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Original Research Article

Effect of Weed Management Practices on Growth and Yield of Lentil (*Lens esculenta* Moench)

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A B S T R A C T

An investigation as On Farm Trial (OFT) conducted on farmers field in Supaul district to evaluate the different weed management practices on growth and yield of lentil during the Rabi season of 2012-13 & 2013-14 revealed that the application of quizalofop ethyl 40 g a.i./ha as post emergence produced 9.5q/ha grain yield of lentil in comparison to pre emergence application of pendimethalin 1.0 kg a.i./ha and minimum grain yield was obtained under farmer practice(5.5q/ha). The improvement in yield of lentil under said treatment might be due to favourable growth and yield contributing characters (plant height, no. of branches/plant, no. of pod/plant, seed wt/pod) and reduction in weed infestation after spray of herbicides as reflected by weed control efficiency of herbicides. This treatment also recorded higher net return (Rs. 20,500/ha) and B: C ratio (2.05). The application of pedimethalin as pre-emergence and quizalofop- p-ethyl as post-emergence in lentil are quite effective in reducing the weed infestation and improvement in grain yield of lentil. The farmers under test were satisfied with the technology of weed control practices in reducing the weed infestation and improvement in grain yield of lentil.

Keywords

Lentil, weed management, weed control efficiency, grain yield, straw yield

Introduction

Lentil (*Lens esculenta* Moench.) is one of the important rabi pulse crops of India next to gram. India is the largest producer contributing about 32% of world lentil production. It is cultivated in an area of 1.42 million hectare with a production of 1.13 million tonnes and productivity of 797 kg/ha during 2012-13 (Reddy and Reddy 2010, Anonymous, 2014). Its seed is a rich source of protein, minerals, and vitamins for human nutrition, and the straw is a valued animal feed. Its ability in nitrogen and carbon sequestration adds to soil fertility (Sarker and Erskine 2006). The nutrient value of lentil composed of 60 % of Carbohydrates, 26 % of protein, 7.5 % of iron, 2 % of sugars and 0.87 of thiamine vitamin B1 (Sharara *et al.,* 2011). It is also an important rabi season pulse crop of Bihar covering an area of 152912 ha with production and productivity of 140063 metric tonnes and 916 kg /ha, respectively during 2014-15.It is also cultivated in sizable area of 1515 ha, production of 1285 metric tones and productivity of 633 kg/ha in Supaul district of Bihar (Anonymous, 2014).

Lentil is usually grown on unproductive marginal and sub-marginal lands of Supaul district under rainfed conditions. The

modern lentil varieties give good yield under the umbrella of good agronomic management practices. Weed infestation is one of the limiting factors in achieving optimum yield of lentil. Among the different crop management practices, weed management is of key importance as 20 to30 % losses in grain yield are quite usual and may increase even 50 %, if the weed management practices are not properly followed (Tanveer and Ali, 2003). Most of the farmers are found reluctant to control weeds in lentil field timely and finally loses yield. Lentil is infested with grassy as well as broad leaf weeds in initial and later part of crop growth. Weed reduces yield through competition with crop plants for space, moisture, light and plant nutrients. The extent of yield reduction depends upon time, duration and intensity of weed infestation and weed competition with crops for growth resources. Inadequate weed control was found to reduce the yield 40-66 % in lentil (Singh & Singh, 1983)**.** Weeds exhaust soil depriving the crop of nutrients causing a considerable reduction in yield. Lentil is poor competitor against weeds due to its short height, slow early growth, small and weak canopy. Lentil is a short-statured crop due to which weeds pose a severe competition and reduce crop yields considerably. Lentil's low competitive ability is compounded when growing season temperatures are low or when moisture is scarce.

Mechanical/manual weeding is normally tedious, labour consuming and costlier. Increased cost of manual weeding, its poor labour efficiency and scarcity during critical periods when labour utilization is diverted to other priority crops made herbicides very attractive in lentil. Herbicides have revolutionized agriculture all over the world and have played key role in enhancing productivity. They are accepted as an essential tool in weed management as they reduce labour requirement enormously and are easy and convenient to use (Rao and Nagamani, 2010). Herbicides have come as a big boon to farmers in areas where the labour supply is limited and wages are high. Application of herbicide can minimize weed infestation if the field can be kept weed free during the critical growth period. Ahlawat *et al.*, (1981) reported that the most critical period of weed competition in lentil is first 4-8weeks. Weed management, which includes use of herbicides and other methods, can prove more economical and beneficial in lentil crop. Various methods followed to manage the weeds have their own merits and demerits. The choice for weed control methods for a particular situation will depend upon the season, climate, soil type, prevalent weed species, crop cultivar and method of propagation. The final selection of any method however, will largely depend on its effectiveness and economics besides available resources with the farming communities. The practical utility of any weed control measure can be best judged based on its economic feasibility besides its efficient weed control. According to Barros *et al.*, (2008) the aim of weed management is to keep the weed community at an acceptable level rather than to keep the crop totally free of weeds. Hence, proper choice of the weed management system would be viable, effective and economical with the varying intensity of weed species, population and their dominant effect on the short stature crops like lentil.

Materials and Methods

The present investigation was conducted as on farm trial on farmer's field during 2012-13 & 2013-14 under KVK, Raghopur, Supaul to study the effect of weed management practices on growth and yield of Lentil (*Lens esculenta* Moench.). The

common weeds observed in lentil fields were *Chenopodium album* L., *Vicia sativa* L., *Anagallis arvensis* L, *Convolvulus arvensis* L., *Melilotus alba* L, *Fumaria indica* L, *Lathyrus spp., Cirsium arvense* and *Cuscutta compestris* L. The experiment was laid out in randomized block complete design considering individual farmers plot as replication in individual plot size of 0.1 ha. The study area is situated in subtropical climate with extremes of temperature in summer 46 ^{0}C and in winter 4 ^{0}C and the area receives the annual precipitation of 1344 mm. Meteorological observation during cropping period at the experimental site revealed the highest maximum temperature in April (34.40^{o}C) and lowest minimum in January (9.5^{o}C) and the crop also received rain showers from October to April (Figure 1).The technological options consisted of TO_1: farmers practice(control),TO_2: application of pendimethalin 1kg a.i./ha as pre emergence,TO_3: application of Quizalfop-ethyl @ 40 g a.i./ha as post - emergence with 10 replications.

The lentil variety L-4076 was grown as test crop with seed rate of 35 kg /ha and fertilizer dose of 20:40 kg N: P_2O_5/ha was applied to crop under rainfed condition during both year of experimentation. Observations of yield and growth parameters like plant height (cm), no. of branches/plant, no. of pod/plant, no. of grain/pod, grain yield (q/ha) and straw yield (g) of maturity periods, and related to weed effect of lentil plot on weed density /m^2 and dry weight of weeds were taken at 30 days interval from the experimental plots from randomly selected area of 50×50 cm. Weed control efficiency (WCE) and harvest index (HI) % were calculated as per the standard formula as well as economics of lentil/ha. The soil was sandy loam in texture having initial soil fertility status PH 6.8, organic carbon 0.48 %, available N, P_2O_5 and K_2O 224, 18, 116 kg /ha respectively. The details of herbicides used are as under:

Pendimethalin 30 % EC

Pendimethalin (N-(1-ethylpropyl)-2, 6-dinitro-3, 4-xylidine) is a selective herbicide used to control most annual grasses and certain broadleaf weeds in field crops and pulses. It is used both pre emergence and early post emergence. The control of most annual grasses weed and fair control of small-seeded annual broadleaves weed. Pendimethalin's herbicidal action lies in its inhibition of the steps in plant cell division responsible for chromosome separation and cell wall formation.

Quizalofop-p-ethyl 5 EC

Quizalofop-p-ethyl (Propanoic acid, 2-[4-[(6-chloro-2-quinoxalinyl) oxy]phenoxy]-, ethyl ester (76578-14-8)) is a selective, post emergence phenoxy herbicide used to control annual and perennial grass weeds in pulses. It does not control broadleaves and have excellent crop tolerance. Weed growth is reduced soon after application by appearing symptoms usually in 1 to 2 weeks. It is used for post emergence control of annual and perennial grasses.

Results and Discussion

Effect on crop

The effect of herbicides on grain and straw yield of lentil was found significant (Table:2)The application of quizalofop - ethyl 40 g a.i./ha as post emergence and pendimethalin 1.0 kg a.i./ha showed the similar effect in increasing the grain and straw yield of lentil but significantly superior to control ie. no weeding practices (5.5q/ha).

Fig.1 Metrological data during the cropping periods (2012 – 13 & 2013 – 14)

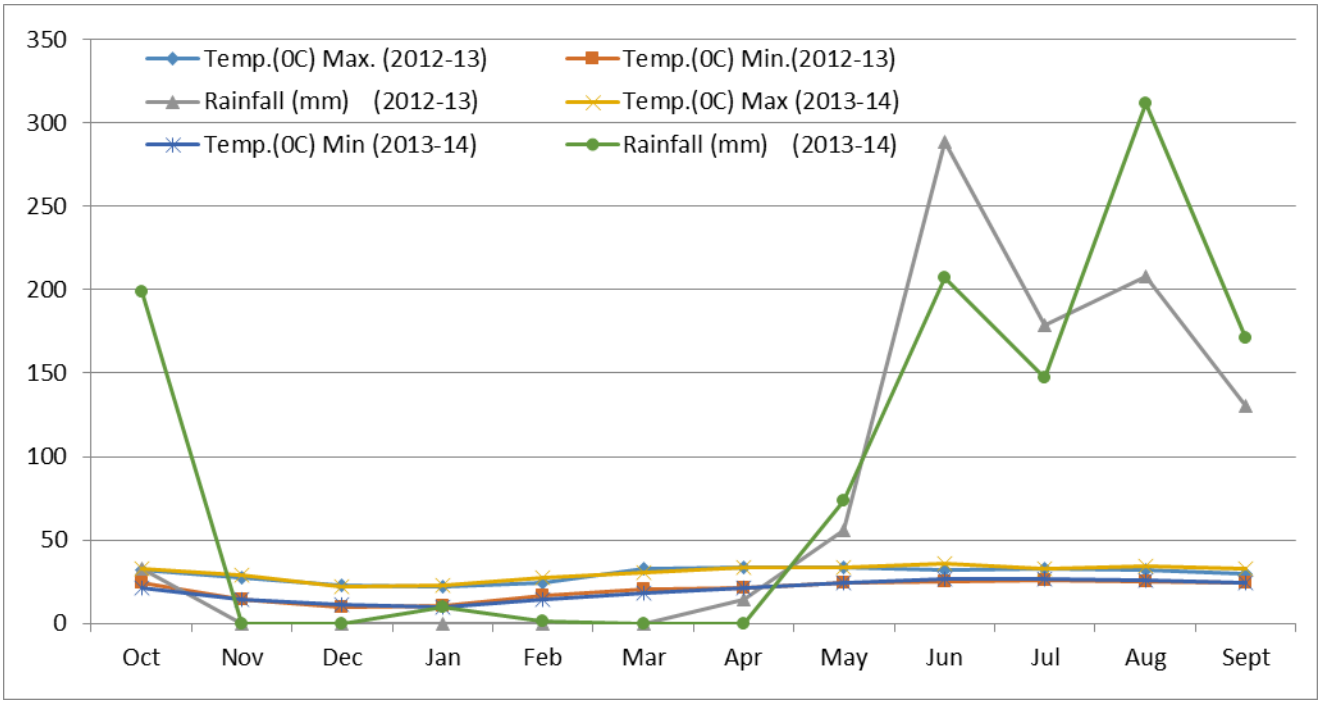

Table.1 Effect of weed management practices on growth and yield attributes of Lentil (Mean of two years data)

Technology Options	Plant Ht. (cm)	No. of branches/ plant	No. of pods/ plant	No. of grains/ pod	1000 - seed wt.(g)	Weed density/m^2 (90DAS)	Weed dry wt./m^2	WCE (%)
Farmer's Practice (control)	30.5	4.1	25.3	1.0	28.2	155.3	124.2	-
Pendimethalin *@1kg a*.i./ha	38.2	6.3	35.0	1.3	29.1	73.6	58.7	52.7
Quizalofop-ethyl 5% @ 40g ai/ha	35.7	6.8	38.6	1.4	29.5	64.8	48.9	60.6
CD (5%)	1.29	1.21	1.29	-	-	5.42	3.20	

Table.2 Effect of weed management practices on yield and economics of Lentil (Mean of two years data)

Technology Options	Grain yield (q/ha)	Straw yield (q/ha)	Harvest Index (%)	Cost of cultivation (Rs./ha)	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
Farmer's Practice(control)	5.5	9.5	36.6	17000	23100	6100	1.35
Pendimethalin@1 kg a.i./ha	8.5	12.3	40.8	18500	35700	17200	1.92
Quizalofopethyl 5%@40g a.i/ha	9.5	12.5	43.2	19500	39900	20400	2.04
CD (5%)	**1.23**	**1.19**	-	-	-	-	-

However higher grain yield of lentil (9.5q/ha) with the application of quizalofop ethyl 40 g a.i./ha as post emergence was observed. The harvest index (HI) was also found higher under the treatments of herbicidal application in comparison to control.

This could be attributed to favorable growth and yield attributing characters like plant height, no. of branches /plant, no. of pods/plant and no of seed/pod as well as efficacy of herbicide in controlling weeds to the extent of 60 %. Chaudhary *et al.,* (2011) found that the application of pendimethalin 3.25 lit/ha just after sowing of lentil gave good control of broad leaved weeds (87.79%) and average control of narrow leaved weeds (77.06%) respectively.

Similar results in controlling weeds of lentil by pedimethalin and quizalofop ethyl were also found by Lhungdim *et al.,* (2013), Yadav *et al.,* (2013) and Chandrakar *et al.,* (2016). In the present study, there was the infestation of annual and grassy weed which were emerged on later part of crop growth were successfully controlled by quizalofop-ethyl post emergence herbicide (Davis 1987).No. of pods/plant is known to have significant positive correlation with grain yield in lentil (Singh *et al.,* 2009).

Effectiveness of these treatments could be attributed to better control of weeds during critical period of crop growth and thus, provide a weed free environment for a better growth and development of lentil (Tepe *et al.,* 2003 and Dhuppar *et al.,* 2013)

This might be justified the effect of pendimethalin to restrict the germination and growth of broad and grassy weeds in early stage of crop while quizalofop ethyl proved its effect for controlling especially grassy weeds in later stage of crop growth

Effect on Weed

The application of herbicides significantly affected the weed characters like weed density, weed dry weight and finally weed control efficiency Table.1.The application of quizalofop - ethyl 40 g a.i./ha as post emergence reduced the weed infestation in terms of weed density, weed dry weight higher value was observed in control. The weed control efficiency (WCI) of the quizalofop - ethyl 40 g a.i./ha and pendimethaline were found to be 60.6 and 52.7 respectively. This could be attributed to better control of weeds as reflected in lower weed density (m^2), dry weight of weeds (m^2) and higher WCE (Phogat *et al.,* 2003).

Economics

The economic studies of data revealed that the use of pre-emergence herbicide pendimethalin and post-emergence quizalofop ethyl recorded higher net return (Rs.17200/ha & Rs.20400/ha) and benefit cost ratio (1.92 & 2.04) respectively. Whereas lowest gross return and net return (Rs.6100/ha) with benefit cost ratio (1.35) were recorded in control. Similar findings were also reported by Turk and Tawaha (2001) and Jain (2007).

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