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## Weed dynamics as affected by practices and straw mulches in chickpea

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### Abstract

A two year field experiment entitled “Effect of weed control practices alone and in combination with crop mulch on weed dynamics, yield and economics of chickpea” was conducted at Live Stock Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur during Rabi 2018-2019 and 2019-2020. The 16 treatments comprising of four weed control practices *viz.* Pendimethalin (38.7% CS) 1 kg *a.i.* /ha as PPI, Hand Weeding at 30 DAS, Hand Hoeing at 30 DAS and Control (No weed control) as a main plot treatments and four crop mulches *i.e.* Wheat straw (5 t/ha), Paddy straw (5 t/ha), Soybean straw (5 t/ha) and Control (No mulch) were assigned in sub-plot treatments and these were laidout in a split plot design with three replications. It is evident from the data *Cichorium intybus* (31.95%), *Medicago truncatula* (21.82%) and *Melilotus indica* (20.52%) were rampant weeds in chickpea. Hand hoeing at 30 DAS caused marginal reduction in density and dry weight of weeds over weedy check. However, hand weeding done at 30 DAS in chickpea curbed the density and dry weight of weeds to the maximum extent followed by pendimethalin 1 kg /ha as PPI and attained the higher values of weed control efficiency (69.68 and 52.12% respectively) compared to hand hoeing (42.23%) and weedy check plots (0.00%). Similarly, application of paddy straw (5 t/ha) reduced the density and dry weight of weeds appreciably and attained higher weed control efficiency (61.34%) followed by wheat straw (53.04%) against soybean straw which reduced weed biomass to the tune 32.62 % only. The chickpea yield was minimum (0.87 t/ha) in control plots, which was increased markedly under different weed control practices and crop mulches. Hand weeding done at 30 DAS produced significantly higher seed yield (1.67 t/ha) being at par to pendimethalin 1kg /ha (1.49 t/ha) than one hand hoeing (1.27 t/ha) and control plots (0.87 t/ha). The seed yield was significantly higher (1.55 t/ha) under paddy straw mulch (5 t/ha) followed by wheat straw mulch (1.40 t/ha) in comparison to no straw mulch plots (1.10 t/ha) and soybean straw mulch (1.23 t/ha).

**Keywords:** Weed dynamics

### Introduction

Chickpea (*Cicer arietinum* L.) is a winter season crop and ranks 3rd among pulse legumes in the world (FAO, 2014) [6]. It contains almost three times more protein (18.24%) than that of cereals and considered as an economical source of quality vegetable protein for human diet. In India, chickpea is cultivated on an area of 8.95 million hectares with a production of 8.43 million tonnes and productivity of 942 kg/ha. Madhya Pradesh stood first among all the states in both area (3.59 mha) and production (4.60 mt) of chickpea but productivity (1280 kg/ha) is far below its yield potential (Anonymous, 2018) [1]. Chickpea is grown under rainfed as well as irrigated conditions in India. But weeds in irrigated areas tend to offer severe competition for growth resources and cause drastic yield reduction to the extent of 75% in chickpea (Balyan and Bhan, 1984; Singh and Singh, 1992) [3, 10]. The most predominating weeds in chickpea affecting its productivity drastically in India are *Chenopodium album*, *Medicago truncatula*, *Melilotus alba*, *Portulaca oleraceae*, *Digera arvensis*, *Phasalis minima*, *Cyperus rotundus*, *Convolvus arvensis* and *Amaranthus viridis* (Bhutada and Bhale, 2013) [4]. In General, weed control in chickpea is done by cultural, mechanical and chemical methods. Pendimethalin as a pre emergence has been found more effective in reducing the weed population of grassy, broad leaves and sedges, resulting in lesser dry weight of weeds, higher weed control efficiency as well as lower weed index (Chavada *et al.*, 2017) [5].

Among cultural methods, mulching is a most effective non-chemical method of weed control (Mahmood *et al.*, 2015) [9]. Since information on efficacy of pendimethalin 38.7% CS formulation as PPI alone and in combination with mulch is very meagre. Therefore present experiment was carried out to judge the suitability of weed control practices and straw mulches on weed growth and yield of chickpea.

### Materials and methods

A two year field experiment was conducted during Rabi season 2018-19 and 2019-20 at Live Stock Farm, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur situated at 23.18° N latitude 79.99° E longitude and an altitude of 411.78 meter above the mean sea level. The soil of the experimental site is sandy loam in texture, neutral in reaction (pH 7.24) having medium organic carbon (0.61%), available N (365.20 kg/ha) and phosphorus (17.97 kg/ha) but high in available K (308.12 kg/ha). The 16 treatments comprising of four weed control practices *viz.* Pendimethalin (38.7% CS) 1 kg /ha as PPI, Hand Weeding at 30 DAS, Hand Hoeing at 30 DAS and Control (No weed control) as a main plot treatments and four crop mulches *viz.*, Wheat straw (5 t/ha), Paddy straw (5 t/ha), Soybean straw (5 t/ha) and Control (No mulch) were assigned in sub-plot treatments and these were laid out in a split plot design with three replications. Chickpea variety 'JG 14' was sown in row 30 cm apart, using 80 kg/ha seeds. Crop was fertilized with 20 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 20 kg K<sub>2</sub>O/ha as basal dressing through urea, single super phosphate (SSP) and muriate of potash, respectively. Pendimethalin was applied as PPI before 2 days of sowing with hand knapsack sprayer fitted with flat-fan nozzle using spray volume of 500 l/ha, and straw mulches were applied after 12 DAS at the rate of 5 t/ha. Weed density and weed dry weight were recorded at 60 DAS with the help of 1 x 1 m quadrat by throwing at randomly at two places in each plot. Data thus recorded, were subjected to square root transformation as  $\sqrt{x+0.5}$ . Weeds were removed and species wise weed dry weight was recorded after drying in hot air oven (60±1°C for 48 hours) and accordingly weed control efficiency was also calculated out of original weed dry weight recorded at 60 DAS. Finally, the seed yield was recorded under different treatments at harvest.

## Results and discussion

### Associated weed flora

Chickpea was infested by wide range of dicot weeds. The major weed species in the experimental plots were compared of *Cichorium intybus* (31.95%), *Medicago truncatula* (21.82%) and *Melilotus indica* (20.52%). However, other dicot weeds like *Anagalis arvensis* and *Chenopodium album* also marked their presence in good numbers (15.45 and 10.26 respectively) at 60 DAS.

### Effect on weeds

Data presented in Table 1 revealed that the total weed density and dry weight were minimum (9.75 m<sup>-2</sup> and 6.31 gm<sup>-2</sup>) under hand weeding once due to elimination of all weeds during the course of hand weeding followed by pendimethalin (38.7% CS) 1 kg *a.i.* /ha as PPI (10.76 m<sup>-2</sup> and 7.58 g m<sup>-2</sup>) due to identical reduction in density and dry weight of weeds after hand weeding and preplant incorporation of pendimethalin as compared to hand hoeing where weeds present within the row were escaped mechanical removal and hence found to inferior to former treatments. Similar finding were endorsed by Baghel (2018) [12]. Among the straw mulches, application of paddy straw mulch recorded lower density and dry weight of total weeds (10.92 m<sup>-2</sup> and 7.00 gm<sup>-2</sup>) on account of better suppression of weeds during the critical period of crop weed competition followed by wheat straw (11.13 m<sup>-2</sup> and 7.78 gm<sup>-2</sup>) relative to no mulch plots which had maximum density and dry weight of weeds (12.90 m<sup>-2</sup> and 10.09 gm<sup>-2</sup> respectively) due to no control of weeds. The maximum weed control efficiency was recorded under Hand weeding done at 30 DAS (69.68%) due to removal of all sort of weeds which were present within and in between the rows followed by pendimethalin (38.7% CS) 1 kg *a.i.* /ha as PPI (57.12%) and hand hoeing (42.23%) and proved better over control plots where no weed control was done due to uninterrupted growth of weeds during critical period of crop-weed competition. Among the straw mulches, application of paddy straw mulch (5t/ha) attained higher WCE (61.34%) due to suppression of all weeds by proper covering of inter row space and poor penetration of light to weeds during the critical period of crop weed competition produced minimum photosynthates by weeds and hence attained higher weed control efficiency followed by wheat straw mulch (53.04%) being lower under soybean straw mulch (32.62%) and no mulch (22.03%).

**Table 1:** Effect of weed control practices and straw mulches on weed density, dry weight and weed control efficiency of total weeds at 60 DAS (mean data of two years)

Weed control practice	Weed density (No./m <sup>2</sup> )	Weed dry weight (g/m <sup>2</sup> )	Weed control efficiency (%)
Pendimethalin 1kg ai/ha as PPI	10.76 (117.33)	7.58 (59.15)	57.12
Hand weeding 30 DAS	9.75 (97.00)	6.31 (41.82)	69.68
Hand hoeing 30 DAS	11.71 (138.33)	8.83 (79.69)	42.23
Weedy check	14.27 (204.33)	11.70 (137.94)	0.00
SEm ±	0.29	0.15	-
CD (p=0.05)	1.04	0.52	-
<b>Straw mulch</b>			
Wheat straw	11.13 (126.25)	7.88 (64.78)	53.04
Paddy straw	10.29 (109.42)	7.00 (53.33)	61.34
Soybean Straw	12.17 (150.75)	9.45 (92.95)	32.62
No mulches	12.90 (170.58)	10.09 (107.55)	22.03
SEm ±	0.13	0.11	-
CD (p=0.05)	0.39	0.34	-

**Note:** Figures in parenthesis are original values

### Effect on crop

All weed control treatments and straw mulches significantly affected the pods per plant. But numbers of seeds per pod and seed index were not influenced significantly by the various weed control treatments and straw mulches. Hand weeding

done at 30 DAS registered the highest value of pods per plant (46.88) over other weed control treatments being at par to pendimethalin (43.52) at 1 kg *a.i.* /ha as PPI due to better growth and development of chickpea plants under weed free environment, produced more flowers better fertilization in

flowers as well as excellent seed development, which in turn favoured more pod formation being the minimum under weedy check plots (20.70) due to more weed pressure during critical period. Similar results have been also given by Sneha (2019) [12]. Among the straw mulches application of paddy straw (5 t/ha) led to record maximum number of pods per plant followed by wheat straw mulch (38.73). Better growth and development of crop plants due to better suppression of weeds under these treatments caused more flower initiation and fertilization due to poor crop-weed competition during critical period and henceforth produced more pods per plants. Jagat *et al.* (2009) [8] also reported similar results. However, minimum number of pods per plant were recorded in no mulch plots followed by soybean straw mulch (5 t/ha) due to more degree of crop- weed competition during critical period. The highest seed yield (1.67 t/ha) was recorded in hand weeded plots being at par to pendimethalin 1 kg *a.i*/ha as PPI (1.49 t/ha) and proved significantly superior over hand hoeing and weedy check plots. The crop under hand weeded plots

attained lush growth due to elimination of all sort of weeds from inter and intra row spaces besides better aeration due to manipulation of surface soil and thus, more space, water, light and nutrients were available for the better growth and development, which resulted into superior yield attributes and consequently the highest yield. Gore *et al.* (2015) [7] and Sneha (2019) [12] also reported that hand weeding was an effective method of weed control for achieving the maximum yield of chickpea. Among the straw mulches, the highest seed yield (1.55 t/ha) was recorded under paddy straw mulch (5 t/ha) followed by wheat straw mulch (1.40 t/ha) due to poor crop-weed competition during critical period and better accumulation of more photosynthates in chickpea plants which led to superior yield attributes and finally higher seed yield. The former treatments proved significantly superior over soybean straw mulch and no mulch treatments. The reverse was true in case of latter treatments. Singh and Guru (2011) [11] also endorsed the similar findings.

**Table 2:** Effect of weed control practices and straw mulches on yield attributes and seed yield (mean data of two years)

Weed control practice	Pods/plant	Seeds/pod	Seed index (%)	Seed yield t/ha
Pendimethalin 1kg ai/ha as PPI	43.52	1.69	15.16	1.49
Hand weeding 30 DAS	46.88	1.75	15.02	1.67
Hand hoeing 30 DAS	34.60	1.67	14.82	1.27
weedy check	20.70	1.65	14.89	0.87
SEm ±	1.07	0.06	0.85	0.09
CD (p=0.05)	3.78	NS	NS	0.30
<b>Straw mulch (5 t/ha)</b>				
Wheat straw	38.73	1.73	15.03	1.40
Paddy straw	42.48	1.75	15.24	1.55
Soybean Straw	33.86	1.64	14.83	1.23
No mulches	30.62	1.64	14.79	1.10
SEm ±	0.81	0.04	0.22	0.05
CD (p=0.05)	2.37	NS	NS	0.13

## Conclusion

Hand weeding done at 30 DAS and pre plant incorporation of pendimethalin 38.7% CS 1 kg *a.i*/ha and paddy as well as wheat straw mulch at the rate of 5 t/ha gave effective control of weeds and found more productive in case of chickpea.

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