



EFFECT OF PLASTIC MULCH ON GROWTH, YIELD AND ECONOMICS OF WATERMELON [*Citrullus lanatus* (Thumb.) Matsum and Nakai] UNDER NIMAR PLAINS CONDITIONS OF MADHYA PRADESS

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ABSTRACT: In order to define the influence of mulching on growth and yield of watermelon, an experiment was laid out as *on-farm* trials entitled "Effect of plastic mulch on growth, yield and economics of watermelon [*Citrullus lanatus* (Thumb.) Matsum et Nakai] under Nimar plains conditions of Madhya Pradesh" at farmer's field in five locations at Khargone district of Madhya Pradesh during two consecutive spring growing season of 2011 and 2012. Watermelon was grown on silver-on-black plastic mulch and without mulch field. The main vine length, number of branches, number of fruits per plant, average fruit weight and yield per hectare were recorded. It was noticed that plastic mulch had significant response on vegetative growth, yield and net profit. Plants in plastic mulch treatment had higher yields ascribed due to higher length of vine, number of branches, number of fruits per plant and average fruit weight. The study revealed that silver-on-black plastic film could be conducive and beneficial in enhancing the yield which lead to 75.29% and 82.10% increase over farmers' practice during 2011 and 2012, respectively with a mean value of 78.70% increase over farmers practice and net profit of watermelon found suitable for an early spring sowing under the Nimar Zone conditions of Madhya Pradesh.

Keywords: Watermelon, plastic mulch, vine, fruit, growth, yield.

Watermelon [*Citrullus lanatus* (Thumb.) Matsum and Nakai] is among the most widely cultivated crops in the world and its acreage has been noticed to increased in the past years (FAOSTAT, 2). The commercial production of watermelon is limited to areas with long growing season. In less suitable regions, the harvest could be delayed and yield reduced by low air and soil temperatures during night, following spring and early summer sowing (Soltani *et al.*, 7). Development of new technologies and especially application of plastic film as mulch, have shortened growing season and enhanced earliness and yield (Goreta *et al.*, 3). Now-a-days, usage of plastic mulch and fertigation are widely adopted by commercial producers of watermelon (McCann *et al.*, 4). Earlier harvest is among the most important advantages of plastic mulch application (Brown *et al.*, 1). Besides beneficial effect on earliness, plastic film as mulch can enhance plant growth and development resulting in an increase yield, decrease soil evaporation, nutrient leaching and

improved fruit cleanliness and quality. Thus the study was conducted to investigate the effect of plastic mulch on growth, yield and economics of watermelon under Nimar plains conditions of Madhya Pradesh.

MATERIALS AND METHODS

Field experiments with watermelon [*Citrullus lanatus* (Thumb.) Matsum and Nakai] cv. Romino was conducted during the spring season of 2011 and 2012 at farmers' field, Dogaon village, Kasravad block of Khargone district of Madhya Pradesh. The soil of farmers field is loamy sand with pH (7.6-7.8), EC (0.43-0.44 dSm⁻¹), organic matter (0.50-0.68%), available N (201.50-246 Kg ha⁻¹), available P (8 Kg ha⁻¹) and available K (380 Kg ha⁻¹). Temperature data (Fig. 1 and 2) during the study period were collected from observatory, ZARS, Khargone (M.P.). The treatments T₁ (Farmers practice-without mulch) and T₂ (Recommended practice-silver-on-black plastic mulch sheet of 30 micron thick and 120 cm width) were arranged and executed at five farmer's field.

The Nimar plains is situated between 20° 40' and 22° 50' North latitude and 74° 42' and 77° 20' East longitude. The region is characterized by hills as well as plain areas. The height ranges between 200-500 m from MSL and major part lies on uplands between the valley of Narmada and Tapti. The Nimar Zone is the hottest belt of the country where the maximum temperature ranges up to 43° to 46°C during summer season and minimum temperature fluctuates between 6°C to 10°C during winter season. The average annual rainfall is 835 mm. Generally monsoon commences from June and maximum rainfall is received during July-August. The Nimar zone has dry climate except during the South-West monsoon season.

A month before sowing, fields were ploughed at 25-30 cm depths. FYM 150 q ha⁻¹+ N 30 Kg ha⁻¹ + P 120 Kg ha⁻¹ and K 90 Kg ha⁻¹ + 25 Kg Magnesium Sulphate ha⁻¹ were applied as broadcast uniformly and cultivated to a 20 cm depth. Additional water soluble fertilizers were also applied as NPK 19:19:19 (25 Kg/ha) during both the years at 15 and 30 DAS, Boron (500 g ha⁻¹)+ Calcium Nitrate (25 kg ha⁻¹) at 40 DAS, NPK 13-00-45 (25 Kg ha⁻¹) at 50 DAS, NPK 12:61:00(25 Kg ha⁻¹) at 55 DAS, NPK 00:52:34 (25 Kg ha⁻¹) at 60 DAS and NPK 13:00:45 (25 Kg ha⁻¹) at 65 DAS and NPK 00:00 50 (25Kg ha⁻¹) at 70 DAS. In total, 46 kg N was fertigated through urea @ 10Kg ha⁻¹ per week till fruit setting stage.

The sowing was done on first week of February in 2011 and 2012. Sowing beds were 0.5 wide and 0.3 m high and covered with plastic mulch. The rows were 2.0 m apart and in-row 0.40 m plant spacing was maintained. Experimental plots were 500 m² each. The drip irrigation tap with emitters spaced every 40 cm and a capacity of 4 LPH was installed near the centre of the bed. Weeds between rows were removed by hand as and when needed, while diseases and pests were controlled as per recommended practices.

The number of branches and the length of vines were recorded from 15 plants in the middle of the each plot. Measurements were done on 30 and

60 DAS in 2011 and 2012. Watermelons were harvested on ripening of fruit and the fruits at first harvest were considered as early yield. Watermelons at each individual site were harvested three times. All fruits were counted and weighed accordingly. The data on yield, cost of cultivation, gross return, net return and B: C ratio was estimated as per paired "t" test of significance to judge the level of significance.

RESULTS AND DISCUSSION

Vegetative growth: The parameters on vegetative growth were found to be affected by plastic mulch. The main vine length was longer at silver-on-black plastic mulch as compared to without mulched fields (Table 1). Longer vines of watermelon plants were noticed on plastic mulch than without plastic mulch indicating the more availability of available nutrient for plant growth which could be due to the balanced moisture availability leading to enhanced mineralization of organic forms of nutrients which also confirms the findings reported by Soltani *et al.* (7). The studies suggest that an altered plant micro- environment due to plastic mulch affected the growth of watermelon main vine length. Watermelon main vines, three weeks after sowing, were growing out from the plastic surface and into the row middles. This could account for the reduced response of watermelon plants to plastic mulches 4 weeks after sowing. Full canopy coverage of the plastic mulch treatments was observed at 7 weeks after sowing. Number of branches (Table 1) showed that the mulch had a significant effect on the number of branches per plant. The number of branches per plant continually was found to increased with plant age over control. Such response could be ascribed due to favourable weather condition and moisture status of the soil affecting the number of branches per plant which confirmed the findings of Singh *et al.* (8) in strawberry and Srivastava *et al.* (9) in mulched tomato plants.

Yield and yield components: The highest number of fruits per plant (Table 2) was observed in plastic mulch (3.40/plant in 2011) and (3.60/plant

Table 1: Effect of plastic mulch on main vine length and number of branches of watermelon plant.

Parameter	2011		2012		Mean		“t” Calculated #
	T ₁	T ₂	T ₁	T ₂	T ₁	T ₂	
Length of the main vine at 30 DAS (Meter)	0.17	0.81	0.19	0.89	0.18	0.85	28.313
Length of the main vine at 60 DAS (Meter)	1.51	2.11	1.57	2.20	1.54	2.15	5.670
Number of branches at 30 DAS	2.80	6.60	3.00	7.20	4.7	6.9	6.487
Number of branches at 60 DAS	5.00	7.20	5.40	7.80	5.2	7.5	5.277

*T₁-Farmers practice, **T₂-Silver on black plastic mulch, #Significant at 5% level of significance.

Table 2: Effect of plastic mulch on yield and yield attributes of watermelon.

Parameter	2011		2012		Mean		“t” Calculated #
	T ₁	T ₂	T ₁	T ₂	T ₁	T ₂	
Number of fruits per plant	1.40	3.40	1.60	3.60	1.50	3.50	12.649
Average weight of fruits (Kg.)	2.51	3.71	2.58	3.80	3.11	3.76	9.348
Early yield q/ha.	0.00	188.60	0.00	193.20	0.00	190.90	9.061
Total yield q/ha	255	447	257	468	256.00	457.50	44.640

*First harvest, one week before farmers practice considered early yield, the three harvests combined for total harvest.

Significant at 5% level of significance

Table 3: Effect of plastic mulch on economics of watermelon.

Parameter	2011		2012		Mean		“t” Calculated #
	T ₁ *	T ₂ *	T ₁ **	T ₂ **	T ₁	T ₂	
Cost of cultivation/ ha.(Rs.)	40076	71326	40819	72089	40448	71708	35.605
Gross return/ha (Rs.)	102000	223500	154200	327600	128100	275550	49.246
Net return/ha (Rs.)	61924	152174	113381	255511	87652	203842	38.782
Benefit : Cost ratio	2.55	3.13	3.78	4.54	3.16	3.84	14.685
Yield increase over farmers practice	-	75.29	-	82.10	-	78.70	-

*Rates of watermelon (Rs. 400/q for T₁ and Rs. 500/q for T₂ in 2011); ** Rs. 600/q for T₁ and Rs 700/q for T₂ in 2012

Significant at 5% level of significance

in 2012) lead to the mean fruit yield (3.50/ plant in 2012). In contrast, control showed the lowest fruits per plant (1.40/plant in 2011) and (1.60/ plant in 2012) lead to the mean fruit yield (1.50/ plant). The increase in the number of fruits per plant of mulched plot was closely associated with the conservation of moisture and improved micro-climate both beneath and above the soil surface due to plastic mulch which resulted the enhanced plant growth and development which in turn increased fruit bearing nodes over control (Plate I and II). The significant effect of plastic mulch on fruit weight was found (3.71 kg/fruit in 2011) and (3.80 kg/fruit in 2012) lead to the mean fruit weight (3.76

kg/fruit) compared to unmulched field (2.51 kg/fruit in 2011) and (2.58 kg/fruit in 2012) with a mean fruit weight (3.11 kg/fruit). Such response of plastic mulch may be due to the increased number of fruits per plant assuming that an early yield is more determined by number of fruits per plant compared to fruit weight. Further the beneficial effect of plastic mulch on the increased early yield was also cited by Romic *et al.* (5). Early yield of watermelon was found to be affected by plastic mulch (Table 2). Which ascribed due to less vegetative developed plants on unmulched field (Table 1) leading to delayed flowering and fruit set. Plastic mulch had higher total yield (Table 2)



Plate I : Growth and yield of watermelon with plastic mulch.



Plate II : Growth and yield of watermelon without plastic mulch.

compared to unmulched fields which lead to 75.29% and 82.10 % increase over control during 2011 and 2012, respectively with a mean value of 78.70% increase over control (Table 2 and 3). Higher watermelon yields from plastic mulch compared to unmulched field were closely associated with the studies reported by Sanders *et al.* (6) and Soltani *et al.* (7).

Economics: The data on yield were statistically analyzed using paired “t” test and the net returns were Rs. 152174 in 2011 and Rs. 255511 in 2012 with a mean value of Rs. 203842 at mulched fields as compared to Rs. 61924 (in 2011) and Rs. 255511 (in 2012) with a mean value of Rs. 87652 at farmer’s field (Table 3). Benefit: cost ratio was 3.13 and 4.54 with a mean 3.84 on mulched field and 2.55 and 3.78 with a mean 3.16 at farmers’ field in 2011 and 2012, respectively.

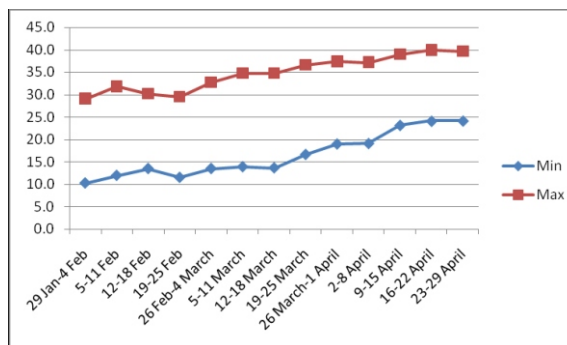


Fig. 1: Temperature during February to April, 2011.

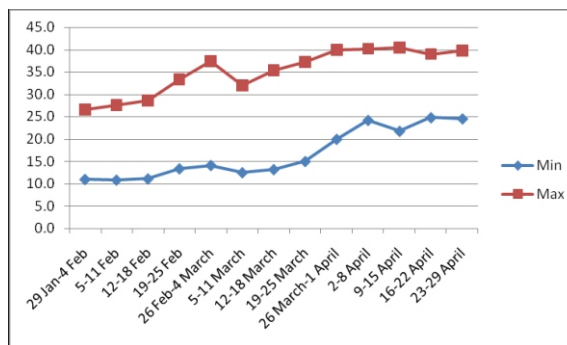


Fig. 2: Temperature during February to April, 2012.

Based on the two years on-farm trial studies, it could be concluded that plastic mulch had tremendous effects on the growth, and yield of watermelon. Therefore, the cultivation of watermelon using silver on black plastic mulch could lead to an ample scope for producing watermelon. Thus, silver-on-black plastic film could be recommended for an early spring sowing of watermelon under conditions of the Nimar Zone of Madhya Pradesh.

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