PRODUCTIVITY AND PROFITABILITY OF LENTIL (*Lens esculenta* L.) AS AFFECTED BY DIFFERENT HERBICIDES IN RAINFED TAL REGION, BIHAR, INDIA

SABHA JEET¹, SHAHINA TABASSUM², RATAN KUMAR³, C. M. DEV⁴ & TUNDUP NAMGIAL⁵

¹Scientist, Genetic Resources and Agro-Technology Division, CSIR-Indian Institute of Integrative Medicine (IIIM),
Jammu & Kashmir, India

²Jr. Scientific Officer, Genetic Resources and Agro-Technology Division, CSIR-Indian Institute of Integrative Medicine (IIIM),
Jammu & Kashmir, India

³SMS, Horticulture, Genetic Resources and Agro-Technology Division, CSIR-Indian Institute of Integrative Medicine (IIIM),
Jammu & Kashmir, India

⁴Associate Professor, Genetic Resources and Agro-Technology Division, CSIR-Indian Institute of Integrative Medicine (IIIM),
Jammu & Kashmir, India

⁵Project Assistant, Genetic Resources and Agro-Technology Division, CSIR-Indian Institute of Integrative Medicine (IIIM),
Jammu & Kashmir, India

ABSTRACT

Farmers' participatory field trials (On Farm Trial) on Lentil was conducted at Mokama Tal region, Patna associated with ICAR-Krishi Vigyan Kendra, Barh, Patna to combat weed during the year 2015-2016. The trials conducted on Randomized Complete Block Design (RCBD) comprised with 5 treatments viz., Pendimethalin 30% EC @ 1.00 kg ai ha⁻¹, Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹, Imazethypar @20g ai ha⁻¹, Two hand weeding (40 DAS & 60 DAS) and Unweeded check, replicated with 4 times (No. of farmers). Total weed density were obtained highest from unweeded check and lowest under Two hand weeding treatment. On the basis of findings, Imazethypar technology options recorded lowest weed density than the Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹. Highest plant height, number of primary branches plant⁻¹, number of pod per plant, no. of seed per pod, 1000-seed weights, grain (1120 kg ha⁻¹), Biological (2688 kg ha⁻¹) yield and Net return (Rs. 37,128 ha⁻¹) were found highest under the treatment with Two hand weeding as compared to Imazethypar @20g ai ha⁻¹ and Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹. Highest B: C ratios were recorded under the application of Imazethypar @20g ai ha⁻¹.

KEYWORDS: Lentil, Weed Control, Quizalofop-p-ethyl, Imazethypar, Yield & Economics

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1. INTRODUCTION

In Bihar, Mokama Tal area is famous in India for its Pulse production. Among the Rabi pulses, Lentil (*Lens esculenta* L.) is one of the major pulses usually grown on Tal lands of state Bihar and other part of country. It is one of the hardiest crop and withstanding extremes of weather and soil condition. Lentil crop having the short stature, slow initial growth, its yield is directly affected by the density of weeds present in crop field. Most prominent weed species in these area are *Fumaria purviflora*, *Vicia sativa*, *Cuscuta compestris* (Dodder) *Chenopodium album* etc. infesting the Lentil crop. Different weed control measures including the use of chemical herbicides maybe economically benefitted for the lentil crop.

Cultivation area in India is (1.55 million ha) and production is (1.61 million ton) (Anonymous, 2018). Weeds play major role affecting the productivity in Lentil (Tepe, 1998). Weeds cause heavy loss to the lentil crop as they rob the

soil of its nutrient and moisture (Ali *et al.*, 1993). This is fact that due to slow early growth of lentil needs special attention for chemical weed control (Yadav *et al.*, 2007). Control of associated and troublesome weeds in Lentil is major issues to protect against decline the productivity, since, productivity reduced by 80% due to weed competition has observed by (Mohamed *et al.*, 1997). In general, up to 30% yield losses in Lentilis fairly usual and may be raise up to 50% with lack of proper weed management practices (Tanveer and Ali, 2003). Productivity of Lentil decline by weed up to 73% by the weed Weed (Phogat *et al.*, 2003). Lentil is an most common type of pulse and yield loss by weed is approximately 40-80% (Saxena and Wassimi, 1980; Al-Thahabiet *et al.*, 1994). Weeds play critical role in yield losses which is 60% and in proper management practices it may be up to 100% (Halila, 1995). Ahmad (1988), delineate that 02 to 06 weeks critical period of weed control in Lentil is most common. Ahlawat *et al.*, (1981) revealed that first 4-8 weeks is the critical period of weed competition in lentil.

Among the weed management options, chemical weed control practice is most effective and helpful to the farmers to decline the production cost as compared to traditional/ manual weeding. In this era of Agriculture, manpower has fetched from village area to the town and cities. In this connection there is difficult to manual weeding due to the lac of manpower and also cost of manpower has been hiked. Therefore, present investigation was undertaken “Productivity and profitability of Lentil (*Lens esculenta* L.) as affected by different herbicides in rainfed Tal region,” may be most profitable and effective control measures for control of weeds in Lentil and may in favour in drudgery reduction.

2. MATERIALS AND METHOD

The experiment {(On Farm Trial (OFT))} for the evaluation of dissimilar herbicides for weed management and enhancing the productivity of lentil was carried out at Farmers Field in Tal region of Mokama associated with ICAR- Krishi Vigyan Kendra, Patna, Bihar in the year, 2014-15. The trial was undertaken on Randomized Block Design comprised with Five treatments combination *viz.*, Pendimethalin 30% EC @ 1.00 kg ai ha⁻¹, Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹, Imazithypar @20g ai ha⁻¹, Two hand weeding (40 DAS & 60 DAS) and Unweeded check, replicated with 4 times (No. of farmers). The crop was grown on heavy clay soil in which pH of the soil was 7.8 and the percentage of organic carbon in the soil was 0.71 %. Lentil seed (HUL 57) was sown with zero-till drill keeping the distance of 30 cm on 20th October 2014. The major weed flora at the experimental site were grassy and broad leaf *viz.*, *Cynodondactylon*, *Cuscuta compestries*, Wild pea, *Lepidium sativum*, *Orobanchefoetida*, *Cuscutareflexa*, *Medicago sativa*, *Anagallis arvensis*, *Melilotus alba*, *Chenopodium album* and *Rumexdentatus* etc. Fertilizer was applied in the field based on soil test analysis and on the basis of recommendation. Hand weeding (two hand weeding 40 and 60 DAS) treatment was manage on the basis of high weed density. Herbicide treatments was done by use of hand sprayer mounted with flat-fan nozzles. In all plots, weed density were recorded by using a quadrant of one square meter and calculated density after the sun and oven dried sample. Harvesting was done at maturity stage in May, 2015 during the time all observation were recorded from harvest area from the each plot *viz.*, plant height, pod number measuring. Yield attributes like number of pod/plant, number of seed/pod, test weight of seed, weed dry weight, weed control efficiency percentage (WCE %), weed index, grain yield and biological yield were calculated to check the effect of dissimilar herbicides in managing the weeds and in enhancing the yield of the crop. Economic status of different treatments was calculated and was compared with each other. Weed control efficiency (WCE) and weed Index (WI) was calculated by the using formula: $WCE (\%) = (x-y)/x \times 100$ {Where x = weed dry weight in weedy check, y = weed dry weight} and weed index $WI (\%) = (x-y)/x \times 100$ {where x = yield from untreated plot, y = yield from treated plots, respectively}. The data were analyzed statistically using CPCS software at 5% level of probability.

3. RESULT AND DISCUSSIONS

3.1 Weed Dry Weight, WCE % and Weed Index of Lentil

The present findings clearly shows that, herbicide treatments relay significantly lower weed dry weight than unweeded check (Table.1). Among the herbicide treatments application Imazithypar @20g ai ha⁻¹ had lowest weed dry weight compared to Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹ and Pendimethalin 30% EC @ 1 kg ai ha⁻¹. Nevertheless, not any of the chemical herbicide treatments were found effective as per the two hand weeding treatment for reducing the weed biomass. Pre-emergence application of Pendimethalin and post-emergence application of Quizalofop -p-ethyl in Lentil are quite effective in reducing weed infestation (Singh *et al.*, 2018). At initial period of time Imazethapyr, when applied at 25 days after sowing of Lentil cause to be slightly visible toxic effect in Lentil leaf but with meantime, plants recovered and excellent plant growth. Quizalofop -p-ethyl had no any toxic visual symptoms on the recommended rate of application. Similar result also announced by (Singh *et al.*, 2014). Chandrakar *et al.*, (2016) reported lowest weed biomass in Lentil by two hand weeding. Herbicide, pendimethalin + imazethapyr 1.0 kg ha⁻¹ relay the lowest weed biomass over rest of the treatments and weedy check. Among the herbicide treatments, Imazithypar @20g ai ha⁻¹ delineate the highest (82%) weed control efficiency (WCE) followed by Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹ (78%) and Pendimethalin 30% EC @ 1.00 kg ai ha⁻¹ (75%). Highest WCE was recorded with the Two hand weeding (92%). Similarly, weed index (WI) was also found highest under Two hand weeding (92%) followed by herbicide application Imazithypar @20g ai ha⁻¹, Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹ and Pendimethalin 30% EC @ 1 kg ai ha⁻¹.

3.2 Growth, Yield Attributing Characters and Yield of Lentil

Growth and yield attributing characters *viz.*, plant height, number of primary branches plant⁻¹, number of seed pod⁻¹ and 1000 grain weight shows (Table 1). Herbicide treatments Imazithypar @20g ai ha⁻¹ were the outlines highest followed by Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹ and Pendimethalin 30% EC @ 1.00 kg ai ha⁻¹. Overall, these parameters were found highest under two hand weeding. The lowest yield attributing characters were found under than unweeded check. Alike results of those conformity was communicated by Mohamed *et al.*, (1997) and Singh and Sardana, (2001).

Among the herbicide treatments, significantly higher grain yield (980 kg ha⁻¹) was announced when the Lentil crop field was treated the herbicides with Imazithypar @20g ai ha⁻¹ at 25 days after sowing than the unweeded check while these yield parameter were found on par field treated with herbicide Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹ (970 kg ha⁻¹) treatments (Table 2 & Fig. 1). Nevertheless, two hand weeding treatment relayed that the highest grain (1120 kg ha⁻¹), and Biological (2688 kg ha⁻¹) yield which were, however, on par with field treated with herbicide Imazithypar @20g ai ha⁻¹ and Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹. Higher grain yield in case of two hand weeding Imazethapyr @20g ai ha⁻¹ and Quizalofop-p-ethyl 5% EC @ 50g ai ha⁻¹ was due to more number of primary branches, pods plant⁻¹ and seed weight which had resulted excellent weeds control as result in lower weed density/ dry weight, higher WCE and higher WI. Significantly, maximum seed and stover yield was obtained with hand weeding twice over all other treatments. Similar findings also revealed by Chandrakar *et al.*, (2016). Our findings communicated with those of Singh *et al.*, (2014), Meena and Jadon (2009) and Yadav *et al.*, (2013). Grain yield and Biological yield was recorded significantly lowest under field treated with herbicide Pendimethalin 30% EC @ 1.00 kg ai ha⁻¹ and unweeded check. Resembled in appearance of the result were described by Yasin *et al.*, (1995).

3.3 Economics of Lentil

The economic studies of data on (Table 2. & Fig. 2 & 3) revealed that among the herbicide treatments, field treated with herbicide Imazithypar @20g ai ha⁻¹ and Quizalofop-p-ethyl found highest net return (Rs.34,168 ha⁻¹) and (Rs.34,168 ha⁻¹), respectively than

the herbicide Pendimethalin. However, Two hand weeding documented high net return (Rs.37,128 ha⁻¹), which was found on par with herbicide Imazithypar @20g ai ha⁻¹ and Quizalofop-p-ethyl. The highest benefit cost ratio (2.75) were accounted under the Imazithypar @20g ai ha⁻¹ but non-significant difference from the Two hand weeding and Quizalofop-p-ethyl. The lowest B:C ratio was documented under the treatment of Two hand weeding it was extremely due to higher cost of cultivation. Whereas, lower gross (Rs. 35125 ha⁻¹) and net (Rs.17325 ha⁻¹) return and lower benefit cost ratio (1.97) was accounted under Unweeded check. Chandrakarel. *al.*, 2016 revealed that higher net returns and B:C ratio were fetched with hand weeding twice owing to successful control of weeds viz., grassy and broadleaf. Similar finding were observed by Yadavel. *al.*, (2013).

4. CONCLUSIONS

It may be concluded from the study that, Lentil sown under the field treated/applied with herbicide Quizalofop-p-ethyl 5% EC @ 50 g a.i ha⁻¹ and Imazithypar @20 g ai ha⁻¹ at 25 days shows lowest dry weight, highest WCE and obtained higher grain yield, lowest cost of production, and highest B:C ratio in rainfed Tal region than pre-emergence herbicide.

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Table 1: Weed Management Options on Growth, Yield Attributes, Weed Dry Weight, WCE and WI of Lentil (*Lens esculenta* L.)

Treatments	Plant Height (cm)	No. of Primary Branches Plant ⁻¹	No. of Pod/Plant	No. of Seed/ Pod	Test Weight (g)	Weed Dry Weight (g/m ²)			Weed Biomass (g Kg ha ⁻¹)	Weed Control Efficiency (%)	Weed Index (%)
						Grassy	BL W	Total			
Pendimethalin 30% EC @ 1 kg ai. ha ⁻¹)	48.0	4.9	92.0	1.6	26.0	15	10	25	250	75	23.0
Quizalofop-p-ethyl 5% EC @ 50 g a.i ha ⁻¹)	52.3	4.8	150.0	1.7	26.1	12	10	22	220	78	36.0
Imazithypar @20 g ai ha ⁻¹ at 25 days)	55.6	4.9	220.0	1.8	28.0	08	10	18	180	82	36.7
Two Hand weeding (45 and 90 DAS) (Farmer Practices)	58.4	5.1	248.0	1.8	28.0	03	05	08	80	92	44.6
Unweeded check	37.8	3.0	54.0	1.5	24.0	75	25	100	1000	-	-
SE d±	0.5	0.1	5.8	0.1	0.69	0.8	1.3	3.7	27.0	-	-
CD (P=0.05)	1.6	0.3	20.9	0.3	2.10	2.8	4.0	11.7	89.1	-	-

Table 2: Weed Management Options on Yield and Economics of Lentil (*Lens esculenta* L.)

Treatments	Grain Yield (kg ha ⁻¹)	Biological Yield (kg ha ⁻¹)	Cost of Cultivation (Rs ha ⁻¹)	Gross Return (Rs ha ⁻¹)	Net Return (Rs ha ⁻¹)	B:C Ratio
Pendimethalin 30% EC@ 1 kg ai. ha ⁻¹)	810	1945	19,502	45,550	26,048	2.33
Quizalofop-p-ethyl 5% EC @ 50 g a.i ha ⁻¹)	970	2344	19,902	54,070	34,168	2.71
Imazithypar@20 g ai ha ⁻¹ at 25 days)	980	2390	19,852	54,745	34,893	2.75
Two Hand weeding (45 and 90 DAS) (Farmer Practices)	1120	2688	25,300	62,428	37,128	2.50
Unweeded check	620	1470	17,800	35,125	17,325	1.97
SE d _±	57	104	--	956	686	0.08
CD (P=0.05)	172	307	--	2840	2050	0.25

Figure 1: Response of Weed Management Options on Lentil Yield.

Figure 2: Response of Weed Management Options on Net Returns (Rs. ha⁻¹).

Figure 3: Response of Weed Management Options on B:C Ratio.