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Effect of different weed control methods on weeds and yield of Chili (*Capsicum annum* L.)

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Abstract
To study the effect of different weed control practices on weeds and growth of chilies, an experiment was carried out at Vegetable Research Farm, Mahrajpur, Department of Horticulture, JNKVV, Jabalpur (M.P.) in the *rabi* season of 2010-2011. The experiment was laid out in a completely randomized block design having there replications, and comprising of sixteen treatments chili variety ''JM-218'' was selected for the experiment and sown in a plot size of 3.0 m x 2.0 m. All the treatments significantly affected the parameters of weed density m^{-2}, fresh weight biomass, and yield components of chilies such as plant height, number of fruits per plant, red ripe fruit yield and dry fruit yield. Highest weed density of all the weed species, fresh weed biomass were recorded in weedy check plots. Pendimethalin @ 1.5 l/ha + black mulch resulted in the highest plant height (75.3 cm), number of fruits per plant (73.33), yield of red ripe fruit (134.7 q ha^{-1}) and yield of dry fruit (22q ha^{-1}) followed by pendimethalin @ 1.5 l/ha + paddy straw mulch. Therefore, pendimethalin @ 1.5 l/ha + black polythene mulch resulted as the most effective treatment in terms of weed suppression and yield enhancement of chili crop.

Keywords: Weed, Chili, biomass, *Capsicum annum* L.

Introduction

Chili (*Capsicum annum* L.) belongs to the family solanaceae and is cultivated as an annual crop worldwide. Chili varieties are generally classified on fruit characteristics, i.e. colour, pungency, flavour, shape, size and use. Chilies are an excellent source of vitamin A and C, also called capsule of vitamin C and contain appreciable amount of calcium, phosphorus and iron. Chili heat (pungency) is due to capsaicin ($C_9H_{14}O_2$) which is a complex of seven closely related alkaloids or capsaicinoids.

Immediately after transplanting, the Peper seedlings grow slowly and are very weak competitors for limiting resources against the weeds (Isik *et al*., 2009) [4]. Furthermore the over irrigation after crop transplanting stimulates a rapid weed growth, resulting in yield losses at harvest up to 97% (Amador-Ramirez, 2002). For these reasons weed control is recognized as the foremost production related problem Effective weed management strategies are limited for chili producers. Current weed controls practices include the use of plastic mulch, selective grass herbicides, hand weeding or tillage practices there are currently no herbicides registered for broad leaf weed control in chili. The development of effective broadleaf weed herbicides, to be used as part of an integrated weed management programme in chili production is essential. In contrary, there are a number of non chemical ways to control weeds, however looking at the economics of the concerned farmers and quick action for a weed free field, the chemical weed control method is still very popular. The cultural methods are described to be useful for safe environment but are getting expensive, laborious and time consuming. However, the environmental safety and integrity cannot be ignored. Keeping in view the importance of losses due to weeds in chili crop, this instant study was designed for the development of an integrated weed control system in chili using organic and inorganic mulches.

Materials and Methods

To study the effect of different weed control methods on weed and yield of chili, an experiment was conducted at vegetable research Farm, Maharajpur, Department of Horticulture, JNKVV, Jabalpur (MP) in the *rabi* season of 2010-2011.

The experiment encompassed sixteen treatments. The experiment was laid out in a completely randomized block design having three replications.

Chili variety JM 218 was transplanted after 30 days with row to row and plant to plant distances of 40 and 30 cm, respectively. For fertilizers, the urea was used as a source of nitrogen, SSP was used as phosphorus source and MOP as potash source. Nitrogen was applied in two splits (half at transplanting time and half after 30 days after transplanting) at the rate of 80:60:40 kg NPK/ha. The whole quantity of P_2O_5, K_2O and FYM were applied at the time of transplanting. Data were recorded on different parameters of weed and crop. Collected data were analyzed statistically according to the procedures relevant to CRBD.

Results and Discussion

Weed Density (m^{-2})

The weed control treatments significantly affected weed density of different weed species (Table 1). Higher weed population was observed in control plots whereas pendimethalin 1.5 l/ha + Black polythene mulching treatments resulted in lower weed population of all the weed species followed by black polythene mulching for all the weed species except *Cyperus rotandus*. The higher weeds density in control plots may be attributed to the open soil surface and niches available to weeds for free and aggressive growth. Timely application of pendimethalin suppresses the germination of weed seeds and cover with black polythine inhibits the growth of weeds might be the possible reason for lower weeds population in these plots. These results are also in accordance with those of khan *et al.* (2012) [5], and Brault and Stewart (2002) [2] who also reported that block polythene mulch provides superior weed control.

Table 1: Effect of different treatments on weed density/ m^2

Treatments	*Chenopodium album*	*Eragrostis cillansis*	*Parthenium hystrophorus*	*Anagalis arvensis*	*Cyperus rotundus*	*Melilotus alba*	*Spergula arvensis*
Pendimethalin @ 1.5lit/ha before transplanting	10.6	10.98	15.06	5.98	20.06	10.95	25.05
Alachlor @1.25 l/ha before transplanting	11.96	18.56	30.00	24.00	29.98	28.05	44.66
Fluchloralin @0.75 l/ha before transplanting	14.03	15.95	38.00	9.00	30.03	26.86	38.00
White polythene as mulch after transplanting	5.98	12.01	14.26	3.98	16.95	9.98	21.01
Black polythene as mulch after transplanting	2.99	9.95	8.00	3.03	18.04	4.98	15.98
Paddy straw as mulch after transplanting	8.04	11.00	19.20	3.98	18.01	8.06	26.00
Pendimethalin + white polythene mulch	11.05	10.78	9.07	7.01	13.01	5.93	25.00
Pendimethalin + black polythene mulch	1.03	6.96	3.95	0.00	4.98	1.95	10.00
Pendimethalin + paddy straw mulch	9.96	11.01	14.00	12.04	13.05	6.03	21.00
Alachlor + white polythene mulch	12.97	11.90	10.06	8.07	18.00	13.06	35.00
Alachlor + black polythene mulch	5.95	10.30	9.97	3.03	15.05	13.96	40.00
Alachlor + paddy straw mulch	18.01	13.01	19.21	6.99	24.05	11.00	41.00
Fluchloralin + white polythene mulch	15.00	11.98	19.20	6.00	15.03	12.06	33.00
Fluchloralin + black polythene mulch	5.01	11.01	8.70	7.96	13.03	7.90	23.00
Fluchloralin + paddy straw mulch	8.05	12.06	14.01	8.00	18.01	14.16	25.00
Control plot	241.83	243.33	120.0	41.33	151.0	50.33	454.00
SEm+-	1.47	2.22	0.73	0.30	0.81	0.37	2.85
CD at 5%	4.27	6.44	2.14	0.88	2.34	1.08	8.25

Fresh weed Biomass (gm^{-2})

Weeds fresh biomass was significantly reduced by pendimethalin 1.5 l/ha + black polythene mulching treatment (Table 2). Highest fresh weed biomass was recorded in control plots. Timely application of pendimethaline suppress the weed seed germination and in black plastic mulch weeds seed might have failed to germinate due to lake of light and rise in temperature under black polythene khan *et al.* (2012) [5] and coolong (2010) [3] has also reported the efficiency of pendimethaline as per emergence application in controlling weeds in chili crop as for as effect of mulch i.e. black polythene is concerned.

Table 2: Effect of different treatments on fresh weight of weed flora/m^2 at 30 DAT

Treatments	*Chenopodium album*	*Eragrostis cillansis*	*Parthenium hystrophorus*	*Anagalis arvensis*	*Cyperus rotundus*	*Melilotus alba*	*Spergula arvensis*
Pendimethalin @ 1.5lit/ha before transplanting	10.60	9.95	15.06	5.98	20.06	10.95	25.05
Alachlor @1.25 l/ha before transplanting	11.98	18.56	30.00	24.00	29.98	28.05	44.66
Fluchloralin @0.75 l/ha before transplanting	14.03	15.95	38.00	9.00	30.03	26.86	38.00
White polythene as mulch after transplanting	5.98	12.01	14.26	3.98	16.95	9.98	21.01
Black polythene as mulch after transplanting	2.99	10.98	8.70	3.03	18.06	4.98	15.98
Paddy straw as mulch after transplanting	8.04	11.00	19.20	3.98	18.01	8.06	26.00
Pendimethalin + white polythene mulch	11.05	10.78	9.07	7.01	13.01	5.93	25.00
Pendimethalin + black polythene mulch	1.03	6.96	3.95	0.00	4.98	1.95	10.00
Pendimethalin + paddy straw mulch	9.96	11.01	14.00	12.04	13.05	6.03	21.00
Alachlor + white polythene mulch	12.97	11.90	10.06	8.07	18.00	13.06	35.00
Alachlor + black polythene mulch	5.95	10.30	9.97	3.03	15.05	13.96	40.00
Alachlor + paddy straw mulch	18.01	13.01	19.21	6.99	24.05	11.00	41.00
Fluchloralin + white polythene mulch	15.00	11.98	19.20	6.00	15.03	12.06	33.00
Fluchloralin + black polythene mulch	5.01	11.01	8.00	7.96	13.03	7.90	23.00
Fluchloralin + paddy straw mulch	8.05	12.06	14.01	8.00	18.01	14.16	25.00

Control plot	241.83	243.33	120.0	41.33	151.0	50.33	454.00
S.Em+-	1.47	2.22	0.73	0.30	0.81	0.37	2.85
CD at 5%	4.27	6.44	2.14	0.88	2.34	1.08	8.28

Weed control efficiency
Significant effect of weed control treatments on weed control efficiency was observed (Table 3). The highest weed control efficiency was observed in pendimetholine 1.5 l/ha + black polythene mulch and lowest weed control efficiency in control plot.

Table 3: Weed control efficiency (%)

Treatments	*Chenopodium album*	*Eragrostis cillansis*	*Parthenium hystrophorus*	*Anagalis arvensis*	*Cyperus rotundus*	*Melilotus alba*	*Spergula arvensis*
Pendimethalin @ 1.5lit/ha before transplanting	81.85	89.42	75.05	71.50	84.75	78.99	92.28
Alachlor @1.25 l/ha before transplanting	68.21	57.82	71.52	61.16	76.26	60.19	92.21
Fluchloralin @0.75 l/ha before transplanting	63.57	68.40	71.52	61.16	79.66	63.19	92.27
White polythene as mulch after transplanting	86.36	84.20	82.22	71.50	83.07	73.61	95.36
Black polythene as mulch after transplanting	90.86	89.42	82.22	71.50	88.15	89.41	96.40
Paddy straw as mulch after transplanting	81.86	84.20	85.76	78.54	88.15	84.20	94.33
Pendimethalin + white polythene mulch	90.86	73.62	85.76	78.54	91.50	89.41	94.33
Pendimethalin + black polythene mulch	95.50	100.00	92.83	92.92	94.91	94.79	96.40
Pendimethalin + paddy straw mulch	86.36	68.40	85.76	78.54	88.15	89.41	95.36
Alachlor + white polythene mulch	86.36	89.42	85.76	78.54	88.15	89.41	92.26
Alachlor + black polythene mulch	90.86	94.78	89.29	85.62	89.83	78.99	93.81
Alachlor + paddy straw mulch	86.36	84.20	89.29	78.54	86.42	78.99	91.76
Fluchloralin + white polythene mulch	81.86	84.20	85.76	78.54	89.83	78.99	92.78
Fluchloralin + black polythene mulch	90.86	89.42	89.29	71.50	91.50	84.20	94.85
Fluchloralin + paddy straw mulch	86.36	84.20	85.76	71.50	88.15	89.41	94.33
Control plot	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Plant height
Plant height was significantly affected by weed control treatments (Table 4). The means analyses showed that highest plant height (75.3 cm) was recorded in pendimethaline 1.5 l/ha + black polythene mulching plots, followed by pendimethalin 1.5 l/ha + paddy straw mulch plots and minimum (52.8 cm) was recorded from weedy check plots in which there was no weeding done. The lowest plant height in weedy check plots might be due to the increased competition for moisture, light and nutrients.

Table 4: Effect of different weed control treatments on plant height, days to 50% flowering, number of fruits /plant, yield of red ripe fruits (q/ha) and dry fruit (q/ha)

Treatments	Plant height (cm)	Days to 50% flowering	No. of fruits per plant	Yield of red rips fruit (q/ha)	Dry fruit (q/ha)
Pendimethalin @ 1.5lit/ha before transplanting	70.10	55	50.0	100.6	16.42
Alachlor @1.25 l/ha before transplanting	63.30	52	41.33	100.0	16.33
Fluchloralin @0.75 l/ha before transplanting	65.40	55	42.66	100.0	16.30
White polythene as mulch after transplanting	65.30	52	41.00	117.7	19.11
Black polythene as mulch after transplanting	69.26	56	42.33	100.0	16.25
Paddy straw as mulch after transplanting	66.96	54	53.00	100.6	16.35
Pendimethalin + white polythene mulch	71.60	55	67.00	100.0	15.90
Pendimethalin + black polythene mulch	75.30	59	73.33	134.7	22.00
Pendimethalin + paddy straw mulch	73.20	53	69.66	120.0	19.60
Alachlor + white polythene mulch	65.20	51	41.66	100.0	16.53
Alachlor + black polythene mulch	66.50	53	42.33	81.3	13.25
Alachlor + paddy straw mulch	65.80	54	43.33	83.6	13.62
Fluchloralin + white polythene mulch	66.30	54	44.33	110.6	18.05
Fluchloralin + black polythene mulch	68.10	52	44.66	99.7	16.25
Fluchloralin + paddy straw mulch	66.40	53	44.00	99.9	16.30
Control plot	52.80	47	36.33	49.7	9.00
S.Em+-	1.15	2.0	2.70	2.3	1.02
CD at 5%	3.34	5.0	7.84	6.8	2.96

Number of fruits plant^{-1}
The number of fruits/plant was significantly affected by weed control treatments (Table 4). The means analysis showed that higher number of fruits per plant (73.3) were recorded in pendimethalin 1.5 l/ha + black polithene mulch, followed by pendimethalin 1.5 l/ha + paddy straw mulch (69.6) and minimum (36.3) was recorded from weedy check plots in which there was no weeding done. The decrease in the number of fruits per plant in weedy check plots might be due to the increased competition for moisture, light and nutrients. Furthermore, the decrease in fruits per plant was proportional to duration of weeds competition. Higher fruits per plant in weed control plots than weedy check might be due to better growth and development of chillies plots and availability of more resources which resulted in more fruit production in chili plant. The results are in agreement with those of Khan *et al*. (2012) [5] who reported that weed control through mulch has increased the number of fruits per plant.

Yield (q/ha)

Yield is the outcome of various yield components that were significantly affected by different weed control treatments (Table 4). Statistical analysis of the data indicated that the application of pendimethalin @ 1.5 l/ha + black polithin mulches resulted in highest yield (134.7 q/ha) as well as dry fruit (22 q/ha) which was followed by pendimetalin @ 1.5 l/ha + paddy straw mulch (120 q/ha) dry fruit (19.6 q/ha) while minimum red ripe fruit yield (49.7 q/ha) and dry fruit yield (9.0 q/ha) was recorded from weedy check plots. Our results are confirmed by the findings of Khan *et al*. (2012) [5] who found that due to weed control yield increase may be attributed to more favorable soil moisture and nutrient utilization.

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