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Plastic use in Horticulture

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INTRODUCTION

The agricultural sector has witnessedsignificant advancements over the years, and incorporating plastic materials in crop cultivation is a notable development. This practice, often called "plasticulture," involves using plastic products in various stages of cropproduction to enhance yield, improve efficiency, and reduce environmental impact. Here, we explore the different applications, benefits, and challenges associated with theuse of plastic in fruit crops.

Why Plasticulture?

A key component in energy saving is the use of plastics. They utilise the least energy during manufacture and transformation into final goods. There are clear benefits to using plastics instead of traditional materials Higher strength/weight ratio.

- Superior electrical properties.
- Superior thermal insulation properties.
- Superior flexibility.
- Impermeability to water, gas, etc.
- Resistance to chemicals.
- Less friction due to a smoother surface.

These are the main application areas of plasticulture technologies

Water management

Water management, using plastic film for covering ponds, canals and reservoirs

Drip & Sprinkler Irrigation

PVC & HDPE pipes used for water conveyance

Sub-surface Drainage

Nursery Management:

- Nursery bags
- Pro-trays, Plastic plugs, Coco-pits, Hanging baskets, Trays *etc.*
- Surface cover cultivation
- Soil Solarisation
- Plastics Mulching

Controlled environment agriculture:

- Greenhouses
- Shade net houses
- Plant Protection nets

Post-harvest Management:

- Plastics crates, bins, boxes, leno bags, unit packaging products *etc.*
- Controlled Atmospheric Packaging (CAP) & Modified Atmospheric Packaging (MAP).

Applications of Plastic in Fruit Cultivation

1. **Mulch Films**: Plastic mulch films are widely used to cover the soil around fruit plants. They help conserve soil moisture, suppress weeds, and maintain soil temperature. Mulch films can be either biodegradable or non-biodegradable. Example: strawberry, cucurbits.
2. **Greenhouses and Tunnels**: Plastics are used to construct greenhouses and low tunnels, providing a controlled environment for fruit crops. This allows for extended growing seasons, protection from adverse weather conditions, and improved pest and disease management.
3. **Irrigation Systems**: Drip irrigation systems, often made from polyethene, ensure efficient water usage by delivering water directly to the plant roots. This reduces water wastage and promotes healthier fruit development.
4. **Shade Nets and Protective Covers**: Shade nets made from UV-stabilized polyethene protect fruit crops from excessive sunlight, hail, and birds. These nets can also help in regulating temperature and humidity around the plants.
5. **Fruit Bags and Wrappers**: Individual fruits are sometimes wrapped in plastic bags to protect them from pests, diseases, and physical damage. This is common in crops like bananas, apples, and grapes.

Benefits of Using Plastic in Fruit Cultivation

1. **Increased Yield**: Plastic mulch and protected cultivation structures like greenhouses can lead to higher yields by creating optimal growing conditions and reducing plant stress.
2. **Water Conservation**: Drip irrigation systems made from plastic significantly reduce water consumption compared to traditional irrigation methods. This is especially beneficial in arid and semi- arid regions.
3. **Weed and Pest Control**: Plastic mulches suppress weed growth, reducing the need for herbicides. Protective covers and nets also help in managing pests without relying heavilyon chemical pesticides.
4. **Extended Growing Seasons**: Greenhouses and tunnels allow for year-round production of fruit crops, increasing the availability of fresh produce and potentially enhancing farmers' income.
5. **Improved Fruit Quality**: Plastic covers and bags can protect fruits from physical damage, pests, and diseases, resulting in higher quality produce with better market value.

Challenges and Environmental Concerns

1. **Plastic Waste**: Using non-biodegradable plastics in horticulture can lead to significant plastic waste, which threatens the environment. Improper disposal can result in soil andwater pollution.
2. **Cost**: The initial investment in plasticulture, including the cost of plastic materials and installation, can be high. This may be a barrier for small-scale farmers.

- **Sustainability**: While plasticulture offers many benefits, its sustainability is questioned due to the reliance on fossil fuels for plastic production and the challenges associated with plastic

3. **Microplastics**: The degradation of plastic mulch films and other materials can lead to the release of microplastics into the soil, potentially affecting soil

health and the broader ecosystem.

Innovations and Future Directions

To address the challenges associated with plastic use in fruit crops, several innovations are being explored:

1. **Biodegradable Plastics**: Research and development of biodegradable mulch films and other plastic products are underway. These materials break down naturally, reducing the environmentalimpact.
2. **Recycling Programs**: Initiatives torecycle agricultural plastics are gaining traction. Farmers are encouraged to participate in recycling programs to properly dispose of used plastics.
3. **Alternative Materials**: Scientists are exploring the use of alternative materials such as natural fibers and bio-based polymers for agricultural applications.
4. **Precision Agriculture**: Integrating plasticulture with precision agriculture techniques, such as soil moisture sensors and automated irrigation systems, can further enhance resource efficiency and sustainability.

CONCLUSION

The use of plastic in fruit crops has revolutionized modern agriculture by improving yield, quality, and resource efficiency. However, it also presents significant environmental challenges that need to be addressed through sustainable practices and innovative solutions. As the agricultural sector continues to evolve, the focus should be on balancing the benefits of plasticulture with the need for environmental stewardship and long-term sustainability.