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RELATIVE EFFICACY OF DIFFERENT WEED CONTROL METHODS IN ONION (*Allium cepa* L.) CROP

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ABSTRACT

Relative efficacy of different weed control methods i.e (1) weedy check (control), (2) Buctril super (Bromoxinil + MCPA) @ 1.25 L ha^{-1}, (3) manual weeding (30 and 60 days after transplanting), (4) Dual gold (s-metolachlor) @ 2.5 L ha^{-1}, (5) Pendimethaline 33% @ 2.5 L ha^{-1}, and (6) hand weeding was studied in onion local cv. "Shah Alam" at Agriculture Research Institute, Ratta Kulachi, D.I. Khan during winter 2006-07 and repeated at Government Seed Farm, Ratta Kulachi, Dera Ismail Khan, Pakistan during winter 2007-08. The study was laid out in randomized complete block design, replicated three times. The major weeds infesting the experimental field were Anagallis arvensis L., Chenopodium album L., Rumex dentatus L., Euphorbia helioscopia L., Convolvulus arvensis L., Lathyrus odoratus L., Medicago denticulata Willd, and Melilotus indica L. Analysis of the data showed that various weed management techniques significantly affected weeds related parameters in onion as compared to weedy check. Bulb yield and yield components of onion in all weed management treatments were significantly increased. For controlling weeds, Pendimethalin 33% was found to be the best for controlling weeds. Maximum bulb yield was found in manual weeding treatments, followed by Pendimethalin, whereas, minimum bulb yield was recorded in weedy check plots. Therefore, hand weeding through out season or the use of Pendimethalin @ 2.5 L ha^{-1} is recommended for getting higher onion yield.

Key words: *Allium cepa* L., efficacy, herbicides, onion, weeds, weed control.

INTRODUCTION

Onion (*Allium cepa* L.) is a biennial and cross-pollinated winter vegetable, which belongs to family Alliaceae. It is a condiment crop, which is consumed usually as chopped or sliced, or fresh in salads as well as used in dishes as a spice (Baloch, 1994). Onions pickled in vinegar are eaten as a snack. Onion can be successfully grown on any type of fertile and well drained soil. Clay, alluvial, sandy loam and muck are the best soil types suited for onion cultivation. A soil pH of 6.0 to 7.0 is recommended for the production of onion crop (Baloch,

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1994). The average yield of onion in Pakistan is very low as compared to other leading countries due to many factors. One of the main limiting factors is weed infestation (Ghaffoor, 2004). Weeds compete with onions for nutrients, soil moisture, space, and light (Singh *et al*., 2006). They considerably reduce the yield, quality and value of the crop through increased production and harvesting costs. Due to smaller leaf size, onions cannot compete well with weeds. Weeds compete with crop plants at very early growth stages. Weeds also harbor insect pests and disease-causing organisms (Singh *et al*., 2006). The losses caused by weeds have been estimated to be much higher than those caused by insect pest and diseases. Generally the yield of crop is reduced by 30 to 60 % due to weeds infestation (Hussain, 1983). Numerous research trials have shown that many herbicides can be used effectively to control weeds in onion (Jilani *et al*., 2003; Thakral *et al.,* 2003; Ghaffoor, 2004; Marwat *et al.,* 2005).

Manual weeding is an important cultural practice to control weeds for marketable bulb. Usually farmers do not control weeds at early stage to prevent crop from major damages caused by weeds. Further, manual weeding is a very tedious and expensive laborious method of weed control, even often damages the crop as well (Melander and Rasmussen, 2001). Khan *et al*. (2002) and Usman *et al*. (2010) also reported that different weed control methods had a substantial effect on crop yield. However, no such work has been done in southern districts of Khyber Pakhtunkhwa province. Therefore, the present study was conducted to study the relative efficacy of different weeds control methods in onion crop grown in field demonstration plots to transfer weed control technology to the farming community of the area.

MATERIALS AND METHODS

Field trial was conducted to study the relative efficacy of different weed control methods in Onion (*Allium cepa* L.) at Agricultural Research Institute, Ratta Kulachi, D.I. Khan during winter 2006-07 and repeated the same experiment at Government Seed Farm, Ratta Kulachi, Dera Ismail Khan, Pakistan during 2007-08. The experiment was laid out in Randomized Complete Block Design (RCBD) with the following six treatments, replicated three times;

T1: Control (weedy check)
T2: Buctril super (Bromoxinil + MCPA) @ 1.25 L ha^{-1} (Post-emergence herbicide).
T3: Manual weeding (30 and 60 days after transplanting)
T4: Dual gold (s-metolachlor) @ 2.5 L ha^{-1} (Pre-emergence herbicide).
T5: Pendimethalin 33% (stomp) @ 2.5 L ha^{-1} (Pre-emergence herbicide).
T6: Weeds free (manually weeding throughout the season)

Nursery bed was prepared by mixing Farm Yard Manure (FYM) and sand in the soil. Seeds of onion local cv. "Shah Alam" were placed in lines and slightly covered with weed seeds free soil. Plot size of 4×3 m was used and irrigation was applied with the help of sprinkler as per need of the crop. Seed germination started within a week after sowing. Further irrigation was done as required.

Land was prepared and recommended dose (25 tons ha^{-1}) of FYM was incorporated into the soil. Nitrogen, phosphorus and potassium (NPK) were applied @ 120-60-60 kg ha^{-1} using urea, single super phosphate (SSP) and sulphate of potash (SOP), respectively. Full dose of phosphorus and potassium and half dose of nitrogen were applied before transplanting, while remaining dose of nitrogen was added one month after transplantation.

Young onion seedlings at 2-3-leaf stage were transplanted to actual experimental plot during the first week of February 2007 and 2008 at each location. Row to row and plant to plant distances of onion were kept 30 cm and 15 cm, respectively. Pendimethalin 33% and Dual gold were sprayed with the help of a Knapsack sprayer immediately after transplanting, whereas, Buctril super was sprayed after emergence of weeds. Manual weeding was done in the weed free plots throughout the crop season. The hand weeding was done twice during the crop season i.e first hand weeding was done 30 days after transplanting, while the second weeding was done 60 days after transplanting. No weeding was done in the weed control plots.

Data Collection and Analysis

Diameter (cm), height (cm), volume (ml), weight (g), and bulb yield (t ha^{-1}), number of weeds (m^{-2}), fresh and dry weed biomass (g m^{-2}) were recorded during the course of study. The data recorded were statistically analyzed using MSTATC Software. The purpose of analysis of variance was to determine the significant effect of treatments on weeds and onion. LSD test at 1% probability level was applied as analysis of variance showed significant effect for treatments (Steel and Torrie, 1984).

RESULTS AND DISCUSSION

The difference between the data of two repeated experiments might be attributed to soil and environmental factors during winter 2006-7 and 2007-8. However, data collected for all studied parameters during both experiments showed similar response to the treatments.

Bulb parameters

Bulb diameter, bulb height, bulb volume, bulb weight and bulb yield were highly significantly ($P<0.0001$) affected by different weed control methods (Fig. 1 and 2). Maximum average bulb diameter, bulb height, bulb volume, and bulb weight were recorded in weed free

plots, followed by plots sprayed with Pendimethalin 33% during the course of the study. Both treatments were statistically at par except average bulb volume and weight during winter 2006-7. Minimum bulb diameter, height, volume and weight were recorded in plots, where weeds were left to grow (control) during both experiments. These results are in accordance with the work of Jilani *et al.* (2003), Ghosh *et al.* (2004) and Gorad *et al.* (2004), Manisha *et al.* (2005), Marwat *et al.* (2005), Ghadage *et al.* (2006) and Nargis *et al.* (2006). They also reported that highest bulb diameter, bulb height, bulb volume and bulb weight were found in plots, where weeds were either controlled manually or sprayed with "Pendimethalin 33%".

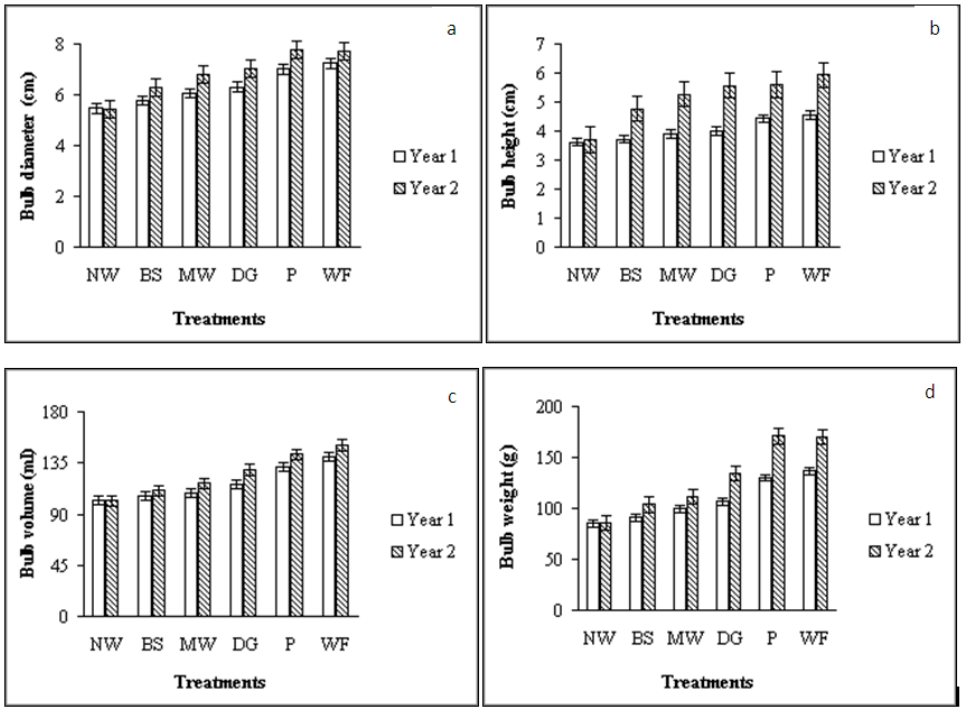

Figure 1. Average bulb diameter (a) average bulb height (b) average bulb volume (c), average bulb weight (d) as affected by different treatments i.e. No Weeding (NW), Buctril Super (BS), Twice Manual Weeding (MW), Dual Gold (DG), Pendimethalin (P) and Weeds Free (WF). Error bars show LSD value at 0.01.

The instant results revealed that highest yield (9.33 and 12.25 tons ha^{-1}) was recorded in plots, where weeds were controlled manually throughout the crop season, followed by plots sprayed with

Pendimethalin 33% (stomp) during both trials. However, both the treatments were statistically at par with each other. The plots with no weed control gave the lowest onion yield of 5.7 and 6.19 t ha^{-1} during winter 2006-7 and 2007-8, respectively. The results are in agreement with the findings of Mishra and Jyotishi (2002). They also found that the highest average onion bulb yield was obtained in the plots which were sprayed with Pendimethalin 33% (stomp). Similar results were also demonstrated by Jilani *et al.* (2003), Zhidkov and Krivtsov (2003), Ghaffoor (2004), Manisha *et al.* (2005) and Zubair *et al*. (2009). They reported that the highest bulb yield was obtained either in plots sprayed with Pendimethalin 33% (stomp) or weeds free treatments.

Weed density (m^{-2})

Statistical analysis of the data (Fig. 2) showed that different weed control methods highly significantly ($P<0.0001$) affected the weed density m^{-2} in onion crop. Maximum weed density (102.7 and 79.33 m^{-2}) was recorded in weedy check. The weed density in plots sprayed with Buctril super @ 1.25 l ha^{-1} (post emergence) was at par with manual (twice) weeding during the crop season. Similarly weed density in plots sprayed with Dual gold @ 2.5 l ha^{-1} and Pendimethalin 33% @ 2.5 l ha^{-1} were also statistically at par (Figure 2). These results depicted that herbicides Dual gold and Pendimethalin 33% effectively controlled weeds. Broad leaf weeds like *Convolvulus arvensis, Chenopodium album, Chenopodium murale, Melilotus indica, Rumex dentatus, Anagallis arvensis* and *Euphorbia helioscopia*, sedges like *Cyperus rotundus* and grasses like *Cynodon dactylon* and *Sorghum halepense* were found in onion crop during the course of study. Buctril super controlled broadleaf weeds but did not control sedges and grasses. The results are in agreement with the findings of Zhidkov and Krivtsov (2003), Ghaffoor (2004), Manisha *et al.* (2005), Marwat *et al.* (2005) and Zubair *et al*. (2009). They found that Pendimethalin 33% effectively controlled weed population. The present study showed that although manual weeding throughout the season controlled weeds but it is too much laborious and time consuming as well as more expensive technique as compared to herbicide application.

Fresh and dry weed biomass (g m^{-2})

Statistical analysis of the data indicated that fresh and dry weed biomass (g m^{-2}) was highly significantly ($P<0.0001$) affected by different weed control methods (Fig. 2). Hand weeding and application of herbicides reduced the fresh and dry weed biomass during both trials. Minimum fresh and dry weed biomass was recorded in plots sprayed with Pendimethalin 33% (stomp), while maximum fresh and dry weed biomass was noted in wedy check, where weeds were not controlled (Figure 2). These results are in agreement with the findings

of Saimbhi *et al.* (2000), Thakral *et al.* (2003), Manisha *et al.* (2005), Qasem (2006) and Zubair *et al*. (2009). They also found similar results in their studies that application of herbicides and hand weeding significantly reduced weed biomass m^{-2}. Similarly, Rahman *et al*. (2011) also found maximum garlic bulb yield in plots, where weeds were uprooted manually with 15 days interval.

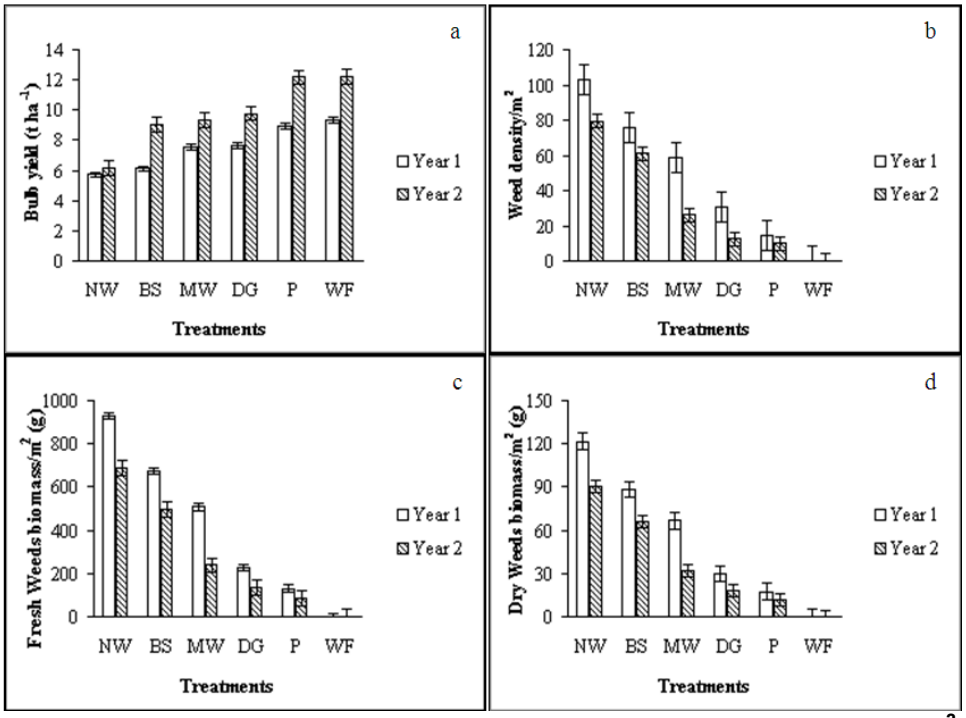

Figure 2. Average bulb yield (a) average No of weeds per m^2 (b) average fresh weight of weeds m^{-2} (c), average dry weight of weeds per m^2 (d) as affected by different treatments i.e No Weeding (NW), Buctril super (BS), Twice Manual Weeding (MW), Dual Gold (DG), Pendimethalin (P) and Weeds Free (WF). Error bars show LSD value at 0.01.

CONCLUSION

It is concluded that different weed control methods significantly reduced the weed density, resulting reduced fresh and dry weed biomass and increased onion bulb diameter, bulb height, bulb volume, bulb weight and bulb yield with either hand weeding or the application of different herbicides. Among overall applied herbicides, Pendimethalin 33% (stomp) was proved to be the best. Hand weeding

throughout the growing season had controlled all weeds, which resulted in the highest onion bulb yield, but it is the most laborious and un-economical method to control weeds as compared to the application of herbicides. The use of Pendimethalin 33% (stomp) as pre-emergence herbicide is therefore recommended in onion crop to achieve maximum yield per hectare.

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