Practical Aspects of Wavelength Selective Spectral Films on Nursery Stock Production in Ireland©

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We evaluated the suitability of a number of wavelength selective spectral films for the production of nursery stock in Ireland. We clad 12 tunnels with two replicates of six films (Superstrength 600, Supergreen 720, Clarix Blue, Sterilite HDF, Superstrength 400, and Celloclim) and grew a range of bedding plants, shrubs, and soft fruit in them. We assessed the crops for a number of production and quality parameters including colour intensity, growth, earliness of flowering, and pest and disease levels. In general, we found few significant differences between the films and attributed this mainly to insufficient replication. Of the significant differences we did find, Superstrength 600 and Superstrength 400 produced plants with greater colour intensity, Supergreen 720 produced plants with a higher weight of prunings and Sterilite HDF caused the earliest flowering. Superstrength 400 had a significantly higher level of pests associated with it.

INTRODUCTION

Polyethelyne greenhouses are widely used in Ireland as an alternative to glasshouses to accelerate growth and improve quality of nursery stock. In recent years, improved polyethylene films have been developed which are longer lasting, heat retentive, and contain pigments that control the wavelength of solar radiation entering the structure. Wavelength can therefore be manipulated to control pest and disease levels and improve plant growth. These films offer exciting potential benefits for horticulture and have been investigated in other countries, for example Germany (Hoffman, 1999a; Hoffman, 1999b), but have not yet been evaluated for use under Irish conditions.

This paper describes an experiment which compared six films and presents the most significant results from studies of their effect on a range of production and quality parameters for bedding plants, soft fruits, and shrubs.

MATERIALS AND METHODS

We erected twelve 12-m × 4.2-m polythene tunnels on a sheltered site at Kinsealy Research Centre, Dublin. The experiment was divided into two randomised replicates and within each replicate we clad each tunnel with one of six polyethylene films, chosen in order to evaluate their usefulness for nursery stock production. The films used and their properties are listed in Table 1.

We installed capillary bed irrigation systems in each tunnel along with temperature and humidity sensors connected to a central datalogger to allow continuous monitoring of internal climate conditions.

Table 1. Polyethelyne films tested.

Film	Characteristics
Superstrength 600	Control treatment
Supergreen 720	Filters near infrared, shading
Clarix blue	Filters UV, disease control, reduces plant growth
Sterilite HDF	Filters UV, reduces heat loss
Superstrength 400	Increases UV level
Celloclim	Filters UV

We chose the experimental crops to represent particular plant characteristics and needs including flowering, leaf colour, shade tolerance, and susceptibility to diseases and pests. We grew a combination of shrubs (*Ceanothus thyrsiflorus* var. *repens*, *Skimmia japonica*, *Lavandula angustifolia* 'Hidcote', *Prunus lusitanica*, *Viburnum tinus* 'Eve Price', *Hebe speciosa, Photinia* ×*fraseri* 'Red Robin', *Ilex aquifolium,* and *Escallonia rubra*), bedding plants (*Antirrhinum* sp., *Clarkia* sp. (syn. *Godetia* sp.), *Aster* sp., *Dianthus barbatus* (sweet William), and *Nemesia*), and soft fruit (strawberries, *Fragaria* ×*ananassa*) in containers under each type of film in a randomised block design. We potted them in a standard peat medium containing Osmocote Exact Standard 12-14 month controlled-release fertiliser.

Plant growth and development was assessed during the growing season. We recorded plant height and spread, time of flowering and number of flowers, intermittent pruning weights,and fresh weight at harvest. Some characteristics such as saleability, colour intensity of leaves and flowers and taste were evaluated on a one to ten scale by an experienced panel.

Pest levels were evaluated visually using a one to ten scale and with the use of sticky yellow Easistik traps, placed in each house at regular intervals during the growing season. We also monitored the plants visually for disease.

RESULTS

Colour Intensity. In our measurements of the colour intensity of the *Lavandula* crop, Superstrength 400 and Superstrength 600 produced the highest intensity scores (8 or greater) while Celloclim, Supergreen 720, Clarix blue, and Sterlite HDF resulted in crops with low intensity scores (5 or less). Similar results were found for *Cotinus*, with Superstrength 400 and Superstrength 600 scoring more than 7 and Celloclim and Supergreen 720 scoring less than 3 (Fig. 1).

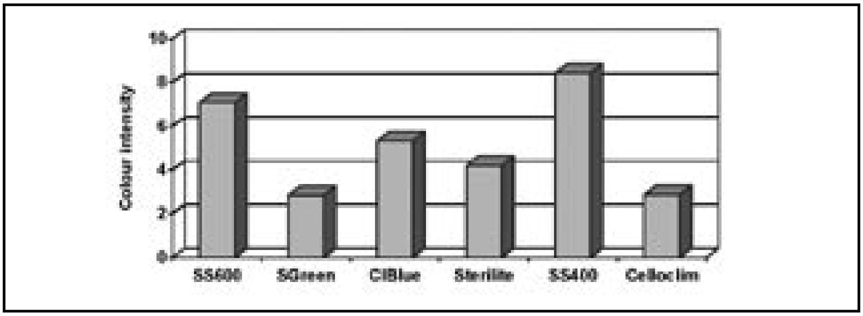

Figure 1. Leaf colour intensity of *Cotinus.*

However, there were no significant differences registered between the films in the saleability scores for both *Lavandula* and *Cotinus* and no significant differences were found between films when the number of flowers per plant was assessed.

Pruning and Crop Weights. The fresh weights of *Ceanothus* and *Photinia* were not significantly different between the films. There was no significant difference in the weight of early season *Escallonia* and *Photinia* prunings between any of the films. *Cotinus* has been pruned twice and the pruning fresh weights show no significant differences between any of the films. *Escallonia* grown under Supergreen 720 produced a significantly higher fresh weight of prunings than those grown under any other film (Fig. 2). The fresh weight of prunings from *Hebe* grown under Superstrength 400 was significantly lower than from those grown under other films.

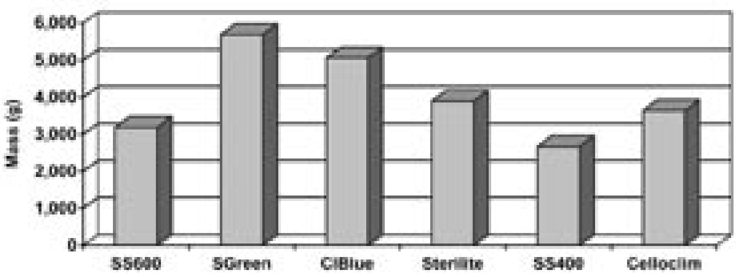

Figure 2. Fresh weight of *Escallonia* pruning.

When we compared the total fresh weights of prunings from all the shrubs under each film we found that Superstrength 400 produced a significantly lower weight than any other film.

Although there was no significant difference in the fresh weight of *Prunus* cuttings between the films, this crop did produce significantly longer internodes, and therefore grew taller, under Clarix Blue.

No significant differences were observed between fresh weights of the destructively harvested bedding crops. *Antirrhinum* under Sterlite HDF flowered significantly earlier than under Celloclim or Superstrength 400.

DISCUSSION

The experiment is on-going but by the time of this presentation we had not recorded many statistically significant differences between the films for the parameters studied, even though the measured differences in some pruning yields between the films have been quite large — and this may result from insufficient replication. We plan to select some of the films for further study and then strip the other claddings from the tunnels, replacing them with the selected films. This will allow greater replication and any significant differences should then become statistically apparent.

Plants grown under increased levels of UV light have lower growth rates than plants grown under standard conditions (Hoffman, 1999a). Plants grown in tunnels clad with Superstrength 400, which increases the ratio of UV light, had lower pruning weights than plants grown in other tunnels. This may be a result of the increased ratio of UV radiation or to a significant difference in pest numbers found between Superstrength 400 tunnels and all of the other tunnels, during the harvest period.

Growing *Chrysanthemum* species and bell pepper (*Capsicum annuum*) under films that selectively decrease the amount of infrared light has been shown to reduce stem elongation, plant height and plant weight (Hoffmann, 1999a; Li et al., 2000). However, in our experiment we found that *Escallonia* plants grown under Supergreen 720, an infrared filtering film, had significantly higher weights than those grown under the other films. Further work is required to examine this result.

We would also like to focus on particular plant-film interactions so that we can develop production systems in which, for example, plants are initially grown under a growth- promoting film and then transferred to a film that enhances flower or foliage colour. Such systems could reduce production time while improving aspects of quality.

LITERATURE CITED

Hoffman, S. 1999a. The effect of UV-radiation on colours of leaves and flowers of ornamental plants. Gartenbauwissenschaft 64(2):88-93.

Hoffman, S. 1999b. The effect of photoselective cladding materials on the growth of ornamental plants II. Effect of UV range on stem elongation. Gartenbauwissenschaft 64(4):183-189.

Li, S., N.C. Rajapakse, R.E. Young, and **R. Oi.** 2000. Growth responses of chrysanthemum and bell pepper transplants to photoselective plastic films. Scientia Hort. 84(3-4):215-225.

Disease Management on Nurseries: Cultural Aspects and Developments in Chemistry©

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INTRODUCTION

Disease control and prevention on nurseries has always been complex because of the diversity of plant species and cultivars, the range of cultural systems, the lengthy production periods, and the number of times plants are moved.

To add to the complexity, the globalisation of trade in ornamentals has seen the introduction of previously unknown pathogens such as *Phytophthora ramorum*. In Ireland, the incidence of this disease and of fire blight (*Erwinia amylovora*), is still relatively low (Table 1a and 1b).

We are also seeing the withdrawal of many plant protection products, resulting in fewer approved products for nursery stock use. Nurseries are increasingly using substances such as nutritional chemicals, micronutrients, and plant derivatives to help manage diseases. In future growers will need to take an integrated approach involving cultural practices as well as chemical applications to prevent and control diseases.

CULTURAL ASPECTS

Successful control demands constant vigilance and attention to detail. Cultural aspects are of prime importance and the application of fungicides and other meth-