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Effect of Various Mulching Material on Yield and Quality of Strawberry (*Fragaria x ananassa* Duch.) cv. Winter Dawn

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ABSTRACT: A research entitled "Effect of various mulching material on yield and yield attributes of strawberry (*Fragaria* × *ananassa* Duch.) cv. Winter Dawn" was completed during the academic years 2020-2021 and 2021-2022 at the Research Farm of the Department of Horticulture at Sam Higginbottom University of Agriculture, Technology & Sciences in Prayagraj (U.P.). Eleven treatments using different mulching material were tested in a Randomised Block Design with three replicates. Treatments were namely T_1 Control (Without Mulching), T_2 Wheat straw (5 t/ha), T_3 Paddy straw (5 t/ha), T_4 Coconut husk (5t/ha), T_5 Paddy husk (5 t/ha), T_6 Saw dust (5 t/ha), T_7 Cut grass (5 t/ha), T_8 Green polythene (200 gaze), T_9 Blue polythene (200 gaze), T_{10} Transparent polythene (200 gaze), T_{11} Black polythene (200 gaze). The main goal of the experiment was to ascertain how different mulching materials affected strawberry yield and qualitative attributes. According to the findings of this study, application of treatment T_{11} Black polythene (200 gaze) proved to be most effective mulching material to increase yield and qualitative traits of strawberry.

Keywords: Strawberry, Mulching, yield and quality attributes.

INTRODUCTION

The strawberry (*Fragaria ananassa* Duch.), one of the most prominent temperate fruits, may also be easily grown in tropical and subtropical regions. According to Ali and Gaur (2007), it is admired for its seductive appearance, distinctly enticing aroma, and refreshing qualities. Strawberries are one of the few crops that give quick capital returns that are extremely high per unit area since they are available for harvest within six months of planting. It is recognized as the second most significant soft fruit after grapes and is liked by people all over the world because of its alluring hue, flavour, and fragrance. Strawberries are grouped together fruits of the achene's genus, or etaerio, according to botany. A medium-loam soil with plenty of organic matter and good drainage is required. The earth must. It is an important soft fruit after grape and being preferred by the people around the world due to its attractive colour, pleasant flavour and aroma. Botanically strawberry fruit is termed as aggregate fruit called etaerio of achenes. It require a well-drained medium loam soil, rich in organic matter. Soil should be slightly acidic with pH from 5.7-6.5. Temperate climate is ideal for strawberry cultivation. Generally, in between 10-25 °C temperature is supportive for this crop. Retentive power of flower commences on minimum 15 °C and it sluggish after more than 37 °C. In winter season plant do not make growth and remains dormant, when day become longer in spring with rise in temperature the plant resume growth and flowering. In the last ten years, strawberries have become the dominant fruit in the soft berry category. The world's strawberry production and area have grown exponentially over the past 20 years as more and more of the crop is being produced in enclosed spaces. According to Rana and Chandel (2003), commercial strawberry farming is practised in the Indian states of Maharashtra, Punjab, Haryana, Delhi, and portions of Himachal Pradesh, Jammu & Kashmir, Uttrakhand, Uttar Pradesh, West Bengal (Darjeeling Hills), and Rajasthan. In Himachal Pradesh, strawberry farming is still in its infancy but has recently picked up steam (Thakur and Shylla 2018).

Mulching is an important cultural practice followed in strawberry. Besides conserving the soil moisture, mulching also improves growth and fruit quality in strawberry (Hassan *et al*., 2000). Different types of organic and inorganic mulches are used. Organic mulches are derived from plant and animal materials. The most frequently used organic mulches include plant residues such as straw, hay, peanut hulls, leaf mold compost, wood products such as sawdust, wood chips and shavings, and animal manures. Organic mulches such as straw-vetch providing environmental benefits such as increased nitrogen, recycling of nutrients, weed emergence, reduced soil erosion, addition organic matter to the soil, reducing soil temperature during hot summer days and acting as a slow-released fertilizer

(Abdul-Baki and Teasdale 1993). In countries with chilly winters and brief summers, matting row systems—common among growers—are frequently employed in conjunction with straw. After blooming, cut wheat straw is generally spread between rows and, after harvest, cultivated into the soil. With annual hill systems, where strawberries are grown on raised beds, plastic mulch is frequently used. In areas with moderate winters and warm summers, such systems predominate (Hancock, 1999). In strawberry agriculture, polythene mulches are essential because they serve to retain moisture, control weeds, manage hydrothermal cycles, and shield the fragile fruits from coming into contact with the soil (Hancock, 1999; Sharma, 2009). Mulches boost water use efficiency, which lowers soil evaporation and increases productivity (Adekalu, 2006). Under plastic mulch, the soil is still friable, loose, and thoroughly aerated. Roots have access to enough oxygen, which enhances microbial activity. Because cucurbits, of which watermelon is one, have relatively shallow root systems and dislike being honed, mulching the soil with plastic film is very advantageous (Messiaen, 1992; Dadheech, 2018).

MATERIAL AND METHODS

The experiment was conducted in 2020–2021 and 2021–2022 on the agricultural research farm of the Department of Horticulture at the Naini Agricultural Institute in Allahabad, India. On the right bank of the Yamuna River along the South of Rewa Road, the location is about six kilometres south of Prayagraj. It is situated 98 metres (MSL) above sea level at 25024'23" north latitude, 81050'38" east longitude. 11 treatments and three replications were used in the experiment's randomised block design (RBD), and they were as follows: T_1 Control (Without Mulching), T_2 Wheat straw (5 t/ha), T_3 Paddy straw (5 t/ha), T_4 Coconut husk (5t/ha), T_5 Paddy husk (5 t/ha), T_6 Saw dust (5 t/ha), T_7 Cut grass (5 t/ha), T_8 Green polythene (200 gaze), T_9 Blue polythene (200 gaze), T_{10} Transparent polythene (200 gaze), T_{11} Black polythene (200 gaze).

Preparation and cultural practices of Experimental field:

For research purpose Before a week of transplanting, the disc harrow deeply ploughed the field. Removal of weeds and levelling of field was done in the next 2-3 days. Research field was divided in to 33 small plots of 2×1m dimensions with 30cm of bunds. 50cm width of irrigation channels were kept between two rows of plots.

For the recommended dose of NPK, FYM and DAP were applied in the field according to the treatments. Before the transplanting, basal dose were applied and mixed well in the soil and rest of doses were applied at the time of plant's requirement. Mulching materials were applied on prepared raised bed before transplanting.

A spacing of 45×30cm between row and plant in each plot respectively were maintained. Strawberry runners were transplanted accordingly. In each plot there were 12 plants transplanted. After the transplanting a light irrigation were provided to the plants.

RESULTS AND DISCUSSION

The observations related to yield and qualitative parameters like Fruit weight, yield/plant, yield/he, Acidity, reducing sugar, non-reducing sugar, TSS and Ascorbic acid were observed after the harvesting of fruits and the data regarding that parameters are given below:

Average Fruit weight(gram). The data related to fruit weight presented in Table 1. States that the maximum fruit weight was noted in T_{11} Black polythene (17.59g) which was also found at par with treatment T_5 Paddy husk (17.01g), T_3 Paddy straw (16.88g) and T_9: Blue polyethene (16.06g), whereas minimum value was recorded in treatment T_1 Without mulch (12.82g) during first year. In the second year treatment T_{11} Black polythene (18.72g) again showed maximum fruit weight which was also followed by T_3 Paddy straw (17.71 g), whereas maximum value was recorded in treatment T_1 Without mulch (12.21g).

The pooled data of two year also showed that highest fruit weight in the treatment T_{11}: Black polythene (18.14 g) which was also followed by T_3Paddy straw (17.28g). The minimum fruit weight was recorded in the treatment T_1: Without mulch (12.52 g). The robust growth of the plants under the black polythene mulches is the cause of the heavier fruit. The use of black polythene as a mulch produced similar results on larger fruits, according to Mathad and Jholgiker (2005). Black polythene mulch established favourable impact on different growth parameters of strawberry plants which also reflects in attainment of maximum fruit weight. The above findings in strawberries are highly congruent with those of Kher *et al.* (2010) and Bakshi *et al.* (2014).

Fruit yield/plant(g). The data presented in Table 1 clearly indicates the significant effect of mulching material on fruit production per plant. Maximum fruit production per plant was noted in treatment T_{11} Black polythene (244.12g) which was followed by with T_3 Paddy straw (232.31g), whereas minimum fruit yield per plant was noted in the treatment T_4 Coconut husk (176.72g) during first year. In the second-year treatment T_{11} Black polythene (270.64g) again showed maximum fruit yield per plant, while minimum was noted in the treatment T_1 Without mulch (170.29g).

The pooled data of two year also revealed that maximum fruit yield per plant in the treatment T_{11} Black polythene (257.36g) followed by T_3 Paddy straw (238.77 g). The minimum fruit yield per plant was recorded in the treatment T_1 Without mulch (174.07g). In contrast, the control group's minimal fruit production per plot and fruit yield per hectare were both noted.

In strawberry, Moor *et al.* (2004), Sharma and Khokhar (2006), and Nagalakshmi *et al.* (2002) reported increased nutrient availability and severely suppressed weeds as causes of improved yield; Pandey *et al.* (2016), Soliman *et al.* (2015), and Bakshi *et al.* (2014) also reported the same outcomes. Mulching had also

significant effect on all over parameters viz. fruit yield and quality as compared to without mulching.

Fruit yield per hectare(t/ha). The data presented in Table 1 clearly indicates the significant effect of mulching material on fruit yield per hectare. Maximum fruit yield per hectare was recorded in treatment T_{11} Black polythene (20.24 t/ha) which was found at par with T_3 Paddy straw (20.06 t/ha), whereas minimum fruit yield per hectare was noted in the treatment T_4 Coconut husk (14.50 t/ha) during first year. In the second-year treatment T_{11} Black polythene (22.11 t/ha) again showed maximum fruit yield per hectare, while minimum was noted in the treatment T_1 Without mulch (13.86t).

The combined two-year data also showed that the treatment T_{11} Black polythene had the highest fruit output per hectare (21.18 t/ha), followed by T_3 Paddy straw (20.37). The treatment T_1 Without mulch (14.24 t/ha) was shown to produce the smallest amount of fruit per plant. In comparison to not mulching, mulching had a considerable impact on all indicators, including fruit output and quality. Plant development and growth were enhanced by mulching. According to Swenson *et al.* (2004) and Miller *et al.* (2002), mulching improved water infiltration and increased water retention. Dobbelaere (2000) also noted an improvement in growth characteristics as a result of mulching. Moor *et al.* (2004) reported similar outcomes as well.

Total soluble solids (TSS). The data presented in Table 1 clearly indicates significant effect of mulching material on TSS content of strawberry. The highest value of TSS was observed in treatment T_{11} Black polythene (7.87 ^{0}Brix) which was found at par with treatment T_3 Paddy straw (7.42 ^{0}Brix), T_5 paddy husk (7.15 ^{0}Brix) and T_9 Blue polyethene (7.09^{0}Brix), whereas lowest value of TSS was noted in the treatment T_1: Without mulch (5.63 ^{0}Brix) during first year. In the second-year treatment T_{11}: Black polythene (8.50 ^{0}Brix) again showed maximum TSS followed by T_3: Paddy straw (7.80 ^{0}Brix), while minimum was noted in the treatment T_1: Without mulch (5.33 ^{0}Brix). The mean of two year also revealed the maximum TSS in the treatment T_{11}: Black polythene (8.17 ^{0}Brix) followed by T_3: Paddy straw (7.60 ^{0}Brix), whereas minimum TSS was obtained in the treatment T_1: Without mulch (5.48 ^{0}Brix). Higher moisture retention, maximal nutrient uptake, and weed-free conditions are all associated to higher fruit quality when treated with black polythene mulch. These findings are consistent with those of Singh *et al.* (2007) and Mathad and Jholgiker (2005). The fact that this environment raises soil temperature and provides favourable conditions for the mobilization of nutrients, metabolites, and energy can be seen as the source of the increase in TSS under black polythene mulching. This environment eventually encourages the growth in TSS. The findings of the current study in strawberries were in agreement with those of Abdalla *et al.,* 2014; Bakshi *et al.,* 2014; and Tariq *et al.* (2016).

Ascorbic acid (mg/100g). The data presented in Table 2 clearly indicates significant effect of mulching material on ascorbic acid content of strawberry. The highest value of ascorbic acid was observed in treatment T_{11} Black polythene (52.26 mg/100g), followed by T_5 paddy husk. whereas lowest value of ascorbic acid was noted in the treatment T_1 Without mulch (31.65 mg/100g) during first year. In the second-year treatment T_{11} Black polythene (56.09 mg/100g) followed by T_5 paddy husk again showed maximum ascorbic acid, while minimum was noted in the treatment TT_1: Without mulch (30.26 mg/100g). The mean of two year also revealed the maximum ascorbic acid in the treatment T_{11} Black polythene (54.16 mg/100g) followed by T_5 paddy husk (46.84). The minimum ascorbic acid was obtained in the treatment T_1: Without mulch (30.96 mg/100g). Higher moisture retention, maximal nutrient uptake, and weed-free conditions are all associated to higher fruit quality when treated with black polythene mulch. These findings are consistent with those of Singh *et al.* (2007) and Mathad and Jholgiker (2005). Black polythene mulch established higher light intensity which leads increase ascorbic acid content. The above findings are in agreement with Abdalla *et al.* (2014), Pandey *et al.*, (2016) and Kumar *et al*. (2018), in strawberry.

Titratable acidity (%). The revealed data in Table 2 clearly indicates significant effect of mulching material on Titratable acidity (%) content of strawberry. The lowest value of acidity (%) was observed in treatment T_{11} Black polythene (0.88%), whereas highest value of acidity (%) was noted in the treatment T_1 Without mulch (1.29%) during first year. In the second-year treatment T_{11} Black polythene (0.78%) again showed minimum acidity (%), while maximum was noted in the treatment T_1 Without mulch (1.63%).

The mean of two year also revealed the minimum acidity (%) in the treatment T_{11} Black polythene (0.83%). The maximum Titratable acidity (%) was obtained in the treatment T_1 Without mulch (1.44%). Similar to this, a lower titratable acidity but higher total soluble solids, sugars, ascorbic acid, and anthocynin contents The colour of mulches affects the temperature below and above the mulch through the absorption, transmission, and reflection of solar energy, which affects the microenvironment surrounding the plants in addition to better soil hydrothermal regimes and moisture conservation that may have induced favourable conditions favourable to the attainment of berries with better size and weight (Lamont, 1999).

Reducing sugars (%). The data presented in Table 2 clearly indicates Mulching material had a minimal impact on strawberry sugar content (%) reduction. Treatment T_{11} Black Polythene had the highest value in reducing sugars (3.86%), whereas lowest value of Reducing sugars (%) was noted in the treatment T_1: Without mulch (2.57%) during first year.

Table 1: Effect of various mulching material on yield and yield attributes of strawberry (*Fragaria x ananassa* Duch.) cv. Winter Dawn.

Treatments	Fruit Weight (g)			Yield/ plant (gm)			Yield (t/ha)			TSS (^{0}Brix)		
	1st year	2nd year	Pooled	1st year	2nd year	Pooled	1st year	2nd year	Pooled	1st year	2nd year	Pooled
T_1-Control (Without Mulching)	12.82	12.21	12.52	177.84	170.29	174.07	14.61	13.86	14.24	5.63	5.33	5.48
T_2-Wheat straw (5 t/ha)	13.81	14.63	14.21	191.62	203.51	197.55	15.99	16.50	16.25	6.07	6.41	6.23
T_3-Paddy straw (5 t/ha)	16.88	17.71	17.28	232.31	245.26	238.77	20.06	20.67	20.37	7.42	7.80	7.60
T_4-Coconut husk (5 t/ha)	13.03	13.89	13.45	176.72	191.98	184.33	14.50	15.34	14.92	5.73	6.14	5.92
T_5-Paddy husk (5 t/ha)	17.01	15.59	16.28	213.73	215.60	214.65	18.20	19.71	18.96	7.15	6.88	7.00
T_6-Saw dust (5 t/ha)	15.43	15.95	15.67	206.48	220.86	213.65	17.48	18.23	17.86	6.54	7.54	7.03
T_7-Cut grass (5 t/ha)	13.06	15.35	14.19	181.14	212.55	196.83	14.94	16.40	15.67	5.74	6.76	6.24
T_8-Green polythene (200 gaze)	15.92	16.08	15.99	220.06	222.81	221.42	18.84	19.13	18.99	7.00	7.09	7.03
T_9-Blue polythene (200 gaze)	16.06	15.50	15.76	220.65	213.27	216.94	18.89	19.17	19.03	7.09	7.35	7.21
T_{10}-Transparent polythene (200 gaze)	13.96	15.16	14.54	193.66	209.88	201.76	16.20	17.14	16.67	6.13	6.68	6.39
T_{11}-Black polythene (200 gaze)	17.59	18.72	18.14	244.12	270.64	257.36	20.24	22.11	21.18	7.87	8.50	8.17
F- test.	S	S	S	S	S	S	S	S	S	S	S	S
S.Ed (±)	0.856	0.897	0.605	9.088	11.021	6.224	0.909	1.102	0.622	0.503	0.472	0.425
SE(m)	0.606	0.634	0.428	6.427	7.793	4.401	0.643	0.779	0.440	0.355	0.334	0.300
C. D. (P.= 0.05)	1.713	1.795	1.210	18.180	22.045	12.450	1.818	2.205	1.245	1.005	0.944	0.850

Table 2: Effect of various mulching material on quality attributes of strawberry.

Treatments	Ascorbic acid (mg/100g)			Acidity (%)			Reducing sugar (%)			Non reducing sugar (%)		
	1st year	2nd year	Pooled	1st year	2nd year	Pooled	1st year	2nd year	Pooled	1st year	2nd year	Pooled
T_1-Control (Without Mulching)	31.65	30.26	30.96	1.29	1.63	1.44	2.57	3.62	3.10	1.00	1.09	1.05
T_2-Wheat straw (5 t/ha)	34.11	36.20	35.14	1.11	1.37	1.22	3.08	3.98	3.52	1.13	1.23	1.17
T_3-Paddy straw (5 t/ha)	41.70	43.68	42.68	1.16	1.24	1.19	3.71	4.89	4.29	1.32	1.41	1.35
T_4-Coconut husk (5 t/ha)	32.17	37.61	34.88	1.14	1.31	1.21	2.90	3.81	3.34	1.02	1.25	1.12
T_5-Paddy husk (5 t/ha)	47.58	46.12	46.84	0.89	1.00	0.93	3.26	4.89	4.06	1.28	1.40	1.33
T_6-Saw dust (5 t/ha)	36.75	39.34	38.03	1.02	1.12	1.06	3.34	4.31	3.81	1.16	1.27	1.20
T_7-Cut grass (5 t/ha)	32.24	37.86	35.04	0.89	1.08	0.97	3.21	3.79	3.48	1.02	1.23	1.11
T_8-Green polythene (200 gaze)	39.32	39.69	39.49	1.09	1.13	1.10	3.36	4.61	3.97	1.24	1.29	1.25
T_9-Blue polythene (200 gaze)	43.14	47.86	45.49	0.94	0.97	0.94	3.23	4.71	3.95	1.24	1.37	1.29
T_{10}-Transparent polythene (200 gaze)	34.47	37.38	35.91	0.95	1.07	1.00	3.17	4.05	3.60	1.09	1.29	1.18
T_{11}-Black polythene (200 gaze)	52.26	56.09	54.16	0.88	0.78	0.83	3.86	5.37	4.60	1.38	1.81	1.58
F- test.	S	S	S	S	S	S	NS	NS	NS	NS	NS	NS
S.Ed (±)	1.800	1.717	1.236	0.099	0.109	0.095	0.394	0.595	0.419	0.390	0.486	0.403
SE(m)	1.273	1.214	0.874	0.070	0.077	0.067	0.278	0.421	0.297	0.276	0.344	0.285
C. D. (P.= 0.05)	3.600	3.435	2.472	0.199	0.217	0.190	0.788	1.191	0.839	0.780	0.973	0.807

In the second-year treatment T_{11}: Black polythene (5.37%) again showed maximum Reducing sugars (%), while minimum was noted in the treatment T_1: Without mulch (3.62%).

The mean of two year also revealed the maximum Reducing sugars (%) in the treatment T_{11}: Black polythene (4.60%). The minimum Reducing sugars (%) was obtained in the treatment T_1: Without mulch (3.10%). Higher fruit quality in strawberry when mulched a weed-free environment, high moisture retention, and maximum nutrient uptake are all associated with paddy straw. The difference in the

strawberry fruit's juice content among the various mulches may be due to superior water and nutrient delivery during fruit growth and conservation efforts. These findings are consistent with those made earlier in strawberry cv by Kumar *et al.* (2012). Charlie the sweet.

Non-reducing sugars (%). The data given in Table 2. clearly indicates non-significant effect of mulching material on non-reducing sugars (%) content of strawberry. The highest value of Non-reducing sugars (%) was observed in treatment T_{11} Black polythene (1.38%), whereas lowest value of Non-reducing sugars (%) was noted in the treatment T_1: Without mulch (1.00%) during first year. In the second-year treatment T_{11} Black polythene (1.81%) again showed maximum Non-reducing sugars (%), while minimum was noted in the treatment T_1 Without mulch (1.09%). The mean of two year also revealed the maximum Non- reducing sugars (%) in the treatment T_{11} Black polythene (1.58%). The minimum Non-reducing sugars (%) was obtained in the treatment T_1 Without mulch (1.05%). Higher fruit quality in strawberry when mulched together with Paddy A weed-free environment, high moisture retention, and maximum nutrient uptake are all associated with straw. The difference in the strawberry fruit's juice content among the various mulches may be due to superior water and nutrient delivery during fruit growth and conservation efforts. These findings are consistent with those made earlier in strawberry cv by Kumar *et al*. (2012). Moor *et al.* (2004) in strawberry, Gaikwad *et al.* (2004) in Nagpur mandarin, Nath and Sharma (1994) in Assam lemon, Verma *et al.* (2005) in apple, Das *et al.* (2010) in guava, Singh *et al.* (2010) in aonla, and Patil (2011) in strawberry are some examples of Sweet Charlie. In response to mulching treatments, Ali and Gaur (2007) found elevated levels of total sugars and ascorbic acid.

CONCLUSION

According to the results of the current experiment, black polythene mulch treatment (T_{11}) had a more positive impact than other treatments on the yield and quality characteristics of strawberry cv. Winter Dawn. Black polythene mulch has been found to boost strawberry plant growth, yield, and health despite the absence of synthetic inputs by releasing substances into the rhizosphere that may prevent several diseases as biocontrol agents. The strawberry producers can use this method of strawberry cultivation to increase their output and productivity. Overall, growers of strawberries might be advised to use this treatment to achieve high yield per hectare in a safe and cost-effective manner.

REFERENCES

Abdul-Baki, A.A., and Teasdale, J.R. (1993). A no tillage tomato production system using hairy vetch and subterranean clover mulches. *Hort Sci.*, *28*, 106-108.

Adekalu, K.O., Okunade, D. A. and Osunbita, J. A. (2006). Compaction and mulching effects on soil loss and runoff from two South-Western Nigeria agricultural soils. *Geoderma.*, *137*, 226-30.

Ali, A. and Gaur, G. S. (2007). Effect of mulching on growth, fruit yield and quality of strawberry (*Fragaria* × *ananassa* Duch.). *Asian J Hort., 2*(11), 149-151.

Bakshi, P., Bhat, D., Wali, V. K., Sharma, A. and Iqbal, M. (2014). Growth, yield and quality of strawberry cv. Chandler as influenced by various mulching materials. *Afr. J. Agric. Res., 9*, 701-706.

Dadheech, S., Ramawtar and Yadav, C. M. (2018). Impact of Mulching Material on the Growth, Yield and Quality of Watermelon (*Citrullus lonatus*). *Int. J. Current Microbiol. App. Sci*., *7*(07), 2774-2782.

Das, B. C., Maji, S. and Mulieh, S. R. (2010). Response of soil covers on guava cv. L-49. *J. Crop & Weed*, *6* (2), 10-14.

Dobbelaere, S., Croonenboghs, A., Thys, A., Ptacek, D., Vanderleyden, J. (2001). Responce of agronomically important crops to inoculation with Azospirilium. *Aust. J Plant Physiol*., *28*, 871-879.

Gaikwad, S. C., Ingle, H. V. and Panchbhai, D. M. (2004). A note on the effect of different types of mulches on growth, yield and quality of Nagpur mandarin. *Orissa J. Hort*., *30*(1), 78-81.

Hassan, G. I., Godara, A. K., Kumar, J., and Hucheche, A. D. (2000). Effect of different mulches on the yield and quality of 'Oso Grande' strawberry *(Fragaria Xananasa). Indian Journal of Agricultural Sciences*, *70*(3), 184.

Hancock, J. F. (1999). Strawberries. CAB International, Wallingfold, UK. 237.3

Khokhar, U. U. (2006). Effect of different mulches and herbicide on growth, yield and quality of strawberry (*Fragaria* × *ananassa Duch*.) cv. Chandler. *New India publishing Agency, New Delhi*, pp. 313-320.

Kher, R., Baba, J. A., 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., Tandon, V., and Mir, M. M. (2012). Impact of different mulching materials on growth, yield and quality of strawberry (*Fragaria* × *ananassa Duch.*). *Progressive Hortic*., *44*(2), 234-236.

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.

Lamarre, M., Lareau, M. J., Payette, S., Fortin, C. (1996). Influence of nitrogen fertilization, row covers and cultivars on the production of day-neutral strawberries in Quebec. *Canad. J Soil Sci.*, *76*(1), 29-36.

Mathad, J. C., and Jholgiker, P. (2005). Effect of synthetic and organic mulches in improving growth, yield and quality of strawberry under subtropical ecosystem. *Acta Hortic*., *696*, 56-61.

Messiaen, C. M. (1992). The tropical vegetables garden, Macmillan presse Ltd., London and Basingstoke in cooperation with CTA. The Netherlands, 514 pp.

Moor, U., Karp, K., Poldma, P. (2004). Effect of mulching and fertilization on the quality of strawberries. *Agric. Food Sci*., *13*, 256-267.

Miller, J. J., Chang, C. J. (2002). Hydrological properties of clay laom soil after long- term cattle manure application. *J environ*., *31*, 989-996.

Nath, J. C. and Sharma, R. (1994). A note on the effect of organic mulches on fruit quality of Assam lemon (Citrus limon Burm.). *Indian J. Hort*., *23*(1), 46-48.

Nagalakshmi, S., Palanisamy, D., Eswaran, S., and Sreenarayan, V. V. (2002). Influence of plastic mulching in chilli yield and economics. *South Ind. Hort., 50*, 262-265.

Panse, V. G. and Sukhatme, P. V. (1967). Statistical methods for agricultural workers. *ICAR Publication, New Delhi, India.* 100-106 pp.

Pandey, S., Tewari, G. S., Singh, J., Rajpurohit, D. and Kumar, G. (2016). Efficacy of mulches on soil modifications, growth, production and quality of strawberry (*Fragaria* × *ananassa* Duch.). *I.J.S.N., 7,* 813-820.

Pandey, S., Tewari, G. S., Singh, J., Rajpurohit, D. and Kumar, G. (2016). Efficacy of mulches on soil modifications, growth, production and quality of strawberry (*Fragaria* × *ananassa Duch.). I.J.S.N.*7: 813-820.

Patil, N., (2011). Response of strawberry (*Fragaria* × *ananassa* Duch.) cv. CHANDLER to different mulches. M.Sc. Thesis, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttrakhand, India.

Probasco, P. R., Garrison, S. A. and Fiola, J. A. (1994). Annual strawberry production on plastic mulch. In: 25th National Agricultural Plastics Congress. Proc. Conf. held in Lexington, k Y., USA, @27 September, (ed. By Jones, T.T.) St. Augustine, USA, *Am. Soc. For Plasticulture*, 215-220.

Rana, R. K. and Chandel, J. S. (2003). Effect of biofertilizers and nitrogen on growth, yield and fruit quality of strawberry. *Progressive Horticulture, 35*(1), 25-30.

Shokouhian, A. A. and Asghari, A. (2015). Study the effect of mulch on yield of some strawberry cultivars in Ardabil condition. *Int. Conference on Agric, Eco. and Bio Engineering.*

Singh, A. K., Singh, S., Rao, A. V., Bagle, B. G., and More, T. A. (2010). Efficiency of organic mulches on soil properties, earthworm population, growth and yield of aonla cv. NA7 in semi-arid ecosystem. *Indian J. Hort., 67,* 124-128.

Soliman, M. A., Abd-El-Aal, H. A., Ramadan, M.A., and Elhefnawy, N. N. (2015). Growth, fruit yield and quality of three strawberry cultivars as affected by mulch type and low tunnel. *Alexandria Science Exchange Journal, 36*(4), 402-413.

Swenson, J. A., Walters S. A., and Chong, S. K. (2004). Influence of tillage and mulching systems on soil water and tomato fruit yield and quality. *Journal of Vegetable Crop Production*, *10*(1), 81–95.

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

Thakur, Mamta and Shylla, Bunty (2018). Influence of Different Growing Media on Plant Growth and Fruit Yield of Strawberry *(Fragaria* × *ananassa* Duch.) Cv. Chandler Grown under Protected Conditions. *Int. J. Curr. Microbiol. App. Sci., 7*(4), 2724-2730.

Verma, M. L., Bhardwaj, S. P., Thakur, B. C. S. and Bhandari, A. R. (2005). Nutritional and mulching studies in apple. *Indian J. Hort*., *62*(4), 332-335.

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