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EFFECT OF RATES AND METHODS OF APPLICATION OF PENTHALENE-PLUS ON WILD ONION (*Asphodelus tenuifolius* Cav.) IN CHICKPEA

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ABSTRACT

An experiment was conducted to study the effect of rates and methods of application of Penthalene-plus (pendimethalin + prometryn) on control of wild onion (Asphodelus tenuifolius Cav.) in Chickpea (Cicer arietinum L.) at farmer's field in district Bhakkar in 2007-08. The experiment comprised of six treatments, including two rates of Penthalene-plus (i.e. 2.5 L and 3.0 L ha^{-1}) and two methods of application (pre-emergence spray and sand mix broadcast application). Manual weed control (hoeing) and weedy check (control) were also included in the experiment for comparison. The experiment was arranged in randomized complete block design with four replications. Wild onion density and its dry biomass m^{-2}, yield and yield components of chickpea were all significantly affected by the Penthalene-plus doses and application methods. The highest density (210 m^{-2}) and dry biomass (436 g m^{-2}) of wild onion were observed in weedy check; while the hoeing treatment had the lowest density (10 m^{-2}) and dry biomass (7.56 g m^{-2}). Similarly, the highest grain yield (2256 kg ha^{-1}) of chickpea was obtained in manual weed control (hoeing), which was not statistically different from Penthalene-plus (2225 kg ha^{-1}) applied at 2.5 L ha^{-1}. The highest and lowest grain yields were respectively 486 and 455 kg ha^{-1} more than that in weedy check (1770 kg ha^{-1}). Chickpea yield following Penthalene-plus at 2.5 L ha^{-1} sand mix broadcast application was 284 kg ha^{-1} more than the weedy check. Penthalene-plus spray at 2.5 L ha^{-1} is the best alternative to manual weed control for controlling wild onion and for increasing chickpea grain yield.

Key words: *Asphodelus tenuifolius*, chickpea, *Cicer arietinum*, pendimethalin, prometryn, weeds, wild onion.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is grown in many countries of the world as a pulse crop mainly in dry areas. In Pakistan, it is grown on an area of 1.06 million hectares and its production is 0.52 million tons. There is a large gap of about 2.8 t ha^{-1} between the potential yield (3.3 t ha^{-1}) and the actual achieved yield (0.5 t ha^{-1}) at farmer's field (Anonymous, 2010-11). Causes of low yield are weed infestation,

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sowing on marginal land, no/low and imbalance use of fertilizer, conventional sowing methods, low rainfall, lack of seed of improved varieties and disease attack etc. Among these yield limiting factors weed competition stands out as especially important. Weeds cause 24-80% yield losses in chickpea (Vaishya *et al*., 1996; Tanveer *et al*., 1998; Tiwari *et al*., 2001; Mohammadi *et al.,* 2005; Aslam *et al.,* 2007). Weeds decrease the quality of chickpea and also reduce its market value (Marwat *et al*., 2005). Weeds can be controlled by different methods such as manual, mechanical, and chemical methods. Manual weed control is always laborious, costly, and uneconomical as compared to chemical weed control. Weed control with herbicides is an effective, quick in action, and time saving (Ahmed *et al.,* 2005).

Wild onion is a very harmful weed for chickpea in rainfed areas of Pakistan due to its high competitive ability and seed production potential. A study about a suitable control of wild onion is very necessary to develop an effective weed management strategy. At present pre-emergence spray of Pendimethalin is recommended for control of weeds in chickpea in irrigated areas. There is a need to evaluate other herbicides for their effectiveness in controlling weeds of chickpea in rainfed areas. The objectives of this research were to evaluate the efficacy of Penthalene plus (pendimethalin + prometryn) either by spray or sand mix broadcast application, and to determine the most effective dose of Penthalene plus (pendimethalin + prometryn) for control of wild onion in chickpea.

MATERIALS AND METHODS

An experiment was carried out in a farmer's field (Thal area) in District Bhakkar (31° N, 71° E). Chickpea variety "Bittal-98" was sown in 30 cm apart rows on 29th October, 2007 with a tractor mounted drill using seed rate of 60 kg ha^{-1}. The experiment was laid out in RCB design with four replications with plot size 5m x 1.8m. The experiment was comprised of six treatments, including two rates of Penthalene-plus (2.5L and 3.0 L ha^{-1}) and two methods of application (pre-emergence spray and sand mix broadcast application) of Penthalene plus (a product of Agrolet International Pvt. Ltd. Lahore), manual weed control treatments (hoeing at 40 and 60 days after emergence (DAE)) and a weedy check (control treatment). Calibration was done before herbicide application to know exact volume of water and sand to spray and broadcast the herbicide, respectively. The herbicide was applied by a hand operated sprayer (Solo-425) with flat fan nozzles.

Data on number of plants plot^{-1}, chlorophyll contents (mg g^{-1}) at 40, 60, 80 DAE, number of pods plant^{-1}, 100-seed weight (g), seed yield (kg ha^{-1}), wild onion density (m^{-2}) and its dry biomass (g m^{-2})

were recorded by following standard procedures. Collected data were analyzed statistically by using Fisher's analysis of variance techniques (Steel *et al*., 1997). Least significant difference (LSD) test was applied at 5% probability level to test the significance of treatment means.

RESULTS AND DISCUSSION

Weed density m^{-2}

There was a significant difference (Table-1) between weed control treatments with respect to wild onion density and dry biomass (g m^{-2}). The highest density of wild onion (210 m^{-2}) was observed in the weedy check, and the lowest density (10 m^{-2}) was observed in manual weed control (hoeing). Manual weed control (hoeing) and Penthalene plus spray@ 2.5 L ha^{-1} resulted in 95% and 89% control of wild onion over weedy check, respectively (Fig. 1b). The lowest density of wild onion with Penthalene plus sprayed @ 2.5 L ha^{-1} could be attributed to better efficacy of Penthalene plus compared with other doses and methods of application of this herbicide. These results are supported by the findings of Marwat *et al.,* (2004) who reported minimum weeds m^{-2} in chickpea plots treated with Stomp 330 EC.

Dry biomass (g m^{-2})

The highest dry biomass (436 g m^{-2}) of wild onion was recorded in the control and the lowest dry biomass (7.56 g m^{-2}) was recorded in manual weed control (hoeing). As maximum number of wild onion was recorded in control (weedy check) which continued to grow till harvest ultimately dry biomass of wild onion was also maximum in these plots. Manual weed control (hoeing) and Penthalene plus used @ 2.5 L ha^{-1} spray proved more effective in controlling wild onion and hence it's dry biomass. These results agree with those of Lyon and Wilson (2005) who reported lower biomass of weeds in chickpea following herbicide application.

Chlorophyll contents of chickpea

Maximum chlorophyll contents (Table-1) in chickpea at 40 DAE (1.28 mg g^{-1}), 60DAE (1.27 mg g^{-1}), 80DAE (0.82 mg g^{-1}) were observed in manual weed control (hoeing). Maximum chlorophyll contents in chickpea (1.27 mg g^{-1}) at 60DAE in manual weed control (hoeing) were statistically similar with Penthalene plus sand mix broadcast application @ 2.5 L ha^{-1} (1. 25 mg g^{-1}). Minimum chlorophyll contents at 40, 60 and 80 DAE (0.77, 0.97 and 0.59 mg g^{-1}), respectively were observed in control (weedy check). Low chlorophyll contents in chickpea at early growth stage (40 DAE) were observed in herbicide treated plots compared with manual weed control (hoeing). But at 60 DAE there was an increase in chlorophyll contents. Chlorophyll contents were higher in herbicide treated plots than untreated (weedy check). This may be due to increased leaf area and maximum photosynthetic activity at this stage due to less weed

competition and utilization of environmental resources by chickpea. Near maturity (at 80 DAE) chlorophyll contents were again decreased. Similar results were reported by Ram *et al.* (2004) and Yadav *et al.* (2007) in chickpea who reported more chlorophyll contents in herbicide treated plots than untreated check.

Plant population and number of pods plant^{-1}

Number of plants plot^{-1} of chickpea was not significantly influenced by different weed control methods (Table-1). Maximum number of pods plant^{-1} (106) was recorded in manual weed control (hoeing). Minimum number of pods plant^{-1} (68) was recorded in control (weedy check). Increased length of wild onion interference with chickpea resulted in minimizing number of pods plant^{-1}. It could be attributed to weed competition from emergence to maturity. Similar results were found by Althahabi *et al.* (1994) who reported reduction in number of pods plant^{-1} due to weeds presence.

100-seed weight and grain yield

Maximum 100-seed weight (22.49 g) was observed in Penthalene plus spray @ 2.5 L ha^{-1} and did not differ statistically from that of manual weed control (hoeing) (22.17 g). Minimum 100-seed weight (19.51 g) was observed in Penthalene plus spray @ 3.0 L ha^{-1}. Maximum 100-seed weight with Penthalene plus spray @ 2.5 L ha^{-1} and manual weed control (hoeing) could be due to better utilization of growth factors for production of assimilates and ultimately their translocation towards seed. These results confirm those of Aslam *et al*. (2007) who reported more 100-seed weight of chickpea in manual weeding as compared to weedy check.

Maximum grain yield (2256 kg ha^{-1}) was noted in manual weed control (hoeing) (Table-1) and did not differ statistically from that of Penthalene plus spray @ 2.5 L ha^{-1} (2225 kg ha^{-1}). The lowest seed yield (1770 kg ha^{-1}) was noted in the weedy check (control). Yield attributing factors (No. of pods and 100-seed weight) were less in the weedy check (control), because of more number of wild onion and maximum dry weight which contributed to minimum yield. These results are in line with those of Hassan and Khan (2007) who reported minimum grain yield in weedy check (control). The highest increase in yield (27.45%) over weedy check (control) was observed in manual weed control (hoeing) and the lowest increase in yield (12.99%) over weedy check was observed in Penthalene plus sand mix broadcast application @ 3.0 L ha^{-1} (Fig-1). Higher yield with Penthalene plus spray @ 2.5 L ha^{-1} and manual weed control (hoeing) was due to increased yield components. Similar results were found by Al-Thahabi *et al*. (1994), Lyon and Wilson (2005), Mohammadi *et al*. (2005). They reported that full season competition led to 48-66% yield reduction in chickpea compared with weed free treatments.

Table-1. Effect of Penthalene plus 35 EC (pendimethalin + prometryn) on wild onion and yield of chickpea.

Treatments	Weed Density m^{-2} at maturity	Weed dry Wt. (g m^{-2})	Chlorophyll contents mg g^{-1}			No. of plants per plot (5×1.8m)	No. of Pods per plant	100-seed weight (g)	Yield kg ha^{-1}
			40 DAE	60 DAE	80 DAE				
Weedy check (Control)	210.2a	436.75 a	0.77 e	0.97 d	0.59 e	180.50	68.75 e	20.62 c	1770.0c
Penthalne plus-35EC spray @ 2.5 L ha^{-1}	21.75 c	13.90 d	1.02 c	1.16 c	0.79 b	181.00	91.25 b	22.49 a	2225.5a
Sand mix broadcast @ 2.5 L ha^{-1}	21.75 c	17.80 c	1.10 b	1.25 a	0.71 c	181.00	88.50 c	21.50 b	2054.2b
Spray @ 3.0 L ha^{-1}	24.75 b	25.62 b	0.95 d	1.18 c	0.63 d	180.75	87.25 c	19.51 d	2032.0b
Sand mix broadcast @ 3.0 L ha^{-1}	27.00 b	17.59 c	1.09 b	1.22 b	0.70 c	181.25	81.00 d	20.46 c	2000.0b
Manual weed control (Hoeing)	10.00 d	7.56 e	1.28 a	1.27 a	0.82 a	181.25	106.25a	22.17 a	2256.0a
LSD (P<0.05)	2.28	1.91	0.03	0.03	0.02	NS	1.98	0.3752	145.85

Means sharing same letter were non-significantly different at 5% probability level.
DAE = Days after emergence.

CONCLUSION

Penthalene plus (pendimethalin + prometryn) @ 2.5 L ha^{-1} spray proved to be the best alternative of manual weed control (hoeing) with respect to controlling wild onion and increasing seed yield in chickpea. There is a need to evaluate new herbicides to control weeds in rainfed areas of chickpea to achieve maximum yield potential of chickpea varieties.

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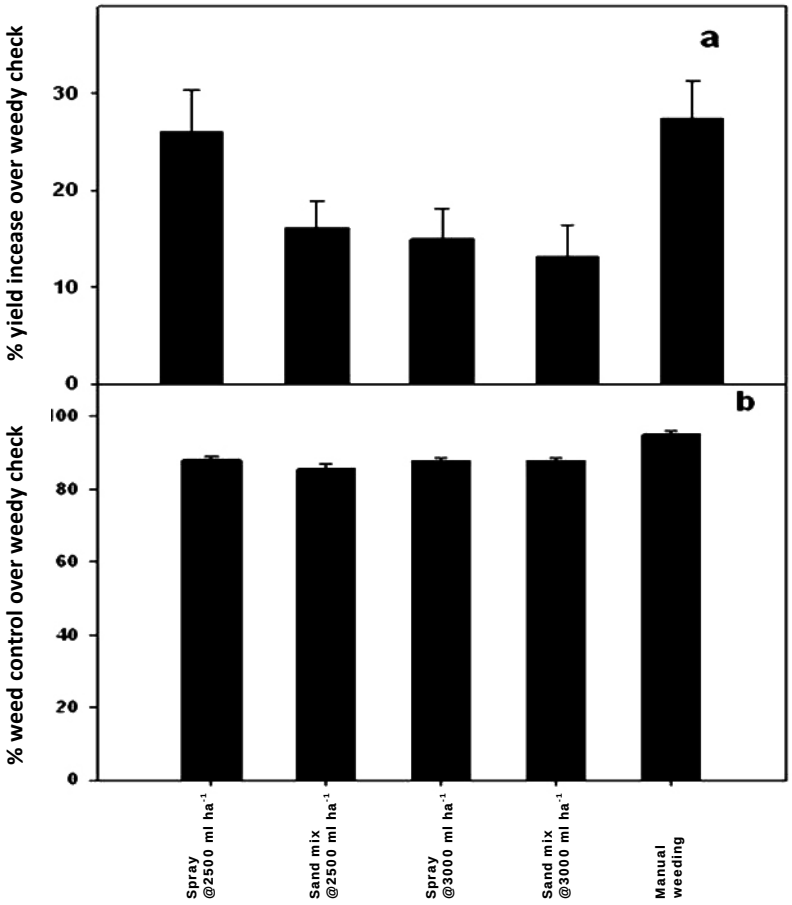

Figure 1. Effect of Penthalene plus 35 EC on (a) percent yield increase over weedy check (b) percent weed control over weedy check.

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