



Utilization of Different Mulch Materials on Strawberry (*Fragaria x Ananassa* Dutch.) Cultivation Under Open Condition in Mizoram

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ABSTRACT

A study was conducted to make use of different mulch materials and its effects on various growth parameters of strawberry (*Fragaria x Ananassa* Duch.) var. Sweet Charlie at N. Vanlaiphai, Mizoram. Mulch materials used were - Straw (T₁), Saw dust (T₂), Wood shaving (T₃), Leaf litter (T₄), Pine needle (T₅), Cut grass (T₆), Rice husk (T₇), Black polythene (T₈), Silver on black polythene (T₉) and Control (T₁₀). The strawberry plants were cultivated under open condition provided with sub-surface irrigation. The maximum plant height (26.89 cm), maximum plant spread (33.16 cm) (N-S), maximum plant spread (31.23 cm) (E-W), maximum no of leaves (26.33) was recorded with black polythene mulch (T₈) up to 90 days after planting. Maximum number of flower (43.2) and fruit formation (38.5) were obtained with black polythene mulch (T₈). Also, highest record of fruit length (4.23 cm), fruit width (3.52 cm) and runner formation (6.8 nos.) were again obtained in black polythene mulch (T₈) along with maximum fruit weight (20.24 g). Highest record of anthocyanin content (38.53 mg/100g) and TSS (8.28 Brix) was again obtained under black polythene mulch (T₈). On the other hand, minimum record of weed intensity (1.33) was in black polythene mulch while maximum record of weeds intensity (15.93) was in control (T₁₀). Thus, black polythene mulch showed superior plant performance among various mulch materials tried in the experiment.

KeyWords: Black polythene mulch, Mulch material, Strawberry, Sub-surface irrigation.

INTRODUCTION

Strawberry (*Fragaria X Ananassa* Duch.) is an attractive, juicy, delicious and wholesome fruit with a distinct and pleasant aroma and delicate flavor. It can be cultivated in tropical, sub-tropical and temperate areas up to an elevation of 3000m around the year. It is mainly consumed fresh, and strawberry syrup are used in soda fountain beverages, ice cream, chocolate, confectionaries and cosmetics.

Mulching is generally practiced in strawberry cultivation to keep the fruit clean and protect it from its contact with the soil to avoid fruit rot. This practice

is also known for moderation of hydrothermal regime and increasing water use efficiency (Verma and Acharya, 1996). In strawberry, mulching has been found to improve plant growth, berry weight, fruit yield and quality. (Hassan *et al*, 2000; Sharma and Sharma, 2003; Moor *et al*, 2004; Singh and Asrey, 2005; Singh *et al*, 2006). The advantage of mulching lies in its effect on soil environment modification. The greatest benefit from plastic mulch is that the soil temperature in the planting bed is raised, promoting faster crop development and earlier harvest. Fertilizer loss by leaching is less beneath the mulch, so that fertilizers are optimally used and not wasted.

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Table 1. Effect of different mulch materials on plant height, plant spread and No. of leaves of strawberry.

Treatments	Plant height (cm)			Plant spread (N-S direction) (cm)			Plant spread (E-W direction) (cm)			No of leaves		
	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP	30 DAP	60 DAP	90 DAP
T ₁	13.31	19.05	23.64	18.72	27.77	30.78	17.91	24.96	28.84	10.53	15.47	25.06
T ₂	12.09	19.11	22.07	18.11	25.31	29.95	16.97	23.03	27.48	9.67	14.73	23.73
T ₃	12.43	16.90	23.63	18.99	26.17	27.93	16.98	24.11	26.07	9.47	14.87	24.07
T ₄	14.01	18.87	21.71	19.76	25.05	27.69	19.27	22.95	26.31	9.67	14.27	24.67
T ₅	11.50	14.91	23.43	18.13	25.85	28.45	16.30	23.96	26.64	9.80	14.33	26.07
T ₆	12.85	18.48	23.27	19.80	25.70	27.39	17.37	24.13	25.89	10.07	15.40	24.40
T ₇	14.07	18.43	23.31	18.50	25.89	29.34	16.45	23.30	27.71	10.07	15.00	24.87
T ₈	16.47	22.08	26.89	21.31	28.93	33.16	20.34	27.44	31.32	10.80	17.80	26.33
T ₉	14.33	20.31	25.64	19.95	26.95	30.43	18.60	25.15	28.94	10.80	17.60	25.47
T ₁₀	10.48	16.66	18.77	13.90	20.09	20.80	12.16	18.24	19.75	8.40	12.73	18.72
CD _(0.05)	1.65	2.90	2.87	1.98	1.77	1.89	1.85	1.59	2.13	1.11	1.57	2.56
SE(m)	0.55	0.97	0.96	0.66	0.59	0.63	0.62	0.53	0.71	0.37	0.52	0.86

*DAP: Days After Planting; T₁: Straw mulch; T₂: Saw dust; T₃: Wood shaving; T₄: Leaf litter; T₅: Pine needle; T₆: Cut grass; T₇: Rice husk; T₈: Black polythene mulch; T₉: Silver on black polythene mulch; T₁₀: No mulch.

Considering the advantages of mulch reported from various researchers which are mainly conducted in traditional areas, a systematic study was conducted in Sweet Charlie strawberry, which is a short day cultivar having resistance to crown rot and fruit rot, two-spotted spider mites, and powdery mildew to determine the efficacy of different mulches in modifying soil parameters, properties, time of harvest, yield and quality of fruit from a non-traditional but potential area for strawberry cultivation in Mizoram.

MATERIALS AND METHODS

The investigation was carried out on clay loam soil in the demonstration farm, KVK, N. Vanlaiphai, Serchhip District, Mizoram for two consecutive years i.e., 2017 and 2018. The climate of the site was characterized as sub-tropical hill climate with temperature ranging from 10°C - 32°C with annual rainfall of 2500 mm which is mainly distributed within June-October. Winter rains are meager

and erratic. Experimental field were ploughed thoroughly along with the recommended dose of fertilizer (80:50:100 NPK) with 15t/ha of FYM. Raised bed of 25 cm high, 0.75 m wide and 1.5 m long were prepared at a distance of 45 cm.

Healthy and disease-free poly-potted runners of Sweet Charlie strawberry were planted during the second week of December at a distance of 30 cm x 45 cm; five plants were selected and marked with metal tag for observation. The experimental plots were laid out in Factorial Randomized Block Design consisting of ten (10) treatments with three (3) replications, viz., T₁ - Paddy straw, T₂ - Saw dust, T₃ - Wood shaving, T₄ - Leaf litter, T₅ - Pine needle, T₆ - Cut grass, T₇ - Rice husk, T₈ - Black polythene mulch (30 micron), T₉ - Silver on black polythene mulch (30 micron) and T₁₀ - No mulch.

Mulching was done after two weeks of planting with different mulching materials as different treatment in different plots by randomization for

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Table 2. Effect of different mulch materials on Av. Fruit length, Av. Fruit breadth, Av. Fruit weight, Av. no of fruit/ plant, Av. Yield per plant, Av. No. of runners, and Av. No. of weeds per m² of strawberry.

Treatments	Av. Fruit length (cm)	Av. Fruit breadth (cm)	Av. Fruit weight (g)	Av. no of fruit/ plant	Av. Yield/ plant (g)	Av. No. of runners/ plant	Av. No of weeds/m ²
T ₁	4.03	3.29	16.857	36.02	559.00	7.33	2.87
T ₂	3.95	3.25	15.740	32.88	470.67	5.60	2.47
T ₃	3.91	3.13	17.617	33.27	520.00	6.00	2.67
T ₄	3.89	3.25	16.913	32.73	511.00	5.40	2.67
T ₅	4.05	3.19	17.047	33.22	510.67	5.93	2.13
T ₆	3.94	3.15	16.963	32.80	512.67	5.93	2.40
T ₇	3.83	3.13	17.403	37.53	520.33	6.73	1.87
T ₈	4.23	3.52	20.243	43.01	774.33	6.87	1.33
T ₉	4.22	3.46	19.690	40.02	762.33	6.40	1.40
T ₁₀	3.59	2.87	14.917	28.13	383.67	4.47	15.93
CD _(0.05)	0.19	0.18	1.886	3.18	46.16	0.79	0.92
SE(m)	0.06	0.06	0.630	1.06	15.42	0.264	0.31

*DAP: Days After Planting; T₁: Straw mulch; T₂: Saw dust; T₃: Wood shaving; T₄: Leaf litter; T₅: Pine needle; T₆: Cut grass; T₇: Rice husk; T₈: Black polythene mulch; T₉: Silver on black polythene mulch; T₁₀: No mulch.

replications. During the crop growing period, periodic records of different parameters *viz.*, plant height, plant spread, no of leaves, no of flowers, no of fruits, no of runners, weed intensity, fruit weight, fruit length, soil temperature, soil moisture content, TSS and Anthocyanin contents were recorded.

RESULTS AND DISCUSSION

Growth and development in a plant are a consequence of excellent coordination of several processes operating at different stages of the plant. This can be achieved through nutrient management, irrigation, cultural practices and plant protection measures (Prasad *et al*, 2014). The growth parameters like number of leaves per plant, plant E-W and N-S spread and fruit weight were found influenced by different type of mulches.

Among the different treatments, maximum plant height was observed under black polythene mulch at 30, 60 and 90 Days after planting (DAP) (16.47 cm, 22.08 cm, 26.89 cm respectively). Similarly,

maximum plant spread (21.31 cm, 28.93 cm and 33.16 cm) in the N-S direction at 30, 60, 90 DAP was found under black polythene mulch followed by straw mulch (18.72cm, 27.77 cm and 30.78 cm) and silver polythene mulch (19.95 cm, 26.95 cm and 30.43 cm).

The maximum plant spread (20.34 cm, 27.44 cm and 31.32 cm) in the E-W direction at 30, 60, 90 DAP was also found under black polythene mulch which is followed by silver polythene mulch (18.60 cm, 25.15 cm and 28.94 cm). Maximum number of leaves (10.80, 17.80 and 26.33) at 30, 60, 90 DAP was also found under black polythene mulch, which was at par with silver polythene mulch (10.80, 17.60 and 25.47). Favourable environment, better moisture conservation, *vis-à-vis* suppression of weeds under black polythene mulch has been reported as reason behind better plant growth parameters (Pandey *et al*, 2016). Favorable modification of hydrothermal regime and physico-chemical properties may also be attributed for better growth as similar observation

Table 3. Effect of different mulch materials on the Average of Soil temperature.

Treatment	30 DAP	60 DAP	90 DAP
T1	21.40	22.10	26.26
T2	21.36	21.50	26.33
T3	21.23	21.96	26.46
T4	20.13	21.76	24.90
T5	20.70	22.26	25.00
T6	21.26	21.90	24.73
T7	21.80	22.60	25.46
T8	22.43	23.03	30.20
T9	22.26	22.90	29.16
T10	20.36	20.70	28.36
CD _(0.05)	0.93	0.61	1.47
SE(m)	0.31	0.20	0.49

was reported by Dwivedi *et al*, 2000, Hira *et al*, 2003 and Qureshi *et al*, 2012.

The average maximum fruit length (4.23 cm), average fruit breadth (3.52 cm), average fruit weight (20.243 g), average number of fruits per plant (43.01) and average fruit yield per plant (774.33 g) was recorded on black polythene mulch, while the average minimum record of fruit length (3.59 cm), average fruit breadth (2.87 cm), average fruit weight (14.917 g), Av. number of fruit per plant (28.13)

and average fruit yield per plant (383.67 g) was observed under control. The average yield under black polythene mulch was double as compared to no mulch. Higher yield under polythene mulch has also been recorded by Pandey *et al*(2016) and Kher *et al*(2010).

The average maximum number of runner (7.33) was observed under plant treated with paddy straw followed by black polythene mulch (6.87) and rice husk mulch (6.73) respectively. The least number

Table 4. Effect of different mulch materials on Anthocyanin content and TSS of strawberry.

Treatment	Anthocyanin content (mg/ 100 g)	TSS (Brix)
T ₁	35.85	8.17
T ₂	34.52	7.92
T ₃	33.98	8.08
T ₄	31.30	7.98
T ₅	33.37	8.17
T ₆	33.16	8.05
T ₇	34.65	8.17
T ₈	38.53	8.28
T ₉	37.58	8.23
T ₁₀	30.89	8.00
CD _(0.05)	N/A	N/A
SE(m)	3.57	0.12

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of runners (4.47) was observed under no mulch. The findings were in conformity with Kaur and Kaur (2017). Favourably modified hydrothermal condition and improved nutrient availability supported better plant growth under black polythene mulch was well translated in the form of highest average fruit weight and highest average yield per plant. Increase in availability of nutrient and highly suppress weeds as a reason for improved yield has been reported by Sharma and Khokhar (2006) and Deb *et al* (2014).

The importance of mulching in controlling weeds is well recognised. Under the present study of using different mulching materials with regards to its effect in controlling weeds growth, different treatments (mulching materials) revealed different results. It was observed that the average number of weeds/ sq.m. was least under black polythene mulch (1.33) followed by silver on black polythene mulch (1.40) whereas maximum weeds infestation was under no mulch (15.93).

The study revealed that mulching significantly reduces the number of weeds/m² irrespective of the mulching materials used as compared to no mulch. Similarly, significant reduction in weeds through use of different mulching materials had been reported by Bakshi *et al* (2014), Verma *et al* (2017), Gunasekaran and Shakila (2014) and Narayan *et al* (2017).

More favourable modification of soil temperature and moisture under black polythene mulch may be attributed for better fruit growth parameter. In this treatment, highest record of temperature (30.20^o C at 90 DAP) was observed in black polythene mulch which was at par with silver polythene mulch (29.16^o C at 90 DAP) at a depth of 5 cm while the average soil temperatures were relatively lower in all other organic mulches. The warming under plastic mulch was attributed to entrapment of long wave radiation from soil, reduction in conduction loss under plastic mulches. Increase in soil temperature due to mulch has been observed under several studies (Singh and Kamal, 2012; Parmar *et al*, 2013).

It was observed from the study that different mulching materials also have an influence on the Anthocyanin content of strawberry. The maximum Anthocyanin content was observed under black plastic mulch (38.53 mg/ 100 g) followed by silver plastic mulch (37.58 mg/ 100 gm) and paddy straw mulch (35.85 mg/ 100 gm).

Maximum TSS (8.28 Brix) was observed under black polythene mulch while the minimum was observed under saw-dust (7.92 Brix). The result was in conformity with Pandey *et al* (2016). The difference in Anthocyanin content and TSS might be explained in terms of higher moisture and nutrient availability, higher root activity including higher uptake of water and nutrients, high photosynthesis and higher enzymatic activity.

CONCLUSION

The different kinds of mulches were useful in altering the hydrothermal regime of the soil and provide favorable soil environment for plant growth. However, black polythene mulch was more pronounced for altering soil environment than all the other mulches under study. It significantly enhanced plant height, plant spread, number of leaves, number of fruits and increases yield per plant. Black polythene mulch increases the soil temperature and conserves more soil moisture than all the other mulch materials undertaken for study. Thus, black polythene mulch may be recommended for obtaining better vegetative growth and for getting increased yield of strawberry under open condition in Mizoram.

REFERENCES

- 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 J Agri Res* 9 (7) : 701-706,
- Bakshi Prashant, Bhat Deep Ji, Wali V K, Sharma Akash. and Iqbal Mudasir (2014). Growth, yield and quality of strawberry (*Fragaria x ananassa* Duch.) cv. Chandler as influenced by various mulching materials. *African J Res* 9 (7) : 701-706.

- Deb P, Sangma D K, Prasad B V G, Bhowmick N and Dey Koyel (2014). Effect of different mulches on vegetative growth of strawberry (cv. Tioga) under Red and Lateritic zone of West Bengal. *Int J Basic and Appl Biol* **2** (2) : 77 – 80.
- Dwivedi S, Singh B. and Elipaljor (2000). Effect of mulch on establishment and growth of Apple sapling in Cold Arid Condition of Ladakh. *Prog Hort* **32** (1) : 32 - 42.
- Gunasekaran P. and Shakila Arumugam (2014). Effect of mulching on weed control and tuber yield of medicinal coleus (*Coleus forskholli* Briq.). *Asian J Hort* **9** (1): 124-127
- Hassan G I, Godara A K, Kumar J and Huchehe A D (2000). Effect of different mulches on yield and quality of ‘Oso Grande’ strawberry. *Indian J Agric Sci* **70** : 184–185.
- Hira L, Rao V K and Singh V P (2003). Effect of various mulches on growth and yield of Apple cv Starling Delicious Orchard. *Prog Hort* **35** (1): 25-30.
- 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, *Int J Recent Trend in Sci and Technol* **25** (1) : 21-25.
- Moor U, Karp K and Poldma P (2004). Effect of mulching and fertilization on the quality of strawberries. *Agri and Food Sc* **13** : 256 -267.
- Pandey S, Tewari G S, Singh J, Rajpurohit D and Kumar G (2016). Efficacy of mulches on Soil modification, growth, production and quality of Strawberry (*Fragaria x ananassa* Duch.). *Int J Sci and Nat* **7** (4) : 813-820.
- Parmer H D, Polara N D and Viradiya R R (2013). Effect of Mulching Materials on Growth, Yield and Quality of Water Melon (*Citrullus Lanatus* Thunb) Cv. Kiran. *Univ J Agri Res* **1** (2) : 30-37.
- Prasad B V G, Chakravorty S, Saren B K and Panda D (2014). Effect of mulching on physiological growth determinants of productivity in French bean (*Phaseolus vulgaris* L.) *Hortflora Res Spectrum* **3** (2) :162-165
- Qureshi K M, Hassan F, Hassan Q, Qureshi U S, Chaughati S and Saleem A (2012). Impact of cultivation system on growth and yield of Strawberry (*Fragaria x ananassa* Dutch) cv. Chandler. *Pakistan J Agric Res* **25** (2): 129-135.
- Sharma C L and Khokhar U U (2006). *Effect of different Mulches and Herbicides on Growth, yield and quality of Strawberry (Fragaria x Ananassa Dutch) cv. Chandler*. In: Temperate Horticulture: current scenario (Eds- Kishore *et al*. New India Publishing Agency, New Delhi), pp: 313-320.
- Sharma R R and Sharma V P (2003). Mulch influences fruit growth, albinism and fruit quality in strawberry (*Fragaria x ananassa* Duch). *Fruits* **58** : 221– 227.
- Singh A K, and Kamal S (2012). Effect of black plastic mulch on soil temperature and tomato yield in mid hills of Garhwal Himalayas. *J Hort and Fty* **4** (4) : 78-80.
- Singh R and Asrey R (2005). Growth, earliness and fruit yield of micro-irrigated strawberry as affected by time of planting and mulching. *Indian J Hort* **62** (2) :148-151.
- Singh R, Asrey R and Kumar S (2006). Effect of plastic tunnel and mulching on growth and yield of strawberry. *Indian J Hort* **63** (1) :18–20.
- Verma S K, Prasad S K, Kumar Sushil, Singh S B, Singh Ravi Prakash and Singh Y V (2017). Effect of mulching and herbicides on weeds, yield and economics of greengram (*Vigna radiata* L.) grown under eight-year-old agrihorti system. *Res on Crops* **18** (3) : 438-443

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