

Comparative Efficacy of Pendimethalin and Oxyfluorfen for Controlling Weeds in Onion (*Allium cepa* L.) Nursery

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ABSTRACT

A field study was conducted at Punjab Agricultural University Regional Station, Bathinda during 2005-06 and 2006-07 to evaluate the effect of different weed control treatments on germination, growth of onion seedlings and weed spectrum in onion nursery. All the treatments reduced weed growth significantly over the unweeded control except plastic mulching and oxyfluorfen at 0.062 kg/ha. Pendimethalin at all the three levels significantly reduced weed population but adversely affected the germination of onion seedlings. The most adverse effect of pendimethalin was observed at 1.0 kg/ha. However, partial control of weed was observed in case of oxyfluorfen. There was significant reduction in weight of 100 seedlings at all the oxyfluorfen levels. So, pendimethalin at 0.5 kg/ha and oxyfluorfen at 0.125 kg/ha can be used for better weed control and higher seedling production in onion nursery.

Key words : Seedling injury, weed control efficiency, herbicide efficiency index

INTRODUCTION

Onion (*Allium cepa* L.) occupies an important place as a commercial crop in India as well as world. Onion nursery production is handicapped by several factors and one of the most limiting is the problem of weeds. The practice of application of farm yard manure (FYM) and frequent irrigation in nursery plots encourages the early establishment and luxuriant growth of weed, sometimes even before the germination of onion seed. Onion is poor competitor of the weeds due to its inherent characters like sparse foliage, non-branching habitat, shallow root system and slow initial growth. Uncontrolled weed growth reduces the bulb yield upto 40-80% depending upon the nature intensity and duration of weed competition in field onion (Prakash *et al.*, 2000). Hand weeding, no doubt, is effective, but it is time consuming and uneconomical due to closer spacing and shallow root system of the crop. Moreover, due to non-availability of timely labour, weeds are not controlled at the proper stage of the crop results in production of unhealthy seedlings. Hence, the use of herbicides is one of the options left with the farmers to eliminate crop weed competition at early growth stage of crop. Several workers have found pendimethalin, oxyfluorfen and oxadiazon to be efficient in controlling weeds in onion (Tewari *et al.*, 1999; Tewari *et al.*, 2001a). Keeping in view the losses in onion nursery due to weed infestation and high cost of manual labour, the present study was undertaken to

test the efficacy of various herbicides for weed control in onion nursery.

MATERIALS AND METHODS

A field study was conducted at Punjab Agricultural University Regional Station, Bathinda during 2005-06 and 2006-07 to evaluate the effect of different weed control treatments on germination, growth of onion seedlings and weed spectrum in onion nursery. The soil of the experimental site was sandy loam soil having pH 8.5, low in organic carbon, medium in phosphorus and high in potash.

The experiment was conducted in randomized block design with 10 treatments viz., unweeded control, weed free, plastic mulching (pre-plant), three levels of pendimethalin (0.5, 0.75 and 1.0 kg/ha) and four levels of oxyfluorfen (0.062, 0.125, 0.187 and 0.250 kg/ha) with four replications during 2005-06 with variety Agri fond light red. Observing the negative herbicide efficiency index (HEI) at higher levels of pendimethalin due to reduced germination of onion seed (Table 1) during 2006-07 the pendimethalin levels were revised viz., 0.2, 0.4 and 0.5 kg/ha, and all the other treatments were kept unchanged. Plastic mulching was done 15 days before sowing with 40 mm thick polythene sheet. Pendimethalin was applied as pre-emergence within 24 h of sowing of onion seed in the nursery beds. Oxyfluorfen was applied as post-emergence 20 days after sowing. The seed was sown

in lines spaced at 5 cm on raised bed having a plot size of 2.0 x 1.0 m, on 15 and 4 November during 2005-06 and 2006-07, respectively. In weed free treatment, plots were kept weed free for the entire nursery season by giving five weedings at different intervals. No weeding was done in unweeded control. The nursery plots were kept free from moisture stress by watering daily/alternate days depending upon the climatic condition and rainfall. The herbicide was sprayed at optimum moisture level in the field. Nursery beds were watered daily both in morning and evening. The weed control efficiency (WCE), weed index (WI) and herbicide efficiency index (HEI) were calculated by using the following formulae :

$$WCE = \frac{\text{Dry wt. of weeds in control plot} - \text{Dry wt. of weeds in treatment plot}}{\text{Dry wt. of weeds in control plot}} \times 100$$

$$WI = \frac{\text{Yield from weed free plot} - \text{Yield from treatment plot}}{\text{Yield from weed free plot}} \times 100$$

$$HEI = \frac{\text{Yield from treatment plot} - \text{Yield from control plot}}{\text{Yield from control plot}} \times 100$$

$$HEI = \frac{\text{Dry matter of weeds in treatment}}{\text{Dry matter of weeds in control}} \times 100$$

Weed flora consisted of *Cyperus rotundus* (0.35%), *Rumex dentatus* (2.4%), *Melilotus alba* (0.35%), *Chenopodium album* (0.35%), *Fumaria parviflora* (1.0%), *Anagallis arvensis* (1.25%), *Veronica agrestis* (0.35%), *Spergula arvensis* (20.3%), *Trigonella polycerata* (1.4%), *Medicago denticulata* (1.05%), *Lepidium sativa* (41.7%) and *Aerva* sp. (29.5%).

RESULTS AND DISCUSSION

Effect on Weeds

Pendimethalin at all the levels significantly reduced the dry matter of dicot as well monocot weeds as compared to unweeded control during both the years of study. However, oxyfluorfen at 0.062, 0.125, 0.187 and 0.250 kg/ha significantly reduced the dry matter of monocot weeds as compared to unweeded control during both the years. Although the lowest dry matter of monocot weeds (110.0 and 85.7 g/m² in both the years,

respectively) was recorded at 0.25 kg/ha but the reduction at higher levels was statistically at par with each other (Table 1). Oxyfluorfen reduced the dry matter of dicot weed significantly at all the levels during 2005-06 and upto 0.187 kg/ha during 2006-07. However, the dry matter of monocot weeds was reduced significantly only upto 0.125 kg/ha and at higher levels oxyfluorfen did not exhibit any significant result. The highest weed control efficiency (91%) was recorded with pendimethalin at 1.0 kg/ha during 2005-06 and 77% at 0.5 kg/ha during 2006-07. Similar results have also been reported by Thakral *et al.* (2003). Oxyfluorfen recorded 38 and 41% WCE at 0.25 kg/ha during both the years, respectively. During 2005-06, the highest herbicide efficiency index (5.29) was recorded with pendimethalin at 0.5 kg/ha. However, the application of pendimethalin at 1.0 kg/ha resulted in negative herbicide efficiency index (Table 1). The highest herbicide efficiency index (4.67) was recorded with application of pendimethalin at 0.5 kg/ha. The herbicide efficiency index decreased gradually by increasing levels of oxyfluorfen during both the years of study (Table 1). The results confirm the findings of early workers (Khurana *et al.*, 1987; Malik *et al.*, 1999; Thakral *et al.*, 2003).

Effect on Onion Nursery

Pendimethalin at 0.5 kg/ha and oxyfluorfen at all levels produced higher number of healthy seedlings during 2005-06 (Table 2). However, during 2006-07, all the treatments except oxyfluorfen at 0.25 kg/ha produced higher number of healthy seedlings. Significant reduction in total number of seedlings was recorded in pendimethalin at higher dose of 0.75 and 1.0 kg/ha. No effect on seedling length was recorded during 2006-07; however, the highest seedling length (21.2 cm) was recorded in weed free treatment. During 2005-06, higher seedling length (25.4 cm) was recorded over the unweeded control when pendimethalin was applied at 1.0 kg/ha. This may be attributed to the reduced crop competition due to less germination. Unweeded control produced the lowest seedling length (15.2 cm) during 2005-06 which may be ascribed to the higher crop weed competition.

During 2005-06, all the herbicidal treatments significantly improved the 100-seedling weight as compared to the unweeded control. The highest seedling weight was recorded in weed free plot and the lowest in oxyfluorfen at 0.25 kg/ha. However, during 2006-07,

Table 1. Dry matter of weeds, weed control efficiency and herbicide efficiency index as influenced by various weed control treatments

Treatments	Dose (kg/ha)	Time of application	Dry matter of monocot weeds (g/m ²)		Dry matter of dicot weeds (g/m ²)		Weed control efficiency (%)		Herbicide efficiency index	
			2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Weed free	-	-	0	0	0	0	-	-	-	-
Unweeded control	-	-	145	116.0	130.0	111.1	-	-	-	-
Mulching	-	Pre-sowing	96.2	110.2	82.8	74.6	35	19	1.74	1.42
Pendimethalin	0.2	Pre-emergence	-	39.1	-	37.4	-	63	-	2.69
Pendimethalin	0.4	Pre-emergence	-	41.8	-	28.1	-	69	-	3.53
Pendimethalin	0.5	Pre-emergence	40.0	33.6	20.5	17.5	78	77	5.29	4.67
Pendimethalin	0.75	Pre-emergence	30.5	-	10.3	-	85	-	0.40	-
Pendimethalin	1.0	Pre-emergence	15.8	-	8.5	-	91	-	1.55	-
Oxyfluorfen	0.062	Post-emergence	141.2	110.5	100.4	78.8	12	17	1.62	1.41
Oxyfluorfen	0.125	Post-emergence	120.7	95.5	82.8	68.2	25	28	1.47	1.25
Oxyfluorfen	0.187	Post-emergence	112.2	88.6	69.8	54.6	34	37	1.43	1.25
Oxyfluorfen	0.250	Post-emergence	110.0	85.7	60.0	47.7	38	41	1.08	0.82
LSD (P=0.05)	-		14.15	8.9	9.6	7.2	-	-	-	-

Table 2. Growth and yield of onion seedlings as influenced by various weed control treatments

Treatments	Dose (kg/ha)	Time of application	No. of seedlings/m ²		No. of healthy seedlings/m ²		Length of seedling at the time of transplanting (cm)		Weight of 100 seedlings (g)		Weed index	
			2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07	2005-06	2006-07
Weed free	-	-	1693.3	1901.8	1560.0	1812.8	19.2	21.2	142.0	142.0	1.0	1.0
Unweeded control	-	-	1333.3	1216.5	540.2	488.2	15.2	18.2	96.6	98.3	0.65	0.73
Mulching	-	Pre-sowing	1445.2	1525.8	1155.0	1148.2	16.9	18.6	118.2	133.0	0.25	0.37
Pendimethalin	0.2	Pre-emergence	-	1455.7	-	1022.4	-	18.9	-	124.2	-	0.44
Pendimethalin	0.4	Pre-emergence	-	1346.3	-	1107.7	-	18.2	-	132.8	-	0.39
Pendimethalin	0.5	Pre-emergence	1296.6	1276.3	1170.0	1150.7	17.2	16.8	118.3	135.0	0.25	0.37
Pendimethalin	0.75	Pre-emergence	796.0	-	-	-	22.2	-	123.0	-	0.63	-
Pendimethalin	1.0	Pre-emergence	536.6	-	-	-	25.4	-	148.0	-	0.70	-
Oxyfluorfen	0.062	Post-emergence	1630.0	1630.3	1310.2	1144.9	18.4	18.4	128.2	136.2	0.16	0.37
Oxyfluorfen	0.125	Post-emergence	1526.6	1520.5	1140.1	991.6	17.9	17.9	120.0	125.0	0.27	0.45
Oxyfluorfen	0.187	Post-emergence	1510.0	1512.9	1050.2	956.3	16.6	16.4	115.3	118.3	0.33	0.47
Oxyfluorfen	0.250	Post-emergence	1506.0	1477.1	901.5	785.5	16.5	16.6	112.5	116.5	0.42	0.57
LSD (P=0.05)			386.2	285.1	137.7	299.8	5.2	NS	9.3	22.4	-	-

NS-Not Significant.

significant improvement in 100-seedling weight was recorded in all the pendimethalin treatments and oxyfluorfen at 0.062 and 0.125 kg/ha over the unweeded control.

It is thus concluded that by keeping the onion nursery free from weeds maximum healthy seedlings can be obtained. Pendimethalin at 0.5 kg/ha and oxyfluorfen at 0.125 kg/ha can be applied for better weed

control and higher seedling production.

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