



REVIEW ON DIFFERENT MULCHING MATERIAL FOR CROP GROWTH AND YIELD OF STRAWBERRY

Pushpit Verma, Jitendra Kumar Sahu* and Meragana Vatsalya Swaroop
Department of Horticulture, Lovely Professional University, Phagwara, Punjab
Email: jitendra.28206@lpu.co.in

ABSTRACT

Mulching is a horticultural and agricultural practise that involves the use of organic materials. This approach is highly useful for protecting plant roots from heat and cold. Mulch is applied to the soil surface surrounding plants to produce a favourable environment for growth. A search for materials to improve various factors like yield, quality, fruit size, etc been pushed by the need to increase food production while also improving the quality of our environment. This study provides an overview of research and development related to the use of various types of mulch materials. Mulch paper lowers the need of chemical fertilizers and herbicides, as well as weed control and maintaining the temperature of the ground. This article summarises the research on mulches that has been published and explores the possibilities for them to solve the problem in agriculture.

Key Words: Mulching, Strawberry and Plant Growth

INTRODUCTION

Strawberry (*Fragaria × ananassa*Duch.) Belongs to the family Rosaceae, it is a soft-fruited, short-lived herb. The commercially grown strawberry is a monoecious octoploid (8n) (2n = 56) hybrid of two dioecious octoploid species, *Fragaria chiloensis*Duch. and *Fragaria virginiana* Spirit with base chromosome number (x) 7. Strawberries have a higher percentage of vitamin C, phenolics and flavonoids compared to other berries. In recent decades, strawberries have emerged as the most important fruit in the soft berry category. The area and production of strawberries around the world has grown tremendously over the last 20 years, with most crops grown in sheltered structures. In India, strawberries are grown on a commercial scale in the states of Maharashtra, Punjab, Haryana, and Delhi, parts of Himachal Pradesh, Jammu and Kashmir, Utrakhand, and Uttar Pradesh.Strawberry is a perennial plant that grows successfully at optimal day time temperatures of 22 ° C to 25 ° C and night time temperatures of 7 ° C to 13 ° C (De en Bhattacharjee, 2012).

Mulches are materials that are applied to the soil surface around plants to benefit the soil and plants. Mulch can be made of polyethylene (plastic), straw, leaves or other materials. Several benefits of using mulch have been reported, including weed control, reduced soil

evaporation, reduced fertilizer and pesticide use, and soil temperature changes. Mulching can also improve water and nitrogen efficiency. As a result, mulching can improve crop yields, especially in arid and semi-arid areas where land is less fertile and water supply is limited.

To protect the strawberry crop from adverse weather conditions, sheltered cultivation under a polyhouse or poly-tunnel is a better option. Mulching is an important cultural practice for growing strawberries. Polyethylene mulch plays an important role in planting strawberries because they help retain moisture, kill weeds, regulate hydrothermal regimes and protect dangerous fruits from direct contact with the soil. Mulching can reduce soil evaporation and increase yield by increasing water efficiency. Currently, the use of black polyethylene plates for mulching strawberries is common practice. Various researchers have also used different colour plastic mulches, saying they have improved crop yields and quality.

Plastic mulches influence plant microclimate by adjusting the dirt energy balance and limiting soil water vanishing influencing plant development and yield. Root zone temperature is significant for root arrangement, improvement, fanning, and generally speaking root development and advancement since it influences physiological cycles in roots like take-up of water and mineral supplements.

Effect of mulching on crop growth and Yield:

Mulching practices helps to increase crop growth resulting increase yield. Bakshi *et al.* (2014) demonstrated from his study that it could be inferred that the performance of various organic as well as inorganic mulches was better than control. However, black polythene mulch resulted in maximum growth, yield and quality as well as reduction in weed population. The that highest yield per plant was observed under black mulch with a yield of 143.38g per plant followed by transparent mulch 115.20g and control with a yield of 60.22g per plant which was lower than that of saw dust and paddy straw 82.58g and 98.73g respectively. Pandey *et al.* (2015)revealed that different mulches differed in their soil warming ability during the study. Among the different mulches used, mean RZT (Root Zone Temperature) was highest under black polythene mulch and lowest in bare soil. Plants mulched with black polythene had better growth than other mulched used. It attributed to better soil hydrothermal regimes, better moisture conservation and suppression of weeds. Same result found by Sharma *et al.* (2015) Reported that all polythene mulch treatments significantly improved the crown height, number of crowns plant, number of leaves plant 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 the study. 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. Red plastic mulch treatments were found to be the most effective in terms of fruit growth, weight, and yield. Comparing red plastic mulch to other mulching treatments, the yield is increased dramatically. Red plastic mulch had the highest yield (11.4 tonnes/ha), followed by black plastic mulch (9.3 tonnes/ha), which had a greater yield than the control (Mann *et al.* 2017). Rao *et al.* (2017) revealed that different types of mulching materials had a substantial impact on watermelon growth parameters such as the number of lateral branches per vine and main vine length when compared to the control. There are a variety of mulching treatments to choose from. Silver plastic mulch increased the number of branches per vine (12.1) and the length of the main vine (136.4 cm). Control, on the other hand, saw the least amount of development. The highest number of fruits per plant was observed under Silver mulch with a yield of 254.04 g/per plant followed by Red mulch 207.17 g/per plant and followed by yield of black mulch 203.63 g/plant. Kumar *et al.* (2018) found that the mulched plots showed improvement in growth and yield when compared to unmulched plots. The results shown gave a conclusion that black mulch gave maximum improvement in all the aspects like- plant height, number of leaves, etc. Black mulch had better growth than those mulched with paddy straw and paddy husk mulch. According to Singh *et al.* (2018) reported that mulching treatments had a considerable impact on yield and fruiting-related parameters. Treatment M2 (Green mulch) increased 'fruit set %,' 'yield per plant,' 'fruit weight,' 'fruit length,' 'fruit girth,' and 'fruit shape index' among the other mulching treatments. The improvement in certain yield parameters was linked to the plant's correct growth and development, which was reflected in yield regimes. The highest number of fruits per plant was observed under Silver mulch with a yield of 254.04 g/per plant followed by Red mulch 207.17 g/per plant and followed by yield of black mulch 203.63 g/plant. Rehamet *et al.* (2019) reported that application of black mulching gave an increase in the yield of fruits by 40-49% and 17-18% in Florida and Winterstar respectively. It was observed that plastic mulch helped in improving fruit quality. Use of black mulch was more profitable for strawberry production. Kumar *et al.* (2021) reported that there was a significant increase in plant height with the application of different types of mulching and plant growth regulators in combination. GA3 75ppm + black polythene was the most

effective combination in retaining maximum (24.4 cm) plant height, followed by GA3 50ppm + black polyethylene (24.3 cm), and treatment control (14.8 cm). The use of mulching and plant growth regulators treatments may have resulted in a more favourable root zone environment because of less weed populations, optimal soil moisture levels, higher nutrient availability, and acceptable soil temperature, and regulated growth of strawberry plant by causing cell elongation and also increase in length of petiole were observed. The application of GA3 75ppm + Black polyethylene resulted in the highest number of flowers (30.1) and the highest number of fruits per plant (24.1). Ngente *et al.* (2021) revealed that mulches of various types were found to be effective in changing the soil's hydrothermal regime and creating a favourable environment for plant growth. Black polythene mulch, on the other hand, had a greater impact on soil environment than the other mulches studied. It increased plant height, spread, number of leaves, number of fruits, and yield per plant by a significant amount. The highest number of fruits per plant was observed under black mulch with a yield of 43.01 fruits/plant followed by silver mulch 40.20 fruits/plant and control with a yield of 28.13 fruits/plant which was lowest in comparison to all other treatments. Tyagi and Singh (2021) reported that mulching has a considerable impact on strawberry cv. Winter Dawn's vegetative development and yield. Silver black mulch had the highest yield (320.8 g/plant), followed by black plastic mulch (314.6 g/plant) and paddy straw mulch (255.29 g/plant). On the basis of the findings of this study, it can be concluded that applying silver black mulch to strawberry cv. Winter Dawn improves growth, yield, and fruit quality. Singh *et al.* (2022) revealed that in comparison to control plants, total soluble solids content of fruits increased significantly with diverse effects of FYM, NPK, Vermicompost, and Mulched with black and white polythene. The treatment nine fruits treated with black polythene with FYM had the highest total soluble solids (11.167), followed by treatment ten (10.100) treated with black polythene and vermi-compost. The highest data clearly revealed that the treatment nine 49.767 mg/100g was followed by the treatment ten 43.900 mg/100g in the case of ascorbic acid. The treatment T1 (control) had the lowest value of 28.067 mg/100g. In comparison to white polythene, Black polythene FYM 100 percent has a significantly higher ascorbic acid concentration in fruits. The treatment that produced the most total sugar (8.567) was treated with FYM and mulched with black polythene, followed by treatment ten (7.533), which used black polythene and vermi-compost. Under controlled conditions, the smallest amount of total sugar (5.200) was detected.

Crops	Material used	Effect	Reason	Reference	Year
Strawberry	Black mulch	Black mulching gave an increase in the yield of fruits and was profitable.	Increased the yield of fruits by 40-49% and 17-18% in Florida and Winterstar.	Rehamet <i>al.</i> .	2019
Watermelon	Silver mulch	Silver mulch produced the highest average fruit weight and output (35.57 t/ha) of all mulching treatments	In comparison to no mulch circumstances, using plastic mulches in water melon cultivation will produce economically viable results.	Rao <i>et al.</i> .	2017
Strawberry	Red plastic mulch	When compared to control and other mulching treatments, red polythene mulch dramatically increased fruit size and weight.	Observed significant increase in fruit size and weight in red plastic mulch.	Mann <i>et al.</i> .	2017

Table 2: Effect on TSS(Total Soluble Solids) of fruits

Crops	Material used	Effect	Reference	Year
Strawberry	Black mulch	The total soluble solids were found highest under black mulch <i>i.e.</i> 7.63	Bakshiet <i>al.</i>.	2014
Strawberry	Red mulch	It was observed that the total soluble solids were highest in red mulch (9.12) as	Sharmaet <i>al.</i>	2015

		compared to other mulch		
Strawberry	Black mulch	soluble solids were produced under black polythene (11.92)	Mann <i>et al.</i>	2017

Table 3: Effect on Acidity of fruit

Crops	Material used	Effect	Reference	Year
Strawberry	Red Mulch	Highest acidity was reported under control (0.80) and was found lowest in red plastic mulch (0.72).	Bakshi <i>et al.</i>	2014
Strawberry	Black Mulch	Treatment of control resulted in the highest acidity (0.59), while treatment of black polythene (0.47) produced the lowest acidity.	Kumar <i>et al.</i>	2018
Strawberry	Black Mulch	Treatment of white polythene and NPK 100% resulted in the highest acidity (0.657%), while treatment of black polythene and FYM (0.363) treated plants produced the lowest acidity.	Singhet <i>al.</i>	2022

Table 4: Effect on Ascorbic acid content of fruit

Crops	Material used	Effect	Reference	Year
-------	---------------	--------	-----------	------

Strawberry	Black Mulch	Highest ascorbic acid was found in black mulch (41.68) and was lowest under control (32.90).	Kumar <i>et al.</i>	2018
Strawberry	Black Mulch	Treatments of black polythene and FYM100% (49.767 mg/100g) and black polythene and vermicompost (43.900 mg/100g) were used. The treatment (control) minimum value was 28.067 mg/100g. Additionally, Black polythene was shown to have a considerably higher ascorbic acid level in fruits than the control.	Singhet <i>al.</i>	2022

QUALITY PARAMETERS

TSS

Bakshi *et al.* (2014) reported that highest soluble solids were produced under black polythene (7.63) followed by cut grass (7.30) and was lowest in control (6.67). Sharma *et al.* (2015) reported that highest soluble solids were found under red mulch (9.12) followed by yellow and black mulch (8.48) and (8.18) and lowest under control (7.48). Mann *et al.* (2017) reported that highest soluble solids were produced under black polythene (11.92) followed by silver mulch (10.27) and then control with TSS of (10.11) and was then followed by other treatment and found lowest in wheat straw. Kumar *et al.* (2018) reported that fruits treated with black polythene which gave us the highest total soluble solids (7.30), followed by other treatment with sawdust (6.65) and was seen lowest under control (5.38). Singh *et al.* (2022) observed that nine fruits were treated with black polythene and FYM which gave us the highest total soluble solids (11.167), followed by other treatment with black polythene and vermicompost (10.00).

Acidity

Bakshiet *al.* (2014) reported that highest acidity was reported under control (0.80) followed by black plastic (0.82) and was found lowest in red plastic mulch (0.72). Sharma *et al.* (2015) reported that the highest acidity was reported under control (0.85) followed by black plastic (0.82) and was found lowest in red plastic mulch (0.72). Mann *et al.* (2017) reported that highest acidity was reported under control (0.90) and was lowest in red plastic mulch (0.72). Kumar *et al.* (2018) observed that treatment of control resulted in the highest acidity (0.59), while treatment of black polythene (0.47) produced the lowest acidity. Singh *et al.* (2022) reported that treatment of white polythene and NPK 100% resulted in the highest acidity (0.657%), while treatment of black polythene and FYM (0.363) treated plants produced the lowest acidity.

Ascorbic acid

Kumar *et al.* (2018) reported that the highest ascorbic acid was found in black mulch (41.68) followed by saw dust (39.00) and was lowest under control (32.90). Singh *et al.* (2022) In the case of ascorbic acid, the most conclusive data indicated that the treatments of black polythene and FYM100% (49.767 mg/100g) and black polythene and vermicompost

(43.900 mg/100g) were used. The treatment (control) minimum value was 28.067 mg/100g. Additionally, Black polythene was shown to have a considerably higher ascorbic acid level in fruits than the control.

Total sugar

Mann *et al.* (2017) the highest levels of total sugar were found in the treatments using red plastic mulch (7.46) in which reducing sugar (2.55) and non reducing (5.64) and was recorded lowest under control (6.24) with reducing sugar (1.98) and non reducing (4.16). Singh *et al.* (2022) the highest levels of total sugar were found in the treatments using black polythene and FYM 100% (8.567%), reducing (7.267%), and non-reducing (.667%) polythene. However, the lowest recorded treatment level for white polythene was 1.33% non-reducing sugar. The treatment that used FYM and mulched with black polythene produced the highest quantity of total sugar (8.567), which was followed by the treatment that used black polythene and vermicompost (7.533). Under control treatment, the minimal amount of total sugar (5.200) was noted.

Conclusion

As we have seen that among all the mulches used, black mulch gave the best results when we are talking about yield. Among all the mulches black mulch was continuously gave best results when applied. The yield was seen highest in black mulches every time it is used.

REFERENCE

- Bakshi, P., Bhat, D. J., Wali, V. K., Sharma, A. and Iqbal, M. (2014). Growth, Yield and Quality of Strawberry (*Fragaria x Ananassa*Duch.) Cv. Chandler as Influenced by Various Mulching Materials. *African Journal of Agricultural Research*, 7, 701–6.
- Das, B., Nath, V., Jana, B.V., Dey, P., Pramanick, K. K. and Kishore, D. K. (2007). Performance of Strawberry Cultivars Grown on Different Mulching Materials under Sub-Humid Subtropical Plateau Conditions of Eastern India. *Indian Journal of Horticulture*, 64(2), 136–43.

Deb, P., Sangma D. K., Prasad B. V. G., Bhowmick, N. and Dey, K. (2014). Effect of different mulches on vegetative growth of strawberry (cv. Tioga) under Red and Lateritic zone of West Bengal. *International Journal of Basic and Applied Biology*, 2 (2), 77 – 80.

Kaur, P. and Kaur, A. (2017). Effect of Various Mulches on the Growth and Yield of Strawberry cv Chandler under Sub tropical conditions of Punjab. *International Journal of Recent Trend in Science and Technology*, 25 (1), 21-25.

Kher, R., Baba, J.A. and Bakshi, P. (2010). Influence of planting time and mulching material on growth and fruit yield of strawberry cv. Chandler. *Indian Journal of Horticulture*, 67(4), 441-444.

Kumar, R., Saravanan, S., Bakshi, P. and Srivastava, J. N. (2011). Influence of plant growth regulators on growth, yield and quality of strawberry (*Fragaria* × *ananassa* Duch.) cv. Sweet Charlie. *Progressive Horticulture*, 43(2), 264–7.

Kumar, R., Tandon, V., Mir, M. M. (2012). Impact of different mulching material on growth, yield and quality of strawberry (*Fragaria* × *ananassa* Duch.). *Progressive Horticulture*, 44(2), 234-236.

Kumar, S. and Dey, P. (2011). Effect of different mulches and irrigation methods on root growth, nutrient uptake, water use efficiency and yield of strawberry. *Science of Horticulture*, 127(3), 318-324.

Mohamed, A. K. A., Haridy, A. G., Soliman, M. S. E. and Abd Elhafez, M. H. A. (2017). Performance of Some Strawberry Cultivars Grown under Assiut Climatic Conditions. *Assiut Journal of Agriculture and Science*, 47, 518–32.

Pandey, S., Tewari, G. S., Singh, J., Rajpurohit, D. and Kumar, G. (2015). Efficacy of mulches on Soil modification, growth, production and quality of Strawberry (*Fragaria* × *ananassa* Duch.). *Int J Sci and Nat*, 7(4), 813-820.

Pandey, S., Singh, J. and Maurya, I. B. (2015). Effect of Black Polythene Mulch on Growth and Yield of Winter Dawn Strawberry (*Fragaria* × *Ananassa*) by Improving Root Zone Temperature. *Indian Journal of Agricultural Sciences*, 9, 95–98.

Shiukhy, S., Mahmoud R. S. and Chalavi, V. (2015). Colored Plastic Mulch Microclimates Affect Strawberry Fruit Yield and Quality. *International Journal of Biometeorol*, 59, 1061–66.

Singh, S., Singh, N. P., Sharda, R. and Sangwan, A. K. (2019). Response of irrigation, fertigation and mulching on plant growth and fruit yield of strawberry. *The Horticultural Society of India*, 76, 233-240.

Sonkar, P., Ram, R. B. and Meena, M. L. (2012). Effect of various mulch material and spacing on growth, yield and quality of strawberry. *HortFlora Research Spectrum*, 1(4), 323–7.

Tariq, S., Bano, A. and Qureshi, K. M. Response of strawberry (*Fragaria x ananassa*) cv. Chandler to different mulching materials. *Science, Technology and Development*, vol. 2016, 35(3), 117-122.

Rao, K. V. R., Bajapai, A., Gangwar, S., Chourasia, L., & Soni, K. (2016). Effect of mulching on growth, yield and economics of watermelon (*Citrullus lanatus* Thunb.). *Environment & Ecology* 35 (3), 2437—2441.

Ansary, S. H., & Roy, D. C. (2005). Effect of irrigation and mulching on growth, yield and quality of watermelon (*Citrullus lanatus* Thunb.). *Environment and Ecology*, 23(1), 141-143.

Mann, A. S., Kachwaya, D. S., Kuchi, V. S., Vikas, G., Kumar, S., & Raturi, H. C. (2017). Effect of different types of mulches on growth, yield and fruit quality of strawberry (*Fragaria x ananassa* Duch.). *Progressive Horticulture*, 12(3), 2047-2049.