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Integrated weed management in brinjal (*Solanum melongena* L.)

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Abstract

Sixteen different weed management treatments in brinjal were evaluated to study their effect on weed population, growth and yield parameters of brinjal in humid sub-temperate conditions. Both black and transparent plastic mulches were found effective over other treatments in managing the weeds, exhibited 100 per cent weed control efficiency, increased growth and yield of the crop. Half of the recommended doses of herbicides in integration with two hand weedings were more effective than full doses in integration with one hand weeding. Various weed control treatments exhibited better performance w.r.t. growth and yield parameters of brinjal over the unweeded check. Among the integrated weed management treatments, Pendimethalin (1.0 kg/ha) followed by two hand weddings was adjudged to be the best treatment exhibiting a weed control efficiency of 87.9 per cent. Although black plastic mulch appeared quite effective w.r.t. weed control efficiency and yield potential, yet its application and cost parameters need to be studied for commercial application.

Key words: Brinjal, *Solanum melongena*, weed management, mulching, herbicide.

Introduction

Brinjal (*Solanum melongena* L.) is one of the most commonly grown vegetables in our country. It is an important annual crop grown commercially in almost all parts of India as one of the principal vegetable. Being a *kharif* season, slow growing and widely spaced crop, it faces competition from a wide spectrum of narrow and broad leaved weeds. Further, wider spacing, more rainfall, higher temperature and humidity during May-June and high rainfall (July- August), provide congenial conditions for luxuriant growth of weeds, which compete with the crop for nutrition, moisture, light etc. and ultimately reduce the crop yield considerably. In brinjal, the weed competition accounts to a reduction in yield by 20-25% (Abak *et al.*, 1992). The relative cost involved, non-availability of labour at peak season, tediousness of operation, non workable soil conditions and re-emergence of weeds render manual weed control impracticable. Therefore, control of weeds through herbicides followed by hand weeding, which needs less interference with the crop during growing season, are more convenient, effective and practical. Use of plastic mulch enhances the initial growth by raising soil temperature and smothers weed population. The present study was, therefore, undertaken to compare the efficacy of different methods of weed control, and also to find out the effect of herbicides and plastic mulches on growth, development and yield of brinjal crop.

Material and Methods

The present investigation was carried out at the Vegetable Research Farm, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur (H.P.) during *kharif*, 2001. This location has a sub-temperate climate with heavy rainfall during monsoons.

The soil of this zone is silty clay loam in texture with acidic reaction. The total rainfall of 1756.7 mm was recorded during the crop season. Sixteen different weed control treatments (Table 1) were included in the present study. The experiment was laid in randomized block design with three replications. The seedlings of Arka Nidhi- a bacterial resistant variety of brinjal, were transplanted on 12.05.2001 at a spacing of 60 cm from row to row and 45 cm from plant to plant in a gross plot measuring 3.0 m x 2.70m. A net plot measuring 1.80m x 1.80m was considered for recording data on various growth and yield attributes. The herbicides were sprayed before transplanting with a knapsack

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sprayer. The pre-plant incorporated herbicides viz., Trifluralin and Fluchloralin were incorporated into soil by inverting the top soil, while the pre-emergence herbicides namely, Metachlor, Alachlor and Pendimetalin were left undisturbed after spraying. The plastic mulches were applied by cutting circular holes at the spacing of 60cm x 45 cm and applied in plots before transplanting. The seedlings were transplanted in the holes. Later on, the holes as well as the sides of plastic mulch were covered with the soil. Recommended cultural practices were followed during the entire growing season.

Results and Discussion

A critical evaluation of the data reveals that the plastic mulches completely checked the weed emergence and hence exhibited high weed control efficiency. This may be attributed to the mechanical barrier caused by the mulches to weed emergence and the higher soil temperatures than bare soil. Further, the black plastic mulch had suppressed the emergence and growth of weeds by obstructing light from reaching the soil. Likewise, under transparent plastic mulch, the weed growth is suppressed by increasing growth of the crop due to higher soil temperature and its mechanical interference to weeds consequently, the mulches created weed free situation. These results are in close conformity with the results obtained by Salman and Gorske (1985), Asiegbu (1991) and Singh (1992), who have obtained high weed control efficiency by using plastic mulches.

All the herbicides alongwith hand weeding treatments were effective in reducing the weed count. Among these, Pendimethalin (1 kg ha^{-1}) with 2 HW significantly reduced the weed population to the minimum level over unweeded check at almost all the stages of observations. The full doses of herbicides and 1 HW were not that effective in reducing the weed count, probably due to the leaching of herbicides with continuous heavy rains after transplanting of the crop. These results are in conformity with those of Raghav (1995), Singh *et al.* (1996, 1997) and Prakash *et al.* (1999) who have also observed that Pendimethalin (1.0 kg ha^{-1}) reduced the weed count. The significant reduction in total count of weeds by Pendimethalin @ 1.0 kg ha^{-1} + 2 HW treatment increased the weed control efficiency. Alachlor (1 kg ha^{-1}) + 2 HW and Metolachlor (0.75 kg ha^{-1}) + 2 HW being at par, also reduced the count of weeds and thus resulted in higher weed control efficiency.

Almost all the weed control treatments reduced weed count significantly over unweeded check. These results are further supported by the findings of Singh *et al.* (1991), Raghav (1995), Singh *et al.* (1996) and Lourduraj *et al.* (1997).

The weed control treatments significantly influenced the growth and development of brinjal plants. The black plastic mulch was the best

Table 1. Details of different treatments

S. No.	Treatments	Dose (kg/ha)	Time of application
1.	Trifluralin + 1 HW	1.2	PPI + 1HW 60 DAT
2.	Fluchloralin + 1 HW	1.0	PPI + 1HW 60 DAT
3.	Metolachlor + 1 HW	1.5	Pre-plant + 1HW 60 DAT
4.	Alachlor + 1 HW	2.0	Pre-plant + 1HW 60 DAT
5.	Pendimethalin + 1 HW	2.0	Pre-plant + 1HW 60 DAT
6.	Trifluralin + 2 HW	0.6	PPI + 2HW 30 and 60 DAT
7.	Fluchloralin + 2 HW	0.5	PPI + 2HW 30 and 60 DAT
8.	Metolachlor + 2 HW	0.75	Pre-plant + 2HW 30 and 60 DAT
9.	Alachlor + 2 HW	1.0	Pre-plant + 2HW 30 and 60 DAT
10.	Pendimethalin + 2 HW	1.0	Pre-plant + 2HW 30 and 60 DAT
11.	Black plastic mulch	-	Applied at the time of transplanting
12.	Transparent plastic mulch	-	Applied at the time of transplanting
13.	Hand weeding (twice)	-	30, 60 DAT
14.	Hand weeding (thrice)	-	30, 60, 90 DAT
15.	Weed free	-	Weeding as and when weeds appeared
16.	Unweeded check	-	Left without any weeding during the entire crop period.

DAT = Days after transplanting PPI = Pre-plant incorporation

Table 2. Effect of different weed control treatments on weed population and brinjal yield parameters

Treatments	Dose (kg/ha)	*Total weed count (No./m^2)	Weed Control Efficiency (%)	Plant height (cm)	Days to 50 % flowering	Days to first picking	No. of fruits/ plant	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Gross yield (q/ha)	Marketable yield (q/ha)
Trifluralin +1HW	1.2	14.21	76.9	79.50	62.34	72.34	6.26	12.99	1.57	23.50	68.84	41.04
Fluchloralin +1HW	1	14.05	76.3	77.80	64.00	73.67	5.20	12.67	1.61	21.60	56.39	33.50
Metolachlor +1HW	1.5	15.50	78.3	81.96	63.00	73.67	7.06	12.55	1.94	23.06	82.52	52.36
Alachlor +1HW	2	15.05	79.3	81.83	60.34	71.00	7.50	13.75	1.97	23.73	93.24	60.60
Pendimethalin +1HW	2	14.05	82.7	84.60	61.67	70.67	7.63	13.78	2.03	26.00	96.73	63.38
Trifluralin +2HW	0.6	14.62	82.4	83.43	58.67	69.34	10.00	13.72	2.05	25.00	128.20	84.43
Fluchloralin +2HW	0.5	16.3	80.2	82.10	61.34	71.34	7.80	14.35	2.22	25.34	93.12	63.28
Metolachlor +2HW	0.75	17.54	83.1	85.06	55.64	66.30	10.67	14.67	2.20	25.46	126.86	88.94
Alachlor +2HW	1	17.20	84.0	87.83	53.67	64.00	10.63	14.59	2.19	25.46	136.86	91.60
Pendimethalin +2HW	1	12.97	87.9	89.86	53.34	62.00	11.73	16.01	2.37	28.73	163.38	125.80
Black plastic mulch	-	1	100	97.80	46.34	55.34	22.73	18.27	2.90	36.80	371.74	310.73
Transparent plastic mulch	-	1	100	90.16	49.00	59.00	20.13	17.49	2.69	34.74	313.35	251.57
Handweeding (twice)	-	20.10	92.6	77.62	62.67	73.00	9.09	14.20	1.92	23.67	103.88	71.48
Handweeding (thrice)	-	14.0	91.3	77.03	62.67	72.34	10.40	14.25	1.96	24.00	127.89	88.70
Weed free	-	1	100	91.57	48.00	57.67	14.23	16.47	2.46	31.53	223.89	165.73
Unweeded check	-	22.7	0	43.67	69.34	77.34	4.86	10.23	1.51	20.53	34.37	16.54
CD (P=0.05)		0.96	-	5.81	3.90	3.51	2.27	0.95	0.18	1.78	24.84	21.22

* Logarithmic values
DAT =Days after transplanting
HW =Hand weeding

$$\text{Weed Control Efficiency} = \frac{\text{Dry weight of weeds of unweeded check - dry weight of the weeds of the treatment}}{\text{Dry weight of weeds of unweeded check}} \times 100$$

treatment in increasing the plant height to significantly highest level. Transparent plastic mulch and Pendimethalin (1.0 kg ha^{-1}) + 2 HW were the next best treatments in promoting plant height. This can be attributed to weed free conditions; higher soil temperatures (in mulched plots), increased availability of nutrients and reduced crop weed competition in these plots. Unweeded check significantly reduced the plant height of brinjal plants. Research findings of Nandal and Pandita (1988) and Singh *et al.* (1991) also corroborate with the present findings.

Black plastic mulch resulted in earliest flowering (46.3 days), weed free (48.0 days) and transparent plastic mulch (49.0 days) being at par with each other were the next best. Days taken to 50 per cent flowering and fruit picking were significantly delayed in unweeded check due to poor growth of the crop under increased crop and weed competition. Black plastic mulch being at par with weed free resulted in earlier picking by reducing the crop-weed competition and increasing growth rate of brinjal. Among the herbicide treatments, Pendimethalin (1.0 kg ha^{-1}) + 2 HW resulted in earlier flowering and was at par with Alachlor (1.0 kg ha^{-1}) + 2 HW. This could probably be attributed to better growth and better availability of nutrients with reduced crop weed competition. The unweeded check took maximum days to fruit picking due to intense and heavy unchecked weed growth leading to reduced crop growth and delayed flowering. These results are in conformity with those of Carter and Johnson (1988) and Singh *et al.* (1991).

Various fruit parameters were significantly influenced by the weed control treatments. The fruit length, fruit diameter and fruit weight were significantly higher in treated plots over unweeded check. This is attributed to the reduced crop-weed competition and increased availability of various resources to the crop plants. The fruit diameter was significantly higher in black plastic mulch, followed by transparent plastic mulch, weed free and Pendimethalin (1.0 kg ha^{-1}) + 2 HW, with unweeded check recording significantly lowest values for the three attributes. However, the fruit length, fruit diameter and fruit weight were significantly highest in black polythene mulch, followed by transparent plastic mulch, weed free, Pendimethalin (1.0 kg ha^{-1}) + 2 HW, which differed significantly among themselves. The enhanced fruit parameters have in turn contributed to the better yield performance in the mulch and herbicide followed by HW treatments. These findings are in close agreement with those of Ranamukaarachichi *et al.* (1992).

The number of marketable fruits per plant was significantly influenced by the various weed control treatments. Black plastic mulch resulted in significantly highest number of marketable fruits per plant, followed by transparent plastic mulch and weed free treatments. The gross yield and marketable yield in all the treatments was found to be significantly superior to unweeded check. Black polythene mulch resulted in significantly highest gross and marketable yield, followed by transparent plastic mulch, weed free and Pendimethalin (1 kg ha^{-1}) + 2 HW due to weed free conditions leading to better crop growth, increased fruit parameters and yield. The full dose of herbicides alongwith hand weeding treatments resulted in lower gross and marketable yield than the corresponding half dose followed by2 HW treatments due to poor weed control because of continuous heavy rains w.e.f. 13th May (19th standard week) to 16th Sep.,(37th standard week) causing leaching of herbicides. Further, the half dose of herbicides alongwith 2HW treatments exhibited better yield performance due to the hand weeding at 30 DAT, which was the critical period for crop weed competition and due to the additional hand weeding done at 60 DAT which caused further suppression of weed emergence and growth. These results are in consonance with earlier findings (Nandal and Pandita, 1988; Singh *et al.*, 1996; Prakash *et al.*, 1999).

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