

## CONVENTIONAL AND CHEMICAL CONTROL OF WEEDS IN FIVE CULTIVARS OF TRANSPLANTED ONION (*Allium cepa* L.)

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### ABSTRACT

Studies were conducted on five cultivars of transplanted onion during two successive years of 2000-2001 and 2001-2002. The treatments included were one handing weeding, three hand-weedings, application of pendimethaline 33% (w/v) EC @ 3.125 lit ha<sup>-1</sup> and S-metolachlor 960 EC @ 2.5 lit ha<sup>-1</sup>. Weedy check was also included for comparison. The experiment was laid down in split plot design with varieties in main-plots and weed control methods in sub-plots, replicated three times. Data on weeds density m<sup>-2</sup>, number of bulbs plot<sup>-1</sup>, bulb diameter (cm) and bulb yield (t ha<sup>-1</sup>) were recorded. The data revealed that weeds population was significantly reduced by different weed control measures. Three hand weedings proved superior in decreasing weeds density (3.133 m<sup>-2</sup>). It was followed by pendimethaline 33% (w/v) EC @ 3.125 lit ha<sup>-1</sup> and S-metolachlor 960 EC @ 2.5 lit ha<sup>-1</sup>, respectively. The highest number of bulbs (69.333) plot<sup>-1</sup> were also produced in plots where three hand weedings were done which were statistically at par with pendimethaline 33% (w/v) EC @ 3.125 lit ha<sup>-1</sup> treated plots. All other treatments were statistically similar. The cultivars also differed significantly in number of bulbs plot<sup>-1</sup>. Different weed control measures significantly affected bulb diameter. The bulbs of the largest diameter were obtained from the plot receiving three hand weedings (6.020 cm). The increase in bulb diameter due to weed control treatments ranged from 11-27% as compared to weedy check. Varieties also varied significantly in bulb diameter. The bulbs of maximum diameter were recorded in cv. Shah Alam local (6.267 cm). The significantly highest bulb yields (20.546 t ha<sup>-1</sup>) were harvested from plots receiving three hand weedings both the years. The lowest yield (16.551 t ha<sup>-1</sup>) was obtained from control plots whereas all other treatments did not differ significantly from one another. The significantly highest yield was obtained from cv. Shah Alam local followed by Naurang local and Panyala local. The lowest yield (16.551 t ha<sup>-1</sup>) was harvested from cv. Phulkara. Almost 12-35% increase in bulb yield was achieved by different weed control methods over the weedy check.

### INTRODUCTION

Onion (*Allium cepa* L.), belonging to the family Amaryllidaceae is one of the most important winter vegetable crop not only in Pakistan, but all over the world. Onion is a

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condiment crop and consumed as a fresh in salad, pickles or added in cooking dishes as a spice. Apart from furnishing nutrition, it also provides relishing flavors to our diets. Weed control is an unavoidable need for successful production of vegetable crops. Production losses increase with weeds infestation. Such losses may arise mainly from the competition between crops and weeds for light, water, space and nutrients. Weeds compete with the crop plants more at very early growth stages. Usually, farmers do not weed early enough to prevent major damages due to this competition. Defoer and Nieuwkoop (1991). It has been shown that farmers are using various ways to control weeds; however, their dependence is mainly one hand weeding and use of a urea based herbicide Tribunil (methabenzothiazuran). Weeds were rank as the most serious problem in onion production in our province. The weed problem is becoming worse in irrigated areas where cropping intensity is rapidly increasing and weed management through cultivation practices has become a challenge. The fixed crop rotation has encouraged the establishment of permanent weed flora, with large seed reserves in the soil (Anonymous, 1998). Weed control is one of the most important production practices in farm management (Aness, 1994).

Onion was grown on an area of 87 thousand ha with a production of 1.218 million tons bulbs during the 1999-2000. Sindh and Balochistan are the major producers of onion in our country. In NWFP, Swat and Dir are the leading districts in onion production (Anonymous, 2000).

Because of slow growth, small stature, shallow roots, and lack of dense foliage cover, onion seedlings cannot withstand competition with weeds. Weed pressures anytime before bulbs formation, can reduce yield. Later in the season weeds may affect bulbs and lead to an earlier senescence of crop.

In Pakistan, despite better inputs viz. high yielding cultivars, adequate seedling per unit area, adequate irrigation and other cultural practices, yield is very low due to weeds infestation. Due to smaller leaf size, onion is the worst competitor with weeds (Appleby, 1996). Whereas, losses from 49 to 86% have been reported from India due to weed interference (Lagoke and Sinha, 1983). Losses up to 96% in onion due to weed competition have been reported from United Kingdom (Bond and Burston, 1996). The critical weed competition is up to 40 days after transplanting (Rajendra et al., 1986). In the weedy control, the yield was decreased by 54% compared to weed free condition (Khurana et al., 1986).

To properly address the weed problem in onions, there is a dire need of developing a package of weed control technology ready for transfer to the onion growers of Pakistan.

## **MATERIALS AND METHODS**

The experiments were conducted at the research block of Department of Horticulture, Faculty of Agriculture, Gomal University, Dera Ismail Khan during 2000-2002, to investigate the weed management in onions. The experiments were laid out in Randomized Complete Block design with split plot arrangement having three replications. The main plots comprised of five onion varieties viz. Naurang local, Panyala local, Phulkara, Shah Alam local and Swat-I. The sub-plots consisted of the following herbicide treatments:

- T<sub>1</sub> = Control (Weedy check)  
 T<sub>2</sub> = One hand weeding  
 T<sub>3</sub> = Three hand weedings at 25 days interval  
 T<sub>4</sub> = S-metolachlor 960 EC @ 2.5 liter ha<sup>-1</sup>  
 T<sub>5</sub> = pendimethalin 33% (w/v) EC @ 3.25 liter ha<sup>-1</sup>.

The main plots and sub-plots were assigned randomly as described by Steel and Torrie (1980). Each sub-plot size was of 1.5 × 1.5 m<sup>2</sup> with row to row and plant to plant spacing of 30 × 10 cm<sup>2</sup>. Onion seedlings were transplanted in the second week of January to a well prepared seed bed. The herbicide S-metolachlor 960 EC and pendimethaline 33% (w/v) EC were sprayed immediately after transplanting. First hand weeding was applied 25 days after transplanting while the second and third hand weedings were applied at 25 days interval.

Data were recorded on weed density m<sup>-2</sup>, number of bulbs plot<sup>-1</sup>, plant survival percentage, bulb diameter and bulb yield in tons ha<sup>-1</sup>. The data were analyzed using analysis of variance techniques appropriate to the design. Treatments means were compared using Fisher's Protected least significant difference (LSD) test as detailed by Steel and Torrie (1980).

## RESULTS AND DISCUSSION

### Weed Density m<sup>-2</sup>

The results revealed that all the weed control methods significantly (P<0.05) decreased weed population as compared to control. The weed decrease in the weed population was recorded in three hand weedings, pendimethaline 33% (w/v) EC and S-metolachlor 960 EC treated and once hand weeded plot. The weeds m<sup>-2</sup> of (38.733) were recorded in the control (Table 1.1). Similar trend was followed in 2001-2002 (Table 1.2). Considering onion cultivar, there was statistically no difference among cultivars in affecting the weed population. These results collaborate with those of Govindra *et al.* (1986) and Patel *et al.* (1986).

Table-1.1. Effect of weed control methods on weed density (m<sup>-2</sup>) of onion varieties during 2000-2001

Varieties	Weed Control Methods					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethalin 33% (w/v) EC	
Naurang local	28.333NS	15.000	1.333	29.600	7.000	16.253 NS
Panyala local	44.333	42.333	3.000	25.667	1.333	23.333
Phulkara	36.000	25.667	3.333	47.667	15.000	25.533
Shah Alam local	43.333	21.333	5.667	22.333	10.000	20.533
Swat-I	41.667	42.333	2.333	17.000	22.333	25.133
Weed Control Methods Means	38.733a	29.333 a	3.133 b	28.453 a	11.133 b	

CV(%) = 36.28

LSD<sub>0.05</sub> for weed control methods = 13.14

**Table-1.2. Effect of weed control methods on weed density (m<sup>-2</sup>) of onion varieties during 2001-2002**

Varieties	Weed Control Methods					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	34.667NS	24.00	101.333	19.667	4.667	16.867NS
Panyala local	33.667	28.333	6.000	14.000	8.000	18.000
Phulkara	49.333	32.000	2.000	14.333	1.000	19.733
Shah Alam local	35.000	26.000	5.000	10.333	6.667	16.600
Swat-I	33.667	30.667	8.333	12.333	10.667	19.133
Control Methods Means	37.367 a	28.000 b	4.533 d	14.133 c	6.200 d	

CV(%) = 32.30

LSD<sub>0.05</sub> for weed control methods = 4.307**Number of Bulbs Plot<sup>-1</sup>**

The weed control methods significantly affected the number of bulbs plot<sup>-1</sup> (Table 2.1). The highest number (69.33) of bulbs plot<sup>-1</sup> were recorded in the treatment where hand weeding was applied thrice which was at par with pendimethaline 33% (w/v) EC 33% (w/v) EC and one hand weeded plots. The lowest number (54.667) of bulbs plot<sup>-1</sup> was harvested in the S-metolachlor 960 EC. The treated plots decrease in the number of bulbs plot<sup>-1</sup> in the S-metolachlor 960 EC may be the result of phytotoxicity of the herbicide to onion plants. Weed control method behaved the same in 2001-2002 (Table 2). Onion varieties significantly differed in affecting the number of bulbs/plot. The highest number of bulbs plot<sup>-1</sup> (73.333) was produced by Shah Alam local in 2000-2001 followed by Naurang local (67.333) and Panyala local (66.333). The lowest number of bulbs plot<sup>-1</sup> (64.000) was obtained in Phulkara. However, onion varieties were statistically at par with the number of bulbs plot<sup>-1</sup> in 2001-2002. These findings confirm the results reported by Hassan and Malik (2001) and Ranjendra (1986).

**Survival Percentage**

Weed control methods significantly differed in affecting the survival percentage of onion plants during both years of study (Table 3.1). The highest survival of onion plants was observed in three hand weedings in both the years of study. The highest decrease in the survival of onion plants was registered in the S-metolachlor 960 EC treatment in 2000-2001 and in weedy control in 2001-2002. The other treatments in increasing survival were pendimethaline 33% (w/v) EC and hand weeding once in both the year of experimentation. The lowest survival in 2001-2002 in the weeding check may be adverse effect of weeds population on survival.

Onion varieties averaged across weed control measures significantly differed in percent survival in 2000-2001 but not in 2001-2002 (Tables 3.1 & 3.2). In 2000-2001, the highest (92.620%) survival was observed in the onion variety Shah Alam, which significantly differed from other varieties used in the study. The lowest survival was found in the Swat-I. The lowest survival in Swat-I may be a lower adoptability of this variety at D. I. Khan

environment. Our results are in conformity with those of Lagoke *et al.*, (1983) and Patel *et al.*, (1986).

**Table-2.1. Effect of weed control methods measures on number of bulbs per plot of onion varieties during 2000-2001**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	68.667	65.333	71.333	50.333	67.333	64.600 b
Panyala local	66.000	69.333	68.333	49.333	66.333	63.867 bc
Phulkara	55.667	63.667	68.000	55.000	64.000	61.267 c
Shah Alam local	71.667	66.333	71.333	64.667	73.333	69.467 a
Swat-I	61.600	65.000	67.667	54.000	64.333	62.400 bc
Methods Means	64.600 b	65.933ab	69.333 a	54.667 c	67.067 ab	

CV(%) = 8.83

LSD for varieties = 3.119

LSD for weed control methods = 4.194

**Table-2.2. Effect of weed control methods measures on number of bulbs per plot of onion varieties during 2001-2002**

Varieties	Treatments					Varieties Means NS
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	69.000ab	68.667ab	71.000a	64.000a-d	68.333a-c	68.200
Panyala local	64.667a-d	65.333a-d	69.667ab	67.667a-c	68.667ab	67.200
Phulkara	65.000a-d	63.333b-d	69.000ab	67.333a-c	61.333cd	65.200
Shah Alam local	69.333ab	68.333a-c	70.333a	68.000d	69.667ab	66.200
Swat-I	65.000a-d	68.333a-c	70.667a	59.000d	68.000a-c	66.200
Methods Means	66.600b	66.867b	70.133a	65.200b	67.200ab	

CV(%) = 4.12

LSD for weed control methods = 3.213

LSD for varieties × weed control methods = 7.184

**Table-3.1. Effect of weed control measures on survival percentage of onion varieties during 2000-2001**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	91.553	87.110	95.100	67.107	88.443	85.865 b
Panyala local	87.997	92.440	91.107	65.773	88.443	95.152 bc
Phulkara	74.220	84.887	90.667	90.220	97.777	923976 a
Shah Alam local	95.553	88.440	97.777	86.220	95.110	92.620 a
Swat-I	81.330	86.863	90.220	71.997	85.773	83.197 bc
Methods Means	86.131 b	87.908ab	92.976 a	72.885 c	88.719 ab	

CV(%) = 8.86

LSD for varieties = 3.935

LSD for weed control methods = 5.601

**Table-3.2. Effect of weed control methods on weed density ( $m^{-2}$ ) of onion varieties during 2001-2002**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	92.000ab	91.555ab	94.666a	85.333a-d	91.111a-c	90.933 a
Panyala local	86.222a-d	87.111a-d	92.889a	90.222a-c	91.555ab	89.600 a
Phulkara	86.666a-d	84.444b-d	92.000ab	89.777a-c	81.777cd	86.933 b
Shah Alam local	92.444ab	91.555ab	93.778ab	90.666a-c	92.889ab	92.266 a
Swat-I	86.666a-d	91.111a-c	94.222a	78.666d	91.555ab	88.444 b
Methods Means	88.800ab	89.155ab	93.511a	86.933c	89.777ab	

CV(%) = 4.13

LSD for varieties = 4.430

LSD for weed control method = 3.340

LSD for varieties  $\times$  methods = 9.705**Bulb Diameter (cm)**

All the weed control methods significantly increased bulb diameter compared to control (Table 4.1). The highest bulb diameter (6.02 and 6.33 cm) were recorded in the three hand weeding plot<sup>1</sup> in 2000-2001 and 2001-2002 respectively (Tables 4.1 & 4.2). The lowest bulb diameters of (4.84 and 4.96 cm) was produced in the control in the respective years of studies. The increase in the bulb diameter in the weed control methods ranged between 11 and 27%. (5.407 to 6.330 cm diameter) compared to (4.835 cm) bulb

diameter in the control. Onion varieties significantly differed with respect to diameter. The onion variety Shah Alam local produced the highest bulb diameter in both the year of study. Other onion varieties used in this study were statistically at par with respect to diameter except Panyala local in 2000-2001 which produced significantly lower bulb diameter.

The results are in accordance with the results of Hassan and Malik (2001) who obtained highest bulb diameter with three hand weedings compared to herbicides application and weedy check. Saikia *et al*, (1997) also reported similar results.

**Table-4.1. Effect of weed control measures on bulb diameter (cm) of onion varieties during 2000-2001**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	4.800	5.500	5.967	6.000	5.833	5.620a
Panyala local	4.910	5.300	6.233	5.733	5.900	5.615a
Phulkara	4.367	4.900	5.733	5.433	5.400	5.167b
Shah Alam local	5.100	5.900	6.267	5.667	5.900	5.767a
Swat-I	5.000	5.433	5.900	5.667	5.500	5.500ab
Methods Means	4.835 d	5.407 c	6.020 a	5.700 b	5.707 b	

CV(%) = 5.24

LSD for varieties = 0.346

LSD for methods = 0.213

**Table-4.2. Effect of weed control measures on bulb diameter (cm) of onion varieties during 2001-2002**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	4.900hi	5.233f-h	6.200bc	5.533d-f	6.067bc	5.587 b
Panyala local	4.933hi	5.367f-h	6.367a-c	5.533d-f	5.467e-g	5.533 b
Phulkara	4.967g-i	5.300f-h	6.300a-c	4.900hi	6.000b-d	5.493 b
Shah Alam local	5.367f-h	6.033b-d	6.733a	6.467ab	5.933c-e	6.107 a
Swat-I	4.667i	4.933hi	6.067bc	5.333f-h	6.000b-d	5.400 b
Means	4.967d	5.373c	6.333a	5.553c	5.893b	

CV(%) = 5.39

LSD for varieties = 0.274

LSD for treatment = 0.223

LSD for varieties × weed control methods = 0.500

#### Yield (t ha<sup>-1</sup>)

Statistical analysis of the data exhibited that all weed control methods significantly ( $P < 0.05$ ) increased bulbs yield as compared to control in 2000-2001 (Tables 5.1 & 5.2). The highest yield of 20.546 t ha<sup>-1</sup> was recorded in three hand weedings treatments followed by pendimethaline 33% (w/v) EC treated plots one hand weeding with 20.546

and 18.093 t ha<sup>-1</sup> bulb yields, respectively. The lowest yield of 15.177 t ha<sup>-1</sup> was obtained in the control. The increase in bulb yield in weed control treatments ranged between 12% and 35% (17.08 – 20.55 t ha<sup>-1</sup>) compared to control (15.18 t ha<sup>-1</sup>). A similar trend was obtained in 2001-2002. Similar findings were reported by Srivastava *et al.* (1986) and Rajendra *et al.* (1986).

The lowest yield in the control was due to the competition of weeds with the onion plants for space, nutrients and light as is evident from the high population of weeds in this treatment (Table 5-5.1). Three times hand weeding reduced weeds competition which resulted in greater number of bulbs plot<sup>-1</sup>, highest survival percentage and highest bulb diameter. Therefore, the highest increase in the bulb yield of 35% was recorded in this treatment.

**Table-5.1. Effect of weed control measures on yield (t ha<sup>-1</sup>) of onion varieties during 2000-2001**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	15.582h-j	17.752e-h	21.420a-c	19.273c-f	18.593e-g	18.524 b
Panyala local	13.770j-k	18.617e-g	21.369a-d	14.931jk	19.068c-f	17.551 bc
Phulkara	16.043g-i	16.750f-c	18.253a-g	14.060jk	17.648e-h	16.551 c
Shah Alam local	17.759e-h	19.572b-e	22.894a	21.659a-c	22.188ab	20.814 a
Swat-I	12.730k	17.777e-h	18.795d-f	15.523h-j	18.446a-g	16.654 c
Methods Means	15.177d	18.093bc	20.546a	17.089c	19.189b	

CV(%) = 8.80

LSD for varieties = 1.436

LSD for methods = 1.170

LSD for varieties × methods = 2.616

**Table-5.2. Effect of weed control measures on yield (t ha<sup>-1</sup>) of onion varieties during 2001-2002**

Varieties	Treatments					Varieties Means
	Weedy check	One hand weeding	Three hand weeding	S-metolachlor 960-EC	pendimethaline 33% (w/v) EC	
Naurang local	15.883	16.838	18.482	17.546	17.042	17.158 a
Panyala local	13.664	12.544	18.768	15.592	17.035	15.520 ab
Phulkara	11.966	13.406	14.693	12.250	13.768	13.217 b
Shah Alam local	15.495	16.616	19.035	17.820	16.978	17.189 a
Swat-I	11.744	16.297	17.023	13.305	12.227	14.119 b
Methods Means	13.750 c	15.140 b	17.600 a	15.303 b	15.410 b	

CV(%) = 11.61

LSD for varieties = 2.443

LSD for methods = 1.323



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