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Bio-Efficacy of Pendimethalin (38.7% CS) as Pre Plant Incorporation against Complex Weed Flora in Chickpea

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A B S T R A C T

A field experiment was conducted at the Livestock Farm, JNKVV, Jabalpur during *Rabi* season 2017 and 2018 to check the bio-efficacy of pendimethalin (38.7% CS) as PPI against complex weed flora in chickpea. Species wise weed data were recorded in weedy check plots revealed that *Medicago denticullate* (62.08%) and *Cichorium intybus* (32.85%) were most dominant. However, other monocot weeds like *Cyperus rotundus* (3.12%), *Cynodon dactylon* (1.95%) were also present in less numbers in chickpea. Weedy check had the highest weed density and weed biomass, which reduced significantly when weeds were, controlled either chemically or mechanically. Among the herbicidal treatments, application of pendimethalin (38.7% CS) as PPI at 774 g/ha arrested the weed density and weed biomass production remarkably and proved superior to its lower doses (580 and 677 g/ha) as PPI and its pre emergence application from 580 to 774 g/ha. Superior growth parameters (plant height, number of branches per plant, effective nodules per plant and crop biomass); yield attributes (pods per plant, seeds per pod, seed index), higher seed and stover yields were recorded in plots receiving pendimethalin (38.7% CS) as PPI from 677 g/ha to 774 g/ha over other herbicide treatments including its application as pre emergence at the same rates (677 and 774 g/ha). However, none of the herbicidal treatments found superior to the hand weeding twice (15 and 30 DAS).

Introduction

Chickpea (*Cicer arietinum* L.) known as gram / Bengal gram is one of the most important *Rabi* pulse crops grown in India. It is rich source of protein (18-22%), carbohydrate (62%), and certain minerals *viz*., Ca, Fe *etc*. and vitamin C in green stage. The productivity of chickpea is low in spite of cultivation of high yielding varieties and adoption of improved agronomic practices. Major reasons of poor productivity are infestation of weeds in the chickpea field, as it is a poor competitor of weeds because of slow growth rate and limited leaf area during early stages.

Important weeds which commonly noticed in chickpea growing areas are *Cyperus rotundus, Dactyloctenium aegyptium, Cynodon dactylon, Eleusine indica* as monocot, and *Chenopodium album, Chenopodium murale,*

Melilotus indica, Cichorium intybus, Medicago denticullate as dicot weeds. Crop yield losses due to weeds have been estimated to the tune of 54.7% (Poonia and Pithia, 2013). The predominant methods of weed control are mechanical hoeing or manual weeding. But this is not feasible for large areas because of labour shortage (due to industrialization and urbanization) and hence weed control task becomes very difficult.

The current trend and future development of intensive agriculture are likely to seek the help of chemicals as an effective weed control measures and replace the conventional method of weed control. Presently, new formulation of pendimethalin (38.7% CS) when applied as pre plant incorporation, controls the grassy and broad leaf weeds effectively in chickpea. But information an efficacy of capsule suspension (CS) against weeds as PPI is very meagre. Therefore, the present investigation entitled "Bio-efficacy of pendimethalin (38.7%CS) as PPI against complex weed flora in chickpea" has been proposed.

Materials and Methods

A field experiment was conducted at Livestock Farm, Department of Agronomy, College of Agriculture, JNKVV, Jabalpur during *Rabi* season of 2017 and 2018 to study the bio-efficacy of pendimethalin (38.7%CS) as PPI against complex weed flora in chickpea. Jabalpur is situated at 23^{0}09' North latitude and 79°58' East longitude with an altitude of 411.78 meters above the mean sea level.

The present experiment was carried out on clayey soil, which was medium in OC (0.62 %), available N (371.00 kg/ha) and P (18.27 kg/ha) but high in K (314.12 kg /ha) and neutral in reaction (7.2pH). The eight treatments comprising of three doses of pendimethalin (38.7% CS) as PPI at 580, 677 and 774 g/ha, three doses of pendimethalin (38.7% CS) at 580, 677 and 774 g/ha as pre emergence, hand weeding twice including weedy check plots, were laid out in RBD with three replication.

Chickpea variety 'JG 14' was grown in the experimental field with recommended package of practices. Fertilizers were applied uniformly at 20-60-20 of N-P.K Kg/ha, respectively. All the herbicides were applied by manually operated knapsack sprayer fitted with flat fan nozzle using spray volume of 500 l/ha.

The species-wise weed population was recorded by the least-count quadrat (0.25 m^2) method at 30DAS. Similarly, the weed biomass was recorded and weed-control efficiency was calculated accordingly. Growth parameters and yield attributing traits were recorded at various time intervals. The economic analysis of each treatment was done on the basis of prevailing market prices of the inputs used and outputs obtained under each treatment.

Results and Discussion

Effect on weeds

The weed density averaged over two seasons revealed that there was pre dominance of dicot weeds (94.93%) as compared to monocot weeds (5.07%) in chickpea crop at Jabalpur (MP). Among the dicot weeds, *Medicago denticullate* and *Cichorium intybus* were pre dominant as both contributed 62.08 and 32.85% relative density. However, monocot weeds like *Cyprus rotundus* and *Cynodon dactylon* marked their presence in lesser numbers (3.12 and 1.95%) in chickpea. All the weed control treatments identically reduced the density of individual weed species including dry weight over weedy

check plots, which had the maximum density of weeds (173.34) and weed dry weight (38.95 g/m^2).The application of pendimethalin (38.7% CS) as PPI at the lowest dose (580 g/ha) caused reduction in density and dry weight of grassy and broad leaved weeds but reduction was more pronounced when pendimethalin (38.7% CS) as PPI was applied at 774 g/ha, which was closely followed by its application as PPI at 677 g/ha and not significantly at par with same rate of pendimethalin (38.7% CS) as pre emergence. Reason behind this is CS formulation of pendimethalin is volatile in nature, so require incorporation in soil as PPI rather than application on surface as pre emergence.

Hand weeding twice at 15 and 30 DAS reduced the density including dry weight of weeds to the maximum extent over herbicidal treatments due to elimination of all sort of weeds during the course of hand weeding. Chandrakar *et al.,* (2015), Chavada *et al.,* (2017) also reported minimal density and dry weight of weeds under hand weeding treatment due to elimination of all types of weeds during the course of hand weeding.

Weed control efficiency (%)

Weed control efficiency (WCE %) of a treatment has strong negative correlation with weed biomass. Therefore, the trend of treatments for increased WCE was in order of weed biomass. The highest weed control efficiency (89.49 %) was attained in case of application of pendimethalin (38.7% CS) as PPI at 774 g/ha (Table 1) closely followed by its application as PPI at 677 g/ha, New formulation of pendimethalin (CS) forms film on the soil surface many times and this unique property is responsible for longer herbicidal activity (Poonia and Pithia, 2013), which may be the main reason for higher WCE and confirming the views of Poonia and Pithia (2013). The poor weed control efficiency (67.30, 67.37, 64.00 and 75.46%) was noticed in case of application of pendimethalin (38.7% CS) as PPI (580 g/ha) and application of pendimethalin (38.7% CS) as pre emergence (580, 677, 774 g/ha) respectively due to poor activity against weed flora. Hand weeding twice at 15 and 30 DAS has curtailed the weed growth to the maximum extent due to elimination of all sorts of weeds. Confirmed by Chandrakar *et al.,* (2015), Kumar *et al.,* (2014).

Effect on yield reduction

Yield reduction due to presence of weeds in chickpea was maximum (59.30%) in weedy plots, which was arrested in the plots receiving mechanical and chemical weed control measures. Application of pendimethalin (38.7% CS) as PPI at lowest dose at 580 g/ha and its application as pre emergence from 580 to 774 g/ha scaled down the yield reduction to the tune of 34.85, 35.03, 35.91 and 26.82% respectively. However, PPI application of pendimethalin (38.7% CS) checked the yield reduction identically (14.30%) at 677 g/ha or 774 g/ha (14.05%).

Effect on crop

Yield attributing traits and seed yield in chickpea was affected significantly due to different weed control treatments (Table 2). The values of yield attributing traits, *viz.,* pods per plant, seeds per pod and seed index, were superior under pendimethalin (38.7% CS) as PPI at 677 and 774 g/ha and these proved significantly superior to its lower rates (580 g/ha) as PPI and its application as pre emergence from 580 to 774 g/ha and including weedy check, because both treatments curbed the growth of the both type of weeds effectively which may be the main reason for higher yield attributing traits and seed yield.

However, hand weeding twice had the highest number of pods per plant due to timely elimination of weeds coupled with loosing/pulverization of soil, which encouraged better growth and development of crop plants. Chaudhary *et al.*, (2005), Chandrakar *et al.*, (2015) have also reported this. The seed and stover yields of chickpea increased appreciably when the weeds were controlled either by herbicides or hand weeding. The seed and stover yields were lower when pendimethalin (38.7% CS) was applied at the lowest rate (580 g/ha) but application of pendimethalin (38.7% CS) as PPI at 677 g/ha and 774 g/ha had higher seed yield and stover yields. However, hand weeding twice due to production of more photosynthate in source and better partitioning in different plant parts of chickpea recorded highest seed and stover yields. These results are in close conformity to the finding of Chandrakar *et al.*, (2015), Gore *et al.*, (2015) and Chaudhary *et al.*, (2005).

Table.1 Influence of herbicides on weed population (30 DAA), weed biomass, weed control efficiency and weed index at harvest in chickpea (mean data of 2 seasons)

Treatment	Rate (g/ha)	Weed population (no./m^2)				Weed biomass (g/m^2)	WCE (%)	Weed index (%)
		Cichorium Intybus	*Medicago denticullate*	*Cyperus rotundus*	*Cynodon dactylon*			
Pendimethalin (38.7% CS) as PPI	580	6.15 (37.33)	8.67 (74.66)	1.77 (2.66)	1.56 (1.94)	7.20 (12.41)	67.30	34.85
Pendimethalin (38.7% CS) as PPI	667	5.14 (26.00)	7.84 (56.66)	1.38 (2.33)	1.51 (1.79)	5.88 (7.75)	80.07	14.30
Pendimethalin (38.7% CS) as PPI	774	4.14 (22.00)	7.24 (52.00)	1.03 (1.33)	1.39 (1.43)	4.64 (5.75)	89.49	14.05
Pendimethalin (38.7% CS) as PE	580	6.46 (42.01)	9.55 (90.66)	2.41 (5.33)	1.77 (2.63)	7.79 (14.33)	64.00	35.03
Pendimethalin (38.7% CS) as PE	667	6.15 (37.33)	9.46 (89.00)	1.77 (2.66)	1.63 (1.94)	7.25 (12.41)	67.37	35.91
Pendimethalin (38.7% CS) as PE	774	5.40 (28.66)	8.35 (69.33)	1.68 (2.33)	1.59 (1.83)	6.36 (9.54)	75.46	26.82
Hand weeding (15 and 30DAS)	Twice	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	2.84 (0.00)	100	0.00
Weedy-check (Control)	-	8.35 (69.33)	9.65 (92.66)	2.61 (6.33)	2.35 (5.02)	12.60 (38.95)	0.00	59.30
SEm±	-	**0.35**	**0.22**	**0.10**	**0.07**		-	-
CD at 5%	-	**1.06**	**0.68**	**0.30**	**0.20**		-	-

Table.2 Influence of herbicides on yield attributing traits, yield and economics of chickpea (mean data of 2 seasons)

Treatment	Rate (g/ha)	Pods/ plant	Seeds/ pod	Seed index (g)	Seed yield (kg/ha)	Stover yield (kg/ha)	GMR (Rs/ha)	NMR (Rs/ha)	B:C Ratio
Pendimethalin (38.7% CS) as PPI	580	29.11	1.85	14.35	991.66	2080.55	49757	22545	1.83
Pendimethalin (38.7% CS) as PPI	667	32.78	1.92	14.55	1304.44	2464.44	62300	34913	2.27
Pendimethalin (38.7% CS) as PPI	774	36.33	1.93	14.81	1308.33	2482.22	65123	37561	2.36
Pendimethalin (38.7% CS) as PE	580	30	1.90	14.11	975.66	2116.66	49093	21881	1.80
Pendimethalin (38.7% CS) as PE	667	30.33	1.92	14.17	988.89	2155.55	49778	22391	1.82
Pendimethalin (38.7% CS) as PE	774	31.56	1.90	14.51	1113.89	2180.56	55578	28016	2.02
Hand weeding (15 and 30DAS)	Twice	49.78	1.97	14.84	1522.22	2572.22	75141	37379	1.99
Weedy-check (Control)	-	18.11	1.75	14.03	619.44	1911.11	30661	4899	1.19
SEm±	-	**1.71**	**0.11**	**0.22**	**61.23**	**40.82**	-	-	-
CD at 5%	-	**5.18**	**NS**	**NS**	**185.74**	**123.82**	-	-	-

Economics

Minimum net monetary returns were fetched under weedy check plots as a result of lower seed and stover yields. However, pre plant application of pendimethalin (38.7% CS) at 677 or higher rate 774 g/ha was found more remunerative, as they fetched higher net monetary returns and benefit-cost ratio.

Application of pendimethalin (38.7% CS) from 677 to 774 g/ha as PPI with good economic yield might be the reason for higher NMRs and B: C ratio over its application at lower rate at 580 g/ha, its application as pre emergence from 580 to 774 g/ha and even to hand weeding as advantage of maximum gross monetary returns was nullified due to higher variable cost for control of weeds (Rs.12000 /ha).

It was concluded that post emergence application of pendimethalin (38.7% CS) at 677 and 774 g/ha as PPI were found more remunerative as it fetched higher values of NMRs and B:C ratio compared to its pre emergence application at same rates. Pendimethalin (38.7% CS) as PPI should also be tested with other compatible herbicides at different rates in chickpea so as to get cost effective method of weed control.

References

Chandrakar S, Sharma A and Thakur DK 2015. Effect of weed management on

weeds and yield of Chickpea varieties. *Advance Research Journal of Crop Improvement* 6 :1-4.

Chaudhary BM, Patel JJ and Delvadia DR. 2005. Effect of weed management practices and seed rates on weeds and yield of chickpea. *Indian Journal of Weed Science* 37(3-4): 271-272.

Chavada JN, Patel CK, Patel SB, Panchal PP and Patel GN. 2017. Weed management in chickpea under north Gujarat conditions. *International Journal of Science, Environment and Technology*. 6 (3)

Gore AK, Gobade SM and Patil PV. 2015. Effect of Pre and Post Emergence Herbicides on yield and economics of chickpea. *International Journal of Tropical Agriculture* 33:2.

Kumar N, Nandal DP and Punia SS. 2014. Weed management in Chickpea under irrigated condition. *Indian Journal of Weed Science* 46(3): 300- 301.

Poonia TC and Pithia MS. 2013. Pre and post emergence of herbicides for weed management in chickpea. *Indian Journal of Weed Science* 45(3): 223-225.

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