HORTICULTURE TERM-DIFFERENCES & TERMINOLOGY

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MSc. (Ag.), Ph.D. (Hort.), NET

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HORTICULTURE

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Dedicated

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PRAKHAR

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Preface

Horticulture is a vast subject directed to nutritional security and bio-aesthetic & environmental conservation in the nation, and it is gaining importance for increasing agricultural productivity and foreign trade. Appropriate knowledge about horticultural terms and differences between two technical terms is quite necessary for students, teachers, scientists, researchers and experts in the field of agriculture, horticulture and plant sciences as well. But, there is no such type of book worldwide which deals with authentic and clearcut differences between two technical terms resembling each other, and a comprehensive definition of terms related to the horticulture. The need for a comprehensive book on differences between two terms and related terminology of horticulture was felt since long. The lack of specialised resource book on term-differences and terminology concerning horticulture has encouraged me to launch this volume. In fact, there was an urgency for such a book as everyone – students, academicians, professionals and farmers & gardeners- associated with horticulture and other plant sciences very often came across a large number of commonly used technical terms and being unware of their meaning they failed to comprehend and differentiate the terms. Their attempts to search the precise definition of a term, and distinctive, authentic and decisive differences between related terms was made more difficult by the fact that sources of definition and explanations of the terms and the differences among them are widely scattered in the literature of the subject concerned. It has been seen that students and aspirants are generally unable to pick out relevant topics in decisive manner from innumerable textbooks on horticulture to differentiate the terms resembling each other. Moreover, they failed to find differences among the terms. There are also a large number of aspirants who want to adorn their career through horticulture, but amidst this stiff competition, proper guidance and reliable study material is of utmost importance. The book "**Horticulture: Term-Differences & Terminology**" overcomes these

shortcomings for readers and students of horticulture and other plant sciences in Indian context.

An attempt has been made in this book to incorporate and compile a lot of authentic and regenerated information on various facets of horticulture and allied plant sciences in the form of terms-differences and terminology. Though, the book is little in volume, it contains a lot of imaginative subject-matter on horticultural terms and their relative differences. This volume of the book has two parts – one is *'term-differences'* and second is *'terminology'*. Part one contains one hundred terms-differences related to horticulture. The differences between two technical terms have been made very precisely by thorough study of chapters of various authentic text / reference books of the concerned subject. There is no book on horticulture which could provide such type of perceptible information on terms-differences in readily available form. This book also provides an innovative approach to understand authentic and clearcut differences among horticultural terms. Second part of the book contains horticultural terminology which has been incorporated with a lot of selected and commonly used technical terms of horticulture in detail with their suitable examples.

"Horticulture: Term-Differences & Terminology" is the only and first book of its kind, written in simple and lucid language in Indian context, which will meet all the requirements of most of the readers and will also serve as good teaching aid for describing differentiation among terms. It is hoped that a lot of subject's intelligence in the form of terms-differences and terminology will provide ample and great assistance to enable the aspirants to take and surpass various competitive – **ARS, NET, SLET, SRF, JRF, UPSC, StatePSCs and Universities' Entrance**-examinations by the easiest way. It may also prove a key guide to the students to get merit for those who are going to attend universities' undergraduate, postgraduate and doctorate examinations and interviews and various other competitive tests. It can also be a supplement text for students and academicians related with other plant sciences. This book

also provides an innovative approach to understand authentic and clearcut differences among horticultural terms.

This book is a sincere and honest effort to provide maximum intelligence about term-differences and terminology in horticulture, and is quite useful for agri-horticulture students, researchers, professionals and most of the readers and aspirants. The book stands a milestone and a masterpiece in horticulture, and active workers, academicians and students in the field of agriculture, horticulture and other plant sciences will certainly like to keep this book on their shelves. All valuable suggestions for further improvement of present endeavour will be highly solicited.

I feel my indebtedness to my Hon'ble **Gurus** especially **Dr. A.R. Singh** (Ex-Porfessor), Deptt. of Horticulture, C.S. Azad University of Agricultural & Technology, Kanpur for ushering me by their tottering talk of subject and it is due to their bleshings that I have been able to get this manuscript compile. I don't find words sufficient to express my indebtedness to my **parents, in-laws,** relatives and wife **Mrs. Vandana Umrao** whose benedictions and inspirations enforced me to complete this content in better way. The cooperation and suggestions extended by erudite colleagues and friends are highly appreciable.

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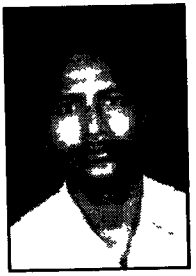
About the Author



Dr. Vijai Kumar Umrao, born at Vill. & P.O. Dhamna Khurd (Amauli), District Fatehpur (U.P.), completed his school education from U.P. Board, and has done his graduation in agriculture (1992) and postgraduation (1995) & Ph.D. (2000) in Horticulture from C.S.Azad University of Agriculture & Technology, Kanpur, and also qualified NET (1998) in Pomology. He was bedecked with M C M (ICAR) scholarship and J.R.F. (ICAR) during graduation and postgraduation, respectively. He was also awarded "University Bronze Medal" for securing third position in the university, and "University Book Prize" for securing first position in the subject during P.G. programme. He has worked as Research Associate in a ICAR ad-hoc research project on 'Salinity Tolerance of Vegetables', and also worked as Asstt. Field Officer in U.P. Sahkari Gram Vikas Bank. He is presently woking as Sr. Lecturer & Head-in-charge, Department of Horticulture, Ch. S.S. Shandilya (P.G.) College, Machhra, Meerut (U.P.) and has also worked as Programme Officer, National Service Scheme (NSS) of college unit for four years. He is a member of Research Degree Committee (RDC) and Board of Studies of horticulture of C.C.S. University, Meerut. He is teaching graduate and postgraduate students and has guided eleven P.G. students for their theses. He is supervising six Ph.D. (Hort.) scholars and three P.G. students for their research work. The author is the active member of the various scientific societies, and has published a number of research papers and popular scientific articles in reputed journals and magazines. He has extensively participated in several national and international symposia/seminars. Recently, he has published two books in co-authorship entitled "**Objective Horticulture**" (in english) and "**Aushadhiya Kharpatwar**" (in Hindi). The book ***Objective Horticulture*** is widely accepted and acclaimed as text guide by agri-horticulture students, teachers and subject experts and all aspirants meant for various agriculture, horticulture and administrative competitive examinations. The book ***Aushadhiya Kharpatwar*** is also widely accepted and appreciated by rural and urban people and academicians interested in herbal and naturopathy.

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Contents

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PART-I

HORTICULTURAL TERM-DIFFERENCES

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TERM-DIFFERENCES

1.	**Arbour**		**Pergola**
(i)	An iron/bamboo frame having flat roof and used for training vine crops.	(i)	Pergola is the series of a number of arches joint together with arch shaped roof but it may be flat also.
(ii)	Arbours are generally constructed in orchards.	(ii)	Pergolas are generally made over path for shading and training ornamental climbers in the garden or bungalows.
(iii)	Iron angle and wires are materials used to construct it.	(iii)	Iron, bamboo and wooden materials are used to give it an artistic shape.
2.	**Grape pruning in N. India**		**Grape pruning in S. India**
(i)	Pruning is carried out once a year.	(i)	Pruning is done twice a year.
(ii)	It is done during end of winter (January).	(ii)	Pruning for fruit (light pruning) in October and renewal pruning (heavy) in April.
(iii)	Several spurs are cut back up to two buds (heavy pruning).	(iii)	Several spurs are cut back up to five buds.
3.	**Potting**		**Shifting (Repotting)**
(i)	Transplanting of seedlings/cuttage/layer age, etc. from seedbed/nursery to a pot.	(i)	Transplanting of plant from one pot to another larger/same size pot.

4.	**Top working**		**Frame working**
(i)	It is the process of changing any inferior variety/unproductive plant to a superior or productive one.	(i)	It is also a process of changing unproductive plant into a productive one.
(ii)	Growing portion of plant about 75-90 cm above ground level is headed back.	(ii)	Secondary or tertiary limbs are headed back.
(iii)	In next season some of vigorous shoots are grafted or budded with scion of superior or desirable variety.	(iii)	Vigorous shoots arising on headed back limbs are grafted/budded with scion/bud of desirable variety.
(iv)	The original shape of plant is changed.	(iv)	Original shape/frame of plant is not changed.
(v)	The operation can be completed in one time/season.	(v)	Operation can be undertaken in two or three seasons.
(vi)	Common in mango, aonla, ber, *etc.*	(vi)	Common in ber, bael, *etc.*
5.	**Balling (Burlapping)**		**Setting out**
(i)	Transplanting of plants mainly evergreens, with a ball of soil supported by burlap or similar material.	(i)	Transplanting of plants, usually herbaceous, from pots, flats or beds to garden or field.
6.	**Evergreen Plants**		**Deciduous Plants**
(i)	Tropical and/or subtropical in habitat.	(i)	Mostly are of temperate nature but some are sub-tropical.

(ii)	They shed their leaves during spring when new leaves are expanding.	(ii)	Shed their leaves in fall or early winter and develop new set of leaves in spring.
(iii)	They always have leaves and so that most of water lost is through leaves.	(iii)	For some period *(in fall)* plants become completely devoid of leaves and looks barren.
(iv)	They make food the entire year.	(iv)	Make food during limited period of year when there are leaves.
(v)	Transplanting should be done during active growth period	(v)	Transplanting is done during dormant period.
(vi)	Transplanted with a ball of earth.	(vi)	Transplanted without ball of earth *i.e.* bare rooted.
(vii)	Regular pruning is not necessary.	(vii)	Regular pruning is necessary to obtain new growth for bearing.
(viii)	Mostly bears on past season growth.	(viii)	Mostly bears on current growth.
7.	**Parthenocarpy**		**Seedlessness**
(i)	Fruits develop without fertilization or even without stimulus.	(i)	Seedlessness due to parthenocarpy or triploidy or in certain cases due to embryo abortion (Stenospermocarpy).
(ii)	Parthenocarpic fruits are usually but not always seedless.	(ii)	Seedless fruits are usually devoid of seeds but in certain cases under-sized abnormal seeds.

8.	**Climacteric fruits**		**Non-climacteric fruits**
(i)	Fruits can ripen on trees as well as after harvesting when mature.	(i)	Mature fruits ripen well only they are intact to the mother plant.
(ii)	They contain mainly carotenoids.	(ii)	They contain mainly anthocyanins.
(iii)	Fruits may be plucked before ripening.	(iii)	Fruits are plucked only after ripening.
(iv)	Fruits may also ripen after harvesting.	(iv)	They cannot ripen if plucked before ripening.
(v)	Respiration in mature fruits increases rapidly.	(v)	Respiration rate is not very high.
(vi)	Climacteric is associated with hydrolysis of reserves in fruit.	(vi)	Hydrolysis of reserves is limited.
9.	**Water Sucker**		**Sword Sucker**
(i)	It has large leaves with broad compact rhizome at base.	(i)	It has thin pointed top of leaves with a pseudostem of thin base.
(ii)	It gives earlier fruiting than sword suckers but poor quality fruits.	(ii)	It takes a little longer time to bear fruit but bunches are large resulting in higher yield.
10.	**Pedicel**		**Peduncle**
(i)	The support/stalk of a single flower of an inflorescence.	(i)	The main stalk of an inflorescence or the stalk of a solitary flower.
11.	**Maturity**		**Ripening**
(i)	Maturity is the complete development of fruit or attainment of full size *i.e.,* quantitative transformation of fruit.	(i)	It refers to qualitative transformation of mature fruits.

(ii)	Maturity completes before starting of ripening.	(ii)	Ripening starts after full maturity of fruit.
(iii)	It is a concentration phase.	(iii)	It is a destruction phase but resembles sometimes concentration process.
(iv)	Generally colour & flavour do not change.	(iv)	Changes in colour & flavour involves physiological changes.
(v)	Low sugar and high acids.	(v)	Sugar increased and acidity decreased.
(vi)	Starch, total carbohydrates and chlorophyll content remains high and respiration low.	(vi)	Total carbohydrates and chlorophyll contents decreases and ethylene evolution & respiration increases.
(vii)	Pectose adheres fruit cells.	(vii)	Pectose hydrolysed to pectin.
(viii)	Seed remains unviable.	(viii)	Seeds become viable & germinable.
12.	**Training**		**Pruning**
(i)	It is judicious removal of plant parts to give a proper shape and size or climbing the vines on a support frame.	(i)	Removal of dead, diseased and undesired parts of the plant to accelerate growth vigorously.
(ii)	It provides a frame work and certain shape to the plant.	(ii)	It objects to enhance growth and productivity.
(iii)	It is orientation of above ground parts (vines) and is associated with bearing.	(iii)	It is done on above ground parts as well as roots also and associated with productivity.

(iv)	Training is done in primary stage before bearing.	(iv)	It is done before or after fruiting or any time according to parts removed.
(v)	Training is a part of top pruning and usually done on shoots.	(v)	Pruning the top always dwarfens the plant and reduces total amount of growth.
13.	**Thinning out**		**Heading back**
(i)	A type of pruning.	(i)	A type of pruning.
(ii)	Entire shoot, spur, branch or limb are removed.	(ii)	Only terminal portion of twig or shoot is removed by remaining basal portion.
(iii)	It stimulates the development of remaining unpruned parts.	(iii)	It stimulates the development of more growing points than thinning out.
(iv)	Terminal head of main branch remains intact.	(iv)	Terminal portion of main branch is removed.
(v)	It provides adequate space to remaining parts for better bearing.	(v)	It encourages lateral buds after severing the terminals.
(vi)	It induces the openness or rangy type growth to the plant.	(vi)	It induces compact, dense or much branched type growth by leading dwarfing and also delays flowering.
14.	**Spur Pruning**		**Cane Pruning**
(i)	Spurs are current or one season old shoots of plant.	(i)	Canes are one year old or more aged shoots of plant.

(ii)	More portion of plant/vine is cut off *(Heavy pruning).*	(ii)	Less portion of plant/vine is removed *(Light pruning).*
(iii)	Pruning vines are cut off by remaining 3-4 buds at base.	(iii)	Vines are cut off by remaining 6-10 buds at base.
(iv)	Practiced in spur bearing varieties.	(iv)	Practiced in cane bearing varieties.
(v)	Mostly practiced in seeded varieties of grape.	(v)	Mostly practiced in seedless varieties of grape.
(vi)	Resulted less yield.	(vi)	Resulted more yield.
15.	**Inter cropping**		**Mixed cropping**
(i)	Main objective is to utilize the space left between two rows of main crop especially during early growth period of main crop.	(i)	The main object is to get at least one crop under any adverse condition.
(ii)	Main emphasis is given to main crop and subsidiary crops are not grown at the cost of main crop.	(ii)	All the crops are given equal care and there is no crop main or subsidiary one. Almost all crops compete with one another.
(iii)	Subsidiary crops are of short duration and harvested much earlier than main crop.	(iii)	All mixed crops are almost of the same duration except some differences in maturity period.
(iv)	Main and intercrops are sown in rows.	(iv)	May be sown in rows or by broad cost.
(v)	Planting/sowing time may be same or main crop is sown earlier than intercrop.	(v)	Sowing/planting time for all the crops is same.

16.	**Monocot seed**		**Dicot seed**
(i)	Testa and pericarp are fused together.	(i)	Testa and pericarp are separate from each other.
(ii)	Only one cotyledon is present in seed.	(ii)	Two cotyledons are found.
(iii)	Cotyledons are thin because they do not store food.	(iii)	Cotyledons become fleshy due to storage of food.
(iv)	After some time growth of radicle stops and no adventitious roots come out from the base of plumule.	(iv)	Due to continuous growth of radicle tap root and adventitious roots are formed.
(v)	Coleoptyle and coleorhiza are present at the end of plumule and radicle, respectively.	(v)	Coleoptyle and coleorhiza are absent.
(vi)	Examples : All grasses, onion, date, coconut, banana, *etc.*	(vi)	Examples : All legumes and most fruits.
17.	**Vermiculite**		**Perlite**
(i)	A micaceous mineral that expended markedly when heated.	(i)	It is a grey-white silicaceous mineral material.
(ii)	Neutral in reaction with good buffering properties.	(ii)	Neutral in reaction but has no buffering capacity.
(iii)	It has cation exchange capacity.	(iii)	It has no cation exchange capacity.
(iv)	Contains mineral nutrients like Mg, Al, Fe.	(iv)	Contains no minerals.
(v)	Particle size small (0.75-1.0 mm) and useful as medium for seed germination.	(v)	Particle size large (1.6-3.0 mm) and useful as rooting medium for cuttings.

(vi)	It is light in weight and capable to absorb more moisture.	(vi)	It is commonly used to increase porosity in a mixture.
18.	**Growth**		**Development**
(i)	It is quantitative increase in size, weight and protoplasm.	(i)	It is a qualitative and internal process influencing the growth of stem and other parts in thickness.
(ii)	The size and dry weight of plant increases.	(ii)	The differentiation of cells, tissues and organs resulting in its characteristic pattern.
(iii)	Size and volume of plant increases.	(iii)	It expresses sexual differentiation as flower, fruit & seeds, etc.
19.	**Lifting of evergreen plants**		**Lifting of deciduous plants**
(i)	Evergreens always have leaves and so most of the water is lost through leaves.	(i)	Deciduous plants become leafless in the fall or early winter and develop new set of leaves in spring.
(ii)	Evergreens are transplanted with large number of leaves.	(ii)	Deciduous are transplanted most advantageously without leaves.
(iii)	Evergreens are lifted with a ball of soil.	(iii)	Deciduous are lifted without ball of earth *i.e.* bare rooted.
(iv)	They are lifted and transplanted during active growth period *i.e.* rainy/spring season.	(iv)	They are lifted during non-growing season *i.e.* dormant season at the time of leaf fall.

(v)	Destruction of more roots may be harmful.	(v)	More roots in lifted plants can be pruned to facilitate transportation.
(vi)	Water loss by transpiration is high.	(vi)	Water loss by transpiration is very low.
(vii)	Requires much care and labour.	(vii)	Requires less care and labour.
(viii)	Less number of plants can be kept per unit area during transportation.	(viii)	More number of plants can be accommodated in a definite area during transportation.
20.	**Hot Bed**		**Cold Frame**
(i)	Hot bed consists of three parts *i.e.* the frame, cover and heating system.	(i)	Cold frame consists of two parts – frame and cover only.
(ii)	Frames of hot bed equipped with heating system.	(ii)	Cold frames are hot beds without any man-made heating system.
(iii)	Hot beds are used to protect plants during cold weather or enhance rooting in hard wood cuttings.	(iii)	These are used to protect plants from frost, light, freeze, hard rains and heavy winds.
(iv)	Temperature within hot beds is maintained by hot air or water or electric heater.	(iv)	During mild weather herbaceous plants are grown in these structures and as the weather becomes warm, the covers are removed.
21.	**Polyembryonic seed**		**Monoembryonic seed**
(i)	More than one embryo in one embryo sac.	(i)	Only one embryo in the seed.

(ii)	One central embryo develops sexually and adjoining embryos are formed asexually.	(ii)	Embryo formed by sexual fertilization only.
(iii)	Seeds give more than one seedlings.	(iii)	Seeds give only one seedling.
(iv)	Seedlings raised from asexual embryos (nucellar cells) of seeds are true-to-the type as their parents.	(iv)	Seedlings are not true-to-the type.
(v)	Stock induces more scion vigour.	(v)	Monoembryonic stock induces poor scion vigour.
(vi)	Vigorous and thick seedlings arise.	(vi)	Seedlings arise are weaker.
(vii)	Germination percentage of seeds is low.	(vii)	Germination percentage is high.
(viii)	Propagation by polyembryonic seed is categorised as asexual one.	(viii)	Propagation by monoembryonic seed is kept under sexual propagation.
22.	**Scarification**		**Stratification**
(i)	It is the process of rubbing the seed coat for roughing the surface of hard seed so that it becomes more permeable to water.	(i)	It is also known as moist chilling and is a method of handling dormant seeds to modify seed coat and physiological dormancy.
(ii)	It is the process of breaking hard seed coat/physical dormancy.	(ii)	It is the process of inducing physiological changes within seeds to break their dormancy.

(iii)	For rubbing seed coat, sand paper, filings or acid (H_2SO_4, 5-25%) are used.	(iii)	In this process, seeds of temperate crops are arranged in alternate layers of moist sand/soil and stored at 32-45^0 F for 1-4 months.
(iv)	Soaking of hard seed coated seeds (guava, rose, date, ber, *etc.*) for 24 hours to 2 weeks accordingly also breaks physical dormancy.	(iv)	Storage of temperate fruit seeds (apple, peach, pear, cherry, etc) in alternate layers of moist medium brings physiological ripening and changes in embryo of seeds.
23.	**Scalding**		**Soaking**
(i)	It is a method of scarification.	(i)	It is also a method of removing inhibitory factors.
(ii)	Seeds are immensed in hot boiling water and are allowed to soak in gradually cooling water for 12-24 hours.	(ii)	Seeds are emerged in cool water for softening hard seed coat *eg.* guava seeds are soaked for 2 weeks before sowing.
(iii)	It softens hard seed coat in short time.	(iii)	It takes much time for softening the hard seed coat.
24.	**Nucleus Seed**		**Breeder Seed**
(i)	Genetically purest seed produced as a result of breeding from which rest of seed categories are multiplied.	(i)	It is the progeny of nucleus seed and it is produced by originating or institution involved in breeding programme under supervision of N.S.C.

(ii)	It is produced in very small quantity and becomes a source of breeder seed.	(ii)	It is produced in some larger quantity and used as source of foundation seed.
25.	**Photo sensitive plants**		**Photo insensitive plants**
(i)	Plants whose reproduction is influenced by variation of length of photo period (the period of exposure of sunlight).	(i)	Plants which can flower, fruit and set seeds under any length of photo period *i.e.* whose reproduction is not influenced by photoperiod.
(ii)	Can be grown in certain season.	(ii)	Can be grown round the year.
26.	**Seed dormancy**		**Rest period**
(i)	The failure of the embryo to germinate (even if it is viable) is dormancy.	(i)	It is the period of rest, or growth controlled by internal physiological factors.
(ii)	It is the chemical or physical condition of seed preventing the embryo to initiate germination even if all favourable conditions for germination are available.	(ii)	It is the period during which a plant or its part remains dormant even though it is given all the external conditions necessary for its growth or germination.
(iii)	It may be external (lack of moisture or favourable temp. or O_2) or internal (chemical or hormonal imbalance).	(iii)	It is due to physiological inactivation of cells or tissues.
27.	**Defloration**		**Defoliation**
(i)	Removal of flowers from a plant in a particular season or year.	(i)	Removal of excess leaves from a plant manually or chemically.

(ii)	Defloration in a particular season/ year results in heavy bearing in the following season/year.	(ii)	It is useful to induce bearing in 'off' year of fruiting in some plants or to induce artificial rest for a plant during adverse weather.
(iii)	The left over chemical energy due to non-bearing of fruits in the previous years seems to be of avail in the improvement of flowering and fruiting in succeeding year.	(iii)	Defoliation is detrimental because it brings about a significant reduction in total carbohydrates, sugars, starch, etc.
28.	**Pollinizer**		**Pollinator**
(i)	It is the source of pollen grains for effective pollination and fertilization in self-incompatible plants.	(i)	It is the mean of transmission of pollen grains from pollinizer to the desirable plant for facilitating effective pollination.
(ii)	Pollinizers may be different varieties of same crop or different species of same genus.	(ii)	Pollinator may be wind, insect, birds, water or man and impliments used.
(iii)	The most of temperate fruit trees require pollinizers (10-11%) for effective fertilization of all trees of an orchard.	(iii)	Almost all plants require a mean (pollinator) for transmission of its pollen grains to the stigma of the same or other flower.
(iv)	Pollinizer should be heavy pollen producer to ensure better cross-fertilization.	(iv)	Pollinator should not be harmful or destructive to female organs of the flower.

	Pollination		**Fertilization**
(i)	It is the transfer of pollen grains from anther to the stigma.	(i)	It is the fusion of one of the sperms with the egg cell to form a zygote.
(ii)	Pollination completes before fertilizaition.	(ii)	Fertilization starts after the completion of pollination.
(iii)	It requires a mean for transferring pollen grains.	(iii)	It is reproduction process between male organ and female egg cell.
(iv)	Pollination may be self or cross.	(iv)	After fertilization new embryo develops within ovary.
(v)	Wind, birds, insects, water, etc. are means of pollination.	(v)	After fertilization mitosis cell division takes place.

30.	**Apomixis**		**Apogamy**
(i)	The phenomenon in which asexual reproduction process occurs in place of normal sexual reproduction.	(i)	In apogamy, synergids or antigonal cells develop into an embryo with or without fertilization.
(ii)	In apomixis, seeds are formed but the embryo develops without fertilization.	(ii)	It is a result of fertilization and may be a haploid or diploid.
(iii)	It results in polyembryony (one sexual embryo and other apomictic cells) in a seed, *e.g.* mango, citrus, jamun, etc.	(iii)	Diplospory leads to apogamy or parthenogenesis.

(iv)	It may be recurrent, vegetative or adventitious.	(iv)	It may be haploid or diploid.
31.	**Adventitious embryony**		**Vegetative apomixis**
(i)	It is also known as nucellar embryony.	(i)	In this case, instead of flowers, vegetative buds or bulbils or slips are developed in the inflorescence, *e.g.* garlic, onion, Agave, *etc.*
(ii)	In this case, embryo do not arise from the gametophytes but arise from the cells in nucellus embryo.		
(iii)	A number of asexual (nucellar) embryo may develop along with the sexual one, *e.g.* jamun, citrus, mango, etc.		
32.	**Recurrent apomixis**		**Non-recurrent apomixis**
(i)	Where female gametophytes develop in normal way from egg mother cell or from some adjoining cells without complete meiosis.	(i)	Where embryo arises directly from the haploid nucleus without fertilization.
(ii)	The embryo develops directly from the diploid egg nucellus without fertilization and with or without pollination.	(ii)	Since the egg is haploid, the resulting embryo is also haploid and similar to egg cell of mother plant.

(iii)	Embryo is diploid and identical with the parent plant, *e.g.* onion, apple, raspberry, etc.	(iii)	This case is rare and primarily of genetic interest, *e.g.* seen in *Solanum nigrum, Datura sp., Crepis capillaris.*
33.	**Soft wood cutting**		**Hard wood cutting**
(i)	Cuttings are always made from herbaceous part of plant with leaves intact.	(i)	Cuttings are made from hard (one or more year old) wood without leaves attached.
(ii)	Small in size (7.5-12.5 cm) with two or more leaves.	(ii)	Large in size (20-25 cm) with 3-4 nodes and without leaves.
(iii)	Cuttings are low in stored food.	(iii)	Cuttings are rich in stored food.
(iv)	These are soft and roots earlier & easier than hard ones but require much attention.	(iv)	These are hard and difficult to root than soft ones.
(v)	Requires misting to check wilting of leaves and to maintain relative humidity for early rooting.	(v)	Requires basal heat for early rooting.
(vi)	Suitable for perennial herbaceous plants such as dahlia, chrysanthemum, geranium, carnation, etc.	(vi)	Suitable for most of trees & shrubs *eg.* fig, quince, olive pomegranate, rose, gooseberry, grape, etc.
34.	**Vernalization**		**Chilling requirement**
(i)	Low temperature treatment of seed or seedling for reducing time between sowing and flowering.	(i)	Low temperature requirement of temperate plants for flower bud burst.

(ii)	It is the artificial ageing of plant material.	(ii)	Temperate fruit trees require a very low temperature (7.2 ^{0}C) for certain period (300-1600 hours) during winter.
35.	**Sterility**		**Incompatibility**
(i)	Inability of the organism to successful fertilization due to unfunctional sexual organs, either male or female.	(i)	Inability of the organism/plant part or pollen grain to form a combination/fertilization for succeeding in the generation due to different morphological or genetic conditions.
(ii)	It is related to sexual organs only.	(ii)	It may be related to vegetative/morphological and/or sexual.
36.	**Self- incompatibility**		**Cross-compatibility**
(i)	Failure of fertilization even though both male and female parts of the bisexual flower are fully functional, as in cabbage, cauliflower, radish, mango, loquat, *etc.*	(i)	Capability of pollen of one variety to fertilize the ovule of another cultivar, but reciprocal may not be cross compatible.
(ii)	It may be sporophytic or gametophytic.		
37.	**Self-fertile**		**Self-sterile**
(i)	Ability to fertilize and set viable seed from the pollen of same flower or variety.	(i)	Inability of a flower or variety to fertilize and set seed/fruit from the pollen of same flower/variety due to non-functional male or female gametes.

(ii)	They do not require compatible pollen grains from other sources (pollinizers).	(ii)	They require pollen grains from other compatible varieties/species for successful fertilization.
(iii)	It encourages self-pollination.	(iii)	It encourages cross-pollination.
38.	**Dicliny**		**Dichogamy**
(i)	It is a condition of flower in which flowers are unisexual (male or female or hermaphrodite in one plant.)	(i)	It is the condition of maturation of stamens and pistils at different time in bisexual/hermaphrodite flowers.
(ii)	It may be monoecy or dioecy.	(ii)	It may be protandry or protogyny.
39.	**Monoecious**		**Dioecious**
(i)	Male and female flowers borne separately in the same plant.	(i)	Male and female flowers borne on different plants of same species.
(ii)	Staminate and pistillate flowers either may occur in same inflorescence (hermarphrodite), *e.g.* mango, litchi, cashewnut, castor, *etc.*	(ii)	The plants are either male or female only, *e.g.* papaya, date, asparagus, pointed gourd, *etc.*
(iii)	Or in different inflorescences or flower of the same plant. *e.g.* most cucurbits, strawberry, chestnut, cassava, maize, *etc.*	(iii)	It is governed by single gene, *e.g.* papaya. asparagus.

(iv)	It may be andromono-ecious (muskmelon) or gynomonoecious (cucumber).	(iv)	It may be androdioecious or gynodioecious.
40.	**Dioecious**		**Gynodioecious**
(i)	Plant in which staminate and pistillate flowers are borne on separate plants of same species, *e.g* date palm, pointed gourd, nutmeg, asparagus, spinach, etc.	(i)	Dioecious plants/ varieties in which either female (pistillate) or hermaphrodite flowers borne on separate plants of same species or variety, *e.g.* some varieties of papaya (Solo, Pusa Majesty, Pusa Delicious, *etc.*)
41.	**Self-fruitfulness**		**Self-unfruitfulness**
(i)	The ability of a cultivar to produce commercial crop of fruit following self pollination or parthenocarpy.	(i)	Inability of a cultivar to produce commercial crop following self pollination or parthenocarpy.
(ii)	Plant/cultivars are self pollinated.	(ii)	Plant/varieties are cross pollinated.
42.	**Autogamy**		**Allogamy**
(i)	Also called as self-pollination.	(i)	Also known as cross-pollination.
(ii)	In this case, pollen grains from the anther fall on the stigma of the same flower.	(ii)	Pollen grains from the anther of male/bisexual flower of one plant fall on stigma of other plant/species flower or same plant.
(iii)	Flowers of self-pollinated crops are in special type and form.	(iii)	Flowers of cross-pollinated crops are attractive in colour and/or odour.

(iv)	Found in leguminous crops, tomato, chilli, brinjal, okra, apricot, potato, peach, *etc.*	(iv)	Found in crucifers, carrot, cucurbits, celery, onion, sweet potato, mango, spinach, pear, date, *etc.*
43.	**Seed hardening**		**Plant hardening**
(i)	It is the process of subjecting seeds to alternate cycles of wetting and drying to induce tolerance to drought, before sowing.	(i)	It is the process of subjecting the new plant/seedling to alternate cycles of moisture and drying before transplanting to induce hardiness against drought/adverse conditions.
44.	**Viability**		**Germination**
(i)	It is the capability of a plant part (embryo/seed/cutting, etc) to show living properties like germination and growth.	(i)	It is resumption of growth of a seed embryo usually reorganized by rupture of seed coat or spore wall and appearance of the radicle & plumule from seed.
45.	**Xenia**		**Meta-xenia**
(i)	Effect of the genotype of pollen grain on the phenotype of seed tissues (embryo & endosperm) due to the phenomenon of double fertilization, *e.g.* date palm, pistachionut.	(i)	The direct effect of pollen grain on the maternal tissues of seed and fruit outside the embryo sac (size, colour, shape *etc.*) *e.g.* coconut.
46.	**Parthenogenesis**		**Parthenocarpy**
(i)	Development of seed without fertilization.	(i)	Development of fruit without pollination or fertilization.

(ii)	Parthenogenetic fruits contain seeds having unfertilized embryo or egg.	(ii)	Parthenocarpic fruits are usually seedless and can be induced artificially also by chemicals (GA_3, NAA, *etc*).
(iii)	It may be haploid or diploid.	(iii)	It may be vegetative or stimulative.
(iv)	Common in mangosteen.	(iv)	Common in banana, grape, pineapple, etc.
47.	**Growth regulator**		**Plant hormone**
(i)	These are organic compounds other than nutrients which in minute amount promote or inhibit or otherwise modify any physiological process of plant.	(i)	Phyto hormones are also growth regulator produced by a plant itself and regulate the physiological processes of the plant.
(ii)	They may be produced itself within plant or synthetic.	(ii)	They are synthesized and act within plant naturally.
(iii)	Generally they act on the spot where they are produced/used in plant tissues.	(iii)	They usually move within the plant from site of production to the site of action.
48.	**Auxin**		**Gibberellin**
(i)	Produced mainly in growing region of shoot tip, young expanding leaves, young embryo and developing fruits, *etc.*	(i)	Produced mainly in root apices, young leaves, immature shoots and seeds.
(ii)	Its precursor is novalonic acid.	(ii)	Its precursor is tryptophane.

(iii)	Polar transportation from shoots to roots in phloem and more slowly by cell to cell.	(iii)	Moves from roots to shoots in xylem and from leaves in phloem and by cell to cell rapidly.
(iv)	Basipetal transport in shoots and acropetal in roots.	(iv)	Moves in all directions in basipetal form in all tissues.
(v)	It promotes elongation of stems & coleoptiles by cell enlargement.	(v)	It promotes stem elongation by increasing cell elongation and division and prevents genetical dwarfism.
(vi)	It promotes geotropic curvature, adventitious rooting & lateral root initiation, xylem differentiation, fruit growth, cambium activity and leaf epinasty.	(vi)	It promotes flowering in long day plants, seed germination, leaf expansion, fruit growth and abscission.
(vii)	It induces femaleness & bending.	(vii)	It induces maleness and bolting & early flowering.
(viii)	It inhibits root elongation, leaf senescence and fruit abscission.	(viii)	It inhibits leaf senescence, adventitious rooting and fruit ripening.
(ix)	It maintains apical bud dominance.	(ix)	It releases buds from apical dominance and winter dormancy.
(x)	Production is inhibited by Zn & P deficiencies and increased by gibberellins & cytokinins.	(x)	Production in roots and movement to shoots is inhibited by flooding.

49.	**Ethylene**		**Abscissic acid**
(i)	It is an olefine gas (C_2H_4), also called as ethene.	(i)	It is a dextrorotatory sesquiterpene.
(ii)	Produced by all parts of plants particularly by ripening fruits, apical growing zones and senescing tissues.	(ii)	It is synthesized in root cap and also found in seeds, fruits, tubers, leaves and buds.
(iii)	Main site of synthesis is old leaves and ripening fruits.	(iii)	Main site of its synthesis is root cap and old leaves & tissues.
(iv)	Promotes senescence, germination, adventitious rooting, leaf epinasty, abscission, fruit ripening and stem elongation in some aquatic plants.	(iv)	Promotes abscission, bud dormancy, tuber formation, adventitious rooting, leaf senescence and stomatal closure and abscission.
(v)	It inhibits stem and root elongation, flowering, cell division, stelar differentiation, geotropic bending of stems & root.	(v)	It inhibits seed germination, transpiration, stem & root elongation, ion transport and flower initiation.
(vi)	Releases axillary buds from apical dominance.	(vi)	Involved in geotropic curvature of roots.
(vii)	Production increased by fruit ripening, senescence of leaves, and flowers, mechanical damage, flooding and drought.	(vii)	Production increased by drought, water stress, flooding, nutrient deficiency, salinity, ripening and senescence.
(viii)	Its precursor is methionine.	(viii)	Its precursor is novalonic acid.

50.	**Abscission**		**Abscission layer**
(i)	The shedding/separation of leaves, flowers, fruits or other plant part from a plant as a result of formation of abscission layer of loosely adhering cells at its base that breaks apart readily.	(i)	A special layer of cells in the petiole or pedicel or other plant structure which separates cells from one another and from neighbouring cells and forms a zone of weakened tissues resulting senescence and breaking of plant part.
(ii)	Abscission occurs during the fall or stress conditions due to formation of abscission layer.	(ii)	Abscission layer occurs due to formation of abscissic acid during aeging and stress conditions.
51.	**Blanching**		**Bleaching**
(i)	Heat treatment given to fruits or vegetables before processing *i.e.* it is pre-cooking process.	(i)	Any process which lightens or fades the colour of fruits, vegetable, leaves or any other part of plant.
(ii)	Steam cooking followed by a cold dip for 10-12 seconds.	(ii)	Chlorination of drinking water by bleachig powder.
52.	**Blanching**		**Scalding**
(i)	Heat treatment of fruits and vegetables with boiling water or steam for short period followed by cooling prior to canning.	(i)	Heat treatment of material or seed in hot boiling water or steam to facilitate early germination in hard seed coated ones.
(ii)	Heat treatment for 10-12 seconds.	(ii)	Heat treatment for 1-3 minutes.

(iii)	Commonly fruits are blanched after peeling as pre-processing.	(iii)	It is done before peeling of thin skinned fruits/vegetables to facilitate easy peeling.
53.	**Temporary Preservation**		**Permanent Preservation**
(i)	Fruits/vegetables and their products are kept safely in fresh condition for short period (1 to 24 weeks).	(i)	Fruits/vegetables and their product may be kept fresh for longer period (1 to 3 years).
(ii)	It can be done by low temperature, use of antiseptics, cleanliness and pasteurization, *etc.*	(ii)	It can be done by use of sugar, salt and vinegar, preservative freezing, canning, fermentation, dehydration and sterilization, *etc.*
54.	**Drying**		**Dehydration**
(i)	Preservation by drying depends upon reducing the moisture content to a level at which micro organisms fail to grow/activate.	(i)	It involves the complete removal of moisture from the fruit/ vegetable to check micro organism activities.
(ii)	It is generally carried out by sun light, hot air or some powders.	(ii)	It is done by a machine-dehydrator.
(iii)	The oldest, simplest and the cheapest method of preservation.	(iii)	It is technical and so costly than drying.
(iv)	In drying, texture and shape of fruits may be changed.	(iv)	In this, generally, texture, shape and appearance of product not changed.

(v)	It is not suitable for high sugar containing fruits.	(v)	It is suitable for both low and high sugar containing vegetables and fruits.
(vi)	It takes more time and depends upon atmospheric conditions/sun light.	(vi)	Takes short time and can be done round the year by dehydrator.
55.	**Dehydration**		**Rehydration**
(i)	Removal of moisture or drying of fruits/vegetables by dehydrator or in sun heat for preservation of the product.	(i)	Soaking of dehydrated/dried fruits, vegetables or other articles to embibe water before use or cooking.
(ii)	Exclusion of moisture/water.	(ii)	Absorption of water.
56.	**Pasteurization**		**Sterilization**
(i)	The process of heating the fruit/vegetables or other products to a temperature of 80^0C or more for certain time that will kill many but not all the micro organisms present in it.	(i)	The process of heating, or chemical treatment, to a temperature of 100^0C (fruits) or 115-116^0C (vegetables) to kill all the micro-organisms present in the product.
(ii)	In this, many of micro-organisms are killed and those remained, their growth & development is greatly weakened or inhibited.	(ii)	In this, almost all the micro-organisms are killed or destroyed.

(iii)	It is a method of temporary preservation and pasteurized products may be kept fresh for 3-6 months.	(iii)	Method of permanent preservation and sterilized product can be kept fresh for 1-3 years.
57.	**Sterilization**		**Processing**
(i)	It is heat or chemical treatment to kill all the organisms from the product.	(i)	It is a broad term consisting of sorting, grading, blanching, heating, exhausting and canning, *etc.*
(ii)	It is the step of processing and it keeps the product free from micro-organisms.	(ii)	It is done to improve the keeping quality, flavour, taste, colour, *etc.*
58.	**Jam**		**Preserve**
(i)	A product prepared by boiling the whole fruit pulp and pieces with sugar to a moderately thick consistency without retaining the shape of fruit.	(i)	Fruits as a whole or in pieces/pulp are preserved in sugar syrup.
(ii)	It can be prepared completely in a single operation.	(ii)	It passess through several stages over a number of days before its completion.
(iii)	Minimum percentage of fruit pulp/portion in final product should be 45%.	(iii)	Minimum percentage of fruit portion in final product should be 55%.
(iv)	T.S.S. low (68^0 brix).	(iv)	T.S.S. more ($70\text{-}72^0$ brix).
59.	**Jam**		**Jelly**
(i)	It is prepared from all fleshy fruits.	(i)	It is prepared from pectin containing fruits.

(ii)	Whole fruit pulp is used.	(ii)	Extract of fruit pulp is used.
(iii)	Prepared from single or mixed fruits.	(iii)	Prepared only from one type fruits.
(iv)	Sugar is added according to sweetness of fruits (30-50% sugar at end).	(iv)	Sugar is added according to pectin grade of extract (65% sugar at the end)
(v)	Acid is mixed according to sugar and fruit's sweetness.	(v)	Acid is mixed according to pectin content.
(vi)	Prepared by single flow sheet method.	(vi)	Prepared by double flow sheet method.
(vii)	It is easy to set.	(vii)	Difficult to set.
(viii)	It is non-transparent and does not have original flavour of fruits used.	(viii)	Transparent and has original flavour of fruit used.
(ix)	T.S.S. 68.5% *(More).*	(ix)	T.S.S. 66-68% *(Less)*
(x)	Acid content at the end should be 0.5-0.6 *(less acidic)* and invert sugar should not be less than 40%.	(x)	Acid content at the end should be 0.75-1% *(more acidic)* and pectin should be 0.5-1%.
60.	**Jelly**		**Marmalade**
(i)	It is prepared from pectin containing sweet fruits.	(i)	It is a jelly prepared from acidic fruits like citrus, etc.
(ii)	It is prepared only from one type fruits.	(ii)	Prepared from two or three types of citrus *(sweet & sour)* fruits.
(iii)	Less acidic and more sweet in taste.	(iii)	Sour & bitter in taste.
(iv)	Prepared from double flow sheet method.	(iv)	Prepared from triple flow sheet method.

(v)	It is transparent.	(v)	Semi-transparent
(vi)	Acid is mixed according to pectin grade.	(vi)	Acid is mixed according to fruit taste and sugar.
(vii)	Difficult to set.	(vii)	Much more difficult to set.
(viii)	It is filled at very hot condition.	(viii)	It is filled at semi-hot condition.
(ix)	Shredded peels are not added.	(ix)	Shredded peels of citrus are suspended.
61.	**Fruit canning**		**Vegetable canning**
(i)	Blanching not required.	(i)	Blanching required.
(ii)	Sugar syrup is used for filling.	(ii)	Brine solution is used for filling.
(iii)	Mostly ripe & semi-ripe fruits are canned.	(iii)	Tender vegetables are used.
(iv)	Before canning peeling is required.	(iv)	Generally peeling is not required.
(v)	Sterilization at 212^0F (100^0C) temperature.	(v)	Sterilization temperature is more (240 ^0F or 115-116 ^0C)
62.	**Tomato Ketchup**		**Tomato Sauce**
(i)	Considerably more spices are added.	(i)	Contains less spices than ketchup.
(ii)	T.S.S. should not be less than 25%.	(ii)	T.S.S. should not be less than 15%.
(iii)	Thick consistency.	(iii)	Thinner consistency.
(iv)	Less acidic in taste.	(iv)	More acidic in taste.
(v)	Minimum acidity per cent should be 1% as acetic acid.	(v)	Minimum acidity as acetic acid should be 1.2%.

63.	**Squash**		**Cordial**
(i)	Consists essentially strained juice with moderate quantities of pulp to which sugar is added for sweetening.	(i)	It is sparkling, clear & sweetened fruit juice from which all the pulp and other suspended material are eliminated.
(ii)	It contains at least 25% fruit juice or pulp and 40 to 50% T.S.S.	(ii)	Contains at least 25% fruit juice and 30% T.S.S.
(iii)	Sweet or less acidic in taste *i.e.* contains about 1.0 % acid.	(iii)	More acidic than squash *i.e.* contains 1.5% acid.
(iv)	Sweet fruits like pineapple, jamun, phalsa, strawberry, etc. are suitable.	(iv)	Lime and lemons are suitable for cordial making.
(v)	It is diluted before use.	(v)	Suitable for blending with wines.
64.	**Crush**		**Nectar**
(i)	Fruit beverage containing at least 25% fruit juice or pulp and 65% T.S.S.	(i)	Fruit beverage containing at least 20% fruit juice/pulp and 15% T.S.S.
(ii)	Contains 1 per cent acid.	(ii)	Contains 0.3 per cent acid.
(iii)	Diluted before serving.	(iii)	Not diluted before serving.
65.	**R.T.S.**		**Syrup**
(i)	Fruit beverage containing at least 10% fruit juice.	(i)	Fruit beverage containing at least 25% fruit juice/pulp.
(ii)	T.S.S. 10 per cent.	(ii)	T.S.S. 65 per cent.

(iii)	Contains about 0.3 per cent acid.	(iii)	Contains 1.3-1.5 percent acid.
(iv)	Not diluted before serving.	(iv)	Diluted before serving.
66.	**Tomato Juice**		**Tomato Soup**
(i)	Minimum per cent of T.S.S. free of salt should be 5%.	(i)	Minimum T.S.S. per cent free of salt should be 7%.
(ii)	The only substances that may be added are salt – not to be in excess of 15% by weight and sugar, dextrose, malic acid, citric acid & permitted colour.	(ii)	The only substances that may be added are salt, spices, sugar, starchy butter & milk solids.
67.	**Chutney**		**Sauce**
(i)	Minimum T.S.S. in final product should be 50%.	(i)	Minimum T.S.S. in final product should be 15%.
(ii)	Acidic fruits are preferred.	(ii)	Less acidic fruits are preferred.
68.	**Cape Gooseberry**		**Goose berry**
(i)	It is known as Husk tomato.	(i)	Also known as black currants.
(ii)	B.N. - *Physalis peruviana*	(ii)	B.N. – *Ribes nigrum*
(iii)	Family-Solanaceae.	(iii)	Family - Saxifragaceae.
(iv)	Tropical in habitat.	(iv)	Temperate in habitat.
(v)	Annual herbaceous.	(v)	Perennial bush.
(vi)	Sensitive to frost.	(vi)	Requires chilling.
(vii)	Pruning not required.	(vii)	Pruning & training required
(viii)	Propagation by seed.	(viii)	Propagation by hard/ soft wood cuttings.

69.	**European Plum**		**Japanese Plum**
(i)	B.N.-*Prunus domestica.*	(i)	B.N. – *Prunus salicina.*
(ii)	Native of Europe.	(ii)	Native of China.
(iii)	Chromosomes - 2n=48, *i.e.* hexaploid.	(iii)	Chromosomes - 2n=16, *i.e.* diploid.
(iv)	Cultivated at higher elevations.	(iv)	Grown at lower & sub mountainous elevations.
(v)	High chilling requirement (800-1000 hours below 7.2 ^{0}C).	(v)	Comparatively low chilling requirement (700-1000 hours).
(vi)	Less resistant to winter cold	(vi)	Much resistant to winter cold and suitable to plant in Northern slopes.
(vii)	Trees large & leaves irregularly serrate.	(vii)	Trees dwarf and leaves closely sharp pointed & medium sized.
(viii)	Fruit medium, oblate or round without apex.	(viii)	Fruit large, heart shaped with a pronounced apex.
(ix)	Lower surface of young shoots & leaves are hairy.	(ix)	Lower surface of young shoots & leaves are soft and non-hairy.
(x)	Fruiting spurs are more and branched.	(x)	Fruiting spurs are less.
(xi)	Normal bearer.	(xi)	Tends to overbear thus fruit size reduced.
(xii)	Requires light pruning & less fruit-thinning	(xii)	Requires heavy pruning & heavy fruit thinning.
(xiii)	Mostly self-fruitful.	(xiii)	Often self-fruitful (self-unfruitful)
70.	**European Pear**		**Oriental Pear**
(i)	B.N.-*Prunus communis.*	(i)	B.N.-*Prunus pyrifolia.*
(ii)	Origin-Central Asia.	(ii)	Origin-China.

(iii)	Tree-pyramidical, medium tall & spiny when young.	(iii)	Tree tall, vigorous & spreading and leaves large.
(iv)	Fruit-pyriform; large & soft	(iv)	Fruit-round with a depression at stem end; medium & very hard.
(v)	Calyx-persistent.	(v)	Calyx-deciduous.
(vi)	High chilling requirement.	(vi)	Low chilling requirement.
(vii)	Fruit pulp melting & buttery	(vii)	Pulp texture crispy; sweet but lack aroma.
(viii)	Susceptible to fire blight.	(viii)	Resistant to fire blight & drought.
71.	**Jackfruit**		**Bread fruit**
(i)	B.N.-*Artocarpus heterophyllus*	(i)	B. N. - *Artocarpus altilis.*
(ii)	Origin-India.	(ii)	Origin-Malaya Pacific Island.
(iii)	Requires humid & tropical	(iii)	Requires more humid & tropical climate than jackfruit.
(iv)	Fruit large size (Biggest among fruit trees).	(iv)	Fruit smaller than jackfruit.
(v)	Tree size large.	(v)	Tree size small.
(vi)	Fruit long.	(vi)	Fruit round (about 15cm).
(vii)	Leaves small.	(vii)	Leaves palmate & large.
(viii)	Propagated by seeds.	(viii)	Propagated by seed & root suckers.
72.	***Vitis vinifera* (Grape)**		***Vitis labrusca* (Grape)**
(i)	Native of S-W Asia.	(i)	Native of North America.

(ii)	Cultivated in whole world.	(ii)	Cultivated in U.S.A.
(iii)	Susceptible to phylloxera.	(iii)	Resistant to phylloxera.
(iv)	Individual berry size large.	(iv)	Individual berry small.
(v)	100-200 berries per cluster.	(v)	40-100 berries per cluster.
(vi)	Skin of fruit adheres to the pulp.	(vi)	Fruit skin separates from pulp.
(vii)	Pulp light, compact.	(vii)	Pulp like jelly.
(viii)	Flowers like muscat *(mu scat flavour).*	(viii)	Flowers like foxy *(foxy flavour).*
(ix)	Stamens small size.	(ix)	Stamens tall & big size.
(x)	Tendrils are divided.	(x)	Tendrils not divided.
(xi)	Early & one time maturing.	(xi)	Late & different time maturing.
73.	**Blueberry**		**Cranberry**
(i)	B.N. - *Vaccinium corymbosum.*	(i)	B.N. - *Vaccinium macrocarpum.*
(ii)	Evergreen & woody bush.	(ii)	Evergreen, woody & trailing vine.
(iii)	Propagation by hard wood cutting.	(iii)	Propagation by runner and seed.
(iv)	Chilling requirement 650-850 hours below 7.2^0C.	(iv)	Requires 2500 cumulative hours below 7.2^0C to break rest period.
(v)	Fine & fibrous roots are devoid of root hairs.	(v)	Fine, divided & fibrous roots have root hairs among which mycorrhiza are ramified.

(vi)	Woody stems develop from underground root stocks forming suckers.	(vi)	Roots possess ability to survive in submerged water for months.
(vii)	Fruits are borne on previous season's growth	(vii)	Fruits are borne on uprights which arise either from runner or other upright.
(viii)	Different cultivated species	(viii)	Cranberry is self-fruitful.
74.	**Dioecious papaya**		**Gynodioecious papaya**
(i)	Male and female flowers are found in separate plants.	(i)	Either female or hermaphrodite flowers are found in same plant.
(ii)	Fruits are bell-shaped and more attractive.	(ii)	Fruits are elongated, pointed at tip and less attractive.
(iii)	Plants are more productive.	(iii)	Hermaphrodite plants are not as productive as female ones.
(iv)	Fruits are more seeded.	(iv)	Fruits are less seeded.
(v)	More seed rate required (2-3 seeds should be sown per pit).	(v)	Less seed rate required (one or sometimes two seeds are sown per pit).
(vi)	Requires pollinizers.	(vi)	No requirement of pollinizers.
(vii)	Dioecious varieties - Pusa Dwarf, Pusa Giant, Pusa Nanha, *etc.*	(vii)	Gynodioecious varieties- Solo, Pusa Delicious, Pusa Majesty, Coorg Honey Dew.
75.	**Indian Gooseberry**		**Cape Gooseberry**
(i)	B.N.-*Emblica officinalis.*	(i)	B. N. - *Physalis peruviana*
(ii)	Family- Euphorbiaceae.	(ii)	Family-Solanaceae.
(iii)	Perennial, deciduous tree.	(iii)	Annual, herbaceous plant.

(iv)	Sex expression-monoecious	(iv)	Bisexual flowers.
(v)	Fruit six-lobed capsule.	(v)	Fruit berry, enclosed in a papery husk constituted by calyx.
(vi)	Edible part – exocarp & mesocarp; endocarp is a stone.	(vi)	Edible part – peri, meso and endocarp (whole fruit).
(vii)	Propagation by shield budding.	(vii)	Propagation by seed.
(viii)	Suitable for making preserve & pickle	(viii)	Suitable for preparing jam.
76.	**Grape**		**Grape fruit**
(i)	B.N.-*Vitis vinifera.*	(i)	B.N.- *Citrus paradisi.*
(ii)	Origin-Caspian Sea region.	(ii)	Origin-South China.
(iii)	Family-Vitaceae.	(iii)	Family-Rutaceae.
(iv)	It is a deciduous & climbing vine.	(iv)	It is an evergreen tree.
(v)	Habitat – Temperate to subtropical	(v)	Habitat – Subtropical to tropical.
(vi)	Its cultivation is known as viticulture.	(vi)	Cultivation of citrus fruits is known as citriculture.
(vii)	Fruits are berry; seeded and/or seedless.	(vii)	Fruits-hespiridium; seeded
(viii)	Edible part-pericarp & thalamus.	(viii)	Edible part fleshy & juicy placental hairs.
(ix)	Propagation by hard wood cuttings.	(ix)	Propagation by seed/budding.
(x)	Requires regular pruning.	(x)	Does not require pruning

77.	**Bael**		**Woodapple**
(i)	B.N.- *Aegle mormelos.*	(i)	B.N.- *Feronia limonia.*
(ii)	Chromosomes : 2n = 36.	(ii)	Chromosomes : 2n = 18.
(iii)	Tree deciduous; white greyish stem and bark is shallowly furrowed & corky.	(iii)	Tree-deciduous; surface of stem & branches are rough & covered with white bloom.
(iv)	Leaf : trifoliate.	(iv)	Leaf : odd pinnate, 3-7 leaflets.
(v)	Flowers borne in clusters, greenish white & sweet scented.	(v)	Flowers borne in terminal or axillary panicles; dull red in colour.
(vi)	Fruit is hard shelled berry (amphisarca) with hard, smooth, greyish yellow pericarp.	(vi)	Fruit is hard shelled berry (amphisarca) with hard, rough pericarp covered with white bloom.
(vii)	Fruit is filled with soft yellow-orange, sweet & fragrant pulp.	(vii)	Fruit is filled with pinkish & sour edible pulp in which seeds are embedded.
(viii)	Seeds are arranged in closely packed tiers surrounded by slimy mucilage.	(viii)	Seeds are dispersed and embedded with pulp.
(ix)	Suitable for squash, syrup & marmalade preparation.	(ix)	Suitable for chutney, pickle & squash preparation.
(x)	Propagation by seed, budding or root cutting.	(x)	Propagation by seed.
78.	**Jamun**		**Gulab Jamum (Rose apple)**
(i)	B.N.-*Syzygium cumunii.*	(i)	B.N.-*Syzygium jambos.*

(ii)	Habitat : Tropical to subtropical.	(ii)	Habitat : Tropical.
(iii)	Tree size large, evergreen.	(iii)	Tree medium, evergreen,
(iv)	Fruit (berry) ovoid & purplish-red and calyx is not persistent.	(iv)	Fruits light yellow-white in colour, rose scented and with persistent calyx.
(v)	Mostly grown in N. India.	(v)	Mostly grown in S. India at 1200 m ASL.
79.	**Pummelo (Shaddock)**		**Grape fruit**
(i)	B.N.-*Citrus grandis.*	(i)	B.N.- *Citrus paradisi.*
(ii)	Native to Malaya	(ii)	Native to S. China..
(iii)	Leaves : large, pubescent beneath along midrib.	(iii)	Leaves : large & glabrous.
(iv)	Tree : spiny, spreading & smaller (5-10 m) than grape fruit.	(iv)	Tree : spreading and larger (10-15 m) than pummelo.
(v)	Twigs are pubescent and petioles are more broadly winged.	(v)	Twigs are glabrous and petioles are broadly winged.
(vi)	Flowers are larger than grape fruit and with creamy petals.	(vi)	Flowers are axillary, 4-5 cm long, fragrant and with white petals.
(vii)	Fruits are globose or pyriform, large to medium (10-30 cm).	(vii)	Fruits are spherical or obovate, medium to large (8-25 cm).
(viii)	Rind is thicker than grape fruit.	(viii)	Rind is thinner than pummelo.
(ix)	Segments open at centre.	(ix)	Segments close at centre.
(x)	Axis semi-hollow to hollow.	(x)	Axis solid to semi-hollow.

(xi)	Pulp tough, solid and pale yellow to pink yellow.	(xi)	Pulp tender & not tough.
(xii)	Seeds are very large, coarsely veined & white within, and mono-embryonic.	(xii)	Seeds are big but smooth surfaced & white inside, and polyembryonic.
(xiii)	Fruits borne singly.	(xiii)	Fruits borne in clusters.
(xiv)	Thrives best in submountainous and humid regions.	(xiv)	Thrives best in hot plains of N. India.
(xv)	Cvs.- Walter, Chakaya, Nagpur Chakotara.	(xv)	Cvs.–Marsh Seedless, Ruby, Foster, Thompson.
80.	**Ambe (Basant) Bahar**		**Mrig Bahar**
(i)	It is the first flowering flush in guava, citrus, pomegranate, *etc.*	(i)	It is second flowering flush in guava, citrus, pomegranate, *etc.*
(ii)	Blooming occurs in spring *i.e.* Feb.-March.	(ii)	Flowering occurs in summer. *i.e.* May-June.
(iii)	Fruits ripen in rainy season *i.e.* June-Aug.	(iii)	Fruits ripen in winter *i.e.* Nov.-Jan.
(iv)	Fruits are inferior quality due to fruit fly infestation.	(iv)	Fruits are superior in quality and less infested by insects.
(v)	Fruits are less sweety and have poor keeping quality.	(v)	Fruits are more sweety and have good keeping quality.
(vi)	Less fruiting.	(vi)	More fruiting.
81.	**South Indian Tea**		**North Indian Tea**
(i)	Growing regions : Kerala, Karnataka, T.N.	(i)	Growing regions : Assam, Tripura, W.B., H.P.

(ii)	*Grevellia robusta* is used as shade tree.	(ii)	*Albizzia* sp. is used for shading.
(iii)	More N_2 feeder (300 Kg/ha).	(iii)	Less N_2 application (120 Kg/ha).
(iv)	Pruning cycle extends over a period of 4, 5, or 6 years.	(iv)	Annual pruning is practiced.
(v)	Regular uprooting and replantation is not practiced.	(v)	Regular uprooting and replantation (2-2.5 % plants) every year is practiced.
(vi)	Crop is plucked throughout the year but in winter (Dec.-March) it is harvested at longer intervals.	(vi)	Crop is plucked weekly from April to Dec. and in winter (dormant season) it is not harvested.
82.	**Arabica Coffee**		**Robusta Coffee**
(i)	B.N.- *Coffee arabica.*	(i)	B.N.– *Coffee canephora.*
(ii)	Chromosomes : 2n = 44 (tetraploid).	(ii)	Chromosomes : 2n = 22 (diploid).
(iii)	Tree - small; leaves smaller, dark green and narrower than robusta.	(iii)	Tree - larger than arabica; leaves broad, large and pale green.
(iv)	Plants are more shade loving and grow well at higher elevations (900-1200 m MSL).	(iv)	Plants are less shade loving and grow at lower elevations (150 m MSL).
(v)	Climate : Annual rainfall requirement-60-250 cm, Temp. : 15-20^{0}C, cool climate.	(v)	Annual rainfall requirement :- 100-200cm; Temp. -20 - 30^{0}C, hot & humid climate.
(vi)	Flowering : Oct.-March	(vi)	Flowering : Nov.-Feb. in S. India

(vii)	Flowers borne in short clusters in leaf axils (10-12 flowers/cluster).	(vii)	Flowers borne on larger clusters than arabica.
(viii)	Flowers are self-fertile (self-compatible)	(viii)	It is self-sterile (cross-pollinated).
(ix)	Early maturity (8-9 months).	(ix)	Late maturity (10-11 months).
(x)	Beans are bold and has less mucilage and thus takes less time for its removal.	(x)	Beans are smaller than arabica and has more sticky mucilage thus taking more time for mucilage removal.
83.	**Strain**		**Clone**
(i)	A group of individuals similar in phenotype. It is a specific type selected from a variety. A strain is known as a variety when released for commercial cultivation by Variety Release Committee (VRC).	(i)	An individual or a group of individuals of a common ancestor which have been propagated vegetatively usually by cutting or natural multiplication. *e.g.* bulbs, tubers, etc.
84.	**Self-incompatibility**		**Male-sterility**
(i)	Failure of pollen grains of a flower to fertilize the stigma of same flower or others of the same plant.	(i)	It refers to the absence of functional pollen grains in otherwise hermaphrodite flowers.
(ii)	Self-incompatible pollen grains fail to germinate on the stigma, if some pollen grains do germinate, pollen tube fails to enter the stigma.	(ii)	It occurs in nature sporodically perhaps due to mutation.

(iii)	It may be sporophytic or gametophytic.	(iii)	It may be cytoplasmic or genetic or combination of both.
(iv)	In self-incompatibility flowers do not set seeds on selfing. It is commonly found in cross pollinated crops/varieties.	(iv)	It has great value in hybrid seed production and gets rid of tedious emasculation process.
(v)	In self-incompatible plants it is necessary to plant two cross-compatible varieties to ensure fruitfulness.	(v)	Male sterility is maintained by removal of stamens from the hermaphrodite flowers, this male sterile line acts as female line in hybrid seed production.
85.	***Muscadinia* (Grape)**		***Euvitis* (Grape)**
(i)	It is a sub-genera of *Vitis* and known as Southern grape.	(i)	It is a sub-genera of *Vitis* and known as Northern grape.
(ii)	Chromosomes : 2n = 40	(ii)	Chromosomes : 2n = 38.
(iii)	It has light bark which does not shed.	(iii)	It possess slightly tight bark that sheds.
(iv)	It possesses simple tendrils.	(iv)	It has forked tendrils.
(v)	Nodes without diaphragm.	(v)	Nodes with diaphragm.
(vi)	It has small clusters with berries that detach as they mature.	(vi)	It has elongated clusters with berries that adhere at maturity.
(vii)	Individual fruit clusters are large.	(vii)	Fruit clusters are small.

86.	***Zizyphus mauritiana***		***Zizyphus jujube***
(i)	Commonly known as Indian ber.	(i)	Commonly known as Chinese ber.
(ii)	Evergreen in nature.	(ii)	Deciduous nature.
(iii)	Common in tropical and subtropical regions.	(iii)	More common in temperate climate.
(iv)	Growing habit-spreading with drooping branches.	(iv)	Growing habit is upright.
(v)	Leaves densely tomentose on their under surface.	(v)	Leaves glabrous on their under surface.
(vi)	Fruits-round to oval.	(vi)	Fruits-oblong to ovoid.
87.	**Incompatibility**		**Sterility**
(i)	It is inability of the organisms to form a combination for succeeding to generation due to differences in genetic constitutions.	(i)	It is inability of an organism to successful fertilization due to non-functional sexual organs either male or female.
(ii)	It may be related to vegetative part as well as sexual also.	(ii)	It is related only to sexual organs.
88.	**Sour lime**		**Sweet lime**
(i)	B.N.-*Citrus aurantifolia.*	(i)	B.N.-*Citrus limettioides.*
(ii)	Tree small; Leaves small.	(ii)	Tree medium to large; Leaves medium, petiole wing margined, leaf lamina cupped.
(iii)	Flowers & fruits are smaller than sweet lime.	(iii)	Flowers & fruits are larger than sour lime.
(iv)	Core-solid at maturity.	(iv)	Core-semi-hollow at maturity.

(v)	Flesh-greenish white in colour.	(v)	Flesh-pale yellow in colour.
(vi)	Juice-highly acidic.	(vi)	Juice-sweet with little bitterness.
(vii)	Seeds are highly polyembryonic.	(vii)	Seeds are less polyembryonic.
(viii)	Varieties : Kagzi lime, Abhaypuri lime.	(viii)	Varieties : Sharbati, Meetha Nimbu.
89.	**Lemon**		**Lime (Sour lime)**
(i)	B.N.-*Citrus limon.*	(i)	B.N. -*Citrus aurantifolia*
(ii)	Origin - E. Asia.	(ii)	Origin-India
(iii)	Flowers have more stamens (20-40).	(iii)	Flowers have less stamens (20-25).
(iv)	Pistils densely dotted with oil glands.	(iv)	Pistils are not densely dotted with oil glands.
(v)	Fruits-oval to elliptical with pointed nipple.	(v)	Fruits-round to oval & without pointed nipple.
(vi)	Leaves broadly winged.	(vi)	Leaves narrowly winged.
(vii)	Seeds are weakly polyembryonic.	(vii)	Seeds are highly polyembryonic.
(viii)	Its root stock has dwarfing effect on scion.	(viii)	It has no dwarfing effect on scion.
(ix)	It is one of the hardiest root stock and frost resistant.	(ix)	It is not so hardy root stock.
(x)	Cvs.- Eureka, Pant Lemon, Lisbon, *etc.*	(x)	Cvs.-Abhaypuri, Kagzi Lime, Tahiti, *etc.*
90.	**Sour Orange**		**Sweet Orange**
(i)	B.N. -*Citrus aurantium.*	(i)	B.N.-*Citrus sinensis.*
(ii)	Origin-India.	(ii)	Origin-China.

(iii)	Fruit : acidic with bitter after taste.	(iii)	Fruit-sweet.
(iv)	Fruits central core semi hollow.	(iv)	Central core solid.
(v)	Rind separates easily.	(v)	Rind tight.
(vi)	Seeds are less polyembryonic (60-80%).	(vi)	Seeds are highly polyembryonic (80-90%).
(vii)	Thorns pointed.	(vii)	Thorns blunt.
(viii)	Petiole broadly winged.	(viii)	Petiole slightly winged.
(ix)	Flowers somewhat longer than *C. sinensis*.	(ix)	Flowers smaller than those of *C. aurantium*.
(x)	Resistant to foot rot, psorosis, gummosis and exocortis.	(x)	Susceptible to foot rot, psorosis, gummosis.
(xi)	Susceptible to tristeza & greening.	(xi)	Resistant to tristeza & xyloporosis.
(xii)	Not common in India.	(xii)	Common in India.
91.	**Mandarin**		**Sweet Orange**
(i)	B.N. –*Citrus reticulata.*	(i)	B.N.–*Citrus sinensis.*
(ii)	Also known as fancy fruit or loose skinned orange (Santara).	(ii)	Also known as Malta or tight skinned orange (Mosambi).
(iii)	Tree size small (2-6m).	(iii)	Tree size tall (6-12m).
(iv)	Leaves small & lanceolate.	(iv)	Leaves large with blunt pointed leaf apex.
(v)	Flowers smaller than sweet orange.	(v)	Flowers larger than mandarin.
(vi)	Fruits globose and orange in colour.	(vi)	Fruits oblate to globose and light orange-reddish in colour.

(vii)	Fruit contains less seeds (10-15).	(vii)	Fruit contains more seeds (15-20).
(viii)	Fruit peel is easily removable.	(viii)	Fruit skin is sticky and tedious to peel.
(ix)	Fruit core is hollow.	(ix)	Fruit core solid.
(x)	Seeds pointed with light green cotyledons.	(x)	Seed consists of whitish cotyledons.
(xi)	Seeds are light in weight (1000-1200 seeds/100g).	(xi)	Seeds are heavier in weight (650-750 seeds/100g).
(xii)	It is hard and can stand in less humid climate.	(xii)	It is less hardy than mandarin and thrives best in more humid climate.
(xiii)	Resistant to tristeza and susceptible to gummosis.	(xiii)	Resistant to tristeza and susceptible to foot rot.
(xiv)	Varieties–Emperor, Kinnow, Nagpur, Khasi & Coorg mandarins, Laddu, Srinagar, Hill.	(xiv)	Mosambi, Valencia, Blood Red, Sathgudi, Washington Naval, Succari.
92.	**Tomato Paste**		**Concentrated Tomato Paste**
(i)	A concentrated tomato juice or pulp without skin & seeds and containing not less than 25 per cent of tomato solids.	(i)	It is a concentrated tomato juice or pulp without skin & seeds and contains not less than 33 per cent tomato solids.
93.	**Medium Tomato Puree**		**Heavy Tomato Puree**
(i)	It is a commercial tomato pulp without skin or seeds, with or without added salt and contains not less than 8.37 per cent salt free tomato solids.	(i)	It is a commercial tomato pulp without skin or seeds with or without added salt which contains not less than 12 per cent salt free tomato solids.

94.	**Glaced Candy**		**Crystallized Candy**
(i)	It is a candied fruit covered or coated with a thin transparent coatings of sugar which imparts to it a glacy appearance.	(i)	It is a candied fruit coated with crystals of sugar either by rolling it in finely powdered sugar or by allowing the sugar crystals from a dense syrup to deposit on it.
95.	**Peach**		**Nectarine**
(i)	Peach has fuzzy skin.	(i)	It is a group of peaches without fuzzy skin.
(ii)	Fruits are variable in size and colour, glabrous and larger than nectarines.	(ii)	Fruits smaller than peach and have greater aroma.
96.	**Sweet Cherry**		**Sour Cherry**
(i)	B.N.–*Punus avium.*	(i)	B.N.–*Prunus cerasus.*
(ii)	Tree size: tall (15-18m), erect and pyramidical.	(ii)	Tree size: small (6-9m), open headed, spreading and branches drooping.
(iii)	Leaves large, thin pubescent beneath and coarsely serrated.	(iii)	Leaves-much smaller, dark green, and more numerous than sweet cherry.
(iv)	Petioles - long with two or more swollen glands.	(iv)	Petioles smaller than sweet cherry.
(v)	Fruit - cordate with deep cavity and round/pointed apex.	(v)	Fruit - roundish-oblate or cordate with slightly compressed side & about 2cm diameter.
(vi)	Mainly used for table or dessert and canning.	(vi)	Mainly used for cooking and processing.
(vii)	It can survive in severe cold & warm both climate.	(vii)	It does not thrive well in warm climate and requires more cold.

(viii)	It is propagated by seeds and does not readily propagate vegetatively.	(viii)	It can easily be propagated vegetatively.
97.	**Intercropping**		**Strip cropping**
(i)	It refers to growing of two or more dissimilar crops simultaneously on the same piece of land which may or may not be sown or harvested at the same time.	(i)	It is the practice of growing crops like erect growing & surface creeping ones alternately along contours or across the prevailing wind direction with the purpose of shelter belt and erosion resisting on slopy lands and conserve soil moisture.
98.	**Intercrop**		**Filler crop**
(i)	It is a crop raised between orchard or any other widely spaced crop for increasing the additional income from the same piece of land.	(i)	When short duration fruit plants – banana, papaya, pineapple, etc. are interplanted in space left between two rows of main crop, the interplanted plants are called as filler crop.
(ii)	The maturity and/or harvesting time of inter crop may be same or different from the main crop.	(ii)	The maturity and harvesting time of 'filler crop' is much earlier than the main crop.
99.	**Criollo Cacaos**		**Amazonian Foresteros**
(i)	These include Venezuelan cacaos and also those which are native to Mexico, Columbia and Central America.	(i)	These include cacaos of Brazil, West Africa and Ecquador.

(ii)	These are good quality cacaos with bland flavour.	(ii)	These are inferior in quality with better taste.
(iii)	Pod wall thin and easy to cut.	(iii)	Pod wall thick and woody and difficult to cut.
(iv)	Pods are usually deeply 10-furrowed, very warty & pointed and have plump seeds.	(iv)	Pods are less deeply furrowed, round ended and have flattened seeds.
(v)	Ripe pods become red or yellow.	(v)	Ripe pods are yellow.
(vi)	Fresh cotyledons are white or pale violet.	(vi)	Cotyledons are violet to black.
100.	**C_3 Plants**		**C_4 Plants**
(i)	Transpiration rate high and there is only one sink.	(i)	Transpiration rate low and there are two sinks.
(ii)	Chloroplasts are found in mesophyll	(ii)	Chloroplasts are found both in mesophyll & bundle sheath.
(iii)	Chloroplast dimorphism & bundle sheath absent.	(iii)	Chloroplast dimorphism & bundle sheath present.
(iv)	In these plants, calvin cycle of photosynthesis is found.	(iv)	In these both C_4-dicarboxylic acid & calvin cycles are present.
(v)	Optimum temp. requirement for photosynthesis is 10-25^{0}C.	(v)	Optimum temp. for photosynthesis is 30-40^{0}C.
(vi)	Photorespiration present and net photosynthesis is less.	(vi)	Photorespiration absent and net photosynthesis is double to that of C_3 plants.

(vii)	CO_2 acceptor is Ribulose-1 5, DP.	(vii)	CO_2 acceptor is PEP.
(viii)	First stable product is PGA.	(viii)	First stable product is OAA.
(ix)	For synthesis of 1 molecule of glucose, 18 ATP are required.	(ix)	For synthesis of 1 glucose molecule, 30 ATP are required.
(x)	Light intensity saturation is 3000 ft. candle.	(x)	Light intensity saturation is 6000 ft. candle.
(xi)	Examples-bean, spinach, lettuce, carrot, beet, cabbage, etc.	(xi)	Examples-globe amaranth, corn, etc.
101.	**Cover crop**		**Inter crop**
(i)	A close growing crops grown between orchard trees to protect the land from erosion, weed growth and evaporational losses of water are called as cover crops	(i)	In common usage, the crops raised in an orchard or other widely spaced crops for increasing the income from same piece of land. *e.g.* vegetables, pulses, oil seeds and short duration fruit crops, etc.
(ii)	Cover crops should be fast growing and more spreading which can cover the soil surface *i.e. surface creeping*	(ii)	The main object of inter crop is to utilize the wide space left between two subsequent rows of main crop or trees. They should be high yielding.
(iii)	They are raised mainly in the beginning or in advancement of rainy season.	(iii)	These are sown or planted with planting or sowing the main crop or later.

(iv)	Cover crops also protect losses of moisture by leaching and serve to draw off surplus moisture during monsoon.	(iv)	When short duration fruit trees are planted in orchard, these crops are called as **filler crop** such as papaya, banana, pineapple, etc.
(v)	Retention of cover crops during summer months is undesirable as it compete with the main crop for soil moisture.	(v)	Generally they do not compete with main crop as they are grown wide spaces between two rows.
102.	**Sod culture**		**Clean cultivation**
(i)	A method of orchard soil management in which a permanent perennial grass is grown without tillage in between trees' rows.	(i)	A method of orchard soil management in which all the vegetation except · main crop is eliminated periodically by soil tillage. Thus, it is the just opposite to sod culture.
(ii)	A limited area around the tree is hoed or tilled.	(ii)	In this, ploughing or disking may be done according to the needs of the orchard sanitation.
(iii)	It is more practicable in hilly/temperate areas and not suitable for plains	(iii)	It is a common practice in plains as well as hills.
(iv)	Sod culture in itself is not favourable for foliage colour, tree growth and fruit yield of main crop.	(iv)	Due to absence of dense grasses main crop receives proper light & nutrients, so get proper & healthy growth.

(v)	Sod culture offers greater difficulty in control of fungal diseases and insect pests as dense grasses provide hostness to pathogens and insects.	(v)	In clean cultivation, most of the host plants for pathogens and insects are eliminated during hoeing and interculture operations.
103.	**Growth Promotor**		**Growth Inhibitor**
(i)	The plant growth regulators or hormones which have catalytical effect, *i.e.* take a vital role in plant growth are called as growth promotor. e.g. Auxins, GA_3, Cytokinin, *etc.*	(i)	The growth regulators which selectively interfere with normal hormonal promotion of growth without appreciable toxic effects such as M.H, CCC, B-9, TIBA, etc. act as growth retardants.
104.	**Disinfectant**		**Disinfestant**
(i)	Chemicals or any other method used for elimination of all the pathogens adhered with seed coat and all organisms present within the seed also.	(i)	Chemicals or insecticides which are to kill all the pathogens or insect-pests present on the surface of seeds.
(ii)	The treatment of seed/soil by disinfectants is called as *disinfection.*	(ii)	The treatment of seeds by disinfestants is called as *disinfestation.*
(iii)	Formaldehyde, hot water, aerated steam, etc. are suitable disinfectants.	(iii)	Calcium hypochloride is an effective disinfestant.
105.	**Seed Certification**		**Seed Testing**
(i)	It is a legally sanctioned system of quality control of seed multiplication and production.	(i)	It is a technique of evaluating the seed quality like purity, germination, health, test weight, *etc.* before it is used for sowing.

(ii)	It is a field work for quality seed production and carried out by seed inspector under the rules of Seed Act.	(ii)	It is an in-laboratory process of evaluation of seed quality and it is done by a seed analyst.
(iii)	It consists of genetic purity, field inspection, supervision of agronomic operations, bulk inspection, sample inspection, etc. to ensure physical and genetical purity of seed.	(iii)	It consists of evaluation of physical health, viability, test weight and germination ability of seed.
(vi)	It is done under the Section-6 of Seed Act.	(iv)	It is done under the Section -4 of Seed Act
106.	**Seed stalk**		**Seed stock**
(i)	It is the erect stem of plant in case of root, bulb & leafy vegetable crops such as radish, carrot, turnip, cabbage, spinach, amaranthus, onion, *etc.* which bear flower and seeds on them.	(i)	It is the bulk of seeds after harvesting & threshing. The seeds may be bagged or heaped and the seed lot of samples are derived from this seed stock.
107.	**Starter solution**		**Buffer solution**
(i)	It refers the solution of fertilizer generally consisting of N:P:K in the ratio of 1:2:1 or 1:1:2.	(i)	A solution that contains a weak acid and its salt (*e.g.* acetic acid & sodium acetate) or a weak base and its salt, and which resists changes in pH by the addition or loss of hydrogen or hydroxil ions.

(ii)	Starter solution is applied to young vegetable and flowering plants at the time of transplanting to help the seedling to establish easily	(ii)	Buffer solution is used in laboratory tests to check changes in hydrogen ion concentration when small amounts of a strong acid or base are added to it.
108.	**Fruits**		**Vegetables**
(i)	Botanically, fruit is a ripened ovary or a group of ovaries with other structures (epicarp, mesocarp, endocarp, *etc*)	(i)	Vegetables are different botanical parts (root, stem, leaves inflore-scence, fruit or seed, etc.) which are commonly used for culinary purpose.
(ii)	A fruit is an edible product of generally woody and perennial plants and its development is closely associated with a flower.	(ii)	A vegetable is an edible product of generally non-woody, herbaceous and annual plants and it may be any part of the plant which is edible.
(iii)	Whole 'fruit' or its part(s) (thalamus, epicarp, mesocarp, endocarp, cotyledons, etc.) is edible	(iii)	All parts (modified roots & stems, leaves, flower stalk, inflorescence, fruit and seeds etc.) are edible.
(iv)	Fruit plants are generally perennials which require special techniques like training & pruning seasonally for better fruiting.	(iv)	Vegetable plants are generally annual or some times biennial and special techniques like pruning & training are generally not required (*only vines are staked or trained*).

(v)	Fruit plants are generally propagated asexually.	(v)	Vegetable plants are generally propagated sexually.
(vi)	Mostly mature and/or ripen fruits are consumed fresh.	(vi)	Mostly tender and/or mature vegetative parts are consumed after cooking and/or fresh as *salad.*
(vii)	Fruits are of acidic nature.	(vii)	Vegetables are of alkaline nature.
(viii)	They are rich source of carbohydrates and vitamins.	(viii)	They are rich in minerals and protein.
(ix)	For canning, fruits are not blanched and filled with *sugar syrup.*	(ix)	For canning vegetables are blanched, and filled with *brine solution.*
(x)	Fruits are sterilized at 100°C (212°F) temperature.	(x)	Vegetables are sterilized at 116°C (240°F) temperature.
109.	**Cool Season Vegetables**		**Warm Season Vegetables**
(i)	Cool season vegetables are those of which the vegetative parts-modified root & stem, leaves, bud, immature flowers, *etc.* are eaten, except sweet potato, New Zealand spinach *etc* which are warm season ones.	(i)	Summer or warm season vegetables are those of which immature fruits are eaten except pea, broad bean, etc which are cool season ones.
(ii)	They are hardy and tolerant to tow temperature and frost	(ii)	They are hardy to sun and susceptible to frost.

(iii)	They require low temperature (10-20°C) for their proper growth and fruiting	(iii)	They require high temperature (30°C or above) and hot summer.
(iv)	Seeds germinate at cooler soil temperature.	(iv)	Seeds germinate at higher temperature
(v)	Root system of these vegetables is shallower.	(v)	Root system of these plants is deeper.
(vi)	Plant size smaller.	(vi)	Plants are larger and spreading.
(vii)	They respond more to N2	(vii)	Less respond to N_2.
(viii)	Examples: beet root, potato, spinach, turnip, tomato, palak, celery, carrot, onion, radish, cole crops, *etc*	(viii)	Examples: beans, brinjal, okra, chilli, cowpea, corn, soybean, cucurbits, New Zealand spinach, sweet potato, *etc.*
110.	**Hydrophytes**		**Hydroponics**
(i)	The plants growing habitually in water or in very wet soils where at least periodically oxygen becomes deficient as a result of excessive water content.	(i)	A system of growing of plants in water solution of essential nutrients without use of soil.
111.	**Seed**		**Grain**
(i)	Botanically, seed is a part of a fruit and is formed by fertilization of ovule within the ovary	(i)	Botanically, grain (*monocot seed*) is a ripened ovary *i.e.* it is a solid fruit containing a minute plant (embryo).
(ii)	Agronomically, seed is a plant part or fruit or seed used for raising a crop.	(ii)	Grain is a fruit and only when used for raising a crop it is called as *seed.*

(iii)	A seed must be viable with living embryo.	(iii)	A grain may or may not be viable but when it is used as seed it must be viable.
(iv)	Cotyledons of a seed (nut crops) or whole seed (seed spices) are consumed and any other asexual or sexual part (seed) or a plant used for multiplication is considered as *seed.*	(iv)	Grains are produced for consumption except that those which are used as seed for multiplication of a crop.
112.	**Breeder seed**		**Foundation seed**
(i)	Breeder seed is the seed or the vegetative propagating material produced by a breeder or an institution where the particular variety is developed.	(i)	Foundation seed is produced under foundation seed programme on Govt. farms or at experimental stations.
(ii)	It is the progeny of *nucleus* or *breeder seed,* and progenitor of foundation seed.	(ii)	It is the progeny of breeder seed, and progenitor of certified seed.
(iii)	Breeder seed is genetically the purest one with 100 per cent germination ability.	(iii)	It is genetically pure with 99% germination ability.
(iv)	Bags of breeder seed are designated by *golden yellow tags* (cards)	(iv)	Bags of foundation seed are designated by *white tags* (cards).
(v)	Isolation distance for breeder seed production is less.	(v)	Isolation distance for foundation seed production is more.

113.	**Hybrid variety**		**Synthetic variety**
(i)	Hybrid variety is the first generation (F_1) progeny of the cross between two pure lines, inbreds open pollinated varieties, clones or other individuals that are genetically dissimilar.	(i)	A synthetic variety is produced by crossing in all combinations of a number of lines that combine well with each other.
(ii)	Hybrids exploit both GCA and SCA	(ii)	Synthetics exploit only GCA.
(iii)	Hybridization can be made by inbred variety cross, intervarietal, inter specific or inter generic crosses.	(iii)	Synthetic variety production can be made by crossing all combinations of lines having a general combining ability.
(iv)	They can be produced in both cross and self pollinated plants/ species.	(iv)	They can be produced only in open cross pollinated crops.
(v)	Hybrids are maintained in the form of their parental inbreds by growing only in isolation.	(v)	Once synthesized, a synthetic variety is maintained by open pollination in isolation.
(vi)	Each year new hybrid seed is required for sowing.	(vi)	A farmer can use the grain/seed produced from a synthetic variety as seed to raise the crop in next year.
(vii)	Hybrid seed production is more tedious and expensive, and thus, seed is costly.	(vii)	The cost of seed in case of synthetics is relatively lower than hybrids.

(viii)	In variable environmental conditions they do not respond well.	(viii)	Synthetic varieties are likely to do better than hybrids in variable environments.
114.	**Pure line**		**Multi line**
(i)	A progeny of a single homozygous self-pollinated plant.	(i)	A mixture of several similar pure lines (genotypes) having different genes for disease resistance
(ii)	Each individual must has same genome	(ii)	For getting stable yield multiline varieties should be sown.
(iii)	It is genetically 100 per cent pure.	(iii)	Multilines are not 100% genetically pure.
115.	**Clone**		**Mutation**
(i)	Clone is a group of plants produced from a single plant through vegetative (*asexual*) reproduction.	(i)	Mutation is a sudden heritable change in the characteristics of an organism.
(ii)	Clone is found in asexually propagated plants	(ii)	Mutation may occur in any plant *naturally* or *artificially*. A new plant/strain produced due to mutation is known as '*mutant*'.
(iii)	Members of a clone have the same genotypes as the parent plant.	(iii)	A *mutant* may differ in genetical constitution from their parent plants.
(iv)	The pheontypic variation in a clone is due to environment only	(iv)	Phenotypic variations in mutants may be genetical as well as environmental.

(v)	Theoretically, clones are immortal *i.e.* a clone can be maintained through asexual reproduction.	(v)	It is a recurrent process and it may become a problem over a long period of time.
(vi)	A clone is always beneficial in yield and regeneration for endangered species.	(vi)	Generally mutations are beneficial, and also have harmful effects on organisms and reduced viability, *e.g.* *'bolter'* mutations in potato.
116.	**Asexual reproduction**		**Vegetative reproduction**
(i)	In asexual reproduction there is no occurrence of fusion of male and female gametes, and asexual reproduction is considered as *vegetative reproduction.*	(i)	Vegetative reproduction is that part of asexual reproduction in which vegetative part of plants is used for their multiplication.
(ii)	Asexual reproduction can be done by vegetative parts of plants or by seed embryos developed without fertilization *i.e.*, nucellar cells in *apomictic seeds.*	(ii)	Vegetative reproduction can be done only by root, stem, tubers, bulbs, corms, rhizomes, leaves and vegetative buds, *etc.*
117.	**Fruit Preserve**		**Candy**
(i)	A preserve is made from properly matured fruit by cooking it whole or in large pieces in a heavy sugar syrup till it becomes tender and transparent.	(i)	A fruit is impregnated with cane sugar and glucose and subsequently drained and dried is called as *candied* fruit

(ii)	Fruit is impregnated with a low percentage of sugar in comparison to candy	(ii)	Fruit is impregnated with a higher percent of sugar or glucose in comparison to preserve.
(iii)	The final syrup strength is 78° brix.	(iii)	The final strength is 75° brix.
18	**Thallophyta**		**Bryophyta**
(i)	It is a broad division of plant kingdom in which lower plants come which have no *thalloids* or leaves.	(i)	It is also a division of plant kingdom and plant of this division have *thalloids* or leaves.
(ii)	Thallophyte have simple structure and their structures are not divided into roots, stems & leaves. Their body is called as *thallus.*	(ii)	Bryophytes have root like structures (rhizoids) but not a true root and also not have conductive tissues (xylem and phloem).
(iii)	Bacteria, Algae, Fungi, Lichen, *etc.* are come under this.	(iii)	Mosses, Liverwarts, *etc.* are come in this division
119.	**Pteridophyta**		**Spermatophyta**
(i)	It is a division of plant kingdom in which plant's structure is chiefly divided into three parts-adventitious roots, rhizome and compound leaf.	(i)	It is broad division of plant kingdom in which plant's structure is divided into root, stem, leaf and flowers. This division is further divided into two sub divisions (Gymnospermae & Angiospermae).
(ii)	Plants are not capable to flower and seed, and have vascular bundles.	(ii)	Plants are capable to flowering and seeding and have well developed bundles and conductive tissues.

(iii)	Plants produce spores in place of seeds and reproduction is done by spores, *e.g.* ferns & their allies.	(iii)	Plants produce flowers and seeds and multiplication occurs by seeds. *e.g.* all angiosperms and gymnosperms. (flowering plants).
120.	**Epigeal germination**		**Hypogeal germination**
(i)	The type of germination in which cotyledons are seen to be pushed above the surface by the elongation of hypocotyl *e.g.* beans, cucurbits, castor, *etc.*	(i)	A type of germination in which the cotyledons remain below the soil surface, as seen mostly in monocots, pea, gram, *etc.*
121.	**Pectose**		**Pectic acid**
(i)	It is found in raw/mature fruits and upto some extent after boiling it can be converted into pectin.	(i)	In over ripe fruits, pectin converts into pectic acid which can not be reconverted to pectin.
122.	**Commercial garden**		**Home garden**
(i)	Commercial gardening is not an ancient practise of vegetable growing but it came in existence very recently	(i)	Growing of vegetables in home area/ compound is as old as history of cultivation.
(ii)	In this type of gardening vegetables are grown on large scale for commercial purpose.	(ii)	In home gardening, fruits, vegetables and ornamental plants are grown in small scale for self consumption and/or beautifying the bungalow compound.

(iii)	It required more land area situated near a city or where the transportation facilities are available.	(iii)	A small land area is available usually in and/or around the home compound
(iv)	Commercial gardening is practice only on the surface of land or water (as *floating garden*).	(iv)	It may be practiced on land available as well as on roofs, terraces and pots, *etc.*
123.	**Hedge**		**Edge**
(i)	Hedge is to be used for screening and/or protection purpose.	(i)	Edge is to be used for lining and demarcation of beds and paths.
(ii)	Hedge is a dense live wall of 2.5' to 10' height made by growing perennial (mostly shrubs) plants.	(ii)	Edge is a demarcation line of upto 30 cm height made by plants (living edge) or bricks/bottles (*mechanical edge*).
(iii)	Mostly ornamental shrubs and some times dwarf foliage trees are grown to make hedge.	(iii)	Perennial and annual plants or bricks, stones, bottles are used to make edges.
(iv)	Some times in hedges, a topiary work can be done.	(iv)	Due to very low height topiary work can not be done successfully.
(v)	Suitable plants: *Clerodendron, inerme, Ingaduleis,* Law *sonia alba Murraya panicvlata, Ixora coccinea, Hibiscus, Bougainvillea, Carissa, carandus,* etc.	(v)	Suitable plants : *Eupatorium,* Iresin, *Justicea, Candytuft* etc.; and bricks, stones, bottles, etc.
124.	**Summer squash**		**Winter squash**
(i)	B.N.-*Cucurbita pepo*	(i)	B.N.-*Cucurbita maxima*

(ii)	Commonly known as *Chappan Kaddu*	(ii)	Commonly known as *Vilayati Kaddu.*
(iii)	Seeds are sown in Jan.-March	(iii)	Seeds are sown in March-April.
(iv)	Generally grown in summer only in plains	(iv)	Commonly grown in hills
(v)	Plants are fast growing	(v)	Plants grow slowly
(vi)	Stem may be erect or trailing and plants are smaller	(vi)	Stems are smooth, trailing type and plants are large
(vii)	Leaves are prickly, deeply notched and hard textured.	(vii)	Leaves are soft textured
(viii)	Fruit stem (pedicel) longitudinally five sided.	(viii)	Fruit stalk (pedicel) is round, soft and spongy.
(ix)	Fruits are smaller and elongated.	(ix)	Fruits are large, fleshy and roundish
(x)	Fruits are harvested when they are immature, tender and green.	(x)	Fruits are harvested only when they are fully mature, and or ripened.
(xi)	Fruits are harvested without leaving any portion of stem.	(xi)	Fruits are harvested with leaving a short portion of stem.
(xii)	Due to immature harvesting fruits can not be stored for long time.	(xii)	Fruits can be stored for 2-3 or more weeks.
(xiii)	Var.- Pusa Alankar, Early Yellow, Green Hubbard, etc.	(xiii)	Var. Arka Suryamukhi, Golden Hubbard, etc.
125.	**Sponge gourd**		**Ridge gourd**
(i)	B.N.-*Luffa cylindrica*	(i)	B.N.-*Luffa acutangula*
(ii)	Commonly known as *Ghiya Taroi.*	(ii)	Commonly known as *Kali Taroi.*

(iii)	Flowers open in the morning.	(iii)	Flowers open in afternoon.
(iv)	Flowers are deep yellow.	(iv)	Flowers are pale yellow.
(v)	Fruit surface is smooth.	(v)	Fruit surface is ridged (5-7 ridges).
(vi)	Fruit pulp is fibrous and at drying the fibrous portion is used as filter or cleaning purpose.	(vi)	Its pulp is also densely fibrous or spongy.
(vii)	Fruits are large and long.	(vii)	Fruits are longer than sponge gourd.
(viii)	Seeds are smooth, thinner, dark black and blunted point	(viii)	Seeds are thicker, light black and pointed.
126.	**Bordeaux mixture**		**Chaubatia paste**
(i)	It is a copper fungicide containing $CuSO_4$, lime and water in ratio of 5:5:50 or 6:6:50 or 4:4:50.	(i)	It is also a copper fungicide containing equal quantities of copper carbonate, red lead powder and lanonin.
(ii)	It is used in liquid form	(ii)	It is used in paste form.
(iii)	It was developed by a French botanist Prof. Millardet (1882) at Brodeaux University, France.	(iii)	It was developed at HETC, Chaubatia (Uttarakhand).
127.	**Photophilous plant**		**Sciophilous plant**
(i)	These are sun loving plants (*photophytes*)	(i)	These are shade loving plants (*sciophytes*).
(ii)	They are light tolerant and do not require shade for their proper growth & development.	(ii)	They are shade tolerant and do not require more light for proper growth.

(iii)	The plants are hardy to sun.	(iii)	Plants are weak, and non hardy to sun.
(iv)	Stem is thick & hard.	(iv)	Stem is thin and soft.
(v)	Internodes smaller.	(v)	Internodes longer.
(vi)	Branches more in number.	(vi)	Less branching.
(vii)	Root fully developed.	(vii)	Roots poorly developed.
(viii)	Flowers are greater in number and take lesser time to bloom.	(viii)	Flowers are less in number and plants take more time to bloom or not blossoming at all.
(ix)	Plants are suitable for growing in open conditions.	(ix)	Plants are suitable for growing indoors.
128.	**Market gardening**		**Truck gardening**
(i)	Vegetables are grown in small area.	(i)	Crops are grown comparatively in larger area.
(ii)	It is intensive method of cultivation.	(ii)	It is extensive method of vegetable growing.
(iii)	Land is situated near the market.	(iii)	Land is located far from the market as one state to another or more.
(iv)	Due to small area, there is less or no mechanization.	(iv)	Farms are fully mechanized.
(v)	Ownership of land is in the hands of seller.	(v)	Ownership is in the hands of producers only.
(vi)	Very short duration fruits and vegetables are grown intensively.	(vi)	Fruits and vegetables having good keeping quality and shelf life are produced extensively.

(vii)	All vegetables are suitable for market gardening.	(vii)	Bulb & tuber crops are more suitable for truck gardening.
129.	**Monocot Plants**		**Dicot Plants**
(i)	The testa and pericarp are fused together in seeds.	(i)	The testa and pericarp are separated from each other.
(ii)	Only one cotyledon is present	(ii)	Two cotyledons are found.
(iii)	Cotyledons are generally thin because they do not store food material.	(iii)	The cotyledons become fleshy due to storage of food material.
(iv)	The coleoptyl and coleorhiza are present at the ends of the plumule and radicale respectively.	(iv)	These two structures are absent and only plumale & radicle are found.
(v)	After some times, the growth of radicle stops and a number of adventitious roots are come out from the base of plumule and form a fibrous root system.	(v)	Tap root in the plant is formed by the continuous growth of radicle.
(vi)	Plants raised from monocot seeds have stems with vascular bundles not arranged in a single cylinder, *i.e. closed vascular bundles.*	(vi)	Plants raised from dicot seeds have stems with vascular bundles in a single circle *i.e open vascular bundles.*
(vii)	Examples: coconut, datepalm, pineapple, banana, onion, colocasia, all grasses, etc	(vii)	Examples: Most of the trees and vegetables and all legumes, etc.
(viii)	Plants are herbaceous annual or perennial or commonly less woody.	(viii)	Plants are herbaceous or woody perennials or annual.

(ix)	Leaves are usually parallel veined and acuminate.	(ix)	Leaves are typically netted and veined in pinnate or palmate form.
(x)	Secondary growth of bundles are not found.	(x)	Wounds and cuts are filled by secondary growth of the tissues.
(xi)	They produce flower parts in groups of three or in multiples of three.	(xi)	Flower parts are in groups of four or five or in mutiples of four or five.
130	**Gymnosperms**		**Angiosperms**
(i)	These are the plants belonging sub-division *Gymnospermae* of spermatophyta division.	(i)	The plants belong to sub-division *Angiospermae* of spermatophyta division.
(ii)	In these plants, companion cells in phloem and trachea in xylem are absent.	(ii)	In this group of plants, companion cells and trachea are found.
(iii)	Transfusion tissues are present.	(iii)	Transfusion tissues are absent.
(iv)	Resin canals are in excess.	(iv)	Resin canals are limited.
(v)	Flowers are generally unisexual.	(v)	Both unisexual and bisexual flowers are found.
(vi)	Archigonia present.	(vi)	Archigonia absent.
(vii)	There is only wind pollination (*aenimophilous*)	(vii)	Pollination may be by different means (wind, insect, birds, etc.)
(viii)	Pollens reach to micropyle directly. Thus there is *single fertilization.*	(viii)	Pollen grains reach first on stigma and thus there is *double fertilization.*

(ix)	Seeds (ovules) are naked and ovary absent.	(ix)	Ovules (seeds) are protected inside a well developed ovary.
(x)	Seeds have more embryos (3-15 cotyledons).	(x)	Seeds may be monocot or dicot.
(xi)	Examples: Thuja, pinus, spruce, cycas, cypress, etc.	(xi)	Examples: All fruits, vegetables, flowers, cereals, legumes, etc.
131.	**Phototropism**		**Chemotropism**
(i)	The bending of stems of plants towards the source of light due to unilateral illumination. The younger stems are positively phototropic.	(i)	The movement or bending in plant organs caused by the stimulus of chemical substances as seen in fungal hyphae.
132.	**Vermiculite**		**Sphagnum moss**
(i)	It is a micaceous soil that expends markedly when heated, and chemically it is a hydrated magnesium-*aluminium-silicate* and also water insoluble.	(i)	It is dehydrated young residue or living portion of acid bog plants in the genus *sphagnum*. Such as *S. papillosum, S. capilloceum, S. palustre,* etc.
(ii)	It is neutral in reaction with good buffering capacity.	(ii)	It is acidic in reaction and light in weight.
(iii)	It has cation exchange capacity.	(iii)	It is plant thus has no cation exchange capacity.
(iv)	It contains mineral nutrients.	(iv)	It not contains mineral nutrients.
(v)	It is able to absorb large quantity of water (3-4 gallons per cubic feet).	(v)	It absorbs more than 10 times water than its own weight.

(vi)	It is the most useful medium for seed germination.	(vi)	It is the most useful rooting medium in air layering and for making moss sticks.
(vii)	It has no fungistatic substances.	(vii)	It contains a specific fungistatic substance which inhibit damping off of seedlings grown on it.
(viii)	Not common in India	(viii)	Commonly used in India.
133.	**Snake gourd**		**Pointed gourd**
(i)	B.N. *Trichosanthes anguina.*	(i)	B.N. *Trichosanthes dioica.*
(ii)	Commonly known as *Chinchida.*	(ii)	Commonly known as *Parwal.*
(iii)	Monoecious in sex form.	(iii)	Dioecious in sex form.
(iv)	It is an annual cucurbit.	(iv)	It is a perennial cucurbit.
(v)	Propagation by seed (*sexual propagation*).	(v)	Propagation by stem cuttings (*vegetative propagation*).
(vi)	Plants are trained over pandal or trellis.	(vi)	Plants are generally allowed to spread on ground or trained over bower or wires.
(vii)	Flower are white and fringed.	(vii)	Flowers are pure white.
(viii)	Fruits are very long (50-100 cm) like snake and tapered at distal end.	(viii)	Fruits are much small and long (5-10 cm) with tapering at both tips.
(ix)	Fruits are light to dark green with white to pale green vertical strips.	(ix)	Fruits are light to deep green with or without strips.

(x)	Tender fruits are harvested.	(x)	Mature and tender fruits are harvested.
134.	**Orchard**		**Garden**
(i)	It is a valuable site embellished with fruit trees only.	(i)	It is a valuable and pleasurable site embelished with different types of plants (fruits, vegetables, ornamentals, etc.).
(ii)	It is developed with the object of income or for self use of products.	(ii)	Its object is mainly to beautify the surroundings.
(iii)	Planting is done at specific distances as recommended for different fruits trees.	(iii)	Planting is done in artistic way to develop a naturalistic effect.
(iv)	Generally land should be levelled.	(iv)	Land may be levelled and/or undullated.
135.	**Tomato**		**Tree Tomato**
(i)	B.N. *Lycopersicon esculentum.*	(i)	B.N. *Cyphomandra betacea.*
(ii)	Plants are annual and herbaceous.	(ii)	Plants are perennial bush.
(iii)	Commonly grown in whole country in cool season.	(iii)	It is commonly grown in S. India at higher elevations (1000-2000 m MSL).
(iv)	Propagation by seed.	(iv)	Propagation by seed as well as by hardwood cuttings.
(v)	Plants start bearing in 2 to 2½ months.	(v)	Plants start bearing in about 2 years.
(vi)	Fruits are round to oval.	(vi)	Fruits are long.
(vii)	Fruits are juicy and sweetish.	(vii)	Fruits are tart.

136.	**European radish**		**Asiatic radish**
(i)	These varieties are temperate type and thrive best in cool climate.	(i)	These varieties are tropical to sub-tropical type.
(ii)	Commonly grown in cool hilly areas.	(ii)	Commonly grown in plains of India.
(iii)	Seeds are sown in September and onwards.	(iii)	Seeds are sown in August to onwards.
(iv)	Seed rate requirement high (12 kg/ha).	(iv)	Low seed rate (10 kg/ha) requirement.
(v)	Sown at closer spacing.	(v)	Sown at wider spacing than european ones.
(vi)	Edible roots are smaller (upto 30 cm).	(vi)	Roots are longer (30-45 cm) than that of temperate types.
(vii)	Roots ready earlier (25-30 days).	(vii)	Roots ready late (40-45 days).
(viii)	They are mild in taste and commonly used as salad.	(viii)	Roots are very pungent in taste and used for cooking as well as salad.
(ix)	Plants produce seeds only in temperate/hilly regions.	(ix)	They seeds well in plains.
(x)	Var.: White Icicle, Pusa Himani, Rapid Red White Tipped, Scarlet Globe, etc.	(x)	Var. : Japanese White, Pusa Desi, Pusa Chetki, Jaunpuri, etc.
137.	**Root Crops**		**Salad Crops**
(i)	Commonly tap root becomes fleshy with some modifications in their form & shape and these enlarged roots are consumed freshly and/or cooked.	(i)	The green leafy vegetables which are consumed uncooked and raw with salt, oil, vinegar and other condiments.

(ii)	A group of vegetable crops whose swollen tap roots, and in some cases, hypocotyl with tap root are edible.	(ii)	Modified roots & stems and leaves and fruits of different vegetables are also used as salad.
(iii)	Mainly tap root is modified as food storage organ and contains fairly large quantities of starch.	(iii)	Generally they do not have fleshy food storage organs except root, bulb & tuber crops.
(iv)	They are herbaceous biennials for seed production except radish which may be annual or biennial.	(iv)	Salad (leafy) crops are annual for seed production.
(v)	Nodes and internodes are absent in edible parts (roots) and have root hairs.	(v)	Salad (leafy) vegetables are always devoid of nodes, inter nodes & root hairs.
(vi)	Root crops include beet, carrot, radish, turnip, rutabaga, etc.	(vi)	Salad crops include lettuce, celery, chicory, parsley, endive chervil, etc.
138.	**Early blight**		**Late blight**
(i)	It is caused by *Alternaria solani.*	(i)	It is caused by *Phytophthora infestans.*
(ii)	Symptoms occur as dead spots with concentric rings on leaves.	(ii)	Symptoms are black to brown fast spreading leaf spots and white mildews on the under side of leaves and water soaked brown lesions on leaf blade.
(iii)	There is no wilting of leaves but chlorosis and necrosis occur.	(iii)	The leaves and stems are dried and whole field shows a burning appearance as fired crop.

(iv)	It is a soil borne disease.	(iv)	It is a seed borne disease.
(v)	The lowest leaves attacked first and then disease progress upwards.	(v)	Generally the lower leaves first show the symptoms and later all parts including petiole, stem (tuber) & leaves are affected.
(vi)	It is not as serious as late blight but causes upto 40% losses.	(vi)	It is the most serious disease of potato and causes 90-100% loss.
(vii)	In dry weather, spots become hard & leaves curl, and in humid conditions affected leaves collapse to form bigger patches.	(vii)	Very low temperature below dew point at night for at least 4 hours and cloudy weather favours to its spread.
(viii)	Occurs in the most of the country as *endemic.*	(viii)	Occurs mostly in hilly areas as well as plains as *epidemic.*
139.	**Scooping**		**Stumping**
(i)	It is the removal of the central portion of mature 'curd' to facilitate easier initiation of flower stalk for seed production.	(i)	It is the cutting/removal of full matured 'head' just below the base keeping the stem with outer whorl of leaves intact.
(ii)	It is practised in cauliflower seed production.	(ii)	It is practised in cabbage seed production.
140.	**Corm**		**Rhizome**
(i)	It is under ground modified stem which stores food.	(i)	It is also a under ground modified stem structure which may be edible or non-edible.

(ii)	It is bulky, short and solid with a smaller base.	(ii)	It is large, long and solid or hollow with broader base.
(iii)	It grows vertically in the ground.	(iii)	It grows horizontally at or just below the ground surface.
(iv)	Corms have distinct nodes and internodes enclosed by the dry brown and fibrous hairy leaves.	(iv)	It has no distinct nodes & internodes and dry leaves and covered by a papery structure.
(v)	Examples: gladiolus, colocasia, elephant foot yam, etc.	(v)	Examples: ginger, turmeric, iris, bamboo, underground stem of canna and banana, etc.
141.	**Ornamental Gardening**		**Landscape Gardening**
(i)	It is a wide term used for growing ornamental plants in artistic way with different garden adornments.	(i)	It comes under ornamental gardening with a new concept of gardening in naturalistic and picturesque style.
(ii)	Generally, it is a formal style of gardening and practiced on levelled land	(ii)	It is an informal or natural style of gardening practiced on undulating as well as levelled lands.
(iii)	It is designed in or around cities where land is flat and limited	(iii)	It is designed around or far from cities where land is unlevelled & unlimited
(iv)	Repetition of same plants becomes less	(iv)	There is more repetition of same plants because every piece of land is landscaped to develop a naturalistic effect.

142.	**Photosynthesis**		**Respiration**
(i)	It is an *endogenic* energy absorbing process.	(i)	It is an *exogenic* energy releasing process.
(ii)	The *kinetic energy* of light is transferred into the potential chemical energy of foods.	(ii)	The *potential chemical energy* of foods is transferred into various forms of kinetic energy.
(iii)	It takes place only in chlorophyll containing tissues of plants.	(iii)	It takes in all the tissues of plants as well as animals.
(iv)	It takes place only in the presence of light.	(iv)	It takes place in light as well as darkness (night).
(v)	The hydrogen (H_2) of water is transferred to CO_2 and the Oxygen (O_2) of water is given off. Thus carbohydrates are synthesized in this biochemical process.	(v)	The hydrogen of organic compounds (simple carbohydrates) is transferred to CO_2 and water (H_2O) is formed.
(vi)	CO_2 is reduced and water is oxidized. Thus it is a *reduction process.*	(vi)	Carbon compounds are oxidized and O_2 is reduced. Thus, it is a *oxidation process.*
(vii)	It always increases the dry weight of plants.	(vii)	It always decreases the dry weight of living organisms.
(viii)	It synthesizes and stores energy.	(viii)	It oxidizes & decomposes organic compounds and releases energy.

143.	**Sweet Potato**		**Irish Potato**
(i)	B.N. *Ipomoea batatas.*	(i)	B.N. *Solanum tuberosum*
(ii)	Family-Convolvulaceae.	(ii)	Family- Solanaceae.
(iii)	Commonly known as *Shakarkand.*	(iii)	Commonly known as *Alu.*

(iv)	It is native of central America.	(iv)	It is native of Peru-Chile region
(v)	Plant is a perennial, twinning or trailing vine.	(v)	It is a herbaceous annual plant attaining a height of about 45-90 cm.
(vi)	Trailing stem bears alternately arranged heart shaped leaves.	(vi)	Profusely branched stem bears pinnately compound leaves.
(vii)	It thrives best in warm-moist tropical climate and considered as warm season crop.	(vii)	It thrives best in cool and moist climate within a temp. range of 40° -50°F.
(viii)	It is propagated by sprouts produced from tubers or by vine cuttings.	(viii)	It is propagated by planting whole or cut tubers having 'eyes' (buds)
(ix)	Its adventitious roots become fleshy due to storage of food and are of elongated and irregular in shape with pale white or reddish skin.	(ix)	Its under ground stem modified into food storage organ which is general round or oval shape with greyish white skin.
(x)	Fleshy tuberous roots (*root tubers*) are edible part of plant.	(x)	Fleshy underground stem (*tubers*) are edible.
(xi)	Its tubers are rich source of starch (18%) and carotene (1180 IU).	(xi)	Its tubers are rich in carbohydrate (22%) and ascorbic acid.
144.	**Ginger**		**Turmeric**
(i)	B.N.-*Zingiber officinale.*	(i)	B.N.-*Curcuma longa*
(ii)	Commonly known as *Adrak.*	(ii)	Commonly known as *Haldi.*

(iii)	The plant is perennial herb consisting of an underground stem (*rhizome*) bearing erect leafy shoots.	(iii)	The plant is a perennial herb consisting of a short and thick underground rhizome and reduced stem bearing tufts of large broad, bright, green leaves.
(iv)	The plants grow best in warm tropical climate and can be grown upto an altitude of 900 meters.	(iv)	Plants require a warm & moist climate and can be grown upto altitude of 4000 feet.
(v)	The inflorescence is an imbricated spike in which the flowers are borne in the axil of large yellowish bracts.	(v)	Pale-yellow flowers covered by greenish-white bracts are borne in a spike inflorescence.
(vi)	The rhizome is a large irregularly lobed, pale, yellowish-brown in colour, 2-4 inches in size and covered externally by brownish scales.	(vi)	The rhizomes are deep yellow to orangish in colour, 7-15 mm thick & 2.5- 7 cm long, nearly cylindrical, slightly curved and tapering at both ends, with prominent tubercle like protuberances.
(vii)	The rhizome's surface is smooth and softer without encircling rings	(vii)	The rhizome surface is rough and hard with encircling ridge like rings.
(viii)	The rhizomes take about 9 months to mature and are harvested when the green leafy stems turn yellow.	(viii)	The plants attain maturity within six months and rhizomes are harvested from January to March.

(ix)	The rhizomes are consumed freshly (*adrak*) or dried (*sonth*).	(ix)	Before consumption, fresh rhizomes are processed by boiling in water and then dried to consume.
(x)	It is rich in starch (42%) and crude fibre (8%).	(x)	It is rich in protein (6.3%), starch (6%) and fats (5.1%).
(xi)	Its characteristic odour is due to volatile sesquiterpene- *zingiberene* and its alcohol- *zingiberol.*	(xi)	The characteristic smell of turmeric is due to a volatile oil containing sesquiterpene ketones - *turmerone* & arturmerone.
(xii)	The pungent principle is an oleoresin - *zingerone.*	(xii)	The bright yellow colour of turmeric is due to the oleoresin- *curcumin.*
145.	**Sweet pepper**		**Tabasco pepper**
(i)	B.N. - *Capsicum annuum.*	(i)	B.N. - *Capsicum frutescenes.*
(ii)	Also known as red pepper, spanish pimento or paprika.	(ii)	Also known as bird chilli, hot chilli or cayenne pepper.
(iii)	Plants are a variable herb or sub-shrub, some times woody at base, much branched and tall (0.5-1.5 m) and annual growth habit.	(iii)	Plants are small and bushy, growing upto a height of 30-90 cm and perennial in growth habit and live for 2-3 years.
(iv)	Flowers and fruits are usually borne singly in the axils of leaves.	(iv)	Flowers and fruits are borne in groups of 2-3 erect berries.
(v)	Corolla milky white, calyx lobing and peduncle solitary.	(v)	Corolla are yellowish white and have two or more peduncles in a node.

(vi)	Fruits are indehiscent, many seeded berry (*Shimla mirch*), large, nearly spherical and dark green in colour.	(vi)	Fruits are small, elongated and conical. When young they are dark, glossy green and later change to red or orange yellow on maturity.
(vii)	Fruits are mildly pungent with a characteristic spicy odour.	(vii)	Fruits are extremely pungent, bitter in taste with a characteristic odour.
(viii)	Bell pepper or shimla mirch are cooked as vegetable when they are green.	(viii)	Hot chillies are generally used as spice (green or dried).
146.	**Black pepper**		**Red pepper**
(i)	B.N.-*Piper nigrum*	(i)	B.N.- *Capsicum annuum*
(ii)	Commonly known as *kalimirch* and it is *king of spices.*	(ii)	Commonly known as sweet pepper or paprika.
(iii)	Family - Piperaceae.	(iii)	Family - Solanaceae.
(iv)	The plant is weak, branched, climbing vine or perennial shrub	(iv)	The plant is herbaceous annual, some times sub-shrub with woody base.
(v)	Commonly cultivated in warm tropics (S.India) as plantation crop.	(v)	Commonly grown in whole India as vegetable crop.
(vi)	From the nodes of the thin stem, adventitious roots, leaves and *catkin* inflorescences arise.	(vi)	Flowers and fruits usually borne solitary in the axils of leaves.
(vii)	The fruit is an one seeded spherical drupaceous berry, ovoid or globose in shape.	(vii)	Fruit is multiseeded, bell shaped, spherical berry.

(viii)	Young fruits are bright red and later turn black & wrinkled on maturity.	(viii)	Young & immature fruits are green and on maturity & ripening they become red or orange yellow.
(ix)	The fruit has a bitter taste and spicy aroma and used as spice.	(ix)	Fruits are mild pungent with a characteristic spicy odour and used for culinary purpose.
(x)	Pungency in black pepper is due to oleoresin - *piperine* and *piperidine.*	(x)	Pungency is due to a volatile compound *capasaicin*
(xi)	Propagated vegetatively by stem cuttings of runner shoots.	(xi)	Propagation by seed.
147.	**Small Cardamom**		**Large Cardamom**
(i)	B.N.- *Elettaria cardamomum*	(i)	B.N. - *Amomum subulatum*
(ii)	It is a true cardamom and also known as green cardamom, Malabar cardamom, Ceylon, Cardamom or *Chhoti elaichi.*	(ii)	It is a false cardamom and also known as Nepal scar cardamom, greater cardamom or *Bari elaichi.*
(iii)	It is one of the most valued spices next to black pepper and commonly known as '*Queen of spices*'.	(iii)	It is the cheap substitute for true cardamon and an important cash crop in eastern region of India.
(iv)	True cardamom is usually grown in evergreen tropical region at an altitude of 2000-5000 feet under light shade conditions.	(iv)	Greater cardamom is cultivated in swampy places, in moist and shady sides of mountain streams and along the hilly slopes, usually at an elevation of 750-1700 m MSL.

(v)	The plant is a bushy perennial herb with a thick ginger like underground rhizome bearing adventitious roots below and aerial stems above.	(v)	The plant is a large bushy perennial herb bearing a lot of surface feeding adventitious roots for their congenial growth
(vi)	The stems are of two types, **vegetative stems** bears numerous, alternately arranged, long lanceolate leaves with sheathing bases, and leaf less **reproductive stems** usually grow horizontally and bear numerous white flowers in the axils of leafy bracts.	(vi)	The leafy stem has oblong lanceolate green leaves which are glabrous on both the surfaces. The plants mature during the third year of their growth, when flowers and fruits are produced.
(vii)	Flowering commences in April-May and continues until July-August.	(vii)	Flowering starts in May and continues upto August.
(viii)	It takes 3-4 months for the fruits to ripe.	(viii)	It takes about 4 months for the fruits to mature.
(ix)	Harvesting is completed in Dec. -Jan (Malabar cardamom) and in March-April (Mysore cardamom). Fruits are picked just before they are fully ripe and generally once a month.	(ix)	Harvesting is done during Aug. to Oct. every year.

(x)	The fruit '*capsule*' is light brown, tri-valved, triangular in shape with papery fruit wall and contains numerous dark reddish-brown seeds enclosed by a membranous aril.	(x)	The fruits are almost the size of nutmeg and dark red-brown and globose capsules (2.5 cm long) contain several seeds in each cell, held together by a viscid sugary pulp.
(xi)	Whole dried fruit '*capsule*' is consumed as flavouring spice.	(xi)	Capsules and seeds are used as a cheap substitute of true cardamom.
(xii)	It is propagated by seeds (seedlings) or bulbs (a section of rhizome or slips).	(xii)	It is commercially propagated by bulbs or slips as well as seeds.
148.	**Black Tea**		**Green Tea**
(i)	It is a fermented product.	(i)	It is unfermented product.
(ii)	The manufacturing of black tea involved four major processes-withering, rolling, fermenting and drying or firing.	(ii)	The tea leaves which are green in color and formed without fermentation are known as green tea.
(iii)	The juice of rolled leaves are allowed to ferment for 3-5 hours and during fermentation, the tannin of leaves partly oxidized and give the leaves their characteristic reddish black colour.	(iii)	The plucked leaves are steamed as soon as possible to destroy polyphenoloxidase and tannin so that fermentation does not take place during rolling.

(iv)	The tea leaves used for the production of black tea are picked with a short stalk.	(iv)	The leaves used for the production of green tea are usually picked without the stalk.
(v)	It is mainly produced in India, Sri Lanka, Indonesia and East Africa.	(v)	China & Japan are main producers of this type tea. India also produces small quantity of green tea but mainly for sale in Iran, Afghanistan and American markets.
149.	**Non alcoholic beverages**		**Alcoholic beverages**
(i)	Also known as 'soft drinks'.	(i)	Also known as "strong drinks' or wines.
(ii)	These may be prepared from infermented fruit juices, from essence flavoured syrups or from the dried leaves or seeds of various plants.	(ii)	They are prepared by fermentation of starchy foods or some fruits by yeasts followed by distillation and rectification.
(iii)	The popular non-alcoholic beverages are tea, coffee and cocoa.	(iii)	The popular alcoholic beverages are *beer, cider, wine, Gin, brandy, Rum, Whisky, Fenni.* etc.
(iv)	The stimulative ingredients of these soft drinks are specific crystalline alkaloids- *Theine (tea), Caffeine* (coffee) and *Theobromine* (cocoa).	(iv)	The stimulative ingredient in these products is mainly *ethyl alcohol* (2-60% acc. to their grade). Alcohol is a poison and in excess it causes harmful effect to the mind.

(v)	Other non-alcoholic beverages or soft drinks used commonly are *Guarana* (from seeds of *Paullinia cupana)* Khat (from the leaves of *Catha edulis), Cola* (from the seeds of *Cola nitida) Cassine* (from leaves of *Ilex vomitoria, Yoco* (from bark of *Paullinia yoco);* Fruit juices and soda water.	(v)	Other fermented beverages are *Chicha* (from maize), *Hard cider* (from apple juice), *Kuass* (from a mixture of malt, barley & rye), *Mead* (from a mixture of honey & water), *Toddy* (from the juice of inflorescence of palms), *Sake* (from rice), etc.
150.	**Unfermented fruit beverages**		**Fermented fruit beverages**
(i)	Fruit juices which do not undergo alcoholic fermentation are termed as unfermented beverages.	(i)	Fruit juices which have undergone alcohol fermentation by yeasts and used fermented or after distillation & rectification.
(ii)	They include natural and sweetened juices, RTS, nectar, cordial, squash, crush, syrup, fruit juice concentrate & fruit juice powder, barley water and carbonated beverages, etc.	(ii)	They include fermented and/or alcoholic containing drinks like wine, champagne, port, sherry, tokay, perry, orange wine, berry wine, *niral toddy*, cider, feni, etc.
(iii)	They are easily digestible, highly refreshing, thirst quenching, appetizing and nutritive.	(iii)	They stimulate and excite the cerebral tissues but in excess they may be harmful/poisonous.

151.	**Oleoresin**		**Gum resin**
(i)	A natural combination of resinous and viscous substances and essential oils extracted from some vegetables and spices, *e.g.* chilli, black pepper, cardamom, ginger, turmeric oleroresins. The oleoresins also include *terpentines* (from coniferous trees), *balsams* (from *styrax*) and *elemis*.	(i)	A mixture of true gums, resins, small amounts of essential oils and traces of colouring matter, *e.g. Asafoetida* (*hing*), from the cortex of the fleshy roots of *Ferula asafoetida, Gulbanum* from lower parts of stem of *Ferula galbaniflua; Myrrh* (from *Commifera caudata; Franki ncense* (from the bark of *Boswellia serrata,* etc.
(ii)	They are liquid or semi liquid in nature and have a distinct flavour & aroma and some times colour as from which it is extracted.	(ii)	They are semi solid or viscous in nature and contain small amount of essential oil and traces of colouring matter.
(iii)	They are obtained from powered product by solvent extraction followed by vacuum concentration.	(iii)	They may be obtained by injury or tapping, but usually occur naturally as milky exudates. Plants of Umbelliferae and Burseraceae are the chief producers of gum resins.
152.	**Carotenoids**		**Anthocyanins**
(i)	A group of yellow, orange, orange-yellow and orange-red pigments present in plant parts - fruits and vegetables.	(i)	These are flavonoid compounds occuring in the cell sap of some fruits and vegetables and responsible for red, blue and purple pigmentation of plant parts.

(ii)	These are either hydro carbons or its derivatives and are composed of isoprene units.	(ii)	These are glycosides which on hydrolysis yield coloured aglycones known as anthocya nidins which are phenylben zopyran derivatives and sugars.
(iii)	Carotenoids may be in forms of *carotene* (carrot, leafy vegetables), *lycopene* (tomato), *capsanthin* (red pepper), *bixin* (annatto) or *neoxanthin, lutein violaxanthin* (green leaves).	(iii)	Anthocyanins are found in forms of *pelargonidin, cyanidin, delphinidin, peonidin, petunidin* and *malvidin.*
(iv)	Coratenoids are fat-soluble.	(vi)	Anthocyanis are water soluble.
153.	**Cacti**		**Succulents**
(i)	*Cactus (pl. cacti)* is the name of one genus.	(i)	Succulents are a group of different fleshy plants.
(ii)	The plants belonging to family *cactaceae* are commonly called as cacti.	(ii)	Succulents may differ in their *genera* and/or family.
(iii)	Cacti have areoles are spine-cushions and some times these areoles are armed with spines or with fine barbed hairs (*glochids*) or with both.	(iii)	Generally succulents do not have spines and plants are devoid of glochids.
(iv)	Cacti are perennials and xerophytic and prefer plenty of sunlight.	(iv)	Succulents may be annual or perennial and xerophytic or mesophytic and may be shade loving as well as sun loving.

(v)	Plants are usually leafless except in the genus *Pereskia*. Leaves modified into spines and fleshy-flattened stems look & work as leaves.	(v)	Plants have well developed fleshy leaves or stem or both.
(vi)	Plants store their food and water in modified fleshy stems.	(vi)	Plants store their food materials in fleshy-succulent leaves as well as stem.
(vii)	The flower petals arise from the top of the ovary.	(vii)	Plants have complete flowers with almost all parts.
(viii)	Flowers have strange variation in their shape, and size and colour and are very short lived.	(viii)	Flowers are of various size, shape and shades and long lived.
(ix)	Flowers arise from or near the areoles.	(ix)	Flowers arise from axils of leaves or terminals of stem and branches.
(x)	The fruit is one-celled berry and seeds are monocot.	(x)	Fruits vary according to plant's family.
(xi)	All cacti are succulents in nature on account of storing water.	(xi)	All the succulents are not cacti.
(xii)	They are usually grown for their strange variation in plant shape and form, size and colour of areoles and thorns and the beauty of flowers of remarkable metallic sheen.	(xii)	They are grown for their ornamental foliage or flowers or both and they are most suitable as indoor plants.

154.	**Bulb**		**Corm**
(i)	Bulb is a specialised underground food storage organ of plant.	(i)	Corm is a modified form of underground stem in which foods are stored as starch.
(ii)	An individual bulb consists of the basal portion of leaves (*scales*), which are attached to a small disc shaped plate like fleshy stem.	(ii)	An individual corm consists of the enlarged and bulky base of a stem which is surrounded by dry, scale like thin leaves.
(iii)	A bulb consists of a short, usually vertical, stems axis bearing at its apex or growing point or a flower primordia enclosed by thick, fleshy scales.	(iii)	Corm is also a short and vertical underground stem but consists of distinct nodes and internodes enclosed by the dry scaly leaves in the soil.
(iv)	Bulbs may be two types- *tunicated* and *scaly*, and food is stored in fleshy scales which are edible in some crops (*onion, garlic*).	(iv)	The whole corm, except thin dry scaly leaves, stores abundant food material (*starch*) which is edible in some crops (*colocasia* elephant foot yam).
(v)	The central core of concentric scales is hollow or semi hollow.	(v)	Corm is a fully solid structure.
(vi)	When planted, adventitious roots develop from the base of their central axis and flower stalks are formed by elongation of central axis upwards.	(vi)	When planted, adventitious roots develop from the lower (basal) portion of a corm, but only one aerial stem develops from the upper part (buds).

(vii)	In general small bulbs (*bulblets*) form around, above, or at the base of the mother bulb.	(vii)	In general, small corms (*cormels*) develop just above the mother corm.
(viii)	Bulbs are produced by monocots and specifically, by certain members of the *lily* family.	(viii)	Corms are produced by certain monocots and generally by *aroids*.
(ix)	Exmaples: onion, tulip, lily, easter lily, narcissuss, garlic, amaryllis, etc.	(ix)	Examples: gladiolus, crocus, colocasia, elephant foot yam, etc.
155.	**Tunicated (laminate) bulb**		**Non-tunicated (scaly) bulb**
(i)	The bulbs which have concentrically arranged, thin, membranous and usually dry outer leaves (*scales*) which completely ensheath the inner portion of the bulb.	(i)	The bulbs which are not surrounded by thin membranous leaves (*scales*).
(ii)	The concentrically arranged inner scales are thick and fleshy due to storage of food material and these fleshy scales ensheath the central axis of the bulb like a *tunic*.	(ii)	The fleshy scales are not concentric but loosely arranged and separated from each other.
(iii)	Examples: bulbs of onion, tulip, amaryllis, hyacinth, etc.	(iii)	Examples: scale like bulbs of lily, garlic, etc.
156.	**Orchid**		**Fern**
(i)	Orchids are a group of flowering plants (*Angiosperms*).	(i)	Ferns are non-flowering plants (*Pteridophytes*).

(ii)	They produce monocot seeds.	(ii)	They produce spores in place of flowers & seeds.
(iii)	Plants may be terrestrial, epiphytic or saprophytic.	(iii)	Ferns may be terrestrial epiphytic or aquatic.
(iv)	Numerous minute and non-endospermic seeds are produced sexually in an inferior ovary.	(iv)	The ordinary fern plant is asexual and is botanically a *sporophyte,* which produces *spores* in *sporangia.*
(v)	Seeds are found in a fruit (*capsule*).	(v)	Spore containing sporangia are found on the under surface or margins of the leaf.
(vi)	Plants are always herbaceous with sympodial stem and abundantly found in temperate and tropical regions.	(vi)	They prefer cool, shady or semi-shaded and moist places both in the hill and plains and are herbaceous in nature.
(vii)	The leaves are simple, alternate or opposite which may be fleshy.	(vii)	Leaves are simple opposite long, large and serrated with pointed or blunt tip.
(viii)	Orchids are grown for their strange and attractive colourful flowers. The lip or *labellum* (a modified petal) is the show part of the flower which show a great range of variation in size, shape, colour and form.	(viii)	Ferns are grown for their dense, dark green and attractive foliage which show a great variation in their size and shape.

157.	**Sympodial orchid**		**Monopodial orchid**
(i)	Orchids in which the growth of main axis, stem or pseudobulb ceases soon, usually at the end of one season's growth, and lateral growth is produced in the following season.	(i)	Orchids which grow continously in one direction stems lengthen indefinitely season after season and bear aerial (adventitious) roots often along the whole length.
(ii)	The main axis is composed of annual portions of successive axes each of which begins with scale leaves and terminates into an panicle inflorescence.	(ii)	The main axis continues to grow year by year and produces flowers only on lateral branches.
(iii)	*Pseudobulbs* (thickened internode of the stem) often develop between the first pair of true leaves.	(iii)	They do not produce pseudobulbs.
(iv)	They possess a short swollen rhizome which produces cylindrical, thread like branched and elongated roots.	(iv)	The roots of monopodials become considerably flattened as they creep over the surface. Adventitious roots develop into a tuber filled up with food reserve.
(v)	They grow horizontally beneath or above the upper surface of soil.	(v)	They grow vertically.
(vi)	Sympodial orchids are tressteiral or epiphytic	(vi)	Monopodial orchids are commonly epiphytic or saprophytic

(vii)	Examples: *Dendrobium, Cymbidium, Cattleya, Bulbophyllum,* etc.	(vii)	Examples: *Galeola altissima, Vanda, Spiranthes,* etc.
158.	**Fern**		**Selaginella**
(i)	The entire fern plant may be only a small hair-like prostrate stem consisting of a few moss like leaves or it may also be a tall tree of 24 m.	(i)	It is commonly known as '*Club moss*'. Plants have small scale-like leaves and may be a minute prostrate annual to an erect or even climbing perennial.
(ii)	Plant has three general organs the root, the rhizome or stem and the leaf (*frond*).	(ii)	Plant has the root, the stem (not rhizome) and fern like leaf (*frond*).
(iii)	Most of ferns are *terrestrial* but some are *epiphytic* or aquatic.	(iii)	Most of selaginellas are terrestrial creepers but some can be grown in pans as semi-aquatics or rockeries.
(iv)	The shape of fronds or leaves may be bipinnate (doubly divided), pinnate or with uniquely shaped cordate pinnules or may be entire (undivided).	(iv)	The fern like foliage is much branched and very handsome, and in various shades of green and some times bronze or bluish.
(v)	Generally they grow round the year in cool, moist and shady location.	(v)	They grow best in rainy season and prefer mild climate.
(vi)	They are propagated by spores, or by division of clump or creeping rhizome	(vi)	Creeping stems root almost at every joint and stem cuttings are taken for propagation.

(vii)	Extremely handsome green and dried leaves can be used in vase & table decoration and in preparing bouquets, button holes, and wreaths as well as whole plants in pots or '*fernery*'.	(vii)	They are suitable for edging beds in a shade garden, emerald gold carpet bedding and leaves (fronds) can be used in preparing bouquets in combinations with flowers.
159.	**Palms**		**Cycads**
(i)	They belong to family- Palmaceae.	(i)	Belong to family - Cycadaceae
(ii)	They have straight unbranched cylindrical or columnar trunks.	(ii)	They look like palms but have no botanical relationship with palms.
(iii)	The spreading canopy of huge feather (pinnate) or flabelliform (digitate) leaves are found at the terminal portion of the trunk.	(iii)	The rosette of leaves arise at the crown of stem and pinnate leaves are fern-like, stiff glossy and gracefully curved.
(iv)	Most of the species prefer sunny situation but some grow well in shade or semi-shade.	(iv)	Most of the plants in this group are slow in growth and prefer partial shade for their growth in the tropics.
(v)	Commonly propagated by seeds but some species like *Rhapis,* produce suckers from ground level which can be propagated by division of the clumps.	(v)	Chiefly propagated from seeds which remain viable for a month and some times by separating offsets/ suckers from stem.

160.	**Sexual propagation**		**Asexual propagation**
(i)	It is the multiplication of plants by their sexual part (*zygotic seed*). Thus, commonly called as *seed propagation.*	(i)	Multiplication of plants by vegetative parts (root, stem, leaf, or nucellar cells in apomictic seeds, etc. Thus, commonly known as *vegetative propagation.*
(ii)	Plants raised by seed are more hardy and well adopted to their habitats and adverse conditions	(ii)	Plants raised by this method require more care to establish well in adverse conditions.
(iii)	Plants are long lived and root system is deeper.	(iii)	Root system is less developed and shallow.
(iv)	Plants developed by this method show genetical differences due to hetero- zygotes in seeds.	(iv)	Plants raised by this method are *true-to-the type* as their parent and differences occur only due to environment.
(v)	Plants are longer and larger in stature	(v)	Plants are generally dwarf in stature.
(vi)	Gestation period of plants is long, and they bear late.	(vi)	They start bearing early and plants are healthy and vigorous.
(vii)	They bear more fruits as they are larger in size.	(vii)	They bear less but quality fruits.
(viii)	Some horticultural plants can only be raised by seeds. *e.g.* most of vegetables, some fruits (papaya, date palm, coconut) and plantation crops (coffee, arecanut, cardamum, etc.	(viii)	Some horticultural plants producing little or no seeds can only be propagated by vegetative means *e.g.* banana, pineapple, pointed gourd, etc.

(ix)	For improvement of existing varieties and evolution of new varieties, *zygotic seed* development and multiplication through seeds is the most important.	(ix)	Plants producing little or no seeds are improved by *clonal selection* or mutation only but for hybridization sexual seed formation is necessary.
(x)	More number of seedlings can be raised at a time by sowing more seeds of a plant or fruit.	(x)	Only a limited off springs are raised from a mother plant.
161.	**Formal style (garden)**		**Informal style (garden)**
(i)	Also known as *geometrical* or *symmetrical* style.	(i)	Also known as *assymmetrical* or *natural* style.
(ii)	It is study of lines and suitable for flat or levelled ground only.	(ii)	It is study of space relation and suitable for flat as well as uneven grounds.
(iii)	Based on geometrial balance.	(iii)	Based on assymmetrical balance.
(iv)	It consists of regular forms regularly placed.	(iv)	It consists of irregular forms irregularly placed.
(v)	Formal arrangements are usually based on bilateral symmetry.	(v)	Plants and garden adornments are selected and arranged to give natural effects.
(vi)	Straight lines and right angles are emphasized on account of their greater precision.	(vi)	It lays more emphasis on curves and round masses.

(vii)	The whole scheme is visible from one point and there is no or little for imagination.	(vii)	As we march ahead new objects are seen.
(viii)	Walks and hedges are prominent and divides the area in different parts.	(viii)	Walks and hedges are not prominent or straight but with zigzag design.
(ix)	Land is forced to fit in plan or design.	(ix)	Plan or design is made to fit in land available.
(x)	It centres on plants and suitable for urban parks.	(x)	It centres at arts and suitable for open rural or hill areas.
(xi)	It is a mixture of symmetrically balanced design with geometrical shape.	(xi)	It combines a number of inadequate balances which forms an unity and beauty is gradually unfolded.
(xii)	It emphasizes the growing of plants without making a picture.	(xii)	It refers making of pictures with plants and aims at an imitation of nature inside the garden.

162.	**Determinate type (tomato)**		**Indeterminate type (tomato)**
(i)	A growth habit where the main axis of the plant or variety terminates with a flower cluster with the ceasure of elongation at this point *i.e.* terminals of shoots terminate into flower buds.	(i)	A growth habit where the main axis of the plant or variety continues to grow indefinitely, *i.e* emergence of inflorescence and elongation of stem/shoot go on side by side.

(ii)	Stem/shoots extend for a small number of nodes only, so growth of stem in limited.	(ii)	Stem/shoot extend for a large number of nodes and elongate throughout the growing season, thus, vegetative growth is unlimited.
(iii)	Plants are low in stature and compact in growth.	(iii)	Plants are high in stature and open or spreading in growth.
(iv)	These plants/varieties develop their fruit for relatively a short period.	(iv)	They produce their fruits for a long period.
(v)	Flowering and fruiting occurs as *basipetal i.e.* from top to bottom.	(v)	Bearing occurs *acropetally, i.e.* from bottom to top.
(vi)	Plants are self-topping or self pruning type.	(vi)	Plants require sufficient staking and training.
(vii)	Due to fruiting/ripening at same time, mechanical harvesing is feasible. Thus fruiting occurs for a short period (for one season/year)	(vii)	Due to continuous growth of plant, fruit maturity and ripening differ which requires picking periodically. Thus fruiting occurs for a longer period (for two or more seasons or year).
(viii)	These varieties are suitable for commercial gardens and canning purposes.	(viii)	These varieties are most suitable for home gardens market gardens and green houses.
163.	**Green house (Glass house)**		**Plastic house (Poly house)**
(i)	Modern green houses consist of foundation wall, side posts, side glass bars and sash, eave plate, roof glazing bars, column, roof ventilating sash, etc.	(i)	Plastic houses also consist of the most materials used in glass house except that a polythene cover in place of glass bars.

(ii)	Green houses are heated by hot water or by steam mechanically.	(ii)	Plastic houses are generally heated either by natural gas (*methane*) or propane.
(iii)	Its construction cost is more.	(iii)	These are low costly.
(iv)	Green houses permit a greater exchange of air due to the cracks between panes of glass.	(iv)	There is less exchange of air due to absence of cracks in the plastic covers.
(v)	The rate of increase in temperature in sunny weather is relatively slow.	(v)	The plastic houses are relatively tight and thus the rate of temperature increase in sunny weather is likely to be more rapid.`
(vi)	They have comparatively little drip due to the drip grooves in the sash bars which carry most of water to the eaves.	(vi)	Due to no provision to carry the drip water to the eaves in plastic houses, the dripping of water is likely to interfere with the irrigation schedule of the plants to increase R.H.
(vii)	Green houses permit a greater transmission of light, *i.e.,* shadows are more intense in glass houses	(vii)	Plastic houses seem to promote a greater diffusion of light.
164.	**Mulching in summer**		**Mulching in winter**
(i)	It is done generally in summer particularly in hot climate.	(i)	It is practised during winter particularly in cool climate.
(ii)	It reduces the rate of evaporation of water from the surface of soil and conserve soil moisture	(ii)	It reduces the loss of heat from the surface of soil and keep the soil comparatively warm.

(iii)	It keeps away the upper layer of soil from getting extremely hot during the mid portion of sunny days, thus, keeping soil temperature close to or within the optimum range for root growth.	(iii)	It prevents heaving of soil, thus keeping the root system intact.
(iv)	It protects the soil from the bullet like impact of intense rain, thus, reducing soil erosion.	(iv)	It reduces the absorption of heat in the early spring, thus, delaying the growth and in some plants, the opening of flowers until the last killing frost.
(v)	It prevents the splashing of soil particles on fruit close to the surface of the soil.	(v)	It keeps the fruit clean, as do summer mulches.
(vi)	It eliminates light from the surface of the soil, thus, preventing the germination of may kinds of weed seeds.	(vi)	It also prevents the germination of weed seeds.
165.	**Central Leader System**		**Open Centre System**
(i)	This training system is also known as '*close centred system*'.	(i)	This system is also known as '*vase shaped system*'.
(ii)	The tree gets a 'dome' shape.	(ii)	The tree looks like a '*vase shape*'.
(iii)	The central leader type of tree has a main branch (*leader*) and a series of well spaced 'subordinate' lateral branches.	(iii)	The open-centre type of tree has no main or central branch but a series of well spaced 'coordinate' lateral branches.

(iv)	The main advantage is the development of strong crotches due to the interlacing of fibres at the junction of the limb and the trunk.	(iv)	All the laterals are given the same dominance by cutting them back equally each year, thus all the co-ordinate branches make the same growth each year.
(v)	Its main disadvantage is shading the interior of the tree due to low penetration of light.	(v)	The main advantage of this form is that light penetration becomes sufficient for the fruiting of inner branches.
(vi)	Due to shading in inner portion of tree, the central leader become weak, thus, shortens the life of the tree.	(vi)	Due to sufficient light penetration tree gets long life and produces more and quality fruits.
(viii	The tree become tall and has a some long stem.	(viii)	The tree is low headed and has a short stem.
(ix)	Due to tall and large size, tree pruning, thinning, spraying and picking operations are difficult.	(ix)	The short stature of the tree facilitates pruning, thinning, spraying and picking operations.
166.	**Square system**		**Rectangular system**
(i)	It is the most common and simplest method of orchard planting.	(i)	It is also simple and similar to square system but not so common.
(ii)	Distance between plant to plant and row to row is the almost same.	(ii)	The distance between row to row is more than plant to plant.
(iii)	Trees are planted at the four corners of the square in straight rows running at right angles, thus, four plants form a square.	(iii)	Trees are planted at the four corners of the rectangle at straight rows, thus, four plants form a rectangle.

(iv)	The number of plants in both sides in rows are same.	(iv)	More plants can be accommodated in a line keeping more space between the rows, and there is difference in the distance between plant to plant and row to row.
(v)	Orchard laidout in this system looks open from both the directions.	(v)	In this system, orchard looks more dense from one direction
(vi)	Cultivation and irrigation and other intercultural operations can be done conveniently from both the directions.	(vi)	In this system also intercultural operations can be done from both the directions.
167.	**Quincunx system**		**Hexagonal system**
(i)	It is also known as '*Filler*' or '*diagonal*' system.	(i)	It is also known as '*equilateral triangular*' system.
(ii)	In this system trees are planted similarly as in square system except that a fifth tree (filler) of short duration is planted at the centre of each square, *i.e.* at the diagonal cut.	(ii)	In this system, trees are planted at the corners of an equilateral triangle and thus, six trees form a *hexagon* with the seventh tree at the centre of hexagon.
(iii)	Two main trees and a filler form an equibilateral triangle.	(iii)	Three main trees form an equilateral triangle.
(iv)	The distance between main trees remains same as in square system but distance between trees in the centre (filler) and the corner (main tree) is much reduced.	(iv)	The distance between row to row is reduced than distance between plant to plant but distance from tree to tree in six directions (hexagon corners) remains same.

(v)	Its layout is as simple as square system and *'filler'* plant can be planted later.	(v)	Its layout is difficult and intercultural operations are done in three directions.
(vi)	All trees are not permanent trees and the central tree (filler) is planted temporarily to fill the central space and to get additional income in the early life of the orchard.	(vi)	All the trees are of permanent nature and it is generally laidout near cities where land is very costly and fertile with ample irrigation facilities.
(vii)	The number of trees including fillers becomes almost double (100+81= 181) then the number in the square system but after uprooting the fillers they remains same as in square system.	(vii)	Hexagonal system accommodates about 15% more plants than in square system, *i.e.* it provides 15% more income from the same piece of land without any increase in the area for trees.
168.	**Triangular system**		**Contour system**
(i)	In this system, the trees are planted as in the square system except that those in even numbered rows (2nd, 4th, 6th.....) are midway between, instead of opposite to those in odd numbered rows (1st, 3rd, 5th,....).	(i)	Paces are marked at various heights of hill from MSL and the points having the same altitude are connected together by a line and the trees are given spacing on this line. Also known as *'terrace'* system.
(ii)	This system is suitable for plains but not of much practical importance as its layout is difficult.	(ii)	This system is meant for hilly or slopy tracts only and much common in these areas.

(iii)	Three trees form a equi-bilateral triangle.	(iii)	Trees in one '*terrace*' form a straight line from one side only. The rows are represented by lines passing through the same contours.
(iv)	This system has no special advantage over the square system except providing more open space for the trees and intercrops.	(iv)	This is the most common method of planting the trees in hilly region and this retards the ill effects of erosion.
(v)	Number of trees reduced to 95 over square system.	(v)	Number of trees can be accommodated according to slope and width of the terrace.
169.	**Floral malformation**		**Vegetative malformation**
(i)	Malformation of the inflorescence (a part of the panicle or all the parts of a panicle) by producing compact mass of sterile flowers (*broom*) being more green and sturdy in a bunch.	(i)	Malformation of the vegetative buds in the leaf axils or the apical meristem of the younger plants by developing numerous abnormally compact rosette like shootlets (*bunchy top*) bearing tiny leaf rudiments.
(ii)	The rachis and secondary branchlets are more thick and short.	(ii)	In malformed shoots tiny leaves and shootlets occur in bunch form with thick leaf stalk.
(iii)	It hits the fruit production directly by converting the panicle to a barren one.	(iii)	It adversely affects the vegetative growth as well as panicle production of a plant.

(iv)	It is very virulent malady occuring in bearing trees of any age and can cause the loss of the entire crop due to no setting of fruits on these panicles.	(iv)	This problem is prevalent on younger trees and not serious on the grown up trees. The affected new shoots on the old trees, however, become thick, stunted and develop a whorl of small leaves.
(v)	All parts of the flower (bracts, sepals, petals and ovary including style) are found larger than those of normal panicles.	(v)	Vegetative buds on leaf axils and growing points become thick and large but shoots and leaves reduced in size too much.
170.	**Black tip**		**Spongy tissue**
(i)	A nutritional disorder of mango fruits characterised by depressed spot of yellowing tissues, which gradually increase and turn black & hard at the distal end of fruits which ripe prematurely.	(i)	A physiological disorder of 'Alphonso' mango in which a non-edible sour patch developed in the mesocarp (spongy flesh) without showing any external symptoms and can be detected only on cutting the ripe fruit.
(ii)	The growth of fruit is almost at a stand still and the fruit becomes soft after premature ripening. Such fruits never reach full maturity and drop earlier.	(ii)	The fruit reaches to full maturity and ripening but a patch of fruit pulp remains unripe due to physiological and biochemical disturbances caused by heat at pre- and post harvest stages and bad odoured cut fruits become unpalatable.

(iii)	It is common in north India and younger fruits (4-6 weeks old) are affected severely.	(iii)	It is common in south India specially in 'Alphonso' variety of mango and mature fruits are affected by this.
(iv)	It is caused due to brick kiln's fume and boron deficiency (nutritional deficiency)	(iv)	There is no nutritional or pathogenic cause but it is a genetical and caused due to unhydrolyzed starch due to convective heat arising from soil at maturity stage.
(v)	It can be controlled by spraying 0.6% borax thrice, and 0.8% caustic soda twice and shifting brick kilns far from the orchard.	(v)	Sod culture, green vegetation or mulching and wind breaks can help in saving the crop from this disorder at pre harvest stage.
171.	**Arid zone fruits**		**Temperate fruits**
(i)	The fruits which can grow successfully in dry/arid climate characterised by low and highly variable precipitation and high temperature and evaporation *i.e.* moisture stress.	(i)	The fruit crops which require a definite chilling winter season and warm summer, *i.e.* temperate climate.
(ii)	They can tolerate alkalinity of high pH soils.	(ii)	They generally prefer slightly acidic loam soils.
(iii)	Trees can tolerate high temperature upto 50°C (as date, kair, ber, etc.) in summer.	(iii)	They are tolerant to low temperature below freezing point during winter.

(iv)	The root system usually consists of deep root system to draw water from deeper soil profile.	(iv)	The root system usually consists of a relatively short tapering/branched taproot and several large, spreading lateral roots which branch into a network of smaller threadlike roots.
(v)	Plants have draught and heat (*loo*) tolerance mechanisms.	(v)	Plants have the mechanism to loterate chilling temperature below freezing point.
(vi)	They shed their leaves in summer and go into the dormancy to conserve moisture.	(vi)	They shed their leaves in the fall and enter into *rest period*. They require a definite chilling period for better flowering.
(vii)	The maximum growth period synchronises with the period of maximum water availability and low vapour pressure deficit in the atmosphere *i.e.* monsoon season.	(vii)	The maximum active growth synchronises with the rising temperature in spring to rainy season.
(viii)	Flowering and fruiting occurs profusely with the onset of monsoon and fruit ripening completed well before the onset of hot summers.	(viii)	Flowering and fruiting occurs profusely with the onset of spring and fruit ripening completed well before the onset of the fall.
(ix)	Examples: ber, date palm, aonla, phalsa, pomegranate, gonda, custard apple, guava, pilu, kair, etc.	(ix)	Examples: apple, peach, pear, almond, plum, walnut, strawberry, etc.

(x)	Growing regions: arid regions of Punjab, Rajasthan, Haryana, Gujarat, Maharashtra, Karnataka, Andhra Pradesh and J & K (Ladakh).	(x)	Growing regions: J&K, Kullu & Kangra Valley, Kotgiri & Nahan (H.P.), Kumaon hills (U.A) and Nilgiril & Palni hills.
172.	**Soft wood grafting**		**Stone (Epicotyl) grafting**
(i)	A detached method of grafting on new terminal growth of seedling (root stock) *in situ*.	(i)	A detached method of grafting on very new growth of seedling (root stock) *in situ* or in polythene bags or in nursery beds.
(ii)	New shoots (2½-3 months old) on stock plants of one or more years old are grafted with scion by following wedge method.	(ii)	Juvenille shoot (7-10 days old) of seedling is grafted with scion by following cleft or splice method of grafting.
(iii)	Scion of one year old is used.	(iii)	Scion of current year's growth is used.
(iv)	The colour of root-stock is green due to more age.	(iv)	The colour of root-stock is bronze as in new emerging seedling with a stone at base.
(v)	Selected scion branch is defoliated leaving only petioles 8 to 10 days prior to expected date of grafting.	(v)	Scion branch of at least 3 months old is selected by remaining all leaves.
(vi)	Commonly practised in mango, sapota, jamun, and cashewnut, etc.	(vi)	Commonly practised in mango, chasewnut, walnut, chestnut, etc.

173.	**Inarching**		**Grafting**
(i)	It is an approach or attached method of scion grafting.	(i)	It is a detached method of scion/bud grafting.
(ii)	The stems of two plants growing independently on their own roots are made or placed to approach together till union completed.	(ii)	Detached scion is placed/carried to the stock plant growing on its own root, *i.e.*, scion is detached before the operation of grafting.
(iii)	Root-stock plant is carried/shifted near to the mother plant.	(iii)	Detached scion is carried to the stock plant.
(iv)	*Matrix* (sliced cut) is made on the middle of the root stock and scion branch.	(iv)	*Matrix* is made on the upper portion of root stock and on the lower portion of scion.
(v)	After completion of the union, the upper portion of root-stock and the lower portion of scion is cut.	(v)	The upper portion of root stock (22.5 cm above ground level) is cut to make the matrix before grafting operation.
(vi)	The diameter of thickness of root stock and scion should be same.	(vi)	The thickness of root stock (generally more) and scion may be dissimilar.
(vii)	This do not provide opportunity to graft a superior variety from abroad with a indigenous root-stock grown far from the mother plant.	(vii)	It provides opportunity to carry and graft superior scions to the root stocks grown anywhere far form the mother plant.
(viii)	There is more success due to providing food by both the mother and root stock plants continuously.	(viii)	There is less success due to defoliation and cutting of root stocks and separation of scions from their mother plants.

174.	**Tillage**		**Mulching**
(i)	It is a soil management practice which loosens soil, changes clod size distribution, kills weeds and increases soil porosity.	(i)	It refers to covering of soil surface with organic or inorganic materials as an aid to soil moisture conservation and weeds suppression.
(ii)	It includes ploughing, pit digging and hoeing.	(ii)	It includes covering the soil surface by plant/organic residues or polythene sheets.
(iii)	It helps in disconnecting capillary connections from sub soil and forms soil mulch and helps in conservation of moisture to be used only by the plant roots	(iii)	It not only helps in conserving moisture by reducing water losses through evaporation but keeps the weed population under control.
(iv)	Tilling of soils at appropriate stage is highly significant for moisture conservation in subsoil strata.	(iv)	Mulching conserves more moisture on upper surface as well as low strata of soil by reducing evaporation by cutting off the radiation falling on the soil surface.
(v)	It enhances the drying of soil by opening the soil surface to the sun.	(v)	It delays the drying of soil and reduces soil thermal regime during day time, and increases soil temperature in winter.
(vi)	It do not prevent the soil surface from the direct hit of rain drops and hot sun rays. Thus, soil erosion increases.	(vi)	It prevents the soil surface from the direct hit of rains and sun rays and also prevents soil erosion and adds organic matter to the soil.

175.	**Drip irrigation**		**Sprinkler irrigation**
(i)	It is a subsurface irrigation system and also called as *trickle irrigation* or *high frequency irrigation,* or daily flow irrigation.	(i)	It is a spray irrigation system and also called as *overhead irrigation.*
(ii)	It involves the application of water below the surface of the soil.	(ii)	It involves the application of water on the surface of crop and soil.
(iii)	Water is supplied slowly under low pressure, drop by drop, to the root zone of the crop only.	(iii)	Water is applied on the surface of crop land under high pressure in the form of spray similar to a gentle rain.
(iv)	Water is conveyed from source (well, tank or pond) through a pipe and its laterals consisting drip type nozzles.	(iv)	Water is conveyed from source through a pipe and its tertiaries fitted with stationary or rotatory nozzles for making the water spray or fine mist. It requires a pump to lift and convey water under pressure.
(v)	This system is the most suitable for arid regions where the availability of water is limited.	(v)	This system is generally suitable and extensively used for protected (*green house*) cultivation and for lawns.
(vi)	Water use efficiency is the highest among all irrigation system.	(vi)	Water use efficiency is lower than that of drip system.

(vii)	The water saving may range from 30-70 per cent because the less loss of water through evaporation and no percolation loss.	(vii)	Water saving is less than drip system because the more loss of water through evaporation
(viii)	Water loss per cent is much less (1-3%).	(viii)	Water loss percent is more (6-20%) than drip system.
(ix)	Installation cost is less than sprinkler system.	(ix)	Installation cost is higher than drip system.
176.	**Surface irrigation**		**Subsurface irrigation**
(i)	An irrigation system in which water is applied directly to the surface of soil from a conveyance method for the crop.	(i)	A method of irrigation in which water is applied directly in the vicinity of the crop root zone below the surface of land.
(ii)	In surface irrigation, water could be distributed by flooding, border/basin method, ring method or furrow method.	(ii)	In sub surface irrigation water is applied through the channels, moles, or pipes (perforated or drip nozzles) spread under ground.
(iii)	In general, this method requires a gentle slope, a deep compact, uniformly textured soil, and plentiful supplies of water and water spread by gravity flow incidential of the land.	(iii)	In general, this method requires relatively large quantities of water and specific soil strata-an *impervious lower layer*, to hold the water against gravitational force; an open, porous intermediate layer to serve as a reservoir for water, and a finely textured top layer to facilitate capillary action.

(iv)	It is not adaptable on rolling land or on fields which contain shallow top soil as it causes soil erosion.	(iv)	It is suitable for slopy lands containing shallow top soil and it controls soil erosion.
(v)	More quantity of water is lost through seapage, percolation and evaporation.	(v)	Water loss by seapage, percolaiton and evaporation is very low.
(vi)	Water use efficiency is much low and wastage (loss) of water is much high (30-50%)	(vi)	Water use efficiency is high and loss of water is very low (2-5%)
177.	**Border irrigation**		**Furrow irrigation**
(i)	It is also known as border *strip* or *check bed* system of surface irrigation where field is divided into a number of long narrow strips with small parallel ridges on the sides.	(i)	A surface irrigation system where furrows are opened between the crop rows at specified intervals.
(ii)	After perfect levelling, strips are connected with the water supply channels.	(ii)	Furrows are levelled in centre and ridged on sides and water is applied through the furrows.
(iii)	The borders may vary from 15-20 cm in height and generally follow the contours.	(iii)	The furrows vary from 10-25 cm in depth and follow the contours.

(iv)	This method is suitable to orchards where intercrops are grown and common in vegetable fields.	(iv)	This method is the most suitable for the crops grown on ridges e.g. root & tuber crops, potato, cucurbits, etc.
(v)	Whole field is irrigated evenly and organic matter & fertilizers are saved within the bed.	(v)	Only furrows are filled with water which moist the ridges through capillaries.
(vi)	More water is required to irrigate whole field.	(v)	There is less requirement of water to irrigate whole field.
178.	**Basin system**		**Ring system**
(i)	A surface irrigation method in which flat inter connected basins are made around the tree trunk.	(i)	A modified basin system of irrigation in which flat/sunken basins (rings) around the tree trunk are connected individually with a common channel passing between the rows of plants.
(ii)	A basin is a small patch of land bunded around a tree which is usually a square or may be circular with the tree in the centre.	(ii)	In this, a basin is made, usually a sunken ring or circle, with the tree in the centre.
(iii)	All the basins or trees in a row are inter connected with an irrigation channel separately.	(iii)	Water is let in through the common channel to the basins (rings) only.
(iv)	Only one row of trees is irrigated through a channel.	(iv)	Two rows of trees are irrigated together through a common channel.

(v)	Organic matter and insect pests and pathogens fallen under a tree is flow out to the other tree/basin or whole row.	(v)	Organic matter, FYM and insect-pests & pathogens do not reach to the other tree/ring, thus, prevents the insects and diseases spreading on other trees.
(vi)	The tree trunk is in the contact of water directly which adversely affect the bark of tree.	(vi)	The soil gradually slopes down from the base of the tree to the 'edge' of ring resulting in a trough, thus prevents the trunk to come in direct contact of water.
(vii)	To irrigate the trees at the terminus of a row, all the trees in a row (channel) must be watered.	(vii)	An individual tree can be irrigated by running water in the common channel.
(viii)	There is less requirement of water to irrigate a row of trees.	(viii)	It requires more water than basin system.
179.	**Top pruning**		**Root pruning**
(i)	It involves the removal of parts of the plant above ground with a view to producing more and superior quality flowers or fruits.	(i)	It involves the removal of portions or all of the younger roots with a view to develop extensively branched root system at the base of plant.
(ii)	Dried, diseased and/or undesirable branches, shoots or terminals are pruned.	(ii)	Younger roots making 'root ball' are pruned.

(iii)	It may be done by *heading back* or *thinning out* or 'pinching' according to bearing behaviour of the plant.	(iii)	It is done only by removal of roots and it not depends on bearing behaviour of tree.
(iv)	It diverts the food translocation to the desired points/branches.	(iv)	It provides artificial rest to the plant as *'wintering'* in roses.
(v)	It promotes the vegetative phase and retards the reproductive phase which may or may not be always desirable.	(v)	It favours reproductive processes and vegetative growth.
(vi)	It always reduces the total amount of growth and influences the vegetative-reproductive balance of the plant.	(vi)	It has the opposite effect of top pruning on the deposition of the carbohydrates and the vegetative balance.
(vii)	It always dwarfens the tree or plant.	(vii)	It also dwarfens the tree or plant in same way, although not to the same degree.
180.	**Stem cuttings**		**Root cuttings**
(i)	Detached stems with or without leaves are called stem cuttings.	(i)	Detached roots used for propagation are called root cuttings.
(ii)	Stem cuttings may or may not have leaves but have some active buds (3-5 buds).	(ii)	Root cuttings are always devoid of leaves and should have adventitious buds.
(iii)	The cuttings can be made from immature (*herbaceous & soft wood* cuttings) or mature stems (*semi-hard & hard wood* cuttings)	(iii)	Cuttings are made from mature roots of pencil thickness.

(iv)	They are planted vertically by having *proximal end* in rooting media and *distal end* above ground.	(iv)	The cuttings may be planted either horizontally or vertically. If planted vertically, the *distal end* is kept at lower side and *proximal end* should be above in the rooting media.
(v)	The size & length of cuttings vary (5 to 22.5 cm) according to the parts cut (herbaceous or hard)	(v)	The length of root cuttings ranges from 5 to 25 cm according to the plant to be propagated.
(vi)	Stem cuttings are made in active growth period or just before the on set of active growing season for the plant.	(vi)	Generally root cuttings are made in early winter and stored in sand, and planted in the onset of spring.
(vii)	It is the most common method of vegetative propagation worldwide.	(vii)	It is not common but in some temperate fruits it is used to produce 'root-stocks'.
(viii)	It is suitable for all (temperate, tropical and sub-tropical) plants to produce true to the types.	(viii)	It is most suitable to plants which enter into the rest/dormancy (temperate fruits) but plants which develop suckers readily are propagated easily by root cuttings.
(ix)	The vegetative buds under ground (in dark in the rooting media) form root system and buds above the ground form stem & bearing portion.	(ix)	A root cutting first produces adventitious shoots and roots appear later from the base of new shoot rather than from the original root (cutting) itself.

181.	**Layering**		**Grafting**
(i)	It involves the production of new individuals usually on stems, by producing adventitious roots on an injured or uninjured node of plant part before they are severed from the mother plant.	(i)	It involves the union of two genetically separate plant parts (*root stock* & *scion*) together so that by tissue regeneration they form a union and grow as one plant.
(ii)	It requires only one mother plant	(ii)	It requires two separate plants (root stock scion)
(iii)	The new individual produced by this method is called as '*layer age*'.	(iii)	The new individual produced by union of two different parts is called as '*stion*' or '*graftage*' which grows on the roots of the stock plant.
(iv)	Its advantages are that the parent plant supplies the new individual with water, food (carbohydrate) and hormones(auxin) until it makes its own foods & hormones.	(iv)	The disadvantages are that only root stock growing on its own roots supplies the water & minerals to its remaining (unsevered) part while scion survives only on its stored food & water.
(v)	It is usually limited to plants which form growing points readily.	(v)	It is limited to plants which develop the secondary plant body i.e. conifers & dicots and monocots can not be grafted very readily.

(vi)	At injured or cut points (nodes) *callus* is formed following emerging adventitious roots which provides water & minerals and a stand for new individuals to grow on their own roots.	(vi)	Two injured portions of root stock & scion unite together by forming a *callus* due to secondary growth of tissues (cambium) and form a new individual which grow on roots of stock plant.
(vii)	It does not facilitate the production of a large number of individuals in a relatively short time, *i.e.* a limited plants can be produced from a mother plant.	(vii)	It is facilitates the production of a large number of individuals in a relatively short time, *i.e.* a large number of scions can be obtained from a mother plant.
(viii)	More healthy, vigorous and large & long plants can be transplanted directly in the field or pot.	(viii)	It takes more time to develop into the transplantable plant except *in situ* grafting and nursed in beds and then transplanted.
(ix)	It does not have any possibility to utilize the good influences of the root stocks or other plants	(ix)	It makes possibilities to change the tops of undesirable trees into desirable one, to grow several kinds of flowers/fruits on one plant and to utilize the influences of root stocks.
(x)	There is no requirement of graft compatibility.	(x)	Both, root stock and scion should be compatible to each other for better performance.

(xi)	The injured portion must be covered with rooting media.	(xi)	The injured portions are only tied to avoid separation from each other.
182.	**Compound layering**		**Mound layering**
(i)	It is also known as *serpentine layering.*	(i)	It is also known as *stooling.*
(ii)	Layering is done by alternately covering and exposing the long slender shoots of the plant over their entire length in the ground.	(ii)	The layering which consists of cutting back the stem of the tree to 10-15 cm above the ground level during the non-growing season and the covering the young shoots with a mound of soil.
(iii)	The layered shoots normally form roots at each node where they are covered and develop new shoots from buds at nodes that are not covered.	(iii)	The covered portion of shoots produce roots in the soil, which are removed in the following fall or spring and set out as separate plants.
(iv)	Commonly two or more plants (layer age) can be obtained from a shoot	(iv)	Only one plant is produced from a shoot.
(v)	It interferes the cultivation and intercultural operations under mother plant.	(v)	There are no interferences with intercultural operations in the orchard.
(vi)	This is practised in plants having long-flexible shoots. e.g. muscadine grape, some ornamental vines, jasmines, wisteria, etc. to produce new individuals.	(vi)	This is generally practised for the production of rootstocks of apple, quince, currants, gooseberry, guava and some ornamental shrubs, etc.

183.	**Ground layering**		**Air layering**
(i)	It involves the covering of the tip or middle portion or whole shoot or the alternate nodes of a flexible stem with moist soil and named accordingly to the portion covered.	(i)	It consists of removing a ring of bark of one to two year old shoots above the ground and covering the cut from surface with a rooting medium air tightly. It is also known as 'marcottage' or *gootee.*
(ii)	The stems/shoots are covered as such or after notching or girdling below the nodes desired to root.	(ii)	The stem is girdled to remove cambium layer just below the node which is desired to root.
(iii)	It is suitable to plants having slender-long shoots which can reach to the ground by bending.	(iii)	It is suitbale to woody trees and shrubs which are unable to bend to the ground.
(iv)	It takes less time to root and to develop into a new individual.	(iv)	It takes more time to root and to develop into a new individual.
(v)	More than one new plants can be produced from a stem at same time.	(v)	Only one new individual is obtained from a shoot at a time.
(vi)	Rooting and success is more.	(vi)	Rooting and success is comparatively low.
(vii)	It is commercially practised for propagation of black berries, climbing roses, spirea, rhododendron, muscadine grapes, etc.	(vii)	It is a commercial method of multiplication of litchi, ficus, persian lime, croton, guava, etc.

184.	**Scion grafting (Grafting)**		**Bud grafting (Budding)**
(i)	It involves the union of two separate, usually woody, plant parts (stems) to form a new plant (*graftage*).	(i)	It consists of uniting a vegetative bud to a seedling stock or to a shoot of mature tree/shrub to form a new plant (*buddage*).
(ii)	Its scion part is a short piece of shoot or twig (10-15 cm long) with 2 to 5 vegetative buds.	(ii)	Its scion part is only a small piece of bark or wood containing a single vegetative bud.
(iii)	The thickness of root stock and scion may be same (*inarching*) or different in their diameter.	(iii)	The thickness of root stock is always greater to the thickness of scion bud.
(iv)	Limited or less number of scions can be obtained from a mother plant.	(iv)	Much more number of scion buds may be obtained from a branch or a mother plant.
(v)	It is most suitable for dicots and conifers having solid stem.	(v)	It is most suitable for trees bearing loose and thick bark.
(vi)	Generally root stock is headed back to make a *matrix* to fit the operated *proximal end* of *scion i. e.* scion is fitted on the upper portion of root stock except inarching & veneer grafting.	(vi)	Generally the root stock is not headed back and cut/incision is made at middle or 15-22 cm above ground to fit the operated bud and root stock is headed back above the inserted bud after *bud take*.

(vii)	It is tedious and less successful in some trees	(viii)	Trees showing much graft incompatibility and hard to unite each other can easily and successfully propagated by budding.
(viii)	It is a commercial method of propagation of mango, loquat, apple pear, cherry, sapota, etc.	(viii)	It is commercially followed in ber, peach, aonla, rose, guava, plum, almond, apricot, etc.
185.	**Shield (T) budding**		**Patch budding**
(i)	It consists of making an incision in the bark of the stock in the form of 'T' and inserting the bud under the bark.	(i)	It consists of removing a square or rectangular piece of bark from root stock and replacing it by similar patch of bark containing a desirable bud.
(ii)	The bud is taken from the *bud stick* along with bark and some wood portion in the shape of *shield* or *boat* hence called as shield budding.	(ii)	The bud is taken from the *bud stick* with bark of same dimension (square/ rectangular) as the matrix is made on the root stock.
(iii)	'T' shape incision on stock holds scion bud firmly and tightly without binding with raffia, rubber band, polythene strip, etc.	(iii)	A patch made on root stock has no flap so there is a chance to drop the inserted bud thus it is necessary to bind thus with warping material as early as possible.
(iv)	Due to shorter base, it provides a small area for secondary growth of tissues.	(iv)	Due to broader base, it provides comparatively a large area for union by secondary growth of tissues.
(v)	It is the most common method of budding and suitable for both the thin and thick barked trees.	(v)	It is a common method of budding and most suitable for thick-barked trees.

(vi)	The length of 'T' shaped incision should be 2.5-4 cm and the length of *'shield'* may be same or some short (2.5-3.5 cm).	(vi)	The patch size should be 2-2.5 cm long & 1-1.5 cm wide in both the root stock and scion bud.
(vii)	It provides early and better union with stock as 'shield' holds better.	(vii)	It takes some more time than 'T' budding for successful union.
(viii)	February, March, June and July months are better for healing as well as growth.	(viii)	It may be practised successfully in any season when bark peels easily and freely.
(ix)	It is commercially practised in rose, aonla, peach, apple, apricot, almond, plum, etc.	(ix)	It is commercially used in pecan, walnut, guava, etc.
186.	**Wedge grafting**		**Veneer grafting**
(i)	It consists of removing a 'V' shaped wedge (*cleft*) of wood tissues down on the top middle of rootstock.	(i)	It consists of making a slanting cut (4-5 cm) on the side of root stock and at the base of this cut, a second, short horizontally downward and inward cut is made to intersect the first cut to remove a piece of wood and bark.
(ii)	It consists of inserting a scion containing 2-3 buds and prepared as a 'wedge' at *proximal end* by removing bark and wood from two sides at base.	(ii)	It consists of inserting a scion containing 3-4 buds and prepared by making a slanting cut (5 cm) on one side and a short slanting cut in the opposite side of first cut at the base (proximal end of scion).

(iii)	Root stock is beheaded before making the cleft ('V' shape cut) on its *distal end.*	(iii)	Root stock is beheaded or not beheaded before making the matrix.
(iv)	Matrix ('V' shaped cleft) is made on top of the root stock.	(iv)	Slanting inward & downward cut (matrix) is made on one side on the stock about 15-20 cm above the ground.
(v)	The combium tissues of root stock and scion are in contact with or close to each other by two sides.	(v)	The cambium tissues of root stock and scion are in contact or close to each other by one side only.
(vi)	About one third to one fourth part of bark and wood at the base of scion is removed from both sides.	(vi)	The cut end is prepared by removing bark & wood to half of scion thickness
(vii)	It takes more time (6-8 weeks) for union.	(vii)	It takes less time (3-4 weeks) to unite as one plant.
(viii)	It is suitable in active growth period (spring & rainy season in evergreens) as well as dormant season.	(viii)	It is practised in active growth period (Aug.-Sept).
(ix)	It is commercially practised in apple, cherry, pear, camellia, mango, etc.	(ix)	It is commercially practised in mango in preference to inarching.
187.	**Tip layering**		**Trench layering**
(i)	It involves the bending and covering the growing tips of stems with moist soil or rooting media to form roots.	(i)	It consists in placing the basal and middle portions of young stems in a shallow trench and covering these sections with moist soil.

(ii)	The bent tips are buried in the soil to depth of 5-7.5 cm.	(ii)	The basal and middle sections of stem are buried in trench to depth of 5-10 cm.
(iii)	Meristem at the tips develops roots and shoots to form new individual	(iii)	Terminal portion of stem is left exposed to manufactured foods and hormones and the root formation occurs from the nodes buried in soil.
(iv)	In general, this method is limited to plants which have flexible stems *e.g.* black & purple raspberries, trailing black berries, longanberries and dew berries, etc.	(iv)	This method requires plant of long and slender stems to bend in a long shallow trench *e.g.* rhododendron, spirea, muscadine grapes, etc.
188.	**Approach grafting**		**Bridge grafting**
(i)	This is asexual method of propagation to reproduce new individual.	(i)	It is not a method of asexual propagation but it is only used to rejuvenate the injured areas of trunk or limbs to save the valuable trees.
(ii)	It consists in joining the stems of two plants growing on their own roots and forming a new plant after union.	(ii)	It consists in joining the two extremes (above and below) of the injured areas (girdles) made by rodents or mechanical means on the trunks or limbs of a tree.

(iii)	Root stock and scion make their food simultaneously till the union completed	(iii)	Due to injured bark (phlolem & combium layer) food made by leaves do not reach to the roots but water from soil is translocated to the top of tree through xylem.
(iv)	After the completion of union, root stock is headed back above the union and scion is severed from mother plant below the union point and new plant (stion) grow on roots of the plant used as root stock.	(iv)	Scion sticks of required length are severed from a healthy desired tree or from the healthy branches of injured tree for bridging the girdles (injuries) on the trunk of same tree or the others.
(v)	It facilitates the development of new individual by using the scion of desired variety	(v)	Bridge grafting facilitates the translocation of food material above and below the girdled portion.
189.	**Sap wood**		**Heart wood**
(i)	The outer region of the old trees is sap wood or alburnum.	(i)	The central region of the old trees is called heart wood or duramen.
(ii)	The sap wood consists of recently formed xylem elements.	(ii)	It is filled up with tannis, resins gums and other substances.
(iii)	It is of light in colour and contains some living cells also in the association of vessels and fibers.	(iii)	It looks black or dark brown due to the presence of various substances in it.

(iv)	It is not hard and durable.	(iv)	It is hard and durable.
(v)	This part of the stem performs the physiological activities such as conduction of water and nutrients, food storage, etc.	(v)	The function of heart wood is not of conduction, it gives only mechanical support to the stem.
(vi)	Generally the vessels are not plugged with *tyloses.*	(vi)	Usually the vessels remain plugged with *tyloses.*
190.	**Primary phloem**		**Secondary phloem**
(i)	The primary phloem is derived from the procambium of the apical meristem.	(i)	This is derived from the vascular cambium which is a lateral meristem.
(ii)	The protophloem and metaphloem elements are clearly demarcated.	(ii)	The secondary phloem is not differentiated into proton and metaphloem.
(iii)	The sieve tubes are long and narrow.	(iii)	The sieve tubes are short and wide.
(iv)	The phloem paranchyma is less developed and scanty.	(iv)	The phloem paranchyma is well developed and abundant.
(v)	*Sclereids* are absent in primary phloem.	(v)	In many plants, sclereids are present in secondary phloem.
(vi)	The phloem fibres, when present, are restricted to the outer most part of the tissue.	(vi)	The phloem fibres are generally found among the phloem paranchyma cells.
191.	**Primary xylem**		**Secondary xylem**
(i)	It is derived from the *procambium* of the apcial meristem.	(i)	It is derived from the *vascular cambium* (a lateral meristerm)

(ii)	It is differentiated in to proto-and meta xylem.	(ii)	It is not differentiated in to proto and metaxylem.
(iii)	The *tracheids* and *vessels* are narrow and long.	(iii)	The tracheids and vessels are short and wide.
(iv)	It may be endarch mesarch or exarch.	(iv)	There is no such distinction in the secondary xylem.
(v)	The *medullary rays* are derived from the apical meristem.	(v)	The *medullary rays* are derived from ray initials of the cambium.
(vi)	The vessels do no contain tyloses	(vi)	The vessels contain tyloses.
(vii)	There are not annual rings	(vii)	The annual rings are well demarcated.
(viii)	The xylem fibres are few in number or absent.	(viii)	The xylem fibres are abundant.
(ix)	It is not differentiated in to sap wood and heart wood.	(ix)	There is clear cut demarcation of sap wood and heart wood in woody trees.
192.	**Xylem**		**Phloem**
(i)	The xylem is the principal water conducting vascular system of the plant.	(i)	The phloem is the principal food (carbohydrate, hormones, etc.) conducting vascular system of the plant.
(ii)	Xylem translocates water and minerals from the soil upward (*acropetal*).	(ii)	Phloem translocates food material from leaves and stem downward (*basipetal*).
(iii)	The xylem is a complex tissue and consists of many type of living and non-living cells.	(iii)	It is a complex tissue and consists of sieve cells and phloem paranchyma only.

(iv)	The xylem is a mechanical tissue containing tracheids vessels and fibres which give strength and rigidity to stems.	(iv)	The phloem as a whole is not a mechanical tissue, however, the phloem fibres are thick walled and aid in mechanical support.
193.	**Stem of monocots**		**Stem of dicots**
(i)	The plant body of monocots is derived from the meristem at the tips.	(i)	The plant body of dicots is derived from the meristem of tips and finally from the cambia - (the vascular-and cork cambium).
(ii)	The vascular cambium in monocots exists for a short time only.	(ii)	The vascular combium in dicots exists from the time it is formed until the plant dies.
(iii)	Mature vascular bundles of monocots lack a cambium and are called *closed bundles.*	(iii)	Mature vascular bundles of dicots contain a cambium and called *open bundles.*
(iv)	There is no secondary growth (secondary xylem and secondary phloem) which lacks wound healing.	(iv)	They show secondary growth markedly thus wounds/cuts heal quickly.
(v)	Since monocots contain a vascular cambium for a limited period only, the stems grow in diameter during the development of the primary tissues only.	(v)	Dicots contain a vascular cambium throughout the life of the plant and they grow in diameter throughout the life of the plant.

(vi)	In moncots, the primary vascular bundles serve as the transportation system throughout the life of the plant.	(vi)	In dicots, the primary bundles serve as the transportation system until the secondary bundles are developed.
(vii)	The inner portion of stem is fibrous, hollow and covered with a thin-hard epidermis only.	(vii)	The epidermis of old stem of dicots is replaced by a thick layer of *cork* or *bark.*
194.	**Fruit**		**Seed**
(i)	Botanically, a fruit is a mature or ripened ovary with adnate parts thereof.	(i)	It is a matured ovule that consists of an embryo, its stored food and protective coverings.
(ii)	It is developed after fertilization or without fertilization of the ovary.	(ii)	The seed develops from the ovule only after few changes.
(iii)	A fruit may be seeded or seedless.	(iii)	A seed may be monocotyledenous or dicotyledenous.
(iv)	A fruit consists of two parts-the *ovary wall* (which develops into pericarp) and the *ovules* (which develop into seeds.	(iv)	A seed consists of embryo and enodsperm in which food is stored.
(v)	The pericarp of fruit generally consists of an outer epicarp, middle mesocarp and inner endocarp which are edible according to fruit type.	(v)	The two integuments develop into two *seed coats* of which out one is the *testa* and inner one is the *tegmen.*

195.	**Pedicel**		**Thalamus**
(i)	It is the stalk of the flower which may be short or long or even absent.	(i)	It is the swollen end of the axis, to which the floral leaves (sepals, petals, stamens and carpels) are attached.
(ii)	It is not edible and only provides support to the flower and/or fruit	(ii)	In pome fruits, thalamus makes an edible part.
196.	**Calyx**		**Corolla**
(i)	This is the first or the lowermost whorl of the flower or the first accessory whorl of it.	(i)	This makes the second whorl of the flower or the second accessory whorl of it.
(ii)	It is composed of a number of green leafy sepals.	(ii)	It consists of a number of usually brightly coloured petals.
(iii)	The primary function of the calyx is to enclose the flower in its bud and protect it from sun and rain.	(iii)	The main function of corolla (petal) is to attract insects for pollination and in the bud stage of the flower, the corolla also encloses stamens & carpels and protects them from external heat & rain.
197.	**Hypogyny**		**Epigyny**
(i)	A phenomenon in which the ovary is being situated at the top on the thalamus.	(i)	A phenomenon in which the thalamus completely encloses the ovary and getting fused with it.
(ii)	The stamens, petals and sepals are separately and successively inserted below the ovary.	(ii)	The flower (thalamus) bears sepals, petals and stamens on the top of ovary.

(iii)	In a hypogynous flower, the thalamus is conical, dome shaped or flat.	(iii)	In an epigynous flower the margin of the thalamus is upward forming a cupular structure to enclose the ovary completely, of course it fused with it.
(iv)	In hypogynous flowers, the ovary is said to be *superior* and rest of the floral appendages *inferior.*	(iv)	Here the ovary is said to be *inferior* and rest of the floral appendages *superior.*
(v)	Hypogynous flowers are found in mustard, brinjal, *magnolia,* china, rose, etc.	(v)	Epigynous flower are found in guava, apple, pear, cucurbits, pomegranate, coriander, etc.
198.	**Simple fruit**		**Aggregate fruit**
(i)	Simple fruits are generally the outcome of the ripening of either inferior or superior and dry or fleshy ovary of one pistil with or without accessory parts.	(i)	Aggregate fruits are a collection of simple fruits or fruitlets developing from an *apocarpous pistil* (free carpels) of a flower.
(ii)	They may be *fleshy* (pome, drupe, pepo, berry, etc.) or *dry* (follicle, legume, capsule, achene, caryopsis, samara, nut, etc.	(ii)	An individual fruitlet is called as *etaerio* and an aggregate fruit may be *etaerio of follicles* (calotropis, michelia), *achenes* (strawberry) *drupes* (raspberry) or *berries* (custard apple).

	Fleshy fruit		**Dry fruit**
199.			
(i)	Simple fruits developed from superior or inferior and fleshy ovary of one pistil with or without accessory parts.	(i)	Simple fruits developed from superior or inferior and mono, bi or polycarpellary ovary of one pistil.
(ii)	They are fleshy and contain high moisture when mature or ripen.	(ii)	They dried and contain low moisture when mature or ripen.
(iii)	Usually they are *indehiscent* when dry and are simple or complex in their structure.	(iii)	They may be *dehiscent* (capsule, pod, regma, siliqua) or *indehiscent* (samara, nuts, cremo carp, etc.)
(iv)	Edible parts may be fleshy receptacle, thalamus, placenta, meso- and endocarp or fruit as a whole.	(iv)	Edible parts are meso and epicarp, cotyledons, endosperm or a seed.
(v)	The fruit wall remains fleshy at maturity in succulent fruits	(v)	The fruit wall dries and become hard at maturity.
200.	**Dehiscent fruit**		**Indehiscent fruit**
(i)	A dry fruit whose pericarp bursts to shed their seeds at maturity.	(i)	Dry fruits whose pericarp dried at maturity but do not split to shed their seeds.
(ii)	Dehisecnt fruits may burst by both the *sutures* (legumes, siliqua, capsule, lomentum, etc.) or by one suture only (follicle, etc.).	(ii)	They do not burst by any *suture* due to hard shelled pericarp at maturity as nuts, samara cremocarp, achenes, etc.

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PART-II

HORTICULTURAL TERMINOLOGY

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TERMINOLOGY

ABIOTIC STRESSES :- Adverse conditions for a crop growth and production caused by environmental factors such as deficiency or excess of nutrition, moisture, temperature and light; frost, drought, etc.; the presence of harmful gases or toxicants and *abnormal soil conditions* (acidity, alkalinity and salinity).It is also called *environmental stress*

ABSCISSION :- Dropping of plant parts (leaves, buds, flowers, fruits, etc.) as a result of an abscission layer of loosely adhering cells at its base which breaks apart readily.

ABSCISSION LAYER :- A layer of thin walled and loosely adhering cells formed at the base of plant parts which become separated from one another through dissolution of the middle lamella before the falling of the organ.

ACCLIMATIZATION :- Gradual process of adjustmet or establishment or adaptation of introduced plant in a new locality or new environmental conditions differ markedly from those of its native habitat.

ACHENE :- It is a one seeded, small dry fruit developed from monocarpellary, superior, unilocular ovary with tough & leathery pericarp. *e.g.* clematis.

ACRIDITY :- The sense of irritation in eating different aroids due to the presence of crystals of calcium oxalate, e.g. Arvi, Elephant foot yam, etc.

ACROPETAL :- Development of organs or movement of liquids/foods towards the apex of plant parts.

ACTINORHIZAL ASSOCIATION :- The association of N_2 fixing *actinomycetes* (a group of multicellular filamentous bacteria) with non-leguminous host plants (trees and shrubs).

ACTIVE COLLECTION :- The collection of genetic resources (germplasm) for short term storage (10 to 15 years). Such germplasm collections are subjected to regeneration. multiplication, evaluation, distribution and documentation after every 10 to 15 years.

ADAPTATION :- The fitness of a genotype or population to a given environment, or the process of adjustment of organisms to the changes in the other environment by which they become more suited to servive and function in a given environment. Adaptation may be of four types- Specific Genotype Adaptation (*AGA*), General Genotype Adaptation (*GGA*), Specific Population Adaptation (*SPA*) and General Population Adaptation (*GPA*).

ADDITIVE VARIANCE :- It is a portion of genetic varaince which is produced by the average effects of different genes at all segregating loci.

ADDITIVE x DOMINANCE EPISTASIS :-Interaction between two loci, one exhibiting lack of dominance and other exhibiting dominance individually.

ADVENTITIOUS BUD/SHOOTS :- Those which arise from any plant part other than terminal, lateral or latent buds on stems.

ADVENTITIOUS EMBRYONY :- A type of apomixis in which the embryos arise from a cell or a group of cells either in the nucleus or in the integuments outside the embryo sac, *e.g.* citrus, mango, *etc.*

AEROPONICS :- A system of hydroponics where the plant roots are continuously or discontinuosly, in an environment saturated with fine drops (a mist or aerosol) of nutrient solution. This method requires no substrate or growing medium and entails growing plants with their roots suspended in a deep air or growth chamber with 100% R.H. The roots are periodically atomized with a fine mist of nutrients. Although a small amount of growing medium may be used to germinate the seed or root a cutting. The first aeroponic system was developed by Dr Franco Massantini at the University of Pia, Italy.

AFTER RIPENING :- Certain physiological and biochemical changes within the seed and/or buds during dormancy or 'rest'. During the after ripening period, some changes like the maturation of embryo, secretion of enzymes, production of

hormones, the absorption of moisture, the diffusion of oxygen into the seed, etc. take place which enable to seed (or bud) to germinate (or sprout). After ripening process occur during the *rest period.*

AGGREGATE FRUIT :- A group of many short fleshy fruits developed from polycarpellary and apocarpous ovaries of a flower. All carpels are associated and form a compound fruit. The group of fruitlets is called as *etaerio*, e.g. custard apple, strawberry, raspberry, blackberry, etc.

AGRICULTURAL CROPS :- The group of certain kinds of plants which produce more food per unit plant or per unit area in terms of quantity and quality than other kinds, and are being grown by man to fulfil his requirements of food, fibre, fuel, etc. These crops are basic elements of agriculture, the activities of man primarily aimed at production of food, fibre, fuel, etc. by optimum use of terrestrial resources.

AIR LAYERING :- It is a layering method of propagation which consists of removing a ring of bark with cambium in aerial shoots and covering the cut from rooting medium till rooting takes place, *e.g.* practised in litchi, lime, croton, etc.

AITONOMIC (STIMULATIVE) PARTHENOCARPY :- A type of parthenocarpy in which fruit development involves pollination (*pollen stimulus*) but no fertilization.

ALBINISM :- The condition of lack of chlorophyll in green plants; and lack of melanin pigment in skin, hair and iris of animals.

ALIEN ADDITION :- Addition of one chromosome of wild species to the normal complements of a cultivated species. When one pair of chromosomes of cultivated species is replaced with those of wild donor species, it is known as **alien substitution.**

ALKALOIDS :- These are heterocyclic, crystaline, basic, nitrogenous compounds of plant origin which are apparent by-product of other metabolic pathways; and they occur in very small amounts rarely above 2 per cent as non-living cell contents

in the leaves, bark, seed, roots, etc. Phytoalkaloids are mild, agreeable palatable, stimulant and therapeutic, or some times highly toxic (Strychnine and Colchicine). Alkaloids are categorized as **mild physiologic stimulants** which are common in non-alcoholic beverages, such as theine in leaves of tea, *caffeine* in seeds of coffee, *theobromine* in seeds of cocoa, and *nicotine* in leaves of tobacco; or *drugs* which are used medicinally such as *morphine* from opium poppy, quinine from bark of cinchona, *colchicine* from meadow saffron, *reserpine* from snakeroot, and *cathartin* from periwinkle, etc.

ALKYLATING AGENTS :- The chemical mutagens which cause mutation by adding alkyl group at various positions in DNA.

ALLELE :- One alternative form of a gene which is located at the same locus on the homologus chromosomes and is inherited in alternative pairs. An allele may be **dominant** (effective) or **recessive** (non-effective) or wild and mutant.

ALLELIC SELF-INCOPATIBILITY :- A type of gametophytic self- incompatibility which is governed by a gene. It may be **monoallelic** (governed by a single gene, as seen in some species of the family Leguminosae, Solanaceae and Cruciferae) or **diallelic** (governed by two genes, as found in the family Graminae) or **polyallelic** (governed by several genes, as found in sugarbeet).

ALLELOPATHY :- Suppression of plant growth of one species by another species by liberation of biologically active allelochemicals (such as *juglone* from walnut and terpenes from soft chaparral) from their root or shoot, which inhibit germination of seeds or growth of roots of other neighbouring plant species.

ALLICIN :- The active principle in garlic which is an enzymatic cleavage product from its precursor allin, a naturally occurring colourless & water soluble aminoacid. Allicin is the principal ingredient of the odoriferous 'diallyl disulphide' compound.

ALLOGAMY :- It is also known as cross-pollination which is the mechanism of transfer of pollen grains of one plant to the

stigma of another plant flowers. Various plant features such as monoecy, dioecy, dichogamy, heterostyly and herkogamy promote allogamy (cross-pollination). Allogamy is the common form of outbreeding which leads to heterozygosity and permits combination of desirable genes from different genotypes or sources.

ALLOSOMAL LINKAGE :- Linkage of genes which are located in allosomes or sex chromosomes.

ALLOSOMES :- The chromosomes, also known as sex chromosomes, which differ in number and morphology in male and female sex.

ALTERNATE SEGREGATION :- The movement of two normal chromosomes (n_1 and n_2) towards one pole and that of two translocated chromosomes (t_1 and t_2) to another pole at anaphase of cell division.

AMINO ACIDS :- These are the organic compounds containing carboxyl (COOH) or acidic group and an amino (NH_2) or basic group; which are basic components of proteins. Amino acids are of two types, *i.e.*, essential and non-essential. There are 20 amino acids required for proper growth and development. e.g., glycine, leucine, lycine, tyrosine, tryptophan, histidine, cystine, methionine, proline, valine, etc.

AMMONIFICATION :- Decomposition and conversion of organic nitrogen into ammonia (NH_4^+) by a group of micro-organisms (soil bacteria, and certain fungi). The ammonia thus formed reacts with other chemicals (*e.g.*, CO_2 and water) present in the soil to form ammonium salts (*e.g.*, ammonium carbonate).

AMPHIDIPLOID :- An *allopolyploid* containing two copies each of two or more distinct genomes *(4x, 6x, etc.)* and as a consequence behaves as a diploid during *meiosis*, e.g. mango.

AMPHIMIXIS :- The normal sexual reproduction in which the morphologically different male and female gametes unite together to form a zygote.

AMPHISARCA :- A superior, multi-celled and multi-seeded

fruit with woody pericarp, in which inner layer of pericarp and the placenta forms the pulpy edible part, *e.g.* wood apple, bael, etc.

ANALOGOUS COLOUR SCHEME :- A colour scheme where the adjoining or related colours of the particular main colour are used together.

ANDRODIOECIOUS :- A sex form in dioecious species where only staminate flowers are borne on one plant and bisexual flowers on another plant of same species or variety are borne.

ANDROECIUM :- The male reproductive component of a flower which consists *stamens* (male organs of the plant). An individual stamen consists of a stalk (*filament*) and an anther (pollen sac). The anther produces pollen grain which in due time contains sperms.

ANDROGENESIS :- The phenomenon of development of embryo from pollens or anthers, where the male nucleus divides and give rise to a haploid embryo.

ANDROMONOECISM :- A type of monoecious form of sex expression where bisexual or hermaphrodite (perfect) and staminate flowers occur separately on the same plant. Plants havings this type of sex expression are called **andromonoecious**. e.g., American varieties of muskmelon or cantaloupe.

ANEUHAPLOID :- Haploid which develops from an aneuploid species. Aneuploids are of four types, viz., *disomic haploids, nullisomic haploids, substitution haploids* (which develop from a substitution line, i.e., n-1+1) and *miss division haploids* (haploid having an isochromosome).

ANEUPLOIDY :- The change in chromosome number which involves one or few chromosomes of the genome. Aneuploids have not an exact multiple of the basic chromosome number (X). Aneuploids are of three types, *viz., monosomic* (2n-1), *nullisomic* (2n-2) and *polysomic*(tri- and tetrasomic).

ANTHOCYANINS :- The group of sap pigments occuring as

glycosides in form of flavonoid compounds (C_6-C_3-C_6) and are responsible for red, blue and purple pigmentation of many flowers, fruits, vegetables and newly emerging leaves. The colour of anthocyanin results from the structure of anthocyanidin which is combined with one or two molecules of monosaccharides and occasionally a pentose sugar. Hence, sugars are necessary for their formation.

ANTIBIOSIS :- Adverse effects of the host on feeding, development and reproduction (i.e., life cycle) of insect-pest. In other words, it is a mechanism of host resistance against insect-pests.

ANTITRANSPIRANT :- This term is used to desinate any material applied to plants for the purpose of retarding transpiration. Retardation of transpiration by artificial means is a desirable objective in the cultivation of high-priced field crops, and in seedling transplantation in nurseries. Colourless plastics, silicon oils, low-viscosity waxes, phenylmercuric acetate (fungicide) are some promising antitranspirats used today with the object of forming a film permeable to CO_2 and O_2 but not to water which retards transpiration from stomata of leaves.

ANTIXENOSIS :- It is also called non-preference or non-acceptance of a host plant which refers to various features (mechanism of host resistance for insects) of host plant which make the host undesirable or unattractive to insects for search of food, shelter or reproduction. While adverse effects of the host plant on feeding, development and reproduction of insects is known as **antibiosis**.

APOGAMY :- A form of apomixis in which development of embryo takes place either from synergids or antipodal cells of embryosac without sexual fertilization.

APOMIXIS :- Development of seed (sexual embryo) without sexual fusion (fertilization), where embryo is produced from a cell in the embryosac or surrounding nucellus which does not undergo meiosis but develops from a zygote of the same genetic make up as the female parent. Apomixis is of four types, viz.,

parthenogenesis, apogamy, apospory and adventive embryony. The seeds (embryo) developed through apomixis are called *apomictic seeds*; and when reproduction in a species occurs by apomictic means only, it is called *obligate apomixis*, and when reproduction takes place by sexual process in addition to apomixis, it is known as *facultative apomixis*.

APOSPORY :- A type of apomixis where development of another embryosac occurs without reduction from the cell of ovule outside the embryosac and then development of embryo directly from diploid egg cell. The new embryosac may develop either from the archesporium (*generative apospory*) or from the integuments or nucellus (*somatic apospory*).

ASEXUAL REPRODUCTION :- The propagation or multiplication of plants without the fusion of male and female gametes, *i.e.*, from asexual parts of the plants, by which true-to-type plants are produced. It is of two types,viz., vegetative reproduction and apomixis.

ASYMBIOTIC N_2 FIXATION :- The chemical union of free atmospheric N_2 with other compounds by the asymbiotic (free living) nitrogen fixers (*e.g.*, aerobic bacteria-*Azotobacter* sp.; anaerobic bacteria-*Clostridium* sp.; and *Cyanobacteria*).

AUTOGAMY:- It is also known as self-pollination, where pollen grain transfers from the anther to the stigma of the same flower. Various mechanisms such as bisexuality, homogamy, cleistogamy, chasmogamy, etc. promote autogamy in crop plants. In highly autogamous plants such as cowpea, clusterbean, dolichos bean, pea, tomato, french bean, fenugreek, *etc.*, cross pollination, if occurs, is less than 5 per cent. Autogamy is the closest form of inbreeding which leads to homozygosity and maintains genetic purity of a species/ variety.

AUTONOMIC (VEGETATIVE) PARTHENOCARPY:- A type of parthenocarpy in which fruits develop without pollination and fertilization, *e.g.* banana.

AUTOSOMES :- The chromosomes which do not differ in

number and morphology in male and female sex.

AUTOTROPHS :- The living beings which have the ability to manufacture complex organic nutritive compounds from simple inorganic sources, *i.e.* they have ability to capture their energy directly as they manufacture substances. Autotrophs, in turn, comprise the **chemomorphs** (organisms which have the ability to transform potential energy in certain inorganic compounds containing sulphur, iron and nitrogen into the chemical energy in foods, *e.g.*, some bacteria) and **photomorphs** (all living organisms which contain chlorophyll and have the ability to transform the kinetic energy of light into the potential chemical energy in foods and other manufactured compounds).

AVAILABLE WATER :- The diference between the field capacity and the permanent wilting percentage, *i.e.*, the amount of water that the plants can absorb or exert from soil, derived from *capillary water* (water that is retained around the soil particles and in the capillary pores of the soil, moving under the forces of capillarity, which is always under a state of tension).

BACK CROSS :- The cross of a hybrid (F_1) with either of its parents and the off-spring of such cross are referred as *back cross generation*. It is useful to transfer most desirable character(s), generally disease resistance, of one of its parent.

BACK PRUNING :- Cutting back of canes to one to two bud level for vegetative growth, generally practiced in grapes in S. India.

BACTERIA :- Unicellular and microscopic free living organisms (*Schizomycetes*) lacking in chlorophyll and well defined nucleus, which may be harmful (causing diseases) and/ or beneficial to the plants and animals.

BACTERIOPHAGE :- A special type of virus which grow only inside the bacteria and kill them.

BAHAR TREATMENT :- Regulation of *bahar* (flowering and fruiting), in fruit crops bearing more than once a year, by cultural, mechanical and/or chemical means, *e.g.* practised in guava, pomegranate, citrus, etc.

BALANCED POLYMORPHISM:- Regular occurence of several phenotypes in a genetic population due to superiority of heterozygote over homozygote. This maintains two or more types of individuals in same breeding population.

BALAUSTA :- A modified form of berry fruit with leathery pericarp and developed from inferior, multi-celled and multi-carpellate ovary; the carpels are placed in two rows, one above the other with thin yellow papery partition wall, the seeds have succulent seed coat *(aril)* which forms the edible part, *e.g.* pomegranate.

BALSAMS :- The highly aromatic and viscous *oleoresins* containing benzoic or cinnamic acid and low oil content, which are tapped as crude turpentine from some conifers (*Pinus insularis, P. roxburghii, Abies balsamea, Styrax* sp.,*etc.*). They are transparent and yield an essential oil on distillation. Different kinds of balsams are- **Canada balsam** or true turpentine (from *Abies balsamea*), **Benzoin** (a solid balsam, have vanilla like aroma, used in medicine as a stimulant and expectorant obtained from *Styrax benzoin*-Siam benzoin, and *Styrax tonkinense*-Sumatra benzoin), **Styrax** (from *Liquidamber orientalis*) and **Gurjun balsam** (from trunk of *Dipterocarpus indicus*). Balsams are industrially used in perfumery, cosmetics and varnishes.

BARLEY WATER :- It is essentially the squash of a fruit containing 25% fruit juice, 30% T.S.S. and 0.25 % barley starch in place of water.

BASE ANALOGUES :- These are the chemical compounds similar to DNA bases such as 5-bromouracil and 2-aminopurine, which are substitutes of thymine.

BASE COLLECTION:- Collection of genetic resources of plants which are meant for medium term storage (upto 100 years). Germplasm or seeds of such type of collection is stored in liquid nitrogen at -18°C to -20°C.

BASE PAIRING :- The pairing of *purine* (adenine and guanine) and *pyrimidine* (cytosine and thymine) bases in DNA molecule.

BASIC NUMBER :- The gametic (genomic) chromosome number (X) of a true diploid species, *i.e.*, the haploid chromosome number of a diploid species or the haploid chromosome number of the ancestral diploid species of the polyploid species.

BERRY :- The most common fleshy type of indehiscent fruits developed from *hypogynous* or *epigynous* flowers having superior & mono or polycarpellary ovary. A berry consists of pericarp, thin epicarp, juicy & fleshy mesocarp and membranous & seeded endocarp layers, *e.g.* tomato, grape, papaya, blue berry, guava, date, etc.

BIENNIAL BEARING (ALTERNATE BEARING) :- Bearing of fruits in alternate years which is marked by normal/heavy bearing in one year *(On year)* and lean/no bearing in the next year *(Off year), e.g.* mango, apple, etc.

BIO-AESTHETIC PLANNING :- The planning of proper utilization of the available flora & fauna in the beautification of the surroundings.

BIOLOGICAL N_2 FIXATION :- The chemical union of free atmospheric N_2 with other compounds , by free living (asymbiotic) and/or symbiotic micro-organisms found in the soil and/or roots of host plants.

BIOLOGICAL NITROGEN CYCLE :- This is the cycle of fixation of gaseous N_2, assimilation of nitrogen by plants and then animals, and return of gaseous N_2 to the atmospere by denitrifying bacteria *Nitrosomonas* sp.

BIOLOGICAL YIELD :- It is the total dry matter production per plant or per unit land area.

BIOMETRICAL GENETICS :- A branch of genetics which deals with utilization of various statistical concepts and procedures in the study of genetics. It includes *quantitative genetics* and *population genetics.* It is also known as mathematical genetics or statistical genetics.

BIOMETRICAL TECHNIQUES :- These are the various

statistical procedures which are used in the study of quantitative genetics.They can be divided into four main groups, viz., (1) aids to assess variability (D^2 statistics, metroglyph analysis), (2) aids to selection of etite genotypes (correlations, path analysis, discriminant function), (3) aids to choose suitable parents and breeding procedures (diallel, partial diallel, line x tester analysis, triallel, quadriallel and generation mean analyses, biparental cross and triple test cross), and (4) aids to the assess varietal adaptability (stability analysis).

BIOMETRICS:-The science which deals with the applicationsof statistical cocepts/procedures to the study of biological problems. It is also known as *biometry.*

BIOTECHNOLOGY :- The science of applications of various biological organisms/procedures for mass production of useful substances/products for industry, medicine and agriculture. It consists of tissue culture and genetic engeneering.

BIOTIC STRESSES :- Adverse conditions for crop growth, development and production caused by biological factors (living organisms) such as diseases, insect-pests and parasitic weeds.

BIPARENTAL CROSS :- Crossing of randomly selected plants in F_2 or subsequent generation of a cross between two pure lines in a definite fashion. This concept was first coined by Comstock and Robinson (1948).

BITTER PIT OF APPLE :- A post harvest disorder of apple caused due to calcium deficiency and characterised by small, brown & necrotic zones in the flesh, 3-5 mm in cross section, more frequent towards the calyx portion of the fruit and sometimes visible through the skin as dark green or brown depressions in flesh.

BITTERNESS IN CARROT :- A storage disorder due to deleterious effect of ethylene to carrot which increases total phenol content and induces the formation of bitter compounds like *isocoumarin* and *eugenin.*

BLACK END OF PEAR :- Also known as hard end of pear. It

is a physiological disorder associated with drought and characterised by blackening and hardening of tissues surrounding the calyx opening accompanied by a pointed or packed apppearance. It is prevalent when *Pyrus pyrifolia* and *P. ussuriensis* are used as root stock.

BLACK HEART OF CELERY :- A physiological disorder due to calcium deficiency resulting in tip burn of the young leaves followed by drying, blackening and killing of the entire heart of the plant.

BLACK HEART OF POTATO :- A disorder of potato especially large tubers where dark grey to purplish or inky black discolouration occurs in the central tissues of tubers and in advanced stages the affected tissues may dry out and separate by forming cavities *(hollow heart).* It occurs due to poor ventilation and high temperature (above 33 ^{0}C) in storage and transportation.

BLACK TIP OF MANGO :- A disorder of mango caused due to brick kilns fumes (SO_2) and boron deficiency specially in younger fruits (4-6 weeks old) and characterised by blackening and hardening of the distal end of fruits which ripe prematurely.

BLANCHING (SCALDING) :- Heat treatment of vegetables to boiling water or steam for 2-5 minutes prior to canning to inactivate the enzymes, setting of natural colours and softening of products for better preservation.

BLEEDING :-This refers to the slow exudation of a watery solution or a milky sap (latex) from an incision made in a plant tissue; *e.g.* in sugar maple (*Acer saccharum*), para rubber tree, poppy, members of milkweed family.

BLOSSOM END ROT OF GRAPE :- A physiological disorder caused due to defective calcium nutrition and assimilation and characterised by a black sunken spot developed at the blossom end of the berry which later on spreads with water soaked region around it.

BLOSSOM END ROT OF TOMATO :- A physiological

disorder caused due to faulty nutrition, irregular moisture supply and high temperature. It is characterised by small & water soaked spots at the blossom end of the half grown fruit which turn light to dark brown in colour, sunken and leathery appearance.

BLOSSOM END ROT OF WATERMELON :- A disorder due to faulty nutrition, irregular irrigation and high temperature and characterised by smooth, leathery, firm, dark green or brown spot, 2.5 to 7.5 cm in diameter around the point of flower attachment.

BOG GARDEN :- An area with stagnant acid soil or water and embalished with bog plants such as sundew, butter worts, *Sagittaria,* etc.

BOLTING :- Initiation of seed stalk or significant stem elongation that proceeds flowering or premature emergence of flower stalk as in case of onion.

BONSAI :- A fascinating Japanese art of growing of woody trees or shrubs in shallow container in miniature form by extreme dwarfing so as to get natural replica of plants as it appears in nature.

BOTTLE GARDEN :- The art of making a miniature garden by growing delicate plants inside a bottle or glassware.

BOTTLE NECK :- A defect of ketchup caused due to oxidation of ferrous tannate due to reaction between tannins of spices and iron equipment. It is characterised by the formation of black ring on the surface of the ketchup in the neck of the bottle.

BOTTOM HEAT :-The application of artificial heat to the rooting medium to keep the basal or proximal end of cuttings relatively warmer than distal tops, which facilitates rapid root formation; usually applied in hard wood cuttings. Bottom heat is supplied in various ways such as by lead-covered electric resistance wires, and by steam or hot water in pipes.

BOULEVARD :- A strip of land between two wide roads protected with low fence and beautified with ornamental plants.

BOUQUET :- A type of floral arrangement utilizing nicely cut flowers, usually presented to kith and kin on the occasion of birthday, marriage or welcome.

BRACING :- A method of strengthening branches that form weak crotches in which a small branch is grafted or supported from one branch into an adjacent branch and sometimes small branches from the two limbs are twisted together and allowed to unite naturally.

BRACTS :- The modified leaves usually associated with a flower or inflorescence, which are either leafy or fleshy. Some times they are *brightly coloured* and take the place of petals, as in dogwood, poinsettia, and bougainvillea; and in others, they become *fleshy* and are used as food, as in Globe artichoke. Whereas, *bracteoles* are small leafy or scaly structures on any part of the flower stalk in between bract and calyx.

BREBA :- The first crop of the pistillate fig tree which matures in the spring.

BREEDING TECHNIQUES :- Various breeding methods/ procedures (introduction, selection, hybridization, mutation, etc.) which are used for genetic improvement of crop plants in relation to their economic use.

BRITISH THERMAL UNIT (BTU) :- The thermal unit which refers the amount of heat required to raise temperature of one pound of water to 1°F. The thermal units are also measured in gram-calorie (g-cal) which is the amount of heat required to raise temperature of one gram of water to 3.5 to 4.5°C.

BROWN CORE :- A low temperature disorder of apple characterised by browning and necrosis of flesh around the seed cavity and in the flesh underlying the stem cavity.

BROWN HEART OF BEET :- A physiological disorder due to deficiency of boron and characterised by young unfolding leaves which fail to develop normally and eventually turn brown or black with a rough, unhealthy and greyish coloured roots.

BROWN STAINING :- A type of chilling injury in grapefruit and mandarins characterised by diffuse irregular superficial discolouration of the peel.

BROWNING OF CAULIFLOWER :- A physiological disorder due to boron deficiency and characterised by the development of pinkish or rusty-brown areas on the surface of the curd.

BROWNING OF LITCHI :- Discolouration of the pericarp associated with desiccation of fruit and development of off-flavour after harvest.

BULK BREEDING :- It is also known as bulk method, which is a selection procedure used in segregating population of self-pollinated crops in which material is grown and harvested in bulk plots from F_2 to F_5 generations with or without selection; and next generation is grown from bulk seed and individual plant selection is practiced in F_6 or later generations and progenies of selected plants are evaluated as done in the pedigree method.

BULL HEAD OF ROSE :- A disorder characterised by flowers having shorter stalks and larger number of petals and petaloids than normal ones due to insufficient carbohydrate supply to developing buds and hard pruning or thrips infestation.

BURR KNOTS :- Rough or irregular protuberances on the stem caused due to preformed latent root initials, as seen in some cultivars of apple and quince.

BUTTON SHEDDING :- Shedding of immature nuts in coconut plants due to lack of pollination, hormonal imbalance, nutritional imbalance and insect-pest or disease attack, etc.

BUTTONING IN CAULIFLOWER :- A disorder due to deficiency of nitrogen or late planting of seedlings of early varieties and characterised by formation of small curds or buttons.

C_3 PLANTS :- The plant species that do not have *Kranz leaf anatomy* and in which during photosynthesis, the first product is C_3-phosphoglycerate (3-phosphoglyceric acid) to which CO_2

fixation takes place largely. Thus, there is only one sink (pathway for formation of initial compound) in C_3 plants. C_3 plants have chloroplasts in mesophyll only with high rates of transpiration and photorespiration. Such plants are less efficient than C_4 ones in conversion of solar energy to dry matter production. e.g., spinach, lettuce, carrot, beans, beet, cabbage, cucumber, crotolaria, mustard, oak, onion, potato,etc. and all evergreen and deciduous tree species.

C_4 PLANTS :- The plant species having *Kranz leaf anatomy* in which during phtosynthesis, the initial product is C_4-dicarboxylic acid as primary CO_2 fixation product followed by decarboxilation of initially produced 4-C acids (malate and asparate) which leads to the production of carbohydrates in vascular bundle sheath cells rather than in chloroplast containing cells. Thus, there are two sinks (pathways)- one results in formation of C_4-dicarboxylic acid and the other , consisting of the decarboxylation of the acid, results in the formation of the reductive pentose-phosphate cycle. In contrast to C_3 plants, C_4 plants are more (at least twice) efficient in the conversion of solar energy to dry matter production under conditions of high light intensity and high temperature (30-40°C). C_4 plants have chloroplasts in both the mesophyll and bundle sheaths and show low transpiration and little or no photorespiration. e.g. corn, sugarcane, amaranth, coastal bermuda, etc.

C_4 SYNDROME :- The set of characteristics that distinguished C_4 plants from C_3 plants is often referred to collectively as C_4 syndrome.

CALLUS :- The undifferentiated mass of parenchymatous cells with various stages of lignification proliferating from cut tissues in response to wounding resulting in union of grafts or rooting of cuttings.

CALLUS :- An irregular and unorganized mass of regenerated parenchymatous cells in culture medium with various stages of lignification which proliferate from cut tissues in response to wounding in normal condition. The aseptic (pathogen free) culture of cell masses on agar medium is known as callus culture.

CALYX SPLITTING :- A physiological disorder of carnation causing splitting of calyx resulting in poor quality flowers. It may be due to sudden fluctuations in day and night temperature, genetic factors, nutritional deficiencies, etc.

CAM PLANTS :- All the plants (specifically plants belonging to the Crassulaceae family,e.g.,*Kalanchoe, Bryophyllum, Sedum*) displaying Crassulacean Acid Metabolism (CAM) are called as **CAM plants**. Such type of plants possess the succulent habit and leaves- and frequently stems and petioles- are fleshy or succulent, and they display a diurnal pattern of organic acid formation.The plants of family-Cactaceae, Agavaceae, Orchidaceae, Portulacaceae and Crassulaceae are generally referred to CAM plants.

CAMBIUM :- A thin layer of tissues as region of differentiation between phloem (bark) and xylem (wood) tissues. The cambia tissues consist of vascular cambium and cork cambium, where, *vascular cambium* is derived from certain parenchyma cells between the primary phloem and the primary xylem, and differentiates into secondary xylem, secondary phloem and medullary rays; and *cork cambium,* rectangular cells with no intercellular spaces, develops from certain cells in the pericycle or cortex and give rise to the layer of cork or bark by taking the place of the epidermis, usually in roots and stems of dicots. Thus, cambium develops secondary plant body, usually in gymnosperms and dicots only.

CANNING :- The process of preserving fruits/vegetables airtightiy in containers with 33-50% sugar solution (fruits) or 2-3 % brine solution (blanched vegetables) followed by sterilizing them by heat.

CAPRIFICATION :- The process of pollination of long styled flowers of edible figs (*Smyrna & San Pedro* types) with pollen grains from a wild or 'male' fig (*Caprifig*) by a wasp *(Blastophaga psens).*

CARBOHYDRATE :- A non-nitrogenous organic compound containing carbon, hydrogen and oxygen (C,H,O) elements only

and yields only polyhydroxy aldehydes (-CHO group) or ketones on hydrolysis.Crop plants in general produce dextroforms (dextrorotary or D-forms) of carbohydrates like D-glucose. Carbohydrates are principal constituent of all plant parts except seeds.The alfa dextrorotary form constitutes the building block needed to make the storage forms of carbohydrates- sucrose, dextrin, starch, inulin, and hemicellulose-substances which contain free energy in potential form. These storage forms are not only necessary for the life of plants but they also provide mankind with available supplies of free energy in the potential form; e.g. grape stores glucose in its fruits, sugar beet stores sucrose in its roots, and potato and sweet potato store starch in their tubers and roots, respectively. Carbohydrates are of three types, viz., *monosaccharides* (such as glucose, fructose, galactose, mannose, etc,) *oligosaccharides* (such as sucrose, maltose, lactose, *etc.*) and *polysaccharides* (such as starch, inulin mannans, or structure such as cellulose and hemicellulose).

CAROTENE :- It is the orange-red carotenoid pigment, associated with chlorophyll and thus occurs in all green tissues of plants, which is the precursor or mother substance of vitamin-A. In hydrolysis, one molecule of Beta- carotene (C_40H_{56}) is converted into two molecules of water soluable vitamin-A, the compound necessary for normal vision. In addition to green parts, it is also stored in the fleshy roots of carrot, in yellow-fleshed varieties of sweet potato, turnip, rutabaga, peach and yellow-flesh of tomato, mango, papaya, etc.

CAROTENOIDS :- A group of yellow, orange and orange-red fat soluble plastid pigments found in chromoplasts. These are either hydrocarbons or its derivatives and are composed of isoprene units. Carotenoids found in different plants may occur in different forms like *carotene* (yellow colour in carrot), *lycopene* (red colour in tomato), *capsainthin* (red colour in chiili), *xanthophyll*, lutein, vioxanthin, neoxanthin, bixin, etc.

CARPET BEDDING :- Covering an area, preferably by a bed or series of beds with dense low growing herbaceous plants

and creating figure according to a set of design.

CATFACE OF TOMATO :- A disorder due to abnormal growing conditions during formation of the blossom and characterised by the distortion of the blossom end of fruit showing ridges, furrows and blotches resulting in death of the cells & black discolouration at the blossom end of the ovary.

CAULIFLOROUS BEARING :- Bearing of flowers and fruits directly on the branches or main trunk in place of axillary bearing, *e.g.* cocoa

CAVITY SPOT OF CARROT :- A physiological disorder due to calcium deficiency and characterised by appearance of cavity in the cortex and in most cases the subtending epidermis collapses to form a pitted lession.

CELL CULTURE :- A type of tissue culture in which a whole plant is regenerated from a single somatic cell or germinal cell (pollen) in culture medium.

CELL DIVISION :- The process of reproduction of new cells from the pre-exhisting cell. It may be either *mitosis* or *meiosis*. The period in which one cycle of cell division is completed is known as *cell cycle*, which consists of interphase and mitotic phase.

CENTRAL LEADER :- A method of training of trees by allowing the main trunk to develop without interruption and primary lateral branches arise from this main trunk at various intervals upwards resulting in the formation of a tall tree.

CENTRE OF DIVERSITY :- A place, region or area where maximum variability of crop plant species and/ or their wild relatives is observed. Some times it is called **'centre of origin'** which refers an area where the specific plant species is beleived to have originated in its greatest genetic diversity within a centre of diversity. The centres of diversity may be *-primary centres* (the original homes of crop plants which are generally uncultivated areas), *secondary centres* (the cultivated areas with vast genetic diversity of a plant species) and*micro-centres* (small

areas within the centre of diversity with a tremendous genetic variability of crop plants).

CENTROMERE :- It is also called primary constriction or kinetochore, which is the region of chromosome with which spindle fibres are attached during metaphase.When centromere is located at median of a chromosome, it is called as *metacentric chromosome* which assumes 'V' shape at anaphase. According to the number of centromeres, a chromosome may be acentric (no centromere), *monocentric* (single centromere), *dicentric* (two centromeres), or *polycentric* (several centromeres); while according to location of centromere, a chromosome may be *metacentric* (centromere located at median), *acrocentric* (centromere located very near to one end), or *telocentric* (centromere located at one end).

CERTIFIED SEED :- It is the progeny of either foundation or registered or certified seed that is so handled as to maintain satisfactory genetic purity and identity and that has been approved by the Central or State Seed Certification Agency. This category of seed is distributed to farmers for cultivation.

CHARACTER:- Any feature of an individual showing heritable variation due to anatomical, physiological, biochemical and behavioural properties which are a product of genotype x environmental interaction. It is also referred to as traits; which are of two types, viz., *oligogenic* or *qualitative characters* (traits governed by one or few genes) and *polygenic* or *quantitative characters* (traits geverned by several genes).

CHASMOGAMY:- A built-in mechanism of pollination where fertilization occurs after opening of flowers. It promotes self-pollination (autogamy), as seen in egg plant, chilli, tomato, etc.

CHEMICAL DORMANCY :- Type of seed coat dormancy in which germination inhibiting chemicals (phenols, coumarin & ABA) accumulated in the fruit as well as in the seed coverings and strongly inhibit germination, *e.g.* citrus, cucurbits, grape, tomato, stone fruits, etc.

CHIASMA :- It is the point of exchange of segment between non-sister chromatids of homologous chromosomes during pachytene in meiosis; and the movement of chiasma away from the centromere towards the end of tetrad is known as *chiasma terminalization.*

CHILLING INJURY IN CITRUS :- The low temperature injury characterised by the appearance of sunken & brown coloured pits on the peel surface when fruits are stored at temperatures below 10 ^{0}C. It occurs most frequently on grapefruit, lime & lemons.

CHILLING INJURY OF BANANA :- The low temperature injury which starts at 12-13 ^{0}C and characterised by the appearance of subepidermal brown streaking, loss of flavour, building up of tannins, watery dark green patches on skin, bitterness of fingers, decrease in ascorbic acid, low conversion of starch to sugar and delayed ripening, etc.

CHILLING REQUIREMENT :- Cold period required for certain plants (temperate) to break physiological dormancy or rest and it is expressed in terms of the required number of hours at

7.2 ^{0}C or less. :-

CHIMERA :- A plant consisting a mixture of two or more genetically different tissues in the same part of a plant which may result from mutation, irregular mitosis, somatic crossing-over or artificial fusion of unlike tissues.

CHLOROPHYLL :- This is a green colour pigment found in chloroplasts (plastid with green colour) of higher plants, which trap the kinetic energy of sun light for the combination of CO2 and H_2O in the photosynthetic reaction.Chemically, chlorophyll is made up from carbon, hydrogen, oxygen, nitrogen and magnesium (i.e., Cn, Hn, On, Nn, Mg, where, *n* is the number of molecules). Thus, both magnesiumand nitrogen are essential for for chlorophyll formation. A chlorophyll molecule consists of two pigments- chlorophyll- a ($C_{55}H_{72}$ Mg O_5 N_4) and chlorophyll- b ($C_{55}H_{70}MgO_6N_4$), where in both pigments,

magnesium is the centre of the molecule and pyrrole rings containing nitrgen are on the outside.

CHROMATID :- One of the two distinct longitudinal subunits of a chromosome, *i.e.*, longitudinal half-chromosome produced by replication during cell division.

CHROMOMERE :- The linearly arranged bead like structures found on the chromosomes; while the thread like coiled structures found in the chromosomes and chromatids are known as *chromonema* or *chromonemata.*

CHROMOSOME :- Small, dark-stained and rod shaped bodies containing genes arranged in linear order which are visible under light microscope in the nucleus during mitotic metaphase of the nuclear division of the cell. The chromosomes were first discovered by Strasburger in 1875, and the term chromosome was coined by Waldeyer (1888).

CHROMOSOME BANDING :- The differentially stained regions (*dark and light zones*) of chromosomes as a result of treatment with various dyes visible under light or flourescene microscope, and this pattern of banding is highly specific to a specific chromosome. The technique of chromosome banding was discovered by Casperson (1971).

CLEISTOGAMY :- A built-in mechanism of breeding where flowers remain unopend till the completion of pollination and fertilization; and promotes autogamy (self pollination) as seen in lettuce beans etc. A species that reproduces by cleistogamy is known as **cleistogameon.**

CLIMACTERIC FRUITS :- Fruits in which the respiration rate is minimum at maturity and remains rather constant even after harvest which gradually increases at the beginning of ripening followed by sudden upsurge in rate of respiration to a peak *(climacteric peak)* and then slowely decline *(post climacteric stage), e.g.* mango, banana, avocado, papaya, apple, guava, etc.

CLIMBERS :- Annual or perennial plants possessing special structures like thorn, tendrils, rootlets, etc. to climb over a support.

CLONAL DEGENERATION :- The loss in vigour and productivity of clones with the time . The term clonal degeneration implies that degeneration is inherent in the clone, *i.e.*, it is due to the vegetative reproduction itself. Clonal degeneration may result from (i) mutation (ii) viral diseases, and (iii) bacterial diseases.

CLONAL SELECTION :- A breeding method for asexually propagated crops like banana, potato, pointed gourd,*etc.* where superior clones are selected from the mixed populations of asexually propagated crops (clones) on visual observations of morphological characters.

CLONE :- This is a progeny of a single parent plant obtained by asexual reproduction (vegetative propagation or apomixis). The genetic duplication by means of vegetative propagation which involves mitosis for the duplication of the genotype is known as **cloning**; and one clone or several closely alike clones propagated by asexual means is known as **clonal variety**.

CLUSTER DIAGRAM :- A line diagram which is used in D2 statistics to depict the genetic diversity among the gentypes/ strains/varieties.

CLUSTERING (JHUMKA) IN MANGO :- A physiological disorder occurs due to adverse climatic conditions, poor pollination & fertilization and characterised by a cluster of fruitlets at the tip of the panicles giving an appearance of bunchy *(Jhumka)* tip.

CODON :- It refers to triplet sequence of RNA nitrogen bases which codes for a specific amino acid.The codons are of three types, *viz., sense codon* (which code for amino acids), *signal codon* (UAA, UAG, UGA or AUG triplets which code for either start or stop signals during transcription) and anticodons (the base sequence of tRNA which pairs with codon of mRNA during translation).

COENZYMES :- The nonfood organic compounds, or metal ion, or both, which are necessary for the activity of a certain enzyme or enzyme system, *i.e.*, an enzyme itself will not operate

its catalytic activity in the absence of its corresponding coenzyme. For example, thiamin (vitamin B_1) is a coenzyme for the enzyme system responsible for the respiration of all living tissues. Other vitamins associated with respiration are riboflavin (vit-B_2), niacin, and pyridoxine (vit-B_6).

COFACTOR :- The activating ion which confers on the protien portion and certain properties of enzyme that enable it to perform its catalytic function. It may assist in the attachment of the substance to the protein of the enzyme or it may affect the charge configuration of key reactive groups in the protein portion of the enzyme.

COHERITABILITY :- The ratio of genotypic covariance to the phenotypic covariance, which measure simultaneous inheritance of two traits.

COLCHIPLOID :- These are *polyploids* induced by colchicine treatment by inhibiting formation of spindle fibres; and the production of such polyploids is known as **colchiploidy**.

COLD FRAME :- An enclosed glass or plastic frame without heating system and used as a propagation unit and for growing or protecting young plants in early stage in temperate climate.

COLE CROPS :- A group of cruciferous vegetable crops originated from wild cliff cabbage of mediterranean region and belonging to genus *Brassica* whose leaves, unopened flower buds, inflorescences or swollen stems are used as cooked or raw, *e.g.* cabbage, cauliflower, broccoli, brussel's sprout, knolkhol, etc.

COLOUR SPORT :- A clone resulting from a mutation in the bud which leads to increased amount of anthocyanins in the outer cell layers of the fruit skin and the occurrence of differently coloured flowers or fruits in an established cultivar due to genetic mutation.

COMBINING ABILITY :- It is also known as *genetic value* of parents, which refers to capacity of a genotype to transmit superior/desirable performance to its crosses. Combining ability as a measure of gene action was proposed by Sprague and

Tatum (1942). It may be of two types, *viz., general combining* ability (gca) which measures additive gene action, and *specific combining ability* (sca) which measures non-additive gene action.

COMPENSATION POINT :- In diurnal cycle, it is the point at which the amount of carbohydrates made equals the amount used, *i.e.,* the rate of photosynthesis equals the rate of respiration at this point which generally occurs just before sunrise or immediately thereafter. As at this stage, rate of photosynthesis equals the rate of respiration, the crop plant uses all of the carbohydrates it has previously stored, the condition of carbohydrate exhaustion or starvation takes place.

COMPLETE FLOWER :- The flowers that contains all four main parts of a flower bud, i.e., flowers that contains sepals, petals, stamens and pistils. The flowers which lack any of the four parts (sepals, petals, stamens or pistils) are called **incomplete flowers**.

COMPLEX POLYEMBRYONY :- Rising of multiple embryos of gametophytic and sporophytic origin.

COMPOSITE VARIETY :- A variety developed by mixing the seeds of various genotypes of a cross pollinated crop which are similar in morphological traits(maturity, height, seed size, seed colour,etc.) and are usually not tested for their combining ability.

COMPOUND POLYEMBRYONY :- Rising of two or more embryos due to simultaneous development of a zygote and an *apogamic embryo* with or without cleavage.

CONSTITUTIVE ENZYME :- An enzyme whose production is constant irrespective of metabolic state of the cell. The enzyme whose production can be inhibited by adding an end product is called as **repressible enzyme**.

CONTRAST COLOUR SCHEME :- When opposite colours of a colour wheel are used side by side in a border, *e.g.* Green-Red; Blue-Orange.

CONTROLLED ATMOSPHERIC (CA) STORAGE :- Storage of commodities under gaseous atmosphere, like gas storage,

where the composition of atmosphere is controlled accurately. The modified atmosphere and controlled atmospheres differ only in degree of control and controlled atmosphere is more accurate.

CONVERGENT IMPROVEMENT :- It is a modified form of back cross which is used for the purpose of improving both the inbred lines of a cross simultaneously. Thus, it is a system of double backcrossing for improving each of the two parental lines without greatly improving the F_1 hybrid. It was proposed by Richey in 1927.

CORE BREAK DOWN OF PEAR :- A storage disorder greatly influenced by handling and storage and characterised by brown, watery collapse of cortex tissues beginning near the core of the fruit and darkening of the main vascular elements between the stem and core.

CORE BROWNING OF APPLE :- A storage disorder characterised by diffuse browning of tissues in the core area next to the carpels occurring after 3-4 months of cold storage at -5 to 3.5 ^{0}C and becoming more extensive in warm temperature after storage.

CORE SPOT OF PEAR :- Bumpy and uneven appearance on the surface as fruits approach maturity, with large masses of brown or greyish necrotic cells underlying individual spot.

COREPRESSOR :- A combination of repressor and metabolite which prevents protein synthesis; and such process is termed as corepression.

CORK SPOT :- A physiological disorder in apple and pear (drought spot) caused due to deficiency of boron and characterised by pitting of the flesh like bitter pit of apples, which develop only on the tree.

CORRELATION :- A statistical measure which is used to find out the degree and direction of associationship (relationship) between two or more variables.The statistical analysis to find out the degree and direction of this correlation is known as

correlation analysis. Correlation between two or more variates may be simple, partial or multiple.

CORTEX:- A layer of tissues of relatively large, nearly rounded, and thin-walled parenchyma cells found in between the epidermis and endodermis of roots and stems. In root-hair zone, this tissue serves as a system for diffusion of water and solutes in water from the root hairs to the endodermis and the diffusion of sugars and other manufactured compounds from the endodermis to the root hairs. In the case of stems, the cortex usually contains both living and dead tissues, where living tissue stores carbohydrates (starch), and the thick-walled and fibrous dead tissue gives strength and rigidity to stems to hold the leaves in the light.

COULURE :- Failure of grape blossom to set, resulting in premature drop.

CRACKED STEM OF CELERY :- A physiological disorder of celery caused due to boron deficiency and characterised by collapsing of affected tissues which become light yellow, and later form a corky layer.

CRACKING (FRUIT) :- A disorder of some fruits occurring due to varietal characteristics or micro nutrient deficiencies, but cracking of fruit surface occurs due to heavy moisture supply (irrigation or rain) after long dry spell.

CRITICAL CONCENTRATION OF NUTRIENT :- It is the minimal concentration of a nutrient that present in a plant when maximal growth is achieved.The *critical concentration* is a narrow transiction zone rather than an exact point between the severily deficient zone and the optimum range of nutrient concentration. Plants containing slightly lower concentrations than the critical concentration are less productive than plants that contain slightly higher concentrations.

CROP IDEOTYPE :- A plant model which is expected to yield greater quantity of flowers/fruits/grains or other useful product when developed as a cultivar. The term ideotype was coined by Donald (1968).

CROPPING INDEX:- The number of crops grown on the same piece of land in a year, which is expressed in percentage.

CROPPING PATTERN :- Yearly sequence and spatial arrangement of crops or crops and fallow on a given land or farm. Cropping pattern and its interaction with farm resources is referred as **cropping system**.

CROSS-COMPATIBILTY :-The ability of the functional pollen of one cultivar or genotype to fertilize the ovule of another cultivar or genotype of same species, but its reciprocal may be cross-compatible or incompatible as seen in sweet cherry, Japanese plum, etc.

CROSS-INCOMPATIBILITY:- The condition when the pollen tube of any given variety fails to grow down the style in time to release the sperms for the fertilization of the egg and endosperm nuclei of the another variety. The two plants or varieties having such type of incompatibility are called **cross-incompatible varieties**. *e.g.*, Sweet cherry (some varieties), Japanese plum (some varieties) and European plum (some varieties).

CROSSING :- Artificial pollination or matting of two or more individuals or strains or genotypes having different contrasting characters. This is generally called *hybridization* and the product of such a mating is known as *hybrid* or *cross*. The mating ability of two or more different genotypes or strains is known as **crossability**.

CROSSING OVER :- The interchange of corresponding segments between non-sister chromatids of homologous chromosomes during pachytene of meiosis due to which combination of gene differs from those that came in with the parents. The term crossing over was coined by Morgan and Cattell (1912).

CROSS-POLLINATION:-It is, also called *allogamy*, the transfer of pollens from the anthers of a flower of a plant to the stigma of a flower of another plant belonging to the same strain or another variety of same species. For completing cross

pollination, *pollinators* (the means of pollen transportation- such as wind, insects, birds, animals or water) are required. The crops reproduced by cross-pollination (allogamy) are called *cross-pollinated* or *allogamous* crops. Cross pollination introduces new characteristics and increases diversity.

CRYOPRESERVATION :- Preservation of seeds or pollens or other products by immersing them in liquid nitrogen at a very low temperature (-196 ^{0}C) and relatively low moisture content.

CULTURE MEDIUM :- A nutrient medium, used in tissue culture, which contains all essential micro and macro nutrients, carbohydrates, vitamins and hormones.

CURING :- A post harvest treatment of tuber and bulb crops by exposing them to relatively high temperature and high humidity to facilitate the drying of upper skin and suberization of the outer tissues, periderm formation and for fast healing of mechanical injuries, lowering the moisture content and reducing the rotting and fungal growths on the surface of the produce. Curing in potato, sweet potato, onion, garlic, ginger, turmeric, etc. resulted in more shelf-life.

CUTICLE :- A layer of wax like material or *cutin* on the outer toothed and flanged tangenial walls of epidermis found on stem, leaves, fruits, *etc.*, which in combination, with the thickening and dovetailing walls in stem, or protective cells in leaves, greatly reduce the rate of transpiration from aerial parts (stem, leaf, fruit, *etc.*) of the plant.

CYCLIC SELECTION :- Selection in one direction for one generation or season and in opposite direction in next generation or season.

CYNOBACTERIA :- This is generally known as *blue gree algae* (BGA) which fix nitrogen generally consist of chain of thick walled, colourless and long filamentous cells (heterocysts); and are found in wet tropical soils.

CYPSELA :- Dry, one-celled and one-seeded fruit of Compositae family which develops from an inferior bicarpellary

ovary, and the pericarp is free from seed coat.

CYTOKINESIS :- The process of division of cytoplasm during cell division.

CYTOPLASMIC DNA :- The DNA which is found in the cytoplasm either in chloroplast or in mitochondria, which governs *cytoplasmic inheritance.*

CYTOPLASMIC GENES :- The genes which are found in the cytoplasm either in the chloroplasts (chlorophyll containing plastids) or in mitochondria. They are also known as *plasma genes* or *cytogenes* or *extra nuclear genes.*

CYTOPLASMIC INHERITANCE :- A typical uniparental inheritance which is governed by cytoplasmic genes or plasma genes located in cytoplasmic organelles like plastid and mitochondria. It is also known as *extra chromosomal inheritance* or *extra nuclear inheritance* or *non-Mendelian inheritance.*The fisrt case of cytoplasmic inheritance was reported by Correns (1909) in Evening Prime Rose.

CYTOPLASMIC MALE STERILITY (CMS) :- The sterility of pollen grains which is caused by cytoplasmic genes or plasma genes rather than by the nuclear genes. It is transmitted only through the female parent *e.g.* sweet corn.

CYTOPLASMIC-GENIC MALE STERILITY(CGMS) :- The sterility of pollen grains which is controlled by both cytoplasmic and nuclear genes, *i.e.*, interaction of sterile cytoplasm and recessive nuclear genes. This type of male sterility is seen in carrot, sugarbeet, onion, *etc.* This type of male sterility was first discovered by Jones and Davis (1944) in onion.

DAY NEUTRAL PLANT :- The plants whose flowering is not influenced by variation in the length of photo-period, *i.e.*, they form their flower buds in both long-light and short dark periods and short-light and long-dark periods, so also called *day-light neutral* plants. Day neutral plants can be grown in summer as well as winter seasons. *e.g.*, everbearing varieties of strawberry, tomato, brinjal, chilli, cucumber, okra, asparagus, snapbean,

polebean, African violet, carnation, petunia, zinnia, cyclamen, *etc.*

DEBLOSSOMING :- Removal of flower from the plant to reduce the crop load, done either by withholding water or by spraying of chemicals or mechanical means.

DEFECTIVE SEEDS :- Seeds in a lot which are broken, diseased and insect-pest infested, undeveloped and unfit for germination though they are viable.

DEGREENING :- The process of decomposing the green pigment in fruits by applying ethylene (1000-2000 ppm) or similar metabolic inducers to give a fruit to its characteristic colour as preferred by consumers, *e.g.* practised in citrus, banana, etc.

DELETION :- Deficiency or loss of a segment from a chromosome.It is of two types, *viz.*, loss of either terminal segment (*terminal deletion*) and loss of intercalary segment of a chromosome (*interstitial deletion*).

DENITRIFICATION :- Biochemical reduction of nitrate(NO_3^-) into nitrus oxide (N_2O) and then to free N_2 and volatile nitrogen oxide, which escape into the atmosphere. Denitrification takes place into the soil in the presence of denitrifying bacteria *Nitrosomonas* sp. which are especially active under anaerobic conditions in wet soils with high organic matter content.

DETASSELLING :- Removal of the *tassel* (the male inflorescence) before it sheds pollen. It is the easiest method of emasculation during hybridization in corn.

DETERMINATE :- A growing habit of plant where the main axis of the plant terminates into flower and cease to elongate at this point *i.e.* stopping terminal growth.

DIALLEL CROSS :- The mating of selected plants in all possible combinations among a series (n) of genotypes. It is of two types, viz. half diallel (all possible one way crosses) and *full diallel* (all possible direct and reciprocal crosses among n genotypes).

DICHOGAMY :- Maturation of anthers and stigma of a flower on different times, *i.e.*, non-synchronization of pollen dehiscence and stigma receptivity in a hermaphrodite flower, which prevents natural self-pollination and opens the conditions for cross-pollination. It is of two types, *viz. protandry* (pollen sheds before the stigma is receptive) as seen in custard apple, passiflora, and *protogyny* (stigma becomes receptive before the pollen is shed on the same flower) as seen in tall coconut.

DICOTS :- The group of angiosperms, also called *dicotyledons*, which develop two seed leaves (embryo with two cotyledons), net-veined leaves in pinnate or palmate form, open vascular bundles in a single circle or like a hollow cylinder in woody or herbaceous stems, and flower parts in groups of four or five or in multiples of four or five, and their body consists of primary tissues (meristem) during the first stages of their growth and development and secondary tissues (cambium) during the later stages, *i.e.*, they have secondary growth as like in gymnosperms. *e.g.*, most of the horticultural plants.

DIFFUSION :- The *simple diffusion* or *diffusion with a gradient* is the movement of ions or molecules of a given substance by virtue of their own kinetic energy from regions of high concentration of ions or molecules to regions of low concentration of the same substance. No external source of free energy is required with this movement. In contrast, *diffusion against a gradient* is the movement of ions or molecules from regions of low concentrations to regions of high concentration, and for this movement, the free energy is necessary which comes from compounds (food) made by photosynthesis and decomposed by respiration.

DIHAPLOID :- A haploid (2X) developed from a tetraploid (4X) species.

DIHYBRID :- An individual or group of individuals which has two heterozygous genes with all remaining genes being, presumably, homozygous, *i.e.*, a dihybrid is obtained by crossing two individuals which differ in two pairs of genes only or in

two pairs of contrasting traits. *e.g.*, AA BB cc DD x aa bb cc DD $=F_1$ (Aa Bb cc DD). With complete dominance, there are four distinct classes of female and male gametes in the F_1, and nine distinct genotypes and four distinct phenotypes with the phenotypic ratio of 9:3:3:1 in the F_2.

DIHYBRID CROSS :- A cross involving two pairs of gene each affecting a different character.

DIOECIOUS :- Plant species in which *staminate* (male) and *pistillate* (female) flowers appear on separate plants, *e.g.* papaya, date palm, pistachionut, asparagus, nutmeg, pointed gourd, etc.

DIOECISM :- A type of sex expression where unisexual flowers with functional stamens (staminate) and functional pistils (pistillate) are produced separately on different plants of same species. *e.g.*, date palm, papaya, nutmeg, persimmon, spinach, certain varieties of muscadine grape, asparagus, pointed gourd, and holly, *etc.*

DIPLOID NUMBER :- It is the somatic chromosome number (2n) of a species. An organism bearing two sets of distinct genome, *i.e.*, having 2 x somatic chromosome number, is called as a **diploid.**

DISOMIC HAPLOID :- A haploid which develops from a *nullisomic* (n-1) individual (an individual lacking one pair of chromosome from a diploid set).

DISRUPTIVE SELECTION :- It is a form of recurrent selection in which both the extreme phenotypes for a character are selected and intermated in segregating population (disruptive mating). In plant breeding poulations, disruptive selection is effective in breaking undesirable linkages, generating diversity and improving adaptation. The concept of disruptive mating and selection was developed by Mather (1953).

DISTANT HYBRIDIZATION :- It is, aslo called *wide crossing* the mating or crossing between two or more different species of the same genus or different genera of the same family. It is of two types, *viz. interspecific hybridization* and *intergeneric*

hybridization. Distant hybridization is associated with cross-incompatibility, hybrid inviability, hybrid sterility and hybrid breakdown.

DISTYLY :- Presence of styles of two positions, *viz.* low and high in a bisexual flower. The flowers with long style and low anthers are called *Pin type*, and flowers with short style and high anthers are called *Thrum type* , as seen in Primula. These two positions of styles leads heteromorphic self-incompatibility.

DIURNAL CYCLE :- The rate of photosynthesis, the rate of respiration, and the amount of carbohydrates available for growth and development during any given 24-hour period.

DIURNAL TEMPERATURE :- The alternating day and night temperatures within any given 24-hours. In general, because the flow of light energy from the sun, temperatures are higher during the day than they are during the night; and thus, these two alternating diurnal temperatures coincide with two important crop-plant activities, *viz.*, the making of abundant quantities of initial foods and related substances during the day, and the making and elongation of new cells during the night.

DNA :- It is acronym for deoxyribose nucleic acid, which is a long thread like macromolecule coiled in double helix along with encoded information in a precise sequence of base (adenine, guanine, thymine and cytosine) that together constitute the basic unit of a gene on a chromosome. DNA is of various types, viz. right handed, left handed, chromosomal, linear, circular, repetitive, unique, double stranded and single stranded DNAs.

DOMINANCE :- The masking effect of one allel of a gene over the others; and the character which expresses in F_1 is known as dominant.

DNA REPLICATION :- The process by which a DNA molecule makes its identical copies. It is of three types, viz. *disruptive*, *conservative* and *semi-conservative* replication.

DOMINANCE VARIANCE :- A portion of genetic variance which arises due to dominant effect of polygenes resulting from intra-allelic interaction. It is due to deviation of heterozygote (Aa) from the average of two homozygotes (AA and aa).

DONOR PARENT :- It is also called non-recurrent parent , which donates one or few genes (desirable character) to the recipient (recurrent) parent in back crossing.

DOUBLE CROPPING :- Cultivation of two crops one after another on the same piece of land in a year, *i.e.*, growing two crops in a year in a field.

DOUBLE CROSS HYBRID :- A hybrid progeny obtained by a cross between two first generation (F_1's) crosses, *e.g.*, (A x B) X (C x D).

DOUBLE CROSSING OVER :- Formation of two chiasmata between non-sister chromatids of homologous chromosomes. When there is one chiasma between non-sister chromatids, it called **single crossing over.** Term crossing over was coined by Morgan and Cattell (1912).

DOUBLE FERTILIZATION :- The fusion of one sperm (male gamete) with the egg and the other sperm with the two endosperm nuclei within the embryo sac, which results the development of endosperm along with a zygote.

DOUBLE SETTING :- A practice of spacing fruit crops in a row at about half the usual distance or incorporating additional rows in the conventional square or rectangular system for use of land during the early years of long lived fruit trees.

DOUBLE TETRASOMIC :- Addition of two chromosomes to two different pairs (2n +2 +2).

DOUBLE TOP CROSS :- It is cross between a single cross (F_1) and an open pollinated variety, *viz.* (A x B) x Open pollinated variety. This method was developed by Davis (1927).

DROUGHT :- It is the condition of soil moisture deficiency or water scarcity at which plants become unable to fulfil their

potential evapo-transpiration demands. Drought damages chloroplasts and lowers output of the photosynthetic apparatus.This condition can be reduced or checked by developing different mechanisms of drought resistance in plants, such as drought escape, drought avoidance, drought tolerance and drought resistance.

DROUGHT AVOIDANCE :- Ability of crop plants to maintain a favourable internal water balance under water deficit conditions.

DROUGHT HARDENING :- It is the improvement in drought tolerance ability of a plant through various seed and seedling hardening treatments.

DROUGHT RESISTANCE :- It is the ability of plant to survive and maintain growth and yield under water deficit conditions without major injury. Drought resistance is a genetically controlled physiological property of a plant species, and drought resistant genotypes have rapid closing habit of stomata; they maintain high photosynthesis under moisture stress by restricting water loss through transpiration.

DROUGHT TOLERANCE :- Ability of a plant to grow, develop and reproduce normally under moisture deficit conditions, *i.e.*, ability of a plant to withstand low tissue water potentials. It is a sum of drought avoidance and drought tolerance.

DRUPE :- A fleshy, one or more seeded and one or more chambered fruit developed entirely from a superior ovary, of which pericarp is distinctly separated into epicarp, fleshy mesocarp and stony endocarp, *e.g.* mango, plum, coconut, ber, apricot, peach, cherry, etc.

DUPLICATION :- Occurrence of a chromatid segment twice in the same chromosome or genome. The duplicated segment may occur in the same or in a different chromosome. It may be of four types, viz. tandem, reverse tendem, displaced and reverse displaced.

DYES :- The coloured organic substances of plant origin which

impart different colour (yellow, blue, indigo, red, brown, etc.) when applied to substrate; The substrate retains these dyes by adsorption, solution and mechanical retention, and the colouring phenomenon is known as *dyeing*. Natural dyes are the secretion product obtained from the different parts of plants, such as **heart wood** (Cutch-*A.catechu*, Logwood-*Haematoxylon sp.*, Fustic-*Chlorophora tinctoria*, Sappanwood- *C.sappan*, Lal Chandan-*Pterocarpus santalinus, etc.*), **barks** (Black oak- *Q.velutina*, Lokao-*Rhamnus globosa*, Teak-*T.grandis*, Kashmal- *Berberis vulgaris,etc.*), **roots and rhizomes** (Madder- *Rubia tinctoria*, Turmeric-*C.longa*, Indian Mulberry- *Morinda angustifolia*, Rasaut-*Berberis aristata, etc.*), **leaves** (Indigo-*Indigofera tinctoria*, Henna-*Lawsonia inermis*, Lodh-*Symplocos paniculata, etc.*), **flowers** (Safflower-*C.tinctorius*, Saffron-*Crocus sativus*, Palas- *B.monosperma*, Harsingar-*N. arbor-tristis*, Red cedar- *Cedrela toona,etc.*),**fruits**(Buckthorn-*Rhamnusinfectoria*,Kamala-*Mallotus philippinensis,etc.*), **seeds** (Annato-*Bixa orellana*, Dharauli -*Wrightia tomentosa), and* **gum resin** (Gamboge-*Garcinia* morella and *G.cowa*, which produces yellow dyes).

ECONOMIC HETEROSIS :- It is also called useful heterosis which is the superiority of F_1 over the better parent for a region.

EMASCULATION :- Artificial removal of immature anthers from bisexual/hermaphrodite flowers or male flowers from monoecious plant prior to pollination. It facilitates crossing in bisexual flowers.

EMBRYO DORMANCY :- It is a type of internal dormancy of seed where the dormancy conditions lie within the embryo itself and stratification *(moist chilling)* is required to overcome this type of dormancy, *e.g.* peach, apple, cherry, etc.

EMBRYOGENESIS :- The process of morphological and physiological development of the embryo, *i.e.*, formation of somatic embryo, from a single celled zygote (callus) in culture medium.

EMERGENCE :- Coming out of a place, such as germinating seedling breaking through the soil surface or a flower from

bud.The emergence phase of growth begins when the embryo penetrate the seed coat and ends when the shoot system is able to sustain the of the plant by photosynthesis. During emergence a root and shoot system develops.

ENDODERMIS:- It is the innermost wavy layer of cortex which consists of a single layer of specified parenchyma cells and often contais numerous starch grains, so also called *starch sheath.* In the root-hair zone, its radial and transverse walls are impregnated with a layer of suberin.

ENDOSPERMIC SEED :- The seeds having a reduced embryo in proportion to the rest of seed and in these seeds food storage lies in the endosperm and perisperm, *e.g.* coconut.

ENDOXEROSIS OF CITRUS :- A physiological disorder of lime and lemons due to faulty irrigation and nutrition and characterised by the deterioration of tissues at the styler end of fruits in begining and loss of water and collapsing of juice vesicles at advance stage. In acute conditions cavities are formed inside the tissues and immature fruits are dropped.

ENZYMES :- These are the nonfood organic compounds composed of proteins with or without some other non proteinaceous compounds.They are specific in action and are effective in minute concentration. They act as a catalyst and thereby greatly accelerate the rate of specific chemical reaction of the cells. *e.g.* the *carbohydrases* work on carbohydrates only, the *lipases* react with lipids only, and the *proteases* react with the proteins only. According to the specificity of action, the enzyme systems are grouped as- *hydrolases* (which conduct hydrolysis reactions, such as carbohydrases, lipases, proteases), *transferases* (*e.g.* hexokinase and transaminases) and *oxidases* (catalase, tyrisinase, ascorbic acid oxidase). The site of production and site of action of an enzyme is same.

EPICOTYL GRAFTING :- A method of splice & cleft grafting in which 7-10 days old seedling stocks are grafted with the current year's shoots *(scion)* which have previously defoliated. This method is also known as *stone grafting* and commonly practiced in mango, cashewnut, walnut, chestnut etc.

EPIDERMIS :- It is a single layer of cells found on primary body of a plant and forms upper coverings. Its structure and functions differ in root, stem and leaf. In case of roots its function is the absorption of water and the essential raw materials dissolved in water by elongating cells in form of root hairs. In the case of stem, epidermis consists mainly of cells with thick radial walls and toothed and flanged tangential walls, of which outer layer cells forms cuticle, which reduces the rate of transpiration of water; and in case of leaves, epidermis consists of two types of cells- the *protective cells* (work as epidermis of primary stem) and *guard cells* (which contain chlorophyll and stomates).

EPISTASIS :- It is also known as *intergenic interaction,* which is the interaction of genes at different loci controlling the same character, where the expression of one gene is affected by another gene and *vice-versa.* The gene which has masking effect is called *epistatic gene.* Epistasis is of several types, viz. recessive, dominant, dominant-inhibitory, duplicate recessive and duplicate dominant epistasis.

EPISTATIC VARIANCE :- It is that portion of genetic variance which arises due to deviations as a consequence of inter-allelic (intergenic) interaction, *i.e.,* epistatic effect of polygenes . It is of three types, viz. Additive x Additive (AA x BB), Additive x Dominance (AA x Bb) and Dominance x Dominance (Aa x Bb).

ESSENTIAL AMINO ACIDS :- A group of amino acids which can not be synthesized in human body and their requirements has to be met through dietary intake. *e.g.,* methionine, leucine, isoleucene, lycine, threonine, tryptophan, valine, histidine, phenylalanine and arginine are considered as essential amino acids.While,amino acids which can be synthesized by human body and need not be supplied through diet are known as *non-essential amino acids.*

ESSENTIAL ELEMENTS :- The chemical elements required essentially for growth and development of the plants and their deficiency or lack may be limiting factor in growth and

development of a plant; they are also called essential plant nutrients. There are sixteen elements which are considered essential for plant's growth and development, and on the basis of their essentiallity in active growth and development of plants, they are grouped as- *primary* or *major* or *macro elements* (C, H, O, N, P, K, Ca, Mg and S) and *secondary* or *micro* or *trace elements* (Fe, Mn, Cu, Zn, Mo, B and Cl). The chemical compounds or parts of chemical compounds which contain one or more essential elements for plants growth and development and are absorbed and utilizes by plants are called essential raw materials or *essential raw minerals.*

ESSENTIAL OILS :- The volatile oils having pleasant taste and strong aromatic odour which are secreted in internal oil glands or in hairlike structures of different parts of the plants to the extent of 0.001 to 2.0 per cent. They are considered to be by-products of metabolism and impart a characteristic flavour and aroma to the plant which helps in pollination and dispersal of fruits and seeds. They have a complex chemical nature as the terpenes or the oxygenated and sulphurated oils, which are used in the making of incense, perfume, and flavouring substances. Volatile or essential oils are extracted from- **fragrant flowers** (Acacia oil from *Acacia farnesiana,* Carnation oil- *Dianthus caryophyllus,* Champaca oil- *Michelia champaca,* Jasmine oil- *Jasminum spp.,* Lavender oil- *Lavendula officinalis,* Rose oil- *Rosa damascena,* Violet oil- *Viola odorata,* Cananga oil-*Cananga odorata*), **leaves and leafy twigs** (Citronella oil, Lemon-grass oil, Palmrosa oil, Ginger grass oil, Neroli oil, Petitgrain oil, Patchouli oil, Rosemary oil, Eucalyptus oil, Spearmint oil, Thyme oil, Geranium oil, Oil of Bay)., **Wood** (Camphor oil - *Cinnamomum camphora,* Cedar wood oil - *Juniperus virginiana,* Sandal wood oil-*Santalum album*), **roots and rhizomes** (Calamus oil-*Acorus calamus,* Oil of Vetiver- *Vetiviera zizanioides,* Orris oil-*Iris germanica*), **fruit peels** (Neroli oil- orange, lemon), **flower buds** (Clove oil- *Syzyzium aromaticum*), etc.

ETAERIO :- An aggregate form of simple fruits borne by single flower having apocarpous pistil (free carpel) and poly carpellary

ovaries. The ovaries of respective carpel mature into fruitlets, clustered together on the pedicel and form a compound fruit. This group of fruitlets is called as *etaerio*. This may be *etaerio of achenes* (strawberry), *etaerio of berries* (custard apple), *etaerio of drupes* (raspberry, black berry), etc.

EUCHROMATIN :- A lightly staining region of chromosomes during inter-phase, which is usually found in the middle of chromosome, genetically active and takes part in transcription.

EUHAPLOID :-Haploid individuals which develop from an euploid species, which are of two types, *viz.*, *monohaploids* (which develop from a normal diploid) and *polyhaploids* (which develop from a polyploid species).

EUPLOIDY :- The change in chromosome number which involves entire set. It includes, monoploid, diploids and polyploids. An organism whose chromosome number is an exact multiple of the basic (X) number, is called *euploid* such as monoploid (1X), diploid (2X), triploid (3X), tetraploid (4X), pentaploid (5X), hexaploid (6X), etc.

EVALUATION :- The process of assessing the performance (yield, quality, disease and insect resistance, etc.) of newly developed strains of a crop through appropriate multi-locational trials.

EVAPOTRANSPIRATION :- The total amount of water loss in vapour form due to evaporation from the surface of soil and vegetation, and transpiration during a specific time from a particular area. This provides basic information on the water requirement of crop plants, such as the amount of water necesary to mature a given crop, the proportion of water applied as irrigation or precipitation, the proportion of water that runs off and drains away the surface, the amount of water needed for different stages of plant growth, etc. Thus, it is also called *consumptive use* (CU) of water.

EXALBUMINOUS SEED :- Seeds in which endosperm is lacking or reduced to a thin layer surrounding the embryo, *e.g.* mango, guava, jackfruit, orange, orchid, etc.

EXANTHEMA OF CITRUS :- A nutritional disorder characterised by black or brown raised lesions on the fruits.

EXHAUSTING :- Removal of air from the head space of container (cans or bottle) either by heat treatment or mechanical method. It is done at 82^0 to 87 ^{0}C for 6 to 10 minutes.

EXOTIC COLLECTION :- The collection or introduction of germplasm (plant material) from other country, and such type of germplasm is called exotic. A foreign variety which is directly recommended for commercial cultivation is called *exotic variety.*

EXPLANT :- The plant part which is used for regeneration in the process of micro-propagation. It may be a tissue, a cell, a protoplast or an organ.

EXTICTION :- It refers to permanent loss of a crop/ plant species due to various reasons.

FALSE BLOSSOM :- A physiological disorder associated with extreme wet or dry conditions and characterised by more or less leaf-like calyx lobes and petals, aborted or malformed pistils and stamens producing little or no fruit with *'witches broom'* appearance of the plant.

FASCIATION :- The condition or deformity of a plant where several stem, branches, *etc.* fuse together in a single plane, causing abnormal and deformed thick growth. This deformity is seen in pineapple.

FERMENTATION :- An anaerobic decomposition of carbohydrate (sugars) in juice by micro-organisms or enzymes. In fermentation sugars of fruit juices are converted into alcohol or acetic acid.

FERTILIZATION :-Union of *male gamete* (sperms liberated from the pollen tube) and *female gamete* (egg and endosperm nuclei) within the embryo sac in sexual reproduction. At the time of fertilization, within the embryo sac, pollen tube liberates two spems, of which one sperm unites with the egg in the formation of zygote (*i.e.*, new plant) and the other sperm unites with the endosperm nuclei in the formation of the endosperm which nourishes the zygote.

FIELD CAPACITY :- The measurable amount of water in the soil which is held against the force of gravity. The field capacity varies greatly with the type of soil, such as sandy and sandy loam soils (coarse-textured soils) have low field capacities and silt and clay loams (fine-textured soils) have high field capacities.

FIELD GENE SEEDS :- Those areas of lands where germplasm of *recalcitrant crop* species is maintained such as coconut, oil palm, rubber coffee, etc. growing areas.

FIELD RESISTANCE :- The capability of resistance of a plant which gives an effective control of parasites or pathogens under field conditions. It may be *seedling resistance* (resistance exhibited by seedlings) or *adult resistance* (resistance exhibited by adult plants).

FITNESS :- It is also called selective value or adaptive value or selective advantage, which is the relative reproductive success of different genotypes of a population in the same environment under natural selection.

FLIPPER :- A mild positive pressure due to hydrogen swelling inside the can resulting in swelling of the lid which can be brought down to its original position with finger pressure and lid remains in that place even after removal of finger pressure.

FLORIGEN :- This is the endogenous flowering stimulus produc ed in leaves and translocated to apical and lateral meristems where flower formation is initiated. The Russian plant physiologist M.Kh. Chailakhyan (1937) proposed the term 'florigen' or flowering hormone for flowering stimulus.

FLOWER :- The reproductive structure of angiosperms consisting of a group of modified and highly specialized leaves, arranged concentrically,and designed for the purpose of sexual reproduction. The groups of modified leaves are- sepals, petals, androeciun and gynoecium, where, androecium (stamens) and/ or gynoecium (carpels) are surrounded by petals and sepals. A flower may be single (having single whorl of usual number of petals) or double flower (with more than the usual number of

petals in two or more whorls and/ or with style and stamens modified to petals.

FLUTE BUDDING :- A method of budding in which a patch of bark is removed leaving a narrow connection between the upper and lower parts of the stock, and a bud patch *(scion)* of same size is fitted to the stock and wrapped with 200 gauge polythene strip.

FOOD :- A nutritious organic substance which is eaten to meet the requirements of body for energy, maintenance of health, growth, development and reproduction.

FOOT CANDLE :- It is the measuring unit of light which refers to the amount of light impinging on a surface one foot away from a standard wax candle, which is equal to 10.764 lux. An instrument 'Weston Illuminometer' is commonly used for this purpose.

FRAME WORKING :- The process of converting the unfruiting or undesirable old fruit trees into a productive or desirable type. In this side branches (small laterals) are replaced by using high yielding scions of the replacement cultivar without beheading the entire plant.

FREE SPACE :- It is a functional concept, and refers to the fraction of the volume of a plant tissue readily accessible to diffusion of an externally applied solute dissolved in water. The boundary of free space is the plasma membrane because most solutes (*e.g.*, dissolved nutrient ions and sugars) do not diffuse readilly through it, but penetrate by active transport.

FREE VARIABILITY :- Phenotypic differences between homozygotes with extreme phenotypes (AABBCC and aabbcc).

FREEZING INJURY :- A post harvest disorder of fruits & vegetables where tissue degeneration occurs due to low temperature storage causing water-soakedness, tissue browning and collapsing, glassy appearance, etc. e.g. freezing injury in cabbage, celery, citrus, onion, potato, etc.

FRESH UNGERMINATED SEEDS :- Viable seeds which can

absorb water but do not germinate and remain fresh in germination test.

FRUITING CANE :- The basal portion of the mature cane usually with 8-12 basal buds left after pruning on the vine to produce fruit's bunches as in grape.

FRUITING SPUR :- Pruned cane (short stubby growth) which is intended to and forms fruiting structure in next growing season.

FULL DIALLEL :- All possible direct and reciprocal (both way) crosses among a series of genotypes, *i.e.*, n(n-1).

FUSIFORM ROOT :- The root swollen in the middle and gradually tappering towards the apex and the base, being more or less spindle shaped in appearance. *e.g.* radish.

GAMETE :- A specialized reproductive haploid cell produced by gametogenesis through meiosis and participates in fertilization, *i.e.*, a gamete is a *sex cell* or *sexual unit.*

GAMETE SELECTION :- A selection procedure for improving inbred lines and which is used for detecting desirable gamete in a heterozygous population and combining the same into the background of an inbred line of known performance and combining ability. This method of selection was proposed by Stadler (1944).

GAMETOPHYTIC SELF-INCOMPATIBILITY:- A type of self-incompatibility which is governed by the genetic constitution of gametes, *i.e.*, haploid pollen grain (*s-locus*) and diploid pistil tissue (*s-allele*). This system of self-incompatibility was first discovered by East and Mangelsdrof (1952) in *Nicotiana sanderae.* This system of self-incompatibility does not permit production of homozygotes, crosses may be sterile, partially fertile or fully fertile, but the racovery of male parent is possible in some crosses. This type of self-incompatibility is found in *Lycopersicon hirsutum, Lycopersicon peruvianum, Solanum phureja,* apple, pear, loquat, ber, almond etc.

GENE :- Functionally, a gene is a basic unit of inheritance of specific character; *structurally*, it is a sequence of DNA nucleotides arranged linearly in the chromosomes and codes for a functional product of RNA or a polypeptide. A gene consists of *recon, muton* (smallest unit within a gene) and *cistron* (largest element within a gene). The term gene was coined by Johannsen (1909), and Benzer (1955) divided the gene into recon, muton and cistron.

GENE ACTION :- The manner in which genes control phenotypic expression of various characters in an organism.

GENE BANK :- An organization where a large collection of living germplasms, representing worldwide genetic diversity, is maintained in living state. It is also called *germplasm bank.*

GENE CLONING :- The technique of genetic engineering by which a gene sequence with several identical copies can be developed.

GENE DEPLOYMENT :- A planned distribution of major genes for specific resistance to pests for use in varietal development and production.

GENE INTERACTION :- Change in the expression of one gene by one or more non-allelic oligogenes. The relationship of the genes for expression of a chracter depends on the presence or absence of another gene at two or more different loci.

GENE POOL :- It is also called genetic stock which is the sum total of genes present in a breeding population or the whole library of different allels of a species. There are three kinds of gene pool, viz. primary, secondary and tertiary genetic stock.

GENE PYRAMIDING :- Incorporation of two or more major genes in a variety for specific resistance to a pest.

GENE SANCTUARY :- An protected area within the centre of diversity where a great genetic diversity of a particular plant species or organism is maintained under natural conditions.

GENERAL GENOTYPE ADAPTATION :- It is the capacity of

a genotype to produce a wide range of phenotypes compatible with a range of environment.

GENETIC ADVANCE :- A genetic parameter which depicts the improvement in the mean genotypic value of selected lines over the parental population.

GENETIC CODE :- The relationship between the sequence of bases (adenine, guanine, cytosine and uracil) and the sequence of amino acids in a polypeptide chain.

GENETIC CONSERVATION :- The protection, conservation and storage of plant genetic resources from genetic erosion either under natural conditions (*in-situ* conservation) or by storing in gene banks (*ex-situ* conservation).

GENETIC DRIFT :- Random change in any direction in gene frequencies due to sampling error.

GENETIC ENGINEERING :- The technique which involves isolation, introduction and direct incorporation of new genetic material (foriegn gene or DNA) into the cells of plants or other organisms and its subsequent regeneration. Plants developed through genetic engineering are known as *transgenic plants.*

GENETIC EROSION :- A gradual and significant reduction in genetic variability of domesticated and wild plant resources due to elimination of various genotypes, mordernization of agriculture, various developmental activities, land degradation, deforestation and land clearance, etc.

GENETIC FREQUENCY :- It is also called *gene frequency* which is the proportion of different allels of a gene in a random mating population.

GENETIC GAIN :- Difference between the mean phenotypic value of the progeny of the selected plants and the base population.

GENETIC POLYMORPHISM :- It is the regular occurrence of several phenotypes in a genetic population due to superiority

of heterozygotes over homozygotes; also called *balanced polymorphism.*

GENETIC PURITY :- Absence of seeds of other variety of the same crop as well as of others, and refers to inherent quality of seed.

GENETIC RESISTANCE :- Ability of some genotypes to higher yield of good quality than others at the same initial level of disease or insect infestation under similar environmental conditions. It is of two types, *viz. vertical resistance* or oligogenic resistance and *horizontal resistance* or polygenic resistance.

GENETIC RNA :- The RNA which acts as DNA or genetic material, which is found in most of the plant viruses (TMV, HMV, etc.) and certain bacteriophages. Fraenkel Conrat and Singer (1957) first reported that RNA is genetic material in Tobacco Mosaic Virus (TMV).

GENIC MALE STERILITY :- Sterility of pollen grains which is governed by single recessive gene, as found in pumpkin, muskmelon, squash, cabbage, cauliflower, lettuce, brussel's sprout, etc.

GENOME :- A genome (X) consists of all the chromosomes of of a dipliid species which do not pair at meiosis and that are distinct from each other with respect to their gene content, and often morphology; *i.e.* , it is a basic or complet monoploid set of chromosomes which inherited as a unit from one parent to offspring. In a genome, each type of chromosome is represented only once.

GENOTYPE :- It is a gene makeup or genetic constitution of an individual, and which is represented as RR or rr (homogygous) or Rr (heterogygous).

GENOTYPE FREQUENCY :- It is also called *zygotic frequency* which is the ratio of different genotypes in a Mendelian population.

GENOTYPIC VARIATION :- It is the genetic or inherent variation within an organism which remains unaltered by

environmental effects. It may be additive or dominant.

GERMINATION :- The process of reactivation of metabolic mechanisms within the seed embryo leading to the emergence of the *radicle* and *plumule* under ideal conditions of light, temperature, moisture, oxygen and nutrients and resulting the production of a normal seedling.Based on the germination capability, seeds are categorized as normal seed, abnormal seed, hard seed, fresh ungerminated seed and dead seeds.

GERMPLASM :- A collection of genotypes of an organism or sum total of genes in a species or the whole library of allels in a crop species.

GIRDLING :- The process of removing the strip of bark and outer living layers from stem or branches which block the downward translocation of carbohydrates, hormones, etc. beyond the constriction which rather accumlates above it.

GLUCONEOGENESIS :-This is the synthesis of sugar (glucose units) from substances other than carbohydrates, *i.e.*, conversion of fatty acids and glycerol to sucrose. In fat-rich seeds the source of sucrose is lipid which reserves in endosperm of these seeds. Fat-rich seeds are converted to sucrose by gluconeogenic enzymes compartmented in cytosol and several subcellular organelles- i.e., glyoxysomes and mitochondria.

GRANULATION :- A disorder of citrus influenced by variety, nutrition, climate, root-stock, etc. and characterised by hardening and drying up of juice vesicles in fruit which results in decrease in soluble sugars, acids, and accumulation of polysaccharides and increase in sodium, potassium, calcium and magnesium content in severe conditions.

GUM RESINS :- They are mixture of both true gums and resins with small amounts of essential oils and traces of colouring matter. Gum resins are obtained by injury or tapping or naturally as milky exudates from different parts-roots, stem, bark and fruits of plants belonging to family Umbelliferae and Burseraceae, such as **Asafoetida-** from the cortex of fleshy roots of *Ferula asafoetida*, **Galbanum-**from lower parts of stem of *Ferula*

galbaniflua, **Myrrh**- from the stem of *Commifera caudata*, **Frankincense**- from the bark of *Boswellia serrata*, and **Mexican linaloe**-from the fruits of *Bursera penicillata*. They are used for flavouring curries, preparing medicines, and in perfumeries.

GUMMOSIS :- A disorder of citrus and stone fruits due to mechanical injury and insect-pest attack, which is characterised by copious exudation and deposition of gum on stems.

GUMS :- They are non-crystaline, viscous and water soluble organic substances of plant origin, which formed naturally as cementing substances in between the cells or due to decomposition of cellulose cell wall or by disintegration of internal tissues (gummosis), and exuded naturally or in response to injury or wounds. Gums are rich in sugar, colloidal and mucilaginous in nature and also insoluble in alcohol and ether. They are extensively used as adhesive, clarifiyng agents in sugar, wine and beverage industries, commercial emulsions, as an ingredients of pastes, polishes, syrups, cosmetics and confectionary, and as medicines. The plants belonging to Anacardiaceae, Combretaceae, Euphorbiaceae, Leguminosae, Moringaceae, Rutaceae, Rosaceae, Meliaceae, Sterculiaceae and Cochlospermaceae families are chief sources of different types of gums.Such as Gum Arabic from *Acacia senegal, A.nilotica, A. ferruginea*; Gum Tragacanth from *Astragalus gummifer*; Karaya gum from *Sterculia urens*; Bengal kino from *Butea monosperma*; Woodapple gum from *Feronia limonia*; Silk cotton gum from *Cochlospermum religiosum*; Cherry gum from various species of *Prunus* (almond, apricot, peach, etc.); Cowa from *Garcinia cowa*; Mesquite from *Prosopis juliflora*; Bean gum from *Cymopsis tetragonolaba*; Shahanjan gum from *Moringa oleifera*; and Gum benjamin from *Styrax benzoin,etc.*

GUTTATION :- This refers to the exudation of droplets of liquid water from the margins and tips of leaves; due to root pressure developed in xylem sap of roots.

GYNOECISM :- A type of monoecious form of sex expression where only *pistillate* (unisexual with functional pistils only) flowers are produced, which give rise a super female plant.

The plants exhibiting such type of sex expression are called *gynoecious. e.g.,* certain varieties of cucumber. The gynoecious plants require interplanting of monoecious or gynomonoecious varieties to provide pollen for gynoecious flowers.

GYNOECIUM :- The female reproductive component of a flower which consists of ovary, style and stigma (collectively called *carpels* or *pistils*- the female organs of the plant).

GYNOMONOECY :- The occurrence of female (*pistllate*) and bisexual (*hermaphrodite*) flowers separately on the same plant.The plants showing this type of sex form are called *gynomonoecious* plants. The coexhistence of female (male sterile) and hermaphrodite individuals in a population is known as *gynodioecy* (gynodioecious plants).

HAPLOID NUMBER :- The gametic chromosome number of a species; and an individual or cell having only one complete set of chromosome is called *haploid.*

HARD SEEDS :- A group of normal and viable seeds which do not absorb water (no imbibition) and remain ungerminated.

HARDENING OFF :- Subjecting new plants to adverse conditions to hasten tissue maturation for increasing hardiness in seedlings before planting out in the field. It is done by holding irrigation.

HARDY PLANTS :- The crop plants which are resistant or tolerant to freezing temperature or frost.These plants posses the ability to bind their water to a greater extent. *e.g.,* apple, plum, pear, peach, cherry, blueberry, *labrusca* grape; cool season vegetables, except potato, such as asparagus, broccoli, cabbage, peas, turnip, garlic, knolkhol, radish, spinach, onion, etc.; rose, spirea, hawthorn, lilac, ornamental peach and quince, etc. On the other hand, *non-hardy crops* are citrus, date, olive, fig, raspberry, blackberry, muscadine grape,litchi, magnolia, nandina,cape jasmine, camellia, and all the warm season vegetables.

HARVEST INDEX :- It is a parameter to determine economic

productivity in terms of dry matter; which refers the ratio of economic yield to the biological yield or the ratio of economic produce to total biomass. It is calculated in per cent.

HEAD TO SEED METHOD :- A method of cabbage seed production where selected plants with fully matured heads are lifted prior to snowfall, stored and again replanted in spring for seed production of cabbage.

HEADING BACK :- Removal of terminal portion of twig, canes or stem by leaving its basal portion intact with parent source for promoting new growth.

HEMIZYGOUS :- A diploid individual having a recessive allel in a single dose.

HEN AND CHICKEN :- A physiological disorder of grapes caused due to deficiency of boron and characterised by maturing of only a few normal sized berries in a bunch and rest being undersized and worthless.

HEREDITARY DETERMINANTS :- The entities *i.e.*, genes which are responsible for inheritance of characters from one generation to another.

HERKOGAMY :- A special condition of structure of male (anther) and female (stigma) parts in a bisexual flower which prove a barrier to self pollination, *e.g.* pansy, iris, orchids, etc.

HESPERIDIUM :- Many seeded succulent fruits, developed from a poly carpellary superior ovary having axile placentation, of which epicarp is strong, mesocarp is fibrous and fused with epicarp forming rind and endocarp remains thin and papery divided into many locules which have many succulent juicy hairs (edible part), *e.g.* citrus fruits.

HETEROCHROMATIN :- A darkly stained region of chromosomes during interphase, found near centromere and telomere.

HETEROGENEOUS POPULATION :- A population which is composed of genetically dissimilar plants such as land races,

mass selected varieties and multi lines (*heterogeneous-homozygous population*) and composites and synthetics (*heterogeneous-heterozygous population*).

HETEROKARYON :- Hybrid cell combining protoplasts of two different species.

HETEROMORPHIC SELF-INCOMPATIBILITY :- Self-incompatibility due to the differences in floral morphology, *i.e.*, different positions of style and stigma. In this system style and stigma may have two positions (*distyly*) or three positions (tristyly) with regard to their lengths.

HETEROPLOIDY :- Any change in the chromosome number from the diploid state. It is of two types,viz. *euploidy* (change in entire set) and *aneuploidy* (change in one or few chromosomes of the genome). An individual having chromosome numbers other than diploid (2x) number is known as *heteroploid.*

HETEROSTYLY:- The presence of styles of two different length (long style and short filament of anther or *vice-versa*) in a bisexual flower which prevents self-pollination and leads cross pollination, *e.g.* brinjal, litchi, pomegranate, etc.

HETEROTROPHS :- The organisms which do not have the ability to manufacture their food themselves and obtain their food or free energy from the food made by *photomorphs* (chlorophyll containing organisms, *i.e.*,green plants).Man considers himself as the dominant or most important heteromorph. In food chain, there are primary, secondary and tertiary heteromorphs. The plants unable to prepare their own food and draw it from other sources are known as heterophytes or heterotropic plants. They are either parasites or saprophytes.

HETEROZYGOUS:- An individual possessing unlike genes of the same allele or allelomorphic series at the corresponding loci, such as progeny of a clone and F_1 hybrid (*homogeneous*) and composites and synthetics (*heterogeneous*). Heterozygous individuals(Rr or Aa) do not breed true on selfing.

HETEROZYGOUS POPULATION :- A population which

segregates on selfing such as F_1 hybrids, composites, synthetics and clones.

HETEROZYGOUS :- Individuals having dissimilar genes of the same allele on the corresponding locus of homologous chromosomes.

HEXAGONAL SYSTEM :- A system of planting in which trees are planted at the corners of an equilateral triangle and thus six trees form a hexagon with the seventh tree at the centre. This system accommodates about 15% more plants over square system.

HIGH DENSITY ORCHARDING :- An orchard where fruit trees are planted at closer spacing to get higher production per unit area.

HOLDING :- A pre-shipment short-term treatment to cut-flowers in which the flowers are placed in 20% or more solution of sucrose for 12-24 hours at 20-27 °C temperature with 100 lux light intensity. This treatment prolongs vaselife, promotes opening and improves the colour and texture of petals.

HOMOEOSTASIS :- The buffering capacity of a genotype to enviromental fluctuations which leads adaptability to that organism.

HOMOGAMY :- The condition of a bisexual flower where androecium (anthers) and gynoecium (stigma) matures at the same time leading *autogamy* (self-pollination).

HOMOGENEOUS POPULATION :- A population of genetically similar plants such as a pure lines and inbred lines (*homogeneous-homozygous population*) and progeny of a clone and F_1 between two pure lines (*homogeneous- heterozygous population*).

HOMOKARYON :- Hybrid cell combining protoplasts of same species.

HOMOMORPHIC SELF-INCOMPATIBILITY :- Self-incompatibility due to physiological or genetical causes rather than differences in floral morphology.

HOMOZYGOSITY :- The proportion of homozygous individuals in a segregating population.

HOMOZYGOUS :- The individuals in which homologous chromosomes possess identical genes with respect to any given pair of alleles or a series of allelomorphs are called homozygous, such as pure lines (homogeneous individuals), and multi lines and mass selected varieties (heterogeneous individuals) in autogamous crops. Homozygous individuals (RR or rr) produce only one type of progeny on selfing.

HOMOZYGOUS POPULATION :- A true breeding population such as pure lines, multilines and mass selected population in self-pollinated species. It may be *homogeneous* (such as pure lines) or *heterogeneous* (as mass selected varieties)

HORIZONTAL RESISTANCE :- It is, also known as polygenic resistance or non-specific resistance or field resistance or general resistance or minor gene resistance, a type of genetical resistance of a host to all the prevalent races of a pathogen.

HORMONE :- An organic chemical substance, other than aminoacids, organic acids, sugars, nutrients, etc. and synthesized in one part (site of production) of a plant in very low concentration and translocated to another part (site of action) where it causes physiological responses, e.g. auxins, gibberellins, cytokinin, ethylene, etc.

HORTICULTURAL MATURITY :- The stage of development of a plant or its part which possesses the necessary prerequisites for utilization by consumer for a particular purpose and it differs according to crop or its edible part.

HOST :- An organism or plant that harbours parasites , and attacked by a disease, insect or parasitic weed.

HYBRDIZATION :- The technique of mating or crossing (artificially or naturally) of two or more plants of dissimilar genotypes.It is of two types, *viz.* intraspecific or intervarietal or close crossing, and distant or wide crossing (*i.e.*, interspecific and/or intergeneric hybridization).

HYBRID BREAKDOWN :- A condition in which F_1 plants of an interspecific cross are vigorous and fertile but their second generation (F_2 progeny) is weak and sterile.

HYBRID INVIABILITY :- It is the inability of a hybrid zygote to grow into a normal embryo under normal conditions of embryo development.

HYBRID STERILITY :- Inability of a hybrid to produce viable off-springs due to sterility caused by genic, cytoplasmic or chromosomal factors.

HYBRID VARIETY :- A F_1 population which is used for commercial cultivation.

HYBRID VIGOUR :- It is generally used as synonym of *heterosis*, but it differs in the sense that it expresses only the superiority of F_1 over its parents; whereas, **heterosis** is the superiority (or even inferiority) of F_1 in one or more characters over its parents which is the combined expression of genetical, cytoplasmic and physiological factors. Heterisis is directly proportional to the number of dominant genes contributed by each parent. The superiority of F_1 hybrid over the better parent for a particular character is known as *heterobeltiosis*, and the superiority of F_1 over its parents in vegetative growth, but not in yield and adaptation is called *pseudo-heterosis* or *luxuriance*. *Economic* or *useful heterosis* is the superiority of F_1 over the popular variety of a region. The term heterosis was coined by Shull (1941).

HYBRID :- The progeny of a cross between two or more genetically dissimilar parents or genotypes. It may be *intraspecific* (a cross two or more parents of same species) or *interspecific* (a hybrid of cross of two or more species of same genera) or *intergeneric* (a cross between parents of two genera) i.e., a hybrid is the F_1 progeny of cross of two or more parents. According to number of parents used, a hybrid may be monohybrid, dihybrid or trihybrid.

HYDROPONICS :- This is the water culture technique of growing plants with their roots in a recirculating aqueous solution of essential nutrients. In a modification of this technique,

plants are grown with their roots anchored in a solid inert aggregate (sand,gravel,vermiculite,etc.) which is wetted with a solution of mineral nutrients. Hydroponics is used extensively at present to grow plants in the laboratories. Moreover, it is used to grow certain high value crops (*e.g.*, tomato, strawberry, vegetables, etc.) in glass houses.

HYPERPLOID :- An individual having addition of one or two chromosomes to single or two different pairs.

HYPERSENSITIVITY :- A host pathogen reaction which leads to prompt death of infested tissues round the point of pathogen entry and prevents further spread of infection.

HYPOBARIC STORAGE :- Preservation of fresh fruits and vegetables under low pressure and in this method, the commodities are kept in vacuum tight and refrigerated containers. Low pressure inside the container reduces the O_2 tension and facilitates the removal of ethylene produced by products which results in retardation of ripening and senescence by decreasing respiration.

HYPOPLOID :- An individual having loss of one or two chromosomes from the diploid complements.

IDEOTYPE :- A biological model of a plant which is expected to perform or behave in a predictable manner within a particular environment. Ideotype,also known as *ideal* or *model plant type*, is a moving goal which changes with change in knowledge, market requirements and national policy, etc. The term ideotype was coined by Donald (1968).

IDEOTYPE BREEDING :- A method of crop breeding which is used to enhance genetic yield potential through genetic manipulation of individual plant character. Ideotype breeding is a moving object and slow method of crop improvement which is used as suppliment to conventional breeding. In this breeding, emphasis is given on individual morphological and physiological trait which enhances the yield for which a conceptual theoretical model is prepared in advance before initiation of breeding work.

IMBIBITION :- This is process of absorption and adsorption of water or liquid by insoluble,solid, hydrophilic, protoplasmic and cell wall constituents. Water is imbibed as a result of both diffussion and capillary action, and moved from a region of higher to one of lower chemical potential of water. It occurs only when solid plant material (*e.g.*, dry wood, cellulose, dead or living air-dried seeds, etc.) comes in contact with water.

IMMUNITY :- The ability of a plant to absolute resistance against the adverse effects of the micro-organisms, insect-pests, etc.; and such plants are called *immune.*

IMPROVED SEED :- A genetically and physically pure seed of a released and popular variety produced by following scientific methods. Improved seed is of five categories, *viz., nucleus seed, breeder seed, foundation seed, certified seed* and *registered seed.* Farmers are generally recommended to grow certified seed.

INBRED :- In allogamous (cross-pollinated) species, a relatively true breeding line obtained by continuous inbreeding. Inbreeding of allogamous species leads to increase in homozygosity in an inbred line which is used as tester in recurrent selection for *sca.*

INBREEDING :- Mating between closely related (by descent or ancestry) individuals such as selfing and sib-mating. It is a form of *genetic assortative mating* which is useful in maintaining the genetic purity of genotypes and in developing inbred lines.

INBREEDING DEPRESSION :- Loss or decrease in vigour, fitness, physiological efficiency and fertility of an organism as a result of inbreeding.

INCOMPATIBILITY :- In sexual reproduction, it is the inability of pollen to grow into pistils of the same flower (bisexual flower) or flowers of the same plant even the pollen is viable *e.g.* sweet cherry, almond, cabbage, and in case of propagation, it is inability of two different plants (*stock* and *scion*) grafted together to produce a successful union and grow as one plant.

INCOMPLETE FLOWERS :- The flowers in which any of the main parts- sepals, petals, stamens or pistils, is absent. According to the lacking or non-functionality of any of these components, an incomplete flower may be-*apetalous* (the flowers which lacks petals), *staminate* (the flowers in which stamens are functional but pistils are non-functional) or *pistillate* (flowers which contain non-functional stamen and functional pistils). In this connection, the plant family or group of plants whose flowers are incomplete, by lacking either corolla or calyx, is called *incomplete*, as in the plants belonging to family Euphorbiaceae and Urticaceae.

INCOMPLETE LINKAGE :- Linkage of genes in which some frequency of crossing over occurs. In absolute or complete linkage, crossing over does not take place.

INDEPENDENT ASSORTMENT :- Random or free segregation of chromosomes and genes during *meiosis* (gamete formation).

INDETERMINATE :- A growth habit where the main axis of the plant continues to grow indefinitely. In case of inflorescence, the opening of the lower flower first, and the terminal ones opening later.

INDICATOR PLANT :- A plant which reflects specific growing conditions like nutrient deficiency symptoms, disease invasion, etc. by its growth characteristics.

INDIGENOUS :- An individual native to a specified region within the country; and the germplasm(s) collected within the country is called *indigenous collection.*

INDIRECT INTRODUCTION :- Introductions which require few years for adaptation in the changed environmental conditions of new areas.

INDUCED MUTATION :- Artificial mutation which is produced by the use of mutagenic agents (*mutagens*) such as X-rays. Induced mutations are useful in the production of haploids.

INDUCIBLE ENZYME :- An enzyme whose production is enhanced by adding the substrate in the culture medium. The

system in which such enzymes can be produced is called *inducible system.*

INDUSTRIAL QUALITY :- Suitability or fitness of a plant product for use as a raw material in industries such as processing quality in fruits and vegetables.

INERT MATER :- Non-living physical impurities such as sand, gravel, pebbles, soil particles, straw, etc. present in a plant multiplication unit or seed.

INFRA RED RAYS :- The long and low frequent invisible rays on one extreme of light expectrum immediately beyond the *'far-red'* rays of the visible spectrum.They have wavelength of more than 760 millimicrons and affect the plant growth but in very little amount.

INOSINE :- A newly discovered DNA base (nucleotide) which is deamination product of adenosine, and found in third position in a codon and can pair with adenine, uracil and cytosine.

INTEGRATOR GENE :- A gene in the operon of eukaryote located very near to *sensor gene* (a signal receivng gene). It initiates *transcription* (synthesis of mRNA from a DNA template) after receiving signal from a sensor gene.

INTERCROPPING :- It is a type of multiple cropping and also known as associated or companion cropping or *simultaneous polyculture.* It refers to growing of two or more crops together on the same piece of land in a year or raising any crop in the alleys of an orchard. It is of four types, viz., mixed inter-cropping, row inter-cropping, stripped inter-croping and relay inter-cropping.

INTERGENERIC HYBRIDIZATION :- A technique of distant hybridization in which a cross is made between two individuals belonging different genera but the same family. Intergeneric hybrids are always *sterile.* Main reason of sterility in wide crosses is lack of structural homology between the chromosomes of two genera and thus, release of hybrids is not possible through intergeneric hybridization. First intergeneric cross,

Raphanobrassica was developed by Karpechenko (1928) by crossing radish (*Raphanus* sp.) and cabbage (*Brassica* sp.).

INTERMITTENT MISTING:- It involves applying the mist on the leaves of cuttings at definite intervals during the light period.Intermittent system is more widely used as it has main advantage that excessive leaching of soluble compounds from the leaves and water logging of the media is not likely to take place. An intermittent system of misting consists of a timing mechanism (misting-cycle time clock), the electronic leaf, and the Misto-matic.

INTERNAL BROWNING OF APPLE :- A low temperature disorder characterised by diffuse brown flesh only in the cortex or the core tissue. It is most evident in a transverse section of the juncture of the stem and core where vascular elements are usually normal and the general texture of the fruit is not noticeably abnormal.

INTERNAL BROWNING OF TOMATO :- A disorder caused due to high temperature, and water and/or nutrient imbalance. It is characterised by grey-brownish discolouration of internal tissues in green fruit which extends to the surface and form lesion that remain greenish or yellow in ripe fruit.

INTERPHASE :- A stage in spindle using cell division, lies between telophase and prophase, during which DNA synthesis takes place. It consists of three sub-stages, *viz.*, G_1 (a pre-DNA replication phase), S (a chromosome and DNA replication phase) and G_2 (a post DNA replication and RNA synthesis phase).

INTERSPECIFIC HYBRIDIZATION :- A technique of distant hybridization, also called *intrageneric hybridization* in which two different species of the same genus are crossed for interspecific hybrid production. First interspecific cross between Carnation and Sweet William species of *Dianthus* (a genus) was made by Thomas Fairchild (1717). Interspecific hybrids are of three types, viz., *fully fertile* (crosses between species having complete chromosomal homology), *partially fertile* (crosses between species having dissimilar ploidy level but have some chromosomes in

common) and *fully sterile* (crosses between species having no chromosomal homology).Interspecific hybridization is more successful in vegetatively propagated species like potato than in seed propagated species.

INTRA-GENERIC HYBRID :- It is also known as interspecific hybrid which refers to a hybrid between two species of the same genus. Interspecific hybrids may be fully fertile, partially fertile or fully sterile.

INTRA-SPECIFIC HYBRID :- It is also called *inter-varietal* hybrid which is a hybrid between two varieties or genotypes of the same species crop. Intraspecific hybrids are of three types, *viz., single cross hybrid* (cross between two inbreds/purelines/ varieties, *i.e.,* A x B), *three way cross hybrid* {a cross between a single cross hybrid and an inbred, i.e., (A x B) x C} and double cross hybrid { a cross between two single cross hybrids, i.e., (A x B) X (C x D)}.

INTRASPECIFIC HYBRIDIZATION :- It is also known as intervarietal hybridization or close crossing in which two or more varieties or genotypes of the same crop species are crossed for F1seed production.

INTROGRESSION :- Transfer of some genes from one species into the genome of another species.

INVERSION :- Alteration or structural change in a group of linearily arranged genes in a chromosome in which a segment is oriented in a reverse order. It was first discovered by Sturtevant (1926). Inversions are of two types, *viz., paracentric inversion* (in which centromere is not involved) and *pericentric inversion* (in which centromere is involved).

ISOALLELE :- An allele which is similar in its phenotypic expression to those of other independently occurring alleles.It may be of two types, *viz., normal isoallele* (which acts within the phenotypic range of a wild trait) and *mutant isoallele* (which acts within the phenotypic range of a mutant characters).

ISOLATION DISTANCE :- A specified separation distance of the field of a variety from that of another variety of the same crop to prevent intercrossing and contaimination in order to maintain genetical purity of the seed. It depends on crop pollination system (self- or cross pollination) and category of the seed to be produced. Cross-pollinated crops require more isolation distance than self-pollinated ones, and breeder seed production requires more isolation than foundation seed, and foundation seed production needs more isolation distance than certified seed production.

JAM :- A product prepared from fruit's pulp after cooking with sufficient amount of sugar, water and acid to a reasonably thick consistency, firm enough to hold the fruit tissues in position. It contains 0.5-0.6 % acid, 45 % portion of prepared fruit and 68 % T.S.S.

JELLY :- A semi-solid transparent product prepared by boiling clear extract of pectin containing fruits with sufficient quantity of sugar and acid. It contains 0.5 - 0.75% acid, 45% portion of fruit juice, 65% T.S.S. and 0.75 - 1.0% pectin.

JONATHAN SPOT :- A post harvest disorder of apple characterised by light brown, irregular, lobed and slightly sunken to deep brown or black sharply sunken spots at the lenticels on Jonathan and some other cultivars of apple.

JUMPING GENES :- These are also called *transposons* or *transposable elements* due to having tendency to keep on changing their position in a chromosome and also between the chromosomes in a genome. The first case of jumping gene was reported by Barbara Mc Clintock (1950) in corn for which he was awarded Noble Prize in 1984.

JUNE BUDDING :- A season of budding existing between late May and early June in the northern hemisphere and November to December in southern hemisphere, *i.e.* the budding practised in early part of active growing season.

JUNE DROP :- The final post-bloom abscission of partially developed fruits (as in mango) occurring in late May or June.

JUVENILITY :- The stage of seedling plants during which they continue to be vegetative phase for a period of time and do not respond to flower induction treatments.

KARYOKINESIS :- It is the process of the division of nucleus, while the division of cytoplasm is known as *cytokinesis.*

KARYOTYPE :- The sum of characteristic features of chromosomes in a cell nucleus of a species, such as chromosome number, size and form.The diagram which is used to represent karyotype is known as *idiogram.*

KELSEY SPOT :- A disorder of stone fruits caused due to high temperature (above 30-40°C) showing several symptoms like heat burn, pit burn, internal browning, cavity development near the pit, etc.

KETCHUP :- A concentrated juice or strained pulp of fully ripe tomato fruits, cooked with salt, sugar, spices, vinegar, etc. to the extent that it contains not less than 12% tomato fruit solids and 20% T.S.S. Tomato sauce contains 30% T.S.S. but relatively thinner than ketchup.

LAMPBRUSH CHROMOSOME :- A chromosome having lampbrush appearance and have large number of loops.

LAND RACES :- The primitive cultivars which were selected as a locally adapted inbred and cultivated by farmers for many generations. Land races have more genetic diversity, wider adaptibility and high degree of resistance to biotic and abiotic stresses.

LANDSCAPE GARDENING :- The beautification of a tract of land using garden design, tools, methods, plants and garden adornments to create naturalistic effect in miniature form.

LATEX :- A gummy liquid or white milky juice containing minute globules and a mixture of water, proteins (1-2%), resins (2-3%), oils, acids, starch, alkaloids, enzymes, queberchitol (0.5%),ash (0.2-0.6%)and caoutchouc(rubber hydrocarbons, 90-96%), etc., which occurs in specialised cells (*lacitifers*) or vessels usually present in cortex of bark, leaves and other soft parts of the

plants. *Rubber hydrocarbon*, the chief constituent of latex, is colourless, odourless, transparent and elastic, being made up of long chain of isoprene units, insoluble in water but soluble in organic solvents. Latex is exuded by tapping or incision of bark of rubber or latex yielding plants, which mainly belong to family Apocynaceae, Euphorbiaceae, Moraceae, Sapotaceae, Caricaceae. Commercial latex yielding plants are-*Apocynum cannabinum* (Hemp rubber), *Hancornia speciosa* (Mangaberia rubber), *Funtumia elastica* (Lagos Silk rubber), *Hevea brasiliensis* (Hevea rubber), *Manihot glaziovii* (Ceara rubber), *Ficus elastica* (Assam rubber), *Carica papaya* (Papain), *Achras zapota* (Chicle gum), *Malinkara bidentata* (Balata gum), etc.

LATH HOUSE:- A plant growing and/or propagation structure made up of bamboo stripes which provide outdoor shade and protect container grown plants from high summer temperature and high light intensities to reduce moisture stress and decrease water requirement of plants.

LAW OF PARALLEL VARIATION :- The genetical concept, also called law of homologous series of variation, which states that a particular variation observed in a crop species is also expected to available in its another related species.

LEAF :- Leaves are modified stems designated primarily for the manufacture of the initial food substances. Though, they vary greatly in size, shape, and arrangement on the stems of different plant species, they have three tissues- *epidermis* (protective cells, and guard cells and stomates), *chlorophyll* containing cells, and *veins*-in common. In general, the structure of epidermis, the position of guard cell and stomates, and the size, shape, and arrangement of chlorophyll containing tissues vary with crop plants.

LEGHAEMOGLOBIN :- It is also called the haemoglobin of legumes, which is a redish protein produced by host cells containing bacteroids. Leghaemoglobin is similar to haemoglobin, the O_2 carrier in mammalian red blood cells, insofar as it combines reversibly with O_2, it is the only haemoglobin like protein present in higher plants.

LEPTOTENE :- A sub stage of meiotic prophase I in which chromosomes look like thin thread and are interwoven like a loose ball of knitting wool.

LETHAL GENE :- The gene which causes inviability or death of its carrier or cell when in homozygous condition.

LETHAL MUTATION :- A mutation which kills the individual that carries it. It may be two types, viz., *sub-lethal mutation* (which kills more than 50% of individuals that carry it) or *sub-vital mutation* (which kills less than 50% of the individuals that carry it). The dose of physical or chemical mutagen causing 50% mortality of the target material is known as *lethal dose*-50 (LD-50).

LEUCOPLAST :- Colourless plastids (self replicating cytoplasmic organelles in plant cells) commonly occur in storage cells of roots, modified underground stems and other parts not exposed to light and which are associated with storage of starch, protein and fat.

LIGHT AND DARK PERIOD :- The length of light and dark periods refers to the period of light (day) and the period of dark (night) for any given 24-hour "day" for any given location. The relative length of the light and dark periods influences photosynthesis and respiration; and also determines the time of flower bud formation in many plants. On the basis of relative light and dark period requirements, plants are categorised as - *short day, long day* and *day neutral* plants.

LIGHT COMPENSATION POINT :- The light intensity at which the rate of gross photosynthesis equals to the rate of respiration. At this point, rate of net, or apparent photosynthesis becomes zero. The light compensation point varies with the kind of plant. *e.g.*, plants requiring low light intensity, *i.e., shade plants*, have lower compensation point; and plants requiring high light intensity, *i.e.,sun loving plants*, have high compensation point.

LIGHT INTENSITY :- The number of *quanta*, or *photons* (particulates of light) impinging on a given area, or the total

amount of light which plants receive. The light intensity varies with the locations, with the seasons, with the day, and with the distance from the equator. It gradually increases from sunrise to mid-day and gradually decreases from middle of the day to sunset.On the basis of optimum light intensity requirements, plants are classified as: **shade loving plants** (which require low light intensity, 500-1000 *ft-c*), **partially shade loving plants** (which require moderately high light intensity, 1000-3000 ft-c), ***sun loving plants*** (which require moderately high light intensity, 3000-8000 ft-c), and ***sun tolerant plants*** (which thrive well over a wide range of light intensity, 2000-8000 ft-c).

LIGHT QUALITY :- The quality of light refers to the composition of properties of waves of photons, which directly influence the plant growth and development. Since the light spectrum is composed of invisible-*ultraviolet rays* (wave lengths range from15-390 millimicrons) and *infrared rays* (wave length >760 millimicrons), and visible colour spectrum (VBGYOR with wave length ranging from 390 to 660 millimicrons), the 'red' and 'blue' lights are more beneficial for producing plant dry weight in geater amounts than 'white' light, while '*green*' light inhibits plant growth.

LIGHT SATURATION POINT :- The light intensity at/ or beyond which further increase in the rate of net photosynthesis is not occurred; and the light saturation point varies with the kind of plant. *e.g. sun loving plants* have higher saturation point, in which rate of net photosynthesis increased from about 100 to 150 ft-c to about 2800 *foot-candles*, at which the rate of photosynthesis levelled off; and *shade loving plants* have low saturation point, in which the rate of photosynthesis increased from 50 foot-candles to about 960 *foot-candles*, at which the rate of net photosynthesis levelled off.

LINE BREEDING :- A system of population improvement in cross-pollinated crops in which a number of selected genotypes (lines) with superior performance for several characters are composited to produce a new variety.

LINE x TESTER ANALYSIS :- It is also known as *factorial mating design* which is a complete pedigree mating design where a member of parents designated as tester are crossed to all other parents in the poulation being tested. In this analysis, additive variance is equal to general combining ability (gca) variance and dominance variance is equal to specific combining ability (*sca*) variance. The cocept of line x tester analysis was developed by Kempthorne (1957).

LINE x TESTER CROSS :- A modified form of top cross which is used for measuring general and specific combining ability variances and effects in large number of genotypes at a time. In this cross, each male is mated with same group of females but each parent does not have equal opportunity to mate with every other parent. In line x tester cross, the common male parents are known as **testers**.

LINKAGE :- Tedency of genes to remain close together in the same chromosome during heriditary transmission. It occurs in two phases, *i.e., coupling* (linkage between eiyher dominant or recessive genes) and *repulsion* (linkage between dominant and recessive alleles).These phases of linkage were given by Bateson and Punnett (1906). The linkage is of four types, viz., *complete* or *absolute linkage* (in which crossing over does not occur), *incomplete linkage* (in which crossing over occurs in some frequency), *autosomal linkage* (occurs in autosomal genes) and *allosomal linkage* (which occurs in sex chromosomes). Presence of linkage leads to higher frequency of parental types than recombination in test cross progeny.

LOCUS :- A fixed position on chromosome which is occupied by an allele. Homozygous individuals have similar alleles on the corresponding locus of homologous chromosomes, while heterozygous ones have dissimilar alleles on the corresponding locus of homozygous chromosomes.

LOMENTUM :- A simple, dry and schizocarpic fruit developed from monocarpellary, unilocular and superior ovary and constricted/divided into many single seeded mericarps/ compartments. *e.g. Imli, Amaltas,* etc.

LONG DAY PLANTS :- The plants, *nyctophobic plants* which require long light (day longer than a critical day length) and short dark (night) periods for the formation of their flower buds.The most *long day- short night plants* require 8 to 10 hours of continuous dark period, and the critical photoperiod for those ranges from 12 to 14 hours. *e.g.*, certain varieties of strawberry, cabbage, lettuce, radish, spinach, mentha, onion, carrot, beet, tuberous begonia, china aster, delphinium, stock, hibiscus, etc.

LONGEVITY OF SEED :- This is the length of time till that embryos retain their viability, often referred to as their *lifespan,* which varies enormously (from few days to several thousand years) for different seeds under different environmental conditions.

LUXURIANCE :- It is also called *pseudo-heterosis* which expresses superiority of F_1 over its parents in vegetative growth but not in yield and adaptation.

LYCOPENE :- A *carotenoid* (red pigment) found in chromoplasts of ripe tomato which is a straight chain derivative of carotene with no vitamin activity. Chemically ($C_{40}H_{56}$), it is same as the carotene composition. It is abundantly found in red varieties of tomato and peppers, red-fleshed varieties of watermelon, and pink-fleshed varieties of grapefruit, etc.

LYE PEELING :- Peeling of fruits/vegetables by dipping them in boiling 1-2% caustic soda solution *(lye-solution)* for 30 seconds to 2 minutes to loose the skin from the flesh underneath to facilitate easy peeling. It is suitable for peach, apricot, sweet orange, carrot, sweet potato, etc.

LYON'S HYPOTHESIS :- The hypothesis given by Lyon (1969), which states that an individual may have any number of sex (X) chromosomes, but only one remains active and others become anactive or condensed.

LYSIMETER :- A device for measuring percolation and leaching losses from a column of soil under controlled conditions; or *cemented microplots* (tanklike concrete boxes) of various sizes

which are used for measuring evapotranspiration and to the study of roots and salt tolerance capacity of plants.

LYSOSOME :- Cellular particles originated from galgi bodies and contain several digestive enzymes. The main function of lysosome is the digestion of intracellular substances and foreign particles.The term lysosome was first used by Dave (1955).

MACRO-ENVIRONMENT :- Environment differences which are easily detectable such as effects of fertilizer doses, planting dates, spacing, irrigation, etc. The concept of micro and macro-environments was coined by Comstock and Moll (1963).

MAJOR GENES :-These are also called *oligogenes* which refer to genes having distinct and easily identifiable individual effect. *Qualitative characters* showing distinct classes are governed by these genes. The genes with small effect on a character are called **minor genes.**

MALE GAMETOCIDES :- These are the chemicals which are used for induction of *male sterility, e.g.* use of Ethidium bromide induces cytoplasmic male sterility in barley and pearl millet. Male sterility induced by gametocides is non-heritable.

MALE STERILITY :- A condition of flowering plants in which either pollen is absent or non-functional in an otherwise hermaphrodite flower. In male sterility, the pollen is abortive or shrivelled or nonfunctional. A pollen sterility may be caused by nucleus genes (*genic male sterility)* or by cytoplasmic genes (*cytoplasmic male sterility*) or by both cytoplasmic and nuclear genes (*cytoplasmic-genic male sterility*). In flowering plants, the male sterility was first reported by Koelreuter (1763). Male sterility promotes cross pollination without emasculation or allogamy (outbreeding) and inhibits self-pollination (autogamy), and it is transferred from one genotype to another by back cross technique. The male sterile line is represented as *A-line.* Male sterility can also be induced artificially by the use of mutagens (mutagen induced male sterility, which is heritable) or male gametocides (gametocide induced male sterility, which is non-heritable).

MALLET CUTTING :- A type of hard wood cutting with a short section of stem of the older wood is attached with them.

MALNUTRITION:- Refers to adversed effect (s) of imbalanced (deficiency, excess or imbalance of nutrients) diet on humal health. It results various disorders and/or diseases.

MANGO MALFORMATION :- A disorder of mango characterised by production of numerous, thick vegetative shoots at the growing point *(vegetative malformation)* or compact mass of sterile flowers in a penicle bunch *(floral malformation).*

MARKET QUALITY :- Fitness of a product for marketing. In fruit and vegetables, it includes uniformity in shape, size, colour and texture, etc. While the suitability of a plant product for human and animal consumption is known as **nutritional quality**.The genetic improvement of crop plants in relation to various qualitative attributes is called **quality breeding.**

MARMALADE :- A type of jelly prepared from citrus fruits (orange & lemon) containing shreded peels of citrus fruits.

MASS PEDIGREE METHOD :- It is a modified form of pedigree method of breeding in which material from segregating generations is maintained by bulk (mass) method till the conditions are unfavourable for selection and when conditions become favourable, selection is carried out by following pedigree method. Mass pedigree method was proposed by Harrington (1937).

MASS SELECTION:- A method of crop improvement in which individual desirable plants, heads or seeds are selected on the basis of their phenotypic superiority from a mixed population and bulked for growing in next succeding year(s) or generation(s) till the desired improvement is achieved. Mass selection is more commonly used in cross-pollinated (*allogamous*) species than autogamous species and rarely used in asexually propagated plants. In cross- pollinated species, mass selected variety is a mixture of several homo-and heterozygotes. Mass selection is of two types, *viz., positive mass selection* (selection of

desirable plants from a mixed population and growing them in next generation from the bulk seed of selected plants) and *negative mass selection* (removal of off- type plants from a mixed population and allowing rest of the plants to grow further generations).

MATERNAL EFFECT :- Influence of the genotype of female parent on the expression of phenotype of its progeny. Maternal effects are inherited by cytoplasmic genes (*cytoplasmic inheritance*).

MATING SYSTEM :- The method by which individuals are paired for crossing. The systems of mating were given by Sewell Wright (1921). There are five systems of mating, *viz., random mating* (in which each female gamete has equal chance to unite with every male gamete), *genetic assortative mating* (mating between genetically similar individuals), genetic disassortative mating (mating between genetically dissimilar individuals), *phenotypic assortative mating* (mating between phenotypically similar individuals) and *phenotypic disassortative mating* (mating between phenotypically dissimilar individuals). The controlled mating following a specific design for the estimation of genetic variance is called *mating design.*

MATRIX :- In *chromosomal morphology,* it is a mass of acromatic material in which chromonemeta are embedded; and in case of *vegetative propagation, (grafting)* it is a place on rootstock where a scion wood or bud is to be inserted for union.

MATTOCKING :- The practice of removing pseudostem or dried flower stalk after harvesting of fruits (in banana) or flowers (in canna).

MEAN HETEROSIS :- It is also called *mid-parent heterosis* which refers the superiority of F_1, i.e., *heterosis,* over the mean value of characters of both the parents.

MECHANICAL DORMANCY :-A type of seed coat dormancy caused by too hard coverings of seed inhibiting embryo to expand during germination.

MEIOSIS :- It is also referred as *heterotypic* or *segregational* or *reduction division* in which two successive spindle using divisions occur which reduce the chromosome number from diploid to haploid, and gives rise to *four haploid cells* from a single mother cell. The all four daughter cells produced by meiosis are different from mother cells in chromosome number and composition. In plants, meiosis occurs in reproductive organs like anthers and ovaries, and leads to production of gametes and spores. It generates variability due to segregation of chromosomes and recombination of genes and their independent assortment.

MERISTEM CULTURE :- A type of *tissue culture* where a plant is regenerated from tissues of actively dividing part, such as shoot tip or apical meristem, grown *in vitro* on suitable culture medium. It is employed for clonal propagation and recovery of virus free plants.

MESSENGER RNA (mRNA) :- The ribose nucleic acid (RNA) which carries information for amino acid sequences from nuclear DNA to cytoplasm for protein synthesis. It moves from the nucleus to the ribosomes where the message for specific protein synthesis is deciphered with the help of ribosomes and specific RNAs. Messenger RNAs are of two types, viz., *monocistronic mRNA* (found in eukaryotes) and *polycistronic mRNA* (found in prokaryotes).

METACENTRIC CHROMOSOME :- A chromosome in which centromere (*kinetochore*) is located in the middle portion, and such chromosomes assume 'V' shape at *anaphase*. A chromosome in which centromere has sub-median position is called *sub-metacentric* chromosome.

META-XENIA :- This term was coined by Dr. Swingle to describe the influence of the pollen on fruits. It is direct physiological effect of pollen on the outer (*maternal*) tissues (size, shape, colour) of seed and fruit outside the embryo sac (*endosperm*).

METSUBERE :- A nutritional disorder of taro *(Arvi)* due to calcium deficiency and characterised by concave or smooth top, brownish colour and varying size of defective corms.

MICRO-ENVIRONMENT :- Environment of single genotype as opposed to another genotype growing at the same time in almost the same place. There is a minute enviroment differences which are not easily detectable.

MICRO PROPAGATION :- It is also known as *microcloning* which is the technique of regeneration of plants from very small isolated meristematic tissues or cells aseptically in a test tube or other container feeded with nurient medium under controlled conditions.This propagation is accomplished with enhancement of adventitious budding and then stimulation of root development from the base of the buds.The process of differentiation of shoot and root from somatic organs (bud, embryo, ovule, anther, pollen, etc.) is called *organogenesis*; and the regeneration capacity of a plant cell to develop into a whole plant is known as *totipotency*. Micropropagation is most commonly referred as **tissue culture** which may consist cell culture (regeneration of whole plant from a single cell) or organ culture (regeneration of a plant from an organ- anther, ovule, embryo and bud) or *meristem culture* (regeneration of a plant from active tissues) or *protoplast culture* (regeneration of a plant from a naked single cell). A plant part which is used for regeneration is known as **explant**.

MILLERANDAGE :- A disorder of grape in which berries fail to enlarge properly and remain under developed and seedless. It may be due to heavy crop load or bad weather during pollination.

MIST :- A fine film of water on the surface of leaves of herbaceous and softwood cuttings planted inside the *misting chamber*; which maintains a high relative humidity of the ambient air and reduces the rate of transpiration to a minimum. The process of spraying of water in form of mist or fog is called **misting**. As a result of misting, water loss through transpiration is reduced to a minimum, the guard cells remain turgid, the stomata open, and the manufacture of photosynthates proceeds unabated even in the presence of high light intensity. There are two techniques of misting- *continuous misting* and *intermittent misting*.

MIST PROPAGATION :-A method of plant propagation by vegetative parts, usually from herbaceous and softwood cuttings which require leaves, inside the *misting chamber* by maintaining a film of water (*mist*) on the leaves and a high relative humidity of the ambient air inside the chamber which reduces moisture loss through transpiration from propagating material.

MITOCHONDRIAL INHERITANCE :- The inheritance which is governed by *mitochondrial genes* (DNA). While inheritance controlled by chloroplast genes is called **plastid inheritance** (in plants). These both type of inheritance are governed by plasma genes associated with mitochondrial DNA or chloroplast DNA.

MITOSIS :- It is also known as *homotypic* or *equational division*, which is the spindle using cell division producing two identical daughter cells from a mother cell (a cell which undergoes division). It is a genetically controlled process which maintains the genetic purity due to lack of segregation and recombination. In plants, mitosis takes place in somatic organs like root tip, stem tip and leaf base, etc. The term mitosis was coined by Flemming (1882). In mitosis, chromosomes are arranged at equatorial plane during early metaphase; chromatids move to opposite pole during anaphase and DNA synthesis takes place during *S-stage* of interphase.

MITOTIC PHASE :- It is second phase of cell division cycle in which replicated DNA separated into two identical daughter nuclei without recombination. It consists of *prophase* (a longest phase in mitosis, in which chromosomes become shorter and thicker), *metaphase* (in which chromosomes are arranged at the equatorial plate), *anaphase* (in which chromatids move towards opposite poles) and *telophase* (in which chromosomes reach the opposite poles).

MIXED CROPPING :- It is also called *mixed intercropping* which deals with raising of two or more crops by mixing their seeds or simultaneously without distinct row arrangement at same time on same piece of land in a year.

MIXED FARMING :- It is also called diversified farming which refers to growing of crops in combination with animals such as dairy, poultry, pigery, fisheries, bee keeping, etc. In diversified farming or a *diversified farm*, no single product or source of income equals as much as 50 per cent of the total receipt and on such farming or farm, the farmer depends on several sources of income.

MODIFIED LEADER :- A tree training method in which the main trunk is allowed to grow to about 1.8 - 2.5 m in height and then cut back for giving a shape intermediate between central leader and open centre.

MONO CULTURE :- A cropping system which refers to repetitive growing of the same sole crop year after year on the same field. The raising one crop alone in pure stands is known as *sole cropping* or *sole planting*.

MONOCOTS :- Also called *monocotyledons*, the angiospermic plants which produce one *seed leaf* (embryo with one cotyledon), parallel-veined leaves, closed vascular bundles, herbaceous and less commonly woody stems, and flower parts in groups of three or multiple of three, and the body of manocots consists of primary tissues (meristem) only through out the life cycle of the plant . *e.g.*, date palm, banana, coconut, onion, pineapple, etc.

MONOECY :- The sexual condition of a plant species in which male (*staminate*-having functional stamens) and female (pistillate-having functional pistils) flowers borne separately on the same plant.These both types of flowers may be persent separately on same inflorescence as in coconut, or in separate inflorescence at the same time as in jackfruit and corn, or in separate inflorescence produced sequentially as in oil palm, cucurbits (except pointed gourd which is dioecious); the plants showing this type of phenomenon of sex expression are called **monoecious** e.g., banana, datepalm, pecan, walnut, filbert, rubber, chestnut, tung, most cucurbits (except pointed gourd and few varieties of cucumber and muskmelon). There are two types of monoecious forms- *andromonoecious* and *gynoecious*.

MONOHYBRID CROSS :- When involvement of only one gene pair of contrasting phenotypic character is taken into consideration during hybridization.

MONOHYBRID :- An individual or a group of individuals which contain one pair of heterozygous genes with the remaining genes being, presumably, homozygous, i.e., a monohybrid is the F_1 progeny obtained by crossing two individuals differring in one pair of genes only or in one pair of contrasting traits. e.g., AA BB cc x aa BB cc = Aa BB cc (F_1). In segregating generation (F_2), complete dominance occurs with the phenotypic ratio of 3:1.

MONOPLOID :- An euploid individual with basic chromosome number or single genome (x) in the somatic nucleus. It differs from haploid as haploid carry a gametic (half) chromosome number (n) in the somatic nucleus. Monoploids which develop from a normal diploid species are referred as **monohaploids**.

MONOPODIAL :- A group of **orchids** devoid of rhizome which grow continuously in one direction only and their single stems lengthen from one season to another throughout its life period, e.g. *Vanda, Phalaenopsis,* etc; or a type of **inflorescence** in which the main stem continues to grow indefinitely by the terminal bud and give off branches laterally in acropetal succession.

MONOSOMIC :- An aneuploid individual, also called *hypoploid,* lacking one of the basic chromosome complement from a diploid set and it is represented by 2n-1(*simple monosomic*) or 2n-1-1 (*double monosomic*).

MORPHOLOGICAL DORMANCY :- A type of seed dormancy in which the embryo is not fully developed at the time of ripening and such seed may have either rudimentary or undeveloped embryo, *e.g.* magnolia, poppy, carrot, primula, etc.

MULCHING :- A loose extraneous covering of soil surface using farm wastes like grass, straw, stump, etc. for conservation of soil moisture, suppressing weed growth and to maintain temperature in root zone of crop.

MULTILINE :- A deliberate seed mixture of *isogenic lines* (genotypes having single locus difference only) or closely related/ unrelated lines. A variety derived by growing any of these mixtures of normally autogamous plants is known as **multiline variety**, and the procedure of developing multiline varieties is called **multiline breeding**. Multilines are homozygous and heterogeneous population and have broad genetic base. The concept of multiline cultivar was developed by Jensen (1952).

MULTIPLE ALELE :- Exhistence of more than two alleles of a single gene present on a locus of homologous chromosomes.

MULTIPLE CROPPING :- Growing of two or more crops simultaneously on the same field in a year. Multiple cropping system helps in stabilizing crop production, best use of land resources and control of pests and diseases. It is of two types, *viz., sequential cropping* and *inter cropping.*

MULTIPLE CROSS :- It is also known as *composite cross* which deals with a cross between more than four inbred lines.

MULTIPLE CROSSING OVER :- Presence of more than two cross overs between non-sister chromatids of homologous chromosomes during *pachytene.*

MULTIPLE FRUIT :- A collection of fruits *(composite fruit)* developed from entire inflorescence by fusion of carpels from many flowers and some time axis and accessary tissues also, *e.g. sorosis* (mulberry, jackfruit, pineapple), *syconus* (fig, banyan), etc.

MUTAGEN :- A physical or chemical agent or treatment which under suitable conditions may cause or greatly enhance the mutation. The induction of mutation by treatment with mutagen is called **mutagenesis**, and the ratio of desirable changes free from associated undesirable changes on mutagenesis is known as **mutagenic efficiency**.

MUTATION :- A sudden heritable change in the phenotype of an individual due to individual gene or chromosomal changes.

On the basis of the degree of visibility, it may be *macro-mutation* (with distinct changes in the phenotype; generally found in *quantitative traits*) or *micro-mutation* (with invisible phenotypic changes; found in *polygenic traits*). On the basis of nature of occurence, it may be *spontaneous* (mutation that occurs naturally by mutator gene) or *induced/artificial* (mutation produced by the use of mutagen). Mutation was first discovered by Wright (1791) and the term mutation was coined by Hugo de Vries (1900).On the basis of site of mutation, it may be somatic (mutation in somatic genes) or *germinal* (mutation in germ line cell) or *nuclear* (mutation in nuclear gene) and on the basis of survival it may be vital (mutation in which all the mutants survive) or *lethal* (mutation which kills the individual that carries it).

MUTATION BREEDING :- Crop improvement by creation of new genotypic and / or phenotypic traits in a plant or genotype, *i.e.*, creation of *mutants* (variety or clone) through mutation. The product of mutation (a genotype or a cell or a polypeptide) is called *mutant.*

MUTATOR GENE :- A gene which causes and enhances the spontaneous mutation rate of another gene(s) in the same genome, e.g., dotted gene in corn. Genes which decrease the frequency of natural mutation of other genes in the same genome are called **antimutator genes**; and a gene which exhibits higher mutation rate than others is known as **mutable gene.**

MUTON :- It is the *smallest unit* within a gene, which can give rise to a mutant phenotype or mutation. It is a unit (site) of mutation in a gene. Highly mutable sites within a gene are known as *hot spots.*

MYCORRHIZA :- A symbiotic association of a beneficial fungus on the young roots of certain plant species, which prevents the growth of root hairs but does their work in the absorption of water and minerals from soil and in return mycorrhiza gets food & shelter from the plant on which it grows, *e.g.* roots of litchi, beech, oak, etc.

NAPIFORM ROOT :- Modification of tap root by swelling in spherical form due to storage of food at upper part and sharply tapering to very thin & fibrous at the lower part. e.g. beet, turnip, etc.

NATURAL SELECTION :- The process of selection in nature without human interference in which the fittest individuals or species survive and rest are wiped out. It refers to differential rate of reproduction of different genotypes of an organism in response to enviromental factors. Natural selection favours those characters which are advantageous for survival of an organism. In contrast, **artificial selection**, *i.e.*, selection made by human efforts favours those characters which are related to yield and quality and useful for mankind.

NEGATIVE INTERFERENCE:- The tendency of one crossover to enhance the chance of another crossover in its adjascent region during pachytene phase. This type of interference is generally found in lower organisms like *Aspergillus* and *bacteriophages*. In contrast,a **positive interfernce** reduces the chance of another crossover in its adjascent region. The term interference was coined by Muller (1916).

NEOPHISIS :- The term coined by Swingle (1948) to *'causing to grow new'*. Regeneration of any plant material by apomictic seedlings in that plant which degenerate due to vegetative propagation from generation to generation.

NITRIFICATION :- The transformation of ammonium ion (NH_4^+) into nitrarte (NO_3^-) and nitric acid in the soil. This a two- stage biological process i.e. oxidation of ammonium and production of nitrite (NO_2^-) via hydroxylamine by Nitrosomonas and related genera of bacteria and then oxidation of NO_2^- to NO_3^- by *Nitrobactor* bacteria. C_4 plants have been reported to use nitrate more efficient than C_3 plants.

NITROGEN FIXATION :- The chemical union or reduction of atmospheric N_2 to ammonium ion (NH_4^+), principally by nitrogen fixing micro-organisms (biologically and industrially), and/or naturally as a result of lightning strokes. This sometimes

also known as *dinitrification* (the prefix "di" emphasizes the two-atoms of nitrogen under go reaction.

NON-CLIMACTERIC FRUITS :- Fruits showing a gradual decline in respiratory rate with ripening. They should only be harvested at full ripe condition, *e.g,* grape, litchi, muskmelon, ber, strawberry, etc.

NONFOODS :- The organic compounds which do not store or liberate free energy, as in the case of foods, nor do they furnish substances for the making or repair of living tissues, They do, however, facilitate the fixation or release of free energy in the numerous chemical reactions taking place in crop plants. These nonfood compounds are commonly known as *enzymes, coenzymes,* and *phytohormones.*

NON-GENETIC RNA :- The ribose nucleic acid (RNA) which does not act as genetic material and found in higher organisms where DNA is the genetic material. On the other hand, RNA found in most of the plant viruses and certain **bacteriophages** act as a genetic material (DNA) where it is called **genetic RNA.**

NON-RECURRENT APOMIXIS :- A type of apomixis where embryo arises directly from a haploid egg nucleus without fertilization, *e.g. Datura, Zea mays, Solanum nigrum, etc.*

NORMAL CHROMOSOMES :- Chromosomes which are normal in shape, size and function. Some chromosomes like lampbrush chromosomes, polytene chromosomes and B-chromosomes differ in structure and function from normal chromosomes so they are called *special chromosomes.*

NORMAL SEEDLINGS :- The seedlings (juvenile stage of a plant grown from a seed) which exhibit normal and satisfactory growth of root and shoot and able to develop into normal plants. Seedlings which are unable to develop into normal plants are called *abnormal seedlings.*

NUCELLUS :- The tissue of the ovule in which the embryo sac develops and surrounded by integuments.

NUCLEAR INCOMPATIBILITY :- Failure of the union between egg and pollen nuclei even though the pollen nuclei has entered the egg thus resulting in a form of apomixis if an embryo develops.

NUCLEOTIDE :- A nuclear molecule formed by the union of deoxyribose sugar (pentose sugar), nitrogen base (A,G,C,T or U) and phosphate linkage (phosphoric acid), *i.e.,* a nucleotide is a combination of phosphate and *nucleoside* (a combination of deoxyribose sugar and nitrogenous base). It is the unit of DNA and RNA organisation.

NUCLEUS :- A specialised, double membrane, spherical or oval protoplasmic structure embedded in the cytoplasm of cells of eukaryotes and contains chromosomes.Nucleus was first discovered by Robert Brown (1833).

NUCLEUS SEED :- An initial and limited quantity seed of a new developed variety/ genotype produced by originating plant breeder or institution. It is progenitor of breeder seed.

NULLISOMIC HAPLOID :- A type of aneuhaploids which develops from a nullisomic (2n-2) and a nullisomic haploid is denoted as *n-1*.

NULLISOMIC :- An aneuploid individual lacking one pair of chromosomes from a diploid set and it is represented by $2n$-2.

NURSE CROP :- The crops which are raised primarily to help a less hardy main crop from sun, frost and other biotic and abiotic stresses or nourishes the main crop by way of nitrogen fixation and adding organic matter into the soil.

NUT :- A hard, dry, one seeded, indehiscent fruit developed from superior, syncorpous and bicarpellary ovary where the fruit wall (*pericarp*) or part of it becomes hard and stony or woody at maturity, *e.g.* walnut, chestnut, pecannut, almond, pistahionut, cashewnut, etc.

NUTRIENTS :- *For living beings*, these are various chemical components of food which provide nourishment and energy to the body, such as carbohydrates, proteins, fat, vitamins, and

minerals; and *for plants,* these are chemical elements available from soil, air and water which are utilized by plants for growth, development and reproduction. The sum of the processes by which organisms take food substances in relation to health, or plants absorb and utilize chemical elements is known as **nutrition.**

OBLIQUE STYLE BONSAI :- A style of bonsai where the plant is grown in an oblique position as it swept by wind and consequently having more branches on one side.

OBSOLETE CULTIVARS :- These are the improved varieties of the recent past. While the currently cultivated high yielding varieties are referred **modern cultivars.**

OFF SHOOT/OFFSET :- A lateral shoot or branch that develops from the base of the main stem and it is generally shortened and thickened stem of rosette like appearance. It is common in date palm, pine apple, banana, etc.

OKAZAKI FRAGMENTS :- Short segments of nucleotides synthesized in lagging strand (a discontinuous replicating strand) of DNA as a result of discontinuous replication.

OLIGOGENIC TRAITS :- The *qualitative characters* which are governed by one or few *oligogenes* (genes having large individual effects). Oligogene results discontinuous variation in a character.

OLIGOSACCHARIDES :- These are formed by joining 2 to 10 units of monosaccharides in glycosidic linkage. They may be **disaccharides** such as *sucrose* (glucose + fructose), *maltose* (glucose + glucose) and lactose (glucose + galactose); **trisaccharides** such as *raffinose* (fructose + glucose + galactose) found in beet root and *melezitose* (glucose + fructose + glucose) found in some conifers.

OPEN CENTRE :- A system of training of fruit trees where in the leader branch is pruned and diverging branches of approximately equal diameters at the base are developed leading to a spreading structure.

OPERON MODEL :- It is a group of closely linked genes which act together and code for the various enzymes of a particular biochemical pathway. The 'operon model' of gene regulation was discovered by Jacob and Monod (1961) for which they were awarded Noble Prize in 1965. A set of *structural genes* whose transcription (protein synthesis) is regulated by a set of *regulator genes* (gene which regulates and directs the synthesis of repressor protein molecule), *promoter genes* (gene located between regulator and *operator genes* and initiates mRNA transcription) and operator genes (gene that controls the function of one or more structural genes).

OPTIMUM TEMPERATURE :- The temperature range within which maximum photosynthesis and normal respiration take place throughout the life cycle of the plant, *i.e.*, the temperature range which is the most favourable for growth and development of any particular plant in a particular enviromental condition. The heat and temperature requirements for different crops may differ, and on the basis of heat requirements, horticultural crops are grouped as: *crops requiring low temperature range (7-13°C)* such as apple, pear, plum, strawberry, blueberry, asparagus, spinach, lettuce, potato, pea, root crops, aster, carnation, geranium, snapdragon,etc.; *crops requiring moderate temperature range (13-18°C)* such as peach, apricot, fig, persmmom, pecan, tomato, eggplant, chilli, bean, azalea, coleus, rose, lily, etc.; and *crops requiring high temperature range (18-24°C)* such as banana, cocoa, cashew, coffee, citrus, papaya, pomegranate, datepalm, sweet potato, yams, cassava, cucurbits, sweet corn, diffenbachia, croton, pothos, dracaena, gloxinia, etc.

ORGAN CULTURE :- The regeneration of a plant by aseptic culture of a *plant organ* (any plant part having separate identity, such as bud, anther, pollen, ovule, embryo, etc.) on nutrient medium to develop new individual. On the basis of plant organ used for regeneration, an organ culture is classified as *anther culture, pollen culture, ovule culture, ovary culture, embryo culture,* etc.

ORGANOGENESIS :- The process of diferentiation of both adventitious shoot and root from *somatic embryos* in culture medium. The process of formation of somatic embryos from the callus is called ***embryogenesis.***

ORTHODOX SEEDS :- A category of seed mostly hard coated seeds which can be dried to a low moisture content up to 5% and would show a loss of viability with the rise in moisture content. They can be stored for a long period at low temperature, *e.g.* peach, plum, lemon, pomegranate, etc.

OSMOSIS :- It is a simple diffusion of liquid (water) through semipermeable membrane from regions of higher concentration of water to regions of lower concentration of water,or from lower concentration of solution to regions of higher concentration of solution. Plants get water by means of osmosis where plasma membrane of root hairs behave as semipermeable membrane. The direction of movement of water occurs as in imbibition, *i.e.* from higher to lower water potential.

OUTBREEDING :- Mating between distantly related individuals such as *cross pollination.* This consists of random mating, and genetic disassortative mating.

OVARIAN SELF-INCOMPATIBILITY :- A type of self-incompatibility in which self incompatibility reaction occurs when the pollen tubes reach the ovary. The failure of fertilization due to occurence of the inhibition of pollen germination or pollen tube growth on the stigma, it is called **stigmatic self incompatibility.**

OVARY :- An ovary is the enlarged and swollen basal portion of the *gynoecium,* formed by folding up of the lamina of the pistil, which produces one or more ovules, each of which in due time contains, with other cells, a fertilized or unfertilized egg. An ovary, after maturation, developes into a fruit, *i.e.,* a matured ovary is called **fruit.**

OVERDOMINANCE HYPOTHESIS :- Occurence of heterosis due to superiority of heterozygote over both the homozygotes.

The condition of intra-allelic interaction when the heterozygote is superior to both the homozygote is known as **over dominance** or **super dominance**. Overdominance hypothesis of heterosis was independently proposed by Shull and East in 1908, and the term over dominance was coined by Hull (1945).

OVERLAPING GENES :- Genes which code for more than one protein. In such genes, the complete nucleotide sequence codes for one protein and part of such nucleotide sequence codes for another protein.

OVULE :- The portion (*macro sporangium*) of the ovary that contains the embryo sac and the egg cell, and which after fertilization, develops into a *seed.*

OXIGENATOR :- The aquatic plants that absorb waste from the animal population of the pond and in return give out oxygen to the animal life in the water, *e.g. Sagittaria netens,Callitriche autumnalis, Elodea canadensis, etc.*

PAPAIN :- The *enzymatic latex* having proteolytic activity and exudated from the unripe papaya fruit.

PARASITE :- An organism (fungi, bacteria, virus, nematode, weed, etc.) which lives upon or within another living organism (host).

PARTHENOCARPY :- The development of fruit (usually seedless) without fertilization of ovum irrespective of whether pollination has occured. Parthenocarpic fruits are banana, naval orange, seedless grape, pineapple, and certain varieties of cucumber.

PARTHENOGENESIS :- The development of embryo (*i.e.* a new individual) either from the *haploid* or *diploid egg cell* without fertilization. If the embryo develops from a haploid egg, it is called haploid parthenogenesis; and when embyo develops from a diploid egg, it is called **diploid parthenogenesis**, *e.g.* mangosteen.

PARTIAL DIALLEL CROSS :- It is also called *fractional diallel* cross which is a modified form of diallel cross in which only a

part of all possible crosses from diallel mating is used for analysis. Pratial diallel fails to provide information about specific combining ability (*SCA*) due to that every parent is mated with some of the other parents but not all. In partial diallel, total number of crosses is equal to '*ns*/2', where *n* is the number of parents and *s* is the number of sample crosses per parent. The concept of partial diallel cross was developed by Kempthorne (1957).

PARTIALLY SHADE LOVING PLANTS :- The plants which require moderately high light intensity (1000-3000 *ft-c*) for their growth and development. They thrive well under shade and direct sun for short time daily. *e.g.*, cocoa, coffee, tea, pepper, vanilla, caladium, gloxinia, peperomia, periwinkle, orchids, sansevieria, etc.

PASTEURIZATION :- Method of temporary preservation by heating a liquid food below boiling (less than 100°C) temperature for a sufficient time to kill the most of the micro-organisms and delaying the development of surviving ones.

PATHOGEN :- A disease causing organism such as bacteria, fungi, virus and mycoplasma, etc. A race of a pathogen capable of attacking a host with specific resistance is called virulent *pathotype*; and ability of a pathogen to induce disease in a host is known as *pathogenicity*.

PEA BERRY :- A coffee fruit (berry) with single seed instead of normal two seeds.

PECTIN :- A complex carbohydrate compound derived from water insoluble pectose and responsible for firmness of cell wall of a fruit.

PEDIGREE BREEDING :- A method of crop improvement by selection in segregating population of self-pollinated crop species with the help of proper ancestral record of plants and progenies selected in each generation. A record of the ancestry of an individual selected plant for its various generations is known as **pedigree**.

PENETRANCE :- The ability and frequency of a gene with which it produces phenotypic (visible) effect in the individual carrying it. Penetrance may be *complete* (expression of a gene in all the individuals carrying it) or *incomplete penetrance* (expression of a gene in less than 100% of its carriers).

PEPO :- A fleshy, many seeded fruit developed from one or three celled, syncarpous and inferior ovary having parietal placentation. Outer thin wall becomes hard, mesocarp fleshy, endocarp fleshy & juicy and enbedded with many seeds, *e.g.* cucurbitaceous fruits.

PERFECT FLOWER :- The flowers which contain both the *functional stamens* (male part) and *functional pistils* (female part) in the same flower bud; also called *bisexual* or *hermaphrodite* flowers, and this type of sex form is known as **hermaphroditism** or **bisexuallity**. *e.g.*, tomato, chilli, brinjal, carrot, cabbage, bean, pea, okra,radish, celery, sweet potato, avocado, raspberry, almond, strawberry, apple, pear, peach, citrus, sweet pea, violet, carnation, rose, chrysanthemum, snapdragon, etc., are the perfect flowering crops.

PERGOLA :- A series of arches joined together from the entrance leading to a house and used to train climbers to provide beauty & shade.

PERICYCLE :- A multi-layered meristmatic zone between the endodermis and the vascular bundles, and occurs as a cylinder encircling the vascular bundles and the pith. The main function of the pericycle in root zone is the formation of lateral roots.

PETALS :- The petals, collectively called *corolla*, are usually the showy, coloured and attractive leafy structures, as second accessary member of the flower whorl, which protect the reproductive organs (stamens and pistils) when the flower is in bud stage; and after the opening of flower bud, the large, showy and highly coloured petals attract pollinating insects.

PETIOLE :- It is also called *leafstalk* which consists mainly of vascular bundles and mechanical tissues and serves as a transportation system between the manufcturing cells of a leaf

and the stem, and also holds the leaf blade in the light. In some plant species, petioles become fleshy and form the edible portion, e.g., celery and rhubarb.

pH :- An acronym for *hydrogen power* (French: *pouvoir hydrogene*), which is expressed as negative log (anti-log) of hydrogen ion concentration. It is universally adopted scale of measuring acidity; which determines the soil reaction whether it is neutral (pH 7.0), acidic (pH<7.0) or alkaline(pH>7.0).

PHENOLIC COMPOUNDS :- Phenolics are derivatives of phenol and are quite diverse in their chemical structure with benzene rings and various substituent groups such as,hydroxil, carboryl or methoxyl, and other non-aromatic or ring structures.They are ranging from such compounds as *catechol, caffeic acid,* and *aesculin* to *anthocyanidins* and other complex polyphenolic compounds. Many polyphenols are brightly hued pigments (blue, red, yellow, orange) and are responsible for colouration in flower petals, leaves, and other tissues. They frequently occur in plants coupled with sugar molecules (anthocyanidin + glucose = anthocyanin) in the form of glycosides.

PHENOTYPE :- The actual appearance or observable characters of an individual without references to its genetic nature such as colour, height, plant texture and sex, etc. Individuals exhibiting same phenotypic traits may appear alike but may not breed alike. The degree to which phenotypic expression is exhibited in a plant community under various enviromental conditions is known as **phenotypic plasticity.**

PHLOEM :- The radially arranged vascular bundle tissues which consists sieve tube cells, companion cells, phloem parenchyma and fibres, and provides channel for the *basipetal translocation* of photosynthates, hormones, and vitamins from leaves to root hairs. It is located between pericycle and primary xylem tissues, and this phloem in combination with pericycle, endodermis, cortex and cork cambium forms the bark.

PHOTONS :- Also called *quanta,* are the tiny particles or discreet units of sun light in which forms *kinetic energy* (light) of the sun comes to us. According to the electromagnetic concept, these photons exhibit the properties of waves, length and frequency, such as having relatively short length and high frequency (*X-rays* and *cosmic rays*), moderately long length and moderate frequency (*ultraviolet* and *visible rays*), long length and low frequency (*infrared rays*), and very long length and very low or no frequency (*radio waves*).

PHOTOSYNTHESIS :- It is essentially an *endogonic* energy-fixing or light trapping biochemical reaction leading to synthesis of organic compounds (basically carbohydrates) in chlorophyll containing tissues (*chloroplasts*) of plants in the presence of water (H_2O), CO_2 and sun light. As water is a primary source of oxygen for all living things, it provides O_2, carbondioxide (CO_2) provides carbon and light provides kinetic energy which changed into *potential energy* in form of photosynthates through biochemical reactions in chloroplasts. Photosynthesis comprises two rather distinct but directly related reactions; *i.e.*, the *photochemical* or *light reaction* and *thermochemical* or *dark reaction.* Photosynthesis takes place in chloroplasts in presence of light only and always increases the dry weight of plant(s).

PHYSICAL PURITY :- Freedom of seed from *inert matter* (non-living materials such as sand, pebbles, soil particles, straw,etc.) and *defective seeds* (broken, diseased, insect damaged, undeveloped, etc.).

PHYSIOLOGICAL DORMANCY :- A type of *internal seed dormancy* where the controlling mechanisms apparently lie within the living, physiologically active seed coverings, found in freshly harvested seeds of many plants of the temperate climate which tends to disappear with dry storage.

PHYSIOLOGICAL MATURITY :- Attainment of final stage of biological function by a plant part or the plant as a whole.

PHYTOHORMONES :- These are commonly known as *plant hormones* or *hormones* which are organic compounds other than

sugars, amino acids, organic acids, etc. synthesized in one part of a plant in biologically very low concentration and translocated to another part where they caused physiological reponses. Like enzymes, they do not act as a catalyst only but take full part in physiological responses, and their site of synthesis and the site of action are different. According to their role in regulation of physiological activities, they are place in two groups, *viz., growth promotors* (which promotes or stimulates the growth and development, such as gibberellins, auxins and cytokinins) and *growth inhibitors* or *growth retardants* (which suppress or retard the growth and development activities, such as abscisic acid, ethylene, coumarin, dormin, phenolic acid, etc.). Besides the naturally occuring hormones, now a days, *growth regulators*, commonly known as *plant growth regulators* (PGR) are also being synthesized industrially with the same chemical structure as natural phytohormones or closely related chemical structures to those natural substances; IAA,IBA, NAA, GA_3, MH, phosphon-D, Cycocel, B-nine, Amo-1618, ancymidol, SADH, Alar, are the some examples of man-made growth regulators.

PICKLE :- A processed product prepared from fruits or vegetables by preserving them in common salt, edible oil, or vinegar with the addition of spices and condiments, *e.g.* mango pickle, lime pickle, etc.

PIGMENTS :- These are the chemical compounds which absorb radiant energy in visible range stimulate the retina of the eye and give the sensatrion of distinctive colour. The pigments are of two types, *viz.*, **plastid pigments** (which occur in the surface of plastids-*chloroplast* or *chromoplast*, such as chlorophyll, and *carotenoids*- carotene, xanthophyll, capsinthin, lycopene, etc.) and **sap pigments** (which are found in the sap of living cells, such as *anthocyanin* and *anthoxanthins*). To the human eye these pigments are coloured; e.g., chlorophyll is *green*, carotenoids are *red* or *yellow*, and phytochrome is *blue*.

PINCHING :- The process of removal of terminal growing portion of shoot to reduce plant height as well as to encourage side growth for getting bushy appearance in plant.

PINK BERRY OF GRAPE :- A disorder of grape where in some berries develops off-pink colour which turns black within a day after harvesting and incidence increases with rising temperature in late season. It is pronounced in Thompson Seedless variety of grape in Maharashtra region.

PISTIL RECEPTIVITY :- The condition of maturation of pistil when its egg is ready to receive the sperm germinated in pollen grain. **Pollen receptivity** is indicated by secretion of sugars and other food substances and hormones on the surface of the stigma. These materials are necessary for the germination of the pollen tube. Obviously, pollen shedding and stigma and pistil receptivity should take place at the same time. If there is differences, the fertilization could not take place and the condition of incompatibility occurs.

PITH :- The central portion or central core of the stem and the tap root, which is usually made up of relatively large, thin walled *parenchymatous cells* with relatively abundant intercellular spaces, which is the storage of food, particularly *starch.*

PITTING OF CITRUS :- A typical form of chilling injury in which depressed areas in the rind turn tan to dark brown, being circular when pits occur singly or form large irregular patches when they collapse.

PLANT GROWTH REGULATOR (PGR) :- Either synthetic organic compound other than plant nutrients or plant hormone that modify plant physiological processes when used in very low concentraction.

PLANT HARDINESS :- This refers to the innate ability of plants to withstand or avoid injury from stress conditions.

PLANT INTRODUCTION :- It is generally called introduction which is the first and important step in breeding programme in which a genotype or crop plant is taken from the place of their growing areas into new areas or environment where it has not been grown earlier. It is of two types, *viz.*, **direct introduction** (introductions which are immediately adapted to the changed

environment or directly released as a variety for cultivation in new area) and **indirect introduction** (introductions which require few years for adaptation). Introductions are used as a direct variety or a variety after selection or a parent of hybrid.

PLANTATION CROPS :- These are man-made standard of tropical perennial fruit/spices crops grown commercially in large scale under uniform system of cultivation and requires some sort of processing before use, *e.g.* cashewnut, tea, coffee, cardamom, black pepper, etc.

PLASMA GENE :- The genes which are found in cytoplasmic organelles either in chloroplasts (*chloroplast genes*) or in mitochondria (*mitochondrial genes*). These are also known as *cytoplasmic genes* or *cytogenes* or extra nuclear genes which are responsible for cytoplasmic or extra nuclear inheritance. Characters governed by plasma genes usually exhibit segregation in somatic tissues such as leaf colour and variegation. Mapping of plasma genes is more difficult than nuclear genes.

PLASTID :- These are self replicating organelles found in plant cells. They may be colourless (*leucoplasts*), green in colour (*chloroplasts*) or coloured other than green (*chromoplasts*); where, *leucoplasts* are associated with storage of protein, starch and fat; **chloroplasts** are associated with photosynthesis; and *chromoplasts* are associated with different colours, other than green, like orange red (*carotene*) and yellow (*xanthophyll*) of plant parts.

PLASTID INHERITANCE :- Inheritance which is governed by the genes found in green plastids, *i.e., chloroplast genes.* This type of cytoplasmic inheritance for leaf colour in Evening Prime Rose was reported by Correns (1909).

PLEIOTROPISM:- A phenomenon in which a single major gene affects more than one phenotypic characters,*i.e.* **pleiotropy** refers to manifold effects of a gene, and the gene showing manifold effects is called **pleiotropic gene.**

POD :- A simple dry, one chambered fruit developed from

monocarpellary, unilocular, superior ovary having marginal placentation and dehisces along two (*ventral* and *dorsal sutures*) sides when ripe and dried, *e.g.* pea, bean, etc.

POLARITY :- The state of having two opposite poles, *i.e.* top and bottom or an inherent pattern of formation of shoots at the distal end and roots at the proximal end of stem cutting and *vice-versa* in root cutting is termed as ***polarity.***

POLLINATION :- The transfer of pollen from the anther of the stamen to the stigma of the pistil of the same flower or the other flower. The transfer of pollen takes place either by the force of gravity or by contact or by *pollinator* (wind, insect or water). Thus, pollination is of two types, *viz. self-pollination* and *cross-pollination.*

POLLINATOR :- The agency by which pollen is transferred from an anther to a stigma of another flower, *e.g.* wind, insect, birds, animals, etc.

POLLINIZER :- The producer of pollen; the tree or variety used as a source of pollen grains for successful cross pollination in self-unfruitful or partially fruitful plants/varieties.

POLLUTION :- Contamination of natural environment (air, water and soil) by pollutants which are inimical to crop plant production. The substances, other than natural components, which are potentially toxic or harmful to man, animals and plant community are called **pollutants.** Pollutants are of two types, *viz., particulates* (the tiny particles of solids such as fly ash,dust, pesticides and soot in thick black smoke), and *gases* (such as SO_2, CO, oxides of nitrogen, and incompletely oxidized hydrocarbons, etc).

POLYCROSS :- Open pollination or random mating among a group of selected genotypes in isolation from other compatible genotypes.

POLYEMBRYONY :- Occurrence of two or more embryos within a single seed which may result from nucellar embryony. The *polyembryonic seed* produces two or more seedlings from a

single *ovule* (seed), *e.g.* Jamum, citrus, some varieties of mango, etc.

POLYGAMODIOECIOUS:- The condition in which the plants are *functionally dioecious* but a few flowers of the opposite sex or a few bisexual flowers appear on all parts during blooming period, *e.g.* some times papaya.

POLYGAMOMONOECIOUS:- The condition in which plants are *basically monoecious* but a few flowers of the opposite sex or a few bisexual flowers appear on all parts during flowering.

POLYGENES :- They are also known as *minor genes* which refer a series of several genes producing cumulative effect of continuous variation on the same character. Mainly quantitative characters (*polygenic traits*) are governed by these genes. The term polygene was first used by K. Mather (1941).

POLYHAPLOIDS :- Euhaploids which develop from a polyploid species. They are of two types, *viz.*, **allohaploids** (polyploids developed from allopolyploid species) and **autohaploids** (polyploids developed from autopolyploid species).

POLYMERIC GENE INTERACTION :- Gene interaction in which two dominant alleles have similar effects when they are separate, but produce enhanced effect when come together, resulting in 9 : 6 : 1 ratio in second generation (F_2).

POLYPLOID :- An individual having more than two identical basic or monoploid sets of chromosomes; and such condition is known as **polyploidy**. Polyploids are of two types, *viz.* **autopolyploids** or **simple polyploids** (a polyploid which develops by multiplication of chromosome of a single species, and which may be *triploid, tetraploid, pentaploid, hexaploid, etc*) and *allopolyplods* or *hybrid polyploid* (a polyploid which develops by combining complete chromosome sets from two or more species. An allopolyploid individual originating by combining genomes of two diploid species is known as *amphidiploid* or *allotetraploid.*

POME FRUIT :- Two or many celled fleshy fruit produced from inferior and syncarpous ovary, calyx cup and floral tube, the thalamus becomes enlarged, fleshy and succulent forming the edible part and covers the ovary which is more or less boney containing seeds, *e.g.* fruits of sub family Pomoidae *viz.* apple, pear, quince, loquat, etc.

POROMETER :- An instrument which is used for measuring stomatal aperture.

POSITIONAL STERILITY :- A type of male sterility (functional *sterility*) where pollens are functional but anthers fail to dehisce, *e.g.* found in some mutants of tomato.

POTENTILA VARIABILITY :- A variability bound or hidden in the heterozygotes or homozygotes which do not have the extreme phenotype. It is of two types, *viz.*, **heterozygotic potential variability** (which is stored in heterozygotes, e.g., AaBb) or **homozygotic potential variability** (which is stored in homozygotes, *e.g.*, AAbb or aaBB).

PRECOOLING :- It is a process practiced soon after harvesting of fruits/vegetables to remove field heat from the produce, usually achieved by dipping the produce in water.

PREPOTENCY :- The property or capacity of an individual or parent to produce off-springs which are identical to each other as well as to the parent.

PRESERVE :- A product prepared from whole fruit/vegetables after inpregnating it with sugar syrup till it becomes tender and transparent and possess a soluble solids of atleast 68 per cent.

PRIMARY GENE POOL :- The germplasm or *genetic stock* or gene pool containing genotypes of related species in which intermating is easy and leads to production of fertile hybrids.It is designated as GP_1. The genetic stock conatining genotypes of related species, and leads to partial fertility on crossing with primary gene pool, is known as **secondary gene pool** (GP_2). The genetic material from **tertiary gene pool** (GP_3) leads to

production of sterile hybrids on crossing with primary gene pool.

PROGENY SELECTION :- It is a method of selection of superior plants from a heterogeneous population on the basis of their progeny performance.

PROGENY TEST :- The test or determination of genotypic value of the parent genotype by studying the performance of its progeny. This test was developed by Louis de Vilmorin, so it is also known as *Vilmorin principle.*

PROMISCUOUS DNA :-The DNA segments which move from one organelle (*generally chloroplast*) to another (*mitochondria* and nucleus).

PROTANDRY :- The condition of flower where the pollen (anther) shedding takes before the pistils of that same variety are receptive; and the plants or varieties showing this phenomenon are called protandrous, *e.g.* carrot, onion, custard apple, etc. The protandrous condition may be complete or partially complete.

PROTEIN :- A class of food nutrients which is a polymer of alpha amino acids, *i.e.*, composed of carbon, hydrogen, oxygen and nitrogen and often sulphur and phosphorus linked together by peptide bonds. Protein synthesis consists of *transcription* and *translation* processes. Starting amino acid for synthesis of protein in eukaryotes is *methionine*, while in prokaryotes, it is N-formyl methionine. A product of the union of two different amino acids is called **dipeptide**, and a product of the union of several amino acids is referred as **polypeptide**. In general, crop plants make two types of proteins, *viz.*, **dyanamic proteins** (which enter into the formation of enzymes and protein compounds of living protoplasm) and **static proteins** (which enter into the formation of storage forms containing free energy in the potential form).

PROTOGYNY :- The phenomenon in flowers where the pollen (anther) shedding in any given variety occurs after the pistils (stigma) of the same variety are receptive; and the plants exhibiting this phenomenon are called **protogynous**, e.g. *Brassica*

sp. This condition may be complete or partially complete.

PROTOPLAST CULTURE :- A tissue culture technique in which a plant is regenerated from a naked single cell (*protoplast*) in culture medium.

PSEUDO GENES :-A non-functional sequence of DNA or a defective copy of a normal gene in eukaryotes.

PSYCHROMETER :- An instrument which is used to measure tissue water potential in plants.

PUFFINESS OF TOMATO :- A disorder due to high or low temperature and low soil moisture where the outer wall of fruit continues to develop normally but remaining internal tissue growth is retarded resulting in partially filled, less firm and light weight tomato fruits.

PURE LINE :- A progeny of a single homozygous and self-pollinated plant, which produces only one type of offsprings on selfing. Pure line theory was developed by Johannsen (1903).

PURE LINE SELECTION :- Development of new pure line variety by identification, isolation and evaluation of a single best plant progeny from a *autogamous* (self-pollinated) crop.

PYRIMIDINES :- The nitrogenous bases with single ring structure, *e.g., cytosine* and *thymine* in DNA and *cytosine* and *uracil* in RNA. The nitrogenous bases with double ring structure, such as *adenine* and *guanine* in DNA and RNA, are called *purines*.The structures of both nucleic acids, DNA and RNA, consists of two pyrimidines and two purines.

QUADRIALLEL ANALYSIS :- Analysis of all possible double crosses among selected parents. The number of all possible double crosses among *n* parents is equal to $n(n-1)(n-2)(n-3) / 8$. This analysis provides maximum information about additive, dominance and epistatic variance. The concept of quadriallel analysis was developed by Rawlings and Cockerham (1962).

QUALITATIVE INHERITANCE :- The mode of inheritance of the character showing distinct class (qualitative characters).

Inheritance of these characters is governed by one or few major genes (*oligogenes*) each having large and distinct effect. It is also known as *oligogenic inheritance.*

QUALITY :- The sum of the characteristics of an economic plant products that differentiate the individual unit of a product from other units in relation to its end use. It determines the suitability or acceptability of plant product by the consumers. The physical appearance, texture, uniformity, absence of defects, flavour, colour and nutritive value, etc. are determinants of quality of a product. The quality of a product depends on the purpose of use of that product, such as market quality, industrial quality, nutritional quality, export quality, etc.

QUALITY BREEDING :- The genetic improvement of crop plants by considering various quality attributes.

QUANTITATIVE INHERITANCE :- The mode of inheritance of the character showing continuous variation (quantitative character). Inheritance of these characters is governed by several genes (*polygenes*) each having small and similar effect. It is also known as **polygenic** or **metric** or **multiple factor inheritance.**

QUARANTINE :- The prophylactic measures which are used to prevent the entry of new diseases, insect-pests and weeds from other countries alongwith plant introductions. Quarantine inspection of agricultural and horticultural crop commodities is carried out by NBPGR.

QUICK FREEZING :- Freezing of products in a relatively short time (30 minutes or less), may be done by direct immersion of the food (packed/unpacked) in a refrigerant.

QUIESCENCE :- It is the condition of seed when it is not able to germinate due to unavailability of external factors (temperature, moisture, humidity, etc.). In other words, the condition of seed in which it can germinate immediately upon the absorption of water in the absence of any internal germination barrier.

RACEME :- A simple indeterminate type of inflorescence in which the flowers are borne on short stalks along a common axis. It is also known as *monopodial inflorescence,* as seen in radish, etc.

RACKING :- An important operation for wine production where wine is siphoned off or separated from the sediment and is transferred to a fresh vat with the help of a false bottom.

RAMBLERS :- These are the vine plants having long pliable stems which fail in their attempt to climb but some how manage to support themselves over the support, *e.g. Quisqualis indica, Rosa multiflora, Rosa wichuriana, etc.*

RANDOM MATING :- It is also called *panmixis* which is a system of mating in which each individual (female gamete) has equal chance of mating or to unite with every other individual (male gamete) of the same population. Random mating is a form of *outbreeding* and is useful in development of synthetics and composites. In random mating, variability, heterozygosity, population mean and genetic correlation between relatives remain constant.

RANDOM MATING POPULATION :- It is also known as *panmictic population* which refers to a population in which each individual of one sex has equal chance of mating (*random mating*)with every individual of opposite sex. In random mating population, gene frequencies remain constant generation after generation in the absence of selection, mutation, migration and random genetic drift. A random mating population with equal survival of all genotypes is known as **Mendelian population.**

RATOON CROPPING :- Also called *ratooning,* is the practice of keeping regrowth of same crop after harvest on the same field for cropping in next season or year. It is followed in pineapple for the emergence of new suckers for cultivation in the next year. In agronomic crops such as sugarcane, jowar, bajra, rice and chari (forrage crop), ratooning is a common practice.

RECALCITRANT SEEDS :- The seeds which require relatively high moisture content for longivity and show drastic loss in viability with decrease in moisture content below 12 to13 per cent. These seeds are usually short lived and can not be conserved in seed banks. They cannot be stored and kept viable for long. These seeds should be sown as soon as they are collected for better germination, *e.g. Quercus, Aesculus, Azadirachta,* Mango, Durian, Litchi, jackfruit, coconut, tea, coffee, rubber, oil palm, etc. The areas of lands in which germplasm of recalcitrant crop species is maintained are known as field gene banks.

RECESSIVE :- It refers to one member or character of an allelic pair lacking to express itself wholly or partially in F_1 when its dominant counterpart is present, i.e.,the character whose effect is suppressed or masked in F_1 due to masking effect of dominant allele of a gene over its recessive counterpart. A recessive gene or character is represented by small letter (rr or aa).

RECIPROCAL CROSS :- A cross between two genotypes in which the order of male and female parent is reversed; and the differences observed by reversing the order of male and female parents in a cross is called *reciprocal difference.*

RECIPROCAL RECURRENT SELECTION :- It is also called *recurrent reciprocal half-sib selection* and refers to a form of recurrent selection which is used to improve both genetic (*gca*) and specific (*sca*) combining ability of a population for a particular character using two heterozygous *testers* (open pollinated varieties). Reciprocal recurrent selection was proposed by Comstock *et al.* (1949). This selection is used for the improvement of those characters which are governed by both additive and non-additive genes action.

RECIPROCAL TRANSLOCATION :- Mutual transfer of chromosomal segments between non-homologous chromosomes.

RECOMBINANT DNA :- The DNA molecule which contains genes from different sources and can combine with DNA of

any organism; and the process of incorporation of a desirable gene of a foreign DNA into the recipient DNA to bring about genetic transformation of an organism is known as **recombinant DNA technology**.

RECURRENT APOMIXIS :- A type of apomixis where embryo sac develops from egg mother cell or from some adjoining cells without complete meiosis. The embryo develops directly from the diploid egg nucleus without fertilization, *e.g.* onion, apple, raspberry, etc.

RECURRENT SELECTION FOR GCA :-It is also called *half-sib selection with heterozygous tester* and refers to a form of recurrent selection which is used to improve general combining ability (*gca*) of a population for a particular character using one heterozygous tester of broad genetic base. Recurrent selection for GCA is used for improvement of those characters which are governed by additive gene action and it is effective with incomplete dominance.

RECURRENT SELECTION FOR SCA :- It is also called *half-sib recurrent selection with homozygous tester* and refers to a form of recurrent selection which is used to improve specific combining ability (*sca*) of a population for a specific character using a single homozygous tester (an inbred line) with narrow genetic base. Recurrent selection for *sca* was proposed by Hull (1950). It is used for the improvement of those characters which are governed by non-additive gene action.

RECURRENT SELECTION :- Reselection of progeny plants generation after generation with mating of selected plants to provide for genetic recombination. The procedure of recurrent selection was outlined by Jenkins (1940) and the term recurrent selection was coined by Hull (1945). It is of four types, viz., *simple or phenotypic recurrent selection* (recurrent selection which does not include a tester), *recurrent selection for GCA, recurrent selection for SCA,* and *reciprocal recurrent selection.*

REGISTERED SEED :- It is the progeny of foundation seed and the progenitor of certified seed, which is so handled as to

maintain satisfactory genetic identity and purity and that has been registered and approved by a certifying agency. In India, registered category seed is generally omitted and certified seed is produced directly from foundation seed.

RELATIVE HUMIDITY (RH) :- The ratio of amount of water vapour in the ambient air compared with the amount of vapour when the air is saturated for any particular temperature; it is expressed as percentage.The rate of transpiration is inversely proportional to the relative humidity of the ambient air, and thus, the rate of diffusion depends on the difference in relative humidity of the stomatal chambers and the out side air.

RELAY CROPPING :- Sowing or planting of succeeding crop after flowering and before the harvest of standing crop on same field. The raising two or more crops in a field in a year in such a way that the second crop is sown or planted before the harvest of previous crop is known as *relay intercropping*. In relay cropping, there is some overlapping period.

RENEWAL SPUR :- Cane or spur cut back to 1-2 basal bud level which is left on the vine to produce fruiting wood for the next year/season.

REPRESSIBLE ENZYME :-An enzyme whose production can be inhibited by adding an end product; and the process of inhibition of production of an repressible enzyme is called *repressible system.*

REPRESSION:- The process of inhibition of synthesis of mRNA from a DNA template (*i.e.*,transcription); while a protein molecule which prevents transcription is called *repressor.*

REPRODUCTION :- The sexual or asexual process by which living organisms/ plants give rise to the progeny (offsprings) of similar kind. It is of two types, *viz., sexual reproduction* or *amphimixis* (multiplication of plants by sexually fertilized embryo/ seed) and *asexual reproduction* (multiplication of plants by asexual/ vegetative parts and/ or apomictic seeds).

REPRODUCTIVE PHASE :- The stage of plant growth and development which concerns the storing of most of the carbohydrate and the formation and development of flower buds, flowers, fruit, and seed, or the enlargement and maturation of storage organs such as fleshy stems and fleshy roots.This phase of plant development occurs after **reproductive maturation** (juvenile-adult transition); and it is associated with several important processes, *viz.*, maturation of the tissues, the thickening of fibres, the formation of hormones for the development of flower-bud primordia, the development of flowers, fruit and seed, and the development of storage organs, etc.

RESINS :- The complex chemical compounds of plant origin formed by oxidation of various essential oils with or without gums and secreted from *resin canals* or glands in fluid condition either naturally or in response to injury in bark. They are mixture of several oxidised hydrocarbons, hence rich in hydrogen and carbon but poor in oxygen; highly inflamable, insoluble in water and soluble in alcohol, ether and other organic solvents; rich in volatile oils and antiseptic properties. Plants of the various family-Anacardiaceae, Burseraceae, Dipterocarpaceae, Guttiferae, Leguminosae, Liliaceae, Pinaceae, Styraceae, Umbellifereae and Hamamelidaceae, etc. are commercial sources of natural resins. Resins are grouped in three categories: **Hard resins** (Amber, Acaroid resins, Copals, Damars, Kinos, Lacquer, Mastic, Shellac, etc.), **Oleoresins** (Turpentines, Balsams) and **Gum resins** (Asafoetida, Galbanum, Myrrh, etc.).

RESPIRATION :- It is essentially an exogonic energy releasing process through oxidation and decomposition of organic compounds (simple carbohydrates) in living cells. In the respiratory reaction, the potential energy of foods is transformed into various kinds of kinetic energy. It takes place in all living cells of both plants and animals either in light and darkness and always decreases the dry weight of crop plants. A respiration reaction comprises two sub stages, *i.e.*, the *fermentive stage* (in which no free oxygen is used) and the *oxidative*

stage (in which free oxygen is necessary).

RESPIRATORY QUOTIENT(R.Q) :- This is the ratio of the moles of CO_2 released by a tissue over a period of time (*e.g.*, an hour) to the moles of O_2 taken up. The magnitude of respiratory quotient of a tissue depends on the oxidation state of the substrate utilized in respiration.

RESPIRATORY SUSTRATE :- Any organic plant constituent oxidized partially (to more oxidized compounds) or completely (to CO_2 and water) in respiratory metabolism. Carbohydrates (sucrose, starch) are the the principal respiratory substrates in cells of higher plants.

REST PERIOD :- It is also called as *physiologic dormant period* which refers to the internal unfavourable physiological conditions for the growth of the leaf and flower buds, particularly for the process of cell enlargement, in many woody trees and shrubs, due to which buds do not expand into leafy shoots or flowers even under suitable growing conditions, and this rest or physiologic dormant period is broken after exposure to sufficient cold or chilling requirement. In general, trees and shrubs in temperate climates enter their rest, or physiologic dormant, period during latter part of the growing season. In addition to temperate woody plants, the buds of the storage organs of certain herbaceous crops, such as fleshy rhizome of rhubarb, the head of cabbage, bulbs of onion, lily and tulip, and the corms of gladiolus, also go into a physiologic dormant period and they require a period of exposure to cold (1.7 to 7.2°C) to break the rest. When the internal conditions are favourable for the growth of the leaf and flower buds of woody perennials plants, but their buds do not show any sign of normal growth, the condition is called as **environmental dormant period**.

RESTITUTION :- Union of broken chromosome segments which restores original gene sequence.

REVERSE TRANSCRIPTION :- It is also known as *teminism* which is the process of synthesis of DNA from RNA in presence

of DNA polymerase. Reverse transcription was first reported by Temin and Baltimore (1970) for which they were awarded Noble Prize.

RHIZOCALINE:- A substance present in the cotyledons, leaves and buds which stimulate the rooting in cuttings. It is a complex of orthodihydroxy phenol, auxin and an enzyme *(polyphenoloxidase)*.

RIBOSE NUCLEIC ACID (RNA) :- A long, unbranched macromolecule consisting more than 75 thousands nucleiotides joined by phospho di ester bonds produced by DNA transcription. In a RNA molecule, a single ring structured nitrogen base pyrimidine *'thymine'* is replaced by *'uracil'* pyrimidine. It is a non-genetic material (*non-genetic RNA*) in most of the higher organisms except some bacteria (*bacteriophages*) and most viruses (TMV, HRV,etc.) where it works as a genetic material (*genetic RNA*). Mainly, RNA is of three types, *viz.*, **messenger RNA** (mRNA) which carries information from nuclear DNA to cytoplasm for protein synthesis, **transfer or soluble RNA** (tRNA) which carries amino acids and attach them with ribisome mRNA complex for use in protein synthesis and **ribosomal RNA** (rRNA) which is the major component of ribosomes.

RIBOSOMES :- Small cellular particles found in cytoplasm, which are the site of protein synthesis.The major part of ribosome is constituted by **ribosomal RNA** (rRNA).

RICYNESS OF CAULIFLOWER :- A disorder characterised by premature initiation of floral buds on curd giving a velvety appearance which may result from any temperature higher or lower the optimum required for a particular variety during curd development.

RING NECK :- A disorder of the avocado which causes drying out and shriveling of surface areas on the fruit pedicels.

RING OIL SPOTTING OF CITRUS :- Appearance of slightly depressed and brown areas on the rind of orange fruits with the oil glands standout in relief above the collapsed tissues which

indirectly affects the marketability, caused due to rough handling during picking and storage of fruits.

RINGING :- Removal of a narrow strip of bark round the periphery of the stem to prevent the downward translocation of food matters beyond that point.

RIPENING :- It is a sum total of physiological changes in colour, texture, flavours and taste as a result of which the fruit becomes edible.

ROGUING :- The process of removal of *off-types* (phenotypically different) or undesirable plants of the crop population from the field of an improved variety to maitain purity of seed and avoid contaimination during seed production. The phenotypically different plants (off-types) of a variety in a crop population are known as **rogues**.

ROOT PRUNING :- Removal of portions or all of the younger roots with a view to develop extensively branched root systems at the base of the plant. It is practised in rose, guava, etc.

ROOTING MEDIA :- Materials such as sand, peat, soil, vermiculite, sphagnum moss or saw dust into which the basal end of the cuttings are placed for root development.

ROOT-TO-SEED METHOD :- A method of seed production in root crops where the fully matured roots are harvested, selected and after giving proper root and shoot cuts, they are replanted for seed production, *e.g.* radish, carrot, turnip, etc.

RUNNER :- A specialised stem that develops from the axil of a leaf at the crown of a plant, grows horizontally along the ground and forms a new plant at the nodes, *e.g.* spider plant, strawberry, etc.

RUSSET SPOTTING OF LETTUCE :- A post harvest disorder characterised by localised spot like lesions that may start either in the epidermis or in the mesophyll which in advance stage may show discolouration of vascular tissues and collapse of mesophyll cells resulting in pit like depression.

S/R RATIO :- The ratio between the size of the shoots and roots of a plant.

SADDLE GRAFTING :- Method of grafting in which a short cut on either side at the *distal end* of stock is made to form the shape of a saddle and a corresponding cut is given at the *proximal end* (base) of the scion so that it exactly fits the stock.

SALINITY TOLERANCE :- The ability of plants to prevent, reduce or overcome the injurious effects of salt stress present in the root zone. *Lysimeter* is used to study the salt tolerance in plants. The interference of plant growth due to the presence of sufficient quantities of soluble salts in the root zone soil resulting increase in osmotic pressure of the soil is called **salt stress.**

SAPLINGS :- Young trees characterised by the absence of dead bark with vigorous height growth.

SAPROPHYTE ORCHIDS :- Orchids that are devoid of chlorophyll, grow on decayed organic matter and absorb food materials from their host.

SAUCE :- A product prepared from the pulp of fully ripe fruits of tomato without seed and skin by cooking it with salt, sugar and spices to the extent of at least 18% total soluble solids.

SAUERKRAUT :- A product obtained by complete fermentation of shredded cabbage. It contains 2-3% salt and not less than 15% lactic acid.

SCALES :- The **modified leaves** which are usually hard and horny which protect the buds on the stems of woody plants during the winter; whereas, in **modified stems** (bulb, corm, tuber rhizome, etc.) scales may be membranous (thin coverings of buds) or fleshy (scaly leaves which stores food, as in bulbs).

SCARIFICATION :- A process of breaking dormancy of seeds by cracking, scratching or mechanically or chemically altering or softening the seed coverings to make it permeable to water and gases.

SCION :- It is a short piece of shoot (or a bud) detached from

mother plant which is added (**grafted/budded**) on root stock to unite and develop new plant.

SCION BANK :- A place where scion materials are stored for a certain period before they are used for grafting or budding.

SCOOPING :- Removal of central portion of the curd for easier initiation of flower stalk in cauliflower for seed production.

SECONDARY CONSTRICTION :- A narrow or constricted region in a chromosome other than centromere.

SECONDARY DORMANCY :- It is *induced dormancy* that develops within the moist seed after it is removed from the plant and subjected to unfavourable environmental conditions.

SEED :- Botanically, it is a *fertilized* and *matured ovule* that consists of an embryo, its stored food (*cotyledon*) and protective coverings (*seed coat*); it also commonly includes the ovules of one seeded dry indehiscent fruits like seeds of plants belonging to family Graminae. A seed may be **albuminous** (seeds with large endosperm which contains most of the food materials) or **exalbuminous** (seeds in which endosperm is lacking or reduced to a thin layer such as guava, mango, jackfruit, orchid, citrus, etc.). But in broad sense, **a seed** is an any plant part (*sexual* or *asexual*) which is used for commercial multiplication of a crop, such as sexual seeds, modified underground parts, plant cuttings, etc. For commercial growing, a seed is categorized as nucleus seed, breeder seed, foundation seed, certified seed and registered seed.

SEED CERTIFICATION :- A legally sanctioned scientific system of seed multiplication which ensures production of high quality seed in terms of genetic- and physical purity and germination. There are four basic requirements for seed certification, *viz.*, improved seed production, genetic purity, physical purity and germination. Seed certification follows some control measures strictly, such as administrative check on the origin of propagating material, field inspection, sample inspection, bulk inspection and control plot testing, etc.

SEED DRESSING :- It is the process of coating the surface of the seed with chemicals, fungicides, insecticides or manures, etc.

SEED GARDEN :- A plantation usually of a superior race raised or treated for the production of seed.

SEED ORCHARD :- Orchards that are established specially for seed production.

SEED PRIMING :- It is a treatment given to freshly harvested seeds before sowing to improve germination and uniformity of seedling establishment and to overcome dormancy by imbibition.

SEED TESTING :- The process of evaluation of seeds in terms of purity, moisture content and germination of seed samples to determine its quality.

SEEDLESS WATERMELON :- It refers to *autotriploid* (3x) water melon which is both male and female sterile due to unequal chromosomal distribution in meiosis resulting in seedless condition in the fruit. Dr. Kihara bred first seedless watermelon 'Pusa Bedana' by crossing Tetra-2 × Pusa Rassal.

SEEDLING :- It is the juvenile plant at its original place of germination and grown from seeds.

SEED-TO-SEED METHOD :- A method of seed production where the plants are allowed to produce seeds in its original place of growing.

SEGREGATION :- Separation of maternal and paternal chromosomes during gamete formation (*meiosis*), and the consiquent separation of alleles resulting phenotypic differences in the offsprings. The *law of segregation* is also known as law of purity of gametes.

SELECTION :- A process of isolating desirable genotype(s) from the mixture of numerous genotypes in the population. It leads the differential survival and reproduction rates of genotypes which change the frequency of alleles and genotypes in a

population. Seletion is the most important step in plant breeding. It is of two types, *viz.*, **natural selection** (which favours those characters which are advantageous for survival or adaptation of a species/ individual in nature) and **artificial selection** (selection by human efforts which favours those characters which are related to yield and quality and are useful for mankind).

SELECTION DIFFERENTIAL :- Difference between the mean phenotypic value of selected plants and mean phenotypic value of parental population.

SELECTION INTENSITY :-The proportion of plants or families selected from a genetic population for study.

SELECTIVE DISADVANTAGE :- It is also known as *selection coefficient* and denoted by *'S'*, which measures the rate of elimination of different genotypes from a population under natural selection in a particular environment. It is the measure of the rate of reduction in the adaptive value of a genotype in relation to standard or the most favoured genotype.If the value of selection coefficient is equal to one *(S=1)*, there would be no survival of genotypes.

SELF - INCOMPATIBILITY :- Failure of fertilization even though both male (*pollen*) and female (*stigma*) parts of a bisexual flower are fully functional, i.e., inability of a plant with functional pollen and stigma to set seed when self-pollinated. It may be due to differences in floral morphology-*distyly* or *tristyly* (**heteromorphic system**) or due to physiological or genetic causes rather than differences in floral morphology (**homomorphic system**).Thus, self incompatibility results due to morphological, genetic and physiological and biochemical causes; and promotes cross-pollination (*allogamy*). The term self-incompatibility was coined by Stout (1917) and it was first reported in *Verbascum phoeniceum.* This condition generates the requirement of cross-pollination. The varieties having such type of incompatibility are called **self-incompatible** ones. Self-incompatibility is the main problem in apple (most varieties), sweet cherry, Duke

cherry (some varieties), Japanese plum (most varieties), European plum (some varieties) and filbert (most varieties), etc. Different types of self-incompatibility have also been observed in cabbage, cauliflower, radish, sugarbeet, red clover, primula, mango, loquat, litchi etc.

SELF-BLANCHING :- Protection of the curd by the very long upright leaves in some varieties of cauliflower to exclude the sunlight which keep the curd pure white.

SELF-FERTILE :- The ability of a cultivar to produce fruit with viable seeds following self-pollination.

SELF-FRUITFUL :- The ability of a cultivar to produce commercial crop of fruit following self-pollination or parthenocarpy.

SELF-POLLINATION :- It is, also called *autogamy*, the transfer of pollen from the anthers of a flower to the stigma of the same flower or between flowers of the same plant. This takes place due to the *force of gravity* (effective when the flower is in the pendent position and the stigma extends beyond the anthers) or *by contact* (effective when the stamens, as they elongate, shed their pollen as the anthers come in contact with the receptive stigma). The crops reproduced by self-pollination (autogamy) are called **self-pollinated (autogamous)** ones. Self-pollination maintains uniformity and reduces variability of any particular strain or variety.

SELF-STERILITY :- Inability of a cultivar to produce fruit with viable seeds following self-pollination because of non-functional male or female gametes, *e.g.* J.H. Hale var. of peach.

SELF-UNFRUITFUL :- Inability of a cultivar to produce commercial fruit crop following self-pollination or parthenocarpy.

SENESCENCE :- The last stage of development when anabolic biochemical processes give way to catabolic processes leading to death of the tissues.

SENESCENT SCALD OF PEAR :- A disorder where dark brown skin discolouration begins in small isolated areas, usually towards the calyx end of fruit which turns yellow in storage, the fruit fails to ripen and soften normally and skin may tend to slaugh off.

SENSE STRAND :- One of two complementary strands of DNA which is used as a **template** (a macro molecule which provides information for synthesis of another complementary macro molecule) for synthesis of RNA. The DNA strand (each of the two helix of DNA) which is not used for the synthesis of RNA is called **non-sense strand.**

SEPALS :- The sepals, collectively called *calyx*, are the specialized modified leaves which form the outermost envelope of the flower bud and protect the petals and the delicate stamens and pistils when the flower is in bud stage and later subtend the floral whorl, when the flower opens.

SEQUENTIAL CROPPING :- Cultivation of two or more crops in sequence, *i.e.*, one after another, on the same field in a year. Some times it is also called *crop rotation*. It is of three types, viz., double cropping (growing two crops one after another on same field in a year), **triple cropping** (growing three crops one after another on same field in a year) and **ratooning** (cultivation of crop regrowth after harvest on same field in a year).

SEX :- The contrasting features determined by sex chromosomes in male and female individuals of a species. A sex may be **heterogametic** (sex with dissimilar type of sex chromosomes such as XY or XO) or **homogametic** (sex with similar type of sex chromosomes such as XX or ZZ).

SEX CHROMOSOME :- The chromosomes which determine sex (male or female) and differ in number and morphology in male and female sex. They are also called *allosomes* and represented by 'X'. Sex chromosomes were first discovered by McLung (1902).

SEX DETERMINATION :- The process of sex differentiation

which utilizes various genetical concepts to decide whether a particular genotype will develop into male or female sex.Universaly accepted *'genic balance theory of sex determination'* was proposed by Bridges (1922). Sex determination is applicable in *monoecious* (male and female flowers on the same plant) and dioecious (male and female flowers on different plants) plant species. In *dioecious* plants such as papaya, sex determination in early stage is the main problem.

SEX LINKAGE :-The association or linkage of genes which are located on *sex* or *X* chromosomes. The inheritance of such genes is known as *sex linked inheritance*. Sex linkage was first discovered by T.H.Morgan.

SEX LINKED TRAITS :- Characters for which genes are located on *sex*-or *X* chromosomes. Characters which express in one sex only are called *sex-limited traits* and expression of a particular character in one sex only is known as *sex-limited.*

SEX MODIFICATION :- Alteration or modification of the sequence of male and female flowers and thereby the sex ratio in monoecious plants such as cucurbits. It may be accomplished by exogenous application of plant growth regulators and some micronutrients.

SEX REVERSAL :- The process of transformation of sex characteristics of an individual from male to female and *vice versa.*

SHADE LOVING PLANTS :- Shade plants are those plants which require low light intensity range (500-1000 *ft-c*) for their growth and development. *e.g.*, African violet, ficus, peperomia, aspidistra, diffenbachia, pothos, philodendron, ferns, and most of the indoor plants.

SHELF-LIFE :- It refers to the span upto which the perishable commodities (flower, vegetable or fruit) can be kept at consumable and marketable stage after harvest.

SHIFTS :- It is a type of *translocation* in which an intercalary segment from one chromosome transfers to the intercalary

position in a non-homologous chromosome. While mutual exchange of segments between non-homologous chromosomes is known as **reciprocal translocation.**

SHORT DAY PLANT :- The plants which require short light (day) and long dark (night) periods, in any given 24-hours period, for the formation of their flower buds. Thus, they are also called *short day-long night plants.* In general, most of the short-day plants require 10 to 14 hours of continuous dark and relatively shorter day for the formation of their flower buds.The critical photoperiod for short-day plants varies from 11 to 14 hours. e.g. coffee, certain varieties of strawberry and potato; sweet potato, snapbean, brinjal, cucumber, pepper, chrysanthemum, cosmos, kalanchoe, poinsettia, gardenia, morning glory, etc.

SHOT BERRY :- Under developed seedless berry of grape that fails to enlarge, caused due to *boron deficiency* or poor pollination.

SILIQUA :- A long, narrow, two chambered, many seeded, dehiscent, dry fruit developed from a superior ovary with parietal placentation, *e.g.* radish, mustard and other crucifers.

SIMPLE RECURRENT SELECTION :- It is also called *phenotypic recurrent selection* which is a population improvement method for cross pollinated crops where reselection generation after generation is done with intermating of selected plants to provide genetic recombination without use of any tester.

SIMPLE TRANSLOCATION :- It is a type of *translocation* in which a segment from one chomosome is transferred to the end of a non-homologous chromosome.

SINGLE CROSS :- The crossing between two specified inbred or pure lines or genotypes, *i.e.*, A x B. The first generation hybrid progeny from a cross between two individuals is known as *single cross hybrid,* which exhibits the highest uniformity.

SINGLE SEED DESCENT :- It is a modification of bulk method of breeding which is used with segregating population of self-pollinated crops in which plants are advanced by selecting single

seed from each plants from F_2 generation onwards and at the end of bulking period (F_5 to F_6), individual plants are selected. The concept of single seed descent method was developed by Goulden (1939).

SLOUGHING OF CITRUS :- A disorder of red and pink grape fruit characterised by progressive browning and disintegration of rind which remains soft and moist and then falls away or sloughs off leaving the flesh exposed.

SMUDGING :- Burning of slow fires emitting smoke in the orchard which induce flowering in some fruit trees as smoke contains acetylene.

SOD CULTURE :- It is an orchard management practice on slopy land in which an orchard is maintained under cover of grasses, legumes, vines, etc.

SOFT SCALD OF APPLE :- A low temperature (below 2.2°C) disorder of apple where symptoms appear as smooth, brown, irregular shaped well defined areas of skin irrespective of the skin colour but usually not at the calyx end.

SOFT SWELL :- A can with bulged ends but the gas pressure inside the can is low enough to permit the ends to be dented by pressure of fingers and with the release of pressure they will get back to their convex position.

SOFT WOOD GRAFTING :- A method of grafting in which root stocks are raised *in-situ* for one year or more and grafting of scion by wedge method on terminal new growth of the stock.

SOIL WORKING :- A cultural operation like deep ploughing, pit digging, weed removal, mounding, trenching, etc. carried out for the success of plantation in orchard.

SOIL-LESS CULTURE :- Growing of plants without soil by providing nutrients in liquid form essential for proper growth and different media such as coarse sand, crushed bricks, rice bran, vermiculite, perlite, sphagnum moss, etc. are used for rooting & holding crop roots.

SOLARIZATION :- The bleaching of dark green chlorophyll (*chloroplasts*) of plant tissues, generally leaves, to yellow-green due to excess light intensity, resulting low chlorophyll content and low rate of photosynthesis.Thus, it is a light dependent absorption of O_2 and the release of CO_2 which is generally evident when plants are moved from low light intensity (shady situation) to excessive light intensity (sunny situation).

SOMACLONAL VARIATION :- Variation occuring between genetic identity of individual cells within the tissues that is generated by *tissue culture*.This variation may be of useful to plant breeder because it may represent latent and novel forms of plant. Depending upon the explant used, it may be - **gemetoclonal** (variation that is observed among plants regenerated from anther or ovule culture) or **protoclonal** (variation among plants which are produced by protoplast culture).

SOMATIC HYBRIDIZATION:- Crossing of two or more plants of same or different genotypes through fusion of somatic cells (protoplasts), leading to the development of somatic or parasexual hybrid(s). Somatic hybrids are of two types, viz., ***homokaryons*** (hybrid cells combining protoplasts of the same species) and *heterokaryons* (hybrid cells combining protoplasts of two different species). Somatic hybridization is useful in production of *allotetraploids* in single step, conserving heterosis and bypassing sexual process.

SOROSIS :- A type of composite/multiple fruit developed from an entire inflorescence *(spadix or spike)* where flower fused together by their succulent sepals and at the same time the axis bearing them grows and becomes fleshy or woody and as a result the whole inflorescence forms a compact fruit mass. The *edible parts* of these fruits are perianth, peduncle and bracts, *e.g.* pineapple, mulberry, jackfruit, etc.

SPADIX :- A type of inflorescence with a fleshy axis which is enclosed by one or more large, often brightly coloured bracts, called *spathes, e.g.* Aroids, date palm, coconut, palmyra palm, banana, etc.

SPECIFIC COMBINING ABILITY (SCA) :- The performance of a parent in a specific cross in relation to general combining ability (*gca*). It is a measure of non-additive gene action and expressed as deviation from the average performance of the lines involved in the cross combinations which is the consequence of intra-allelic interactions. It primarily includes *additive variance, additive* x *additive epistasis* and *dominance* x dominance epistasis. It is estimated from full sib crosses. High values of sca are indicative of non-additive gene action and has relationship with heterosis in the development of hybrids.

SPECIFIC POPULATION ADAPTATION (SPA) :-The capacity of a heterogeneous population to adapt to specific environment. A composite variety and varietal mixture are examples of this type adaptation.The adaptation of a genotype to a limited environment is called **specific genotype adaptation** (*sga*) as seen in water loving plants.

SPERMATOPHYTES :- The plants which produce pollen, which eventually conatins sperms, and ovules, with other cells (an egg.They produce a new individual (*embryo* or *seed*) by uniting a sperm and an egg, i.e., spermatophytes produce seed. Spematophytes are divided into two groups- **gymnosperms** (which produce neither flower nor fruits and hence naked seeds are produced by open carpel, *i.e.*, seeds are not enclosed within the fruit. e.g., pine, spruce, fir, juniper, hemlock and other conifers), and *angiosperms* (which produce flowers and fruits and hence enclosed seeds, and comprise a large group of flowering plants).

SPHAGNUM MOSS :- A rooting medium, and product of dehydrated young residue or living portions of *acid bog* plants *(Sphagnum spp.).* It is relatively sterile, light in weight and has very high water holding capacity. It absorbs 10 times water of its weight.

SPICE :- These are the plant products which are used for seasoning of foods by adding distinctive flavour and aroma, *e.g.* clove, black pepper, coriander, nutmeg, cinnamon, ginger, turmeric, etc.

SPIKE :- An unbranched inflorescence, in which the main axis is elongated with a series of sessile flowers. The lower flowers open earlier than the upper ones as in raceme, *e.g.* tuberose amaranthus, gladiolus, etc.

SPLIT GENES :- The genes with intervening or interrupted sequences.They are also known as *interrupted genes;* and are usually found in eukaryotes.

SPLITTING OF CARROT :- A physiological disorder of carrot characterised by root cracks. It is caused due to *boron deficiency* as well as heavy side dressing of nitrogen in early stages.

SPONGY TISSUE :- A physiological disorder of some varieties of mango (Alphonso) in which fruit develops bad odour with sponge like mesocarpic tissues having air pocket due to inactivation of hydrolytic enzyme by convective heat. This disorder shows no external symptoms but on cutting of fruit shows spongy development in the flesh with a bad odour.

SPONTANEOUS MUTATION :- A sudden heritable change, *i.e., mutation,* that occurs naturally without any mutagenic treatment. Mutations which are produced by the use of mutagens are called **induced mutation.**

SPOROPHYTIC SELF-INCOMPATIBILITY :- A type of *homomorphic system of self-incompatibility* in which the incompatibility reaction of the pollen is governed by the genotype of pollen producing plant, *i.e., sporophyte.* In this system of incompatibility there are smaller number of alleles involved that may display either dominant or may have individual action. This system of self-incompatibility permits production of some homozygotes in some crosses, and the crosses would be either fully fertile or fully sterile. The recovery of both male and female parents is also possible in this type of self incompatibility. Such type of self-incompatibility is seen in radish, cabbage, cauliflower, mango, turnip, sweet potato etc.

SQUASH :- An unfermented fruit juice beverage containing strained juice with moderate quantities of fruit pulp to which

cane sugar is added for sweetening. Squash should contain at least 25 per cent juice and 45% T.S.S.

STABILITY :- Suitability of a variety/ genotype for general cultivation over a wide range of environmental conditions, *i.e.*, stable performance of a variety in various environments. It is of two types, *viz., genetic-* and *phenotypic stability.* A regression analysis based on phenotypic performance of the genotype (s) over environments to identify stable genotype (s) which which are suitable for a specific environment or for a wide range of environments is known as **stability analysis**. Freeman and Perkins model of stability (1971) provides independent estimation of mean performance and environmental index.

STABILIZING SELECTION :- It is also known as *centripetal selection* which refers the selection of intermediate types of genotypes rather than both the extreme types which satisfy most of the conditions of maximum fitness.

STAMINAL STERILITY :- A type of male sterility where only pistillate flowers are produced in some monoecious cucurbits which act as *super female plant, e.g.* gynoecious lines of cucumber.

STECKLING :- Matured roots of radish, carrot, turnip, sugarbeet, etc. to be replanted after overwintering for seed production.

STECKLING :- The matured and fleshy roots of biennials such as gargen beet, carrot, turnip, radish and rutabaga which have to be maintained in a viable condition from harvest time in the fall to replanting time in the following spring for seed production. That is, the *stecklings* are the matured roots of biennials which are replanted after over-wintering for seed production in root to seed method.

STENOSPERMOCARPY :- A condition in *seedless* cultivars of grape (Perlette, Beauty Seedless, Thompson Seedless, etc) in which seedlessness occurs due to abortion of embryo after fertilization.

STERILIZATION :- A method of permanent preservation of foods in which product is heated at high temperature (fruits 100 °C and vegetables 116 °C) to kill all the micro organisms present in product.

STION :- A plant developed after the union of root stock and scion.

STIONIC EFFECT :- The effect of root stock on scion and *vice versa* which determines the graft incompatibility/compatibility.

STOLON :- A modified, slender, undergound lateral stem which grows horizontally to the ground and enlarge at its tips, *e.g. Cynodon dactylon, Mentha,* etc.

STONE FRUITS :- A type of simple succulent fruits (*drupe*) which develop from *mono* or *polycarpellate,* syncarpous superior ovary, having four different layers-uppermost (*fruit coat*), outer layer (*epicarp*), mid (*fleshy mesocarp*) and innermost (*stony endocarp*). Endocarp is modified into a hard, boney layer and known as *'stone or pit'* containing one or rarely two seeds, *e.g.* peach, plum, cherry, apricot, almond, etc.

STRATIFICATION :- A method of breaking seed dormancy by subjecting the imbibed seeds to chilling temperature (1-5 °C) by placing them in stratified layers of sand, soil or saw dust.

STRESS :-Adverse conditions potentially unfavourable for growth and reproduction of crop plants, which are caused either by environmental factors (***abiotic stress***) or by biological agents (***biotic stress***). The ability of the plant to survive under these unfavourable conditions is known as **stress resistance**, which may be *morphological* or *genetical.*

STRESS CONDITION :- The term stress, as used by plant physiologists, refers to the external environmental factors (*e.g.* drought, cold) capable of inducing a potentially injurious effect in a living organism; butmore often refers to the injurious effect itself (*e.g.,* reduction in photosynthesis, reduction in rate of growth, stomatal closure, wilting). Most frequently, stress condition in plants occurs due to water stress which is caused

by suboptimal soil moisture supply, coupled with a rate of transpiration in excess of the rate of absorption of water by roots.

STRIP CROPPING :- Growing crops in a systematic arrangement of alternate strips or bands which serve as vegetative barriers to wind and water erosion. The planting or seed sowing densely in anrrow strips usually to definite intervals from one another, as done in planting hedge plants, is known as **strip sowing.**

STRIP INTERCROPPING :- A type of intercropping where two or more crops are grown together in a field but in distinct strips. The raising of two or more crops together but in separate rows is known as **row intercropping.**

STROMA :- The space found inside the inner membrane of a green coloured plastid, *i.e., chloroplast.* While small cylindrical structures found inside the inner membrane of a chloroplast is known as **grana.** Several units of *stroma* and *grana* are collectively known as **quantosomes.**

STRUCTURAL GENE :- A gene in operon model which controls the protein synthesis by determining amino acid sequences through mRNA.

STUMPING :- A method of seed production in cabbage where the *'head'* after full maturity is cut off just below the base keeping the stem with outer whorl of leaves intact.

STYLE :- A part of the carpel (*pistil*) which connects the ovary and stigma and through which the pollen tube grows from stigma to the ovary, *i.e.,* the *style* is the connecting tissue between ovary and stigma. The **stigma** is the flattened and sticky portion at the apex of pistil, usually style, which receives pollen grains from male organs of the same flower or from the others. Some times **style** denotes the method of presentation to the public of a prepared product such as carrot may be canned as whole roots, sliced or in a vaiety of other styles.

SUB-CULTURING :- Transfer of tissues or callus from old culture medium to fresh culture medium.

SUBERIN :- A layer of oxidized fatty-like substances which makes the tissues impermeable to water, gases and substances in solution in water; so that the sugars and other foods in roots which pass to the root hairs are under protoplasmic control, and in stems, it renders the tissue resistant to the attacks of rot-producing organisms. **Suberin** is a polymer that contains a phenolic matrix somewhat similat to lignin; within this matrix is embedded a variety of waxes and fatty acids. In the endodermis, suberin takes the form of a bandlike structure (**Casparian stip**) which acts as an impermeable barrier to the inward radial movement of water and dissolved nutrients through cell wall.

SUCCULENT :- A group of herbaceous and perennial plants which store food and water by means of swollen or fleshy stems, leaves, or tuberous roots, *e.g. Agave, Sedum, Pedilenthus, Portulaca,* etc.

SUCKER :- A shoot that arises on a plant from adventitious buds below ground (roots), *e.g.* banana, pineapple, raspberry, etc.

SULPHURING :- Exposing the prepared fruits to the fumes of burning sulphur before dehydration which help to maintain colour, texture and kills many of micro organisms present and destroys oxydizing enzymes.

SUN BURN :- A disorder caused by combination of hot sunrays and inadequate moisture supply and characterised by discolouration leading to leatheriness in fruits, vegetables, stem and twigs.

SUN LOVING PLANTS :- The plants which require high light intensity (3000-8000 *ft-c*) of direct sun for their optimum growth and development. *e.g.*, citrus, mango, banana, pineapple, coconut, date, fig, olive, papaya, chilli, brinjal, corn, cucurbits, sweet potato, carnation, chrysanthemum, rose, gladiolus, snapdragon, etc.

SUN SCALD OF APPLE :- A physiological disorder caused in fruits exposed to intense sun and characterised by bleached or brown areas on the side of fruits, sometimes accompanied by water soaked subepidermal tissues which often becoming darker after removal from storage, the cortex tissues under lesions is likely to be diffusely brown and bitter in taste.

SUN SCALD OF PINEAPPLE :- A physiological disorder caused due to exposure of fruits to direct sunlight when the peduncle bearing the fruit fall on one side where cells under the skin of exposed surface get damaged.

SUN SCALD OF TOMATO :- A physiological disorder caused due to sudden exposure of fruits to sunlight in hot weather and characterised by appearance of blistered water soaked area followed by rapid desiccation and formation of sunken spots of grey or white colour in green fruits and yellowish in red fruits.

SUN TOLERANT PLANTS :- Plants which require a wide range of light intensity (2000-8000 *ft-c*) and thrive well under slight shade and also able to tolerate direct sun. *e.g.*, apple, pear, peach, plum, rubber, cabbage, potato, forsythia, gardenia, nandina, magnolia, etc.

SUNKEN GARDEN :- A garden laid out below the ground level. It can be laid out in an already existing depression of land or a portion of the garden may be especially dug to layout such garden.

SUSPENSION :- A liquid medium in which free cells of a callus are dispersed (related to *tissue culture*); or a liquid in which very fine solid particles of chemicals (plant growth regulators , insecticides or fungicides, etc.) are dispersed but not dissolved.

SWELL :- A can with tightly bulged ends due to formation of CO_2 or other gases inside the can as a result of microbial decomposition of foods and due to this generally discoloured and sour odoured food becomes not fit for consumption.

SWORD SUCKER :- A type of sucker of banana which have

well-developed base with narrow sword-shaped leaf blades at the early stages and used as propagating material.

SYCONUS :- A type of *composite fruit* developed from hypanthodium (inflorescence) and thalamus forming a hollow and disc like structure enclosing a number of minute, male and female flowers. At maturity thalamus changes into an edible fleshy and juicy part, *e.g.* fig, banyan, peepal, etc.

SYMBIOTIC N_2 FIXATION :- The chemical fixation of free atmospheric N_2 with other compounds by the micro-organisms (*Rhizobium, Azospirillum, Azolla, Nostoc,* etc.) living symbiotically in or on the roots of host plants. Symbiotic N_2 fixation gene rally occurs only in legume nodules (small, knoblike protuberances) containing viable bacteria. Symbiotic nitrogen fixation is found in most of the plants of Leguminosae family. *e.g.*,peanut, garden pea, beans, lucern, soybean, clover, alfalfa, etc.

SYMPODIAL ORCHID :- A type of orchids that are able to make separate new growths through the extension of rhizome and each new growth produces its own set of roots and sometimes possess *pseudobulbs, e.g. Cattleya.*

SYNAPTONEMAL COMPLEX :- A proteinaceous frame work which is found betwen paired chromosomes.

SYMBIOSIS :- An intimate physiological association of two or more organisms' species (generally micro-organisms) resulting in mutual benefits. *e.g.*, symbiotic bacteria such as *Rhizobium;* and *Mycorrhiza* (fungi) on the roots of their host plants.

SYNCARPOUS :- In a compound pistil when carpels are united together in one ovary, *e.g. Dianthus.*

SYNCHRONUS PROTOGYNY :- A condition in which all of the flowers on the same plant are first functionally pistillate and later become functionally staminate, *e.g.* avocado.

SYNERESIS OF JELLY :- A condition of spontaneous exudation of fluid from a jelly caused due to excess of acid leading to breakdown of jelly structure through hydrolysis or

decomposition of pectin, low sugar concentration, insufficient pectin, premature gelation and fermentation of jelly.

SYNTHETIC BEVERAGE :- Any non-alcoholic beverage or *syrup* containing no fruit juice but having an artificial synthetic flavour and colour resembling any fruit.

SYNTHETIC VARIETY :- First generation progenies developed by intercrossing a specific set of lines of cross pollinated crops having good general combining ability (GCA). It usually contains mixtures of genetically distinct seeds/lines/clones which are phenotypically similar.

SYRUP :- A solution of cane sugar in water, or a beverage containing at least 25 per cent juice and 65 per cent T.S.S.

TABLE GRAPES :- Grapes which are utilized either as a fresh fruit or for decoration purpose. These are generally seedless varieties, *e.g.* Beauty Seedless, Pusa Seedless, Thompson Seedless, Bhokri, Banglore Blue, Perlette, etc.

TANDEM :- Occurrence of a segment twice in the same chromosome (*duplication*) with normal gene sequence similar to the original segment.The duplication of segment with reverse sequence of genes as compared to original segment is known as *reverse tandem.*

TANNINS :- The complex phenolic compounds which are derivatives of polyhydroxy benzoic acid, and are glucosidal in nature , acidic in reaction, bitter and astringent in taste with antidessicating properties, and capable of combining with animal proteins (*tanning*) to form leather.These are considered secondary substances of plants which may be secreted in any part of the plant such as **bark** (Hemlock-*Tsuga canadensis,* Oak-*Quercus montana,* Wattle-*Acacia decurrens,* Mangrove-*Rhizophora mangle,* Golden shower- *Cassia fistula,*Avarram-*Cassia auriculata,* Ber-*Zyzyphus jujuba,* Sal- *Shorea robusta, etc.),* **wood** (Chestnut-*Castanea dentana,* Quebracho-*Schinopsis lorentzii, etc.),* **roots** (Palmetto-*Salbal palmetto,*Canaigre-*Rumex sp., etc.),* **leaves** (Gamber-*Uncariagambir,* Sumac-*Rhus glabra,etc.) and* **fruits**

(Myrobalan- *Terminalia chebula & T.bellerica,* Babool- *Acacia arabica,* Aonla- *Emblica officinalis,* Divi-divi- *Caesalpinia coriaria,* Persimmon- *Diospyros embryopteris,* Valonia- *Quercus macrolepis, etc.).*They are used in small quantities to improve the flavour of tea, coffee, cider, and beer and in large quantities to change animal hides to leather.

TAP ROOT :- A root developed directly from the radicle giving rise to the main root of the plant. A tap root system results from the continuous and vigorous growth of primary roots, *e.g.* carrot, radish, turnip, etc.

TAPKA :- A traditional maturity index for harvesting of mango indicated by fall of few ripe fruits naturally from a tree.

TASTE :- A sensation appreciated by the taste buds on the tongue, which has four dimensional phenomenon like sweet, sour, bitter and salty.

TAUTOMERIZATION :- The process of shift of hydrogen atoms from one position to another either in a *purine* or in a *pyrimidine* base.

T-BUDDING (SHIELD BUDDING) :- A method of budding done by making a cut (*matrix*) in the bark of the stock in the shape of 'T' and inserting the 'Shield' shaped bud under the bark, *e.g.* generally practised in aonla, rose, etc.

TELOCENTRIC CHROMOSOME :- A chromosome in which centromere is located at one end.The terminal region of chromosome on either side is known as **telomere.**

TELOPHASE :- A stage of mitotic phase of spindle using cell division in which chromosomes form two groups and reach the opposite poles.

TEMPLATE :- A macro molecule of DNA which codes and provides information for the synthesis of another complementary macro molecule. mRNA also takes information from a template.

TENDRIL :- Slender, threadlike-filiform or spiral or hooked structures, developed as modification in a leaf or its part, arising

from leaves or nodes of stem which have the ability to twine around objects as a means of support for climbing the plant or other bodies. *e.g.* garden pea, sweet pea, *Antigonon, Passiflora,* etc. climb upward with the help of tendrils.

TERRACE :- A raised space of ground constructed around a dwelling house or at the corner of a garden or the side of a hill to have an easy look of the garden.

TERRACE GARDEN :- The sort of gardening by arranging potted plants or growing ornamental plants on raised, more or less levelled or horizontal strips of terraces.

TERRARIUM :- It is also known as *'Wardian Cases'* in the honour of its inventor 'Nathaniel Ward'. Terrarium is a glass case of 1×0.5×0.5 meter size, like *aquarium,* for growing plants where environment best suited to plants is provided.

TERTIARY GENE POOL :- The germplasm (genetic material) of a species which leads to production of sterile hybrids on crossing with primary gene pool of that species. It is designated as GP_3.

TEST CROSS :- The cross of F1 with its homozygous recessive parent.

TETRAPLOID :- An organism which contains four sets of chromosomes or genomes *(4x).*

TETRASOMIC :- An aneuploid-polysomic individual having one pair of chromosomes (two chromosomes) in addition to the one pair of normal somatic chromosome complement and it is represented as $2n + 2$. Tetrasomics are of two types, viz., **simple tetrasomic** (addition of two chromosomes to one pair, represented as $2n + 2$) and **double tetrasomic** (addition of two chromosomes to two different pairs, represented as $2n + 2 + 2$).

TEXTURE :- It is one of the most important characteristics of quality of horticultural products. It refers to the arrangement of fibres in fabrics being dependent on the turgor of cells as well as the supporting tissues and the cohesiveness of the cells.

THALAMUS :- The suppressed swollen end of the flower axis (*pedicel*) on which the *floral leaves* (sepals, petals, stamens, carpels, etc.) are inserted.

THAWING :- The process of making a frozen product into unfrozen or liquid state before cooking or using by exposing them to temperature higher than the frozen temperature.

THERMODORMANCY :- A type of physiological dormancy in seed where germination of the freshly harvested seeds is sensitive to temperature.

THINNING :- Removal of extra seedlings from a bed, or flowers, fruits, shoots, canes or entire twigs from a plant to avoid injury due to over-crowding.

THINNING OUT :- A type of top pruning where the entire shoot or twig or cane is removed.

TIP LAYERING :- A type of ground layering in which the growing tips of trailing type shoots are bent down and burried in the soil to the depth of 5-7.5 cm for rooting.

TISSUE CULTURE :- It is also called *in-vitro* culture which refers to regeneration by the growing of tissues or cells or *organs* (anther, ovule, pollen, embryo, bud, etc.) of living organisms or plants in a suitable culture medium.The plant part which is used for regeneration is known as **explant**. According to explants used, in vitro culture techniques are- **cell culture** (regeneration of plant from a somatic or germinal cell), **organ culture** (regeneration of a plant from an organ), **meristem culture** (regeneration of a plant from meristem tissues), **protoplast culture** (regeneration of a plant from protoplast), **callus culture** (regeneration of a plant from an unorganised masses of cells) and **suspension culture** (regeneration of a plant from a suspension of free cells and small cell masses), etc. Tissue culture has potential application in vegetative multiplication, recovery of virus free plants, production of somatic organelles and hybrids, and cytoplasm transfer and genetic transformation. The capacity of a plant cell to reproduce (regenerate) into a whole plant somatically is known as **totipotency**.

TISSUE :- Group of cells which have a common function. Tissues, in turn, join with adjacent tissues to promote the work of any given structure or organ. Cells do not work alone, they work together in groups in form of tissues.

TOLERANCE :- Ability of a host or plant to withstand the effect of *adverse growing conditions* (drought, excess of water, insect-pest and disease attack, etc.). It is the capability of a variety to produce more yield and quality than susceptible one at the same level of adversed condition (disease or insect-pest attack) under similar environment conditions. Escape of a variety from insect or disease attack either due to earlyness or its cultivation in the season when insect population is very low is known as **avoidance.**

TOP WORKING :- The process of changing an inferior variety or unproductive plant into a superior variety or productive plant by grafting on standing tree.

TOPIARY :- An art of training plant into certain ornamental shapes or figures like birds, animals, domes, umbrellas, cones, etc.

TOPPLE IN GLADIOLUS :- Breaking of spikes as florets open in the vase which is closely correlated with calcium content of stalk tissues.

TOPPLING OF TULIP :- A physiological disorder of tulip characterised by the collapse of a small portion of the internode of the floral stalk just underneath the flower.

TOTAL SOLUBLE SOLIDS (T.S.S.) :- Total sugars, organic acids, and other soluble components in the juice or product which is measured in terms of *degree* brix or per cent.

TOTIPOTENCY :- The ability of a somatic cell to reproduce the entire new plant somatically.

TRAILERS :- Plants which are unable to climb vertically and do not form any roots or supporting structure at their nodes.

TRAINING :- Judicious removal of plant parts, tieing, fastening and staking of plant to give proper shape.

TRANSCRIPTION :- The process of synthesis of messenger RNA (mRNA) from a DNA template.It may be *symmetrical* (synthesis of mRNA from both the strands of DNA) or *asymmetrical* (synthesis of mRNA from only one strand of DNA). The substance (*e.g.*, lactose in lac operon) which allows initiation (induction) of transcription is called **inducer**. The process of DNA synthesis from RNA in the presence of DNA polymerase is known as reverse **transcription** or **Teminism**.

TRANSFER RNA (tRNA) :- It is also known as *soluble RNA* and refers to a type of ribose nucleic acid which carries amino acids and attach them with ribosome mRNA complex for use in protein synthesis.

TRANSFORMATION:- Non-sexual transfer of desired genetic information through DNA segment from one organism to the other directly through *bio-technology* or *genetic engineering* (incubation or somatic hybridization, *i.e.*, it is genetic recombination of naked DNA of one cell of an organism with one cell of another organism.The genetic recombination in bacteria in which DNA is transferred from one bacterial cell to another bacterial cell *via bacteriophage* is known as **transduction**.

TRANSGENIC PLANTS :- These are also called *genetically modified plants* (GMP) which refer to plants containing foreign DNA or plants developed by the process of transformation of genetic material (genetic /bio- engineering).

TRANSGRESSIVE SEGREGATION :- The phenomenon of appearance of extreme variation in an individual in F_2 or later generations outside the range of both the parents. *Transgression* is only possible in case of polygenic characters. The segregants which falls outside the limits of either parents are known as **transgressive segregants**.

TRANSITION :- Substitution of one purine by another purine or one pyrimidine by another pyrimidine. It occurs in a single strand of DNA. The substitution of a purine by a pyrimidine or *vice-versa* is known as **transversion** which occurs in both strands of DNA.

TRANSLATION :- The process of protein synthesis in ribosomes from information provided by mRNA.

TRANSLOCATED GRAFT INCOMPATIBILITY :- A type of graft incompatibility in which the incompatibility condition is not overcome by the insertion of a mutually compatible interstock between stock and scion.

TRANSLOCATION :- In plant **physiology,** it is the movement of food and other material within the plant body. In **cytology,** translocation is the one way or reciprocal exchange of segments of a non-homologous chromosome to another part of the same chromosome or to a different chromosome.Translocation homozygotes change the linkage map and translocation heterozygotes exhibit cross shaped configuration at pachytene. The cytological translocations are of three types, viz., *simple, shifts* and *reciprocal.*

TRANSPIRATION RATIO :- It is the transpirational loss of water by a plant to its dry matter production during growing season which measures the efficiency of water consumption by a plant species. The larger the ratio, the less efficient is the plant species in its use of water. Transpiration ratios of most of crop plants range from 200 to 500 or more; *i.e.* it takes 200 to 500 g of water or more to bring 1g (dry weight) of plant to maturity. C4 plants produce two or three times more dry matter per unit of water used than C_3 plants.

TRANSPIRATION :- It is essentially a biophysical process of outgoing (loss) of water in vapour form from the tissues of plants. Although any part of a plant exposed to the air may give off water vapour, the aerial parts especially leaves give off the most because of their structure, shape, position and function under the influence of sunlight. It is regulated by opening and closing of guard cells (*stomata*) and to some extent by the protoplasm.

TRANSPIRATION STREAM :- This is the upward transpiration of water in specialized water-conducting cells in vascular system (*xylem tissue*) of plant from root to leaf, and its ascent depends on transpiration.

TRANS-POSITION :- It is also called *repulsion phase of alleles* which refers the presence of one wild and one mutant allele in each homologous chromosome. While the exhistence of two wild alleles in one homologous chromosome and their mutant allele in another homologous chromosome is known as **cis-position** or **coupling phase** of alleles.

TRELLIS :- A frame or lattice of wooden or iron bars crossing either at right angles or diagonally which is used to support climbing plants.

TRENCH LAYERING :- A method of ground layering which consists of placing a stem in the shallow trench and covering with soil and after producing roots from the nodes the new individual is removed from the mother plant.

TRIALLEL CROSS :- It is also known as *three way cross* which refers to all possible three way crosses among selected parents. In triallel cross, number of all possible three way crosses among *n* parents is equal to *n (n-1) (n-2)/2*. The three way hybrid of a particular set of males and females is known as *triallel*. The analysis of all possible three way crosses among selected parents is called triallel analysis in which each cross involves three parents. The concept of *triallel analysis* was developed by Rawlings and Cockerham (1962). This analysis provides information about additive, dominance and epistatic variances.

TRIANGULAR SYSTEM :- A system of planting in which trees are planted as in the square system but the plants in the *even rows* (2nd, 4th, 6th, ...) are planted midway between the *odd rows* (1st, 3rd, 5th, ...) and three plants form a *bilateral triangle.*

TRIHYBRID :- An individual obtained by crossing two individuals differring in three pairs of heterozygous genes with all remaining genes being, presumably, homozygous. With complete dominance, the trihybrid produces eight kinds of female and male gametes in the F_1, and 27 distinct genotypes and eight distinct phenotypes in the F_2, with a phenotypic ratio of 27:9:9:9:3:3:3:1.

TRIMMING :- An operation to remove the terminal herbaceous portion of unwanted/undesirable parts of plants.

TRIMONOECY :-It is also called *trioecy* or *gynoandromonoecy* form of sex where staminate, pistillate and hermaphrodite flowers are produced separately in the same plant in varying proportions. The plants showing such type of sex expression are called **trioecious** or **trimonoecious** or **gynoandromonoecious** plants, such as papaya.

TRIMORPHISM :- It is also called *tristyly* or *heterogeny* which refers to exhistence of styles having three positions (low, medium and high) or styles of three lengths (long, medium and short) among the flowers of a species.The occurrence of trimorphism (tristyly) leads to *heteromorphic system* of *self-incompatiblity.* This type of style situation is found in plants of the family Lythraceae, Linaceae, Oxalidaceae, etc. When styles have two positions (low and high or short and long), the condition is known as **distyly.**

TRIPLE CROPPING :- It is a multiple-sequential cropping system where three crops one after another is grown on the same piece of land in a year.

TRIPLE TEST CROSS :- Crossing of randomly selected F_2 plants with both the parents (P_1 and P_2) involved in the cross, and with their F_1 hybrid. The *triple test cross analysis* was developed by Kearsey and Jinks (1958). A triple test cross analysis involves F_2, F_1, P_1 and P_2 generations which provides information about additive and dominance variances and presence or absence of epistasis.

TRISOMIC :- An aneuploid- polysomic individual having an extra chromosome in addition to one pair in a diploid set and it is represented as 2n + 1. Trisomics are of three types, viz., primary trisomic (in which additional chromosome is normal), secondary trisomic (in which the additional chromosome is isochromosome) and tertiary trisomic (in which the additional chromosome is translocated one).

TRISTYLY :- The condition where styles of a bisexual flower have three positions, *viz.* low, medium and high, which lead heteromorphic self-incompatibility.

TROPHY :- An arrangement of colourful potted plants, which may be annual or herbaceous perennials.

TRUCK GARDENING :- The term 'truck' has been derived from a French word *'troquer'* meaning *'to barter'*. Truck gardening is an extensive type of vegetable farming where the grower specializes to grow one or two special vegetables in large quantities for distant markets. Potato, onion, pumpkin, etc. are suitable for truck gardening.

TRUE POLYEMBRYONY :- A type of polyembryony where the additional embryos develop from the same embryo sac, *e.g.* Acalypha.

TUBER :- A swollen, modified subterranean stem structure that functions as an underground storage organ whose nodes are marked by *'eyes'*, *e.g.* potato, nutgrass, Jerusalem artichoke, etc.

TUBERCLES :- Small aerial tubers produced in the leaf axils above the ground, *e.g.* yam.

TUBEROUS ROOTS :- It is massive enlargement of secondary roots having no nodes or internodes. The buds are produced on the crown of stem on proximal end and the roots are produced on the distal end, *e.g.* dahlia, sweet potato, etc.

TUNICATED BULB :- A type of bulb which remains covered by dry, thin and membranous coverings and central axis of the bulb like a tunic, *e.g.* onion, tulip, daffodil, amaryllis, etc.

TURGOR PRESSURE :- It is the outwardky directed hydrostatic pressure exerted by the contents of the cell on cell wall. It is equal in magnitude and opposite in direction to the pressure of cell wall. Turgor pressure ensures the maintenance of normal rigidity in a plant cell and helps cell enlargement during cell growth.

TWINNER :- A type of herbaceous climbing plants which do

not possess any definite organs for climbing but climb over a support by twinning themselves spirally, *e.g.* honey suckle, beans, cowpea, railway creeper, etc.

ULTRAVIOLET RAYS (UV-RAYS) :- Non-ionizing radiations produced from mercury vapour lamps or tubes and used as a mutagen for induction of artificial mutation in lower organisms. U V-rays are moderately long and moderately frequent *invisible rays* on one extreme of light spectrum with the wave length ranging from 50 to 390 millimicrons.They are near the visible end of the spectrum, *i.e.*, near the ' violet' rays of the visible spectrum, they has no advantage in increasing plant dry weight.

UMBEL :- A type of inflorescence with flat or rounded clusters of flowers in which all the individual stalks arise from a common point at the top of the main flower stem, *e.g.* coriander, carrot, etc.

UNDEVELOPED EMBRYO :- Partially developed torpedo-shaped embryos that may attain a size upto one half that of the seed cavity at maturity, *e.g.* carrot, primula, *Rhododendron,* etc.

UNFRUITFUL :- A species or cultivar that fails to produce commercial crop of fruit.

UNIDIRECTIONAL REPLICATION :- Replication of DNA in one direction only from the point of origin. When replication of DNA occurs in both the directions from the point of origin it is called **bi-directional replication.**

UNIFORM EXPRESSIVITY :- The similar or uniform expression of a penetrant gene in all the individuals that carry such gene. Differential or variable expression of a penetrant gene in the individuals that carry it is known as **variable expressivity**. The degree of expresion of a penetrant gene in its carriers is called **expressivity**.

URTICLE :- A dry, one-celled, one or few-seeded fruit developing from a superior monocarpellary ovary, and the fruit is provided with a thin membranous loose pericarp which is not attached to the seed coat, *e.g. Basella, Chenopodium,* etc.

VAPOUR PRESSURE (VP) :- The pressure exerted by the water vapour molecules to escape from ambient air and from the plant or other surface during transpiration and/or evaporation. The vapour molecules present in ambient air and transpiring or evaporating surface exerted this pressure due to which transpiration and/or evaporation takes place. The rate of transpiration is directly proportional to the difference (*vapour pressure deficit*) between the vapour praessure of the transpiring surface and that of the ambient air.The mathematical relation between the rate of transpiration (Tr) to the vapour pressure deficiit (VPD) is expressed as- VP (Tr surface) -VP (Ambient air) =VPD =Rate of Tr.

VARIETAL DETERIORATION :- Permanent reduction either in the genetic or agronomic value of a released variety. It may be occur due to various reasons, secondary selection or other means. **Varietal purity** can be maintained by keeping proper isolation distance and removal of offtypes. The re-establishment of a released variety which has run out of cultivation or deteriorated due to various reasons is called **varietal revamping.**

VARIETY :- A homogygous group of genotypes whose distinguishing characters are controlled by the breeding approach (s) and which is released for commercial cultivation either by Central or State Variety Release Committee.

VASCULAR BREAKDOWN OF APPLE :- A physiological disorder characterised by browning of main vascular bundles and of some adjacent tissues but the remaining cortex may appear normal. It is associated with cool growing season, 6-7 months of cold storage at 0 ^{0}C or with CA storage at 3 ^{0}C.

VASCULAR BUNDLES :- The group of radially arranged primary phloem and primary xylem. This radial arrangement of bundles allows the water and solute to pass directly to the primary xylem.The *primary phloem* provides channel for the passage or translocation of foods, hormones, and vitamins; and the *xylem* provides a channel for the translocation of water and essential raw materials.

VASE-LIFE :- A period for which a flower remains fresh and remains suitable for being used in vase arrangement.

VEGETABLE :- A plant part or its product eaten cooked or raw as a main part of a meal, side dish, or appetizer.

VEGETABLE FORCING :- The growing of vegetables out of their normal season in specialized structures (poly house, green house, etc.) by forcing (providing optimum atmospheric conditions suitable for growth).

VEGETATIVE APOMIXIS :- A type of apomixis where *vegetative buds,* or *bulbils* are produced in place of flowers in an inflorescence which on falling to the ground subsequently develops into a new plant, *e.g.* garlic, *Agave, Allium cepa* var. *viviparum, Poa bulbosa,* etc.

VEGETATIVE PHASE :- The stage of plant growth and development, prior to flowering, which concerns essentially the utilization of carbohydrates and development of the stems, leaves, and absorbing roots. This phase is associated with three important processes, *viz.*, cell division, cell enlargement and the initial stages of cell differentiation, during which crop plant is using most of the carbohydrates it is produced.

VEGETATIVE REPRODUCTION :- It is commonly known as *vegetative propagation* which is a type of asexual reproduction or multiplication of plants or other organisms, *i.e.*, reproduction or multiplication of plants by various vegetative parts (root, stem, leaf, tissues, etc.) rather than sexual parts (fertilized embryo/seed). It may ocur in nature (**natural vegetative reproduction**) or can be achieved by artificial means (**artificial vegetative reproduction**) such as cuttings, layering, grafting, budding, etc. Vegetative reproduction facilitates for the production of *true-to-type* offsprings.

VEINS :- These are relatively small vascular bundles of leaf which are arranged in a certain manner (*veniation*) in leaves of different plant species.Veins are of two types, *viz.*, **veinlets** (small veins which are in close contact with manufacturing cells and conduct the foods, hormones, and vitamins from , and

water and raw minerals to, these cells) and **veins** (large veins which have sheaths of thick-walled cells give strength and support to the leaves, in addition to the vascular transportation of foods and minerals).

VENEER GRAFTING :- A method of detached grafting in which a slanting cut is given on the side of stock and at the base of this cut, a second, short, downward and inward cut is made to intersect the first cut so as to remove a piece of wood and bark. The scion is prepared by giving a slanting cut on one side down to other side and stock and scion are then matched securely to unite as one plant, *e.g.* practiced in mango, cashewnut, etc.

VENI :- A kind of flower arrangement widely used in South India to decorate the long plait of hairs.

VERMICULITE :- A micaceous mineral and chemically hydrated magnesium - aluminium - silicate, very light in weight, insoluble in water, and is able to absorb a large quantities of water and used as rooting medium.

VERNALIZATION :- A low temperature preconditioning to seeds soaked in just enough water to permit germination to start but not to continue or method of inducing early flowering in plants by pretreatment of the propagating materials with very low temperature.

VERTICAL RESISTANCE :- A type of genetical resistance where a host or genotype exhibits the resistance to the particular race of a pathogen (*pathotype*). It is pathotype specific and complete but not permanent and inherited through major genes or oligogenes by a gene-for-gene system. It is also called qualitative or oligogenic or major gene or non-uniform or race specific resistance. Vertical resistance can be exploited through development of varieties with individual major gene, development of multilines, gene pyramiding and gene deployment.

VIABILITY :- The ability of pollen grain or seeds, etc. to live,

grow and germinate, to produce healthy seedling under favourable conditions.

VINEGAR :- Acidulous liquid product prepared by alcoholic and acetic fermentation of sugary and starchy materials and useful for preserving pickles.

VIRULENCE :- The ability of a physiological race (pathotype) of a pathogen to attack or infect a specific host genotype to incite a disease. A race of pathogen capable of attacking a host having specific resistance is known as **virulent**; and a pathotype unable to attack a host with specific resistance is called **avirulent**.

VIRUS INDEXING :- Detection of virus infection and other systemic organisms of a plant by grafting it on to a sensitive indicator plant.

VITAMIN :- These are the organic substances as essential dietary factors required in minute amounts for the normal metabolism. Because most function as cofactors in enzymic reactions, vitamins are usually found within the cell in minute amounts. Lack or insufficient supply of vitamins in nutrition leads the occurence of nutritional disorders. Plants are able to synthesize vitamins, however, whereas animals must depend on plants for their supply of vitamins.They are of two types- **water soluble** {Vit-B and C) and **fat-soluble** (Vit-A,D,E,K Q and F).

VITAMIN-B :- The B vitamin is a group of water soluble vitamins {Vitamin-B_1(thiamine), B_2(riboflavin), B_6(pyridoxine), B_{12} (cobalamin), folic acid, nicotinamide, pantathenic acid and biotin}, which are essential components (*prosthetic groups*) of coenzymes necessary in cellular metabolism. Vitamin-B_1 (thiamine) is the active group in the carboxylase enzyme, nicotinamide is a component of NAD and NADP, and pantathenic acid is a part of coenzyme.

VITAMIN-K :- This is one of a group of compounds known as *quinones* that function in the electron transport chain in photosynthesis.Vitamin-K is the fat-soluble one.

VIVIPARY :- The phenomenon of germination of embryo in the ovary while it still remains attached with the parent source; or germination of seed in the fruit while it is still attached to the mother plant.

WATER ABSORBING SURFACE :- The surface in the soil from which root hairs absorb water, which depend upon depth of the *absorbing surface* (the depth of the soil penetrated by the roots) and **density of the absorbing surface** ((the number of root hairs and fine roots which occupy each unit volume of soil). The depth and density of water absorbing surface varies with the stage of growth, the kind of plant and plant root system, and the type of soil.

WATER CORE :- A pre-harvest disorder of apple which is characterised by the presence of translucent liquid infused tissues around the vascular bundles only or affecting additional tissues within or outside the core area. In severe cases, most of the tissues may be damaged and lenticels secrete droplets of sap.

WATER GARDEN :- A shallow pond or a lake of natural formation in which the water does not overflow and beautified with aquatic ornamental plants and animals.

WATER POTENTIAL :- It is the difference between the energy of water activity of water molecules in pure distilled water at atmospheric pressure and 30°C and the activity of water molecules in any other given system. Water oatential is expressed in bars or megapascals. This is used to measure water deficit or water stress in plant cells and tissues. Water potential in a plant tissue is always less than zero and hence a negative number. From the standpoint of *thermodyanics*, the water potential in than soil is greater the the water potential in the *root hair zone* (*i.e.,* in the xylem).

WATER SPOT :- A disorder of orange fruits characterised by a water soaked appearance when fruit matures under cool and wet conditions.

WATER SPROUT :- New vigorous shoots that arise from latent growing point or buds along with the stem or branch on which they occur.

WATER TABLE :- The upper surface of zone in soil which is saturated with ground water. In this zone, the pore space is entirely filled with water, and as a result insufficient quantities of oxygen are available for the growth and respiration of the root system. In general, soils with a *water table* close to the surface throughout the period of growth of a crop are unsatisfactory for crop production. The optimum depth of water table for crop production varies with soil texture and the plant to be grown.

WATSON AND CRICK BASE PAIRING :- The normal pairing of bases in DNA or RNA, *viz., adenine* with *thymine* (i.e., A-T) and *guanine* with *cytosine* (*i.e.*, G-C) in a DNA molecule; and *adenine* with *uracil* (*i.e.*, A-U) and *guanine* with *cytosine* (*i.e.*, G-C) in RNA molecule. A double helical molecular model of DNA was first reported by Watson and Crick (1953) for which they were awarded by Noble Prize in 1958.

WAXY BLISTER OF TOMATO :- A disorder of tomato fruits characterised by white to cream coloured irregular blisters, 3-6 mm in diameter and often more than 3mm high which becoming light to dark brown, depressed and cracked as fruits ripen.

WESTON ILLUMINOMETER :- A quite compact, portable and inexpensive instrument for measuring the amount of light in foot candle. This consists of a light receptor cell, a sensitive galvanometer, and a volt meter from which the number of *foot-candles* can be read directly.

WHIP TAIL :- A nutritional disorder of cauliflower caused by *molybdenum deficiency* and characterised by severe reduction of the leaf lamina leaving the large bare mid rib in acute condition.

WHITE BUD :- A nutritional disorder of sweet corn caused by *zinc deficiency* and characterised by pale yellow or almost white young leaves.

WHITE HEART :- A physiological disorder of watermelon characterised by whiteness at the central portion instead of uniform development of pink colour from centre to rind indicating poor quality.

WIDE CROSSING :- It is also called *distant hybridization* which refers to mating between different species of the same genera (*interspecific* or *intrageneric crossing*) or mating between different genera of the same family (*intergeneric hybridization*).

WILD GARDEN :- A comparatively recent style of gardening propounded by William Robinson. The concept of wild garden is not only against the formalism but also breaks the rule of landscape. This idea aims to naturalize plants in shrubberies and grass should remain unmoved as in nature and few bulbous plants should be grown scattered in grass to imitate a wild scenery.

WILTING :- It is also known as *flagging* which refers the condition of vegetative parts, ususally leaves, of hanging or drooping loosely without normal *rigidity* (as guard cells lose turgor) owing to insufficient water in the tissues. The amount of water in soil at which rapidly growing plant or its parts, usually leaves, wilt or flagged and fail to recover from wilting under conditions of low transpiration (humid conditions) is known as **permanent wilting point** (PWP) or **permanent wilting percentage**.

WIND BREAK :- Planting of rows of tall growing trees along with boundaries of garden/orchard towards the direction of wind to give effective protection to the fruit trees against strong hot and cold winds. They should be planted in N-W side of orchard.

WINTERING :- A management practice in rose to bring the plants under artificial rest by withholding irrigation and exposing the roots to the sun for one to two weeks. It is generally practiced in the month of October-November inwet soils where rose does not enter into natural dormancy.

WITCHES BROOM :- A physiological disorder of stem or branches causing profuse number of branching and resulting in a very brushy condition like a broom.

WOBBLE BASE PAIRING :- The pairing of mRNA with tRNA anticodon in which first two bases of codon have normal pairing and the third base has abnormal base pairing. *Wobble hypothesis* was proposed by Crick (1966).

WORKING COLLECTIONS :- The germplasm which is meant for short term storage (3 to 5 years). Such collections are stored at 5 to 10°C.

XENIA :- Effect of the genotype of pollen grain on the phenotype of endosperm of the seed due to phenomenon of *double fertilization.*

X-RAYS :- Sparsely ionizing and highly penetrating radiations generated in X-ray tubes and used for induction of artificial mutations. X-rays were first discovered by Roentgen (1895) and first use of X-rays for induction of mutation in plants was done by Stadler (1928).

XYLEM :- The specialised vascular bundle consisting *xylem tube* or *vessels,* which provides channel for *acropetal transportation* of water and essential plant nutrients in water from soil to leaf. It is located between pith and the primary phloem, and the xylem in combination with pith forms the wood.

YEAST :- Unicellular plant body (fungi), very minute, (somewhat larger than bacteria) containing cell wall and single nucleus and cause fermentation of sugar into alcohol.

Z-DNA :- A DNA molecule having left handed double helical madel in which sugar and phosphate linkages follow a zigzag pattern.

ZERO ENERGY COOL CHAMBER :- A cool chamber used to enhance the shelf-life of fresh fruits and vegetables by maintaining the low temperature and relative humidity during summer and winter season naturally. It is based on the principle

of direct evaporation cooling and there is no requirement of electricity and power. It is prepared by a square shape pit on the earth and its double walls are made by bricks and the space between pit and brick wall is filled by moist sand.

ZONING OF BEET :- The development of alternate white and coloured circles in beet root grown under unfavourable conditions particularly in hot weather.

ZYGOTENE :- A sub stage of meiotic prophase I in which homologous chromosomes begin to pair.

INDEX FOR TERM DIFFERENCES

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