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# Coloured mulch as a weed control technology and yield booster for summer savory

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## Summary

An investigation into the effect of coloured mulch technology as a technique to control weeds when growing the essential oil plant, summer savory (*Satureja hortensis*) was made. As well as weed control, the effects on the production of crop biomass and essential oil content and quality were also considered. The mulch treatments produced significantly more biomass than either of the control treatments (which used no mulch either with or without herbicide). The white mulch treatment produced the greatest biomass, closely followed by the red mulch treatment. The blue mulch treatment was third in ranking, although not significantly greater than the black mulch. Estimates of the quantity of essential oil produced by each treatment followed a similar trend to that shown by biomass production.

**Key words:** Plastic mulch, colour, *Satureja hortensis*, essential oil

## Introduction

A major problem associated with novel crops, as with organic crops, is weed control. Summer savory (*Satureja hortensis*) is being investigated for its essential oils, as these possess both antioxidant and anti-microbial properties, and have the potential to be used as health supplements for both humans and animals. Agrochemical use is likely to reduce the marketable quality of the extracts because of the risk of contamination with pesticide residues, so production without resorting to herbicide use will enhance the quality and saleability of the product.

The use of mulches is a well recognised method of reducing weed pressure on high value herb and horticultural crops, and the technology is potentially a viable option for summer savory. As the use of mulches is expensive, any additional benefits to its use should be exploited to the full. The use of coloured mulches has been investigated in a number of studies in which the spectral qualities of the reflected radiation on the underside of a number of crops including tomatoes (Kasperbauer & Hunt, 1998), strawberries (Kasperbauer, 2000), Brassicas (Antonious *et al*., 1996) and pepper (Kasperbauer & Wilkinson, 1995) was altered. These studies concluded that changes in the spectral quality of the light caused by the mulches can effect the crop's accumulation and partitioning of secondary metabolites including lipids, sugars and glucosinolates, with this being attributed to stimulation of the plant's phytochromes. Studies in growth cabinets with light quality altered by the use of spectral filters to change the ratios of red, far-red and blue light (e.g. Halva *et al*., 1992) have shown that the growth, flowering and essential oil characteristics of dill (*Anethum* *graveolens*) and chamomile (*Matricaria recutita*) can be changed by such treatment. The present paper describes a preliminary glasshouse experiment to evaluate the potential use of coloured mulch for both weed control and improved accumulation of the desired essential oils in summer savory.

## Materials and Methods

The experiment was undertaken in a glasshouse at SAC Aberdeen with the aid of supplementary lighting (400W Son-T Agro) to maintain a 16 hour day length. Seed of the summer savory was supplied by CN Seeds, Ely, Cambridgeshire, England and had been sourced from northern Europe. Seed were sown in general purpose compost in seed trays before being pricked out and transplanted into 2 cm plug trays where they were grown on to the 4–5 leaf growth stage. On transplanting to 20 cm square pots containing general purpose compost, additional N fertiliser was added (equivalent to 100 kg N $ha^{-1}$). 20 g of soil from a known weedy field was placed on the surface of the compost.

Six treatments were used, four using coloured mulches (white, red, blue and black) and two controls, one using propachlor (off label approval) and one without. In order to maintain uniformity of the porous black plastic mulch, the colour was applied using car spray paint, including the black treatment. A spectrophotometer was used to quantify the quality and quantity of the light being reflected from the mulch treatment surfaces. Seedlings were transplanted through 4 cm cross slits in the sheet (1.5 $m^2$ used per 'plot'), or directly into the control pots. After a light watering, the herbicide treatment was applied to the appropriate pots at 480 g $L^{-1}$ (a.i.). All pots were watered regularly during the experiment. A randomised block design was used with each 1.5 $m^2$ 'plot' containing a four by four matrix of 16 pots each with a single summer savory plant. Each 'plot' represented one treatment and was lined with a 40 cm high screen of highly reflective mylar film in order to prevent light pollution between treatments. There were four replicates of each treatment.

Plants were harvested at full flower and were cut just above the soil surface. The percentage of weed cover for each plot was estimated in order to evaluate the effectiveness of the weed control properties of the treatments. The dry biomass of the summer savory was measured as was the quantity of essential oil from each treatment. The results were statistically analysed using the ANOVA function of GENSTAT (Genstat 5 Committee, 1992).

## Results and Discussion

At harvest, significantly more weed cover was produced by the treatment with no weed control measures, at approximately 60% coverage of the plot. The treatment applied with herbicide had the second highest weed cover (around 45%), although this did not differ significantly from the mulch-treated plots with the exception of the red mulch treatment (around 18% coverage). These data are shown in Fig. 1. The reason why the red mulch produced significantly less weed cover than the other treatments was not immediately apparent, although it is possible that the red mulch created a favourable spectral environment that induced weed seed germination or seedling growth compared to the other treatments (Mayer & Poljakoff-Mayber, 1982). There is the possibility that the random soil samples taken from the weedy field and placed on the top of the compost may have contained a greater proportion of large prostrate weeds than the other treatments. The other mulch treatments, although not significantly different from the herbicide treated control in terms of weed coverage at harvest, would have a potentially greater marketing advantage over the herbicide treated crop (Kleinhenz *et al*., 2003). A reduction in the size of the slits used in the mulch through which the transplants were positioned could also significantly improve the weed control performance of the mulch, irrespective of the colour. Data (not shown) were collected for the dry weight biomass of the weeds, although this proved to be extremely variable with no significant differences apparent between treatments.

Significantly more crop biomass and essential oil was produced by the white mulch treatment than all of the other treatments, with the red mulch treatment producing more than the blue and black mulch treatments although this was not significant. The two non-mulch control treatments (with and without herbicide) produced significantly less crop biomass and essential oil per unit area than all the of the mulch treatments, although they were not significantly different from each other in this respect. These data are shown in Fig. 2. The lower crop biomass and associated essential oil volume harvested from the non-mulch treatments was probably due to the bare soil being less effective at retaining soil moisture than the mulch treatments, as temperatures during the experiment rose to more than 40°C at times, even with glasshouse ventilation.

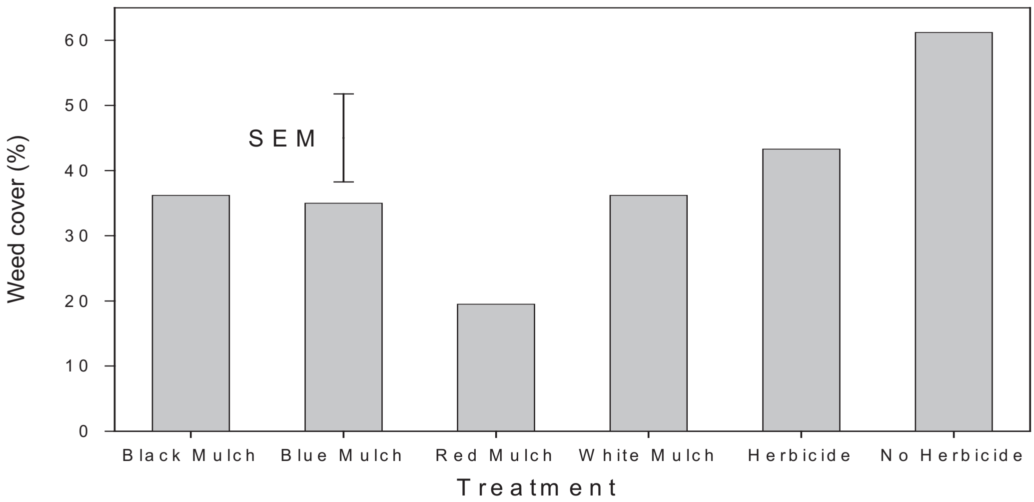


Fig. 1. The estimated percentage of weed cover at harvest for each treatment.

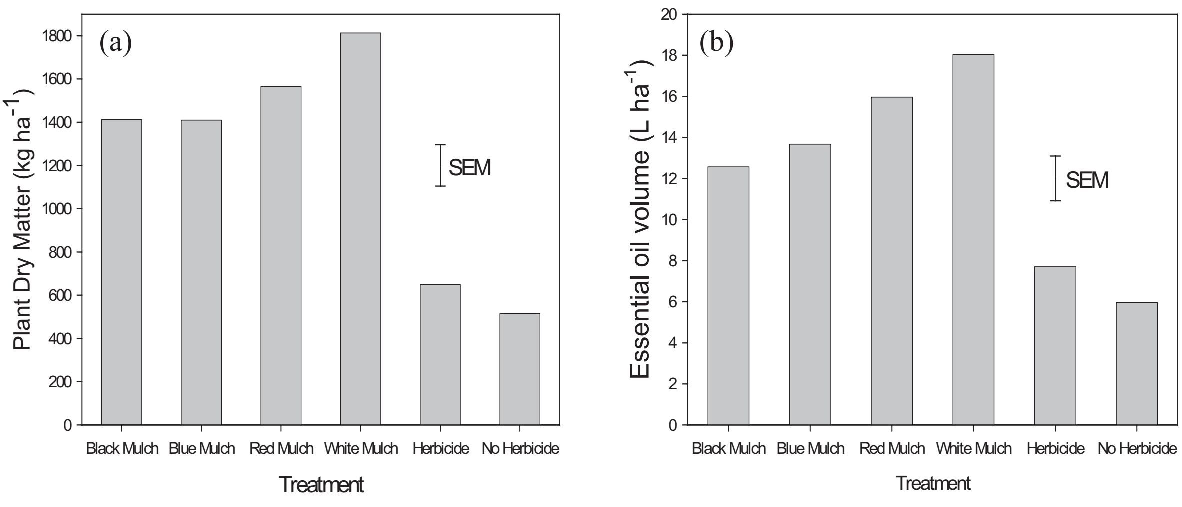


Fig. 2. (a) the estimated summer savory biomass produced by each treatment at harvest; (b) the estimated volume of essential oil produced by each treatment.

In terms of the mulch treatment effects on biomass and essential oil volume at harvest, the trend for the white mulch treatment to produce the most, followed respectively by the red, blue and black treatments, was thought to be closely associated with the quantity of photosynthetically active radiation (PAR) that was reflected onto the underside of the crop (Beadle *et al*., 1985). This mirrored the trend shown by the light quality reflected from the mulch treatments themselves (Fig.

3). There may have been interactions between the mulch treatments and the light quality reflected from them onto the plant phytochromes, but this experiment was unable to quantify this.

Treatment interactions between the crop biomass and essential oil production exacerbated the trend found for biomass alone, with the interactions having a multiplying effect on oil produced per unit area.

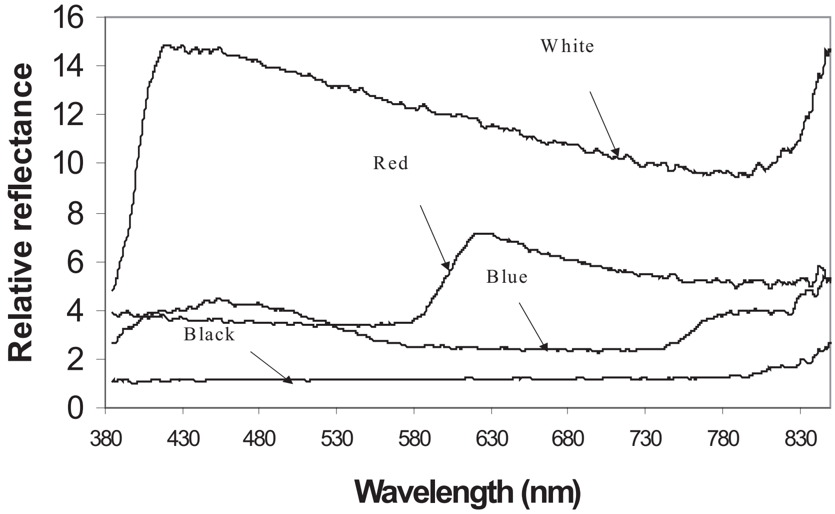


Fig. 3. Light quality and relative quantity reflected by the coloured mulch treatments.

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