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Effect of Mulching Material on Growth, Yield and Quality of Watermelon (Citrullus Lanatus Thunb) Cv. Kiran

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Abstract The field experiment conducted on watermelon (*Citrullus lanatus* Thunb) cv. Kiran at Fruit Research Station*, "Lalbaugh"*, Department of Horticulture, College of Agriculture, J.A.U., Junagadh during summer season of 2010 to study the effect of different mulching material on growth, yield and quality of water melon cv. Kiran. All the plant growth, yield and quality characters were superior with silver on black polyethylene mulch while, plants without mulch (control) resulted poor growth and yield. With economic point of view, silver on black mulch resulted in the highest net return and found to be more economical with highest cost:benefit ratio.

Keywords Mulching, Plastic Mulch, Watermelon

1. Introduction

Watermelon (*Citrullus lanatus* Thunb.) is one of the important cucurbits vegetable crops grown extensively in India and in tropical and sub tropical countries of the world. It is a major river-bed crop of Uttar Pradesh, Rajasthan, Gujarat, Maharashtra and Andhra Pradesh. It is a popular dessert vegetable with year round availability. Cucurbits share about 5.6 per cent of the total vegetables production of India. Mulching in general is a beneficial practice for crop production. Mulch conserves soil moisture, retained heat as well as it suppresses weed growth (Ahmad *et al*., 2007, Sharfuddin and Ssiddique, 1985).The greatest benefit from plastic mulch is that the soil temperature in the planting bed is raised, promoting faster crop development and earlier harvest. Black plastic mulch can give a harvest earlier by some 7-14 days, while clear plastic may advance the harvest date by 21 days. Soil water loss is reduced under plastic mulch. As a result, a more uniform soil moisture is maintained and irrigation frequency can be reduced. The growth of plants on mulch can be twice that of plants in unmulched soil. Because larger plants will require more water, mulching is not a substitute for irrigation. Black and white on black mulches will reduce light penetration to the soil. Weeds cannot generally survive under such mulch. Excess water runs off the impervious mulch. Fertilizer beneath the mulch is not lost by leaching, so that fertilizers are optimally used and not wasted. The soil under plastic mulch remains loose, friable and well-aerated. Roots have access to adequate oxygen, and microbial activity is enhanced. Cultivation is eliminated, except in the area between the mulched strips. Use of reflective mulches to delay onset of aphid vectored viruses in summer squash has been well documented in the research literature. (Black 1980, Lancaster *et al*. 1987, Conway *et al*. 1989 and Lamont *et al*. 1990).Therefore, considering the importance of different mulching in various vegetable crops, the present investigation was carried out to study the effect of different mulching material on growth, yield and quality of watermelon.

2. Materials and Methods

The field experiment was conducted on water melon cv. Kiran at Fruit Research Station*, "Lalbaugh"*, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh during summer 2010. The experiment was laid out in Randomized Block Design with three replications. There were total eight treatment of mulching materials viz., control (T_1), wheat straw (T_2), silver on black polyethylene mulch (T_3), yellow on black polyethylene mulch (T_4), red on black polyethylene mulch (T_5), black on white polyethylene mulch (T_6), white on black polyethylene mulch (T_7) and dry leaves mulch (T_8). Mulching applied up to 50 cm both the side from the stem of watermelon. Temperature and moisture content will be carried out at 10 cm and 15 cm depth. The thickness of all polyethylene much was 30 micron while dry leaves and wheat straw much was applied at 6 inch thick. Single seed of cv. Kiran" was dibbled at each hill on 23rd March 2010 at 2 m x 1 m spacing. The fertilizers were applied at the rate of 100:50:50 NPK kg/ha. Full dose of P_2O_5 and K_2O was applied as basal dose and nitrogen was given in two equal split as basal and top dressing at 30 DAS. The farmyard manure @ 20 tonnes per hectare was mixed in soil uniformly to all the treatments. The observations on growth, flowering, yield and quality parameters were recorded and subjected to statistical analysis of variance technique as described by Panse and Sukhatme (1985).

Table 1. Effect of different mulching material on growth and yield of watermelon cv. Kiran

Sr. No.	Treatments	No. of branches per vine	Vine length (cm)				No. of node	M:F (sex) ratio	Fruit length (cm)	Fruit girth (cm)	No. of fruits/ vine	Fruit wt. (kg)	Fruit yield (t ha^{-1})
			30 DAS	45 DAS	60 DAS	Harvest							
T_1	Control (no mulch)	7.40	83.85	105.56	117.49	159.67	42.78	5.97	28.03	14.59	2.17	2.80	22.59
T_2	Wheat straw	11.07	94.12	112.68	138.52	185.26	44.33	5.43	30.01	15.32	2.24	2.83	25.37
T_3	Silver on black	14.90	125.13	156.37	180.27	224.97	59.58	4.57	37.45	17.62	3.23	3.61	35.37
T_4	Yellow on black	11.00	104.13	123.03	139.31	178.23	49.07	5.31	32.90	16.19	2.45	3.04	26.30
T_5	Red on black	13.43	110.74	132.61	146.06	190.00	52.34	4.63	33.13	16.57	2.73	3.35	30.37
T_6	Black on white	13.63	116.44	142.11	161.01	206.62	57.86	4.93	35.35	17.68	2.97	3.56	33.52
T_7	White on black	12.83	100.61	120.48	143.53	189.67	49.16	5.20	31.12	15.08	2.46	3.05	29.26
T_8	Dry leaves mulch	10.67	99.26	118.14	140.08	186.67	45.62	5.07	30.14	15.07	2.30	2.97	25.56
	S.Em.±	0.599	5.100	5.280	6.376	7.866	2.369	0.297	1.390	0.770	0.121	0.132	1.229
	C.D. at 5 %	1.82	15.47	16.02	19.34	23.86	7.19	NS	4.22	NS	0.37	0.40	3.73
	C.V. %	8.74	8.47	7.24	7.57	7.17	8.19	10.01	7.46	8.33	8.18	7.23	7.46

Table 2. Effect of different mulching material on fruit quality number of watermelon cv. Kiran

Sr. No.	Treatments	Fruit pulp wt. (g)	Rag wt. (g)	No. of seed/fruit	TSS (%)	Acidity (%)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)	Av. soil temp.	Moisture (%)
T_1	Control (no mulch)	1983.33	860.00	516.00	10.07	0.44	1.27	2.90	4.17	33.7	47.5
T_2	Wheat straw	2101.33	843.33	524.67	10.20	0.41	1.53	3.20	4.73	31.6	46.3
T_3	Silver on black	2418.67	815.33	578.33	10.43	0.37	1.80	3.67	5.47	30.9	48.1
T_4	Yellow on black	2115.00	818.00	523.67	10.27	0.40	1.60	3.50	5.10	32.2	45.0
T_5	Red on black	2185.00	853.33	546.67	10.18	0.41	1.63	3.56	5.19	31.6	46.0
T_6	Black on white	2308.67	816.33	564.33	10.24	0.36	1.76	3.61	5.37	31.7	46.8
T_7	White on black	2148.67	844.67	536.33	10.24	0.38	1.59	3.19	4.78	32.2	47.2
T_8	Dry leaves mulch	2065.33	834.00	517.67	10.24	0.40	1.57	3.31	4.88	32.1	44.7
	S.Em.±	75.339	53.337	23.666	0.378	0.017	0.099	0.158	0.257	-	-
	C.D. at 5 %	228.54	NS	NS	NS	0.05	0.30	0.48	0.78	-	-
	C.V. %	6.03	11.06	7.61	6.40	7.22	10.77	8.16	8.93	-	-

NS= non significant

3. Results and Discussion

3.1. Effect on Growth and Yield

The results revealed that different types of mulching materials significantly influenced the growth parameters of watermelon viz., number of branches per vine, main vine length and number of nods per vine over control. Among different mulching treatments, treatment T3 (Silver on black plastic mulch) resulted higher number of branches per vine, increased main vine length and number of nods per vine. However control recorded the minimum growth. The increase in growth parameters was attributed to sufficient soil moisture near root zone and minimized the evaporation loss due to mulching. The extended retention of moisture and availability of moisture also leading to higher uptake of nutrient for proper growth and development of plants, resulted higher growth of plant, as compared to control. The changes in soil temperature below PE mulch could be attributed to different manners of heating and heat transfer to soil and also to heat accumulation during day and loss during night. Similar findings have also been obtained by Dean ban *et al.* (2004), Ansary and Roy (2005) in wateremelon, Al-Majali and Kasrawi (1995) in muskmelon, Hallidri (2001) in cucumber, Alemayehu-Ambaye and Joseph (2002) in melon, Sharma and Agrawal Narendra (2004) in tomato, Angrej-Ali and Gaur (2007) in strawberry, Aruna *et al.* (2007) in tomato.

The results indicated that the effect of different mulching material on fruit length of watermelon was significantly increased than control. Maximum fruit length was observed in treatment silver on black plastic mulch, whereas the minimum fruit length of watermelon was noted in control. The highest fruit length under silver on black mulch was due to congenial soil moisture results higher uptake of nutrition for better growth of fruit, the reduction in evaporation losses of soil moisture caused by mulches covered the soil surface in row of watermelon. The above results were in consonance with those of Johnson *et al*. (2000), Ansary and Roy (2005) in watermelon, Sharma and Agrawal Narendra (2004) in tomato, Suresh and Ashok kumar (2006) in pointed gourd.

Silver on black polyethylene mulch was found to have significantly better effect on the extent of fruit set than other mulching materials tried. This mulch consistently increased higher fruit set than other mulch and no mulch. This might have been influenced by favourable soil temperature, moisture conditions and pest-disease control as influenced by silver on black mulch. The present finding was in accordance with Andino and Motsenbocker (1998), Johnson *et al*. (2000), Ansary and Roy (2005) in watermelon and Hanna (2000) in cucumber.

It was found that all treatments of mulching material were significantly increased the average fruit weight (kg) of watermelon than control. Among all mulching treatments, maximum average fruit weight was recorded in treatment silver on black mulch. It appears that silver on black polyethylene mulch might have induced favourable conditions conducive to attainment of fruits with higher weight. The above results were in agreement with those of Ansary and Roy (2005), Arancibia and Motsenbocker (2008) in watermelon, Sharma and Agrawal Narendra (2004), Aruna *et al.* (2007) in tomato and Angrej-Ali and Gaur (2007) in strawberry.

It was found that all the treatments of mulching material were significantly increased the fruit yield of watermelon. Among all mulching treatments, maximum fruit yield recorded in treatment silver on black polyethylene mulch. Yield of watermelon was higher in plants mulched with silver on black polyethylene, which was higher as compare to other mulch and no mulch. Plants under polyethylene mulch (silver on black) produced larger fruit and have higher fruit yield per vine because of better plant growth due to favourable hydro-thermal regime of soil and complete weed free environment. The above results were in consonance with those of Rudich *et al*.(1978), Battikhi and Ghawi (1987), Bhella (1988), Qadir (1992), Al-Majali and Kasrawi (1995), Johnson *et al*. (2000), Dean ban *et al.* (2004), Ansary and Roy (2005), Cenobio *et al.* (2007) and Arancibia and Motsenbocker (2008) in watermelon, Siwek and Kunicki (1998), Ibarra–Jimenez *et al*. (2008), Hallidri (2001) in cucumber, Ibarra *et al.* (2001) in muskmelon.

3.2. Effect on Quality

The data indicated that the effect of various treatments of mulching material on quality parameters viz., Total soluble solid, fruit pulp weight (g), acidity (%), reducing sugar, total sugar and non-reducing sugar was found significant in fruit of watermelon. It was found that all treatments of mulching material were significantly increased the fruit pulp weight of watermelon but it was unable to exert a significant influence on rag weight and number of seeds per fruit than control. Among all treatments of mulching, maximum fruit pulp weight was recorded in treatment silver on black mulch. An increase in fruit pulp weight in mulched plants may further attributed to the reason that plants remain physiologically more active to build up sufficient food stock for the developing fruits. The above results were in agreement with those of Suresh and Ashok Kumar (2006) in pointed gourd, Angrej-Ali and Gaur (2007) in strawberry, Aruna *et al.* (2007) in tomato, Aruna and Roy (2005) in watermelon.

It was found that application of mulching material had produced a significant effect on acidity per cent in fruit of watermelon than control. Among all the treatments of mulching significantly minimum acidity were observed in treatment silver on black mulch over control. The present finding was in accordance with Sharma and Agrawal Narendra (2004) and Aruna (2007) in tomato. The total soluble solids (%), reducing sugars (%), total sugar (%) and non reducing sugar (%) were significantly increased than the control. Among all treatments of mulching, maximum TSS, reducing sugars, total sugar and non-reducing sugar of watermelon fruit were observed in treatment silver on black mulch. While, the minimum sugar content of watermelon fruit was observed in control treatment. The present findings were in close confirmation with Ansary and Roy (2005) in watermelon, Sharma and Agrawal Narendra (2004) and Aruna *et al*. (2007) in tomato.

Table 3. Effect of different mulching material on economics of watermelon cv. Kiran

Sr.No.	Treatments	Yield (t ha^{-1})	Gross realization (Rs. ha^{-1})	Total Expenditure (Rs. ha^{-1})	Net realization (Rs. ha^{-1})	CBR
T1	Control (no mulch)	22.59	225900	209770	16130	1:1.08
T2	Wheat straw	25.37	253700	210120	43580	1:1.21
T3	Silver on black	35.37	353700	214480	139220	1:1.65
T4	Yellow on black	26.30	263000	214480	48520	1:1.23
T5	Red on black	30.37	303700	214480	89220	1:1.42
T6	Black on white	33.52	335200	214480	120720	1:1.56
T7	White on black	29.26	292600	214480	78120	1:1.36
T8	Dry leaves mulch	25.56	255620	209790	45830	1:1.22

Price: Watermelon @ Rs.10 kg^{-1}, mulching material @ Rs. 3.5 m^{-2}

It was observed from Table 3 that highest net return with maximum CBR was obtained with treatment silver on black mulch followed by treatments black on white mulch. The lowest net return with minimum CBR was obtained in control (no mulch). The net realization was increased due to different mulches as compared to control treatment. The treatment of silver on black mulch recorded higher fruit yield though higher net realization was recorded under this treatment silver on black mulch. These findings are in close agreement with the results of Singh *et al.* (2006) in cabbage, Suresh and Ashok Kumar (2006) in pointed guard and Balraj Singh *et al.* (2007) in bittergourd.

4. Conclusions

It is concluded that application of mulches over contro is beneficial to farmers. Higher the CBR, needs to be adopted first by farmers based on availability of mulch material and other priority criteria.

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