American-Eurasian J. Agric. & Environ. Sci., 15 (11): 2184-2187, 2015
ISSN 1818-6769

DOI: 10.5829/idosi.aejaes.2015.15.11.12730

Influence of Different Herbicides on Growth, Yield and Economics of Lentil *(Lens culinaris medikus* subsp. *Culinaris*)

[1]D.K. Chandrakar, [1]S.K. Nagre, [1]D.M. Ransing, [2]Kusum Chandrakar and [1]A.P. Singh

[1]Department of Agronomy, College of Agriculture, IGKV, Raipur, Chhattisgarh, India
[2]Government B.P. Arts, Science and Commerce College, Arang, Chhattisgarh, India

Abstract: A field experiment was conducted during *rabi* season of 2011-12 and 2012-13 at Research Cum Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh to study the most effective herbicide, their appropriate dose and time of application for weed control in lentil. The various treatment combination the best result found in hand weeding twice at 20 and 40 days after sowing (DAS) closely followed by Pendimethalin + Imazethapyr 1.0 kg ha^{-1} at pre emergence recorded lowest weed dry weight at 60 DAS, maximum weed control efficiency, tallest plant, maximum branches $plant^{-1}$, highest plant dry matter accumulation, highest pods $plant^{-1}$, seeds $plant^{-1}$, test weight, maximum seeds and stover yields, maximum net return and B:C ratio over all the treatments.

Key words: Quizalofob-ethyl · Imazethapyr · Chlorimuron ethyl · Pendimethalin · Seed yield · Weed control efficiency · Weed index.

INTRODUCTION

The lentil *(Lens culinaris* medikus subsp. *Culinaris*) is a lens-shaped grain legume well known as a nutritious food. Lentil is an integral part of Indian and Middle Eastern diet, but also feature in many French and Italian regional dishes, where they are often cooked with salted fish or meat a legacy of peasant food. Lentil is an important food legume, among more than a dozen pulse crops grown in India. It is not only a rich source of improved nutrition for people but also provide nutritious straw for cattle. Lentil contains about 11 per cent water, 25 per cent protein and 60 per cent carbohydrate. It is also rich in calcium, iron and niacin and high lysine and tryptophane content. As an added bonus they are relatively inexpensive and their storage is not complicated. It can be kept in a cool dry place for an indefinite amount of time without loss in nutritional value, taste or freshness. Lentil *(Lens culinaris* medikus) is an important winter season pulse crop in India. 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 prominent weed species infesting lentil crop are *Cynodon dactylon, Chenopodium album, Euphorbia hirta, Melilotus alba, Anagallis arvensis* and *Xanthium strumarium* etc. 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. During recent past, it has been progressively realized that for a more permanent agriculture, one must develop concept of "Weed management" in variance with the more popularly known weed control. 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 percent [4]. It is estimated that loss in seed yield may likely to go to the extent of 45-65% under unweeded condition [3]. 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. To control weeds generally hand weeding is in practice that is now costly as well as difficult because of non-availability of labour in peak period. With the advancement of agro techniques, chemical weed control is become an effective and cheap alternative to control weeds. It is effective and economical measures to control weeds as compared to manual weeding.

Corresponding Author: D.K. Chandrakar, Department of Agronomy, College of Agriculture, IGKV, Raipur, Chhattisgarh, India.

MATERIALS AND METHODS

A field experiment was conducted at Research Cum Instructional Farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (21°4 N latitude, 81°39 E longitude and 298 m above mean sea level), Chhattisgarh during *rabi* season of 2011-12 and 2012-13 to find out the most effective herbicide, their appropriate dose and time of application for Lentil. The soils of the experimental plot was sandy loam in texture (*Inceptiso*l) with pH 7.69 (neutral), low in organic carbon (0.48 %), low in available N (181 kg ha^{-1}) and P (7.74 kg ha^{-1}) and high exchangeable K (311 kg ha^{-1}) with normal electrical conductivity. The experiment was laid out in randomized complete block design (RCBD) comprising of 8 treatments *viz.*, Quizalofob ethyl @ 50 g/ha at 30 DAS, Imazethapyr @ 37.5 g/ha at 30 DAS, Chlorimuron ethyl @ 4 g/ha at pre plant incorporation, Pendimethalin 1.0 kg/ha at pre emergence, Pendimethalin + Imazethapyr 0.75 kg/ha at pre emergence, Pendimethalin + Imazethapyr 1.0 kg/ha at pre emergence, Hand weeding twice at 20 and 40 DAS and Weedy Check. Crop was sown at a seed rate of 40 kg/ha with a row spacing of 25 cm and plant spacing 5 cm in line during last week of November in 2011 and 2012, respectively. Recommended dose of N (20 kg/ha), P (17 kg/ha P_2O_5/ha) and K (16 kg K_2O/ha) through urea, diammonium phosphate and murate of potash were drilled in the soil before sowing. The crop was raised under irrigated condition with recommended package of practices for the zone.

All the herbicides were sprayed as per their time of application mentioned above by knapsack sprayer using a flat fan nozzle at 500 l/ha volume by diluting with water. The economics of treatments was computed on the basis of prevailing market prices of inputs and outputs under each treatment. Pooling was made on the basis of two years data as similar trend was noticed during all the years.

RESULTS AND DISCUSSION

Floristic Composition: The predominant weeds observed in the experimental field were *Cynodon dactylon* (doob grass) among grasses, *Chenopodium album* (bathua), *Cirsium arvense* (kateli), *Melilotus alba* (senji), *Euphorbia hirta (doodhi)*, *Anagalis arvensis*, *Xanthium strumarium (gokharu), Convolvulus arvensis* (hirankhuri) among broad leaf and *Cyperus rotendus* (motha) among sedges during all the two years. Similarly weed flora have also been reported by Chandrakar [2]. Thus, broad leaved weeds were dominant compared to grassy and sedges during both year.

Effect on Weeds: All the weed control treatments significantly curtailed weed dry weight compared to weedy check (Table 1). However, hand weeding twice at 20 and 40 DAS recorded lowest weed biomass compared to other treatments. Amongst the herbicides, lowest weed biomass at 40 and 60 DAS was recorded with Pendimethalin + Imazethapyr 1.0 kg/ha at pre emergence (31.19 and 38.85 g/m^2, respectively) and was closely followed by Pendimethalin + Imazethapyr 0.75 kg/ha at pre emergence over rest of the treatments and weedy check, respectively. Combination of Pendimethalin + Imazethapyr and Imazethapyr alone effectively controlled germinating broad leaved as well as grassy weeds might be due to inhibition of weed seedling emergence, resulting in least weed biomass and higher crop growth. Similar findings were reported by Ram *et al.* [7] in field pea and Ram *et al.* [6] in Rajmash. On the other hand, hand weeding twice at 20 and 40 DAS recorded the lowest weed biomass (19.87 g/m^2 at 40 DAS and 24.00 g/m^2 at 60 DAS) over all the herbicide treatments including weedy check by controlling weed population to the extent of 74.59 % (Table 1). On efficiency factor, pre emergence application of Pendimethalin 30 EC + Imazethapyr 2 EC @ 1.0 kg/ha had maximum weed control efficiency (58.86 %) recorded at 60 DAS and was closely followed by pre emergence application of Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg/ha whereas, it was the least under Chlorimuron ethyl @ 4 g/ha applied at pre plant incorporation. This might be due to the lower weed biomass and higher efficiency of weed control under combination of Pendimethalin + Imazethapyr against both broad leaved and grassy weeds (Table 1). Similarly, minimum weed index (21.06 %) was recorded with pre emergence application of Pendimethalin 30 EC + Imazethapyr 2 EC @ 1.0 kg/ha over rest of the herbicide treatments and weedy check (Table 1) as the treatment effectively controlled both broad leaved and grassy weeds. Similar findings were reported by Godara and Deshmukh [5].

Effect on Crop: All the pre and post emergence herbicide treatments had significantly higher values of crop growth and yield contributing characters over the weedy check. Among the herbicide treatments, tallest plants (41.63 cm), highest branches/plant (5.23), plant dry matter

Table 1: Influence of different herbicides on weed biomass, weed control efficiency at 60 DAS and percent reduction in yield due to presence of weeds of lentil (mean of 2 years)

Treatments	Total weed biomass (g/m^2)		Weed control efficiency at	Weed dry matter (kg/ha)		Weed
	40 DAS	60 DAS	60 DAS (%)	40 DAS	60 DAS	index (%)
Quizalofob ethyl @ 50 g/ha at 30 DAS	43.98	54.98	41.78	439.8	546.8	37.46
Imazethapyr @ 37.5 g/ha at 30 DAS	36.30	44.67	52.71	363.0	446.7	31.20
Chlorimuron ethyl @ 4 g/ha at pre plant incorporation	60.52	66.14	29.97	605.2	661.4	44.59
Pendimethalin 1.0 kg/ha at pre emergence	40.10	48.96	49.21	401.0	489.6	34.28
Pendimethalin + Imazethapyr 0.75 kg/ha at pre emergence	32.83	40.27	57.36	328.3	402.7	24.87
Pendimethalin + Imazethapyr 1.0 kg/ha at pre emergence	31.19	38.85	58.86	311.9	388.5	21.06
Hand weeding twice at 20 and 40 DAS	19.87	24.00	74.59	198.7	240.0	-
Weedy Check	78.33	94.43	-	783.3	944.3	61.65
SEm(±)	2.76	3.06		27.6	30.6	
CD (P=0.05)	8.38	9.28		83.8	92.8	

Table 2: Influence of different herbicides on growth and yield attributes of lentil (mean of 2 years)

Treatments	Plant height at harvest (cm)	Branches $plant^{-1}$ (Nos)	Plant dry matter Accumulation (g/m^2)	Pods $plant^{-1}$ (Nos)	Seeds pod^{-1} (Nos)	Test weight (gm)
Quizalofob ethyl @ 50 g/ha at 30 DAS	34.78	4.07	21.80	25.80	1.60	22.45
Imazethapyr @ 37.5 g/ha at 30 DAS	38.03	4.40	23.43	30.00	1.79	23.31
Chlorimuron ethyl @ 4 g/ha at pre plant incorporation	34.20	3.63	21.73	25.00	1.52	21.33
Pendimethalin 1.0 kg/ha at pre emergence	36.50	4.20	23.36	27.73	1.71	23.60
Pendimethalin + Imazethapyr 0.75 kg/ha at pre emergence	39.83	4.80	23.73	32.30	1.85	23.68
Pendimethalin + Imazethapyr 1.0 kg/ha at pre emergence	41.63	5.23	24.57	34.17	1.89	24.68
Hand weeding twice at 20 and 40 DAS	49.23	5.90	26.30	40.97	1.98	24.74
Weedy Check	33.30	3.13	18.38	20.30	1.39	18.90
SEm(±)	2.41	0.21	1.10	1.72	0.09	1.12
CD (P=0.05)	7.31	0.66	3.33	5.23	0.27	3.41

Table 3: Influence of different herbicides on seed yield, stover yield, harvest index and economics of lentil (mean of 2 years)

Treatments	Seed yield (kg/ha)	Stover yield (kg/ha)	Harvest index (%)	*Gross return (Rs/ha)	*Net return (Rs/ha)	B:C ratio
Quizalofob ethyl @ 50 g/ha at 30 DAS	790.15	1390.67	36.79	32996.67	20507.67	1.64
Imazethapyr @ 37.5 g/ha at 30 DAS	869.23	1637.18	34.65	36406.18	24317.18	2.01
Chlorimuron ethyl @ 4 g/ha at pre plant incorporation	700.06	1272.25	35.47	29274.65	17635.65	1.52
Pendimethalin 1.0 kg/ha at pre emergence	830.31	1618.43	33.84	34830.77	21627.77	1.64
Pendimethalin + Imazethapyr 0.75 kg/ha at pre emergence	949.17	1778.60	34.82	39745.27	26982.27	2.11
Pendimethalin + Imazethapyr 1.0 kg/ha at pre emergence	997.30	1836.97	35.14	41728.97	28470.97	2.15
Hand weeding twice at 20 and 40 DAS	1263.37	2171.83	36.84	52706.48	36937.50	2.34
Weedy Check	484.52	837.59	36.65	20218.25	9249.26	0.84
SEm(±)	50.06	91.42	2.35	1985.02	2807.24	0.16
CD (P=0.05)	151.85	277	NS	6020.94	6020.94	0.47

*The price of Quizalofop ethyl Rs. 1200/-lit, Imazethapyr Rs. 1600/-lit, Pendimethalin Rs. 580/- lit**,** Chlorimuron ethyl Rs. 350/-, Pendimethalin 30 EC+Imazethapyr 2 EC)- Rs. 630/-lit, The cost of two hand weeding (20 and 40 DAS) were Rs. 4800/- for 30 mandays, Sale price Rajmash grain Rs 50/kg and Stover Rs 1/kg.

accumulation (24.57 g/m^2), pods/plant (34.17), seeds pod^{-1} (1.89) and test weight (24.68 g) were recorded with application of Pendimethalin 30 EC + Imazethapyr 2 EC @ 1.0 kg/ha as pre-emergence and was closely followed by Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg/ha as pre-emergence. Because of poor weed control efficiency and higher weed competition index among weeds, chlorimuron ethyl @ 4 g/ha as pre-plant incorporation was least effective for raising crop growth and yield contributing characters of lentil (Table 2). On the contrary, hand weeding twice at 20 and 40 DAS recorded significantly tallest plants (49.23 cm), highest branches/plant (5.90), plant dry matter accumulation (26.30 g/m^2), pods/plant (40.97), seeds pod^{-1} (1.98) and test weight (24.68 g) over weedy check and most of the treatments.

Seed and stover yields of lentil varied significantly due to weed control treatments. Significantly maximum seed and stover yields (1263.37 and 2171.83 kg/ha, respectively) was obtained with hand weeding twice at 20 and 40 DAS over rest of the treatments. Among the herbicides, application of Pendimethalin 30 EC + Imazethapyr 2 EC @ 1.0 kg/ha as pre-emergence recorded maximum seed and stover yields (997.30 and 1836.97 kg/ka, respectively) which was obvious due to its higher values of yield attributes, weed control efficiency (58.86 %) and lower weed index (21.06 %) compared to the rest of the herbicide treatments. However, this treatment was at par with treatment Pendimethalin 30 EC + Imazethapyr 2 EC @ 0.75 kg/ha as pre-emergence. Effectiveness of these treatments could be attributed to better control of weeds during critical period of crop – weed competition and thus, provided a weed free environment for a better growth and development of rajmash. These findings are in close proximity with that of Billore *et al*. [1] and Ram *et al*. [7] with Imazethapyr on field pea. Lower seed yield under chlorimuron ethyl could be attributed to its poor weed control efficiency and higher weed index against grassy weeds.

Economic Analysis: The highest net return (Rs. 36,937.50/ha) and benefit: cost ratio (2.34) was fetched with hand weeding twice at 20 and 40 DAS owing to effective control of broad leaved as well as grassy weeds (Table 3) over rest of treatments. Among the herbicide treatments, highest net return (Rs. 28470.97/ha) and benefit:cost ratio (2.15) was recorded with Pendimethalin 30 EC+Imazethapyr 2 EC @ 1.0 kg/ha-PE and was followed by Pendimethalin 30 EC+Imazethapyr 2 EC @ 0.75 kg/ha-PE and Imazethapyr @ 75 g/ha at 30 DAS. Excellent control of dominant broad leaved as well as grassy weeds without any adverse effect on crop growth resulting in higher seed yield might have caused superior economic indices in these treatments. Least net return (Rs. 9249.26/ha) and B:C ratio (0.84) was recorded with weedy check due to both poor weed control and low crop yield.

Thus, it may inferred from the above that hand weeding twice at 20 and 40 DAS could be recommended for effective control of mixed weed flora in lentil for getting higher productivity and profitability. However, in case of unavailability of agricultural labour at appropriate time for manual weeding in rajmash pre emergence application of Pendimethalin 30 EC+Imazethapyr 2 EC @ 1.0 kg/ha could be a good alternative to control the weeds effectively and economically

REFERENCES

1. Billore, S.D., O.P. Joshi and A. Ramesh, 1999. Herbicidal effect on nodulation, yield and weed control in soybean (*Glycine max* L.) Indian J. Agric. Sci., 69: 329-331.
2. Chandrakar, U.K., 2011. Chemical weed control in lentil (*Lens culinaris medikus subsp. Culanaris*). M. Sc. (Ag) Thesis, IGKV, Raipur (CG).
3. Mishra, J.S., 2006. Efficacy of post emergence herbicides against wild oat in field pea. Indian J. Weed Sci., 38: 140-142.
4. Mohamed, E.S., A.H. Noural, M.I. Mohamed and M.C. Saxena, 1997. Weed and weed management in irrigated lentil in Northern Sudan. Weed Research Oxford, 37(4): 211-218.
5. Godara, S.P. and S.C. Deshmukh, 2002. Weed biomass, weed control efficiency and yield of soybean (*Glycine max* L.) as influenced by various weed control measures. In: Proceedings of 2nd International Agronomy Congress on Balancing Food and Environment Security–A Continuing Challenge, 26-30 November 2002, IARI, New Delhi, pp: 1198-1200.
6. Ram Baldev, Punia, S.S., D.S. Meena and J.P. Tetarwal, 2012. Efficacy of post emergence herbicides on weed control and seed yield of rajmash (*Phaseolus vulgaris* L.). Journal of Food Legumes, 25(4): 306-309.
7. Ram Baldev, Punia, S.S., D.S. Meena and J.P. Tetarwal, 2011. Bio-efficacy of post emergence herbicides to manage weeds in field pea. Journal of Food Legumes, 24: 254-257.