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Evaluation of Different Herbicide on Weed Growth, Yield Attributes, Yield and Economics on Lentil (*Lens culinaris*)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at Aurangabad district of Bihar during 2014-15 and 2015-16. The experiment was laid out in randomized block design with five replications and six treatments. The major weeds in experimental field were *Chenopodium album, Phalaris minor, Anagalis arvensis* and *Convolvulus arvensis* were recorded with some other minor weed species. Lowest weed density (4.90 m^{-2} & 6.20 m^{-2}) at 30DAS was recorded where pendimethalin was applied @ 1.0 kg a.i./ha as PE followed by Imazethapyr @40 g a.i./ha at 25 DAS, which was statistically at par with Imazethapyr @40 g a.i./ha at 25 DAS in 2014-15 and 2015-16, respectively. Similarly weed density and dry weight at 30DAS and harvest during 2014-15 and 2015-16 were recorded significantly lower

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with pendimethalin was applied @ 1.0 kg a.i./ha as PE followed by Imazethapyr @40 g a.i./ha at 25 DAS, which was statistically at par with Imazethapyr @40 g a.i./ha at 25 DAS. Significantly decreased the weed density (38.77% & 60.37%) at 30DAS with pendimethalin applied @ 1.0 kg a.i./ha as PE followed by Imazethapyr @40 g a.i./ha at 25 DAS, which was statistically at par with Imazethapyr @40 g a.i./ha at 25 DAS during 2014-15 and 2015-16 and similar finding was also recorded at harvest stage in both the year. Grain yield was recorded with pendimethalin was applied @ 1.0 kg a.i./ha as PE followed by Imazethapyr @40 g a.i./ha at 25 DAS 17.61 q/ha and 14.61 q/ha, respectively during 2014-15 and 2015-16 being at par with Imazethapyr @40 g a.i./ha during both the year among other treatments. The highest net returns of Rs. 61925 & Rs 67140 and B:C 4.57 & 4.27 were recorded by pendimethalin was applied @ 1.0 kg a.i./ha as PE followed by Imazethapyr @40 g a.i./ha at 25 DAS being on par with Imazethapyr @40 g a.i./ha during both the year.

Keywords: Weed control; lentil; economics; pendimethalin and imazethapyr.

1. INTRODUCTION

Lentil is an important crop among Rabi pulses and usually grown on marginal and sub-marginal lands of South Bihar without weed management. It is herbaceous annual plant which originated from Middle East and it is not only rich sources of improved nutrition but also provide nutritious straw for cattle. In 2012, globally it was grown on 4.24 million hectare area with a total production of 4.55 million tonnes and average productivity of 1070 kg/ha [1]. Canada, India, Turkey, Australia, USA, Nepal and China are the important lentil producing countries. It is hardier and capable of withstanding extremes of weather and soil condition. However, due to its short stature, slow initial growth and long duration, its productivity is adversely affected by the presence of weeds. The concept that high input in high yield also means is high risk, if weeds are not controlled. A weed free crop environment is therefore important both for increasing yield and income for the security of crop. There are number of reasons of low production and productivity of lentil out of which weeds, being serious negative factors in crop production are responsible for reduction in the yield of lentil to a tune of 84% [2]. Loss in seed yield may go to the extent of 45-65% under unwedded condition. During winter season, broad-leaved weeds may become dominant in the early stages of crop growth because of their fast growth and deep root system. Presently not only the productivity and production are diminishing but area is also shrinking under this crop. Among various barriers like hungry and discarded soil, lack of promising cultivars, improper fertilization, pest, disease, poor weed management is the most important yield limiting factors. Weed reduces yield of lentil to the extent of 73% [3]. Lentil is a short statured crop due to which weeds pose a severe competition and reduce crop yields considerably. Various pre-plant incorporation/pre-emergence herbicides such as trifluralin, pendimethalin recommended for controlling weeds in lentil, are effective only for the initial about one month period, whereas lentil is a long duration crop (145 days) and weeds emerging later also compete with crop plants. Information regarding use of post emergence herbicides in this crop, particularly in India is meager. Mechanical/manual weeding is normally tedious, labour consuming and costlier. Weed management, which includes use of herbicides and different planting methods, can prove more economical and beneficial in lentil crop. Thus, the objective of this study was to verify suitable application of pre and post-emergence herbicides to reduce the weed dynamics, increased in yield attributes, yield and economics of lentil.

2. MATERIALS AND METHODS

A field experiment was conducted at five farmers of Aurangabad district of soth bihar during Rabi season of 2014-15 and 2015-16. Six treatments consisted with T_1 - Farmer Practice (No use of herbicides & 1 hand weeding), T_2-Pendimethalin@ 1.0 L/ha as Pre-emergence, T_3-Imazethapyr 20 ml a.i./ha as Post emergence (25DAS), T_4 - Imazethapyr 40 ml a.i./ha as Post emergence (25DAS), T_5 -Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 20 ml a.i./ha as Post (25DAS) T_6 -Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 40 ml a.i./ha as Post (25DAS) were laid out in randomized block design with five replications. The soil of experimental site was clay loam in texture, normal in reaction (pH 7.8), low in nitrogen and phosphorus and medium in potassium status. Lentil variety 'HUL-57' was sown in last week of October during both the seasons of investigation. Recommended

package of practices, except weed control treatments was adopted to grow the experimental crop. Herbicides were applied with knapsack sprayer fitted with flat fan nozzle. Species wise weed population, finally seed yield and yield attributes and economics were recorded.

3. RESULTS AND DISCUSSION

3.1 Effect on Yield Attributes and Yield

Application of herbicides had significant effect on yields and yield attributes of lentil (Table 1 and Table 2). Plant population/m^2 (68.40) was recorded maximum with pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence (25DAS) during 2014-15 whish was significantly more over other weed management practices. However, in 2015-16 significantly more number of plant/m^2 (65.30) recorded with application of pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being on par with imazethapyr 40 ml a.i./ha as post emergence both were significantly higher among other weed management practices. Number of branch/plant 13.10 and 13.90 was recorded maximum during 2014-15 and 2015-16, respectively with application of pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being at par with imazethapyr 40 ml a.i./ha as post emergence (12.70 and 12.50) in 2014-15 and 2015-16 both were significantly higher over other weed management practices. Application of pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence recorded significantly maximum number of pods/plant 66.60 and 61.50 during 2014-15 and 2015-16 ,respectively among other weed management practices during both years. Maximum number of grain/pod (1.98 & 1.84) was recorded with application of pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being at par with imazethapyr 40 ml a.i./ha as post emergence (1.92 and 1.78) during 2014-15 and 2015-16, respectively both were significantly higher over other weed management practices. Test weight (22.86 g) was recorded maximum with application of pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being at par with imazethapyr 20 ml a.i./ha as post emergence, imazethapyr 40 ml a.i./ha as post emergence and pendimethalin@ 1.0 L/ha as pre-emergence + imazethapyr 20 ml a.i./ha as post emergence they were significantly more over Farmer Practice (No use of herbicides & 1 hand weeding) and pendimethalin@ 1.0 L/ha as pre-emergence during 2014-15. However, in 2015-16 maximum test weight (22.86 g) recorded with pendimethalin@ 1.0 L/ha as pre-emergence followed by Imazethapyr 40 ml a.i./ha being at par with imazethapyr 40 ml a.i./ha as Post emergence and Pendimethalin@ 1.0 L/ha as pre-emergence + imazethapyr 20 ml a.i./ha as post emergence those were significantly more over other weed management practices. Similar results were also reported by Jain [4].

Maximum biological yield (37.45q/ha and 30.87q/ha) was recorded with pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being at par with imazethapyr 40 ml a.i./ha as post emergence (30.87 q/ha & 28.45 q/ha) during both year, respectively and significantly more over other weed management practices. Similarly, significantly maximum grain yield recorded (17.61 q/ha & 14.61 q/ha) in 2014-15 and 2015-16, respectively with pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being at par with imazethapyr 40 ml a.i./ha as post emergence (16.82q/ha & 12.82 q/ha) among other weed management practices during both years. Application of pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence produced 154.11% and 169.06% more grain yield over farmer practice during 2014-15 and 2015-16, respectively. However, application of imazethapyr 40 ml a.i./ha as post emergence also produced 142.71% and 136.09% more grain yield over farmer practice. Straw yield was recorded maximum with pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence (19.84 q/ha and 16.26 q/ha) during both the year, respectively being on par with imazethapyr 40 ml a.i./ha as post emergence (19.41 q/ha and 14.63 q/ha) during 2014-15 and 2016, respectively they were significantly more over other weed management practices. Harvest index was significantly influenced by different weed management practices. Maximum harvest index recorded (47.0%) during 2014-15 with pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence being on par with imazethapyr 40 ml a.i./ha as post emergence (46.4%) both were significantly more over other weed management practices.

Table 1. Effect of various weed management practices on yield attributes of lentil

Technology option	No. of plants/ M^2		No. of Branches/plant		No. of Pods/plant		No. of grains/pod	
	14-15	15-16	14-15	15-16	14-15	15-16	14-15	15-16
T_1 – Farmer Practice (No use of herbicides & 1 hand weeding)	44.60	40.50	5.80	4.30	40.50	38.36	1.41	1.58
T_2—Pendimethalin@ 1.0 L/ha as Pre-emergence	59.60	52.30	7.10	6.18	41.80	40.23	1.62	1.52
T_3– Imazethapyr 20 ml a.i./ha as Post emergence(25DAS)	60.60	56.25	7.30	6.30	44.30	43.50	1.64	1.48
T_4– Imazethapyr 40 ml a.i./ha as Post emergence (25DAS)	64.40	59.10	12.70	12.50	57.50	52.50	1.92	1.78
T_5– Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 20 ml a.i./ha as Post (25DAS)	61.30	63.30	10.20	9.45	47.20	45.20	1.68	1.52
T_6– Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 40 ml a.i./ha as Post (25DAS)	68.40	65.30	13.10	13.90	66.60	61.50	1.98	1.84
LSD=0.05	3.66	03.15	01.71	01.56	3.58	03.37	0.18	0.12

Table 2. Effect of various weed management practices on yield of lentil

Technology option	Test weight (g)		Biological yield(q/ha)		Grain yield (q/ha)		Straw yield (q/ha)		HI (%)	
	14-15	15-16	14-15	15-16	14-15	15-16	14-15	15-16	14-15	15-16
T_1 - Farmer Practice (No use of herbicides & 1 hand weeding)	21.89	21.98	18.46	16.52	6.93	5.43	11.53	11.09	37.5	32.9
T_2- Pendimethalin@ 1.0 L/ha as Pre-emergence	21.72	21.72	21.53	19.85	9.03	8.12	12.5	11.73	41.9	40.9
T_3 - Imazethapyr 20 ml a.i./ha as Post emergence (25DAS)	22.34	22.54	27.56	25.39	11.66	10.56	15.9	14.83	42.3	41.6
T_4- Imazethapyr 40 ml a.i./ha as Post emergence(25DAS)	22.37	22.17	36.23	28.45	16.82	12.82	19.41	14.63	46.4	45.06
T_5 -Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 20 ml a.i./ha as Post (25DAS)	22.57	22.57	28.67	25.21	12.50	10.85	16.17	14.36	43.6	43.0
T_6 - Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 40 ml a.i./ha as Post (25DAS)	22.86	22.86	37.45	30.87	17.61	14.61	19.84	16.26	47.0	47.3
LSD=0.05	0.60	00.52	3.18	2.98	1.27	1.48	1.64	1.21	0.72	0.68

Table 3. Effect of various weed management practices on weed population of lentil

Technology option	Weed density			
	2014-15		2015-16	
	At 30DAS	At harvest	At 30DAS	At harvest
T_1 - Farmer Practice (No use of herbicides & 1 hand weeding)	47.10	59.50	51.40	58.30
T_2 - Pendimethalin@ 1.0 L/ha as Pre-emergence	18.20	36.30	17.30	30.13
T_3 - Imazethapyr 20 ml a.i./ha as Post emergence(25DAS)	13.50	20.10	12.36	18.25
T_4 - Imazethapyr 40 ml a.i./ha as Post emergence (25DAS)	06.80	10.10	8.50	9.75
T_5 - Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 20 ml a.i./ha as Post (25DAS)	12.00	18.50	10.70	16.50
T_6 - Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 40 ml a.i./ha as Post (25DAS)	04.90	06.20	5.30	8.20
LSD=0.05	02.33	03.20	02.73	03.17

Table 4. Effect of various weed management practices on economics of lentil

Technology option	Cost of Cultivation (Rs/ha)		Gross return (Rs/ha)		Net Return (Rs/ha)		B:C	
	14-15	15-16	14-15	15-16	14-15	15-16	14-15	15-16
T_1 – Farmer Practice (No use of herbicides & 1 hand weeding)	18650	21670	31185	32580	10735	10910	1.52	1.50
T_2—Pendimethalin@ 1.0 L/ha as Pre-emergence	16650	19320	40635	48720	23985	29400	2.44	2.52
T_3– Imazethapyr 20 ml a.i./ha as Post emergence(25DAS)	16250	18070	52470	63360	36220	45290	3.22	3.51
T_4– Imazethapyr 40 ml a.i./ha as Post emergence (25DAS)	16925	18470	75690	76920	58765	58450	4.47	4.16
T_5– Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 20 ml a.i./ha as Post (25DAS)	17050	20120	56250	65100	39020	44980	3.26	3.24
T_6– Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 40 ml a.i./ha as Post (25DAS)	17320	20520	79245	87660	61925	67140	4.57	4.27
LSD=0.05	-	-	5718	5711	5709	5711	0.33	0.32

T_1 - Farmer Practice (No use of herbicides & 1 hand weeding)

T_2 - Pendimethalin@ 1.0 L/ha as Pre-emergence

T_3 – Imazethapyr 20 ml a.i./ha as Post emergence(25DAS)

T_4 - Imazethapyr 40 ml a.i./ha as Post emergence (25DAS)

T_5 – Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 20 ml a.i./ha as Post (25DAS)

T_6 – Pendimethalin@ 1.0 L/ha as Pre-emergence + Imazethapyr 40 ml a.i./ha as Post (25DAS)

Fig. 1. Crop and weed situation in lentil crop as per treatment at 30DAS

In 2015-16 significantly maximum harvest index (47.3%) was recorded with pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence over other weed management practices. Singh et al. [5] also reported similar result. Result was also supported by Guriqbal et al. [6].

3.2 Effect on Weed Studies

The major weeds in experimental field were *Chenopodium album*, *Phalaris minor*, *Anagalis arvensis* and *Convolvulus arvensis* with some other minor weed species. The annual dicot weeds were dominant among the weed flora throughout the crop season during both the years. All the treatments of weed management practices proved significantly superior to farmer practice in reducing weed density at 30 DAS and at harvest stage (Table 3). Picture addLowest weed density 4.90 m^{-2} and 5.30 m-2 at 30DAS was recorded where pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence which was statistically at par with imazethapyr 40 ml a.i./ha as post emergence 6.80 m^{-2} and 10.10 m^{-2} during 2014-15 and 2015-16, respectively both were significantly more over other weed management practices in both year. Similarly at harvest stage during both year lowest weed population 5.30 m^{-2} & 8.20 m^{-2} recorded with pendimethalin @ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence which was statistically at par with imazethapyr 40 ml a.i./ha as Post emergence 8.50 m-2 and 9.75 m-2 during 2014-15 and 2015-16, respectively both were significantly more among other weed management practices in both year. Similar findings were also reported by Singh et al. [7] and Jain [4]. Imazethapyr 90 g/ha at 21 or 28 DAS have been reported to provide effective control of weeds in black gram [8]. Our finding is in accordance with those of Meena and Jadon [9] not found in the literature cited.

3.3 Effect on Economics

Data presented in Table 4 revealed that the highest gross returns (Rs. 79245/ha and Rs. 87660/ha), net returns (Rs.61925/ha and Rs.67140 /ha) and B:C (4.57 and 4.27) was recorded with application of where pendimethalin@ 1.0 L/ha as pre-emergence followed by imazethapyr 40 ml a.i./ha as post emergence which was statistically at par with imazethapyr 40 ml a.i./ha as post emergence during 2014-15 and 2015-16, respectively both were significantly more over other weed management practices in both year. Whereas lowest gross return and net return were recorded in farmer practice in both the year. Similar findings were also reported by Turk and Tawaha [10] and Jain [4].

4. CONCLUSION

Therefore, it was concluded that Pendimethalin@ 1.0 L/ha as Pre-emergence followed by Imazethapyr 40 ml a.i./ha as post emergence and Imazethapyr 40 ml a.i./ha as Post emergence during both year are better for broad spectrum weed control, including grasses as well as broad leaf weeds. Both weed management practices also produced significance in yield attributes, yield as well as economics of lentil crop.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. FAOSTAT; 2013.
   Available:http://faostat.fao.org
2. Mohamed ES, Noural AH, Mohamed MI, Saxena MC. Weed and weed management in irrigated lentil in Northern Sudan. Weed Research Oxford. 1997;37(4):211-218.
3. Phogat SB, Kumar S, Sangwan N, Hooda RS. Effect of herbicides and cultural practices on weed flora of lentil. Indian Journal of Pulses Research. 2003;16(2): 119-121.
4. Jain VK. Integrated weed management in lentil (*Lens culinaris* Medik.). M.Sc. Ag. Thesis, Dept. of Agronomy, S.V.P. University of Agriculture & Tech., Meerut (UP) India; 2007.
5. Singh S, Singh I, Gill RK, Kumar S, Sarkar A. Genetic studies for yield and component characters in large seeded exotic lines of lentil. Journal of Food Legumes. 2009; 22:229-232.
6. Singh Guriqbal, Kaur Harpreet, Khanna Veena. Weed management in lentil with post-emergence herbicides. Indian Journal of Weed Science. 2014;46(2):187–189.
7. Singh G, Mehta RK, Singh OP. Weed control in lentil under rainfed low land conditions. Indian Journal of Pulses Research. 1994;7(2):132-136.

8. Veeraputhiran R, Srinivasan S, Chinnusamy C. Evaluation of post emergence herbicide and its time of application on blackgram under rice fallow condition. Madras Agricultural Journal. 2008;95:376-379.
9. Meena DS, Jadon C. Effect of integrated weed man- agement on growth and yield of soybean (*Glycine max*). Current Advances in Agricultural Sciences. 2009;1: 50-51.
10. Turk MA, Tawaha AM. Effect of time and frequency of weeding on growth, yield and economics of chickpea and lentil. Research on Crops. 2001;2(2):103-107.

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