Effect of Plastic Mulch Colour on Growth, Fruiting and Fruit Quality of Strawberry under Polyhouse Cultivation

N. C. Sharma[1*], S. D. Sharma[2] and R. S. Spehia[3]

[1]Temperate Horticultural Research Station, Dr. Y. S. Parmar University of Horticulture and Forestry, Kotkhai, District Shimla, H.P. (171 202), India
[2]Department of Fruit Science, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (173 230), India
[3]Department of Soil Science and Water Management, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (173 230), India

Article History

Manuscript No. c283
Received in 18th September, 2012
Received in revised form 4th June, 2013
Accepted in final form 7th June, 2013

Correspondence to

E-mail: naveenuhf@gmail.com

Keywords

Strawberry, mulch, growth, fruit quality, polyhouse

Abstract

The field experiment was conducted during 2007-09 to study the effect of plastic mulch colour on growth, fruiting and fruit quality of strawberry under polyhouse cultivation. All three coloured plastic mulches (black, red and yellow) significantly increased the growth of strawberry plants as compared to control during both the years of study, but did not differ significantly among themselves with respect to plant growth. Red plastic mulch significantly extended the duration of flowering and fruiting and improved the fruit set as compared to control and black plastic mulch. Considerably higher yields, fruit size & weight and better fruit chemical composition (total soluble solids, total sugars, reducing sugars, ascorbic acid and anthocynin contents) were recorded in the plants mulched with red plastic as compared to black plastic mulch and no mulch (control). Though red plastic mulch was statistically at par with yellow plastic mulch with respect to all the parameters recorded during both the years of study but red plastic sheet was found to be most effective for increasing yield and improving fruit quality of strawberry under polyhouse cultivation.

1. Introduction

Strawberry has a unique place among cultivated berry fruits. Its fruits are attractive, lucious, tasty and nutritious with a distinct and pleasant aroma, and delicate flavour. Adverse weather conditions like occurrence of frost, heavy rains, hails and temperature fluctuations especially during flowering and fruiting are limiting factors in strawberry cultivation. To protect the strawberry crop from adverse weather conditions, protected cultivation under polyhouse or polytunnel is a better option. Strawberry plant is shallow rooted and surface feeder therefore moisture and temperature conditions of the upper layer of soil significantly influence the growth and fruiting of the plant. Polythene mulches play a vital role in strawberry cultivation as it helps in conserving moisture, controlling weeds, regulating hydrothermal regimes and protecting the delicate fruits from direct contact with the soil (Hancock, 1999 and Sharma, 2009). At present, use of black polythene sheets for mulching in strawberry is a common practice. Different coloured plastic mulches are also being used and reported to improve the yield and quality of crops by various researchers. Keeping in view the above facts, present investigations were under taken to study the effect of plastic mulch colour on growth, fruiting and fruit quality of strawberry.

2. Material and Methods

The studies were carried out in the research farm of the Department of Soil Science and Water Management, Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan, India during 2007-09.The experiment was laid out in Complete Randomized Design (CRD) in polyhouse with four plastic mulch treatments viz., black mulch, yellow mulch, red mulch and no mulch (control) and each treatment was replicated 5 times. Runner of cultivar Chandler were planted in the 3rd week of September at a spacing of 20×30 cm. Polythene sheets of 100 gauge thickness were used and spread over the beds as per the treatments one month after planting when runners were fully established. Corresponding to the position of plant, incisions were given on mulch sheet and plant stem were taken out through the slits to keep the foliage uncovered. Drip system of irrigation was adopted for application of water

© 2013 PP House

to the plants. Uniform cultural practices and plant protection measures were followed for all the plants. The observation on plant growth, fruiting and fruit quality were recorded from all the treatments. Biochemical analysis of fruits for evaluation of quality was done as per standard procedure described by AOAC (2000).

3. Results and Discussion

Plant growth, flowering and fruiting of strawberry (Table 1) were significantly influenced by mulch treatments. All polythene mulch treatments significantly improved the crown height, number of crowns plant^{-1}, number of leaves plant^{-1} and leaf area in comparison to control, however, colour of polythene mulches did not influence the plant growth significantly but red polythene mulch treatment was found to be the most effective during both the years of study. For all the growth parameters, higher values were recorded in 2nd year of study i.e. 2009. Higher growth under polythene mulch may be attributed to its direct impact on the microclimate around the plant by modifying the radiation budget (absorbitivity vs. reflectivity) of the surface and better moisture conservation and weed suppression(Hassan et al., 2000 and Tarara, 2000).

Flowering and fruiting of strawberry were significantly enhanced by coloured polythene mulches. Plants under red polythene mulch were first to come in to flowering followed by yellow and black polythene mulches. Red polythene mulch enhanced the flowering by 3 weeks and plants under this treatment had initiated the flowering during first week of December during both the years of study. Flowering under red, polythene mulch treatments was found to be extended by 16 and 18.2 days during 2008 and 2009, respectively as compared to control. Similarly fruing duration was significantly extended by different coloured polythene mulches in comparison to control. All coloured polythene mulches significantly improved the fruit set as compared to control but these coloured polythene mulch treatments did not differ significantly themselves. However, red polythene mulch treatment was found to be most effective in extending the flowering and fruiting period and improving the fruit set during both the years of study. This might have been influenced by favourable soil temperature and moisture conditions modified by coloured polythene mulches. Red and yellow polythene have distinct optical characteristics thus reflect different radiation patterns into the canopy of a crop and thereby affect plant growth and development.

Yield and yield attributes (Table 2) and biochemical composition of the fruits (Table 3) appeared to be greatly influenced by various coloured polythene mulch treatments. Red polythene mulch treatment considerably and significantly increased the fruit yield and yield attributes like berry size and berry weight than black polythene and no mulch treatments. Red polythene mulch was statistically at par with yellow polythene mulch with respect to yield, berry size and berry weight. Similarly, higher total soluble solids, sugars, ascorbic acid and anthocynin contents but lower titrable acidity was

Table 1: Effect of plastic mulch colour on growth of strawberry plants under polyhouse cultivation

Treatment	Crown height (cm)		Number of crowns		Number of leaves		Leaf area (cm^2)		Duration of flowering (Days)		Duration of fruiting (Days)		Berry set (%)	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Black plastic mulch (T_1)	16.62	18.90	8.00	8.82	21.40	22.80	92.40	93.90	93.60	97.00	93.20	94.40	78.32	78.98
Yellow plastic mulch(T_2)	19.22	20.28	8.60	9.98	22.80	25.10	97.20	98.80	98.20	101.2	98.02	98.70	80.96	81.68
Red plastic mulch(T_3)	20.40	22.10	9.80	10.62	24.00	26.40	101.5	102.3	102.8	106.6	101.6	103.0	82.72	83.68
No mulch or Control(T_4)	12.50	12.80	6.12	6.80	15.80	19.02	82.00	85.20	86.80	88.40	87.80	89.20	73.00	74.25
CD (p=0.05)	3.92	3.32	1.87	2.01	4.01	3.53	9.85	8.67	5.23	6.35	4.92	4.68	5.28	4.57

Table 2: Effect of plastic mulch colour on fruit yield, size and weight of strawberry under polyhouse cultivation

Treatment	Yield (q ha^{-1})		Fruit length (mm)		Fruit breadth (mm)		Fruit weight (g)	
	2008	2009	2008	2009	2008	2009	2008	2009
Black plastic mulch(T_1)	72.00	74.80	34.58	35.26	24.97	27.01	16.98	16.76
Yellow plastic mulch(T_2)	76.20	79.20	37.68	38.35	26.02	29.09	19.06	20.24
Red plastic mulch(T_3)	80.20	82.60	40.54	41.08	30.64	31.72	20.88	21.44
Bare ground or control(T_4)	65.40	68.80	30.58	31.35	22.87	23.55	14.14	14.84
CD (p=0.05)	5.72	5.36	4.56	4.13	2.77	2.90	2.05	2.06

© 2013 PP House

Table 3: Effect of plastic mulch colour on fruit quality of strawberry under polyhouse cultivation

Treatment	Total Soluble Solids (ºB)		Titratable acidity (%)		Total surags (%)		Reducing sugars (%)		Ascorbic acid (mg 100 g fruit^{-1})		Anthocyanin content at OD 530 nm	
	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Black plastic mulch (T_1)	8.18	8.34	0.82	0.78	6.72	6.86	4.54	4.88	47.60	49.20	72.00	74.80
Yellow plastic mulch (T_2)	8.48	8.66	0.77	0.73	7.22	7.38	4.78	5.14	49.80	52.60	76.20	79.20
Red plastic mulch (T_3)	9.12	9.48	0.72	0.70	7.46	7.60	5.06	5.32	51.20	53.80	80.20	83.60
Bare ground or control (T_4)	7.48	7.68	0.85	0.81	6.22	6.32	4.14	4.46	44.20	47.20	65.40	68.80
CD (p=0.05)	0.40	0.39	0.02	0.03	0.44	0.43	0.54	0.52	3.03	3.14	5.72	5.36

recorded in plants mulched with red plastic sheet, which was significantly higher as compared to plants mulched with black plastic or not mulched but statistically at par with plants mulched with yellow plastic sheets. Beside better soil hydro-thermal regimes and moisture conservation which might have induced favourable conditions conducive to attainment of berries with better size and weight, colour of mulches affect the temperature below and above the mulch through the absorption, transmission and reflection of solar energy, which affects the microenvironment surrounding the plants((Lamont, 1999). Coloured mulches selectively absorb Photosynthetically Active Radiation (PAR), while transmitting solar infrared radiation, thus red and yellow plastic mulches have the ability to increase the ratio of red:far-red wavelengths (R:FR) in the light reflected to the plant canopy, which resulted in increased photosynthetic activity of the plants and accumulation of anthocynin content in the fruits and this could have perhaps improved the size, weight and chemical composition of the fruits under red and yellow plastic mulches.

4. Conclusion

It is concluded from the studies that coloured plastic mulches (black, red and yellow) significantly increased the growth of strawberry plants as compared to control. Red and yellow plastic mulches significantly extended the duration of flowering and fruiting and improved the fruit set. Though red and yellow plastic mulches increased fruit yields, fruit size, weight and improved fruit chemical composition (total soluble solids, total sugars, reducing sugars, ascorbic acid and anthocynin contents) but red plastic mulch was found to be most effective for increasing yield and improving fruit quality of strawberry under protected cultivation. However, investigations need to be conducted in outdoor conditions and other coloured plastic mulches also need to be tested.

5. References

AOAC, 2000., Official Methods of Analysis. Association of Official Analytical Chemists, Benjamin Franklin Station, Washington, D.C. 1018.

Hassan, G.I., Godara, A.K., Kumar, J., Huchehe, J.A.D., 2000. Effect of different mulches on yield and quality of Grande strawberry. *I*ndian Journal of Agricultural Science 70, 184-185.

Hancock, J.F., 1999. Strawberries. CAB International, Wallingfold, UK. 237.

Tarara, J.M., 2000. Microclimate modification with plastic mulch. HortScience 36,169-180.

Johnson M.S., Fennimore S.A., 2005. Weed and crop response to coloured plastic mulches in strawberry production. HortScience 40, 1371-1375.

Sharma, V.K., 2000. Effect of mulching and row spacing on growth and yield of strawberry. Indian Journal of Horiculture 66, 271-273.

Lamont, W.J., 1999. The use of different colored mulches for yield and earliness. The New England Vegetable and Berry Growers Conference and Trade Show, Sturbridge, Mass. 299-302.

© 2013 PP House