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A Review Paper on Plasticulture

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ABSTRACT- In the previous decade, plastics have achieved tremendous advances in horticulture. Because of its structural integrity, chemical properties, and versatility, plastic has become a prominent material in our everyday lives. Drip irrigation, plastic mulches, packaging and storage for better product quality, and post-harvest management are just a few of the numerous uses for plastic in high-tech horticulture. The use of polymers in agriculture, horticulture, water management, food grain storage, and other industries is known as plasticulture. Despite the fact that the number of agricultural plastic manufacturers has decreased by 40% in the past 10 years, the use of plastic in horticultural crop production has risen significantly. The use of plasticulture in the cultivation of horticultural crops like veggies, tiny fruits, flowers, plantation crops, and ornamentals helps to minimize the sometimes severe weather changes that occur in various parts of the nation, particularly temperature, rainfall, and wind.

KEYWORDS- Horticulture, Plastic, Plasticulture.

I. INTRODUCTION

Plastics have gained critical headway in cultivation during the previous ten years. We know that plastics play a part in many organic product crops, from planting to post-collect taking care of and handling [1], [2]. From seed bundling through planting, proliferation, mulching, watering, collecting, natural product pressing, and safeguarding, plastic is used at each progression of the agricultural life cycle[3], [4]. Plasticulture is the term used to portray the utilization of plastics in horticulture. India fabricates around 5 million tons of plastic each year and uses roughly 0.35 million tons in agribusiness[5]–[9]. Plastics are utilized in nurseries to invigorate advancement and creation, as well as in mulching to control weeds and safeguard soil temperature and dampness, and in seedling and soil solarization compartments to limit bug and infection[10]–[12].

Plastic is entirely significant on the grounds that to its capacity to be shaded, dissolved, shaped, and squashed, as well as its minimal expense, light weight, impermeability to dampness and gases, and capacity to be moved into sheets or framed into filaments [13]. Higher strength/weight proportion, magnificent consumption obstruction, predominant warm protection properties, prevalent adaptability, protection from most synthetic substances, positive gas penetrability, astounding dampness hindrance properties, smooth surface bringing about diminished grinding misfortunes, phenomenal light contagiousness are a portion of the one of a kind benefits of plastic over traditional materials[14], [15]. Coming up next are the various strategies for involving plastics in natural product creation[10], [16], [17].

The Green Revolution, which underscored high-yielding assortment seeds, composts, herbicides, and worked on horticultural procedures, cleared over the Indian wide open like a wave [18]. We went from being food-grain-insufficient to becoming independent because of it. Be that as it may, horticultural yields should ascend couple with populace development. Another green transformation, or rather, a greener insurgency, is expected to keep up with food grain independence. To further develop Indian agribusiness, imaginative agro strategies should be utilized. Plasticulture is a combination of two words: plastics and agribusiness, and it is one of the imaginative utilizations of plastics. India's per capita plastic utilization is 9.7 kg/individual, far underneath the worldwide normal of 45 kg/individual. Subsequently, the utilization of plastics in agribusiness gives a critical potential to modernize Indian horticulture [7]. Plastics are utilized in plant and creature agribusiness, as indicated by the definition. Plasticulture is the utilization of plastics in agribusiness, cultivation, water the executives, food capacity, and different fields. Plasticulture applications utilize a scope of plastic materials and finished results for water saving, water system effectiveness, harvest and climate assurance, as well as finished result capacity and transportation. Plasticulture applications are the main backhanded horticulture input, bringing about dampness preservation, water investment funds, compost utilization decrease, exact application that is financially reasonable, plant insurance using nets, and imaginative bundling arrangements that assistance in expanding timeframe of realistic usability and during the assortment, stockpiling, and transportation of ice free produce [7], [19]. Plastics can possibly save a great deal of energy. They utilize minimal measure of energy in their assembling and transformation to conclusive merchandise. Plastics have various benefits over conventional materials, including a higher solidarity to-weight proportion, predominant warm protection properties, magnificent consumption obstruction, prevalent electrical properties, unrivaled adaptability, and impermeability to

water, synthetic opposition, and diminished grinding because of a smoother surface.

II. DISCUSSION

A. Mulching

To limit dissipation, keep up with uniform soil temperature, forestall disintegration, oversee weeds, enhance the dirt, or keep organic product spotless, a defensive covering like that represented in Figure 1 is spread or left on the ground [20]. These fill in as a dampness obstruction and a hindrance between the dirt and the environment. It helps with the guideline of soil temperature and microclimate in the plant root zone, bringing about expanded yield and harvest development. Plastic mulch may likewise assist with keeping soil wet and decrease weed advancement around plants. As a general rule, dark plastic mulch film is utilized in natural product creation, however two-sided shaded plastic mulch movies like yellow/dark, white/dark, red/dark, or silver/dark are additionally utilized specifically crops, which influence the miniature environment encompassing the plant and direct its energy transmitting conduct. Plastic mulch film comes in a variety of thicknesses to select from, depending on the kind and age of the plant. It comes in a variety of thicknesses ranging from 7 to 100 microns, but 25 to 50 microns is ideal for medium-term crops and 50 to 100 microns is ideal for long-term crops.

Figure 1: Illustrates the Mulching process [21]

Different advantages incorporate giving positive soil dampness to root and establish improvement, as well as an ideal climate for night crawlers and other advantageous soil microorganisms for crops, forestalling weed development, further developing soil microclimate, preserving water, compelling in dry land cultivating, expanding crop yield and keeping the harvest spotless, working on nature of produce, and forestalling soil disintegration and run-off. Mulching these days is finished utilizing LDPE (Low Density Polyethylene) as well as LLDPE plastic covers. In organic product creation, plastic mulch is applied at a thickness of 25 to 40 microns.

B. Drip Irrigation

Drip irrigation is the precise as well as controlled distribution of irrigation water and plant nutrients into the root zone of the plant utilizing a tight network of pipes at low pressure and at regular intervals through drippers/emitters [22]. The benefits of drip irrigation include improved quality, early crop maturity, water savings of 40 percent to 70 percent, weed control, fertilizer savings (30 percent) and labor cost savings (10 percent), efficient fertigation/chemigation, disease control, uses of saline water, soils erosion elimination, and suitability for uneven lands.

The unit constructed of plastics is rust resistant, which is the most essential characteristic of plastics in drip irrigation systems. Other features include UV resistance, a broad pressure compensation range, simple accessory installation, fracture resistance, and ease of rollback. HDPE plastics make up the majority of this system. The wall thickness of the sub lines and lateral lines ranges from 0.50 to 2.0 mm.

C. Soil Solarisation

Figure 2 shows how soil solarisation is often done during the summer months when the air temperature surpasses 35°C [23]. This is done by covering the moist soil with a transparent polyethylene sheet that has been exposed to the sun. Soil solarisation helps to reduce the use of weedicides/herbicides and pesticides by limiting the development of weeds, the incidence of bacteria, fungus, nematodes, and other soil borne diseases and pests, and the presence of bacteria, fungi, nematodes, and other soil borne pathogens and pests. Soil solarisation aids plant development by improving soil color, temperature, structure, as well as hydration, among other things. Soil solarisation is influenced by soil moisture, day duration, temperature, and sunshine intensity. For soil solarization, a 25 micron clear polyethylene film is recommended.

Figure 2: Illustrates Soil Solarisation process [23]

D. Protected Cultivation

Greenhouses are framed structures with glasses or plastic films coverings in which plant are cultivated in a partly or completely controlled environment. Greenhouse technology has played a significant role in bettering space use, producing crops in severe climatic conditions, and in regions with heavy rainfall. The greenhouse plastic sheet acts as a selective radiation filter. The "greenhouse effect" is a phenomena in which solar radiation travels through the greenhouse and captures the thermal energy generated by the things kept within. The cladding material has UV stabilized, lamp, anti-fogging, as well as anti-algae properties. Greenhouse cultivation is important because it can help to grow crops in a variety of climatic conditions by providing favorable conditions for planting and growing high-value crops for export markets. It can also help to increase yield, quality, as well as crop length of time, preserve moisture thus requiring less agriculture, cultivate off-season crops, and help to grow crops in a variety of climatic conditions and provides favorable conditions for planting and growing high-value crops for export markets. It also helps with the creation of early nurseries for different crops, as well as the hardening of tissue grown plants and grafts. Shed net, which is composed of polythene threads, is used in the construction of nursery structures. Various shed nets, such as 15 percent, 35 percent, 40 percent, 50 percent, and 90 percent, are available to decrease light intensity. It comes in a variety of hues, including green, white, black, blue, and red, as well as color combos such as green and black, black and black, green and green, and white and green. It aids with pest and disease management, microclimate modification, and insect proofing, as well as providing self-employment possibilities for educated young.

E. Propagation and Nursery

In proliferation, plastics are frequently utilized for layering and uniting. In uniting, polythene strips are utilized to interface the stock and scion. Different shaded poly-coverings were utilized in the layering system. Blue, red, and dark poly-coverings have a higher achievement rate in roots and endurance through expanding physiological movement (etiolation impact), which is expected for cell division and development. A nursery sack, plug plate, container, and hanging bushel are completely made of plastic in the nursery. It's not difficult to keep up with, relocate, plant, and migrate. Different sizes and thicknesses of plastic nursery sacks might be utilized concurring on the harvest.

F. Packaging

Bundling is one of the main parts of horticultural item dissemination and advertising. Between the homestead and the client, over 30% of horticultural item is lost. Significant distance transportation, environment, capacity conditions, and different taking care of all through appropriation and advertising of horticultural items are for the most part factors that should be thought of. Conventional bundling strategies, for example, wooden containers and jute sacks have various disadvantages, including the way that untreated wood can without much of a stretch become polluted with organisms and microorganisms, that the material might be excessively hard or unpleasant for produce, for example, delicate natural products, that the cartons should be discarded after use, and that the material is eventually more costly. Plastic materials utilized in natural product bundling incorporate LDPE (Low Density Polyethylene), HDPE (High Density Polyethylene), PP (Polypropylene), PVC (Polyvinyl Chloride), LLDPE (Linear Lowdensity Polyethylene), and PA (Polyamide). Plastic bundling is fundamental since it is adaptable, light weight, cost proficient, sterile, straightforward with the goal that the item should be visible from an external perspective, easy to print, reusable, and broadens the timeframe of realistic usability of the item. It is utilized in the development of different bundling materials, for example, adaptable plastic movies, plate with over wrap, punnets, net pack, froth sleeve, and containers, as well as the capacity, conservation, and transportation of new and handled natural products.

G. Sleeving

The sleeving method uses a 16-18 micron thick cylindrical plastic bag with both ends open to protect banana bunches from wind, rain, hail, dust, pests, and other elements. It is used when the fingers begin to curl upward. As the fruit develops, it shields the fruit's skin against leaf bug and bird damage. Fruits size is more consistent and bigger through the bunch as a result of sleeving, and the color is also improved.

H. Benefits of Plasticulture

The first driving variables for the utilization of plastics in agriculture were to work on the earliness and generally speaking harvest result of high-esteem green yields, to exploit unavailable creation, and to utilize a defensive covering that was pretty much as compelling as glass however significantly less exorbitant [24]. For most field delivered agricultural harvests when plastics are utilized, the improvement of earliness is connected to more useful and unsurprising generally speaking yields. Early response to plastic covers for vegetable harvests like tomato, cucumber, pepper, brinjal, melon, sweet corn, and cut blossoms is especially fundamental. Plastic covers are frequently utilized in light of the fact that they improve the nature of cut blossoms. Different benefits of involving plasticulture with column crop mulching or covers in the field incorporate water saving, a diminishing in soil supplement misfortune by means of filtering, weed control (especially for plant crops), insurance of plants from wind, hail, downpour, as well as bugs, and an increment in environmental CO2.

I. Plasticulture Technologies' Role in Post-Harvest Management

Plasticulture technologies are important in the area of postharvest management. As previously noted, plastics' features make them an attractive alternative for post-harvest management from field to consumer basket. Plasticulture technologies are utilized in post-harvest management for drying, short-term and long-term storage, material handling, and transportation of agricultural goods. A drying machine's operation is a simple method of preserving agricultural produce. Plasticulture technology, such as the polyhouse multitier drier, makes good use of changing microclimatic conditions while drying fruits and vegetables. High drying

rates, which reduce dyeing time, and great quality from open sun drying are two advantages of this plasticulture technology.

Agricultural goods may be stored and transported using the plasticulture process. It helps to keep food fresh for longer periods of time, from short-term to long-term storage. Packaging generates a microclimate for the food, increasing its shelf life and retaining its freshness. It provides a number of advantages, including ease of handling, transportation and storage flexibility, and lower operational expenses. The quality of agricultural products is preserved while storage losses are decreased. Some of the most well-known plasticulture technologies are plastic crates, bins, boxes, leno bags, unit packaging items, colorful shade nets, and Modified Atmospheric Packaging.

III. CONCLUSION

Mulching, cladding materials for protective structures, netting, pressurised irrigation, soil solarization, plastic traps, propagation, sleeving, and packaging are all examples of how plastics may be utilized in horticulture production. When compared to conventional methods, using plastics in fruit culture boosts yield while also reducing insect, disease, and weed populations, extending fruit shelf life, conserving fertilizers and water, and reducing herbicide and pesticide use. All across the world, plasticulture has been proved to increase agricultural yield. It's gaining traction in India as a way to increase agricultural yield and post-harvest management while reducing transportation and storage losses. Despite this, the actual benefits of plasticulture are not being realized at the farmer level due to a lack of knowledge, uniform designs and packages of practices, local level services, and the availability of inexpensive technology. In order to improve the overall production situation, the PET AICRP is striving to establish strategies for the use, development, and evaluation of efficient and cost-effective plasticulture processes.

There will be several new developments in plastics for controlled environment horticulture. Plastics allow horticulture crop output to grow vertically and horizontally while also enhancing the quality of the items produced. During the next decade, plastic films will be employed on a greater variety of crops and in poorer countries. Biodegradable polymers will be manufactured in the future to eliminate unwanted residues, solve disposal issues, reduce plastic pollution, and be more ecologically friendly.

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