



Evaluation of mulch colour for enhancing winter-strawberry production under polyhouse in mid-hills of Himachal Pradesh

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ABSTRACT

Strawberry cultivation in Himachal Pradesh is mainly based on outdoor planting using hay as mulch and, very recently, using black polythene as mulch. The bulk of its production under field conditions usually occurs in April-May when market price is quite low. In an effort to make the crop remunerative through enhanced winter-production, a polyhouse experiment was set up to investigate influence of mulch colour on off-season fruiting response, fruit size and quality in strawberry (*Fragaria x ananassa* Duch.). Plants of cv. Chandler were planted in September, 2004. Irrigation was imposed using the given through T-Tape system, from 8.00 AM to 5.00 PM. Yellow plastic mulch significantly increased number of fruits, effected early and higher total yield compared to black or silver-over-purple plastic mulches. Un-mulched bed produced lowest yield and fruit quality. Yellow plastic mulch raised soil temperature by at least 2°C compared to the un-mulched bed.

Key words: Strawberry, polyhouse, mulch colour, fruit yield, fruit quality

INTRODUCTION

Strawberry (*Fragaria x ananassa* Duch.) is one of the important small-fruit crops, belonging to the family Rosaceae. It is a rich source of vitamins, minerals and has a tantalizing flavour and aroma. The added advantage with strawberry is that it gives early and very high returns per unit area compared to other fruit crops because the crop is ready for harvest within six months from planting. Though previously concentrated in the temperate region, with advent of day-neutral cultivars, it is now profitably grown in the tropical and sub-tropical regions as well. In India, a sizeable increase in area and production of strawberry has been observed in recent years. Being highly remunerative, it has become very popular among growers, especially, closer to towns and cities. In India, Maharashtra is a leading state in production of strawberry fruits. It has also become popular in the plains and hilly areas of Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Rajasthan, Punjab and Haryana, as a low-volume, high-priced fruit crop, in places where sufficient irrigation facilities exist.

In Himachal Pradesh, strawberry cultivation has gained momentum only in the past few years and the area

under cultivation is 13 ha, with a total production of 89 MT (Anonymous 2006). Generally, it is planted in the second fortnight of September under open conditions by traditional methods using hay-mulch and, very recently, using black plastic mulch (to a small extent). The bulk of production under field conditions usually occurs in April-May, when the average market price is quite low. High market-price can be realized if winter-production is enhanced. Thus, the key to maintaining profitability in the strawberry industry in Himachal Pradesh (and thereby, commercialization of the crop) is enhanced winter-production. This can be done under controlled environment, along with use of micro-irrigation system and coloured mulch for better productivity and quality. With this in view, the present study was conducted to assess the effect of mulch colour on growth and cropping in strawberry and to explore the possibility of enhancing winter-production of this fruit under polyhouse.

MATERIAL AND METHODS

The study was conducted at the experimental farm of Department of Soil Science and Water Management, Dr. Y.S. Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh, during 2004-2005. The experiment was

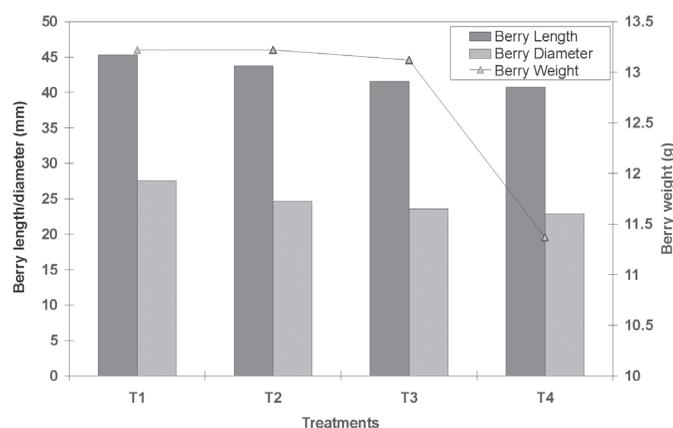
laid out in Completely Randomized Block Design under a polyhouse with misting facilities, and the crop was irrigated through the T-Tape irrigation system. Uniform runners of cultivar ‘Chandler’ were planted in 1x1 m raised-beds at a distance of 20 x 20 cm, in the second fortnight of September with planting density of 16 plants m⁻² and 4 rows per bed. Plants were mist-irrigated with tubes hanging 1.5 m above the plant-surface. Misting was terminated at 4 weeks, and then, the plants were irrigated through two T-Tape drip-irrigation tubes per bed. After 30 days of planting, the beds were covered with mulch treatments and plants were pulled up through a 5 cm dia perforation in the plastic. Treatments included three polyethylene-mulch colours: black (T₁); silver-over-purple (T₂); yellow (T₃), plus a bare- ground treatment i.e., control (T₄). The experiment was laid out in Randomized Complete Block Design with three replicates. Recommended basal doses of phosphorus (40 kg ha⁻¹), potash (40 kg ha⁻¹) and FYM (50 t ha⁻¹) were applied at the time of preparation of beds. Nitrogen was applied in two equal split doses. Half the nitrogen was applied one month after planting, and the remaining half after flowering. Soil Temperatures were monitored on a daily basis, while, soil moisture was recorded at weekly intervals. Marketable fruits were harvested for early (15 December to 15 February) and total (15 December to 15 May) yield. Mean fruit weight, mean fruit size, fruit number and TSS were also recorded and subjected to statistical analysis of variance.

RESULTS AND DISCUSSION

All growth and yield parameters were significantly influenced by mulching through its modifying effect on hydrothermal regimes and physico-chemical properties of the soil, as also reported by various workers (Monescu and Ciofu, 1970; Tripathi and Katiyar, 1984; Poling, 1994). These are also very efficient in reducing competition from weeds for nutrients and water (Shylla *et al*, 2005). Mulch-colour markedly affected plant growth and cropping and these results are in agreement with findings of Mohamed (2002). It was possible to produce fruits of good size and taste during

winter months under polyhouse, wherein the environment (Fig. 3) was quite favourable for growth and harvest of good quality fruits starting from December.

A perusal of data presented in Table 1 and Fig. 1 reveals that maximum average berry weight (13.22 g), length (45.32 mm) and breadth (27.54 mm) was recorded under black polythene mulch which was statistically at par with silver-on-purple polythene mulch (Gupta and Acharya, 1993; Himerlick *et al*, 1993; Gupta and Acharya, 1994). This may be attributed to better soil hydrothermal regimes (Fig. 3-5), better moisture conservation and suppression of weeds in a crop mulched with black polythene rather than with other mulches (Badiyala and Aggarwal, 1981; Tarara, 2000; Sharma and Sharma, 2004). Maximum number of fruits per m² was recorded under yellow polythene mulch, which was statistically different from all other treatments. This may be attributed to better moisture conservation, optimum soil temperature and nutrient supply in weed-free plots during fruit development in strawberry. Marumoto *et al* (1991) also reported a positive influence of soil temperature and mulch on growth and cropping in strawberry. Black polythene mulch improved fruit quality as indicated by increased total



T₁ = Black polythene mulch, T₂ = Silver-over-purple polythene mulch, T₃ = Yellow polythene mulch, T₄ = Control (bare-ground)

Fig 1. Effect of mulch-colour on fruit quality in polyhouse-grown strawberry

Table 1. Major effects of mulch colour on growth, yield and quality of strawberry grown under polyhouse

Treatment	Berry weight(g)	Berry length (mm)	Berry diameter (mm)	Fruit number/m ²	TSS(%)	Early yield (Q/ha)	Total yield (Q/ha)
T ₁ = Black polythene mulch	13.22	45.32	27.54	27.20	10.00	48.81	104.94
T ₂ = Silver-over-purple polythene mulch	13.22	43.74	24.67	25.60	10.20	51.85	111.48
T ₃ = Yellow polythene mulch	13.12	41.58	23.59	35.00	8.00	7.61	143.30
T ₄ = Control (bare-ground)	11.37	40.80	22.89	15.60	9.00	31.47	76.98
CD (P=0.05)	0.09	0.59	1.08	5.96	0.87	17.31	26.98

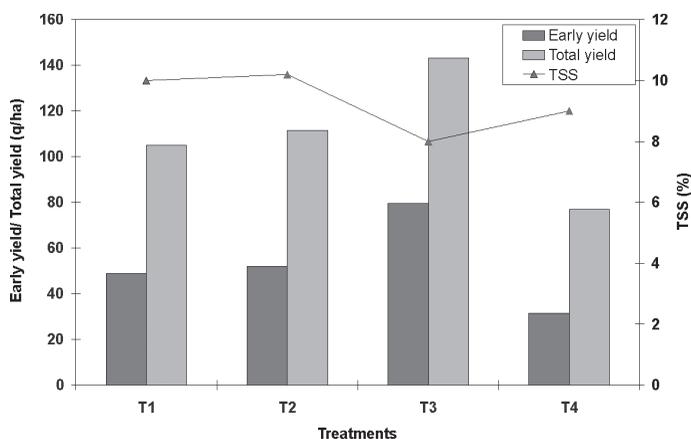


Fig 2. Effect of mulch colour on fruit yield and TSS of polyhouse grown strawberry

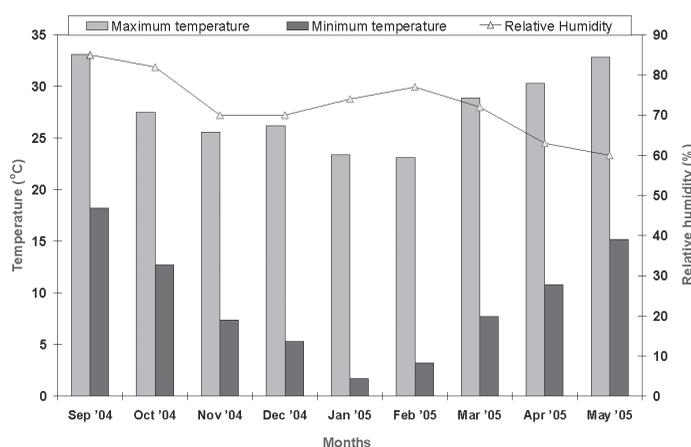


Fig 3. Environmental parameters under polyhouse

soluble solids (Fig. 2). This effect may be attributed to increased soil temperature (Fig. 4) and optimum soil moisture (Fig. 5), which may have led to early fruit-ripening. These results are in accordance with findings of Hassan *et al* (2000) Shylla and Chauhan (2004) also reported maximum TSS, minimum acidity, maximum TSS/acid ratio, with black polythene mulch. Fruit size, weight and TSS were low in bare-ground, which is congruent with findings of Hassan *et al* (2000) and Shylla & Chauhan (2004). Early yield as well as maximum total yield was observed under yellow polythene mulch, though the fruits were less sweet than in other treatments. This may be attributed to the fact that yellow-coloured sheets faded to a white under polyhouse conditions. Similar results of highest yields for ‘Chandler’ with white-on-black mulch were reported by Himerlick *et al* (1993). When the effect of black plastic mulch on early and total yield is compared to that in silver-on-purple plastic mulch, the latter resulted in earlier and greater total yield, though these were statistically at par. Mohamed (2002), however, reported silver-on-purple (S/P) plastic mulch to significantly

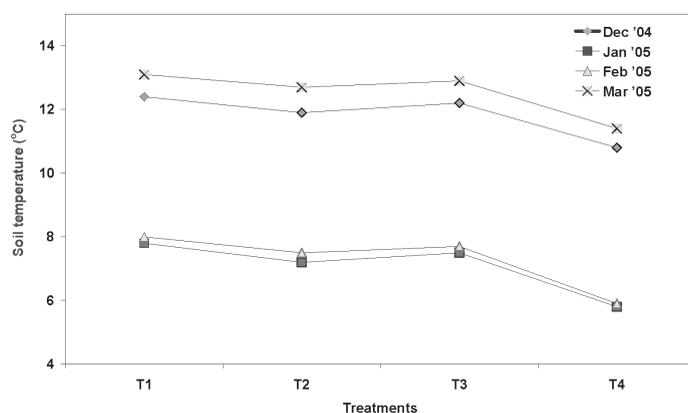


Fig 4. Effect of mulch colour on soil temperature of polyhouse grown strawberry

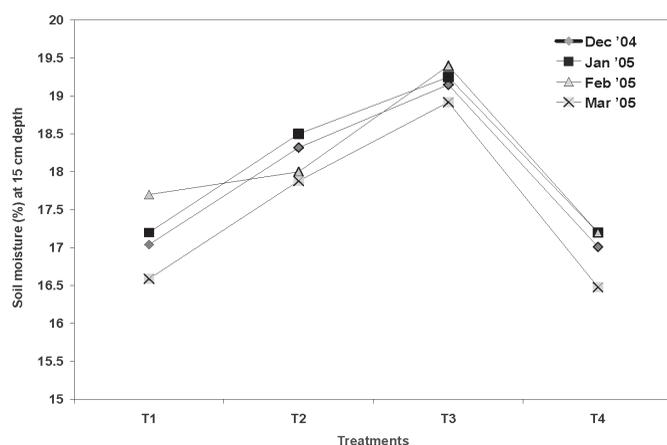


Fig 5. Effect of mulch colour on soil moisture of polyhouse grown strawberry

increase early and total yield over clear or black mulch. Besides black polythene mulch, increase in yield using coloured plastic mulch has also been reported by various workers in strawberry (Fear and Nonnecke, 1989; Albrechts and Chandler, 1993; Himelrick *et al*, 1993; Mohamed, 2002). Plants on bare-ground had poorest growth and cropping performance, which is in conformity with findings of Hassan *et al* (2000) and Shylla and Chauhan (2004).

Under polyhouse conditions, maximum and earliest yields were observed under yellow polythene mulch, while, better quality fruits were obtained under black polythene mulch. Till date, strawberry cultivation in the mid-hill zone of Himachal Pradesh is practiced only in open fields where bulk of the fruit production usually occurs in April-May, fetching a low price in the market. Hence, results obtained in the present trial offer a possibility of producing off-season, good quality strawberry under polyhouse during winter months in the mid-hill zone of Himachal Pradesh. This can fetch a better price and prove to be highly remunerative to strawberry farmers.

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