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Future trends in protected cultivation: A review

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Abstract
Protected cultivation is one of the newest types of farming methods that can able crops that can be easy to generate is adopted for smart farming the plants that are cultivated can able to generate a new door for the increase of the GDP (gross domestic product) and also it gives a new environment and could provide a huge scope for the Protected cultivation, with some control over wind speed, humidity, temperature, mineral nutrients, light intensity, and atmospheric composition, can do much to improve our understanding of growth factors and input requirements to improve crop productivity. I went to so in the fields. Protected cultivation is a unique and specialized form of farming. Protective devices or techniques (windbreaks, irrigation, soil mulching) or structures (greenhouses, tunnels, furrow covers) can be used with or without heat. The intention is to modify the natural environment to extend the harvest season, often to earlier maturity, to increase yields, to improve quality and to improve production stability so that raw materials are available when they are available. It's about growing crops where they can't survive by allowing them to. No external production. The main focus is the production of high-quality horticultural crops (vegetables, fruits, flowers, shrubs and bedding plants).

Keywords: Smart farming, agroclimatic condition, protected device

Introduction
In the present condition, defended cultivation creates a big smash in husbandry, which gives a huge yield and can be an alternate source of the product. These innovations are not limited for opening doors at higher levels since increased production standards benefit producers with smaller landholdings as per the agricultural economic relevance. Protected cultivation is a type of agriculture that is precise, progressive, and parallel, encompassing nearly all aspects of agriculture and somewhat under closer examination of technical relevance to situations, as well as grower and market economics. Because protected cultivation includes a wide range of agricultural practices, this review attempts to bring its current status into the global arena by examining various aspects of this important and emerging field of horticulture. Production areas for crops have been growing a lot in recent years. This is because outdoor farming is more affected by weather than indoor farming. This is a big industry, and it is primarily dependent on the weather. (Wittwer, Sylvan *et al*, 1995) [15].

The land is an essential factor in the production of certain cereals, millets, and beats but as a specification, the further yield will be gaining many seasons. In conclusion, in the final affair, the profit isn't covering the essential requirements of the planter in many cases, or some cases, the total plutocracy is spent on paying back the loans. defended civilization has a good compass in the trending request at present and unborn conditions but as the situation in India the people aren't veritably much apprehensive of the defended civilization and there's a monopolistic system of the crops like only many crops will be taken into consideration to overcome this problem there should a stimulant towards defended civilization government needs to give the subventions for the upgradation of the husbandry culture and ingrowth of the GDP (gross domestic product). Substantially the fortune of the defended civilization is for only soft tender crops.

One reason protected cultivation is becoming more important is because of the changing climate. The world is getting warmer, and the amount of water available for farming is gradually shrinking. Pests and diseases are also becoming more common, and people are increasingly buying eco-friendly food. Consequently, protected cultivation is becoming more popular in India. Protected cultivation means growing crops in special, sealed containers that protect them from pests, diseases, and other problems that can damage them. This is usually more expensive than growing crops in open fields, but it can be more profitable.

The crops grown in protected cultivation tend to be more beneficial than those grown in open fields, and they can be rewarded with government subsidies.

Compass and significance of the protected cultivation

1. Advanced quality & quantum of manufacture over a long period
2. Use of water is optimised and there is a reduction in its consumption by 40- 50
3. Effective application of inputs
4. Prevalence of sickness and pests is reduced or excluded
5. Crops will be full-grown throughout the time.
6. Stylish technology for the artificial products of high-worth crops like flowers, medicinal shops, etc
7. further tone- employment openings for educated youth on granges
8. Manipulation of microclimate and bug- evidence point of the hothouse for factory parentage and, therefore, the elaboration of recent kinds and products of seeds

Objects of defended cultivation

Protection of shops from abiotic stress (physical or by the non-living organism) similar to temperature, excess/ deficiency water, hot and cold swells, and biotic factors similar to pest and complaint frequentness, etc.

- Minimised operation of water and controllable weeds growth
- Enhancing productivity per unit area.
- Minimising the use of fungicides in crop products.
- Promotion of high-value, quality horticultural yield.
- Propagation, an adaptation of high value, and addition to the crops are known to grow in specific regions
- Time-round and off-season products of flower, vegetable, or fruit crops.
- Product of complaint-free and genetically better transplants.

New trends of defended cultivation for ornamental crops

Adaptation of methods for agriculture for indoor greenhouse cultivation of flowers In India, growing vegetables in greenhouses is a more recent development that is being employed more often to produce premium goods for export during the off-season. Export-focused manufacture of ornaments only effective production will make a floriculture unit successful. Is fantastic and the quality is superb. Adopting the most recent technology in greenhouse manufacturing is required to ensure consistency in production quantity and quality while maintaining reasonable costs. Research on, for example, agricultural technology standardisation. Practical Utilisation of Cheap Greenhouses Rose, gerbera, carnation, and tuberose cultivation Always more productive and superior to the flowers (Sindhu, S. S., 2018) [11].

New trends of defended cultivation for vegetable crops

Vegetables are a good source of nutrition and have been consumed for decades. The upgradation will be taken up by the fantastic crops to be taken up a large number of growers, who are living in peri-urban areas of the country can successfully diversify their traditional husbandry by espousing or using colourful situations of defended civilization technologies for the production of horticultural crops looking to their coffers, the vacuity of arising request of usual and unusual off-season horticultural yield, time-round demand of high- value vegetables like slicing tomatoes, coloured peppers, and parthenocarpic cucumbers, etc. High-quality nursery raising in vegetables is the other area, where complete diversification in the traditional system of nursery caregiving is needed. The low-cost or medium growers have simple structures because of the lack of investment. Poly house civilization of vegetables is arising as a technical product technology to overcome biotic and abiotic stresses and to break the seasonal hedge to product-defended technology enhanced crop duration as compared to an open field condition. The loftiest number of fruit weights and yield were achieved in poly houses as compared to open field conditions. Different defended technologies displayed lesser net return and BC in the poly house while it was smallest in open field conditions.

New trends of protected cultivation for seed production

The cultivation of seeds is currently an important component for effective growth, and seeds produced in poly house structures are free from the pests and illnesses that are common in open agriculture. With the goal of producing seeds, several structures are used: The primary structures include climate-controlled greenhouses, semi-controlled greenhouses, naturally ventilated greenhouses, insect-proof net homes, walk-in tunnels, inexpensive poly-houses, and plastic low tunnels, among others.

1. **Climate and semi-climate-controlled glasshouses:** Glasshouses with temperature regulation or semi-climate control; poly houses are utilised for raising high-value exotic crops for hard growing seasons and increased yields. Otherwise, in an open field, the growth season is shorter. The high-value vegetables, such as sliced tomato products, cherries, sweet peppers, parthenocarpic cucumbers or etc., are suitable for growing within these structures. The main obstacle to using this type of structure is the initial or starting point of fabrication and ongoing cost of similar glasshouses, which substantially increases the cost of seed when compared to seeds produced under other structures or in open fields. Yet, both the yield and the quality of seeds under similar structures are always significantly greater.
2. **Naturally ventilated greenhouses:** Greenhouses have natural aeration; these may be utilised to grow tomatoes, sweet peppers, and cucumbers, including parthenocarpic cucumbers, summer squash, muskmelon, etc. as seeds. However, compared to climate-controlled or semi-climate-controlled greenhouses, the duration of cultivation and seed production is shorter.
3. Net houses that are insect-proof can be used commercially to produce sweet pepper, tomato, brinjal, and other vegetable seeds, such as cucurbits. These constructions can protect crops from viruses and other insects such as fruit bores during the rainy and post-rainy seasons. In comparison to all types of greenhouses, the seed yield is always lower, but the cost of production is also considerably lower.
4. Walk-in tunnels can be utilised for cucurbit seed production, such as muskmelon, watermelon, summer squash, bottle gourd, bitter gourd, etc (Nair, Barche *et al* 2014) [5]. High tunnels are used in temperate regions of the world to extend the growing season by warming the soil for crop development. (Lamont, William *et al*., 2009) [4]

Intercultural operations in protected cultivation

Training and pruning

The growth pattern, fruit-bearing pattern, and seed output are impacted by the source-sink connection in both solanaceous and cucurbit veggies. In the case of tomatoes, the growth habit may be indeterminate, semi-determinate, or determinate. In greenhouse hybrid seed production, indeterminate varieties/hybrids are favoured. Such plants can generate numerous fruit trusses and be grown for an extended period. Staked and upright-trained indeterminate tomato cultivars. To retain a single stem or a double stem at the most, side branches must be pruned. Deciduous or semi-deciduous types are less common and not favoured for greenhouse seed production. In the event of hybrid seed production, the first to fourth clusters at each branch are usually picked for emasculation. Terminal pinching is done after 6 weeks in single stems. Lateral shoots are removed regularly. Defoliation of the leaves begins only when the fourth cluster is formed. Training and pruning are routine processes in greenhouse tomato crops, so paying close attention is always beneficial for high seed yield. Pruning in sweet pepper is typically restricted to the shoots that grow on the stem below the first branching or to some of the weak side shoots. Because pepper leaves have low photosynthetic efficiency, a large area of active leaves is required to produce sufficient dry matter. Pruning is done only in a few cases where the growth is lush. Pepper stem structure is frequently too weak to take under protected cultivation.

Irrigation facilities and upgradation of the micro irrigation

The water system is a significant part of green yields in parched and semi-dry areas. A legitimate supply of water and supplements to plants is fundamental to guarantee opportune development, wanted yield and satisfactory organic product quality. A Dribble water system is one of the most proficient techniques for water and supplement application to agricultural harvests and is being elevated to improve water efficiency and supplement use productivity amid worries over water accessibility and natural corruption. It is a strategy for the water system where water is helped through a line framework to the mark of utilisation and water is applied as beads at designated spots (root spread region), leaving a portion of the space between the yields as dry. A Dribble water system has been suggested for a reception for generally dispersed harvests like plantations, vegetables and field crops like cotton and sugarcane. Numerous regions are encountering water shortages because of restricted accessibility. Rising food demand is supposed to keep on assisting in incrementing strain on water assets. Water the executive's specialists progressively concur that the best long-haul system for managing water shortage is the better efficiency of existing water assets, for example gathering additional food from restricted water assets. Consequently, the reception of water-saving systems for effective water use in farming is vital. Water saving in the trickle water system strategy is related fundamentally to the controlled utilisation of water in restricted pieces of the complete field when contrasted with surface and sprinkler water system strategies. Due to how water is applied by a trickle water system framework, just a piece of the dirt surface and root zone of the all-out field is wetted. Restricted wetting of soils additionally implies restricted exploitable zone for water and normally accessible supplements that plants developed with dribble water systems can use, requiring regular water and supplement applications. As an outcome, the framework should be more dependable since disappointment edges are extremely thin and botches are harder to survive. When the dependability of the framework is guaranteed, the restricted wetted zone of plants under the dribble water system framework serves to expand the viability of the water and minerals provided to the plants. Legitimate information on the ideas of water and supplement accessibility is fundamental to accomplishing the best yield from the speculations made in dribble water system frameworks. Biswas.

Water system: Appraisal of water necessity of the yield/plant viable is a significant stage for the plan and activity of any water system framework. The significance of measurement of water necessity can be checked from the way that regardless of the water system works on being utilised since days of yore, tests are as yet proceeding to evaluate water prerequisite of various yields. Generally, water system frameworks apply a known profundity of water because of the dampness stockpiling limit of soil and recurrence of utilisation is concluded in light of the wasteful use pace of the harvest. Under the trickle water system framework, recurrence of application is an administration choice relying upon the functional part of the framework too as harvest reaction to the recurrence of water application and water holding qualities of the soil. As a rule, any water shortfalls that lessen plants happening likewise decline the creation of biomass in all yields. Nonetheless, for the overwhelming majority of tree crops where the organic product is the monetary item, a decrease in biomass creation doesn't necessarily bring about an equal decrease in natural product creation. It has for quite some time been realised that natural products from trees developed submerged shortfalls that tasted better than those from completely watered trees. As of late, research results have recommended a few benefits of shortfall water systems including further developed natural product quality (for explicit natural products) combined with water investment funds. By the way, a few quality boundaries, for example, natural product size or appearance, might be adversely impacted. Essentially, there are two strategies to execute a shortage water system for a yield:

1. By diminishing how much water system water is applied,
2. By expanding the period between water system cycles. The two procedures are not difficult to carry out with a trickle water system.

Fertiliser interface to water

Fertigation: Fertigation is the utilisation of required composts/plant supplements (water solvent) with the water system water at a sluggish and controlled rate to meet the wholesome prerequisites at various phases of harvest development. Traditionally, the entire manure sum expected by a specific tree is applied in a few parts. Under Fertigation, the required measure of composts can be applied in 10-15 or more parts relying on the wholesome necessity at various phases of harvest. With fertigation, plants can get little measures of compost ahead of schedule in the crop‟s season when plants are vegetative. The measurement is expanded as natural product burden and supplement requests become and afterwards diminished as plants approach the end of the crop‟s cycle. This establishes the required measures of manure all through the development cycle, as opposed to only a couple of enormous portions. Fertigation results in

equivalent or higher yields with significant reserve funds in the compost when contrasted with customary. The right blend of water and supplements is the key to high return and the nature of produce. Safeguarded Development of Green Yields Composts (fluid or water-solvent) can be infused into the dribble framework utilising both of the following three strategies:

1. Manure tank: some portion of the water streaming into the framework is gone through a tank containing manure and coming about arrangement again joins the primary stream
2. Venturi: A venturi is introduced in a shunt pipe lined up with the primary line and making sufficient pull to such the compost arrangement into the framework
3. Fertigation syphon: A positive dislodging syphon is utilised to infuse compost arrangement into the mainline. The primary rules to conclude the sum, type and season of manure application are supplement request of the plants - all out as well as at various development stages; fruitfulness status of the dirt; physical-synthetic properties of the earth; compost qualities - supplement content and its structure, dissolvability, accommodation and cost of the accessible manure material and water system water quality. Information on the wholesome prerequisite of various yields is exceptionally fundamental for effective fertigation. It is vital to comprehend that the absolute nourishing necessity of organic product trees may not be impacted by the water system strategy. Be that as it may, it is normal practice under surface water systems to add the expected manures in 2-3 parts, while compost application might be planned for a huge number of parts according to the necessities of organic product trees while rehearsing fertigation. For example, for Guava plants it is normal practice under the surface water system to apply half of the required supplements (N, P_2O_5 and K_2O).

Other significant contemplations for the water systems and fertigation include

Fertigation recurrence, much of the time, isn't so significant as the right measure of the use of supplements to yield during a predefined period. On extremely sandy soils, more continuous fertigation may be important to try not to filter misfortunes. During stormy seasons, a mass infusion of a bigger measure of manure may be expected to prepare a crop when no water is required.

Phosphorus ought not to be brought into the trickle lines if solvent Fe particles are available in the water. When iron phosphate accelerates happen, flushing the framework with nitric corrosive breaking up the synthetic accelerates is the best way to eliminate the encourages from the water system lines.

The exhibition of a miniature water system framework may quickly break down on the off chance that it isn't regularly kept up with by checking for spills; discharging and cleaning channels; intermittent line flushing; chlorinating; acidifying (if vital) and cleaning or supplanting stopped producers.

Post-establishment framework observing is fundamental to guarantee ideal execution/manageability. Thus, select a vendor with the capacity to give proficient/specialised help.

Look at the wetted region at the surface of various plants. Any variation in the space of wetted surfaces, for fields with uniform soil types, demonstrates non-uniform water application accordingly showing the requirement for a few medicinal measures.

Trickle water system framework may not end up being viable assuming it is to be utilised for old plantations before being rainfed or inundated with surface techniques. A miniature sprinkler (35-250 mph), bubbler (270-480 lph) or bowl water system might be more reasonable for such old

plantations having spread root foundations. Nonetheless, a dribble water system framework might be more fit and efficient for recently developed plantations or high-thickness plantations

Management of insects by Integrated pest management

Greenhouse cultivation of high-quality vegetables and cut flowers have great potential for the past decade or so. About protected fruit and vegetable crop areas Cultivation, China 1st (27,60,000 ha), and India is 7th (25,000 ha) With the liberalisation of the economy and the emergence of new technologies, In agriculture, greenhouse cultivation in the agricultural field is increasing worldwide. This technology not only paves the way to higher levels but also for producers with Smaller land holdings because higher productivity levels keep agriculture economically important. This technology involves growing horticultural crops in controlled environments with Factors such as temperature, humidity, light, soil, water and fertiliser. that is Operated to achieve maximum production, while still allowing their regular supply (Rathee, Mandeep, *et al*. 2018) [9]

Robotics in protected cultivation

Automation is a good technology in which a part of robotic work is maintained. There are different types of machinery that involve the strategy of safeguarding technology. Safeguarded development is an escalated creative strategy with high speculation and functional expenses, consequently allowing just the creation of high-esteem foods crops like tomatoes, sweet pepper and cucumber, blossoms like roses, chrysanthemums and gerbera and many kinds of pruned plants. In Western social orders, this sort of creation has been gone up against with expanding the size of creation offices, rising work costs, expanding issues with the accessibility of adequately talented work, medical conditions of the representatives because of weighty and dreary undertakings and developing rivalry on the public and worldwide business sectors. Furthermore, accuracy cultivation approaches in which plants are treated on a singular premise are becoming normal since they empower to improve the amount and nature of yield creation while involving assets as effectively as expected. Given the ongoing imperatives on human work, this has prompted a significantly more grounded call for computerization and advanced mechanics. In the view of different operations like harvesting one of the criteria where mechanization recently has come up and established it (Van Henten, Jan *et al.*, (2013) [14].

India's Protected Vegetable Farming Issues or Challenges

While being very old, protected vegetable farming is relatively new in India. Exploiting the enormous potential of protected vegetable agriculture has received very little attention.

The followings are some limitations and issues that limit the cultivation of protected vegetables in India:

1. Despite the importance of vegetables like the tomato, cherry tomato, sweet pepper, and cucumber, no specific breeding work has been done to generate varieties or

hybrids that are appropriate for production in greenhouses or other protected environments. Because exotic seeds are so expensive, Indian farmers cannot afford them.
2. Even though some of these vegetable kinds are sold domestically, they do not match the requirements for export or higher-end markets.
3. Their high initial cost and ongoing operating expenses, climate-controlled greenhouses are not suitable for Indian growers.
4. Many regions of the country need a more regular power supply to run the greenhouses' heating and cooling systems.
5. In some regions, sun radiation during particularly crucial times may reduce the yields of specific plants, such as sweet pepper in Delhi conditions during the winter.
6. Not little has been done to standardise greenhouse and other protected structure designs for the country's many agro-climatic areas.
7. Potential vegetable crop production technologies have not been tested for the country's varied agroclimatic zones under various sorts of protected structures.
8. Materials for cladding the necessary qualifications are not easily accessible. Moreover, greenhouses lack the proper instruments for controlling the atmosphere.
9. There aren't any special research initiatives on cultivating protected vegetables.
10. For the provision of high-quality products to markets, there is a paucity of packaging and on-farm value-addition materials. (Sabir, Naved, and Balraj Singh.2013) [10].

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