**The Journal of Animal & Plant Sciences, 21(4): 2011, Page: 734-737**
**ISSN: 1018-7081**

# ECONOMICAL WEED CONTROL IN LENTILS CROP

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## ABSTRACT

The effect of weed-management practices in lentil was studied through field experiments conducted during Rabi 2006-07 to 2008-09 at Adaptive Research Farm Gujranwala, Pakistan. The treatments studied were application of Stomp 330 E (pendimethalin) @3.25 lit/ha at seed bed preparation and just after sowing, respectively. Puma Super 7.5% EW (phenoxyprop-p-ethyle)@ 1.25 lit/ha as post emergence and two hand hoeing at 30 and 60 days after sowing(DAS) compared with untreated plot. Hand hoeing gave higher weed control i.e. 95.77 and 98.12 % of broad and narrow leaved weeds, respectively and produced lowest weed dry matter (15.46 g/$m^2$). Puma Super failed to control the broad leaved weeds. Application of Stomp at seed bed preparation was weak for the control of broad leaved weeds (61.04%) whereas narrow leaved weeds were controlled effectively (97.58%), but germination was affected. Highest grain yield (1519.56 kg/ha) was recorded from the plot with two hand hoeing. It gave maximum net income (Rs41247/ha) with a cost benefit ratio (CBR) of 1:5.16. Among the herbicides application of Stomp @ 3.25 lit/ha just after sowing + Puma super @ 1.25 lit/ha 45 DAS gave yield of 1415.67 kg/ha with 102.59 % increase in yield. It gave net income of Rs40093 /ha with a CBR of 1:13.73.

**Key words**; Lentils (*Lens culinaris*), hand hoeing, herbicides, weed control, economics.

## INTRODUCTION

Lentil crop is an important pulse crop. It is grown under rain fed and irrigated conditions and it adds to soil fertility. Among the crop management practices, weed management is of key importance. Generally 20 to 30% losses in grain yield are quite usual and may increase even 50%, if the crop management practices are not properly followed (Tanveer and Ali, 2003). Lentil crop is not very competitive against weeds due to small and weak canopy. Ahmad (1988) stated that first 02 to 06 weak after crop sowing is critical period for weed control. Whereas Ahlawat *et al*. (1981) reported that the most critical period of weed competition in lentil is first 4-8 weeks. Ahmad *et al*. (1990) stated that pre-emergence application of herbicides as spray and broadcast after mixing with sand produce the yield less than that of hand weeding. Bukhtiar *et al*. (1991) found that hand hoeing 30 to 40 and 70 to 80 days after emergence produced significantly higher grain yield (1027 and 1019 kg/ha), respectively than that of check (551 kg/ha). Chlorbromuron @ 1.5 kg a.i. per hectare and chlorbromuron @ 1.5+ pronomide @ 0.5 kg. a. i. per hectare as pre-emergence spray resulted in higher mortality of crop plant and significantly lower yield.

Rajput *et al*. (1992) found that highest grain yield (902.28 kg/ha) was obtained with two hand weeding. It gave highest net profit (Rs3904.20) and cost benefit ration 1:6.50 followed by Gesagard 1:3.30 alone and in combination with Kerb 1:3.10. Yasin *et al*. (1995) evaluated different herbicides for weed control in chickpea and lentil. Application of pendimethalin as pre-emergence proved better for control of weeds and high yield. According to Ahmad *et al*. (1996) pre-emergence application of Stomp-330 E @ 1.25 and 1.50 kg a.i. /ha and hand weeding were equally and much more effective in reducing dry weight of weeds than Treflan-48 EC. Stomp-330 E @ 1.5 kg a.i./ha showed some phytotoxicity to lentil by affecting germination and growth, Whereas, Stomp-330 E @ 1.25 kg a.i. /ha gave higher seed yield (1398 kg/ha). It was followed by hand weeding (1364.6 kg/ha). Mohamed *et al*. (1997) advocated that pre-emergence herbicides provided excellent control of weeds and yield was significantly increased over weedy check. Weed growth was significantly reduced by the use of herbicides and resulted in increased yield up to 50% than control (Stork, 1998). Fazal *et al*. (1999) found that Orifan @ 3.00 lit /ha was better than 1.5 lit/ha in reducing weed population, weed biomass and 58% increased yield over control. Weeds controlled by dab method gave yield of (1305 kg/ha) while manual weed control produced 1330 kg/ha yield of lentil(Anonymous 2005) while Aslam *et al*.(2007) reported that flat sowing cum hand weeding gave the maximum average yield of 3039.88 kg/ha and weed infestation reduce 38% in chickpea yield. Fathi *et al* (2010*)* worked on weed control in lentil and concluded that hand hoeing followed by paraquat herbicide were superior in number and dry weight of broad-leaved weeds(8 weeds m-2 and 11 g m-2) and (35.22 weeds m-2 and 53 g m-2), respectively. Kayan and Adak (2005) statedthat hand hoeing was more effective than herbicide application interms of reducing weed population and increasing chickpea yield.

Hence, the present experiment was planned to find out the most suitable application time of Stomp -330 E, efficacy of Puma Super and effect of hand hoeing on weed control and yield of lentil crop.

## MATERIALS AND METHODS

The evaluation of different herbicides and their time of application for weed control in lentil crop was studied through the field experiments conducted at Adaptive Research Farm Gujranwala, Pakistan during Rabi 2006-07 to 2008-09 under irrigated conditions. The common weeds observed in lentil fields were *Avena fatua* L. (Wild oat), *Phalaris minor* Retiz. (Bird's seed grass), *Chenopodium album* L. (lamb's quarters/Goose foot), *Vicia sativa* L. (common vetch), *Anagallis arvensis* L. (Blue pimpernel), *Convolvulus arvensis* L. (field bindweed), *Melilotus indica* (L.) All. (Yellow sweet clover), *Medicago polymorpha* L.(Bur clover/Medic), *Coronopus didymus* (L.) Smith (Swine cress), *Rumex dentatus* L. (Broad leaf dock) and *Fumaria indica* (Hausskn) Pugsley (fumitory). Previous crop was rice in the field where experiment was conducted. The experiment was laid out under RCBD with three replications having plot size of 5x15 meter. The variety Masoor-2000 was used as test crop. The crop was sown during 2nd fortnight of November. Rows were 30 cm apart with seed rate of 25 kg/ha. The recommended dose of Nitrogen, Phosphorus and Potash (NPK 30:80:30) kgs per ha was applied at the time of seed bed preparation and no irrigation was given to crop throughout the crop period. All other agronomic practices were kept uniform in each treatment. The detail of treatments and time of herbicides application is given in Table-1.

**Table-1 Detail of treatments employed in the experiment.**

| Treatments | Detail of treatments | Chemical name |
|---|---|---|
| $T_1$ | Control (Untreated plot) | - |
| $T_2$ | Manual Hoeing 30 & 60 DAS | - |
| $T_3$ | Stomp @ 3.25 lit/ha at SBP | Pendimethalin |
| $T_4$ | Stomp 3.25 lit/ha JAS | Pendimethalin |
| $T_5$ | Stomp 3.25 lit/ha at SBP + Puma Super @ 1.25 lit/ha at 45 DAS | Pendimethalin +Fenoxyprop-p-ethyle |
| $T_6$ | Stomp 2.5 lit/ha at SBP + 2.5 lit/ha JAS | Pendimethalin |
| $T_7$ | Puma Super @ 1.25 lit/ha at 45 DAS | Fenoxyprop-p-ethyle |

DAS=Days After Sowing, SBP= Seed Bed Preparation, JAS= Just After Sowing

Data were recorded from randomly selected three places measuring one square meter for traits. 1. Weed density. 2. Biomass of weeds. 3. Plant population. 4. Yield. All the parameters except yield were recorded 30 days before harvesting the crop. Yield was recorded after harvesting the crop during first fortnight of April. Dry weight of weeds was recorded after drying the samples in an oven at $70^0$C for 48 hours. CBR was computed on the basis of prevailing rates of labour, inputs and the produce. The data were analyzed statistically using Analysis of Variance Techniques (Steel *et al*. 1997) and means were compared through LSD test.

## RESULTS AND DISCUSSION

**Weed density:** Density of broad and narrow leaved weeds was significantly influenced by the application of herbicides and hand hoeing (Table-2). Hand hoeing provided highest broad and narrow leaved weed control (95.77 and 98.12%, respectively). $T_6$ gave the highest mortality of broad and narrow leaved weeds (93.19 and 97.93 %, respectively). $T_7$ failed to control the broad leaved weeds and was at par with weedy plot, whereas narrow leaved weeds controlled efficiently (90.50%). $T_3$ was weak for the control of broad leaved weeds (61.04%) but much effective for controlling the narrow leaved weeds (97.58%). $T_4$ gave the good control of broad leaved weeds (87.79%) and average control of narrow leaved weeds (77.06%). This was in accordance with the findings of Fazal *et al*. (1999), Mohammad *et al*.(1997) and Yasin *et al*.(1995). Yasin *et al*. (1995) evaluated different herbicides for weed control in chickpea and lentil and concluded that application of pendimethalin as pre-emergence proved better for control of weeds and high yield. Mohamed *et al*. (1997) advocated that pre-emergence herbicides provided excellent control of weeds and yield was significantly increased over weedy check.

**Biomass of weeds:** Manual and herbicidal treatments significantly reduced dry weed biomass as compared to untreated control (Table-3). $T_2$ produced the lowest dry weed biomass (15.46 g/m$^2$) and was at par with $T_6$ and $T_4$ (19.17 g/m$^2$). $T_5$ gave 43.55 g/m$^2$ of dry weed biomass. $T_1$ produced the maximum dry weed biomass (516.73 g/m$^2$). Among the herbicides, $T_7$ produced highest dry weed biomass (185.70 g/m$^2$) followed by $T_4$ (124.52 g/m$^2$). This confirms the findings of Ahmad *et al*., 1996, Fazal *et al*., 1999 and Mohamed *et al*., 1997 and Stork (1998). According to Stork (1998), weed growth was significantly reduced by the use of herbicides and resulted in increased crop yield up to 50% than control. According to Ahmad *et al*. (1996) pre-emergence application of Stomp-330 E @ 1.25 and 1.50 kg a.i. /ha and hand weeding were equally and much more effective in reducing dry weight of weeds.

**Table: 2 Mortality of weeds in Lentil as affected by different weed control treatments (Pooled data of Rabi, 2006-07 to 2008-09)**

| Treatments | Weed density per meter square | | | |
|---|---|---|---|---|
| | Narrow leaved weeds | Mortality (%) | Broad leaved weeds | Mortality (%) |
| Control (Weedy plot) | 124.00a | - | 47.33a | - |
| Manual Hoeing 30 & 60 DAS | 2.33c | 98.12 | 2.00c | 95.77 |
| Stomp @ 3.25 lit/ha at SBP | 3.00c | 97.58 | 18.44b | 61.04 |
| Stomp 3.25 lit/ha JAS | 28.45b | 77.06 | 5.78c | 87.79 |
| Stomp 3.25 lit/ha at SBP + Puma Super @ 1.25 lit/ha at 45 DAS | 5.11c | 95.88 | 4.45c | 90.60 |
| Stomp 2.5 lit/ha at SBP + 2.5 lit/ha JAS | 2.56c | 97.93 | 3.22c | 93.19 |
| Puma Super @ 1.25 lit/ha at 45 DAS | 11.78c | 90.50 | 47.55a | 0.00 |
| LSD P < 0.05 | 10.397 | - | 7.700 | - |

**Table: 3 Dry weed biomass, plant population and yield of Lentil as affected by different weed control treatments (Pooled data of Rabi, 2006-07 to 2008-09)**

| Treatments | Biomass of weeds ($g/m^2$) | Plant Population ($m^2$) | Yield (kg/ha) | Yield (%) increase |
|---|---|---|---|---|
| Control (Weedy plot) | 516.13a | 104.56ab | 698.78e | - |
| Manual Hoeing 30 & 60 DAS | 15.46e | 106.89a | 1519.56a | 117.46 |
| Stomp @ 3.25 lit/ha at SBP | 78.37cd | 98.11b | 1183.33b | 69.33 |
| Stomp 3.25 lit/ha JAS | 124.52c | 102.00ab | 1063.89bc | 52.25 |
| Stomp 3.25 lit/ha at SBP + Puma Super @ 1.25 lit/ha at 45 DAS | 43.55de | 105.22ab | 1415.67a | 102.59 |
| Stomp 2.5 lit/ha at SBP + 2.5 lit/ha JAS | 19.17e | 87.78c | 866.44d | 23.99 |
| Puma Super @ 1.25 lit/ha at 45 DAS | 185.70b | 106.00a | 910.00cd | 30.23 |
| LSD P < 0.05 | 57.846 | 7.647 | 157.024 | - |

Means sharing the same letter do not differ significantly at P< 0.05, using LSD test.
DAS=Days After Sowing, SBP= Seed Bed Preparation, JAS= Just After Sowing

**Plant population:** Application of herbicides and hand hoeing significantly affected the plant population (Table-3). Application of $T_6$ showed significant reduction in plant population (87.78 plants /$m^2$). While $T_2$, $T_7$, $T_5$, $T_1$ and $T_4$ gave statistically equal plant population /$m^2$. Ahmad *et al*., (1996) and Bukhtiar *et al*., (1991) also reported similar findings. However, $T_3$ gave plant population (98.11 plants /$m^2$).

**Grain yield:** All treatments gave significantly higher grain yield than control (Table-3). Significantly highest grain yield of (1519.56 kg/ha) was obtained by $T_2$ with an increase in yield of 117.46 % over control plot. Among the herbicides $T_5$ gave highest yield of (1415.67 kg/ha) with an increase of 102.59% followed by $T_3$ (1183.33 kg/ha) with an increase in yield of 69.33 %. $T_6$ produced lower yield (866.44 kg/ha) than other treated plots. It was due to phytotoxicity to lentil crop which affected germination. However, control gave lowest yield of 698.78 kg/ha. These results were according to the findings of Ahmad *et al*., 1990, Ahmad *et al*., 1996, Stork 1998 and Tanveer and Ali 2003 who reported that 20 to 30% losses in grain yield were quite usual and may increase even 50%, if the crop management practices are not properly followed. Stork, (1998) found that weed growth was significantly reduced by the use of herbicides and resulted in increased yield up to 50% than control. Manual hoeing gave maximum increase in yield (117%) because it gave early and 100% eradication of all types of weeds. $T_5$ gave 102.59% more yield than control but it was more economical than $T_2$.

**Additional return:** Additional return received from different weed control treatments are given in Table- 4. The highest additional return of Rs41247/ha with a cost benefit ratio (CBR) of 1:5.16 was obtained by hand hoeing twice. Among the herbicides application of Stomp @ 3.25 lit/ha just after sowing + Puma Super @ 1.25 lit/ ha at 45 days after sowing gave the maximum net return of Rs40093 /ha and with a CBR of 1:13.73 which was followed by the spray of Stomp @ 3.25 lit/ha at seed bed preparation (Rs27303/ha) with a CBR of 1: 15.42 and this treatment provided maximum CBR. While, the lower

**Table: 4 Additional returns by different weed control treatments in Lentil (Pooled data of 2006-07 to 2008-09)**

| Treatments | Yield (kg/ha) | Increase in yield over check (kg/ha) | Additional income over check (Rs/ha) | Additional expenditure over check (Rs/ha) | Net benefit (Rs/ha) | Cost Benefit Ratio (CBR) |
|---|---|---|---|---|---|---|
| Control | 698.78 | - | - | - | - | - |
| Manual Hoeing 30 & 60 DAS | 1519.56 | 820.78 | 49247 | 8000 | 41247 | 1:5.16 |
| Stomp @ 3.25 lit/ha at SBP | 1183.33 | 484.55 | 29073 | 1770 | 27303 | 1:15.42 |
| Stomp 3.25 lit/ha JAS | 1063.89 | 365.11 | 21907 | 1770 | 20137 | 1:11.38 |
| Stomp 3.25 lit/ha at SBP + Puma Super @ 1.25 lit/ha at 45 DAS | 1415.67 | 716.89 | 43013 | 2920 | 40093 | 1:13.73 |
| Stomp 2.5 lit/ha at SBP + 2.5 lit/ha JAS | 866.44 | 167.66 | 10060 | 2625 | 7435 | 1:2.83 |
| Puma Super @ 1.25 lit/ha at 45 DAS | 910.00 | 211.22 | 12673 | 1400 | 11273 | 1:8.05 |

CBR (1:5.16) of hand hoeing was due to higher labour costs. Minimum net return Rs7435/ha with a CBR of 1:2.83 was obtained by the application of Stomp @ 2.5 + 2.5 lit/ha at seed bed preparation and just after sowing, respectively due to phytotoxic affect on crop by affecting germination. These results coincide with the findings of Ahmed *et al*. 1996 and Rajput *et al*. 1992.

**Conclusions:** Hand hoeing is most effective but not economical. Stomp @ 3.25 lit/ha at seed bed preparation, controls narrow leaved weeds effectively. Stomp @3.25 lit/ha just after sowing is effective for the control of broad leaved weeds. Puma Super @ 1.25 lit/ha is effective as post emergence against narrow leaved weeds.

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