GROWERTALKS

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The plastic world of horticulture

Staff

The plastic world of horticulture by Gerald Y. Kinro
Growing of any agricultural commodity is difficult. Competition in marketing of those products is great as consumers demand reliability and consistency in both quantity and quality. Those growing crops in areas where environmental conditions are more favorable for productivity and quality have a definite edge. Furthermore, some areas, especially those in colder climates, have a short growing season with extremes in temperature and precipitation. This limits their production, affects their reliability and gives rise to insect and disease pathogens to infest stressed plants.

The use of chemical controls for weed, insect and disease management has enjoyed success. However, the high costs of these pesticides and the potential for phytotoxic damage to the crop, environmental impacts, and worker health and safety has caused many growers to look at alternatives to pesticides and alternative means to modify the growing environment.

Enter plastics or plasticulture. It has grown in popularity, making agriculture literally a plastic world. It is not, as many would imply, a phony, artificial environment void of sincerity. Instead, it describes an industry so reliant on plastic products, including building materials, tunnels, mulch, irrigation systems, and row covers for the production of some crops.

Plastics have been used to effectively modify growing conditions by:

- Reducing temperature and moisture fluctuation
- Allowing the use of biological control agents
- Extending growing seasons
- Allowing the production of warm weather crops that thrive best in a constant and predictable temperature
- Allowing a more precise application of fertilizers
- Allowing a more precise irrigation schedule
- Reducing pesticide use
- Creating a safer environment for workers.

In summary, plastics have allowed growers to produce better crops economically and with greater safety to workers and the environment.

Made in the shade?

Besides plastic irrigation systems, the widest use of plastics in flower production is in construction materials for

growing areas. Greenhouses have enabled growers to raise flowers otherwise not suited for their locales by allowing climate modification. Hot areas can produce plants accustomed to cooler areas and vice versa. Short growing seasons have been lengthened. Plastics have assisted in the management of pests by excluding them and by habitat modification.

Exciting research continues and different plastics are being constantly introduced to suit the needs of the individual growers.

Lesson from a tomato grower

Colored mulches have been shown effective for cucurbits (cucumbers, melons, squashes), solanacious crops (potatoes, tomatoes, peppers), crucifers (mustards and cabbages), and corn. Unfortunately, there is no panacea. A single color is not suited for all crops, nor effective against all pests. While red plastic has shown to produce the best results in tomatoes for growth, Terence Shintaku of Green Growers, an outdoor hydroponic tomato operation in Hauula, Hawaii, installed silver mulch in his operation to control his whitefly problem. His results were dramatic: Not only did he effectively manage his whitefly problem, he experienced some control of thrips that vector spotted wilt virus. Furthermore the increased reflected light yielded better plants that bore more fruit, jumping his summer production from the average 7,000 pounds per acre per week to 9,000 pounds per acre per week, an increase of nearly 20% of quality marketable fruit.

Living in the light

We have been taught to believe that the sun's ultraviolet rays (UV) are the devil and for good reason: UV has been shown to cause many health problems, including cataracts and some forms of skin cancer. It is also damaging to building materials, even those that are used in greenhouse construction.

But according to Dr. Bill Sakai, a professor at the University of Hawaii at Hilo, UV is not all bad. The pigment anthocyanin, which is responsible for a flower's color, is formed from a flavenoid. For pigmentation to occur, the pH in a cell’s vacuole must be at an optimum. UVB light increases the amount of flavenoids and brings vacuolar pH to an optimum. The result: a better color. He also points out that many flowers have been bred for growing in an environment that lacks UVB. In these cases, there will be little if any change. However, there are enough varieties of flowers whose colors are enhanced with UVB light, such as many varieties of orchids.

In Hawaii, many growers use shade cloth as a cover in orchid production. This has worked in color enhancement as this material will cut down the total amount of light but not filter UVB. However, the porous nature of shade cloth allows water dripping in moist areas, consequently making the plants vulnerable to many diseases.

To capitalize on this, manufacturers have created greenhouse film that lets in UVB light. With this cover, many growers in wet areas can enjoy the benefits of better-colored blooms with fewer diseases.

It does not end here. As we learn more about light, its components and their effects on plant growth, plastic materials that filter other types of light enter the marketplace all to fit the individual grower’s needs. In many areas, consumers are demanding flowering pot plants that are more compact. This trend actually helps growers, of course, because a smaller plant occupies less bench space, allows more plants to be grown, and is easier to ship. Growth retardants have been effective in delivering this type of plant. However, research has shown that plastic covers that filter far-red light may present a chemical-free solution: Far-red filters affect the activity of gibberelic acid, a growth hormone, which limits cell elongation and restricts growth.

Some markets, however, require larger plants and plastic covers are once again a practical solution: Blue light encourages apical dominance and covers that filter this type of light reduce apical dominance, which brings about more branching.

For more information on plasticulture, contact the:

American Society for Plasticulture, 526 Brittany Drive, State College, Pennsylvania 16803, United States. Tel: (1) 814 238 7045; info@plasticulture.org

http://www.plasticulture.org

Being well-grounded

Some of the most exciting new uses of plastic has been as mulching materials, although the use of plastic mulches in crop production is not new. Black plastics have been used for many years as mulch—to control weeds, retain soil moisture, and to manage soil temperature.

New research indicates that plastic mulches of different colors can do everything from fool pests to encouraging crop growth. For instance, certain pests (such as whiteflies and aphids) do not perceive plant shapes but instead various wavelengths of light. Reflective mulches, especially the silver ones, emit ultra-violet rays (UV) that have a repellent effect on these insects. Colored mulches are also able to fool the crops themselves. The mulches reflect light, and with more total light, there is better growth and more photosynthesis. The results are healthier plants, and possibly, bigger and better tasting fruit. There is also another angle to the plastic mulch's ability for deception: Plants, as living things, are competitive by nature. Reflective mulches encourage competition by mimicking plants when they emit colored light. A plant picking up these cues thinks that there are other plants nearby, which activates competition, causing the plant to take in more positive inputs such as water and nutrients. The result is better plants. While on the increase, the use of colored plastics is still relatively new with new discoveries being made. Nevertheless, growers are picking up this practice and the use of polyethylene mulch has increased dramatically in the last 10 years.

While most of the research in this area has been in vegetable production, there is also acknowledgement that the use of plastic mulches in flower production has great potential. It may enhance plant growth and help manage pest problems. With this, we can conclude that the plastic world of horticulture is likely to grow.

—Gerald Kinro is a horticulture consultant in Hilo, Hawaii, United States. gkinro@hgea.org