

## SHORT COMMUNICATION

### Growth, yield and economics of rain fed chickpea (*Cicer arietinum* L.) as influenced by integrated weed management

S S Kaushik<sup>1\*</sup>, Anil Kumar Rai<sup>2</sup>, Pawan Sirothia<sup>3</sup>,  
Ashok Kumar Sharma<sup>4</sup> and A K Shukla<sup>5</sup>

<sup>1, 2 & 4</sup>Deendayal Research Institute, Krishi Vigyan Kendra  
Majhaganwan, Satna, Madhya Pradesh, India

<sup>3</sup>Soil Science Division, Mahatma Gandhi Chitrakoot Gramodaya  
Vishwavidyalaya, Chitrakoot, Satna

<sup>5</sup>Deendayal Research Institute, Krishi Vigyan Kendra, Ganiwan,  
Uttar Pradesh, India

Received 29 August 2012; Accepted 16 June 2014

An experiment was conducted at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna, Madhya Pradesh in Rabi season of the years 2009-10. The experiment containing 12 treatments mechanical i.e. hand weeding at 25 and 50 DAS (Days After Sowing) and chemical i.e. pre emergence application of Alachlor @ 2 kg a.i./ha, Pendimethalin @ 1 kg a.i./ha, Oxyfluorfen @ 0.2 kg a.i./ha, and post emergence application of Imazethapyr @ 100 g a.i./ha at 30 DAS and in combination with Alachlor @ 1.5 kg a.i./ha as Pre-E + 1 HW 25 DAS, Pendimethalin @ 0.75 kg a.i./ha /ha Pre-E + 1 HW 25 DAS, Oxyfluorfen @ 0.15 kg a.i./ha Pre-E + 1 HW 25 DAS, Imazethapyr @ 75 g a.i./ha Post-E 30 DAS + 1 HW 50 DAS. These treatments were laid out in randomized block design. Growth parameters were recorded at successive crop growth stages, yield and yield contributing character recorded at maturity and economics of study was done after harvest. The weed population at 60 DAS was found to be minimum in Pendimethalin @ 0.75 kg/ha + 1 hand weeding at 25 DAS treatment and this treatments has been found suitable for higher seed production and economically viable in rain fed chickpea.

**Keywords:** Chickpea, *Cicer arietinum*, Weeds, Pendimethalin, Rain fed crop, Pulses.

**IPC code; Int. cl. (2014.01)**–A61K 36/00

#### Introduction

India is the largest producer, importer and consumer of pulses in the world, accounting for 25% of the global production, 15% trade and 27% consumption, as sizeable population in the country still depends on vegetarian diets to meet its protein

requirement. In India, 40 % area is occupied by chickpea with an average yield of 600-650 kg/ha<sup>1</sup>. The crop of chickpea which has highest contribution in total pulse production in the country may play an important role in this direction. Among pulse crops, chickpea is grown on largest area of 6.4 million ha with the production of 5.10 million tons in India<sup>2</sup>. The state Madhya Pradesh grows chickpea on largest area in the country. It is occupying the highest acreage of 2.74 million ha under chickpea and contributes 46 % of the total chickpea production in the country<sup>3</sup>. Thus, any effort made in increasing the productivity of chickpea in the state of Madhya Pradesh will certainly help in increasing total pulse production in India.

In chickpea production, one of the major constraints is weed infestation. Weeds compete with crop plants for space, water and nutrients and hence, it causes considerable yield losses<sup>4</sup>. Thus weed is one of the major constraints to obtain high grain yield of improved crop cultivars if they are not controlled timely and properly. Singh and Bajpai studied the effect of different crop production inputs on chickpea and found that maximum yield reduction of 87% was observed due to elimination of weed control<sup>5</sup>. Bhalla *et al*, also recorded considerable yield losses in chickpea to the extent of 88 % if weeds are not controlled within critical growth period of crop<sup>6</sup>. Chickpea is a poor competitor to weeds because of slow growth rate and limited leaf area development at early stages of growth and establishment. Therefore, the present study was conducted to study the effect of weed management practices on growth and yield of chickpea.

#### Materials and Methods

The field experiment was conducted during *Rabi* season of 2009-10 at Rajaula Agriculture Farm of Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna. The farm is located in Bundelkhand region of Northern Madhya Pradesh. Geographically the place of experiment Chitrakoot is situated at 25° 10' N latitude and 80° 85' E longitudes. The elevation from mean sea level is in between 190 and 210 m. The soil of the experimental area is almost neutral (7.2), poor in organic matter content (0.31), low in phosphorus (12.6 kg/ha) and

\*Correspondent author:

E-mail: sskfarm1975@rediffmail.com

Phone: 09424654119 (Mob.)

high in available potassium (278.7 kg/ha). The climate of the region has mean minimum temperature 4-5 °C during winters whereas May and June are the hottest months while January is the coldest. The total average annual rainfall is 950 mm. The experiment containing 12 treatments [T<sub>1</sub>-Control, T<sub>2</sub> - Three hands weeding (HW) at 15, 30, 50 Days After Sowing (DAS), T<sub>3</sub> - One HW at 25 DAS, T<sub>4</sub> - Two HW at 25 and 50 DAS, T<sub>5</sub> - Alachlor 2 kg /ha Pre-emergence (Pre-E), T<sub>6</sub> - Pendimethalin 1 kg /ha Pre-E, T<sub>7</sub> - Oxyfluorfen 0.2 kg /ha Pre-E, T<sub>8</sub> - Imazethapyr 100 g/ha Post-E at 30 DAS, T<sub>9</sub> - Alachlor 1.5 kg/ha Pre-E + 1 HW 25 DAS, T<sub>10</sub>- Pendimethalin 0.75 kg /ha Pre-E + 1 HW 25 DAS, T<sub>11</sub> -Oxyfluorfen 0.15 kg /ha Pre-E + 1 HW 25 DAS, T<sub>12</sub> -Imazethapyr 75 g /ha Post-E 30 DAS + 1 HW 50 DAS] was laid in simple randomized block design with three replications.

## Results and Discussion

### Effect of weed control treatments on growth contributing characters of chickpea crop

It can be observed from the Table 1 that control treatment was taken for comparison. Among herbicidal treatments, Post-E application of Imazethapyr showed minimum weed population which might be due to better weed control efficiency of Imazethapyr compared with other herbicides. Plant height was recorded highest in the treatment of hand weeding and lowest in control. Treatments of Imazethapyr and one HW 25 DAS could not increase plant height significantly over control treatment. It might be due to the reason that in Imazethapyr treated plots, crop plants were suppressed by weeds in early stage which could not resume their height even under effective weed control in later stages after 30 days of sowing. In the plots of one HW treatment, crop plants faced competition with weeds in later stages which might have checked the plant height<sup>7,8</sup>. Number of branches/plant was recorded maximum in hand weeded treatment and significantly minimum in control plots. The treatments of 2 HW, alone Pendimethalin and integrated use of herbicides except Imazethapyr + 1 HW produced branches at par with hand weeded treatment.

### Effect of weed control treatments on yield contributing characters of chickpea

Numbers of pods/plant were recorded significantly higher in hand weeded plot and significantly minimum in control plots (Table 1). Among other treatments

one HW and Imazethapyr treatments produced significantly lesser pods than others which remained almost at par with each other. Numbers of pods seem to be associated with number of branches/plant which also behaved in a similar manner under different treatment. Increased number of branches may provide more points for pod formation, thus it increased the number of pods/plant. Weed control might have been responsible for all these effects<sup>9</sup>. It might be due to better development of pods in weed free and controlled weeds atmosphere which was provided by most of the weed control treatments. In control plots, crop plants face much competition with weeds throughout life period which may restrict the pod development resulting in minimum number of seeds/pod, increased number of seeds/pod in pulse crops due to effective weed control by herbicides or manual weeding has also been reported<sup>10</sup>. Harvest index was worked out significantly highest in the plots of hand weeded plots (Table 1) which might be due to proper reproductive growth due to timely translocation of photosynthesis from source to sink. Such condition may increase the seed production ration in total produce. In other treatments, formation and translocation of photosynthesis might have been limited due to crop-weed competition which may restrict the reproduction growth of crop plants, thus harvest index reduced. Similar explanation stands for minimum harvest index in weedy check treatment. Grain yield was recorded highest under weed free check treatment. It might be attributed to different yield attributes in general and to seed weight/plants in particular. As the plant stand was not affected by treatments, seed weight/plant is mainly responsible for grain yield per unit area. The treatment of Pendimethalin 0.75 kg/ha *fb* HW 25 DAS also produced grain yield at par with weed free treatment. It also might be attributed to seed weight/plant. Single application of herbicides reduced grain yield compared with their integrated use with one hand weeding. Such yield reduction might be attributed to crop-weed competition particularly in later stage of crop when effect of herbicides was diluted perhaps crop suffered second flush of weed infestation. Grain yield was produced lowest in control treatment which was due to maximum crop-weed competition throughout crop life. It is proved from yield attributes also. It is thus proved that integrated application of Pendimethalin @ 0.75 kg/ha as pre-E + 1 HW 25 DAS yielded at par with hand weeded treatment<sup>11</sup>.

Table 1—Effect of integrated weed management on growth, yield and economics of rain fed chickpea

Treatments	No. of weeds/m <sup>2</sup> (60 DAS)	Plant height (cm)	No. of branches/ plant at maturity	No. of pods/ plant	No. of seeds/ pod	Seed yield (q/ha)	Harvest index (%)	Cost of cultivation (Rs/ha)	Net Return (Rs/ha)	C : B ratio
T <sub>1</sub> – Weedy	9.47 (89.9)	27.45	4.54	18.02	1.10	5.27	35.75	12400	1578	0.15
T <sub>2</sub> – Weed free	0.71 (0.0)	33.50	8.00	46.33	1.36	16.19	45.43	18580	24237	1.30
T <sub>3</sub> – One hand weeding at 25 DAS	3.38 (11.9)	29.60	6.00	30.66	1.25	10.94	39.13	14460	14932	1.03
T <sub>4</sub> – Two hands weeding at 25 and 50 DAS	3.13 (9.3)	31.00	7.33	34.40	1.33	13.39	43.19	16520	19068	1.15
T <sub>5</sub> – Alachlor @ 2 kg/ha Pre-E	5.34 (28.0)	30.00	7.00	32.60	1.23	11.47	42.41	13368	17177	1.28
T <sub>6</sub> – Pendimethalin @ 1 kg/ha Pre-E	4.38 (18.7)	31.00	7.33	35.00	1.30	12.65	41.11	13121	20678	1.58
T <sub>7</sub> – Oxyfluorfen @ 0.2 kg/ha Pre-E	4.67 (21.3)	30.50	7.00	33.67	1.26	11.52	38.45	13121	17892	1.36
T <sub>8</sub> – Imazethapyr @ 100 g/ha Post-E	3.61 (12.5)	29.75	6.33	31.20	1.23	12.09	43.66	12874	19223	1.49
T <sub>9</sub> – Alachlor @ 1.5 kg/ha Pre-E + HW 25 DAS	4.22 (17.3)	30.90	7.67	34.80	1.33	13.84	41.57	15263	21671	1.42
T <sub>10</sub> – Pendimethalin @ 0.75 kg/ha Pre-E + HW 25 DAS	3.19 (9.7)	31.60	7.67	38.33	1.35	14.89	41.67	15078	24648	1.63
T <sub>11</sub> – Oxyfluorfen @ 0.15 kg/ha Pre-E + HW 25 DAS	3.44 (11.3)	31.10	7.67	36.13	1.33	13.96	40.51	15078	22282	1.48
T <sub>12</sub> – Imazethapyr @ 75 g/ha Post-E + HW 50 DAS	2.91 (8.3)	30.20	6.67	31.60	1.21	13.02	40.51	14893	19951	1.34
S Ed ±	0.41	1.24	0.70	2.08	0.07	1.05	0.81		1.593	0.09
CD <sub>5%</sub>	0.84	2.57	1.44	4.32	0.14	2.18	1.67		3.305	0.19

#### Effect of weed control treatments on economics of chickpea

Cost of cultivation was involved maximum in hand weeded treatment (Table 1) and it was due to cost of labour engaged in repeated three HW. Integrated treatments of herbicides + HW required higher cost than single application of herbicides and only one HW treatment because of extra labour cost engaged in HW. Control treatment showed minimum cost as no extra cost was involved other than common cost of crop cultivation. Walia also stated similar effects on cultivation cost under manual and herbicidal weed control methods<sup>12</sup>. The net return from chickpea was obtained maximum under the treatment of pre-emergence application of Pendimethalin @ 0.75 kg/ha plus HW at 25 DAS (Table 1). It was found at par with the net returns obtained under hand weeded plots and Pre-E application of Oxyfluorfen @ 0.15 kg/ha + 1 HW 25 DAS but significantly higher than all other treatments. Though gross return was maximum in

weed free check, their higher cost involved reduced the net return as compared with Pendimethalin + HW treatment which required lesser cost. Among herbicides, Post-E application of Imazethapyr treatments gave lesser net return than other herbicides. Integrated use of herbicides + HW gave significantly higher net return than lone application of herbicides except Imazethapyr<sup>13,14</sup>.

Net return was recorded highest of Rs.24,248/ha in the treatments of Pendimethalin + HW followed by weed free treatment with net return of Rs.24,237/ha. The treatment of Oxyfluorfen + HW also gave net return (Rs.22,282/ha) at par with above mentioned treatments. It was followed by the treatments Alachlor + HW (Rs.21,674/ha), alone Pendimethalin (Rs.20,678/ha), Imazethapyr + HW (Rs.19,951/ha) and 2 HW (Rs.19,068/ha). The control treatment gave only Rs.1,578/ha as net return from chickpea cultivation. In this way, the weeds caused a loss

of Rs.23,070/ha if these are not controlled properly in chickpea field.

### Conclusion

It can be inferred from the above results that the application of Pendemethalin 0.75 kg/ha as Pre E + 1 HW at 25 DAS resulted in maximum net return (Rs. 39,726/ha).

### References

- 1 Ali M and Kumar S, Pulses: Good option for Rain fed areas, *The Hindu Survey of Indian Agriculture*, 2007, 39-41.
- 2 Pramanik SC, Singh NB and Singh KK, Yield, economics and water use efficiency of chickpea (*Cicer arietinum*) under various irrigation regimes on raised bed planting system, *Indian J Agronomy*, 2009, **54** (3), 315-318.
- 3 Singh RV, Sharma AK and Tomar RKS, Weed control in chickpea (*Cicer arietinum* L.) under late sown condition, *Indian J Agronomy*, 2003, **48** (2), 114-116.
- 4 Tiwari AN, Mishra JS, Singh ON and Verma VK, Weed dynamics and management options in pulse based production systems, *Proceedings National Symposium on Legumes doe Ecological Sustainability: Emerging Challenges and Opportunities*, held at IIPR, Kanpur, November 3-5, 2007, 280-291.
- 5 Singh VK and Bajpai RP, Effect of crop production inputs on gram (*Cicer arietinum*) in North-eastern hills zone of Madhya Pradesh, *Indian J Agronomy* 1996, **41** (4), 655-656.
- 6 Bhalla CS, Kurchania SP and Pasadkar N R, Herbicidal weed control in chickpea (*Cicer arietinum* L.), *World Weeds*, 1998, **5**, 121-124.
- 7 Arya RL, Integrated weed management in chickpea (*Cicer arietinum*) + mustard (*Brassica juncea*) inter cropping system under rainfed conditions, *Indian J Agronomy*, 2004, **49**(2), 98-100.
- 8 Singh G, Mehta RK and Singh OP, Weed control in lentil under rainfed lowland conditions, *Indian J Pulses Res*, 1994, **7**(2), 132-136.
- 9 Chaudhary M and Singh CM, Studies on weed control in chickpea through glyphosate, *Indian J Agronomy*, 1987, **32**(1), 85-87.
- 10 Kumar S, Singh J, Balyan RS and Bhan VM, Evaluation of herbicides for weed control in pea, *Indian J Pulses Res*, 1991, **4**, 181-183.
- 11 Dadhich SC and Mali AL, Effect of herbicide and phosphorus on crop weed competition of chickpea, *Cicer arietinum*, *Indian J Agronomy*, 1991, **36** (Suppl.), 283-285.
- 12 Walia US, Methods of weed control, Economical method, Weed Management, Kalyani Publications, New Delhi, 2009, 12.
- 13 Singh AK and Nepalia V, Comparative efficacy of Fluchloralin and pendamethalin for weed control in field pea (*Pisum sativum*), *Indian J Agronomy* 1994, **39**(1), 164-165.
- 14 Singh AK and Singh RA, Weed management in rice (*Oryza sativa*) – Lentil (*Lens culinaris*) sequence under dry land condition of Varanasi, *Indian J Agronomy*, 1994, **39**(4), 608-611.