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Effect of Different Mulches on the Growth and Yield of Two Potato Varieties

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Abstract: An experiment was conducted at the Horticulture Farm of Bangladesh Agricultural University, Mymensingh during the period from December, 1995 to examine the effects of different mulch materials on potato yield. There were seven mulching treatments viz., no mulch with no irrigation (control), no mulch with irrigation, natural mulch with irrigation, rice straw water hyacinth, black polythene and white polythene. The mulching treatments were applied on two potato varieties viz., Lal Pakri and Cardinal. The experiment was laid out in randomized complete block design with three replications. The black polythene mulch took minimum time (12 days) to reach 80% emergence. Variety Lal pakri took longer time (97.33 days) to attain maturity than the Cardinal (87.91 days) and white polythene mulch enhanced early maturity (89.17 days), while natural mulch + irrigation treatment took longer time, (96.33 days). The maximum yield was obtained from water hyacinth mulching (47.70 t ha⁻¹ for Cardinal and 28.4 t ha⁻¹ for Pakri) and the lowest was in the control (38.54 and 19.79 t ha⁻¹ for Cardinal and Lal Pakri, respectively). Water hyacinth mulch was found to be economically best mulching treatment.

Key words: Mulches, potatoes, variety, yield

INTRODUCTION

The potato (*Solanum tuberosum* L.) belongs to the family Solanaceae is an important food crop in the world^[1]. It is also best vegetable crop of Bangladesh both in terms of area and production^[2]. The area and production of potatoes vary from year to year in Bangladesh. The average yield is 10.96 t ha⁻¹^[3]. The area and production can be, increased through bringing up the new area under cultivation and adoption of scientific method of cultivation including use of mulching in and regions of the country. In Bangladesh, potatoes is grown during its winter season when the rainfall is scanty. Irrigation is considered necessary for successful production of this crop. But its facilities are not uniform in all the regions of Bangladesh due to costly establishment of pumps and also downfall of underground water layer. Under such condition, the use of mulches may be a good practice for potato production. Mulching may be carried out by using rice straw, water hyacinth, black and white polythene. Mulching helps in better utilization of all the nutrients in the soil, help economic utilization of existing soil moisture and thus increasing the yield^[4,5]. However, under Bangladesh conditions, very little information is available regarding the influence of different mulches on the growth and yield of potato. The present study was, therefore, undertaken to investigate the effects of different mulches on the growth and yield of potato.

MATERIALS AND METHODS

The experiment was conducted at the Bangladesh Agricultural University Horticultural Farm, Mymensingh during the, period from December 1994 to March 1995. The soil was sandy loam in texture and belongs to the Bramaliputra Alluvial Tract having a pH value of 6.8. The land was prepared to its maximum tilth and the crop was fertilized with 20 tons cowdung, 276 kg urea, 185 kg triple superphosphate (TSP), 322 kg muriate of potash (MP), 5 kg gypsum and 25 kg zinc sulphate per hectare. Cowdung was applied during final land preparation. One third urea and rest of the fertilizers were applied in furrows between the rows in the plots that were covered by mulching materials and the irrigation plots. The rest of urea were applied before irrigation at an interval of 30 and 60 days after planting. The unit plot size was 2.4x2.0 m, having, 42 plots with three replications. The gap between the two adjacent plot was 50 cm and 1 m between the block. There were six rows in each plot. There were seven treatments : (I) no mulch and no irrigation (T₁) (ii) no mulch and irrigation (T₂) (iii) natural mulch and irrigation (T₃) (iv) mulching with rice straw (T₄). (v) mulching with water hyacinth (T₅) (vi) mulching with black polythene (T₆) and (vii) mulching with white polythene (T₇). They were tested on two potato varieties viz., Lal Pakri (V₁) and Cardinal (V₂). The experiment was laid out in Randomized Complete Block Design. Natural mulch means breaking up

of upper soil crust manually. The seed tubers of Lal Pakri and Cardinal of 20-30 and 35-45 mm size, respectively were used in the study. Whole seed tubers of Lal Pakri and half cut tubers of cv. Cardinal were planted in furrows at a depth of 7 cm at a spacing of 60x20 cm on 6 December 1994. Black and white polythene sheets were spreaded over the plot before planting. In these mulches the seed tubers were planted after tearing the polythene sheet at proper spacing. Mulching with the rice straw and water hyacinth were done by spreading over the plots after planting on the basis of 1 kg m⁻². Two irrigations were given in the required plots by water can following fertilizer application. Diethane M-45 was sprayed (2.5 kg ha⁻¹) fortnightly as preventive measure against disease. Furataf @ 25 kg ha⁻¹ was applied against soil insects during final land preparation. Ridomil MZ 72 WP was sprayed at the rate of 25 g 10⁻¹ I when the weather was cloudy to prevent the attack of late blight disease. The potato cv. Lal-Pakri and Cardinal were harvested at 95-100 and 85-90 days after planting, respectively as they attained maturity, when the foliage was turned yellow and dried over different mulches. The data on different growth parameters such as days required to 80% emergence, height of plant, foliage coverage (%) at 60 and 80 DAP,

number of main stem per hill, yield of tubers per plot and yield per hectare were recorded and analyzed statistically for interpretation of result.

RESULTS AND DISCUSSION

The main effects of different mulches on the growth and yield of potato have been presented in Table 1 and 2. There were no significant variations among the varieties in respect of days to attain 80% emergence. The mulching treatment black polythene (T₆) took minimum time (12 days) to reach 80% emergence closely followed by white polythene (T₇) 13.83 days. Water hyacinth (T₅) and rice straw (T₄) mulches took longer time by 17.93 and 17.50 days, respectively to complete 80% emergence. The results of the study are in agreement with the previous reports^[6-8]. The earliness of emergence caused by black polythene mulch may be accounted for its physical properties of absorbing solar radiation which possibly increased soil temperature and extended such effect. The variety Lal-Pakri (V₁) produced tallest plant (93.73 cm) while, the Cardinal (V₂) gave comparatively shorter ones (60.06 cm). But there were no significant differences among the mulching treatments as well as interaction

Table 1: Effect of different mulching treatments on the yield contributing characters and yield of potato

Treatments	Days to 80% emergence	Plant height (cm)	Foliage coverage (%)		Number of main stem/hill	
			60 DAP	80 DAP		
Lal-Pakri	14.91	93.73	65.62	73.95	4.40	
Cardinal	14.86	60.06	67.14	75.62	4.97	
LSD (0.05)	NS	3.97	0.34	0.28	0.36	
	Haulm weight Kg hill ⁻¹	Days to maturity	Number of tubers hill ⁻¹	Weight of tubers hill ⁻¹ (g)	Yield of tubers /plot (kg)	Yield (t ha ⁻¹)
Lal-Pakri	0.29	97.33	50.02	339.00	11.59	24.14
Cardinal	0.12	87.91	10.16	571.19	21.01	43.77
LSD (0.05)	0.04	0.39	1.74	11.63	0.15	0.31

Table 2: Effect of different mulching treatments on the yield contributing characters and yield of potato

Treatments	Days to 80% emergence	Plant height (cm)	Foliage coverage (%)		Number of main stem/hill	
			60 DAP	80 DAP		
T ₁	14.16	72.00	61.33	68.50	4.68	
T ₂	15.50	72.77	67.50	77.00	4.48	
T ₃	14.33	78.33	67.67	77.83	4.26	
T ₄	17.83	80.15	66.17	75.83	4.75	
T ₅	17.50	78.70	67.33	77.00	4.35	
T ₆	12.00	79.42	73.50	79.67	5.10	
T ₇	13.83	76.88	61.17	67.67	5.16	
LSD (0.05)	0.66	7.42	0.63	0.53	0.67	
	Haulm weight Kg hill ⁻¹	Days to maturity	Number of tubers hill ⁻¹	Weight of tubers hill ⁻¹ (g)	Yield of tubers /plot (kg)	Yield (t ha ⁻¹)
T ₁	0.15	90.50	36.25	328.33	14.00	29.17
T ₂	0.20	93.83	26.00	415.83	16.02	33.37
T ₃	0.26	96.33	30.70	535.83	17.89	37.27
T ₄	0.22	93.00	26.62	428.33	16.20	33.75
T ₅	0.25	95.50	33.00	596.67	18.27	38.07
T ₆	0.20	90.00	31.53	480.00	16.82	35.05
T ₇	0.15	89.17	26.52	400.67	14.89	31.02
LSD (0.05)	0.07	0.73	3.26	21.71	0.28	0.58

between the varieties and mulching treatments in respect of plant height (Table 1 and 2). The foliage coverage of the variety Lal pakri was less at 60 (65.62%) and 80 (73.95%) DAP than the variety Cardinal which covered 67.10 and 75.62%, respectively at 60 and SO DAP (Table 1). The maximum foliage coverage at 60 (73.50%) and 80 (79.67%), DAP were found from the treatment black polythene (T_6) and the minimum was observed in white polythene (T_7) both at 60 and 80 DAP (61.10 and 67.67%), respectively but there were no significant variations with no mulch and no irrigation (T_1). At 60 (68.50%) DAR Both the varieties covered lowest percentage of foliage under the treatment T_1 . The superiority of black polythene in respect of foliage coverage may be attributed to its possible favourable moisture conserving capacity in the soil. This corresponds to the findings of Harris^[9]. The treatments had no influence on the number of stem for both the varieties

The variety Lal-Pakri produced highest fresh haulin weight ($0.29 \text{ kg hill}^{-1}$) than that of Cardinal ($0.12 \text{ kg hill}^{-1}$). Natural mulch and irrigation T_3 gave the maximum fresh haulm weight ($0.26 \text{ kg hill}^{-1}$) while the minimum was found from the plants under the treatment T_7 ($0.15 \text{ kg hill}^{-1}$). The variety Lal Pakri took longer time (97.33 days) to attain maturity compared to that of the variety, Cardinal (87.91 days). The longest time to attain maturity was found under the condition of natural mulch and irrigation (96.83 days). This was statistically identical in both the varieties with the treatment T_2 (95.95 days) and the minimum was obtained from T_7 (89.17 days) (Table 1 and 2). Similar results were also found by Waggoner *et al.*^[9]. It is evident from Table 1 that the number of tuber production ability of the variety Lal Pakri was much higher (50.02) than that of Cardinal (10-16). Maximum number of tubers per hill (36.25) was found in the treatment T_1 and minimum (26.52) from T_7 (Table 2). However the variety Cardinal did not respond to any mulching treatments regarding the number of tuber production per hill. For this variety the maximum number of tubers were obtained from T_5 (12.87) and minimum from T_1 (7.80) and the minimum from T_1 (7.80). The tuber yield was highest (43.77 t ha^{-1}) in the variety Cardinal than that

of Lal Pakri (24.14 t ha^{-1}). The mulching water hyacinth T_5 treatment gave the highest yield (38.07 t ha^{-1}) and the lowest yield was obtained by no mulch + irrigation treatment (29.17 t ha^{-1}).

However, further study is needed on economics of potato production using water hyacinth mulch before recommending the practice for use at farmers level.

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