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# EFFICACY OF PRE AND POST EMERGENCE HERBICIDES TO CONTROL WEEDS IN CHICKPEA *(Cicer arietinum* L.)

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## ABSTRACT

*A field experiment was conducted at Agronomic Research Institute, Faisalabad, during 2007-08 and 2008-09 to evaluate the effect of different herbicides for chickpea, which can be cost effective and acceptable to the growers of this crop. Three pre emergence herbicides viz. Stomp 330E @ 3.00 or 3.50lit, Dual gold 960E @ 2.00 or 2.50 lit and Cruze 10SL @ 2.00 or 2.50 lit.ha$^{-1}$ and two post emergence herbicides Puma super 75EW @ 1.25lit and Topik 15WP @ 250 g ha$^{-1}$ were tested. Hand weeding and weedy check (un- treated) treatments were also included in experiment for comparison of economics. Weed control efficacy (WCE) was better in higher dose of pre emergence herbicides i.e. Stomp 330E @ 3.50lit (94.6%), Dual gold @ 2.50lit (90%) and Cruze 10SL @ 2.50lit ha$^{-1}$(85.36%) as compared to lower doses. WCE of post emergence herbicides i.e. Puma Super 75EW @ 1.25lit (65.76%) and Topik 15WP@ 250 g ha$^{-1}$ (58.41%) is lower than pre emergence herbicides. Highest WCE (96.22%) was recorded in hand weeding treatments (three at 15, 30, 45 days after sowing). Highest Cost Benefit Ratio (C.B.R) was in lower dose of pre emergence herbicides i.e. Stomp 330E @ 3.00lit. (1:17), Dual gold 960E @ 2.00 (1:12) and Cruze 10SL @ 2.00 (1:16), while it was lower in hand weeding (1:11) and post emergence herbicides i.e. Puma super 75EW @ 1.25lit. or Topik 15WP @ 250 g ha$^{-1}$ (1:3).*

**Key words:** Pre and post emergence herbicides, WCE, CBR, chickpea, weed control.

## INTRODUCTION

Chickpea is one of the important conventional pulse crops in Pakistan. Among pulses, it alone contributes 75 percent to total pulses grown in Pakistan. In Pakistan total area under chickpea was 1046 thousand hectares with an annual production of 823 thousand tones and its average grain yield was 786 kg ha$^{-1}$ (Economic Survey of Pakistan, 2007-08). The chickpea yield is lower as compared to maximum potential of cultivars. One of the limiting factors is weed infestation. Chickpea is poor competitor to weeds because of slow growth rate and limited leaf area development at early stages to crop growth and establishment (Solh and Pala, 1990). Yield losses due to weed competition vary considerably depending on the level of weed

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infestation and weed species prevailing. Tiwari *et al.,* (2001) observed a reduction of 80% in chickpea when weeds were allowed to compete for full season.

The major weeds of chickpea in irrigated area of mix cropping zone of Punjab are *Chenopodium album*, *Chenopodium murale*, *Fumaria indica*, *Rumex dentatus*, *Vicia sativa* and *Avena fatua*. In Pakistan, weeds reduce yield by 24-63% in chickpea (Tanveer *et al.*, 1998.) Potential yield losses in chickpea due to weeds range between 22-100% (Sexena and Yadav, 1976). Bhalla *et al*., 1998 reported that the herbicide treatment gave 50-54% weed control in chickpea. Hassan and Khan (2007) reported an increase of 12-14% by pre emergence and 6-23% by post emergence herbicides in chickpea crop. Weeds affect growth, yield and quality of crop plants adversely and reduce soil fertility, compete with the crop plants for soil moisture, nutrients, space and sunlight. Considerable yield losses in chickpea were recorded to the extent of 88percent if weeds are not controlled within critical growth period of crop (Bhalla *et al*., 1998).

Weed emergence with the rabi sown chickpea crop creates a severe competition unless controlled timely and effectively. Inter-row cultivation is not sufficient and inter-row hand weeding is necessary under most conditions. There is, therefore an urgent need to move from the costly manual mechanical weed control to chemical weed control (Marwat *et al*., 2003). The present study was undertaken to see the efficacy of pre and post emergence herbicides and to find out the environment friendly, safe and economical herbicides to control weeds in chickpea.

## MATERIALS AND METHODS

A field study was carried out at Agronomic Research Institute, AARI, Faisalabad, Pakistan during Rabi season 2007-08 and 2008-09 Chickpea variety, Punjab-2000 was sown @25kg $ha^{-1}$ in first week of November with single row cotton drill. The experiment comprised of 10 treatments replicated thrice using randomized complete block design (RCBD). The plot size was 1.5×7.0 $m^{-2}$ comprising 30cm apart-rows. Three pre emergence herbicides viz., Stomp 330E (3.0 and 3.50 lit, Dual gold 960E (2.00 and 2.50 lit) and Cruze 10SL (2.00 and 2.50 lit $ha^{-1}$) and two post emergence herbicides viz., Puma Super 75 EW (1.25 lit) and Topik 15 WP (250g $ha^{-1}$) were tested. Pre emergence herbicides were tested for narrow and broad leaf weeds and post emergence herbicides only for narrow leaved weeds. Hand weeding (on 15, 25 and 35 days after sowing) and control (weedy check) were also included in experiment. All other agronomic practices were kept uniform in all the treatments. The data were recorded on weed density, plant height at maturity, branches $plant^{-1}$, number of pods

plant$^{-1,}$ 1000 grain weight and grain yield. The data on individual trait were subjected to ANOVA and significant means were separated by using LSD test at 5 percent probability level (Steel and Torrie, 1980).

## RESULTS AND DISCUSION

The close proximity of weeds and their number causes sub-optimal absorption of growth factors resulting in reduction in growth and yield of crops. The data given in Table-1 revealed that there were significant differences among the treatment means. In both the years, the highest weed count was recorded in weedy plots (control) which was 118 and 110 $m^{-1}$ during the year 2007-08 and 2008-09, respectively. It was followed by post emergence Topik 15WG @ 2.50g $ha^{-1}$ and Puma Super 75EW @ 1.25 l $ha^{-1}$ producing weed density of 35.60, 33.60 & 44.00, 57.30 $m^{-1}$ during the year 2007-08 and 2008-09, respectively. Whereas, the two years mean reveales the lowest density of only 6.5 weeds $m^{-1}$ in Stomp 330E and hand weeding (4.31 $m^{-1}$).

**Table-1. Effect of different doses of pre and post emergence herbicides on weed density, and weed control efficiency (WCE).**

| Treatments (l /g $ha^{-1}$) | Weed density (No. $m^{-2}$) at harvest | | | WCE on Pooled basis (%) |
|---|---|---|---|---|
| | 2007-08 | 2008-09 | Pooled | |
| Stomp330E @3.00 (Pre-em) | 8.00 ef | 12.33 def | 10.16 | 91.00 |
| Stomp330E @3.50 (Pre-em) | 6.30 f | 6.00 f | 6.15 | 94.6 |
| Dual gold @2.00 (Pre-em) | 13.00 be | 22.33 d | 17.66 | 84.33 |
| Dual gold @2.50 (Pre-em) | 9.30 ef | 13.30 def | 11.3 | 90.00 |
| Cruze10SL@2.00 (Pre-em) | 19.60 c | 20.00 d | 19.8 | 82.59 |
| Cruze10SL@2.50 (Pre-em) | 16.30 cd | 17.00 de | 16.65 | 85.36 |
| Puma super75EW@1.5 (post-em) | 33.60 b | 44.00 c | 38.8 | 65.76 |
| Topik15WP@250 g $ha^{-1}$ (post-em) | 35.60 b | 57.30 b | 46.45 | 58.41 |
| Hand Weeding at 15, 30 45 DAS | 4.33 f | 04.30 f | 4.31 | 96.22 |
| Weedy check (Untreated) | 118.00 a | 110.00 a | 114.0 | - |
| LSD 0.05 | 5.50 | 11.51 | | - |

The highest weed control was obtained from plots where the crop was given 3 hand weedings (15.30 & 45 day after sowing) which is statistically at par with Stomp 330E and Dual gold 960E in both the years. Highest weed control efficacy (WCE) was noted in higher dose of Stomp330E, Dual gold 960E and Cruze 10SL which is 94.6, 90.0 and 85.36%, respectively, but it gave phytotoxicity to crop plants too. Weed density in lower doses of Stomp 330E, Dual gold960E and Cruze 10SL in both the years is at par statistically, producing WCE 91.00, 84.34 & 82.59% respectively.

Number of pods per plant is an important variable contributing to final crop yield. Means in Table-2 indicate that the numbers of pods per plant were influenced significantly by different doses of pre and post emergence herbicides in 2008-09. Higher numbers of pods per plant were produced in the plots of chick-pea where the crop was kept weed free by hand weeding (15, 25 and 35 DAS). Among the herbicides, Stomp 330E @ 3.00 lit $ha^{-1}$ produced higher number of pods $plant^{-1}$ due to safe behavior of herbicide against crop plants and phytotoxic effect on weeds. The lowest numbers of pods were obtained from plots where the crop was kept weedy throughout the growing period and it was due to severe weed competition for resources, nutrients, moisture, light & space (Bhalla *et al*., 1998). The development of grain reflects the photosynthetic potential of a crop plant and its capacity to transport it assimilates to economically valuable plant organs. The data pertaining to 1000 grain weight presented in Table-2 revealed that the H.W. and herbicides (Pre and post emergence) had significant effect on 1000 grain weight. In the year 2007-08, highest 1000 grain weight were recorded in plots maintained weed free (Hand Weeding) which was statistically at par with Stomp 330 @ 3.0 or 3.50 l, Cruze 10SL @ 2.00 l or 2.50 l $ha^{-1}$ and Topik 15WP @ 250g $ha^{-1}$. The maximum No. of pods and test weight under above said treatments might be due to effective control of weeds at critical crop-weed competition stages which might have helped in increasing nutrient uptake and thereby the crop growth and formation of bold seeds and consequently increased the weight of 1000 seeds.

The grain yield is a function of integrated effect of various yield components. Table-3 clearly showed that the effect of different doses of pre and post emergence herbicides and hand weeding treatments had a significant effect on the grain yield of chickpea. In the first year, the highest seed yield of 2627 kg $ha^{-1}$ was obtained from the hand weeding treatment that is statistically at par with Cruze 10SL @ 2.0lit $ha^{-1}$ and Stomp 330E @ 3.00lit $ha^{-1}$ at 2539kg and 2434kg $ha^{-1}$ respectively. Upadhyay and Bhalla (2002) also reported higher seed yield under manual weeding treatment. The lowest grain yield (1481kg

$ha^{-1}$) was produced in the plots where weeding was not done throughout the growing season. However, during the second year, the hand weeding (2481 kg $ha^{-1}$) out yield all other herbicidal treatments included in the study. The higher seed yields under hand weeding (15, 25 and 35 DAS), Cruze 10SL @ 2.0 l $ha^{-1}$ and Stomp 330E @ 3.00 l $ha^{-1}$ may be due to the effective control of weeds which led to direct increase in uptake of nutrient and thereby proper growth and development of crop which resulted in maximum number of pods $plant^{-1}$ and test weight ultimately resulting into increased seed yield These results are similar to Marwat *et al*., (2003), Iqbal *et al*., (1991) and Bhan *et al*., (1987).

**Table-2. Effect of different doses of pre and post emergence herbicides on yield attributes and yield of chickpea.**

| Treatments | No. of Pod $Plant^{-1}$ | | 1000-grain Wt (g) | | Seed Yield (kg) | |
|---|---|---|---|---|---|---|
| | 2007-08 | 2008-09 | 2007-08 | 2008-09 | 2007-08 | 2008-09 |
| Stomp330E @3.00 l $ha^{-1}$ | 49.26 | 51.53b | 283.7ab | 233.3 | 2434ab | 2224b |
| Stomp330E @3.50 l $ha^{-1}$ | 48.63 | 48.46c | 284.6ab | 229.6 | 2178cd | 1795cd |
| Dual gold @2.00 l $ha^{-1}$ | 48.10 | 46.88c | 280.3bc | 233.0 | 1938de | 1841c |
| Dual gold @2.50 l $ha^{-1}$ | 48.03 | 42.93d | 281.3bc | 229.3 | 1940de | 1748de |
| Cruze10SL @2.00 l $ha^{-1}$ | 48.33 | 47.00c | 284.6ab | 234.3 | 2539a | 1913c |
| Cruze10SL @2.50 l $ha^{-1}$ | 48.33 | 46.46c | 282.6ab | 235.3 | 2287bc | 1828cd |
| Puma super 75EW @1.5 l $ha^{-1}$ | 49.00 | 40.80de | 280.6bc | 225.3 | 1692ef | 1538e |
| Topik 15 WP @250g $ha^{-1}$ | 47.80 | 39.26e | 284.6ab | 224.6 | 1587f | 1442f |
| Hand weeding at 15, 30, 45 DAS | 49.60 | 62.13a | 287.3a | 236.3 | 2627a | 2481a |
| Weedy check (Untreated) | 46.40 | 32.66f | 277.6c | 222.6 | 1481f | 1238f |
| LSD (P=0.05) | N.S | 2.30 | 4.745 | N.S | 249.20 | 144.90 |

The reduction in yield due to weeds i.e. weed index (WI) was the highest (50.1%) in untreated plots while the lowest 7.34-1035% in Stomp 330E (3.00 lit $ha^{-1}$) and 35.59-38.0% in Puma Super 75EW (1.25 lit $ha^{-1}$). The weedy situation prevailing throughout the crop

period caused 50.1% WI in chickpea over all higher than the rest of the treatments i.e. the herbicides and hand weeding. Like most grain legumes chickpea is more tolerant to pre emergence herbicides as compared to post emergence herbicides (Solh and Pala, 1990).

**Table-3. Effect of different doses of pre and post emergence herbicides on yield of chickpea and weed index (WI).**

| Treatments | Economic yield (kg ha$^{-1}$) at harvest | | | Weed index (%) |
|---|---|---|---|---|
| | 2007-08 | 2008-09 | Pooled | |
| Stomp 330 E @3.00 l ha$^{-1}$ | 2434ab | 2222b | 2328 | 8.84 |
| Stomp 330 E @3.50 l ha$^{-1}$ | 1938de | 1794cd | 1866 | 26.89 |
| Dual gold @2.00 l ha$^{-1}$ | 2178cd | 1844c | 2009 | 16.44 |
| Dual gold @2.50 l ha$^{-1}$ | 1940de | 1667de | 1844 | 27.84 |
| Cruze 10 SL @2.00 l ha$^{-1}$ | 2539a | 1913c | 2226 | 13.11 |
| Cruze 10 SL @2.50 l ha$^{-1}$ | 2288bc | 1793cd | 1957 | 14.63 |
| Puma super 75 EW @1.5 l ha$^{-1}$ | 1639ef | 1538e | 1562 | 36.79 |
| Topik 15 WP @250g l ha$^{-1}$ | 1587f | 1205f | 1567 | 40.72 |
| Hand Weeding at 15, 30, 45 DAS | 2628a | 2382a | 2554 | - |
| Weedy check (Untreated) | 1481f | 1206f | 1359 | 51.48 |
| LSD (0.05) | 249.2 | 144.9 | - | - |

The economic analysis revealed that application of herbicides seems to be economical in all treatments over control in enhancing yield by 11-71% and accumulating net return over control (Table-4). Treatment wise net return against per rupee spent was calculated to the tune of Rs. 1.17 and 1.8; 1.12 and 1.7, 1.16 and 1.11 in case of pre emergence herbicides i.e. Stomp 330E Dual gold 960E and Cruze10SL, respectively. Similarly, the net gain out of post emergent was of Rs. 1.3 in both Puma super and Topik 15 WP. Stomp 330 E @ 3.0 lit ha$^{-1}$ proved its worth in killing weeds as a post emergence herbicide and earned highest net return followed by Cruze 10 SL @ 2.0 lit ha$^{-1}$ which also showed better performance. On the basis of economic analysis it is suggested that Stomp 330 E @ 3.00 l ha$^{-1}$ at pre emergence stage is economical herbicides to control broad leaved and grass weeds. Hand weeding (on 15, 25 and 35 DAS) treatment gave highest yield (2554 kg ha$^{-1}$) but earned lower than all pre emergent return (1:11) because of intensive and expensive labor technology.

**Table-4. Economic analysis of different weed control techniques in chickpea (average of two years).**

| S.No. | Treatment | Price $kg^{-1}$ $pack^{-1}$ | Cost of weedicide (Rs.) | Yield (kg $ha^{-1}$) | Increase In yield (kg) | Value (Rs.) | Expenses (Rs.) | Net return | CBR |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Stomp330E @3.00lit. (Pre-em) | 450 | 2224 | 1350 | 986 | 34510 | 1850 | 32660 | 1:18 |
| 2 | Stomp330E @3.50lit. (Pre-em) | 450 | 1795 | 1575 | 557 | 19495 | 2075 | 16070 | 1:8 |
| 3 | Dual gold960E @2.00lit. (Pre-em) | 500 | 1841 | 1250 | 603 | 21105 | 1750 | 19355 | 1:11 |
| 4 | Dual gold960E@2.50lit. (Pre-em) | 500 | 1741 | 1525 | 510 | 17850 | 2025 | 15825 | 1:9 |
| 5 | Cruze 10 SL @ 2.0 lit. (Pre-em) | 500 | 1913 | 1250 | 675 | 23625 | 1750 | 21875 | 1:13 |
| 6 | Cruze 10 SL@2.50lit. (Pre-em) | 500 | 1828 | 1525 | 590 | 20650 | 2025 | 16600 | 1:8 |
| 7 | Puma Super75EW @1.25lit. (Post-em) | 425 | 1538 | 1062 | 300 | 10500 | 1562 | 4888 | 1:3 |
| 8 | Topik45WG@250 g (Post-em) | 450 | 1442 | 1125 | 204 | 7140 | 1625 | 5515 | 1:3 |
| 9 | Hand Weeding(3) | 1100 | 2481 | 3300 | 1243 | 43505 | 3300 | 40205 | 1:12 |
| 10 | Control (un-treated) | -- | 1238 | 00 | -- | -- | -- | | |

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