A
REPORT ON BEEKEEPING AND REARING

By

Redg. No. 200804130124, 125, 126, 127, 128, 129, 130, 131, 133, 134, 135, 136, 137, 142, 144, 145, 146, 147, 148, 150, 151, 152, 153, 154, 155, 156 & 157.

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March 2022

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Date: 25.03.2022

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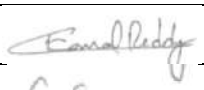
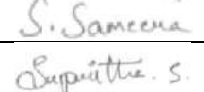
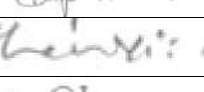
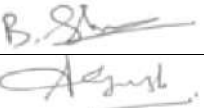
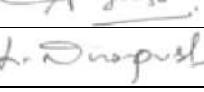
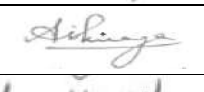
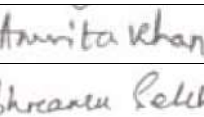
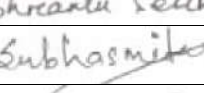
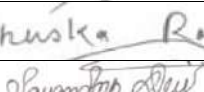
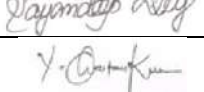
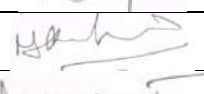
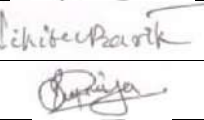
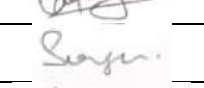
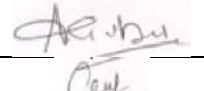
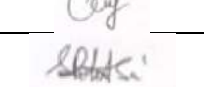
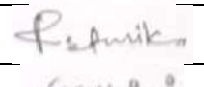
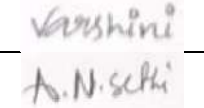
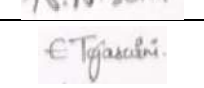
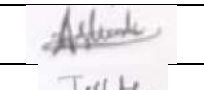
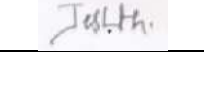
1	C KAMAL REDDY	200804130124	
2	SANDAKA CHAITANYA SAMEERA	200804130125	
3	SOMU VENKATA SAI SUPRITHA	200804130126	
4	KINTALI JAHNAVI	200804130127	
5	BANTU SRI HARSHA	200804130128	
6	AYUSH KUMAR SAHU	200804130129	
7	LENKA DURGA PRASAD	200804130130	
8	RAVI VENKATA SURYA SAI AISHWARYA	200804130131	
9	AMRITA KHAN	200804130133	
10	SUBHRANSU SEKHAR	200804130134	
11	SUBHASMITA BHOL	200804130135	
12	ANUSKA ROY	200804130136	
13	SAYANDEEP DEY	200804130137	
14	YADLA CHAITANYA KUMAR	200804130142	
15	M.PRAVEEN KUMAR	200804130144	
16	NIKITA BARIK	200804130145	
17	SUPRIYA MUNI	200804130146	
18	CHODISETTI SURYA TEJA	200804130147	
19	AKSHITA DAS	200804130148	
20	PALLI CHANDANA	200804130150	
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APIARY UNIT:

This unit was established in 8th January 2019 for academic purpose with an aim to initiate AELP program on Apiculture to develop entrepreneurship among the students. Learning during working in the unit will develop self-confidence for handling Bee-boxes and to generate income through producing Honey and bee colonies. Visit to the apiary by the farmers will inspire and motivate the farmer to promote beekeeping in this South-Eastern district of Odisha. Such interested farmers can be educated by conducting Farmers training at University level by the Scientist and the AELP students.

Therefore, inside M.S. Swaminathan School of Agriculture, CUTM, Paralakhemundi campus apiculture unit has been established with 25 numbers of boxes (Indian honeybee, *Apis cerana indica*) of which 16 boxes have been installed in Coconut Orchard behind Dispensary, 7 boxes in Tribal village and 2 boxes are placed in the lawn of MDC, Guesthouse. Apart from this, 10 boxes of the same species are also there in Jatni Campus, CUTM, Bhubaneswar. For expanding the unit with a aim to increase the colonies, 25 more number of boxes were installed in different area of the campus on 27.04.2022. Each unit consisted of a wooden box containing colony of *Apis cerana indica* placed over a cemented stand. Subsequently boxes of each unit have been topped with a slanting wooden roofing top for protection and beautification.

Future of Beekeeping in CUTM:

With respect to all of the above mentioned condition and availability of honeybee colonies we can easily increase our unit. We can increase the unit by purchasing some more colonies from the beekeeping entrepreneurs. After our establishment, we can produce more bee colonies by colony division of existing colonies and the bee boxes can be constructed by our wooden lab present in Jatni campus.

STANDARD OPERATION PROCEDURE

Purchase of Bee-hives alongwith divided colonies of new *Apis cerana indica* colonies

Digging of holes, Fixing of cemented hive stands , Installation of honeybee colonies. Application of mobil around the stands

Cleaning of bottom boards weekly and inspection of the hive frames to confirm their proper development

Seasonal management of the colonies
Summer Management - Honey flow Period
Rainy season –Dearth period
Winter season – Miner Honey flow season

Extraction of Honey, Processing of Honey, Extraction of bee wax, Colony division, Colony union, Drone management, Selling *A.c indica* Honey, Wax and Colony

Project preparation

OUT COME :- Skill development in apiculture. Confidence development for handling bee colonies and utilization of gained knowledge for using it to act as job provider.











(Interaction with Vice president Sir during Kishan Mela 2020)











Honey production






Propagation of horticultural crops and their management

By

Redg. No. 210804130216, 217, 218, 219, 222, 223, 225, 226, 227, 228, 229, 230, 231, 233, 234, 235, 236, 237, 239, 241, 243, 244, 245, 246 & 247.

Faculty In charge: Dr. G. Anitha
Assistant Professor
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Centurion University of Technology and Management

March 2022

CERTIFICATE

This is to certify that
the registration number 210804130216, 217, 218, 219, 222, 223, 225, 226, 227, 228, 229, 230, 231, 233, 234, 235, 236, 237, 239, 241, 243, 244, 245, 246 & 247.of B. Sc. (Agriculture) have completed the project on Propagation of horticultural crops and their management from November 2021- March 2022.

Faculty In charge: Dr. G. Anitha

Date: 30-03-22

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INTRODUCTION

Propagating new plants is both a science and an art. The study of it can provide a lifetime of challenges and opportunities to learn more about this fascinating craft, a basic knowledge of it can provide the students with the skills and techniques to start their own business in nursery production of horticultural plants since the demand for planting material of horticultural plants is ever increasing. It can be of great fun to grow your own plants. Plant propagation is the multiplication of plants by both sexual and asexual means.

Main

What is Plant Propagation?

Plant Propagation is defined as the multiplication of plants by both sexual and asexual means. Propagation is an art of multiplication of plants. The propagation methods are broadly classified as sexual and asexual propagation.

Sexual Propagation

Sexual propagation is the raising of plants by means of seed which is formed due to the fusion of male and female gametes within the ovule of a flower. In ancient times when the asexual methods of plant propagation were not known, this was the only commercial method for plant propagation. Papaya, phalsa and mangosteen, mostly vegetable crops and annual flowers are being propagated by seed.

Advantages

- Seedling trees are generally long-lived, bear more heavily and all comparatively more hardy.This is the only means of reproduction, where asexual propagation is not possible or economical e.g. Papaya, phalsa, mangosteen etc.
- To develop new varieties, hybrids are first raised from seed and it is essential to employ this method in such cases. Rootstocks upon which the fruit varieties are budded or grafted are mostly raised from seeds.
- Seedlings are cheaper, easy to raise and easily transported to distant places, does not require high technical knowledge and skilled labour.

Limitations/disadvantages

- Seedling trees are not uniform in their growth, yielding capacity and fruit quality.
- Seedling trees have long juvenile period and take more years to bear the first crop.
- Seedlings become large for economic management. .
- Seed propagation will not be applied in many plants e.g. banana

• It is not possible to avail the modifying influence of rootstock on scion or scion on rootstock.

Asexual propagation

Propagation of plants through any vegetative parts is called vegetative or asexual propagation. The goal of vegetative propagation is to reproduce progeny plants identical in genotypes to a single source plant.

Advantages:

• Vegetatively propagated plants are true to type, uniform in growth, yielding capacity and fruit quality.

• Vegetatively propagated plants come into bearing earlier.

• It is possible to regulate the tree size, fruit quality, precocity etc. according to one's requirements by using different rootstocks.

• Cross pollination can be effected by grafting shoots of other suitable varieties (pollinizers) on some of the branches of self-unfruitful variety.

• Grafting can be used to encourage healing of tree wounds caused by rodents, implements.

Limitations

• No new variety can be evolved by means of the vegetative method of propagation.

• Sometimes, it is more expensive.

• Vegetatively propagated plants are comparatively short lived.

Methods of Asexual Propagation:

Plant Propagation by Cutting:

A portion of a stem, root or leaf is cut from the parent plant and is placed under certain favourable environmental conditions to form roots and shoots. Thus a new independent plant is produced which in most cases identical with the parent plant.

Stem-cuttings: Hardwood cuttings are easily handled and transplanted. One-year-old mature shoots are collected during November-February. Grape, fig, pomegranate, currant,gooseberry, some plums and apple are propagated by hardwood cuttings. Many deciduous ornamental shrubs are started readily by this type of cuttings. Length of cuttings should be between 10 and 45cm. It should contain at least 2 buds. Just on the base of shoot below the node a straight cut is given while on the top of the cutting, 1-2cm above the bud a slanting cut is given. This helps maintain the polarity of the shoot and if rain occurs, water does not accumulate on the tip of cutting. Semi-hardwood cuttings are mostly used in evergreen fruit plants-mango, guava, lemon and jackfruit. Treating cuttings with rooting hormone gives better results. Naphthelene Acetic Acid (NAA) and Indole-3-Butyric Acid (IBA) are the two most commonly used root promoting hormones used. Soft wood cuttings: Cuttings are prepared from the soft succulent new spring growth of species which are 4 to 6 months old. Many ornamental woody plants can be propagated by softwood cuttings. Typical examples are the Nerium, crotons, Eranthemum, Graftophyllum etc.

Leaf Cuttings: Certain plants with thick and fleshy leaves have the capacity to produce plant lets on their leaves. In leaf cuttings, the leaf blade with or without petiole and axillary bud is used for starting new plants. Begonia, African violets and peperomia are propagated by leaf cuttings.

Root cuttings: As the name indicates, roots of the plant are utilized as propagating material. Roots 1 cm thick and 10-15cm tall are used. Blackberry and raspberry are commercially propagated by this method.

Propagation by layering Layering is the method of propagation in which roots are developed on a stem while it is still attached to the parent plant. After proper rooting, the stem is detached and becomes a new plant for growing on its own roots. The high success of layering is obtained by ringing or wounding, etiolation (absence of light), use of rooting hormone (IBA, NAA) and favourable environmental condition (temperature and humidity).

The layering techniques generally employed in fruit plants are:

Tip-layering: In tip-layering, rooting takes place near the tip of current season's shoot which is bent to the ground. It is commonly followed in Guava, black berries, raspberries and dewberries.The tips of these shoots are buried 5-10 cm deep in soil. Rooted layers are detached and planted in soil during spring.

Serpentine layering: It is modification of simple layering in which one-year-old branch is alternatively covered and exposed. The stem is girdled at its lower part. The exposed part of stem should have at least one bud to develop a new shoot. After rooting, the sections are cut and planted. eg. Guava

Air-layering: In this method, roots are formed in the aerial part of the plant. The stem is girdled and rooting hormone (IBA) is applied to upper part of cut. The moist rooting medium (moss grass) is wrapped with the help of small polythene strip (200-300 gauze, transparent). This method is commonly known as goottee. Many plants like litchi, kagzi lime, jackfruit, guava and cashewnut as well as Ficus species, Croton, Monstera and philodendron are propagated through air-layering. Rooting in air layers generally commences within 25-30 days and layers are ready for transplanting within 3 months. Buds above ground Rooting from buried node 38 Mound layering/stooling: In this method, the plant is headed back to 15cm above the ground level during dormant season. The new sprouts will arise within 2 months. These sprouts are then girdled near base and rooting hormone (IBA), made in lanolin paste is applied to the upper portion of cut with moist soil. These shoots are left as such up to two days for proper absorption of rooting hormone (IBA) before they are covered with moist soil. The concentration of rooting hormone varies from plant-to-plant but in general 3,000-5,000ppm is most commonly used. The rooting of shoots is observed within 20-30 days. After 2 months, the rooted shoots are separated from mother plants and planted in nursery. Litchi and guava are commercially propagated by this method.

Plant propagation by grafting

Grafting is an art of joining parts of two independent plants in such a manner that they unite and grow together into single independent plant. The part of graft combination which is to become the upper portion or the shoot system or top of the new plant is termed as scion and the part which is to become the lower portion or the root system is the root stock or under stock or some time stock.

Methods of grafting:

Inarching / Approach grafting: The distinguishing feature of this method of grafting is that two independent plants on their own roots (self sustaining) are grafted together. This method provides a means of establishing a successful union between certain plants which are difficult to graft by any other method as the two plants will be on their own roots till the formation of successful graft. Examples are Guava, mango, sapota.

Veneer grafting: This method of propagation holds promise for large scale commercial propagation. The method is simple and can be adopted with success. Eight months to one year old seedlings are used as rootstocks. In this method, a downward and inward 3-4 cm long cut

is In case of grafting, a bud stick consisting of two or more buds is inserted into the stock whereas in budding only single bud with or without wood is inserted into the stock. 40 made in the smooth area of the stock at a height of about 20 cm. At the base of cut, a small shorter cut is given to intersect the first so as to remove the piece of wood and bark. The scion should be of matching thickness with the stock, preferably a terminal non-flowered shoot of 3 to 4 months maturity. Remove the leaf blades from the selected scion shoot on the mother plant keeping the petiole intact, about 7 to 10 days prior to detaching. This helps in forcing the buds to swell and in increasing the grafting success. The scion stick is given a long slanting cut on one side and a small short cut on the other so as to match the cuts of the rootstock. The scion is inserted in the rootstock and the graft union is then tied with polythene strip. The rootstock should be clipped in stages when the scion takes and remains green for more than 10 days.It is used widely for grafting plants such as Mango, Avacodo etc.

Epicotyl (Stone) Grafting: This method of grafting is done on the epicotyl region of the young seedlings; hence the name epicotyl grafting. This method is simple, economical and useful for multiplication of mango plants in large number in a less time.

Soft wood grafting: This method is similar to that of cleft or wedge grafting. In the past, this technique has been used for in situ orchard establishment under dry land conditions as the grafting operation is performed using cleft/wedge method on the newly grown top portion of the plant one year after the establishment of rootstock in the field.

Cleft grafting: This method is employed in the nursery when the rootstock is quite thicker than the scion. It can be done successfully in the rootstock having a diameter of 3-10 cm. 42 Tongue Grafting This method is highly effective and widely employed for the propagation of peach and pear.

Plant Propagation by Budding

Budding is also a method of grafting wherein only one bud with a piece of bark and with or without wood is used as the scion material. It is also called as bud grafting. The plant that grows after union of the stock and bud is known as budding.

Methods of budding:

T-Budding (Shield budding): This method is known as T-budding as the cuts given on the stock are of the shape of the letter T, and shield budding as the bud piece like a shield. This method is widely used for propagating fruit trees and many ornamental plants. This method is generally limited to the stock that is about 0.75 to 2.50cm in diameter and actively growing so that the bark separate readily from the wood. Example is Rose and Citrus.

Inverted T- Budding: Inverted T budding procedure is same as that of T budding except the horizontal cut on the stock is made at the bottom of the vertical cut rather than at the top.

Patch Budding: In this method a regular patch of bark is completely removed from the stock plant and is replaced with a patch of bark of the same size containing a bud from the desired mother plant.. Example is ber.

Double working: It is practiced for several purposes (i) to over come incompatibility between the stock and scion. Incompatible stock and scion may be united by means of a piece of interstock that is compatible to both (ii) to secure resistance to drought or cold by providing a disease or cold resistant trunk by means of double working.

Top working: Top-working for changing a variety is generally done on long lived species, growing in a healthy condition. Short lived species, old trees or diseased trees are not suitable for top working; in such cases new planting is considered more economical and useful than top working.

CONCLUSION

To start with, start growing a few tomato plants from seeding in kitchen garden, to the conservationist growing endangered species of orchids in test tubes, to the commercial nurseries that grow the millions of annuals, perennials, bulbs, shrubs and trees sold every year, a working knowledge of plant propagation makes all of these endeavors possible. This knowledge will give the students greater confidence in producing plants from seed, cuttings, grafting, budding, layering and specialized vegetative structures along with essential skills to work in the horticulture industry.

A REPORT ON
Characterization of Plant Metabolites

By

Redg. No. 210804130187, 188. 190, 191, 192, 193, 194, 195, 197, 198, 200, 201, 202, 203, 204, 205, 207, 208, 209, 212, 213, 183, & 214.

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Alluri Nagar, R. Sitapur, Uppalada, Paralakhemundi, Gajapati, Odisha-761221
www.cutm.ac.in

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CERTIFICATE

The registration number 210804130187, 188. 190, 191, 192, 193, 194, 195, 197, 198, 200, 201, 202, 203, 204, 205, 207, 208, 209, 212, 213, 183, & 214. of B. Sc. (Agriculture) have completed the project on Characterization of Plant Metabolites from November 2021 to March 2022.

Faculty In charge

Date: 31 / 3 / 2022

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A field project involving **characterization of plant metabolites** was undertaken by a group of 4th year students belonging to Plant Biotechnology domain as part of the requirement of their curriculum. Plants represent the largest group in the planet earth and there is a rich diversity of plants possessing immense potential in terms of their disease alleviating properties. The property is due to the containment of important metabolites both primary and secondary in plants. The advent of metabolomics as one of the important disciplines to explore the unknown regulatory networks that control plant growth and development further studying the multitude of biochemical interactions among plants across different temporal and spatial networks helps to decode the complex biological pathways and thereby provide a platform to study the potential impact of biotic and abiotic stresses on any critical biochemical process through the detection of metabolites.

The performance as well as success of metabolomics study relies on its methodologies and instruments to comprehensively identify and measure each metabolite. Several integrated technologies and methodologies such as mass spectrometry (MS) based methods, including gas chromatography-mass spectrometry (GCMS), liquid chromatography mass-spectroscopy (LCMS), capillary electrophoresis-mass spectrometry (CEMS), fourier transform ion cyclotron resonance-mass spectrometry (FTICRMS), matrix-assisted laser desorption/ionization (MALDI), ion mobility spectrometry (IMS) and nuclear magnetic resonance (NMR) are being routinely used for large-scale analysis of highly complex mixtures of plant extracts.

The students involved in the study had selected to work on some medicinal plants growing in the biodiversity rich district of Gajapati and had collected these plants from the tribal pockets within a radius of 40 kms from the university along with some preliminary information about the uses of these plants in folklore medicine from the health workers.

The study involved the following activities including:

Collection and ethnobotanical characterization

↓

Cleaning, storage and homogenization

↓

Metabolite extraction

(concentration, derivatization and resuspension)

↓

↙ ↘

Targeted metabolites **Untargeted metabolites**

(specific class of metabolites) (Different class of metabolites)

↓ ↓

Analytical measurement

(separation and detection of metabolites from sample)

↓

Data pre-processing

(Filtering, retention time correction, chromatograph alignment and peak detection)

↓

Data preparation

(Data normalization and scaling)

↓

Statistical analysis

(Multi- and univariate analysis and clustering)

Schematic representation of the multiple step workflow of a plant metabolomics study

Table showing the presence of key metabolites in the medicinal plants under study and the analytical tools used for their identification:

SL No.	Plant species	Analytical tools used	Key metabolites identified
1.	*Arabidopsis thaliana*	UHPLC-MS	Scopolin, skimmin, esculin, esculetin
2.	*C. arietinum*	GC-MS	Sucrose, cellobiose, galactose, myo-inositol
3.	*P.ovata*	LC-MS	luteolin, catechin, kaempferol, limocitrin
4.	*Mentha piperita*	GC-MS	Menthone, menthol,

			menthofuran, pulegone
5.	***Achyranthes bidentata***	**HPLC**	**Olenolic acid and ecdysterone**
6.	**Ocimum gratissimum**	**GC-MS**	**Eucalyptol, naphthalene, azulene and comphor**
7.	***Beta vulgaris***	**HPLC-MS**	**Olenolic acid, gypsogenin, hederagenin**
8.	***Jatropha curcas***	**GC**	**Oleic acid, palmitic acid, linolenic acid**
9.	***Plantago ovata***	**GC-MS**	**α-linolenic acid, linoleic acid and palmitic acid**
10.	***Fritillaria thunbergii***	**GC-MS**	**Tryptophan, phenylalanine and histidine**

The science of medicinal chemistry makes use of natural products derived from plants and most of the popular medicines used today are the outcome of natural products research. Natural products mostly include secondary metabolites and these are unique to a genus or species providing defence against predators, pheromones for mating purposes, plant pigments, colouring agents etc.

The findings of this study would surely pave ways for investigating the stress-specific metabolites for different climatic stresses, evaluating candidate metabolic gene functions to analyzing the biological mechanism in plant cells and dissecting the genotype-phenotype relationship in response to the various biotic and abiotic stresses. Further, metabolomics will be able to contribute a lot to agriculture science such as crop breeding and genome editing for crop improvement, better grain yield as well as elucidating their unknown and novel metabolic pathways.

A

REPORT ON CROP MULCHING

By

The Reg.no. 200804130132, 159, 161, 194, 195, 196, 199, 220, 250, 259, 260, 280, 294, 295, 301, 305, 313, 314 and 323.

Faculty In charge: Dr. Sagar Maitra & Dr. Tanmoy Shankar

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Date: 28-Feb-2022

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Introduction

Smart agriculture is not only about bringing information technology in agriculture, but rather more about creating and using knowledge through technology. Agricultural machines and devices should be enabled by information technology to process and analyze data—and finally, make some decisions, or prepare them semi-automatically. Protected cultivation can be defined as cropping techniques where in the micro-climate surrounding the plant body is controlled partially or fully, as per the requirement of the plant species grown, during their period of growth and development. The activities performed during the reporting period namely cultivation of high value vegetables on mulching bed and effects of different mulch.

Objectives

(i) To impart practical knowledge on production of vegetables under polythene mulching.

(ii) To study the effect of different types of mulching on different vegetables.

Scope and Importance of Mulching

1) Alteration of soil temperature The use of plastic mulch alters soil temperature. Dark mulches and clear mulches applied to the soil intercept sunlight warming the soil allowing earlier planting as well as encouraging faster growth early in the growing season. White mulch reflects heat from the sun effectively reducing soil temperature. This reduction in temperature may help establish plants in midsummer when cooler soil might be required.

2) Soil moisture retention Plastic mulches reduce the amount of water lost from the soil due to evaporation. This means less water will be needed for irrigation. Plastic mulches also aid in evenly distributing moisture to the soil which reduces plant stress. Plastic mulching film create a barrier of photosynthesis and avoid to rise of other plants.

3) Suppress the weed growth Plastic mulches prevent sunlight from reaching the soil which can inhibit most annual and perennial weeds. Clear plastics prevent weed growth. Holes in the mulch for plants tend to be the only pathway for weeds to grow.

4) Reduction in the leaching of fertilizer The use of drip irrigation in conjunction with plastic mulch allows one to reduce leaching of fertilizers. Using drip irrigation eliminates the use of flood and furrow irrigation that applies large quantities of water to the soil which in turn tends to leach nitrogen and other nutrients to depths below the root zone. Drip irrigation

applies lower amounts of water with fertilizers injected and thus these fertilizers are applied to the root zone as needed. This also reduces the amount of fertilizer needed for adequate plant growth when compared to broadcast fertilization.

5) Improved crop quality Plastic mulches keep ripening fruits off of the soil. This reduced contact with the soil decreases fruit rot as well as keeps the fruit and vegetables clean. This is beneficial for the production of strawberries, for example

6) Reduction in soil compaction The plastic mulch covering the soil decreases the crusting effect of rain and sunlight. The reduction in weed quantity means a decreased need for mechanical cultivation. Weed control between beds of plastic can be done using directly applied herbicides and through mechanical means. The soil underneath the plastic mulch stays loose and well aerated. This increases the amount of oxygen in the soil and aids in microbial activity.

7) Reduction in root damage The use of plastic mulch creates a practically weed free area around the plant, removing the need for cultivation except between the rows of plastic. Root damage associated with cultivation is therefore eliminated.

Plastic mulching

Mulching is the process or practice of covering the soil/ground to make more favourable conditions for plant growth, development and efficient crop production. Mulch technical term means ‘covering of soil’. Plastic mulches are completely impermeable to water; it therefore 3 prevents direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface. In this manner it plays a positive role in water conservation. The suppression of evaporation also has a supplementary effect; it prevents the rise of water containing salt, which is important in countries with high salt content water resources.

Basic properties of mulch film

(a) Air proof so as not to permit any moisture vapour to escape.

(b) Thermal proof for preservation of temperature and prevention of evaporation (c) Durable at least for one crop season

Methods of mulching

- Mulching area should preferably be equivalent to the canopy of the plant.

- Required size of mulch film is cut from the main roll.
- Cleaning of required area by removing the stones, pebbles, weeds etc.
- Ploughing of the soil and application of a little quantity of water before Mulching.
- Small trench could be made around the periphery of the mulching area to facilitate anchoring of the mulch film.
- Covering of the film to the entire area around the tree and the end should be buried in¬ the ground.
- Covering of the corners of the film with 4-6 inches of soil on all sides to keep the film¬ in position.

Mulch Laying Techniques

(i) Mulch should be laid on a non-windy condition

(ii) The mulch material should be held tight without any crease and laid on the bed

(iii) The borders (10 cm) should be anchored inside the soil in about 7-10 cm deep in small furrows at an angle of 45°.

Preparation of raised bed

Mixing of fertilizers (Urea, DAP, MOP)

Application of fertilizers as basal dose

Levelling of the raised bed

Laying mulching sheet on bed

Fixing the mulching sheet by covering with soil

Making holes in the mulching sheet

Removing soil for transplanting

Transplantation of seedlings

Activate Wi
Go to Settings t

Propagation of horticultural crops and their management

By

Redg. No. 210804130216, 217, 218, 219, 222, 223, 225, 226, 227, 228, 229, 230, 231, 233, 234, 235, 236, 237, 239, 241, 243, 244, 245, 246 & 247.

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INTRODUCTION

Propagating new plants is both a science and an art. The study of it can provide a lifetime of challenges and opportunities to learn more about this fascinating craft, a basic knowledge of it can provide the students with the skills and techniques to start their own business in nursery production of horticultural plants since the demand for planting material of horticultural plants is ever increasing. It can be of great fun to grow your own plants. Plant propagation is the multiplication of plants by both sexual and asexual means.

Main

What is Plant Propagation?

Plant Propagation is defined as the multiplication of plants by both sexual and asexual means. Propagation is an art of multiplication of plants. The propagation methods are broadly classified as sexual and asexual propagation.

Sexual Propagation

Sexual propagation is the raising of plants by means of seed which is formed due to the fusion of male and female gametes within the ovule of a flower. In ancient times when the asexual methods of plant propagation were not known, this was the only commercial method for plant propagation. Papaya, phalsa and mangosteen, mostly vegetable crops and annual flowers are being propagated by seed.

Advantages

- Seedling trees are generally long-lived, bear more heavily and all comparatively more hardy.This is the only means of reproduction, where asexual propagation is not possible or economical e.g. Papaya, phalsa, mangosteen etc.
- To develop new varieties, hybrids are first raised from seed and it is essential to employ this method in such cases. Rootstocks upon which the fruit varieties are budded or grafted are mostly raised from seeds.
- Seedlings are cheaper, easy to raise and easily transported to distant places, does not require high technical knowledge and skilled labour.

Limitations/disadvantages

- Seedling trees are not uniform in their growth, yielding capacity and fruit quality.
- Seedling trees have long juvenile period and take more years to bear the first crop.
- Seedlings become large for economic management. .
- Seed propagation will not be applied in many plants e.g. banana

• It is not possible to avail the modifying influence of rootstock on scion or scion on rootstock.

Asexual propagation

Propagation of plants through any vegetative parts is called vegetative or asexual propagation. The goal of vegetative propagation is to reproduce progeny plants identical in genotypes to a single source plant.

Advantages:

• Vegetatively propagated plants are true to type, uniform in growth, yielding capacity and fruit quality.

• Vegetatively propagated plants come into bearing earlier.

• It is possible to regulate the tree size, fruit quality, precocity etc. according to one's requirements by using different rootstocks.

• Cross pollination can be effected by grafting shoots of other suitable varieties (pollinizers) on some of the branches of self-unfruitful variety.

• Grafting can be used to encourage healing of tree wounds caused by rodents, implements.

Limitations

• No new variety can be evolved by means of the vegetative method of propagation.

• Sometimes, it is more expensive.

• Vegetatively propagated plants are comparatively short lived.

Methods of Asexual Propagation:

Plant Propagation by Cutting:

A portion of a stem, root or leaf is cut from the parent plant and is placed under certain favourable environmental conditions to form roots and shoots. Thus a new independent plant is produced which in most cases identical with the parent plant.

Stem-cuttings: Hardwood cuttings are easily handled and transplanted. One-year-old mature shoots are collected during November-February. Grape, fig, pomegranate, currant,gooseberry, some plums and apple are propagated by hardwood cuttings. Many deciduous ornamental shrubs are started readily by this type of cuttings. Length of cuttings should be between 10 and 45cm. It should contain at least 2 buds. Just on the base of shoot below the node a straight cut is given while on the top of the cutting, 1-2cm above the bud a slanting cut is given. This helps maintain the polarity of the shoot and if rain occurs, water does not accumulate on the tip of cutting. Semi-hardwood cuttings are mostly used in evergreen fruit plants-mango, guava, lemon and jackfruit. Treating cuttings with rooting hormone gives better results. Naphthelene Acetic Acid (NAA) and Indole-3-Butyric Acid (IBA) are the two most commonly used root promoting hormones used. Soft wood cuttings: Cuttings are prepared from the soft succulent new spring growth of species which are 4 to 6 months old. Many ornamental woody plants can be propagated by softwood cuttings. Typical examples are the Nerium, crotons, Eranthemum, Graftophyllum etc.

Leaf Cuttings: Certain plants with thick and fleshy leaves have the capacity to produce plant lets on their leaves. In leaf cuttings, the leaf blade with or without petiole and axillary bud is used for starting new plants. Begonia, African violets and peperomia are propagated by leaf cuttings.

Root cuttings: As the name indicates, roots of the plant are utilized as propagating material. Roots 1 cm thick and 10-15cm tall are used. Blackberry and raspberry are commercially propagated by this method.

Propagation by layering Layering is the method of propagation in which roots are developed on a stem while it is still attached to the parent plant. After proper rooting, the stem is detached and becomes a new plant for growing on its own roots. The high success of layering is obtained by ringing or wounding, etiolation (absence of light), use of rooting hormone (IBA, NAA) and favourable environmental condition (temperature and humidity).

The layering techniques generally employed in fruit plants are:

Tip-layering: In tip-layering, rooting takes place near the tip of current season's shoot which is bent to the ground. It is commonly followed in Guava, black berries, raspberries and dewberries.The tips of these shoots are buried 5-10 cm deep in soil. Rooted layers are detached and planted in soil during spring.

Serpentine layering: It is modification of simple layering in which one-year-old branch is alternatively covered and exposed. The stem is girdled at its lower part. The exposed part of stem should have at least one bud to develop a new shoot. After rooting, the sections are cut and planted. eg. Guava

Air-layering: In this method, roots are formed in the aerial part of the plant. The stem is girdled and rooting hormone (IBA) is applied to upper part of cut. The moist rooting medium (moss grass) is wrapped with the help of small polythene strip (200-300 gauze, transparent). This method is commonly known as goottee. Many plants like litchi, kagzi lime, jackfruit, guava and cashewnut as well as Ficus species, Croton, Monstera and philodendron are propagated through air-layering. Rooting in air layers generally commences within 25-30 days and layers are ready for transplanting within 3 months. Buds above ground Rooting from buried node 38 Mound layering/stooling: In this method, the plant is headed back to 15cm above the ground level during dormant season. The new sprouts will arise within 2 months. These sprouts are then girdled near base and rooting hormone (IBA), made in lanolin paste is applied to the upper portion of cut with moist soil. These shoots are left as such up to two days for proper absorption of rooting hormone (IBA) before they are covered with moist soil. The concentration of rooting hormone varies from plant-to-plant but in general 3,000-5,000ppm is most commonly used. The rooting of shoots is observed within 20-30 days. After 2 months, the rooted shoots are separated from mother plants and planted in nursery. Litchi and guava are commercially propagated by this method.

Plant propagation by grafting

Grafting is an art of joining parts of two independent plants in such a manner that they unite and grow together into single independent plant. The part of graft combination which is to become the upper portion or the shoot system or top of the new plant is termed as scion and the part which is to become the lower portion or the root system is the root stock or under stock or some time stock.

Methods of grafting:

Inarching / Approach grafting: The distinguishing feature of this method of grafting is that two independent plants on their own roots (self sustaining) are grafted together. This method provides a means of establishing a successful union between certain plants which are difficult to graft by any other method as the two plants will be on their own roots till the formation of successful graft. Examples are Guava, mango, sapota.

Veneer grafting: This method of propagation holds promise for large scale commercial propagation. The method is simple and can be adopted with success. Eight months to one year old seedlings are used as rootstocks. In this method, a downward and inward 3-4 cm long cut

is In case of grafting, a bud stick consisting of two or more buds is inserted into the stock whereas in budding only single bud with or without wood is inserted into the stock. 40 made in the smooth area of the stock at a height of about 20 cm. At the base of cut, a small shorter cut is given to intersect the first so as to remove the piece of wood and bark. The scion should be of matching thickness with the stock, preferably a terminal non-flowered shoot of 3 to 4 months maturity. Remove the leaf blades from the selected scion shoot on the mother plant keeping the petiole intact, about 7 to 10 days prior to detaching. This helps in forcing the buds to swell and in increasing the grafting success. The scion stick is given a long slanting cut on one side and a small short cut on the other so as to match the cuts of the rootstock. The scion is inserted in the rootstock and the graft union is then tied with polythene strip. The rootstock should be clipped in stages when the scion takes and remains green for more than 10 days.It is used widely for grafting plants such as Mango, Avacodo etc.

Epicotyl (Stone) Grafting: This method of grafting is done on the epicotyl region of the young seedlings; hence the name epicotyl grafting. This method is simple, economical and useful for multiplication of mango plants in large number in a less time.

Soft wood grafting: This method is similar to that of cleft or wedge grafting. In the past, this technique has been used for in situ orchard establishment under dry land conditions as the grafting operation is performed using cleft/wedge method on the newly grown top portion of the plant one year after the establishment of rootstock in the field.

Cleft grafting: This method is employed in the nursery when the rootstock is quite thicker than the scion. It can be done successfully in the rootstock having a diameter of 3-10 cm. 42 Tongue Grafting This method is highly effective and widely employed for the propagation of peach and pear.

Plant Propagation by Budding

Budding is also a method of grafting wherein only one bud with a piece of bark and with or without wood is used as the scion material. It is also called as bud grafting. The plant that grows after union of the stock and bud is known as budding.

Methods of budding:

T-Budding (Shield budding): This method is known as T-budding as the cuts given on the stock are of the shape of the letter T, and shield budding as the bud piece like a shield. This method is widely used for propagating fruit trees and many ornamental plants. This method is generally limited to the stock that is about 0.75 to 2.50cm in diameter and actively growing so that the bark separate readily from the wood. Example is Rose and Citrus.

Inverted T- Budding: Inverted T budding procedure is same as that of T budding except the horizontal cut on the stock is made at the bottom of the vertical cut rather than at the top.

Patch Budding: In this method a regular patch of bark is completely removed from the stock plant and is replaced with a patch of bark of the same size containing a bud from the desired mother plant.. Example is ber.

Double working: It is practiced for several purposes (i) to over come incompatibility between the stock and scion. Incompatible stock and scion may be united by means of a piece of interstock that is compatible to both (ii) to secure resistance to drought or cold by providing a disease or cold resistant trunk by means of double working.

Top working: Top-working for changing a variety is generally done on long lived species, growing in a healthy condition. Short lived species, old trees or diseased trees are not suitable for top working; in such cases new planting is considered more economical and useful than top working.

CONCLUSION

To start with, start growing a few tomato plants from seeding in kitchen garden, to the conservationist growing endangered species of orchids in test tubes, to the commercial nurseries that grow the millions of annuals, perennials, bulbs, shrubs and trees sold every year, a working knowledge of plant propagation makes all of these endeavors possible. This knowledge will give the students greater confidence in producing plants from seed, cuttings, grafting, budding, layering and specialized vegetative structures along with essential skills to work in the horticulture industry.

A

REPORT ON GREEN FODDER PRODUCTION

By

Redg. No. 210804130123, 129, 130, 131, 132, 133, 134, 135, 136, 137, 139, 140, 141, 142, 144, 146, 147, 149, 151, 152, 153, 154, 155, 156 and 158.

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Faculty In charge

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INTRODUCTION

Green fodder production is being done for cattle feeding purposes. Centurion University has several plots marked for fodder production at Paralakhemundi campus. Napier grass is a fast-growing perennial grass native to sub-saharan Africa that is widely grown across the tropical and subtropical regions of the world. It is a multipurpose forage crop, primarily used to feed cattle in cut and carry feeding system.

- Scientific Name: *Pennisetum purpureum*
- Origin: Sub-Saharan Africa
- Family: *Poaceae*
- Chromosome number: 28
- Variety: Coimbatore Variety

OBJECTIVES

1. Optimisation of fodder yield
2. Broader leaves and succulent stems
3. Winter hardiness and gives stable yield throughout the year

DESCRIPTION

Hybrid Napier is tall and its formation will be rousted and the clumps will look like bamboo. This grass plant is heterozygous and the seeds of this plant do not form completely. The reproduction of Napier grass is done in a vegetative way through shoots which are horizontal called stolons which locate above the soil extending from the parent to the offspring. The Napier grass has a very high production of biomass. It produces about 45 tonnes per hectare in a year and the harvesting can be done at least four times a year. Moreover, for the production of Napier grass, less water and nutrients are required. As an alternative, the plantation of the grass can be done by using stem cuttings of stolons. The plantation of the stem cuttings can be done by insertion of these with the furrows with a distance of 80 cms, between and along the rows.

For fodder production, a sequence of activities is being followed. Initially, the land is being prepared for cultivation. The main objective of land preparation is to create a favourable environment for Napier grass to germinate and for proper growth. Adequate land preparation will help to improve soil structure, texture, better ventilation, permeability, water holding capacity, better drainage and loosening of root zone to make better root penetration. Deep ploughing is done for proper penetration of stems in the ground. This will make the plants more resistant to drought. Harrowing is done with the help of Rotavator.

After preparation of land, transplantation is being done. Plantation of Napier grass is done at an angle of 45° from the ground. Two of the nodes of the grass are being buried in the soil and one node will be above the ground level. The mode of planting method is propagation through stem cutting with a spacing of 30 x 30 cm

For plant growth irrigation is most essential. The irrigation is being done at field level at every 10 days interval through the furrows. Flood irrigation method is being applied for watering, where water is delivered to the field by ditch, pipe, or some other means and simply flows over the ground through the crop.

Weeding must be done at regular interval to removing of unwanted plants from the crop field, it is necessary because unwanted plant reduce the fertility of soil. Weeding is one of the most important practices in many crops for the different factors such as water, sunlight, nutrients and space and hence affect plant growth

Basal dose of NPK at initial period and foliar application of urea at recommended dosages are being done for proper growth of plants. The plant harvesting is being done before 50% flowering stage (mostly around 80-day interval after cultivation and between subsequent cutting. These cutting are chaffed and being fed to cattle.

FOR GREEN FODDER PURPOSE:

- HN is a fast-growing fodder crops with more foliage and ability to cover the land quickly
- It has high dry matter and nutrient accumulation in leaves
- It is resistance or tolerance to pest and diseases
- Throughout year production
- Less water requirement
- Best for animal feeding

OUTCOME OF GREEN FODDER PRODUCTION:

1. Green fodder production meets the essential feed requirement by ruminants.
2. Feeding of green fodder to cattle reduces concentrate feeding which in turn reduce the feeding cost.
3. The reproductive health of animal is being monitored due to feeding of green fodder.
4. HN is available throughout year and is a multi-cut fodder meeting all essential nutrient of ruminants.

FIGURES

Fig 1. Land preparation

Fig 2. Planting of stem cutting

(a) (b)

Fig 3 a & b. Flood irrigation through furrows

(a) (b)

Fig 4 a & b. Plants with basal applications

Fig 5. Harvesting of fodder