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1. HORTICULTURE

Plant Protection Measures in Maintenance of Commercial Horticulture Nurseries

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Abstract

As it is incorporated into all other nursery management practises, nursery pest management is the most practical and environmentally responsible method of controlling nursery pests. Integration of strategies is necessary for pest management because it protects the environment from potential risks while preventing pest damage from growing to economically harmful dimensions. The methods can be divided into cultural, physical, mechanical, chemical, and biological categories. Their choice is based on how effectively they can help manage insect populations.

Inroduction

In order to feed the growing population, more food must be produced. To ensure that this objective can be accomplished, it could be necessary to modify the systems and technologies now in use and adopt new technologies**.** The main obstacle to achieving this goal is pests**.** Pesticides will continue to play a crucial role in the foreseeable future in preventing insect infestations on crops because there are currently no practical alternatives. Yet, there have been a number of recent constructive events that give reason for hope for the future**.**

Management of Pests in Nursery

You will see cuts on the leaf margins, holes on the leaves, chewed and damaged plant parts, stains on the leaves, etc. if you ever visit a garden or agricultural field. They result from the onslaught of several creatures referred to as pests. They result from numerous organisms known as pests attacking humans. Any creature, animal, plant, or microorganism that harms humans, animals, or plants is considered a pest. Pests are organisms that compete with humans for resources like food, fibre, and shelter, spread diseases, eat human food, and endanger people's health, welfare, or comfort.

Major Pest Groups

Insect pest: Crops suffer significant harm from insect pests and mites. About 200 of the one million insect species that exist can be categorized as significant agricultural pests.

Plant Diseases: Plants and insects get sick from fungi, bacteria, and viruses.

Snails: Molluscs are pests that attack gardens, lawns, greenhouses, and ornamental landscaping.

Weeds: This includes plants that might obstruct the use of water and land resources or compete with agricultural plants, lowering quality and productivity

Vertebrate pests: Most of them are birds, rodents and some other animals like bats and rabbits that damage crops and stored commodities.

Control of Pests

A nurseryman uses a variety of techniques to guard seedlings against pests. This process is referred to as pest control or applied control. Chemical insecticides are traditionally used to manage pests. In the modern sense, pest control refers to all techniques used to avoid illnesses and pests while minimizing environmental disruption.

Methods of Pest Control

1. **Cultural Method:** It refers to changing farming procedures to check the pests deep summer ploughing, Crop rotation, water management, high seed rates, trap cropping and altering the date of sowing are a few of the crucial cultural techniques.
2. **Physical Method:** To reduce or eliminate insect problems, these strategies entail altering the physical aspects of the environment. Physical strategies include using sound, light, temperature, and moisture manipulation, among others.
3. **Mechanical Method:** This describes the removal and extermination of pests utilizing machinery and tools**.** Screens, traps, nets, and suction devices are a few of them. putting iron rod-based hooking devices within the insect's borehole, wrap the stem with oil or polythene sheets net-covered seedlings, trenching, and water-barrier pans.
4. **Regulatory Method:** To prevent the spread of pests, the state and federal governments have suggested a number of legislative restrictions. This category can be used to list laws like the Destructive Insect Pests Act and Inspection and Quarantine Act.
5. **Resistant Varieties:** When using resistant types, pest attacks can be avoided, tolerated, or recovered from. In a number of crops, resistant cultivars have been found against numerous pests.
6. **Biological Method:** This approach employs parasites, microbes, predators, or pathogens that are pests natural enemies to manage the pest species. The mass breeding and release of parasites, predators, and bacteria; the preservation and promotion of native natural enemies; and the importation of foreign natural enemies are all methods that may be employed to carry out a biological control programme.
7. **Chemical Control:** Chemical control is the practice of using chemicals to eradicate pests. Chemicals known as pesticides are used to eliminate, prevent, attract, or sterilize bugs. Without a question, pesticides are an efficient way to immediately and on-demand eliminate pests. No other pest management technique offers users a quick and obvious manner of eradicating pests.
8. **Use of botanical pesticides:** The possible application of plant-based pest control measures is one of them. There are several plant-based products that can stop the spread of pests and illnesses, including oils cakes and leaf extracts. Oils and extracts from plants are sprayed on the crops. Neem based products (neem oil, and cake can be used to manage pests.

Use of Pesticides in Pest Control:

Applying pesticides requires using the proper timing, rate, and equipment. To combat various pests and illnesses, pesticides are sprayed on seeds, leaves, and other sections, as well as in the soil. Pesticides are applied in a variety of ways, including seed treatment, seedling root dipping, foliar spray, granular application, fumigation, soil application, baiting, and other techniques.

Pest	Damage	Management
Aphids	As aphids feed on young leaves, they injure plants by sucking the sap, wrinkling cotyledonary leaves, and, in severe cases, causing the plants to wither away.	Spray Metasystox (0.1-0.2%) or Malathion (0.1 %)

Jassids	Adults and Nymphs both ingest the sap from the underside of the leaves. The margins of the infected leaf curl upward and may turn yellow and display burned-up spots.	Spray Dichlorvos (0.05%) or Malathion (0.1%)
Leaf Roller	Rolling the leaves, the caterpillars eat the chlorophyll within the creases. The folded leaves dry out and wither.	Spray Malathion (0.05%) or Carbaryl (0.1%)
Red Spider mite	There are colonies of various stages of mites that are encased in white, silky webs on the underside of leaves. Adults and nymphs both drain cell sap, which causes leaves to develop white patches. Damaged leaves become brown, become mottled, and drop.	Wettable Sulphur (0.3%) and Acaricides like Omite (0.05%) gives effective control of mites.
Mealy Bug	Adults and Nymphs of mealy bugs consume the sap present in leaves, fruits and tender shoots. On the honeydew-like droplets that mealy bugs excrete, a heavy, black sooty mould may grow.	Apply chlorpyriphos (0.05%) or dichlorvos (0.02%) with fish oil rosin soap.
Root-Knot Nematodes	The roots of the damaged plants have developed galls. The plants become stunted, and the indications of chlorosis are visible on the leaves.	Applying Neem Cake at 1 kg/m2 or Phoret at 5 g to the nursery beds Choose resilient plant varieties.
Cabbage Diamond back Moth	Leaf skeletonization is complete in severely afflicted leaves.	Spray Profenofos (0.25-0.5 kg a.i./ha) or Malathion (0.1%)
Thrips	Black adults and Nymphs feed on tender leaves, causing the leaves to become silvery, mottled, and distorted.	Apply Thimate 15 gm/bed
Leaf Folder	The larva gathers chlorophyll from the leaves and consumes it. The affected leaves skeletonize and dry out.	Spray Quinalphos @0.05%
Leaf miner	Larvae feed on the epidermal layers of tender leaves by digging serpentine tunnels, which trap air and give the larvae a silvery appearance.	Spraying the plants with Quinalphos @0.05%
Leaf Eating Caterpillar	These leaves are consumed by larvae voraciously at night, which feed by scraping the lower surface of the leaves.	Quinalphos @0.05% or Carbaryl @ 0.1% or Chlorpyriphos @0.05%
Cutworms	During the night, the delicate plants are discovered soggy at ground level. Early larvae eat indiscriminately on leaf, but later they separate and move into the soil.	Phorate soil treatment (1 kg a.i./ha)
Whitefly	Whitefly damage also results in leaf discoloration, reduced growth, and, in extreme cases, leaf shedding.	spraying 1.5 ml of Triazophos 40 EC and 1.0 ml of Dichlorvos 76 EC per litre of water.
Pseudostem Borer	The grubs eat inside the stem after boring through it.	Application of Carbaryl WP (0.1%)
Red Pumpkin Beetle	Cucurbit leaves are punctured by them. The outcome is that the seedlings die when they are still young.	Spraying Metacid (1 ml/liter of water) or Carbaryl (4 g/liter)

Conculsion

For the effective growth of nursery plants, the adoption of plant protection measures, well in advance and in a planned

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manner, is essential. To get healthy seedlings, it is crucial to apply plant protection measures in the nursery against the occurrence of pests. It's crucial to take periodic care to regulate them. It is necessary to keep a close eye out for insect and disease attacks.

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2. HORTICULTURE

Recent Trends with Hi-Tech Nursery Practices on Horticulture Crops

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Abstract

To attain food, economic security & nutritional demand of the country Horticulture has very crucial role. Hi-tech Horticulture is capital intensive technology having high precision & modern mechanization but most importantly it is less dependent on environment which fulfils the farmer's economical gain by boosting the productivity. Integrated Nutrient Management, Integrated Disease Management, Plant protection, Germplasm Conservation, precision farming, value addition etc. are very important in case of Hi-tech Horticulture by increasing fruits, vegetables & flowers production. Due to its beneficial aspect Hi-tech Horticultural practices getting attention worldwide. This article illustrates recent trends of Hi-tech Horticultural practices & its future prospects.

Introduction

According to estimation of 2020-21, Agriculture & allied sector contributes 20.19 GVA which is around 3616523 crore. Contribution of Agriculture & Allied sector to economy of India is higher than World average (6.4%).A large chunk of this about 33% of GVA of Agriculture sector comes from Horticulture sector. Currently 320.48 mt of Horticulture produce is being produced in India from 25.60 mha area only. Between 2004-05 & 2021-22(3rd advance estimate) productivity of Horticulture increased by 38.5% (12.49t/ha).Vegetables (59-61%), fruits (31-33%) % share of production in Horticulture sector. After Cereals, fruit & vegetables plays very important role for attaining food security & very important part of Indian economy. Due to increasing population, shrinking, unsuitability of area for production & increasing demand for healthy foods it will be a challenge considering gap in demand & supply of Horticulture Produce. So the most effective solution is to adoption of hi-tech horticulture as mentioned in National Agricultural Policy Paper (Chadha 2001).Integrated mechanized approach having proper precision & less environment dependent technology is the need of the hour. Govt. Of India has sanctioned 2200 crore Rupees for the development of Horticulture sector for this financial year (2023-24).

Advantages

The recent increase in demand of Hi-tech horticultural practices is due to

1. Uniformity & high quality of produce
2. Precision plays a major role in saving inputs (water, pesticides, fungicides, herbicides & fertilizers)
3. Off season availability of products-Available round the year
4. Yield & productivity increases drastically-5-7 times

5. Less dependent on environment
6. Uneven area & problematic soils can be utilized for production

Components of Hi-Tech Horticulture

1. Protected Cultivation in Greenhouse
2. Precision farming of Horticultural crop
3. Use of Hydroponics
4. Vertical Gardening
5. High-density Planting
6. Hi-tech Cultivars
7. Use of GIS, GPS & Drones
8. Processing & value addition of produce
9. Fertigation
10. Selection of GM crops
11. Hi-tech Mechanization
12. Integrated Nutrient Management & Enhancement of Nutrient uptake efficiency.
13. Integrated Disease Management.
14. Suitable cold chain setup.

Hi-Tech Horticulture in India

Hi-tech production in protected manner in the most of the Indian states is common now a days. As playhouses are highly costly it is not suitable for in every part. But low cost poly tunnels & net houses are being adopted by farmers. As it is less dependent on environment, soil, chemicals & high output value inspite of high initial cost many farmers/entrepreneurs are adopting it well. A comparative study by TNAU shown below depicts about benefits of Hi-tech Production.

Hi-tech technology like HDP has very great impact on Indian horticulture sector. Crops like Banana, apple, papaya, mango, guava, pineapple, grapes are cultivated under HDP by tenth five years plan by using HDP technology. Availability of dwarf cultivars played a major role in this for increasing production than conventional technology.

In India there are lot of germplasm of horticultural crops both indigenous & new varieties. As we follow mostly traditional method of storing it takes more space so cryopreservation & in vitro conservation are being followed in India (NBPGR) now a days to store various genetic diversity in gene bank.

Various Hi-tech propagation methods like micropropagation, plug plant propagation, modernized computerized grafting in fruits & vegetables are being followed in India. In Chhattisgarh various fruit crops like Mango guava grapes etc. & in vegetables watermelon, capsicum, brinjal are being propagated by plug plant propagation in large scale. Also foot operated grafting machine are used as hi-tech horticulture propagation

Initiatives for Hi-Tech Horticulture in India

- Krishi Karna project, a joint initiative of State Agri Horticultural Society (SAHS)- the government-accredited cooperative society (involved in promoting agri-horticultural practices), Sustainable Foundation (Thiruvananthapuram-based NGO, promotes sustainable development) and Qore3 Innovations (start-up that provides ‘end-to-end support for farms’), launched in Pallikal Panchayat of Thiruvantapuram, Kerala in July 2021 to promote hi-tech farming.
- Policy Paper by National Academy of Agricultural Sciences depicts about various aspects of Hi-tech Horticulture in India and way forward.
- State Planning Commission of Tamil Nadu in 2013 has initiated Hi-tech Horticulture planning in state and organized state level workshop same year in order to proper.
- To improve vegetable production in the remotest parts Odisha, ICRISAT in partnership with the World Vegetable Center has established naturally ventilated polyhouse hi-tech nurseries in the state’s tribal districts of Koraput, Nabarangpur and Rayagada in December 2021.
- An Initiative to Double the Farmer Income by Hi-Tech Horticulture through CoE on Precision Farming in Horticulture crops has been established under RKVY Scheme of 2015-16 at Maddur, Karnataka state. The principle of more profit by using per drop of water is encouraged by centre for adoption. Morever this protected cultivation, related training, demonstration of technology in field & subsequent distribution of quality planting materials to farmers for doubling up their income.

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- In next 5 years will see many excellence centres and hi-tech nurseries in all the 75 districts of U.P to boost horticulture and food processing industry in the state which is one of the important plans of Govt. of U.P in agri sector.

Conclusion

Hi-tech horticulture though it is very profitable for farmers as well as economic condition of the country. As the majority of farmers of India are small & marginal & also less aware about the new modern mechanized technology so the adoption of technology is way less. There is a need of awareness as well as capital funding & subsidy to the farmers by setting up the proper infrastructure viz.post handling facility, cold chain set up in block or cluster level etc. will be helpful. Also there is a chance of improvement in real time data updation to decision maker so that the major policy decisions can be in line with the field level. Use of cloud computing, AI, Drones, Central area network in addition to using of indigenous technology will be the way forward for future.

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3. HORTICULTURE

Essentiality and Utility of Polyembryonic Rootstocks in Commercial Fruit Production

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Abstract

The occurrence of many embryos in polyembryony may either due to the differentiation of tissues (maternal and zygotic) in close proximity to the ovule of seed or because of the fertilization of more than one embryo sac. The polyembryonic seeds of horticultural crops linked to nucellar embryony, produce many seedlings after germination which paves a way for commercial importance in propagation.

Introduction

Polyembryony is the phenomenon in which multiple seedlings arise due to the emergence of more than one embryo from a single seed. The nucellar embryony, a common characteristic in horticultural crops, is the embryo that develops from the nucellus. As early as 1719, Leeuwenhoek first described polyembryony in citrus. In 1859, the research on various cases of polyembryonic plants was carried out by Braun.

Polyembryony in Fruit Crops

In fruit crops, Mango, Citrus, Jamun, Rose apple are known to exhibit the characteristics of polyembryony. In the past, polyembryony was seen to be an abnormal trait, but today it is viewed as a desirable trait in fruit crops to produce homogenous planting material. Within the species and varieties, the number of seedlings emerge due to polyembryony varies. About two to four seedlings occur commonly and in few species, more than eight embryos arise.

Polyembryonic Rootstocks

The polyembryonic trait in fruit crops has its prime utility on the development of rootstocks for propagation. Polyembryony can be widely used to obtain true to type planting material with superior characteristics. These polyembryonic rootstocks are advantageous over monoembryonic ones in various aspects through biotic and abiotic stress tolerance.

Importance of Polyembryonic Rootstocks

- Better root growth and development occurs since the rootstocks are from nucellar seedlings of tap root. After repeated vegetative propagation, the vigour lost in the nucellar seedlings is restored.
- The ecological relevance through polyembryonic rootstocks improves the chances of growth in various cases.
- The adventives embryos, which originate from nucellar embryos, give root stocks homogeneous seedlings that produce fruit consistently.
- In Citrus sp., nucellar embryony is the feasible method of producing virus free polyembryonatic planting materials (clones).

Mango (Mangifera indica)

In mango, the polyembryony is observed on certain varieties which are used as rootstocks in general. Since, grafting is the commercial method of propagation in which the genetic purity of the propagated variety is retained. In order to obtain quality grafted plants, the polyembryonic rootstocks are significantly essential.

- Bappakai, Sabre, Olour, Kurukkan, Chandrakaran, Kensington, Kitchner, Mylepelian, Nekkare, Muvandan, Pahutan, Peach, Prior and Starch are used as polyembryonic rootstocks in Mango.
- Under saline conditions, Kurukkan was discovered to have the highest levels of polyembryony, germination rate, and seedlings/stone among the polyembryonic mango rootstocks.
- In some cases, the combination of certain rootstocks and scion helps in improving the rate of photosynthesis by lowering transpiration and other physiological processes.
- The phenolic compounds and polyphenol oxidase enzyme activity were raised in trees grown on the Olour and Kurakkan rootstocks.
- The rootstocks also influence the vigorosity of trees which include Olour (semi-vigorous), Vellaikolumban (moderate vigorous) and Nekkare (less vigorous). These cultivars are used as rootstocks for various planting densities.

Citrus (*Citrus* sp.)

Among the fruit crops, Citrus is the significant group on expressing the polyembryonic traits. All the species of Citrus are polyembryonic except Citron, Pummelo and Tahiti lime.

- Since the majority of citrus species' seeds are polyembryonic, nucellar seedlings are employed for growing uniform rootstocks as well as for planting directly in acid lime and mandarin. They also aid in growing healthy plants because the majority of citrus viruses are not spread by seeds.
- The percentage of nucellar embryony varies amongst rootstocks, ranging from less than 50% to 100%, when almost all of the plants in a stand of seedlings are nucellar in origin. The rootstocks Rangpur lime, Italian-76, and Jambhiri yielded 91%, 98.6%, and 82% nucellar seedlings, respectively.
- In Central and Southern India, the most promising rootstock for mandarin and sweet orange is Rangpur lime.
- In comparison to other rootstocks, *Citrus volkameriana* discovered as superior rootstock for the Navel orange, Valencia orange, Ruby Red, and Marsh grapefruit trees.

Jamun (Syzygium cuminii)

The phenomenon of polyembryony observed in Jamun was found to be a maximum of four embryos. Nuceller seedlings can be used to create true-to-type plants because polyembryony can occur in jamun up to 20.50 percent of the time.

- The rootstock *Syzigium densiflora* is the promising one for *S. cuminii* which provides resistance against termite attack.

Conclusion

The essentiality of polyembryony through development of rootstocks in propagation of horticultural crops is noteworthy. Despite its importance, polyembryony has a fact that it impedes the hybridization programme. Zygotic embryos are produced during hybridization, but polyembryony hinders zygotic embryo growth, which has an impact on plant hybridization. Hence, the phenomenon is beneficial for propagation rather than breeding aspects.

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4. HORTICULTURE

Eco Physiological Facts over the Viability and Germination Phenomenon of Seeds in Horticultural Crops

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Abstract

Seed consist of stored food material i.e endosperm which is covered by protective covering During germination embryo become active and cell metabolism increase ,seed covering rupture and seedling emerged .Some factor like water, light, oxygen, temperature, presence of auxin , dormancy, seed viability may have adverse effect on seed germination

Introduction

The germination process of a seed involves several biochemical, physiological, and morphological changes. The embryo must be alive and capable of germination for the seed to be considered viable. It can be concluded that a seed is not dormant if there is no chemical inhibitor of germination or dormancy. The proper combination of environmental elements, such as humidity, temperature, air (O_2), and light, must exist.

FACTORS AFFECTING SEED GERMINATION

Abiotic factors

Seed germination can be affected by external factors like light, temperature, water, oxygen, salinity etc.

Light: Some plant species' ability to germinate can be stimulated or inhibited by visible light. Light is an absolute necessity for epiphytic plants. The germination of some plant species, such as Allium amaranths, is inhibited by light. Light encourages the growth of cauliflower, tobacco, and lettuce.

Temperature:

- Temperature affects the absorption of water. The oxygen intake and chemical processes that occur as seeds germinate. There are three stages of temperature: minimum, maximum, and optimum. Germination is prevented by a minimum or maximum temperature below or above the seed.
- Optimal temperature is generally regarded as being between 26.5 to 36°C, where the majority of seeds and specific species germinate. Small grains, clover, radish, onion, and other non-dormant seeds all germinate at temperatures very near 20°C. At 10°C or very near to 20°C, spinach seeds begin to sprout.
- Cucumber and watermelon seeds that have just been collected begin to sprout at a temperature of 30°C. Maize seeds (5 to 45°C) and wheat seeds (slightly above 35°C) can both germinate at a variety of temperatures.
- 15°C or 20°C for 16–18 hours and 30°C for 6–8 hours are typical practices.
- Thermo-periodism is the term used to describe how changing temperatures affect germination.

Water:

- The physical and chemical processes that take place in the germination of seeds require water. With the imbibition of water, the seed coat becomes soft and permeable to water.
- Each stage of germination, including imbibition, enzyme activation, the breakdown of complex food into soluble forms, and transport to absorption into live protoplasm, require water.

Aeration (Oxygen):

- Growing seeds require enough oxygen since they breathe extremely actively. The oxygen needed for seed germination is found in the soil's air.
- Due to a lack of oxygen, most seeds planted deeper in the ground or in soil that has been heavily waterlogged frequently fail to germinate. Growing seeds require enough oxygen since they breathe extremely actively.

Salinity: Germination is slowed down or prevented by salt in the soil and poor water quality used to irrigate the seed beds. Salts are prone to harm small, thinly sowed seeds. This issue can be resolved by employing soils with sufficient organic matter, irrigation water containing little salt, and less frequent irrigation to allow salt buildup to be leached off.

Biotic factors

Seed germination can be affected by internal factors like presence of auxin , immature embryo, hard seed coat , dormancy period ,seed viability etc..

Presence of auxin: Auxin develops in the seeds, which stimulates germination. Additionally, a different protein known as heteroauxin develops in certain seeds to boost. Both auxin and heteroauxin are called growth regulators.

Immature embryo: In some plants the embryo is not fully mature at the time of seed shedding. They do not begin to grow until the embryo is fully developed.

Hard seed coat: Because of the tough seed coat, water cannot penetrate the seed. It prevents the entry of oxygen, which is necessary for breathing. Radicals are unable to flee because of the mechanical resistance it produces.

Dormancy period:

- When the seed sheds, the embryo is not yet fully grown. Such seeds don't start to sprout until after the embryo has finished growing.
- In some plants, the newly discharged seed might not contain enough growth hormones to support the development of the embryo. The hormones must be generated in these seeds over a period of time.
- When a seed is not exposed to light, it may remain dormant since it needs a particular amount of light to germinate.

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The seed coat may be dense and/or rigid, restricting the embryo's ability to physically expand or absorb oxygen or both. Scarification is a method for reversing this form of dormancy. The seed coat can be made soft and thin for simple germination by scarification.

- All plants have seeds that are viable or live for a certain amount of time. This viability period might last anywhere between a few days and many years. The greatest viability duration for lotus seeds is 1000 years. Before the end of their viability periods, seeds germinate.

Seed viability:

- A seed is viable depends on its state: living, dormant, or dead. The seed won't sprout if it is not viable.
- Seed viability refer to presence of life in embryo.
- Classified into two group orthodox and recalcitrant. Seed can be stored to certain moisture level in seasonal vegetables field crops and flower are orthodox in nature. Most of the horticulture crop lose their viability when dried to certain moisture level these are called recalcitrant.
- Viability of seed can be tested by tetrazolium test, excised embryo test and germination test.

Conclusion

Seed requires ample amount of oxygen, water, sunlight, temperature for better germination. Germination test can be carried out to check the viability of seed. Non germination of seed due to absence of suitable condition i.e, dormancy which can overcome by scarification, leaching of inhibitor, stratification, rupturing of seed coat .

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5. SOIL SCIENCE

Role of Organic Medias in Production of Elite Horticulture Nursery Plants

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Abstract

Crops produced in nursery require a range of cultural inputs to be successful. Among these, the kind of growth media employed may be the most crucial. For the growth of plants in containers, field soils are typically unsuitable. This is mostly because soils lack the necessary aeration, drainage, and water holding capacity. Several soilless growth media have been created to help improve this condition. Growing media proven to be beneficial for increasing horticulture crop output because of their strong water holding capacity, aeration, and increased nutrient uptake. High value crops including Tomato, Chilli, Brinjal, Banana, Carnation, Orchids, Gerbera, Alstroemeria, Rose and Lilium are reported to grow well in a variety of growing media like

Sphagnum Moss, Peat, Sawdust, Cocopeat, and Compost etc, Because Growing Media play a direct or indirect function in plant growth. Hence we can get the highest net profit in Horticultural Crops when it is grown in variety of Organic Growing Media. In this article, we can get to know the role of different Organic Media in the Propagation of Horticultural Crops.

Keywords: Organic Media, Soil less, Water Holding Capacity, Propagation, Nursery.

Introduction

Growing media is any substance, Organic or Inorganic, that holds the root system of plants to give them a place to anchor. It offers the vital plant elements necessary for a plant's growth, metabolism, and development. The majority of horticultural production methods depend heavily on Organic growing media. In essence, organic growth media are bulk goods.In general, Organic and Inorganic materials are used as growing media. While Organic growing medium can be made of synthetic materials (like Polyurethane) or naturally occurring Organic matter (like Peat Moss, Compost, Wood Based Substrate etc.) Growing media can alternatively be categorised as granular (like Perlite) and fibrous (like Coir) and categorised as active (like Peat) or inert (like Sand) depending on a variety of factors, including their Chemical qualities.

Classification OF Media

1. Soil Media
2. Soil less Media
   a. Organic Media (Originates from living objects, such as Plants)
   b. Inorganic Media (Artificial or Extracted)

Organic Media

Compost, Coconut coir/ Cocopeat, Peat moss, Composed Bark, Rice hulls, Leaf Mould, Bagasse and other suitable, readily accessible materials are examples of common organic Media. These materials are thin, have a high CEC and water-holding capacity, and some even have trace levels of mineral nutrients.

Compost

Compost is the end result of the breakdown of organic material. Farm animal manures, leaves, grass clippings, wood scraps, and grass clippings are a few of the usual elements used to make compost. Major and minor nutrients that plants require for healthy growth are present in compost. Compost used as rooting media has a wide range of physical and biochemical characteristics, depending on the materials utilised, the approach taken, and the maturity level. Compost's nutritional contribution to a growing medium is by far its most advantageous effect. A significant quantity of nitrogen can be immobilised in immature compost, but once stabilised, compost functions largely as a slow-release fertiliser.

Peat

Peat serves as the foundation of soilless media mixtures. It is made up of the remains of a marshy bog. It has some organic nitrogen and is good for seedlings that have germinated or newly rooted cuttings. Plant matter partially decomposes under low oxygen circumstances to make it. It is made up of at least 30% (dry mass) of dead organic material that has collected on bogs, fens, and other land areas where water predominates. Peat has essential properties that keep soil moist when it is dry and prevent roots from being killed by excess water when it is wet. Various kinds of peat are Present.

Mass Peat

It comes from sphagnum or other mosses and has a low degree of decomposition. It can hold a lot of moisture, almost 15 times its dry weight. From pale tan to dark brown, its colour fluctuates. It has very little nitrogen and has a pH between 3.2 and 4.5 that is very acidic. The course grade is the most common sort of peat used in horticultural nurseries. Peat moss must first be broken up into smaller pieces and soaked before it can be utilised as a propagation media in mixtures.

Reed Sedge Peat

Reed sedge peat is made up of grass, reed sedge, and other remnants of wetland plants. It has a pH range of 4.0 to 7.5 and can hold nearly ten times as much water as its dry weight.

Peat Humus

Peat humus is a heavily degraded substance. It might come from peat made of reed sedge or hypnum moss. Its pH ranges from 2.0 to 3.5, and it has an extremely limited moisture holding capacity.

Sphagnum Moss

The most prevalent organic material used in growing media in temperate zone nurseries.The dehydrated remains of acidbog plants from the genus Sphagnum, including *S.palustre, S.papilliosum, S.capillacem* and are used in the production of commercial sphagnum moss. It is often harvested during the rainy season from the tree trunks of forest species in the south Indian highlands over 1500m above MSL. It is sterile, acidic, lightweight, and has a strong water holding capacity. Because it is the juvenile residue or live section of the plant, it varies from peat moss. The most typical air layering medium is this one. For the long-distance transportation of seedlings, it is frequently used to maintain the moisture of the live material

Coir Pith

The coconut husk, which is used to make coir fibre, is one of the biggest by products of the coconut. The coir dust or coir pith produced during this extraction procedure is a significant amount. The processed form of coir pith is known as coco peat because it resembles peat and has many traits with sphagnum peat, the most popular potting soil used in gardening. A perfect soil supplement and component of soilless container media for horticultural plants, coco peat has gained widespread recognition due to the growth of commercial horticulture and the decrease in the availability of sphagnum peat as well as its advantages over it. Because of its low cost, aeration, drainage, and extended shelf life, this by-product of the coconut industry is utilised extensively as a substrate. 8–9 times as much water can be held in by coco peat. It has a maximum four-year shelf life. Coco Peat has qualities that make it to fungi and bacterial development resistant.

Vermi Compost

Worm castings, worm humus, and worm dung are other names for vermicompost. Vermicompost is the by-product of the earthworm breaking down biological material. Vermicomposting is the practise of using earthworms to create manure. A sufficient supply of the micronutrients, N, P, and K, necessary for plant development. Nutrient composition of Vermicompost are N-2.5-3.0%, P-1.0-1.5%, K-1.5-2.0%.

Role and Media Selection Criteria Of Growing Media

- Should be well drained, porous, aerated, etc.
- Free of pests, weed spores, pathogens, etc.
- Be sufficiently firm to help or support the vegetation.
- Offers ventilation to facilitate gas exchange.
- Shouldn't contract or grow quickly.
- Should be reasonably priced and readily accessible.
- Must be readily sterilizable.

Desirable Characteristics of Organic Growing Media

1. Should have a high concentration of organic matter that won't degrade rapidly. There should be more organic materials present than 0.5%.
2. For a fast rate of decomposition, the C:N (carbon to nitrogen) ratio should be narrow (10:1 to 20:1).
3. A substrate should have a pH between 6.2 and 6.8 and 5.4 and 6.0, respectively.
4. EC values between 0.4 and 1.4 ds/m are ideal.
5. Adequately porous to allow for adequate aeration, water mobility, root penetration, and water retention.
6. The nutrient reserve should have a large cation exchange capacity (6–15 me/100cc).
7. The medium must be clear of nematodes, diseases, insects, and plants.

Conclusion

Due to their role of excellent water holding capacity, aeration, and increased nutrient uptake, growth media have been shown to be effective in increasing the production of horticultural crops. High value crops can be grown using a variety of growing media, including peat, cocopeat, compost, etc.but Most crops perform better when cocopeat is used alone or in conjunction with them.

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6. HORTICULTURE

Influence of Plant Hormones in Wound Recovery Process with Horticultural Propagules

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Abstract

Plants that are subjected to an onslaught of wound-causing agents trigger mechanisms that promote recovery and further defense. Mechanical damage responses can be either local or systematic, or both, and thus entail the generation, translocation, detection, and transduction of wound inducible genes. Although the jasmonic acid has a well-established role in plant responses to wounding, other compounds and phytohormones such as ABA, Ethylene, Auxin, Cytokinin, Brassinosteroids, Stigolactones, and Gibberellins also play a part in wound signaling, which leads to wound recovery.

Introduction

The vascular tissue of the plant transports water, nutrients, photosynthetic products, and signalling molecules. It provides mechanical support to the plant, letting it to grow in size and adapt to various surroundings. Plants have effective systems for creating vasculature in newly formed organs, expanding vasculature in existing organs, and mending vasculature following injury or stress. Water, minerals, and nutrients are transported from the roots to the shoots via xylem, whilst photo assimilates are transported by phloem. Phytohormones influence plant growth and responses to biotic and abiotic stresses. We investigate the role of eight major plant hormones in the wound repair and vascular development processes in plants, as graft formation is considered to comprise components of these processes. Because it has yet to be related to vascular development or grafting, salicylic acid was not explored. In this article, we intend to offer an overview of each hormone's significance during vascular growth and wound recovery. From the origin to the basin tissues etc. These tissues also include signaling substances like phytohormones.

Auxin

Auxin is the most extensively studied phytohormone, and it is involved in nearly each developmental phase, including apical dominance, organ formation, and gravitropism. Auxin is also necessary for vascular development. When supplied exogenously to undifferentiated tissues, it induces the formation of vascular threads. Auxin is delivered to the wound site by PIN proteins, where it induces vascular tissue regeneration in Arabidopsis stems and pea epicotyls. Auxin supplied basipetally from leaves and buds, for example, enhances xylem regeneration following wounding, but removal of these tissues above the cut site, but not below, inhibited xylem regeneration of wounded Coleus blumei internodes. A blockage in basipetal auxin transport, on the opposite hand, induces unbalanced auxin accumulation in wounded Arabidopsis stems. Since auxin response factor (ARF) 6 and 8 promote the expression of the NAM, ATAF, and CUC (NAC) TF ANAC071 above the cut while reducing the expression of related to AP2 6L, this asymmetry is important during tissue reunion. (RAP2.6L). Reduced auxin levels, on the opposite hand, result in a reduction in ARF6 and 8 expressions, which inhibits RAP2.6L. ANAC071 and RAP2.6L promote pith cell division and are essential for successful tissue reunion of incised stems when expressed at the top and bottom of the cut site, respectively.

Abscisic Acid

Abscisic acid (ABA) is a phytohormone that plays an important role in both biotic and abiotic stress responses. Some studies have discovered an indirect link between ABA and vascular development. Furthermore, vascular development and ABA signalling appear to be dependent on Arabidopsis thaliana homeoboxS 7 (ATHB7), a homeodomain-leucine zipper-type transcription factor (TF) that is selectively generated in developing xylem and is also activated by drought stress and ABA treatment. Injury and other abiotic stresses produce ABA accumulation. ABA treatment boosts the expression of wound-activated genes in the absence of injury, however when ABA-deficient mutants are wounded, wound-activated genes exhibit decreased induction, demonstrating a direct function for ABA in the wound response. In contrast, ABA buildup around the site might be due to desiccation of wounded tissues instead of a direct reaction to the injury itself. According to a recent study, mutants with decreased ABA production or signaling were more effective at creating wound-induced callus, indicating that ABA may have wound-recovery inhibitory effects.

Cytokinins

Cytokinins (CKs) are phytohormones that are synthesized from adenine. These effects are typically handled by interactions with the auxin signalling system, which dose-dependently affects cambium activity. CKs control the location of PIN proteins in developing vascular tissues in Arabidopsis to enhance auxin transport during vascular development. In turn, auxin promotes xylem growth by activating the CK signalling inhibitor histidine phospho-transfer protein 6. (AHP6). These data suggest that CKs have a negative interaction with auxin and impede xylogenesis. When injury, CK biosynthesis genes are activated, CK levels rise, and CK responsiveness is enhanced. These reactions are thought to result in wound-induced callus development at the cut surface because wound-inducible TF WIND1 up regulates and promotes callus formation via CK signaling activation. As a matter of fact, CKs appear to facilitate vascular reconnection during transplantation.

Ethylene

Ethylene is a gaseous hormone that influences several processes, including root initiation, fruit ripening, senescence, and stress-related and non-stress-related responses. These transcription factors are found in all plant species and are triggered by a range of stresses or developmental events. Ethylene is linked to abiotic stresses; for example, wounding enhances ethylene production in the area surrounding the wound. In Arabidopsis stems, ANAC071 is activated above the cut, and its activation is partly dependent on ethylene signaling. Suppressing ANAC071 function inhibited cell division but not cell elongation, making cells incapable of tissue reunion. The fact that ethylene signaling is required for tissue reuniting in injured stems but not in grafted hypocotyls shows that these differences are attributable to ethylene signaling.

Gibberellins

Gibberellins (GAs) are diterpene phytohormones that play an important role in plant development, particularly in plant growth control, due to their ability to drive cell expansion, differentiation, and proliferation. The role of GAs in wounding is becoming clear. In cucumber and tomato hypocotyls, GAs generated from cotyledons promotes cambium cell development and differentiation. Inhibiting GA synthesis or signalling decreased the growth of cortical cells that seal the graft interface in grafted Arabidopsis hypocotyls but had no effect on vascular tissue cell proliferation. Prior study has demonstrated that endogenous GA levels decrease following decapitation of peas and tobacco but may be recovered by apical auxin treatments, demonstrating that auxin increases GA synthesis or accumulation. GAs, in turn, promotes auxin transport by controlling PIN protein generation. As a result, GAs appears to be essential for wound sealing cell growth, whereas auxin appears to be needed for vascular tissue multiplication and rejoining across the wound.

Brassinosteroids

Brassinosteroids (BRs) are hormones that regulate cell development and plant morphogenesis. BRs also promote xylem production, but their effect during wounding or grafting has not been studied. However, experiments utilizing grafting to explore BR transport in pea plants revealed that the BR biosynthesis mutant lkb successfully grafts. As a result, BRs are unlikely to be essential for grafting. BRs interact with several phytohormones in a wide variety of biological processes. BR, auxin, and Cytokinin signalling pathways, for example, interact during Arabidopsis root growth by BRAVIS RADIX (BRX), which is a regulator of protophloem differentiation that is both activated by auxin and mildly suppressed by BRs. Given the probable function of BRs in xylem development and their interactions with other phytohormones.

Jasmonic Acid

Jasmonic acid (JA) and its compounds are plant hormones derived from lipids that are known to be activated in responses to both abiotic and biotic stress, including healing process. The establishment of a cambium promotes JA signaling in Arabidopsis stems, showing that JAs are involved in vascular creation. A recent study discovered that JA treatments increase xylem production in Arabidopsis exotic roots but not in JA signaling mutants. JAs build up in response to injury. Arabidopsis stems with asymmetric JA signalling gene expression exhibit greater expression below the cut than above the cut. RAP2.6L expression rises below the cut following dissection and methyl jasmonate injection, indicating that it is activated by JA signaling.

Conclusion

During plant growth, almost every known phytohormone impacts the growth and differentiation of vascular tissues. Despite this, auxin appears to be the primary controller of vascular cell differentiation and morphogenesis, with other hormones influencing the process via auxin synthesis, transport, and/or signalling pathways. Because grafting is dependent on vascular tissue reconnection during tissue reunion, it should come as no surprise that the same hormones and genes that control vascular growth in developing organs also control vascular tissue regeneration at the wound. The cutting process activates wound-responsive hormones and signalling pathways, altering the processes and dynamics of vascular tissue growth and tissue adhesion.

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7. HORTICULTURE

Current Scenarios in Bud Mutation with Horticultural Propagule Production

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Abstract

Lateral shoots, inflorescences, or solitary blooms or fruits that differ phenotypically from the remainder of the plant are called "bud sports." The new feature is frequently caused by a persistent somatic mutation in a single cell, which is passed on to its clonal progeny and

eventually fills all or part of a meristem. Frequently, a bud sport can be vegetatively reproduced, preserving the distinct trait without sexual reproduction. Many bud sports that offer new characteristics while retaining the favourable characteristics of the parent plant have been developed into popular cultivars.

Introduction

A mutation is an abrupt genetic alteration in an organism's personality. Gene or point mutations are mutations brought on by changes in the base sequence of genes. Chromosome mutations are those that result from alterations in chromosome structure or even chromosome number. Bud mutation refers to mutation that takes place in somatic tissues employed for propagation's buds. For example, clonal crops. If a mutation arises in any of the actively dividing meristematic tissues, the branch that emerges from that tissue will, if it is dominant, exhibit the mutant phenotype. This occurrence is known as a bud mutation. Somatic cells are equally prone to mutation, however it happens more frequently at maturation divisions. If a mutation occurs in the cells that give rise to the buds, they will be genetically separate from the rest of the plant. These are referred to as "bud mutations" or "sports."

It may take several vegetatively propagated generations and numerous propagations from numerous buds of the same plant to find a novel mutant within a clone. Numerous "sports" have evolved into profitable cultivars. Fruit (colour, form, and maturity time) and tree structure (spur type), as well as a variety of other features, may be affected by mutations.

Current Scenarios In Bud Mutation

In recent times Mutation breeding plays a vital role in introducing new cultivars. Sometimes these mutants have incredibly beneficial horticultural qualities that have led to the development of significant new cultivars (the "Ruby Red" grapefruit, red-coloured apple and pear sports, grapes colour variations etc.). Some of the major works that were carried out in bud mutation in crops like citrus, apple and carnation are discussed below.

Citrus

The pleiotropic sweet orange (*Citrus sinensis*) mutation known as the "Hong Anliu" is characterised. Fruits with this trait have an accumulation of carotenoids, high amounts of sugar, and low levels of acid. The fruit's high sugar and low acid levels were caused by an excess of sucrose and a deficiency of citric acid, according to a gas chromatography analysis. This mutation has no impact on the carotenoid concentration of foliage.

The mutant had a significant impact on the carotenoid concentration and biosynthetic gene expression of segment membranes, fluid sacs, and albedo. The quantity of lycopene that collected in the juice sacs was regulated by the coordinated expression of genes involved in carotenoid biosynthesis. This implies that at least two processes must be in play to prevent the lycopene in "Hong Anliu" berries from building up. These results suggest that sizable quantities of lycopene could be generated in the juice sacs, moved to the segment membrane, and then accumulated in the albedo.

Apple

Due to its extensive variety of nutritional advantages, the apple (*Malus domestica*), a member of the Rosaceae family, is one of the most commonly cultivated, eaten, and adored fruits in the world. Finding spontaneous mutations and bud sports and reproducing them asexually is a fast and efficient way to produce new apple varieties. It was also discussed how apple bud sports were identified molecularly and how epigenetic regulation led to the enormous gene pool diversity based on differences in biochemical, organoleptic and phenological characteristics over their parents. Other phenotypes and regulation mechanisms of apple bud sports included the development of fruit peel colour, flowering time, and fruit maturation time.

New studies on the epigenetic regulation of apples and mutated bud sports. Accidental genetic changes are the main cause of commercial apple varieties. Bud sports provide a significant amount of genetic variety due to variations based on morpho-physical, biochemical, and organoleptic traits compared to their parents.

Carnation

Spray carnation cultivars in the Mini Tiara family were developed through bud mutations between the pink-flowered "Mini Tiara Pink" (MP) and the pink, creamy-flowered "Mini Tiara Cream," which have unique, thin sword-shaped petals in a variety of colours (MC). The "Mini Tiara Sunshine" (MS), which had orange flowers, also contained pelargonidin glucoside and chalcononaringenin 2'-glucoside. While MP had pelargonidin glucoside as a dominant pigment, the cultivar "Mini Tiara Lilac," which was derived from MC, had pale purple flowers and carried cyanidin glucoside as a main anthocyanin.

Therefore, the variance in petal colour in the Mini Tiara series was caused by the various quantities and categories of flavonoid pigment in the petals. Compared to the other cultivars, MS displayed a greater incidence of flower colour mutations and produced a range of flower colour mutations. The Mini Tiara series consequently functions as a highly lucrative product for the flower business as well as an important source for study on the malleability of carnation petals.

Conclusion

Bud sport mutations bring new genetic variety to plants that lack or are incapable of sexual reproduction. Because somatic mutations can also create useful new characteristics while maintaining the favourable traits of the progenitor plant, a number of well-liked varieties have come from sports. In some cases, the study of sports has revealed novel information regarding the roles of specific genes in specific developmental stages or has provided useful knowledge regarding how genes act in those processes. As genomic technology develops, sports can offer a lens through which to examine the processes that propel genetic evolution.

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8. HORTICULTURE

Possible Approaches by Layering in Commercial Horticulture Crop Multiplication

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Abstract

This "Possible approaches by layering in commercial horticulture crop multiplication reviews the information available on vegetative propagation of Horticultural crops including cutting, layering, budding and grafting. In this, layering is the simplest and easiest method. Review also highlights the possible approaches and importance of layering in major tree spices and fruit crops.

Introduction

Plant propagation is defined as reproduction or else multiplication of plants. Different types of techniques are developed with objective of uniformity, resistant to pest and diseases , early bearing , increase in production rate . There are two methods of propagation - sexual and asexual. In sexual method, propagation is done with the use of seeds. In asexual method, propagation is done with the use of vegetative structures like leaves, shoots, roots, buds, underground rhizomes or bulbs, stem etc. Different types of asexual method of propagation includes cutting, grafting, layering, budding.

Layering

Layering is the attached propagation method. In layering, the stem will be girdled and, in that portion, it is filled with media like sphagnum moss (rooting media) and the roots will develop while it is still attached to the mother plant. After attaining development of roots, this portion will be separated from mother plant and potted in a pot with a suitable media and allowed to grow as a new plant with its own root.

Types of layering

- Simple layering
- Compound or serpentine layering
- Mound layering or stooling
- Trench layering
- Air layering

Nutmeg

According to Nichols and Cruickshank - 1964, Nutmeg plants can be propagated by air layering and it is reported as a successful method on West Indies, Grenada and Guinea. Nearly 60% rooting was reported in New Guinea for a period of about 6 months but rooted layers were failed to adopt and establish in the field. The success percentage was very low which is about 8.5% when cultivated in Grenada.

Clove

Air layering can be done in young branches of clove. In Bogor, Indonesia - reported a success of 65% by marcotting 1 cm of diameter shoot with a combination media of sand, soil, leaves, and humus right after ringing. In a clove, the rooting of cent percent can be achieved by using combination of IBA with naphthalene acetic acid and IBA. But, the performance of these layers in field was not good because of certain physiological conditions in the layered shoots, hardening and the root type produced by the shoots. These are the factors which play a main role in establishment of layers in field.

Cinnamon

Air layering in cinnamon was achieved using gallic acid of 100 ppm which is a phenolic compound helps in rooting with a successive rate of 80%. In Maharashtra, during the months of July, June, January the rooting percent was about 88%, 65 %, 0% respectively.

All Spice

Layering can be done in soft wood and semi - hard wood shoots and rooting can be increased by using IBA of 4000 ppm and NAA of 4000 ppm. In Maharashtra, rooting takes more days of about 18-28 months and January is the best month for rooting.

Tamarind

Air layering can be successfully done in tamarind. For rooting, usage of IBA alone or combination of IBA and NAA of about 2500 pm gave 90 % of success. June -July is the best method for rooting using sphagnum moss as a media. When 8-10 months of old shoots with pencil thickness are air layered, rooting takes place within 80-85 days.

Jack Fruit

In jack fruit, air layering and mound layering are practiced. In air layering, pretreatment is done with IBA application of 3000-5000 ppm which helps in 100% rooting. In mound layering, in lanoline paste IBA of 500 ppm will provide better rooting. From medium sized stool, highest number of bud emergence is obtained.

Pomegranate

Etiolated and pre-girdled shoots are the best material for air layering in pomegranate. During the month of May and July, the rooting percent of 85 and 95 respectively were reported in these shoots. For cent percent rooting, usage of p-hydroxybenzoic acid of 1000ppm can be during during the month of July.

Black Pepper

Serpentine layering is the cheapest method of propagation in pepper. 500 g of potting mixture kept in polybag which serve as the media for mother plants. As the mother plant grows it produces few nodes. Press the nodes gently into the polybag of 20*10cm which is filled with potting mixture and it should be kept under each node. The midrib of coconut leaflet can be kept at the junction of nodes for easy rooting . The 1st 10 nodes will rooted profusely within 3 months. Cut should be given just below the rooted portion and it is placed in a polybag filled with solarized soil, granite powder and FYM at 2:1:1.

Rambutan

The plants with problem of formation of male to female flowers and fruiting can be overcome by layering. In cultivar **Seechompoo**, layering can be done in immature branches and the rooting rate is about 80% without the use of growth hormones.

Conclusion

Layering is the simplest and easiest method of propagation and the success is mainly depends on the rooting media. Generally fruit crops and ornamental plants are propagated by layering, and nowdays layering is well suited for tree spices also.

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9. HORTICULTURE

Tactics in Elite Propagule Production of Horticulture Crops

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Abstract

Nursery is the only place where seasoning of seedling is possible. Producing good quality planting materials requires a series of horticultural practices and interventions which enable the raise of plant from start to finish by slow, steady, undisturbed growth and with minimal stress and guarantee appropriate growth rate, optimum root to shoot ratio, good stand establishment capabilities and high yield potentials. The leading of great nursery management is to arrange planting material for the best possible quality. Knowledge about mother stocks, rootstocks and their ideal characteristics and maintenance of nursery are provided in this branch.

Introduction

Plants are propagated and cared for in nurseries during their early years. The vast majority of horticultural crops are grown in nurseries first before being transported into the field. The nursery guarantees better germination and establishment, as well as time, space, and labour savings as well as simple upkeep. Plant propagation has three components: 1) the art of propagation, 2) growth and plant structure, and 3) knowledge of propagation techniques. The majority of plant propagation is done via traditional techniques, including as sexual and asexual ways. Yet, in recent years, the mass production of plants has greatly benefited from plant propagation using biotechnological technologies.

Sexual Method of Propagation

In this technique, seeds are used to grow the

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plants. For the development of new types through breeding, seed propagation is crucial. As viruses cannot be transmitted through seeds, most seedlings are virus-free. Compared to plants produced asexually, seedlings have a longer juvenile phase and begin to bear later.

Asexual (Vegetative) Method of Propagation

Asexual or vegetative propagation refers to any method of plant reproduction other than sexual reproduction. Due to exact chromosome duplication occurring during cell division, the daughter plant inherits all of the traits of the parent plant. As a result, the plants' growth, ripening, yield, and fruit quality are all true to type. This is the only means of multiplication available for some fruit plants that do not produce seeds. As compared to seed storage, the preservation of genetic material is more expensive and space-intensive.

Methods of Vegetative Propagation

Several techniques can be employed to commercially multiply a variety of fruit plants. They include grafting, cutting, layering, and budding.

Source of Planting Material

The supply of planting materials, such as scion wood seed, is the second crucial component for nurseries. The nurseryman should create his own mother plant blocks if at all possible, or he might choose the best plants from the current orchard.

Selection of Elite Mother Trees

It ought to have a well-known identity. It should be capable of being produced. Commercial acceptance is required. It should be free of infections and pests.

Selection of Scion Wood

The scion needs to come from an established shoot that is at least a year old. For excellent bud wood, a scion wood with a diameter of 0.6–1.2 cm is acceptable. The scion shoot should have spherical, plump buds that are healthy and well-developed. Scion should be chosen from elite trees recognized for producing high-quality fruits. There shouldn't be any bacterial, fungal, or viral illnesses present in scion wood. When the scion is chosen for grafting on rootstock, it should be dormant. From the middle or the base of the shoot, the best scion wood can be collected. It is best to eliminate the terminal parts, which are typically succulent.

Collection and Storage of Bud Wood

Typically, shoots developed the season before yield the best scion wood. Scions should be cut with clean, well-kept shears or blades and put in moist plastic bags as soon as possible. Cleaning the cutting instruments frequently is a good idea, while harvesting scions and creating grafts.

Selection of Rootstock

Rootstock needs to have healthy vigour and growth patterns. To avoid contracting pests and diseases from the soil, rootstock must be resistant. Na, Mg, and Ca, among other hazardous salts, should not harm rootstock. It should be very adaptable to various climatic and soil conditions. There shouldn't be any mutations in it. Its age should be between one and one and a half years, but no older than two. Its diameter must be at least one centimeter.

Plant Propagation Structures

To multiply, maintain, and cultivate nursery plants, a variety of plant propagation devices are employed in nurseries. The crucial ones include polyethylene tunnels, hot beds, cold frames, Lath houses, shade net houses, and green houses.

Growing Media

The growing medium needs to be available, decomposed, stable, appropriately porous, low in salinity, devoid of disease and pests, dependably uniform, and affordable. The most popular growing media are sand and compost. To eliminate pathogens, weed seeds, and other hazardous organisms present in the growing medium, the growing medium must be treated. The most popular option is heating. The medium can be most effectively and economically treated with solar energy.

Maintenance of Nursery

Water Management

The growth and survival of the plants are influenced by the type and quantity of water. The irrigation system with sprinklers and drippers can make efficient use of the water supply. Although it contains less salt, rainwater collection is a suitable choice for nursery plants.

Weed Management

For nursery plants, particularly early seedlings, weed control is crucial. To effectively kill the weed seeds, the potting material should be thoroughly prepared. More mulching can be applied to control weed growth between plant rows. Before it rains, broad-spectrum weedicides like glyphosate can be applied on the nursery's bare sections.

Disease and Pest Management

Safe insecticides and organic disease, pest formulations can be used for nursery plants to control pest and disease outbreaks.

Conclusion

A focus on crops, farmers are familiar with and systems of production that built on what was already practiced. The marketing and strategic choices made by nursery men should help them get a competitive edge. The marketing and strategic choices made by nursery men should help them get a competitive edge. If the supply chain companies who engage in nursery farming are going to be able to shift to fulfil the varing client.

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10. HORTICULTURE

Role of IPR in Establishment of Commercial Nursery

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Abstract

Horticulture is an engine for economic growth. Intellectual rights are very much relevant in horticulture. IP protection in horticulture can take the form of patent, trademark, geographical indication, copyright, plant variety protection & trade secret. The term cultivar means a particular variety of plant whose characteristics have been controlled by people in the way it has been bred. A cultivar is the result of plant breeding. New cultivars are sold on the market for profit protection of cultivar as intellectual property rights ensure that all the profit goes to the breeder or innovator.

Introduction

The establishment of a commercial nursery involves the propagation and distribution of various types of plant for commercial use. In today's competitive market, it is essential for any business to differentiate itself from its competitors and protect its valuable assets, including unique plant varieties, trademark and other intellectual property. This is where intellectual property right (IPR) come into play.

IPR refers to a set of legal rights that protect intellectual creations, such as invention, literary and artistic work, and plant varieties. IPR can provide a competitive advantage to commercial nursery by protecting its valuable assets, fostering innovation, and enhancing its reputation. In this article, we will explore the role of IPR in the establishment of a commercial nursery

Understanding IPR

Before delving into the role of IPR in a commercial nursery, it is important to understand the different types of IPR that are relevant to the nursery business. These include patents, trademark, copyright, and plant variety protection.

Patent are granted for inventions that are new, non-obvious, and useful. In the nursery industry, patents can be grants for new plant varieties, new propagation method and new plant-related products. Patents can provide a legal monopoly to the patent holder, preventing other from producing, using, or selling the patented invention for a set period of time.

Trademark are signs, symbol, or name that distinguish the goods or services of one business from another. In the nursery industry, trademark can be used to protect brand name, logo, and other distinctive mark associated with a nursery's products.

Copyright protects original literary, artistic, or other creative work, such as books, photograph, and music. In the nursery industry, copyright can be used to protect original written or pictorial descriptions of plant varieties or other creative work.

Plant variety protection is a type of intellectual property right that specifically protects new plant varieties. It grants the holder the exclusive right to sell, produce, and use the protected variety for a set period of time.

Importance of Ipr for a Commercial Nursery

IPR can play a critical role in the establishment of a commercial nursery by providing protection for its unique plant varieties, trademark and other valuable intellectual property. For example, a commercial nursery can protect its new plant varieties by applying for a patent or plant variety protection, preventing others from reproducing and selling those varieties without permission. This can provide a significant competitive advantage, as the nursery can offer a unique product that cannot be found elsewhere.

Trademark can also help establish a commercial nursery's reputation and brand identity. By registering a trademark, a nursery can prevent other from using a similar name or logo, which can help consumer easily recognize and identify their products.

Challenge of Ipr in Nursery Industry

Despite the benefits of IPR, there are also challenge and complexities associated with obtaining and enforcing IPR in the nursery industry. For example, plant variety protection can be difficult to obtain, as the variety must be new, distinct, uniform, and stable. Proving novelty and non-obviousness can be especially challenging, as many plant traits are controlled by multiple gene and can be difficult to differentiate from existing varieties.

Enforcing plant variety rights can also be difficult in different countries. Different countries have different laws and requirement for plant variety protection and some countries do not recognize foreign plant variety rights. This can make it challenging for a commercial nursery to protect its plant varieties in different markets.

Conclusion

IPR protection is an important tool for businesses in the commercial nursery industry. By obtaining patents, trademarks, and PVP certificates for their plant varieties, businesses can protect their investment in research and development, generate revenue from licensing and selling their proprietary plants, and gain a competitive edge in the marketplace. However, businesses must also be aware of the challenges involved in obtaining and enforcing IPR protections, and be prepared to take appropriate steps to safeguard their proprietary plant material.

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11. HORTICULTURE

Essentiality of Apomixis in Clonal Multiplication in

Horticultural Crops for Modern Days

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Abstract

In wild species seed formation occurs without fertilization is known as apomixis. Identification of apomitic controlling genes was complex and transmission of this genes through crosses are also not successful. transgenic technology is the efficient way for introducing apomixis in crops by which the plant produce superior genotypes, disease free and uniform plantlets .

Introduction

Apomixis was originally discovered in *Alchornea ilicifolia* and has since been described in more than 400 flowering plant species. Many important Asteraceae and Poaceae families have been reported as typical apomictic plants, such as Hieracium, Taraxacum, and Pennisetum. Some species in these families have been extensively studied to investigate the genetic control of apomixis. Apomixis is also widely found in horticulture plants, including citrus fruits, crabs, walnuts, mangoes, peppers, and Chinese chives.

Definition

The term apomixis was previously used as a synonym for vegetative reproduction. Currently, it is mostly limited to the concept of asexual reproduction by seeds. In apomixis reproduction, the embryo develops autonomously from an unreduced cell with the same chromosomes as the mother and gives birth to plants that are clones of the mother plant.

Mechanisms of Apomixis

Apomixis has several mechanisms, some of which result in unstable chromosome numbers. Only those with stable chromosome numbers and those important for reproduction will be discussed here without further detail. The development of apomictic seed formation takes place in three stages:

- Inhibition of meiosis (apomeiosis),
- Endosperm formation without fertilization (parthenogenesis),
- Seed formation (pseudo apomixis) or without (autonomous fertilization)

In its simplest form (random embryo), apomixis occurs without formation of an embryo sac. In other words, the process begins directly in the somatic cell of the nucleus or inner membrane, bypassing meiosis entirely (also called sporophytic apomixis). These cells differentiate and form an embryo. In species with a developed endosperm, the endosperm consists of polar nuclei.

Transformation of An Apomictic Plant

Three Ways to Transform Sexual Cultures into Apomictic Plants

- Genetic Transformation
- Distant hybridization with Apomictic wild relatives
- Mutation

Types of Apomixis

Recurrent Apomixis

Without fertilisation, the embryo sac grows from the mother cell of the diploid egg or from other diploid cells within the embryo sac. Similar to the mother plant, the egg possesses the typical diploid number of chromosomes. E.g., Parthenium, Rubus, Malus (apple), Taraxacum, and Allium.

Non recurrent apomixis

Without fertilisation, the haploid egg cell or other haploid cells of the embryo sac directly give rise to the embryo. Thus, the embryo that is produced is likewise haploid. Seldom does this kind of apomixis take place. Eg. Solanum nigrum with Lilium species .

Adventitious apomixis

Adventitious embryony, also known as nucellar embryony, occurs when an embryo grows from the nucellus or integuments rather than the cells of the embryo sac. Moreover, the resulting embryo is diploid. In addition to the conventional embryo, such embryos typically develop outside the embryo sac. Although it is seen in many plant species, citrus and mangoes exhibit it the most.

Vegetative apomixis

In the inflorescence, vegetative buds or bulbils are formed instead of flowers. Although still connected to the mother plants, these buds or bulbils may develop into new plants. For instance, Agave, Poa, Dioscorea, and certain grasses

Idea of Apomixis in Horticultural Crops and Its Significance.

- In contrast to seedlings produced through sexual reproduction, apomictic seedlings are quite uniform and relatively healthy.
- During hybridization, apomictic seedlings are useful for identification (e.g. trifoliate leaf character in citrus).
- Viruses that are otherwise not spread through seeds can be screened using apomictic seedlings.
- For the production of consistent rootstocks in apple (Malus toringoides and M. sikkimensis), citrus, jamun, and other plants, apomictic seedlings are helpful.

Impact of Clonal Propagation through Apomixis

Crops that are propagated by cloning may benefit from apomixis technology. Pathogens which build during multiple rounds of vegetative propagation, limit the yields of clonal crops.

Apomixis technology in these crops would offer the extra choice and advantage of clonal seed propagation, producing disease-free material that is easier to store and transport. The advantages of using apomictic seed as an alternative to vegetative planting materials (lower costs and higher yields) are similar to those of using true seed for these crops today (such as true potato seed (TPS)). Around 10% of the world's potato crop is diverted from food usage for planting purposes. Despite several issues with TPS systems (such as low germination rates, uneven tubers, and higher irrigation requirements), there are also many instances of great success (e.g., in Vietnam). TPS might become a more alluring choice for potato breeders and producers because to apomixis technology. The advantages of apomixis technique for propagation could help potato and cassava farmers.

Recent Developments

Although there have only been a few reports of apomixis in woody plants, including orange, bramble (*Rubus alceifolius*), walnut, and so forth, it has long been assumed that apomixis occurs in all Angiosperms.

Cotoneaster latifolius, C. purpurescens, C. thimphuensis, C. ignescens, C. kingdonii, C. yui, C. brickellii, C. vandelaarii, C. lancasteri and C. shannanensin were among the newly discovered species in Rosaceae that had apomictic property. The Rosa division of the Caninae had only polyploid and apomict plants. It was previously believed that gymnosperms did not experience apomixis. Yet, one study found apomixis in Mediterranean cypress for the first time. In this investigation, androgenesis led to paternal apomixis. These findings collectively demonstrate the apomixis ubiquity in the plant kingdom. In some intra and interspecific Juglans spp., such as Juglan nigra L., Juglan regia L., Juglan mandshurica Maxim., Juglan sieboldiana Maxim, Juglan cinerea L., and two interspecific hybrids of juglandaceae family exhibit apomixes.

Apomictic crabapples are used as rootstocks. More effective than the current pricey usage of stool beds or micropropagation techniques would be apomictic seed propagation of clonal rootstocks. The worth of apomictic apple clones as rootstocks, however, goes beyond their simplicity in replication and also depends on their compatibility with scion cultivars, impact on tree size and productivity, stress tolerance, and susceptibility to harm from pathogens, viruses, and pests.

Identification of Apomixis: Progeny tests, cytohistological procedures, seed screens using flow cytometry, as well as biochemical, isozyme, and molecular markers, can all be used to identify apomixis seedlings.

Limitations to Apomixis Exploitation

The juvenile status of apomiticts for the multiplication of fruits and nut cultivar producing plants is a drawback. They are strong but have juvenile characteristics like thorns and a delayed flowering period, making them unsuitable for horticulture until they reach an adult condition. With apomicts, it might be challenging to maintain the purity of maternal seed.

Conclusion

However, apomixis is rarely present in other commercial crops. It occurs in citrus, mangosteen, mango, apple, turf, forage grasses, berries and in beta species. Many issues faced by the mango, citrus, and apple industries may be resolved by the mass production and use of apomictic seedlings as rootstocks for asexual propagation. To facilitate the transmission of the characteristic to crops lacking naturally occurring apomictic relatives as a source of the genes, recent investigation has concentrated on understanding the molecular basis of apomixis.

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12. HORTICULTURE

Hormonal Regulation of Seed Germination and Seedling Production in Commercial Horticultural Nursery

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Abstract

The need of this special issue, "Hormonal regulation of Seed Germination and Seedling production in Horticultural Nursery" is to present the recently developed technologies in role of hormones in increasing the Seed Germination and Seedling Production in Horticultural Nursery. Plant Growth Regulators are generally used in different techniques involving plant propagation from Seeds, Cuttings, Grafting, Micro propagation and Tissue culture. Plant propagation by cuttings, stems or leaves is done using auxin (rooting hormone). Auxin promotes the callus formation in grafted plants which joins the surface of grafts together. In micropropagation, PGRs helps shoot multiplication and rooting of the plantlet.

Introduction

Innovative plant propagation methods help in production of quality planting materials with the same characteristics of parent in the nursery. The organic compounds that are present naturally in plants, which play an important role in growth of plant are called Plant hormones or Growth regulating substances. They are also known as Phyto hormones. When these hormones are artificially synthesized, they are known as Plant Growth Regulators (PGRs). The management of growth and development need the combined coordination of various signals, in which PGRs play the major role. The use of PGRs in plant propagation is an excellent technology for the production of quality planting materials in the nursery. Phyto hormones are also known as Biostimulants or Bioinhibitors.

Commercial Applications

- Application of GA3 @500ppm for 40 hrs. helps breaking of dormancy in Apple seeds.
- Application of NAA increased rooting in rootstocks of apple (MM-109, M-4, M-9) that have poor rooting ability.
- In crab apple rooting was achieved by using NAA@10,000ppm. This high rooting percentage in difficult to root rootstock species is because of the combined effect of auxins in root initiation and growth (2006, Tripathi et al.)
- Tissue culture in apple (Golden delicious) using the leaf explants (Kumar et al., 2016) MS medium: BA (2.0 mg/L) and NAA (0.02 mg/L) - high shoot regeneration from leaf calli, BA (2.0 mg/L) + NAA (0.02 mg/L) + GA3 (0.4 mg/L) – high shoot elongation, IBA (1.0 mg/L) alone – rooting of shoots (96.66% rooting achieved). The in vitro seedlings were acclimatized in pots and transplanted in the main field.
- In grapes & banana, BA and NAA are necessary for establishment of explants in grapes and banana. Gibberellic acid and salicylic acid are important for proliferation of stem explants (Fry and Street, 1980)
- Usage of epicormic buds (cytokinin: auxin) from age advanced trees in the mother block with proper propagation lineages for budding to avoid the non-infectious bud failure (NBF) disorder in Almond.
- Blueberry nursery plants from cuttings using various concentration of IBA in combination with *Azospirillum brasilence* (a genus of PGPRs – which helps in increased phytohormone production and nitrogen fixation). IBA 1000mg/l + *A.brasilense* – increased the root length of the cuttings.
- Invitro plant regeneration of *Capsicum annum* from different explants (cotyledonary nodes, shoot tip, cotyledons and leaves) from seedling of 25 days old- cultured in MS basal medium with IBA (0.5) or NAA (0.05)
- ‘Aeroponic Cloning’ a clonal propagation strategy in *Capsicum annum* peppers had good node formation and root volume.
- *Nerium oleander* nursery production-cuttings of 10-14cm length and 3–4 nodes treated with IBA had rooting percentage from 52% - 94%.
- Increased adventitious root formation is obtained in shoot cuttings of Gerbera by application of NAA(1mg/l) and IAA(5mg/l).
- Usage of *Trichoderma aggressivum f.europaeum* or *T.saturnisporum* under nursery condition to improve the seedling growth of tomato and pepper.
- Broccoli (cv. Green marvel)-Propagation using shoot tips as explants. 5mg/l BAP -100% shoot formation achieved and for rooting of shoots NAA, IAA and IBA at 0, 0.2 and 1 mg/l is used.
- Callus formation in the tuber segments of Potato (cv. Diamant) was obtained on MS medium added with 2, 4-D at 3mg/l or in combination with BA at 2mg/l.
- Biostimulants: Radifarm®- increased the rate of germination and seedling weight in plants like Marigold, Moss rose, Zinia.
- Tomato seedlings treated with Radifarm® increased root growth while Megafol® stimulated the shoot growth (Vinkovic et al., 2009)

Conclusion

The demand of todays progress in

agriculture and horticulture world is the highest yield which can be achieved through increased production of quality planting materials at the Nursery. The exploitation of new technologies using PGRs can help us achieve it.

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13. HORTICULTURE

Roles of Hormones in Rejuvenation Process of Horticulture Propagules

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Abstract

Hormones are signal molecules that are both chemical and synthetic chemicals, as well as naturally occurring components that promote plant development. Major growth-regulating hormones produced by plants include auxin, gibberellin, and cytokinins. Yet, a few plant hormones, like ethylene and abscisic acid, also act as growth inhibitors. PGRs are crucial for all aspects of a plant's life cycle, including growth, development, blooming, fruiting, ageing, senescence, fruit colour enhancement, stem elongation prevention or promotion, leafing, and leaf fall.

Introduction

Plant hormones are a group of signaling molecules or a mixture of substances that are found in extremely small quantities in plants. These hormones primarily control plant growth, separation, and development, but they also have an impact on several processes, including stomatal development.

Auxin

Cuttings are known to root more quickly when auxin is present. IBA is the auxin that is most frequently used for commercial rooting. IBA and NAA are still the most often used auxins for rooting stem cuttings and micro-cuttings made in tissue culture today. Auxin is important growth and development regulator for plants. They influence the formation of primary, secondary and adventitious roots among other things. Indole-3-acetic acid is the name given to the auxin that is present in plants naturally (IAA). The most used auxin is synthetic Indole-3-Butyric Acid (IBA), which encourages adventitious root growth more effectively than natural Indolyl-3-acetic acid (IAA).

Applications: The most crucial element that contributes significantly to the quality generation and germination of herbaceous plant cuttings is rooting media. Rooting media must be modified to give the proper physical

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and chemical qualities required for plant growth due to the relatively shallow depth and constrained volume of a container. The process of root regeneration in cuttings and their survival depend heavily on the use of commercially available, auxin-based rooting hormones. Auxins, a type of plant growth regulator, are crucial for promoting cutting roots.

Mussaenda pink and Hibiscus hardwood cuttings treated with IBA. It produces the most main roots per cutting, the longest roots, the largest leaves, and the highest rooting percentage. IBA significantly increased the number of primary and secondary roots, longest root length, maximum fresh weight of roots per cutting, and number of leaves per cutting in poinsettia cuttings.

The commercial cut flower cultivar of rose known as "First Red" was treated with IBA and NAA, which results in early root appearance, maximum rooting, the highest primary root number, the longest root, and field survival in cuttings treated with IBA @ 1500 ppm. The use of auxin significantly improved rooting characteristics in roses. Application of IBA + NAA @ 150 ppm greatly increased the number of roots and longest roots in marigold tip cuttings.

The adventitious root's genesis, growth, and geotropic reactions are all controlled by the auxin gradient. The effective propagation of superior horticulture crops depends on the production of adventitious roots. Three stages of adventitious root formation are - induction, initiation, and extension.

Gibberellin

Gibberellin is responsible for promoting cell division and cell elongation, stem expansion, spreading germination, regulating the production of enzymes during germination, and breaking seed dormancy. These actions prevent genetic dwarfism. In low densities, GA3 acid was a crucial component for the media culture. Also, it was noted that the nature of GA3 was comparable to that of auxin when it was added to culture media; if it was utilized at a higher concentration, the callus cells' rate of growth changed.

The decorative plant Petunia, a member of the Solanaceae family, is used to germinate the seeds for an effective method of plant regeneration. Petunia explants from the shoot tip and node were cultivated on MS baseline media with varied concentrations and mixtures of BAP, NAA, IBA, and GA3. In MS material that had been improved with BAP and NAA, the longest shot length was attained. The MS medium has the most shootings with the addition of BAP and IBA. In MS media containing IBA and NAA supplements, regenerated shoots were successfully rooted.

Cytokinin

The family of plant growth regulators known as cytokinins (CKs) is chemically varied and exhibits a wide range of effects on plant growth and development, which is why it is used in agriculture for crop management and improvement.

Cytokinins can promote the growth and development of the plant when auxin is present. Cell division is encouraged. DNA synthesis, mitosis, and cytokinesis are the final steps in the cell division process. IAA participates in mitosis, the second stage of cell division, and DNA synthesis, the first stage. Kinetin regulates cytokinesis. When an appropriate ratio or concentration of kinetin and IAA is applied together, the growth response is substantially greater. Furthermore, cytokinin delays the senescence of leaves. Furthermore, kinetin promotes cell elongation.

In organogenesis and somatic embryogenesis protocols, CK types and concentrations have been optimized in a variety of horticultural species, including commercially grown fruits like Citrus, Apple, Litchi, Guava, Banana, Passion fruit, Pomegranate, Grapes, and Payaya.

A variety of explants, such as petioles, leaves, shoot meristems, seeds, cotyledons, anthers, filaments, pistils, nucellar, endosperms, inner integuments, and protoplasts, can be used to produce somatic embryos.

Conclusion

The rejuvenation process appeared to boost the plant's roots capacity, which most likely caused the plant to assume a juvenile shape. Many naturally occurring plant hormones found in plants have been shown to promote plant growth and development.

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14. HORTICULTURE

Importance of New Generation Plant Bio Regulator in the Production of Propagules under Horticulture Nursery

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Introduction

There is a need to investigate new solutions due to changing customer demands and difficulties with fruit production. One of them is the use of modern PGRs in fruit crops. Plant bio-regulators (PBRs) are also known as plant growth regulators (PGRs). When employed in modest concentrations, organic substances that are not nutrients will impact the physiological functions of plants. Auxins, gibberellins, cytokinin, ethylene, and abscisic acid are the five traditional growth hormones, each of which has a particular role in the growth and development of which Fruit crops already economically exploited. An emerging trend in fruit crops is the use of growth regulators of the new generation. They are applicable to all phases of fruit development, including biotic and abiotic stress creation as well as quality improvement.

Brassinosteriod

Brassinosteroids are a group of polyhydroxy steroid plants that are found in practically all plant parts, including those of the Brassicaceae family. Fruit abortion and fruit fall decreased after BR application, whereas pollen tube development and fertilization increased. It also controls the activity of defense-related enzymes that could build potent defense mechanisms against certain pathogenic bacteria, preventing the premature abscission of fruit. Moreover, it was important for the growth of anthers, stalk lengthening, flowering, petiole lengthening, and leaf expansion. Brassinosteroids are a group of polyhydroxy steroid plants that are found in practically all parts of Brassicaceae plants. Fruit abortion and fruit fall decreased after BR application, whereas pollen tube development and fertilization increased. Homobrassinolides, a derivative of brassinosteroids, increase photosynthesis and metabolite mobilization in the flower, reducing floral size.

Jasmonic Acid

A plant immune hormone called jasmonic acid (JA) is produced from linolenic acid and can be transformed into a range of derivatives, including methyl jasmonate (MeJA). MeJA was first identified in jasmine essential oils as a secondary metabolite. Jasmonic acids have a crucial function in the control of physiological plant processes, in the growth and development of plants. Jasmonic acid is often found in lowest concentrations in roots and mature leaves and in maximum concentrations in flowers, reproductive tissues, and young leaves. Senescence, leaf growth, reduced leaf abscission, plant injury responses, and defensive responses are all regulated by it. 'Shelly' , Kent, and 'Maya' mangoes were preharvest sprayed with 0.4% prohydrojasmon (PDJ), it caused higher fruit set, a delay in fruit abscission, and red skin colour. It also caused a rise in anthocyanin deposition, particularly in the fruit on the outside of the tree canopy.

Salicylic Acid (SA)

Saliciline, a chemical produced from white willow, is a secondary metabolite derived from ortho-hydroxybenzoic acid (Salix alba). In 1979, SA was identified as a tobacco plant elicitor that induced resistance to the Tobacco Mosaic Virus (TMV). Utilisation of Plants involved in developing systemic acquired resistance in plants and responding to pathogen attack. When mature litchi fruits (cv. Purbi) are treated with salicylic acid (1.0 mM) and chitosan (2%), pericarp browning, weight loss, and decay are decreased but antioxidant capacity, phenolics, anthocyanins flavonoids, antioxidants, and ascorbic acid capacity are all maintained. As a result of SA's antisenescence function, fruit's ascorbic acid doesn't degrade as quickly while being stored (Kumari *et al.*, 2015)

Peptide Hormones

High molecular weight precursors are cleaved by proteolytic enzymes to produce active peptide hormone. The three types of water-soluble plant peptide hormone are non-secreted peptides, small peptides that have undergone post-translational modification, and peptides rich in cysteine (CRPs). Systemin, PSK (phytosulfokine), , Pep1, HypSys (hydroxyproline-rich glycopeptide systemin), CLE (CLAVATA3/embryo surrounding region related)/TDIF (tracheary element differentiation inhibitory factor), CEP (C-terminally encoded peptide), PSY (plant peptide containing sulphated tyrosine), RGF/CLEL, and others are among the small peptide signals produced by plants Active peptide hormone is produced during the procedure.

Prohexadione – CA

In fruit crops, particularly pome fruits, prohexadione-calcium (calcium 3-hydroxy-5-oxo-4-propionyl-cyclohex-3- enecarboxylate, or ProCa) is predominantly utilised as a plant bioregulator to influence vegetative development and fruit yield. The main purpose of it is to stop fruit trees and other crop plants from undergoing excessive vegetative growth. The substance structurally mimics 2-oxoglutaric acid. As a result, this molecule is blocked, which has an impact on the dioxygenases (such GA20 3ß-hydroxylase) involved in the production of gibberellin. As a result, treated plants make fewer gibberellins, which encourage growth and maintain compactness. Moreover, ProCa contributes to reduced ethylene production, reduced fruitlet abortion, increased fruit set, and decreased bacterial, fungal, and insect pest disease incidence.

Methylcyclopropene

To stop the activity of ethylene in fruit crops, 1- MCP, a gaseous hormone, is used in agriculture as a synthetic plant growth regulator. Preharvest spraying with 1-MCP is known to have a number of beneficial impacts on fruit crops, including delaying fruit harvest, increasing fruit weight and firmness, lessening fruit storage disorders, and reducing fruit drop during harvest. Conclusion Next generation bio-regulators may be a wise alternative for improving the yield and quality of fruit crops due to their organic make-up, safety during use, and possible efficacy.

Melatonin

In 1995, multiple groups made the first observations of the well-known animal hormone melatonin (N-acetyl-5-methoxytrypalmitine) in plants. This has been identified and measured in several plant components (leaves, shoots, seeds roots, and fruits).

Serotonin

It was also shown that serotonin (5-hydroxytryptamine) is an animal hormone. Its existence in plants was first noted in 1954 in the cowhage Mucunapruriens, a therapeutic plant. Serotonin plays a role in the plant's vegetative growth and morphogenesis, supporting the development of shoots, their growth, and multiplication, the accumulation of biomass, and the postponement of seed germination, senescence, and somatic embryogenesis.

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15. HORTICULTURE

Physiological Means of Graft Incompatibility in Horticultural Crops

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Abstract

Grafting is the joining of two or more pieces of tissues from a living plant to develop into a single plant. Incompatibility between the scion and rootstock is a drawback of grafting. The incompatibility of graft failure or incapacity of rootstock and scion together to create a successful transplant. Graft Incompatibility happens as a result of physiological interactions after grafting, transmission of virus or phytoplasma and skeletal misalignments in the vascular tissue. Auxin, ethylene (ET), cytokinin (CK), gibberellin (GA), abscisic acid (ABA), and jasmonic acid (JA), among other plant hormones, control a number of critical biochemical and physiological processes that take place at the site of the graft union. Numerous physiological and biochemical processes go through considerable alterations when a scion is grafted, which have an impact on horticultural qualities.

Introduction

Asexual propagation is accomplished through grafting. The rootstock (or root segment) of one plant is attached to the scion (or shoot segment) of another plant through the centuries-old horticultural method of grafting. The basic goal of grafting is to produce true-to-type plants. Grafted materials can alter scion architecture, cropping, production, and resilience to insect pests, bacterial infections, and fungi diseases. Differences in hormone signalling, gene expression, protein turnover, metabolites, RNA silencing, water relations, and ion uptake and transport in the grafted trees are likely the mechanism causing these effects.

Graft Incompatibility

Graft failure can be brought on by anatomical misalignment, shoddy workmanship, diseases, unfavourable environmental conditions and incompatibility with grafts. The stock/scion union must closely integrate in order to continue operating, offering a workable framework for mineral absorption and translocation, water, hormones and assimilates throughout the entire plant's life span. Graft incompatibility, on the other hand, results in sickly plants, breakage at the graft union, early demise or inability and graft combination failure to create a solid, long-lasting relationship that is useful. There are two known categories of incompatibility: localised and translocated graft incompatibility.

Mechanism Of Graft Formation

The rootstock and scion adhesion, callus cell growth or callus bridge, and vascular differentiation across the graft interface are the key events in the creation of a compatible graft union. The rootstock and scion must have a vascular connection for the scion to successfully resume growing. Contrarily, cell proliferation triggers graft union development, and after a mass of pluripotent undifferentiated callus forms, vascular differentiation joins the phloem and xylem across the graft union. A vital stage for the development of new shoots from buds on the scion is the re-establishment of the vascular link by fresh xylem and phloem.

Role of Phytohormones In Grafting

A rootstock-scion combination's compatibility is determined by the interaction between plant hormones, particularly auxins, and phenolic chemicals. Increased amounts of phenolic chemicals above the graft union, which have a negative impact on auxin transport, have been linked to incompatibility. Low auxin concentration in combinations that are incompatible with one another affects lignification and the differentiation of vascular tissues.

Auxin is a crucial phytohormone for the development of successful graft unions. Cell division close to vascular tissues, which is essential to the cellularization of the graft union, is required for the creation of callus tissue. In numerous plant species, auxin has been found to convert callus to phloem at low concentrations, whereas at high concentrations, it causes the production of both phloem and xylem.

Ethylene encourages cell proliferation, callus development, and cell expansion and is also involved in the wound healing process. Additionally, ethylene controls the expression of crucial genes for wound healing.

When a wound is healing, cytokinins (CKs) can cause callus proliferation in the graft union. Along with auxins, this phytohormone stimulates vascular differentiation and raises the phloem/xylem ratio, which can speed up the repair of sieve tubes and stem wounds by promoting the regeneration of new blood vessels.

Phenolic Compounds

Phenolic compounds have also been associated with the different processes involved in cell division, development, and differentiation. Low indole-3-acetic acid (IAA) content in incompatible combinations may then affect the differentiation of xylem and phloem, as well as lignificationThe buildup of flavonols in graft unions and the oxidation of those flavonols by oxidases can have a significant impact on the metabolism and growth of tissues.

Physiological Means of Incompatibility

The cause of physiological incompatibility is the stock or scion's inability to provide the other component with the quantity or quality of materials required for proper operation. There is some evidence that, in some graft combinations, one-part (scion or stock) releases compounds harmful to the other and, as a result, kills the entire plant.

Strong unions are formed as a result of the cell walls' lignification processes. Graft union is weak when lignin production is inhibited. Additionally, during graft union, cellular recognition is required, and incompatibility may be caused by procambial differentiation failure as a result of direct cellular communication between the graft partners. However, after a wound response that joins the grafting partners with direct cellular contact with plasmodesmata in the callus bridge, the necrotic layer dissolves, resulting in the production of secondary plasmodesmata between cells of nearby tissues. Therefore, the effects of incompatibility may depend on this physical link. However, it's possible that cellular recognition doesn't contribute to grafting incompatibility.

Apple: When Jonathan apple is grafted with Mailing-9 rootstock, the portion develops molybdenum deficiency while no such symptom is apparent in the rootstock. This is an example of the physiological causes of incompatibility. This form of physiological incompatibility is attributed to Mailing-9 rootstock's inability to absorb molybdenum in appropriate quantities.

Pear: When pear is grafted onto quince rootstocks, a cyanogenic glucoside, prunasin, normally found in quince is translated into the phloem of pear where it gets broken down into garft union region as hydrocyanic acid. This acid makes the cambial activity inactive at the graft union leading to graft incompatibility.

Peach: Hale's early peach was incompatible when grafted on Myrobalan-B plum stock. But when a mutually compatible inter stock Brompton plum was used incompatibility persisted due to the factors translocated from the rootstock to scion through phloem.

Citrus: When Eureka Lemon was grafted on trifoliate orange rootstocks it became incompatible due to a toxic substance released by the scion damaging the conducting tissues of rootstock.

Conclusion

The relationship between the scion and the rootstock is essential for optimum development, water uptake, and nutrient transfer. Water and mineral deficiencies could result in the plant's growth being stifled.Low glucose concentrations in the root and scion will decline root development, which results in a lack of water and nutrient intake, and lessen the availability of carbs as fuel for active ion absorption Physiological disturbances brought on by vascular union discontinuities at the graft union, in other words could result in growth suppression as a result of limited communication between the rootstock and scion.

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16. **HORTICULTURE**

Impacts and Utility of Chimera in Horticulture Crop Production

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Abstract

The chimera is the composition of different cells in the meristem of graft union result the development of new cultivars which have intermediate characters over parents. It offers an important tool in the horticulture crop improvement in various aspects to meet the consumer market demand.

Introduction

Heterogeneous is the core for the improvement of plant species and development of different cultivars. Chimera is the type of heterogeneity. Chimera is also known as mosaic. Most of the chimeras originate spontaneously in graft union. So, it was called as graft chimeras. The synthetic chimeras also produced through induce mutations. The stability of transition of chimera from generation to generation is the problem. Because it was reverse in nature. Periclinal chimera was relatively stable in nature which too reverse due to switching of

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layer. The commercially important improvement in different crops was done using chimeras. It also used to study whether the tissue autonomous or non-autonomous.

Chimeras And Its Types

When mutations occur on a segment of the meristem that became composed with two or more genetically distinct tissues adjacent to each other is called chimeras. The tissue of one genetic composition occurs as a relatively thin skin with several layers over a genetically different core is called periclinal chimera. It is the most common and stable chimera and propagated vegetatively. The periclinal chimera occupy only a segment of the circumference is called mericlinal chimera. The growing point of the shoot compose of genetically different tissues situated side by side in distinct sectors of stem is called sectorial chimera.

Utility Of Chimera

The chimera was used to develop chlorophyll variegated foliage, floral colour, fragrance, floral size, petal arrangement and morphology in ornamental plants. It was used to induce insect resistance, production, peel colour through interspecific and intervarietal chimeras which obtained through graft union. In transgenic plant production, chimeras play the vital role in altering the targeted tissues.

Impacts Of Chimera In Horticulture Crop

The grafting of *Solanum pennelli* on tomato improves the resistant against whitefly, the vector of tomato yellow leaf curl virus. *S. pennelli* induces periclinal chimera on tomato which alter the morphological characteristics of tomato. It makes the resistant epidermis (sticky glandular hairs) similar to *S. pennelli* on tomato which induce the resistance against whitefly infestation.

The interspecific chimera increases the production of cassava. The wild species *Manihot fortulezensis* and *Manihot esculentum* were whip grafted. The graft induces the periclinal chimera i.e., results in formation of *M. esculenta* epidermis on the sub-epidermal and internal tissues of *M. fortulezensis*. The roots are tuberous, cylindrical, longer than cultivated cassava with light cream periderm.

The stable periclinal chimeras generate from the graft junctions between *S.pennelli* and *Lycopersicum esculentum* produce type IV trichomes on the epidermis which secrete 2,3,4-triacylglucose similar to *S.pennelli* in tomato. This creates the resistance against aphids. This mutation also reduces the production of sugar esters.

The intervarietal graft between Yashin kanran and Murasaki kanran of cabbage produce the chimerictic progenies on both green-domination and purple-domination. The purple-dominating chimera possess intermediate characters of two parents.

The artic apple developed using chimeric polyphenol oxidase gene target to disrupt the expression of polyphenol oxidase enzyme on post-transcriptional silencing approach to prevent the browning in fruit flesh. This reduces the post-harvest wastage.

The chimeric tissue used in transgenic plant production with effective containment of pollen and seed mediated gene flow with tissue specific ablation or perturbation.

The floral colour, petal arrangement, fragrance was enhanced by inducing chimeras through various methods in ornamentals for the demand of floriculture industry.

Opportunities For Chimeral Breeding

The potential of chimera was producing progenies with intermediate characteristics and well suited for vegetatively propagated plants like perennial fruit crops, tuberous crops, ornamental plants. The synthetic chimeras introduce the new characters rapidly from related species through intervarietal and interspecific chimeras. The chimeras used in the production of transgenic plants for target tissue mutation. But, the chimeric shoot regeneration and the stability of chimeras are the circumstances.

Conclusion

Chimera plays a great role in the improvement of new characters in horticulture crops. The study over the circumstances of chimeral breeding paves the way for the new standard breeding approach in the improvement of horticulture crops.

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17. HORTICULTURE

Mechanized Grafting – A Way towards Elite Propagule Production of Horticulture Crops

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Abstract

Grafting is the process of connecting together different plant components through tissue regeneration. In recent days, mechanized grafting is becoming more popular among farmers. These grafting techniques were introduced in Japan and commercialized in various developed countries like China, South Korea, etc., Recently, it is being popularized in countries like India, Thailand, etc., Many machines and robots are developed to make the grafting more mechanized and easier. In this article we have discussed various aspects of mechanized techniques and tools.

Introduction

Grafting is the process of attaching a piece of one plant (bud or scion) to or on top of a stem, root, or branch of another (stock) such that a union forms and the partners continue to grow. The component of the combination that supplies the root is known as the stock, and the additional component is known as the scion. In some cases, an intermediate part is required for easing the compatibility process. This intermediate part is known as the inter-stock when there are more than two sections involved.

Grafting is used in modern horticulture for many different things, including the rejuvenation of damaged trees, the production of dwarf trees and shrubs, the strengthening of plant resistance to specific diseases, the preservation of varietal characteristics, the adaptation of varieties to challenging soil or climatic conditions, the assurance of pollination, the production of multifruited or multiflowered plants, and the propagation of some species (such as hybrid roses) that cannot be propagated in any other way.

Mechanized Grafting

Each year, the orchard regenerates a sizable number of fruit trees. The currently most popular technical method is the use of grafted seedlings for fruit tree rejuvenation. As a result, a substantial quantity of grafted seedlings be needed. It takes time and effort to do a lot of grafting tasks during an efficient grafting phase. A quick and effective grafting technology is proposed in order to lower the labour intensity of planting farmers, reduce labour expenses, increase production efficiency, and improves economic efficiency. Promoting the industrialized nursery and mechanical seedling production has significant practical implications. Along with the widely acknowledged benefits of disease resistance and high crop yields, grafting technology is also very effective at reducing crop losses brought on by unfavorable environmental factors like low soil temperature and high soil salt content.

Now a day's robots are used for mechanized grafting. The "One Cotyledon Splice Grafting" system was developed in 1980s in Japan which involves robot for the vegetable grafting. This system is the first mechanized grafting system in the world. For cucurbits, a grafting robot prototype was first created (Onoda et al., 1992). While CSKHPKV-Palampur is the first agricultural university in the nation to acquire a semi-automatic grafting robot for expediting research and instruction on vegetable grafting; IIHR-Bengaluru is the first agricultural institute in India to install a semi-automatic grafting machine. TNAU-Tamil Nadu is the other agricultural university that came after CSKHPKV.

Machines Or Robots In Mechanized Grafting

Various machines or robots used in mechanized grafting are,

- One Cotyledon Splice Grafting system
- prototype grafting robot
- Grafting robot G892
- Prototype semi-automatic grafting system
- Full automatic grafting robot
- Multiuse semiautomatic grafting machine
- Rotary grafting machine
- Semi-automatic grafting machine
- Robotic Grafting Machine GR-600 CS
- Grafting robot GR-800CS

Materials

Cutting the rootstock and scion seedlings is straightforward, fixing them with iron nails is simple to automate (using an air nailer), and sealing with melted grafting wax (70 °C) is simple to do while providing effective sealing.

Feeding wheels, grippers, conveying wheels, cutters, fixing clipper, discharger, controller, and power supply are components of a grafting robot used to mechanically graft cucurbitaceous vegetables.

The internal splitting of the Pin-loc grafts was provided by stainless steel wire metallic pins that were put into the stem centres that had been splice-cut in rose grafting.

In one- or two-person automated vegetable grafting procedures, the grafted partners are joined together using adhesives, plastic grafting clips, or elastic plastic tubes.

Automatic grafting machine the device is mainly composed of the manipulator and control system, the end clip mechanism for mango grafting.

Plug-seedling clamping and positioning device with a frame-shaped positioning matrix, an upper clamping-sliding plate, and a lower clamping-sliding plate are used in Full-Tray Grafting Device for Grafted Melon Seedling Production, as well as the grafting mechanism and existing grafting clamps and equipment.

Success Rate

Mechanical grafting success rate in Grafting Robot G892 was 98%, successful grafting agglutination after acclamation was 95%, and successful union was 87%. The success rate for mechanical grafting on cucumbers is 97 percent.

Cutting success rates for melon and pumpkin scions were 92% and 100%, respectively. Vegetable grafting machines had an average grafting success rate of 67% and a rootstock and scion grafting efficiency of 2134 plants per hour.700 plants per hour are anticipated to be produced using an automated grafting equipment. Throughout the mango grafting procedure, the machine will multiply output by seven times. Success rate for the mechanical Whip and Tongue (99%) more than manual Whip and Tongue (95%) in grape grafting. The success rate of seedling cutting during the splicing grafting process of gourd and solanaceous seedlings in the vegetable grafting robot was 98%, which could satisfy the demand of the grafting technique. The rate of grafting was 884 plants per hour, with a 95.7% success rate and a 96.8% survival rate.

Cost Benefit Analysis

A Case study was held in grafted eggplants by comparison of the cost benefit ratio of both manual and semi automatic grafting methods. The study concluded that the labour expense of semiautomatic grafting was reduced by 0.5 times the manual grafting. By comparing the various expenditure, it was realized that remarkable lower cost price of more than 16.3% when compared with the manual grafting.

Conclusion

From these data, it is evident that Mechanized grafting techniques are more significant than manual grafting. These modern methods reduce the cost and number of skilled labours required. The modern grafting technique helps to produce many grafted plant materials in most of the horticultural crops within a short period of time and less use of labour. With help of this technique we will be able to propagate large number of seedlings that are required in a particular season more easily.

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18. HORTICULTURE

Trends and Practices in Senile Orchard Management System for Perennial Horticultural Crops

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Abstract

India is a sizable nation blessed with a variety of horticultural crops. Due to specialized new interventions and use of cuttingedge research technical equipment, there has been a significant growth in the output of horticulture crops, particularly fruits, and the nation is currently among the top fruit producing countries, ranking second only to China. Despite the favourable agro climatic conditions in the nation, quality fruit yield has been significantly low in recent years.

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This is due to increase in number of senile orchards. These Senile orchards can be renovated and the productivity can be improved which is discussed in this article.

Key Words : Senile orchard, rejuvenation, top working.

Introduction

India is the second largest producer of fruits and vegetables in the world. Large area is under fruit plantation. But the average productivity of orchard is getting reduced due to prevalence of senile orchards. At senility, due to continuous fruiting the twigs or branches or the entire tree loss their ability to produce vigorous branches that have the capacity to bear fruit. So, it is important to rejuvenate these senile orchards to improve their productivity. Nearly, 30 – 35 % of area in India, are under old and diseased orchards.

Characters of Senile Orchards

- Presence of more unfruitful branches.
- Yellowing of foliage, reduced growth and sickly appearance of trees.
- Branches begin to die from the tip and produce small sized fruits in less number.
- Trees will be of irregular shape and size.
- Restricted sunlight penetration due to overcrowding of branches in inner part of canopy.
- Reduced fruit yield and produces malformed fruits .
- More pest and disease incidence.

Causes for Senility

- Improper management of orchard by growers is the major cause for senility.
- Selection of unsuitable location and climatic condition for orchard establishment.
- Intercropping and inadequate nutrient supply.
- Planting materials of poor quality.
- Adopting inappropriate planting system.
- Pest and disease incidence.
- Biotic and abiotic stress.
- Not adopting proper intercultural and management practices like mulching, pruning etc.

Need for Rejuvenation

- Perennial horticultural crops have long juvenile phase. So, planting a new plantation is not advisable. It is better to rejuvenate these senile orchards to improve both quality and quantity of the produce.

Objectives of Rejuvenation

- To increase the productivity of inferior and low yielding varieties by converting them into superior and high yielding varieties.
- To improve the ability of plants to tolerate biotic and abiotic stress.
- To reduce pest and disease incidence.
- To improve economic age of plant.

Principle of Rejuvenation

- In order to improve root: shoot ratio, the trees are headed back at certain point and latent buds are activated which gives new sprouts. These sprouts grow into fruit bearing branches.
- As the branches are headed back, an imbalance is created in root: shoot ratio. In order to balance this, new shoots arise from the plant.

Management Practices Adopted in Senile Orchard

- The productiveness of old and unproductive trees in the senile orchard can be enhanced by top working.
- During Dec – Jan, the trees are headed back at about 2.5 – 3m above ground level.
- On cut portion, in order to prevent fungal infection cow dung paste or Bordeaux paste can be applied.
- After heading back, new shoots emerge below the cut portion. Only

few shoots at periphery are retained with proper spacing.

- During Mar – Apr, pruning and thinning of crowded branches is done. 2 to 4 healthy shoots which appear in opposite direction with wide crotch angle are selected and are encouraged to grow.
- Remaining unwanted branches are removed.
- During June – July, budding or grafting with any superior variety is done. Scion is selected from healthy mother plant of any superior variety.
- Either patch budding or modified ring budding or grafting is carried out on newly developed shoots.
- After budding, the side shoots which emerge on the pruned branches are removed regularly.
- During initial year, the production will be less due to small canopy area.
- From third year onwards, flowering and fruiting will occur on top worked trees.
- The production of rejuvenated trees increases in succeeding year. Some top worked trees will come into bearing within five years. But it varies depending on the budded or grafted cultivar.

Irrigation

Optimum soil moisture should be maintained for better flowering and fruiting of rejuvenated trees. To avoid drying of trees, immediate irrigation is given after reiterative pruning during dry spell. Irrigation should be given after application of manure and fertilizer. Generally, during summer and winter season, pruned trees are irrigated at 8 to 10 days interval and 15 to 16 days interval. This is adopted for most of the perennial horticultural crops. Basin system of irrigation is more suited but drip irrigation was also found effective in rejuvenated orchard.

Mulching

Mulching around pruned tree trunk in basin is practiced to conserve moisture and also to check weed population. Mulches like sugar cane thrash, paddy straw, dried grasses, dried leaves of banana, mango, litchi can be applied to a thickness of 10 to 15 cm. Black polythene sheet (200/400 gauge) can also be used as a mulch.

Intercropping

After three months of reiterative pruning, intercropping can be done at interspaces in rejuvenated orchards. Intercrops can be grown for a period of three years. These intercrops will give a significant income, also control weed growth, pest and disease incidence. Intercrops should not compete with the main crop for nutrition and water. They should not interfere the area where roots of main crop are concentrated.

Conclusion

Proper management of orchard by adopting appropriate intercultural and management practices is important for maintaining the productivity of perennial horticultural trees. As time goes orchard becomes old and improper management practices makes the orchard unproductive. Replanting of this old and unproductive orchard is a cumbersome process as perennial horticultural trees have long juvenile period and it is an expensive process. Hence, rejuvenation by top working is the best alternate method for restoring the productivity of senile orchard in short duration. The wood obtained after pruning also offers significant income to farmers.

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19. HORTICULTURE

Assessment Values and Importance of Seed Quality Tests in Nursery Vegetable Crops

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Abstract

A quality seed that's genetically and physiologically elite seed is wished by the farmers for their quality produce. To meet this demand the seed producing companies tend to give assurance for their seed by having various control measures. But as time passed the seed quality tests took a great advancement along with the technology. The Rigveda, 2000 BC indicate the importance accorded to seed and the mother earth. The evolution in scientific study resulted in development and release of new varieties.

The knowledge added with technology enhancement resulted in rapid development of seed quality control measures. These all resulted in quality produce and control, as well as examination. On the one hand, seed variety, or heterogeneity is a biologically useful phenomenon, that happened as a part of evolution helped in sustaining the stability in ecology. Such quality criteria take into account how a seed lot was generated, condition, deliver, treat, and store. Since vegetables are grown by using seeds as the main propagation material the quality of seed plays a crucial role. Treatment is the comparable use of materials and techniques to guard against the activity of storage pests and diseases or to limit the amount of dust produced when handling seed. The article addresses various aspects with regard to seed quality in nursery vegetable crops.

Introduction

The old scripture, Manu Smriti says "Subeejam Sukshetre Jayate Sampadyathe" i.e., good seed in good soil yields abundantly. In 5th century Kautilya Artha Shastra, Surapalas Vrikshayurveda mentioned importance of seed and mentioned about seed treatments to ensure good germination.

The Rigveda, 2000 BC indicate the importance accorded to seed and the mother earth. Seed quality has been treated as sacred, being an important factor in the improvement of agriculture and agrarian societies. The quality of a seed depends on the germination percentage. It must be free from pathogens, diseases, with proper moisture content and weight.

Low seed quality can occasionally cause a delay in the growth of domestic agricultural output. Uniform seeds with high field germination are required by contemporary technologies that allow for direct and exact planting of seeds in the ground, the elimination of crop thinning, and ways for regulating plant stands.

The rate of seed production in vegetable crops is very severe. Large morpho biological diversity, increased heat demand of the majority of species requires a careful approach to the organization of seed production. The majority of conventional seed quality control techniques are labour- and time-intensive and result in the destruction of the sample being tested. The use of automated seed quality evaluation techniques is made possible by contemporary scientific research, allowing for the quicker and more thorough collection of data.

Usually seed producers desire for varietal production but at the same time the variability in seed is not a great choice in agricultural production. On the one hand, seed variety, or heterogeneity is a biologically useful phenomenon, that happened as a part of evolution helped in sustaining the stability in ecology. Unevenness of seedlings, different productivity of plants and heterogeneity of products in terms of quality is largely determined by the poor quality of seeds.

Importance Of Maintaining Seed Quality

- Capacity to withstand the adverse conditions.
- Seedlings produced will be more vigorous, fast growing and can resist pest and disease incidence to certain extent.
- It will respond well to added fertilizer and other inputs.
- Ensures uniform growth and maturity.
- Easy handling in postharvest operation and yield prediction.
- Minimize seedling rate and maximize seedling emergence.
- High return per unit area as the genetic potentiality of the crop can be fully exploited.
- Good quality seeds of improved varieties ensure higher yield at least by 10 – 12 %.
- Development of root system will be more efficient that aids absorption of nutrients efficiently and results in higher yield.
- High produce value and marketability.

Seed Quality

In the production and testing of seed for sowing, quality is frequently viewed as a multi-component property that includes germination ability and vigour, varietal purity (genetic), analytical purity (the absence of contaminant foreign species and inert matter), "pure live seed," seed health (the absence of seedborne pathogens), moisture content, and the uniformity of mixing and blending.

METHODS OF TESTING SEED QUALITY

Purity Evaluation

A lot of seed has a quality that is reflected in the amount of inert matter, the number of weed seeds present, and the number of other crop seeds present.

Germination testing

Establishing the quantity by percentage of pure seeds with the capacity to generate established seedings in the field is the goal of official germination testing. In reality, the variety of tools and techniques employed affects how the outcomes from various laboratories differ. The germination test is carried out with a variety of substrates.

Substrates Used

Using paper as a substrate

- TP: On Top of Paper
- BP: Between Paper
- PP (Pleated Paper)

Using Sand as a substrate:

- S (in sand)
- TS (Top of Sand)

Vigour Test

Direct vigour test

- Corn Cold Test
- Deep Soil Method.

Indirect Vigour Test

- Tetrazolium technique
- Differential Permeability

Speed Of Germination

Respiration, stress methods, moisture, temperature, chemical soaks are other methods to estimate seed quality.

Importance Of Seed Treatment In Quality Maintenance

Treatment refers to a wide variety of materials, formulations, techniques, equipment, and processes that may be purposefully applied to seed after the application of conventional seed conditioning technologies. Treatment of seeds is done to improve seed physiological performance, "planting value," and physical handling characteristics, as well as to protect or enhance the growth of seeds, emerging seedlings, and established plants.

Various Seed Treatments

The primary pre-sowing seed treatments employed in contemporary, established agricultural systems may be divided into the following groups based on their goals and fundamental technology.

1. 1. Using pesticides or other crop protection methods to protect seeds and seedlings from pests and diseases that cannot be managed by resistant cultivars or by biological, cultural, physical, or hygienic techniques.
2. 2. Thermography, chemical immersion, or exposure to certain electromagnetic enhancements such as radiation, electrical or magnetic fields of varying intensities.
3. 3.Encrusting or pelleting seeds to change their colour or alter how they handle them in order to make planting easier. Pre-sowing therapy known as "seed priming" alters the physiological condition of the seed to improve germination.
4. 4.Seed physiological manipulations, including pre-germination, soaking or steeping, humidification exposure to plant hormone, or different energy sources.
5. 5. Application nutrients as symbiotic biological fertilisers.

Scientific Findings of Seed Quality and Treatments

- Grain soybean is the source of vegetable soybean. Comparative transcriptome and metabolome analyses of developing seeds from grain (Williams 82) and vegetable (Jiaoda 133) soybeans were carried out in order to better understand the improvements in seed quality in vegetable soybean.
- With an average pod length of 81 mm and a pod width of 15 mm, the size of the pod in lablab grew and reached a maximum at 20 DAA. At 15 DAA, 13 mm seed length, and 12 mm seed width, the largest possible seed was produced.
- The BCT-25 tomato cultivar's germination and seedling vigour under various priming treatments in an effort to improve crop establishment in the field. We primed seedlings with distilled water for 12 hours, 2% KH_2PO_4 and 93 ppm NAA (at 4°C) for 6 hours, 1% NaCl for 36 hours, 10% Polyethylene glycol (PEG) for 12 hours, 100 ppm GA_3, 5% KNO_3 (under dark condition), and 1000 ppm Thiourea for 24 hours, as well as the control (T_0).
- Boron Seed Coating 1.5 g B/kg Chickpea Improved seedling growth, nodulation, and grain yield.
- Tomato seeds treated with a coating inoculum of T. harzianum and P. fluorescens (either separately or together) exhibited significantly higher germination rates (more than 48%) and shorter mean germination times (less than 2.5 days.
- In their study of cucumber seeds, Pill et al. used a commercial T. harzianum preparation as a coating agent and found that coated seeds had better seedling emergence and seedling shoot fresh weight than uncoated seeds.
- In glasshouse trials, carrot and onion seeds were seeded primed with helpful microbes (Clonostachys rosea, Pseudomonas chlororaphis, Pseudomonas fluorescens, T. harzianum, and T. viride), and the treated carrot seeds emerged more quickly and with greater quality.
- Khan et al experiment 's with hot pepper under salinity stress found that hydro-priming for 12 hours and priming with calcium aluminium silicate (1:0.4:1; Seed:SM:Water) for 24 hours both significantly increased seed germination, seedling vigour, mean germination time, and marketable fruit yield in okra.
- The negative effects of salinity were successfully mitigated by priming with NaCl. The seedlings' vigour index, plumule and radicle length, dry weight, germination percentage, germination index, and germination speed were significantly increased as compared to the control.
- The build-up of proteins and antioxidant chemicals in the leaves

was positively impacted by the use of CNMs in the nano-priming of tomato seeds. The combination of CNMs + NaCl potentiated the rise in enzymatic and non-enzymatic antioxidant molecules, however this effect was more pronounced under NaCl stress.

Conclusion

The quality of seed is quite important in every step of the growth process. The findings and various methods discovered proves that seed quality and treatment are indeed crucial for quality produce. It is relevant to investigate the efficacy of beneficial microbes for seed treatments of the main crops whose cultivation cycle begins with direct seed planting, as seed quality is a fundamental aim of the agricultural business and several seed-treatment methods are currently accessible.

In reality, robust seedlings that emerge quickly have the capacity to make use of the resources at hand, tolerating biotic and abiotic challenges as well as other unfavourable environmental factors, and both germination and seedling vigour contribute to effective crop performance, thus all the aspects bring the conclusion as quality seed is equal to quality produce.

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20. HORTICULTURE

Law and Regulation in Commercial Horticulture Nursery Establishment

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Abstract

Planting material, such as seedlings, saplings, cuttings, etc., is nurtured, multiplied, and propagated in a nursery under ideal circumstances before being transplanted into beds that have been prepared. Production of profitable decorative crops is dependent on the availability of high-quality, true-to-type planting material. The establishment of a nursery is a lengthy project that calls for preparation and knowledge. Plants are fostered in nurseries by being given the best circumstances for growth to guarantee germination. The nursery significantly reduces the time needed to raise the following crop. Most annual flower harvests are grown from seeds, and a nursery is necessary to raise the seedlings. For the planting of cuttings and the sowing of seeds for roots and establishment, herbaceous perennials require nurseries. Woody perennials are cultivated from seeds in order to replicate the same genetic traits in the rootstocks through cuts,

layering, and grafts.

Introduction

In order to increase productivity, which is extremely low for horticultural crops in the area, a strong network of high-quality nurseries is required for healthy propagation and distribution of high-quality planting materials. At a horticulture nursery, plant materials such as seedlings, saplings, trees, shrubs, and other types of plant life are grown and cared for until they are either sold or placed in permanent locations. It is a very difficult work to grow the plant and keep it in excellent health; this calls for regular plant monitoring. At a nursery, the process of raising seedlings and caring for the young plants is ongoing. The proper handling, packing, and transport of nursery plants, the careful filling and moving of plants into new pots or bags, the use of mulch to reduce water use, the application of plant growth regulators for plant propagation, the proper handling, packing, and transport practices of nursery plants, and the efficient sale of plants by offering customer care services are all crucial elements in the management of a nursery. Aesthetics and beautification are becoming more significant due to the expanding cities and quickening growth of the country. Now that it is managed as a business, the horticultural nursery has advanced in status. Planting supplies are offered to the public by retail nurseries. Wholesale nurseries provide products to both commercial landscape gardeners and other nurseries. The demands of institutions or private estates are met by private nurseries.

Nursery Registration Act

Fruit nurseries must maintain a scion block, a seed block, and a stock bed and must only employ propagation material from these sources in order to produce certified nursery stock. A planting of registered trees that provides scion wood for the growth of approved nursery stock is referred to as a "scion block." The term "seed block" refers to the planting of registered seed trees that provide seed for growing seedlings that will be used to propagate certified nursery stock. The goal of the stool bed is to produce vegetatively propagated (clonal) rootstock utilized in the propagation of certified nursery stock. It is a method of planting self-rooted registered mother trees or mother stools. One of the main reasons our country's horticultural, plantation, and other crops are not more productive is the supply of low-quality nursery plants. The model nursery regulatory legislation was created by the Indian government in 1954. According to this comparison, some state governments have also passed their own state nursery registration laws in accordance with the available crops and regional specifications to guarantee that farmers have access to legitimate planting material. The Himachal Pradesh fruit nursery registration rules, for instance, were created by Act No. 15 of 1973. In accordance with the provisions of the Act, a request for a license to open a fruit nursery must be made in Form I and submitted to the appropriate authorities with a Treasury Challan in original for Rs. 100 payable to the relevant state's director of horticulture. The license is originally issued for a term of three years after satisfying all of the act's codal requirements. It may be extended further by submitting a renewal application to the appropriate authorities 90 days before the license's initial expiration date. However, despite the Nursery Registration Act, unlicensed local nurseries that only observe the norms and regulations are proliferating everywhere. They are also favored by the authorities' subpar or insufficient inspections. To provide high-quality seed, rootstock, and scion sources, a nursery should be registered. Inspection, testing, and disease, virus, and pest-free certification are all necessary for nursery stock.

Licensing Requirements Of Nursery

- Anybody who deals directly with the distribution of plants, plant products, plant material, or nursery stock is obligated to let the department know about offspring plants' existence and how they're being used. Before beginning such a firm, he or she needs get a nursery industry license.
- According to the local nursery statute, the aforementioned company or

individual(s) must renew their licenses for the nursery industry annually or every three years in order to keep their business operating.

Responsibility Of The Applicant

Upon receiving departmental permission, the applicant nurseryman will be in charge of choosing the places and ensuring the correct upkeep of planted plants that have been registered. In accordance with the department's guidelines, the nurseryman must keep a record of the dates of various operations and applications, as well as nursery stock of various crop kinds.

Location Of Planting

The department must approve the planting location, which must be in a place with low risk of infection or pest dissemination by drainage, floods, irrigation, or other channels. The department must authorize the rootstocks used to develop the fruit tree nursery stock, which must come from either registered seed trees or registered stool beds. A pre-plant nematicide should have been applied to the soil, or a soil sample taken before to planting should have revealed the absence of any viruses, vectors, or nematodes. When nursery stock that satisfies the standards is marketed, it must include the variety, interstock, and rootstock designations, if appropriate.

Refusal, Suspension or Cancellation

Every plant that is a component of a planting stock may have registration or certification rejected, suspended, or revoked under any of the following circumstances:

- If the nursery is not operating to the standards required by state or national government laws and regulations. Virus-infected plants or plants with abnormal traits may be found in the nursery.
- If, following routine indexing, a registered mother tree is discovered to be virus-infected.
- If, an inspection reveals that the pest control criteria have not been adequately followed if the plants have not been kept up adequately.
- If the registration number is used fraudulently.

Civil Penalties

Any section of the act that has not already been mentioned will result in a civil penalty, the confiscation or destruction of any plants, plant materials, or nursery stock found on the premises or in the shipment in question, as well as the suspension or revocation of the current license for the nursery industry or any future operating privileges granted under the act. The nursery serves as the foundation for horticulture's future growth. High-quality planting supplies are nursery centers for horticulture. On the caliber and veracity of the mother plants, the fate of the nursery hinges. In addition to genetic characteristics, mother plants should be chosen based on their availability and environmental adaption. An increase in planting material quality will have a big impact on both the productivity and output of horticulture as well as the food security of the world. As a result, nurseries are a need for horticulture, particularly in the Northeast. In 2014, the Ministry of Agriculture, Department of Agriculture, and Cooperation approved Central Institute of Horticulture for Accreditation of Horticulture Nurseries for Northeast Area for all horticulture crops. The National Horticultural Board, which is part of the Ministry of Agriculture, initially handled nursery accreditation under a voluntary method of recognition based on a system of graded certification of production system and procedure in respect of a potential nursery. The Ministry of Agriculture has agreed to authorize an institution or institute under this department to accredit nurseries for horticulture crops in addition to the current agency, the National Horticulture Board, in order to expedite the certification of such nurseries. Based on the standards and criteria created by the National Horticultural Board, the institution will accredit nurseries.

Nursery Grower Registration and Certification

Nursery producers can get Certificates of Registration from the Division. The proprietor of the company fills out a nursery grower application before starting business. An inspection of the operation is required before a Certificate of Registration may be granted to make sure there are no alien species, illnesses, or insect pests present. An first inspection report is produced and sent to the Albany office by a horticulture inspector after the inspection. After then, the Certificate of Registration is sent out and renewed every two years. At least once every licensing cycle, a horticulture inspector conducts further inspections. Businesses that transport significant quantities of plants or cultivate many crops annually are likely to undergo additional inspections.

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Answers to MCQs of previous issue

Q.No.	Answer	Q.No.	Answer	Q.No.	Answer
1	A	2	C	3	B
4	A	5	A	6	C
7	B	8	D	9	C
10	B	11	A	12	B
13	D	14	B	15	C
16	B	17	C	18	C
19	C	20	C		

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