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Yield and economics of chickpea (*Cicer arietinum* L.) as influenced by weed control methods

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Abstract
A field experiment was conducted during rabi season of 2019-20 at Odisha University of Agriculture and Technology, Bhubaneswar under East and Southeast Coastal Plain Zone of Odisha to study the effect of various weed management practices on yield and economics of chickpea (*Cicer arietinum* L.). The experiment was laid out in randomized block design replicated thrice with eight treatments such as control plot (weedy check), weed free plot, pre-emergence application of pendimethalin @ 750 ga.i. ha^{-1}, pre-emergence application of pendimethalin @ 750 ga.i. ha^{-1} followed by hand weeding at 30 DAS, pre-emergence application of oxyfluorfen @ 50 ga.i. ha^{-1}, pre-emergence application of oxyfluorfen @ 50 g a.i. ha^{-1} followed by hand weeding at 30 DAS, post emergence application of quizolofop-p-ethyl @ 50 g a.i. ha^{-1} and post emergence application of quizolofop-p-ethyl @ 50 g a.i. ha^{-1} followed by hand weeding at 40 DAS. Pre-emergence application of pendimethalin or oxyfluorfen coupled with one hand weeding resulted in 42.4 and 47.2% higher weed control index than their lone application, respectively. Pre-emergence application of oxyfluorfen followed by one hand weeding yielded maximum grain (1311.3 kg ha^{-1}), which was at par with pre-emergence application of pendimethalin with one hand weeding. The highest net return of Rs. 42,945 ha^{-1} was obtained in weed free treatment and was followed by pre-emergence application of oxyfluorfen with one hand weeding, which gave net profit of Rs. 39,932 ha-1 with the highest benefit: cost ratio of 2.66.

Keywords: Chickpea, weed management, pendimethalin, oxyfluorfen, Quizolofop-p-ethyl

Introduction
Chickpea (*Cicer arietinum* L.) is one of the important pulse crop grown in rainfed farming system throughout India (Patil *et al*., 2014) [10]. Weeds are the most distinctive hurdles in crop production because competition from weeds leads to reduction in crop yield (Chandrakar and Raj, 2018) [2]. The crop is vulnerable to weed competition due to slow growing habit in the early growth phase, which in turn may result in yield reduction. In present day context, emphasis is given on adoption of alternative methods of weed control through integrated weed management practices. The yield of chickpea is highly affected by weed infestation due to low soil moisture condition during rabi season. Efficient management of weeds at proper time can help in appropriate utilization of available resources, which will ensure adequate plant growth, good yield and economic return from chickpea. There is need to identify the effective and economical weed management practice in chickpea (Kalyani and Srinivasulu, 2011) [6]. This can be achieved through judicious combination of chemical, manual and cultural methods for effective weed control (Sunil *et al*., 2011) [13]. Earlier research findings indicated application of pendimethalin, oxyfluorfen and quizolofop-p-ethyl are effective to control weeds in chickpea. As per findings of Dubey *et al.* (2018) [4], pre-emergence application of pendimethalin @ 1.0 kg a.i. ha^{-1} along with post-emergence application of quizalofop-p-ethyl @ 60 g a.i. ha^{-1} proved superior over other methods of weed control. It requires further refinement to precisely recommend situation specific weed control practices for the benefit of the farmers. With this backdrop, an experiment was conducted during rabi season of 2019-20 to study the effect of different weed control methods on yield and economics of chickpea.

Materials and Methods
The experiment was conducted at Odisha University of Agriculture and Technology, Bhubaneswar under East and Southeast Coastal Plain Zone of Odisha during *rabi* season of 2019-20. The soil of the experimental site was sandy loam in texture with pH 5.65. It was medium in available nitrogen, phosphorus and potassium. The experiment was laid out in a randomised block design with eight treatments and three replications.

The treatments were T_1-Control plot (weedy check), T_2-Weed free plot, T_3-Pendimethalin (pre-emergence) @ 750 g a.i. ha^{-1}, T_4-Pendimethalin (pre-emergence) @ 750 g a.i. ha^{-1} followed by hand weeding at 30 DAS, T_5-Oxyfluorfen (pre-emergence) @ 50 g a.i. ha^{-1}, T_6-Oxyfluorfen (pre-emergence) @ 50 g a.i. ha^{-1} followed by hand weeding at 30 DAS, T_7-Quizolofop-p-ethyl (post emergence) @ 50 g a.i. ha^{-1} and T_8-Quizolofop-p-ethyl (post emergence) @ 50 g a.i. ha^{-1} followed by hand weeding at 40 DAS. The seeds of JAKI – 9218, a *desi* type chickpea were sown on 21st November, 2019 with a spacing of 30 cm between rows and 10 cm within the row. A fertilizer dose of 20 kg N, 40 kg P_2O_5 and 20 kg K_2O ha^{-1} was applied as basal.

The pre-emergence herbicides pendimethalin & oxyfluorfen and post emergence herbicide quizolofop-p-ethyl were taken in the experiment. For pre-emergence application, required quantity of herbicide was uniformly sprayed one day after sowing (DAS). In case of post emergence application, the herbicide was sprayed at 15 DAS. The spray volume used for the herbicide application was 500 l ha^{-1}. In weed free plot, hand weeding was done thrice at 15, 30 and 45 DAS.

Results and Discussion

Weed population

The effect of pre-emergence application of either pendimethalin or oxyfluorfen was well evidenced with reduction of number of weeds. The effect of post-emergence application of quizolofop-p-ethyl was conspicuous after 30 days of sowing as the chemical was applied after 15 DAS. However, the total weed population maintained the minimum value ranging from 20.2 m^{-2} (30 DAS) to 10.5 m^{-2} (45 DAS) in the weed free plot provided with three hand weeding (Table 1) may be due to eradication of all types of weeds by manual weeding. Similar finding was also reported by Singh and Jain (2017) [11], who opined that two hand weeding was most effective in minimizing weed population in chickpea. Irrespective of type of weeds, pre-emergence application of either pendimethalin or oxyfluorfen followed by one hand weeding reduced total weed population by 80.2 and 80.9%, respectively at harvest as compared to weedy check plot.

The weed dry matter was similarly affected by the treatments with the minimum value ranging from 5.9 to 9.4 g m^{-2} in the weed free treatment after 30 days of sowing till harvest. Reduction in weed population with pre-emergence application of either pendimethalin or oxyfluorfen with one hand weeding at 30 DAS was reflected in the minimum weed dry weight of 17.1 g m^{-2} and 17.5 g m^{-2} at harvest, which was 77.9 and 77.4% less than the weedy check treatment, respectively. Under Ludhiana situation, Singh *et al.* (2008) [1] also reported that pre-emergence application of pendimethalin @ 0.5 kg a.i. ha^{-1} with one hand weeding reduced the weed dry matter by 86.0% as compared to weedy check.

The weed control index maintained a plateau after 45 days of sowing till harvest due to smothering effect of the crop canopy that arrests the active growth phase of the weeds. Obviously, the weed free plot exhibited maximum weed control index at 30 DAS (81.0%), 45 DAS (89.4%), 60 DAS (89.1%) and at harvest (87.9%). The effect of one hand weeding along with pre-emergence application of pendimethalin or oxyfluorfen on weed control index was 42.4 and 47.2% higher than their lone application, respectively at harvesting stage (Table 1). This may be attributed to added advantage of hand weeding at active vegetative stage of the crop, which reduced the crop-weed competition considerably. The weed control efficiency was maintained at highest level in the weed free plots at 30 DAS (73.0%), 45 DAS (88.5%), 60 DAS (85.5%) and at harvest (85.3%), which might be due to clean culture obtained by periodical hand weeding (Table 1). This was corroborated by Kachhadiya *et al.* (2009) [5], who reported highest weed control efficiency (WCE) in weed free plot.

Table 1: Effect of weed management practices on various weed parameters

Treatments	Weed density (no. m^{-2})				Weed dry weight (g m^{-2})				Weed control index (%)				Weed control efficiency (%)			
	30 DAS	45 DAS	60 DAS	At Harvest	30 DAS	45 DAS	60 DAS	At Harvest	30 DAS	45 DAS	60 DAS	At Harvest	30 DAS	45 DAS	60 DAS	At Harvest
T_1	74.8	90.7	96.6	100.4	32.6	56.1	75.9	77.3	0	0	0	0	0	0	0	0
T_2	20.2	10.5	14.0	14.8	6.2	5.9	8.3	9.4	81.0	89.4	89.1	87.9	73.0	88.5	85.5	85.3
T_3	38.1	42.7	48.1	53.1	16.8	29.3	34.0	36.5	48.1	47.7	55.2	54.7	48.8	52.6	50.2	46.9
T_4	33.7	13.8	18.4	19.9	16.6	10.4	16.5	17.1	48.9	81.4	78.4	77.9	54.6	84.9	80.9	80.2
T_5	34.8	48.3	54.4	64.6	17.4	30.2	36.2	36.7	46.6	46.2	52.3	52.5	53.5	46.8	43.6	35.7
T_6	32.2	11.9	17.0	19.2	17.7	11.0	17.4	17.5	45.5	80.4	77.0	77.3	57.0	86.8	82.4	80.9
T_7	40.8	36.2	41.3	46.6	10.8	25.9	32.5	33.5	66.8	53.6	57.2	56.7	45.1	60.1	57.2	53.5
T_8	37.05	15.7	27.5	30.9	10.4	12.0	22.3	23.1	67.9	78.6	70.7	70.1	50.5	82.7	71.5	69.2
S.E(m) +	1.81	1.93	1.13	2.01	0.86	1.11	0.91	1.26	2.38	1.68	1.38	1.02	2.33	1.74	0.82	1.80
CD (0.05)	5.48	5.84	3.42	6.11	2.61	3.37	2.75	3.82	7.28	5.15	4.21	3.11	7.14	5.34	2.51	5.52

Yield attributes

The quantum of weeds in the crop field directly influenced the yield attributing characters such as plant stand, pods per plant, grains per pod and weight of grain due to variation in crop growth parameters as a result of differential effect of the weed control treatments. Higher number of pods per plant (18.5) was realized in the weed free plot followed by pre-emergence application of pendimethalin with one hand weeding (17.9). This was in conformity with the findings of Kaushik *et al.* (2014) [8], who reported that application of pendimethalin @ 0.75 kg a.i. ha^{-1} with one hand weeding at 25 DAS produced more number of pods per plant. Conducive environment due to reduction in weed population created by pre-emergence application of pendimethalin or oxyfluorfen with one hand weeding resulted in healthy grains as evidenced from maximum grain weight (23.1g) of hundred seeds. All the yield attributing parameters were at their lowest value due to excessive weed competition in the weedy check plots. The competition from weeds are well detected in the chickpea crop with enhancement of 90.9% in pods per plant, 27.3% in grains per pod and 19.6% in grain weight (Table 2).

Yield

Enhanced values of yield attributing characters contributed

directly to yield of grain and haulm. The weed free plot produced 66.7% higher grain yield (Table 2) as compared to the weedy check plot because of 28.3% more plant population, 86.9% more pods per plant, 27.3% higher grains per pod and 19.6% heavier grains. However, Kumar *et al.* (2014) [9] reported 68.0% reduction in grain yield of chickpea in presence of weeds throughout the crop growing season. The haulm yield was 101.9% higher in case of weed free plot than the weedy check plot due to 28.3% higher plant density and 46.5% taller plants. Pre-emergence application of oxyfluorfen with one hand weeding resulted in maximum grain yield (1311.3 kg ha^{-1}), which was at par with pre-emergence application of pendimethalin with one hand weeding (1264.3 kg ha^{-1}) due to creation of comparatively weed free environment from initial crop growth stage and augmenting the weed control later by hand weeding at active crop growth stage. Kamble *et al*. (2014) [7] also opined that pre-emergence application of oxyfluorfen @ 100 g a.i. ha^{-1} followed by one hand weeding at 30 DAS resulted in highest yield of chickpea. As per Tepe *et al*. (2011) [14], the critical period of weed infestation starts after two weeks of crop emergence and continues up to eight weeks in chickpea, which might be the reason for obtaining 8.9 and 16.9% higher yield with pre-emergence application of pendimethalin and oxyfluorfen with one hand weeding than their lone application, respectively.

The harvest index was maximum (42.03%) in weed free plot (Table 2). Among herbicidal treatments, pre-emergence application of pendimethalin & oxyfluorfen with one hand weeding and post emergence application of quizolofop-p-ethyl with one hand weeding resulted in similar values (40.26 – 40.97%) of harvest index. This was in conformity with the findings of Dewangan *et al.* (2016) [3], who obtained maximum harvest index of 43.8% with two hand weeding, which was at par with pre-emergence application of pendimethalin or oxyfluorfen.

Economics

The economics of cultivation goes in favour of weed free plot with maximum net return of Rs. 42,945 ha^{-1} as a result of higher grain yield (Table 2). Singh and Jain (2017) [11] reported maximum net profit with two hand weeding at 20 and 40 days after sowing of chickpea. Pre-emergence application of pendimethalin and oxyfluorfen with one hand weeding at 30 DAS resulted in higher net profit of Rs. 37,584 and Rs. 39,932 ha^{-1}, respectively due to higher yield. The highest benefit: cost ratio of 2.66 was obtained with pre-emergence application of oxyfluorfen with one hand weeding at 30 DAS, which was followed by pre-emergence application of pendimethalin with one hand weeding (2.56) and weed free treatment (2.54). Buttar *et al.* (2008) [1] also realized maximum benefit: cost ratio with pre-emergence application of pendimethalin. Although manual weeding in weed free plot resulted in higher yield, the benefit: cost ratio was lower as compared to herbicide treatments due to high cost incurred in manual weeding.

Table 2: Effect of weed management practices on yield parameters, yield and economics

Treatments	Plant stand ($No.m^{-2}$)	Pods $plant^{-1}$	Grains pod^{-1}	100 grain weight (g)	Grain yield (kg ha^{-1})	Haulm yield (kg ha^{-1})	Harvest Index (%)	Net returns (Rs ha^{-1})	B:C ratio
T_1	24.7	9.9	1.1	19.9	482.7	992.3	32.69	10,034	1.74
T_2	31.7	18.5	1.4	23.8	1451.7	2004.0	42.03	42,945	2.54
T_3	29.7	16.0	1.3	22.8	1161.0	1828.7	38.87	32,636	2.36
T_4	31.3	17.9	1.5	23.1	1264.3	1879.3	40.26	37,584	2.56
T_5	29.0	15.7	1.3	22.7	1121.0	1819.3	38.16	32,506	2.47
T_6	31.0	17.3	1.6	23.1	1311.3	1888.7	40.97	39,932	2.66
T_7	29.0	14.8	1.2	22.4	1030.7	1648.0	38.48	27,768	2.24
T_8	30.7	16.2	1.3	22.6	1189.0	1716.7	40.92	33,088	2.33
S.E(m) +	0.90	0.66	0.08	1.16	24.22	55.36	0.525	-	-
CD (0.05)	2.74	1.99	0.25	3.51	73.46	167.89	1.593	-	-

Conclusion

The findings of the present investigation indicated that pre-emergence application of oxyfluorfen with one hand weeding at 30 days after sowing was the best weed management practice to obtain maximum grain yield and profit from chickpea during rabi season. It was closely followed by pre-emergence application of pendimethalin with one hand weeding at 30 days after sowing.

References

1. Buttar GS, Aggarwal N, Singh S. Efficacy of different herbicides in chickpea (*Cicer arietinum* L.) under irrigated conditions of Punjab. Indian Journal of Weed Science. 2008;40(3&4):169-171.
2. Chandrakar S, Raj VC. Response of chickpea (*Cicer arietinum* L.) cultivars to weed management Practices - A Review. Trends in Biosciences. 2018;11(3):262-267.
3. Dewangan M, Diproshan Singh AP, Chowdhury T. Influence of Herbicides on Phytotoxicity and Soil Dehydrogenase Enzyme Activity in Chickpea. International Journal of Bio-resource and Stress Management. 2016;7(4):533-538.
4. Dubey SK, Sharma JD, Choudhary SK, Kumar V, Shruti S. Weed management in Chickpea under irrigated conditions. Indian Journal of Weed Science. 2018;50(1):85-87.
5. Kachhadiya SP, Savaliya JJ, Bhalu VB, Supriya PAG, Savaliya SG. Evaluation of new herbicides for weed management in chickpea (*Cicer arietinum* L.). Legume Research. 2009;32(4):2293-297.
6. Kalyani D, Srinivasulu K. Integrated Weed management in Chickpea (*Cicer arietinum* L**.).** Master's thesis submitted to ANGRAU, Ragendranagar, Hyderabad, 2011.
7. Kamble AB, Rawan SA, Thawal DW, Pathan SH, Bodake PS. Integrated weed management in chickpea under irrigated condition. Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management, 2014 February 15-17.
8. Kaushik SS, Rai AK, Sirothia P, Sharma AK, Shukla

AK. Growth, yield and economics of rain fed chickpea (*Cicer arietinum* L.) as influenced by integrated weed management. Indian Journal of Natural Products and Resources. 2014;5(2):282-285.
9. Kumar N, Nandal DP, Punia SS. Weed management in chickpea under irrigated condition. Indian Journal of Weed Science. 2014;46(3):300-301.
10. Patil PV, Gore AK, Gobade SM. Effect of weed flora and yield on irrigated chickpea. Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 2014 February, 15-17.
11. Singh A, Jain N. Integrated weed management in chickpea. Indian Journal of Weed Science. 2017;49:93-94.
12. Singh S, Walia US, Singh B. Effective control of weeds in chickpea (*Cicer arietinum*). Indian Journal of Weed Science. 2008;40(1&2):51-55.
13. Sunil CM, Shekara BG, Ashoka P, Murthy KK, Madhukumar V. Effect of integrated weed management practices on nutrient uptake in aerobic rice. Research on Crops. 2011;12(3):629-632.
14. Tepe I, Erman M, Ozkan RY, Bakun B. Critical period of weed control in chickpea under non-irrigated conditions. Turkish Journal of Agriculture and Forestry. 2011;35(5):525-534.