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EVALUATION OF PRE AND POST-EMERGENCE HERBICIDES FOR WEED MANAGEMENT IN LENTIL *(LENS CULINARIS* MEDIK.)

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ABSTRACT:- The weeds in lentil are one of the major constraints in obtaining maximum yield. The manual weed control is simply not feasible because it is time consuming and costly. The chemical weed control is the effective method of weed management. A field study was conducted to evaluate pre and post-emergence herbicides for weed control in lentil. The experiment comprised eight treatments including three herbicides, manual weeding and check (no weeding). The yield was higher in manual weeding but in herbicide treatments Isoproturon as pre-emergence @ 2 kg ha^{-1} produced statistically at par grain yield to that of manual weeding followed by Isoproturon after one month of planting @ 2 kg ha^{-1}. Both the treatments showed 193.9% and 109.2% yield increase, respectively, over the check. It indicates that Isoproturon @ 2 kg ha^{-1} can be used pre or post-emergence in lentil fields to control the weeds without causing injury to lentil plants.

Key Words: Lens culinaris; Weeds; Pre-emergence; Post-emergence; Herbicides; Crop Yield; Pakistan.

INTRODUCTION

The weeds are one of the major constraints in high yield production in all crops. In lentil weeds are severe production constraint because its plant is inherently short stature, grows slowly and is unable to attain protective canopy to overcome the weeds. Therefore, lentils are known as poor-competitor and good weed control is essential for successful production (Muehlbauer et al., 1995; Mohamed et al., 1997). Major weeds of lentil in Pakistan are maina (*Medicago denticulata*), senji (*Melilotus indica*), lehli (*Convolvulus arvensis*), bathu (*Chenopodium album*), chattri dodhak (*Euphorbia helioscopia*), wild oats (*Avena fatua*), papra (*Fumaria indica*), kandiari (*Carthamus oxyacantha*) (Sultan and Nasir, 2007). Yield losses of 40-80% have been reported due to weeds in lentil (Saxena and Wassimi, 1980; Al-Thahabi et al., 1994). Various cultural practices such as tillage, planting, fertilizer application, irrigation etc., are employed for creating favorable condition for the crop and thus help in reducing weed population. Physical methods like hand weeding, harrowing and rotary hoeing are also used for weed management (Brand et al., 2007). Hand weeding is an effective practice in traditional growing

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areas but it is not feasible on large areas (Bhan et al., 1987; Gollojeh et al., 2013) because it is labor-intensive expensive operation (Mohamed et al., 1997). The use of herbicides can eliminate weeds at early stages and prevent the yield losses successfully. Thakar et al. (2000) determined that the application of linuron @ 0.94kg ha^{-1} gave the highest weed control up to 92.3% resulting in the highest yield of pigeon pea. Skrobakova (1999) stated that postemergence herbicides, ethofummesate and pyridape gave the good control of broadleaf weeds in chickpea and lentil and caused no phytotoxicity to the crops. Elkoca et al. (2005) investigated the effect of 12 herbicides in lentil crop growing under dry land conditions in Turkey. The herbicides linuron and prometryn were effective in controlling weeds without any toxic effects on lentil and increased the total crop biomass and seed yield over 49%. In Iran, Mojeni et al. (2005), suggested that the treatments of pendimethalin + pyridate, pendimethalin + one hand-weeding and trifluralin + one hand-weeding compared with the control proved to be the most appro-priate treatments for weed control in lentil crop.

The present study was undertaken to evaluate the pre and post emergence herbicides treatments and manual weeding to find the effective and safe weed control method to increase lentil production.

MATERIALS AND METHOD

The experiment was conducted at National Agricultural Research Centre (NARC), Islamabad during *rabi* season 2011-12. An advance lentil line, NARC-02-2, was used. An experiment comprising eight treatments including check (no weeding) was laid out in a Randomized Complete Block Design (RCBD) in a plot size of 9.6 m^2 in 3 replications. Row-length was 4 m and width was 30 cm. Fertilizers were not used in this ex-

Table 1. Detail of treatments used in the study

Treatment	Herbicides	Time of application	Dose
T_1	Isoproturon	Pre-emergence	2 kg ha^{-1}
T_2	Isoproturon	Post emergence (one month after planting)	2 kg ha^{-1}
T_3	Isoproturon	Post emergence (two months after planting)	3 kg ha^{-1}
T_4	Fenoxaprop-p-ethyl	Post emergence (one month after planting)	1.5 l ha^{-1}
T_5	Fenoxaprop-p-ethyl	Post emergence (two month after planting)	3.0 l ha^{-1}
T_6	Pendimethalin	Pre-emergence	3.75 l ha^{-1}
T_7	Manual weeding	One and two months after planting	-
T_8	Check (no weeding)	-	-

periment (Table 1).

Crop was sown with single-row hand-drill by keeping the seed rate of 50 kg ha^{-1}. It was planted during the last week of October. The data were recorded on weed and crop biomass using 1 m^2 quadrat, seed yield and percentage yield increase over the weedy check. The data were subjected to analysis of variance (Steel et al., 1997) to determine the significance of differences between treatments. Least significance difference (LSD) test was applied for comparison of means between individual genotypes using soft ware package, MSTATC.

RESULTS AND DISCUSSION

Six herbicide treatments and one hand weeding treatment were tested for weed control. The results of analysis of variance indicated that all treatments showed significant differences at 1% probability level. The test treatments exhibited variations in response against weed population (Table 2). Herbicidal treatments and hand weeding significantly reduced the biomass of the weeds as compared to the weedy check. The weed biomass ranged from 727 to 2444 kg ha^{-1}. Isoproturon when applied after one month of planting @ 2 kg ha^{-1}, produced the lowest weed biomass (727 kg ha^{-1}). However, this treatment is at par with the T_1 and T_7 while T_8 (weedy check) produced maximum weed biomass (2444 kg ha^{-1}). The treatments also significantly increased the crop biomass and seed yield. Crop biomass showed variation from 2080 to 4473 kg ha^{-1}. Maximum crop biomass was produced by the T_1 as compared to the T_8 (weedy check) produced 2080 kg ha^{-1} crop biomass. All treatments gave significantly higher grain yield than weedy control. Highest grain yield (756 kg ha^{-1}) was obtained from manual weeding with 203.6% yield increase over the check. Among the herbicides T_1 gave the highest yield (732 kg ha^{-1}) with 193.9% increase in yield followed by the T_3 having 168.6% yield increase. T_4 produced lower yield than other treated plots.

The weed biomass was greatly affected by the application of Isoproutron both as pre and post emergence treatment. T_1, T_2 and T_3 wherein Isoproutron was used showed greatest impact on controlling weeds and had similar response like manual weeding that controlled the weeds tremendously and produced low weed biomass. Yasin et al. (1995) and Elkoca et al. (2004) reported that pre-emergence chemicals are effective and safe in controlling weeds of lentil. According to Stork (1998) weed growth was significantly reduced by the use of herbicides. The other herbicidal treatments T_4, T_5 and T_6 were less effective in controlling weeds. T_1 was statistically at par with manual weeding and gave higher crop biomass and seed yield. Gollojeh et al. (2013) reported the equality of post-emergence herbicide (Haloxyfop-Ethoxyethyl) with hand weeding in total seed production in lentil under dry land conditions. The seed yield was significantly affected by the weed controlling treatments and it was significantly higher in the treatments that controlled the weeds effectively than those which were non-effective. The Isoproturon had effectively controlled the weeds and gave seed yield of 732 kg ha^{-1}. As the weeds were

controlled and there was no competition between the crop plants and weeds for nutrients, the crop plants had obtained more nutrients and there was more accumulation of protein and carbohydrates which consequently increased the weight of grains. Although there is no significant difference between T_1 and hand weeding on the yield but economically the herbicide were more beneficial than hand weeding by labourers. The chemicals used in this study were never used before for the control of weeds in lentil or to see their phytotoxic effect to the lentil plants. Some of the herbicide chemicals like sniper, brodal, pronomide, chlobromuron, oxadiozon and pendimethalin used to control weeds in lentil crop caused severe injury at its early growth stages (Singh et al., 1989; Bukhtiar et al., 1991). The most effective herbicide Isoproutron used in this experiment had no adverse effects on plants and did not cause injury to lentil plants.

The present study concluded that weed management practices improved the yield of lentil as compared to weedy check. In weedy check plot, there was an intense competition between crop plants and weeds for soil and climatic resources. As regards weeding techniques, growth of weeds in the treated plots resulted in less weeds and weed biomass as compared to weedy check where weeds were left unchecked. Overall, the yield was noticeably higher in manual weeding but in herbicide treatments where (Isoproturon as

Table 2. Effectiveness of different herbicides and manual weeding on weeds and yield of lentil

Treatment	Weed biomass (kg ha^{-1})	Crop biomass (kg ha^{-1})	Seed yield (kg ha^{-1})	Yield increase (%)
T_1	807	4473	732	193.9
T_2	727	3640	521	109.2
T_3	988	4056	669	168.6
T_4	2260	2612	357	43.3
T_5	1768	4002	529	112.4
T_6	1378	2497	368	47.7
T_7	733	4056	756	203.6
T_8	2444	2080	249	-
Mean squares	1450323.6**	3776247.2**	136845.8**	-
LSD (P<0.05)	85.07	98.39	63.36	-

*** Significant at 1% probability*

pre-emergence @ 2 kg ha^{-1}) produced statistically at par grain yield to that of manual weeding followed by T_2 (Isoproturon after one month of planting @ 2 kg ha^{-1}). Hence, Isoproturon proved to be the best herbicide which @ 2 kg ha^{-1} can be used as pre or post-emergence in lentil to control the weeds without causing injury to lentil plants.

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