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Integrated Weed Management in Onion

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ABSTRACT

Pre-emergence application of fluchloralin at 1.0 kg ha^{-1} supplemented with two hand weedings at 30 and 60 DAT recorded the least weed count and dry matter production favouring the highest yield of onion bulbs (72.4 t ha^{-1}). Fluchloralin, pendimethalin, alachlor, trifluralin and oxyfluorfen at lower doses in combination with one or two hand weedings produced significantly higher yields than their application alone at higher doses.

INTRODUCTION

Onion is the most important commercial vegetable crop grown from ancient times in India. India is the second largest producer and third largest exporter of onion in the world. Maharashtra is the leading producer state of onion in the nation. Being a slow growing crop and having erect tubular leaves, it suffers heavily from weed competition during establishment of seedlings and weeds overtop the crop. Frequent irrigations are required for raising the crop which promote emergence of weeds in several flushes. Weeds interfere development of onion bulbs thereby reducing bulb yield to the extent of 40-80% (Singh *et al.*, 1992; Verma and Singh, 1996). Hand weeding, no doubt, is effective; but it is a time consuming, cumbersome and under many situations becomes uneconomical. Herbicides are important tool for weed control, but it is not effective in controlling all the weeds present in the crop. Similarly, late emerging weeds hinder bulb development and create problems in harvesting. Hence, it becomes necessary to control the weeds during the later period also. In an integrated concept, each method has its own role to play in the overall weed management. Now, it is a high time to develop an integrated weed management for higher yield of onion bulbs.

MATERIALS AND METHODS

An experiment was conducted during **rabi** seasons of 2003 and 2004 at University Department of Horticulture, Dr. PDKV, Akola. The soil of the experimental field was medium black. The experiment was laid out in randomized block design with three replications and 17 treatments comprised five herbicides (fluchloralin, pendimethalin, alachlor, trifluralin and oxyfluorfen) each at two doses, lower dose supplemented with one hand weeding (HW) at 45 DAT and two hand weedings at 30 and 60 DAT, three hand weedings at 20, 40 and 60 DAT and unweeded control (Table 1). Herbicides were applied before transplanting of onion seedlings by knapsack sprayer fitted with flat fan nozzle in a spray volume of 500 l water ha^{-1}. Sixty days old seedlings of onion variety Akola Safed were transplanted on January 9 during 2003 and 2004 at a spacing of 10 x 10 cm in flat beds. Data on weed count and weed dry weight were transformed to square root.

RESULTS AND DISCUSSION

Effect on Weeds

The prominent weed species in the experimental plots were *Cyperus rotundus*, *Cynodon dactylon, Physalis minima, Chenopodium album, Portulaca oleracea, Euphorbia hirta, Amaranthus viridis, Tribulus terrestris* and *Parthenium hysterophorus*. All treatments caused significant reduction in total weed population and dry weight of weeds as compared to unweeded control during both the years (Table 1). During 2003

Table 1. Effect of treatments on weeds

Treatment	Weed density (No. m^{-2})				Dry matter of weeds (g m^{-2})			
	2003		2004		2003		2004	
	80 DAT	At harvest	80 DAT	At harvest	80 DAT	At harvest	80 DAT	At harvest
Fluchloralin at 2.0 kg ha^{-1}	100	116	138	148	114.4	126.9	131.7	136.0
	(10.0)	(10.7)	(11.7)	(12.1)	(10.7)	(11.2)	(11.3)	(11.5)
Fluchloralin at 1.0 kg ha^{-1} fb 1 HW 45 DAT	68	80	68	84	22.0	28.6	56.4	66.4
	(8.2)	(8.9)	(8.2)	(9.1)	(4.7)	(5.3)	(7.4)	(8.1)
Fluchloralin at 1.0 kg ha^{-1} fb 2 HW 30 & 60 DAT	33	40	42	48	11.7	14.0	18.9	20.8
	(5.8)	(6.3)	(6.5)	(6.9)	(3.4)	(3.8)	(4.3)	(4.5)
Pendimethalin at 1.0 kg ha^{-1}	130	150	129	150	131.6	150.8	103.8	110.9
	(11.4)	(12.2)	(11.3)	(12.2)	(11.4)	(12.2)	(10.0)	(10.4)
Pendimethalin at 0.5 kg ha^{-1} fb 1 HW 45 DAT	72	92	74	93	31.3	39.4	62.4	74.0
	(8.5)	(9.6)	(8.6)	(9.6)	(5.6)	(6.2)	(7.8)	(8.5)
Pendimethalin at 0.5 kg ha^{-1} fb 2 HW 30 & 60 DAT	34	45	49	62	12.4	16.0	23.2	23.7
	(5.9)	(6.7)	(7.0)	(7.9)	(3.5)	(4.0)	(4.8)	(4.8)
Alachlor at 2.0 kg ha^{-1}	150	173	169	190	142.2	161.0	165.8	168.9
	(12.1)	(13.0)	(13.0)	(13.8)	(11.9)	(12.7)	(12.8)	(12.9)
Alachlor at 1.0 kg ha^{-1} fb I HW 45 DAT	64	78	86	101	29.8	41.4	56.5	72.6
	(8.0)	(8.8)	(9.2)	(10.0)	(5.4)	(6.4)	(7.5)	(8.5)
Alachlor at 1.0 kg ha^{-1} fb 2 HW 30 & 60 DAT	45	57	85	100	16.4	22.0	28.4	30.4
	(6.7)	(7.5)	(9.2)	(10.0)	(4.0)	(4.6)	(5.2)	(5.4)
Trifluralin at 1.0 kg ha^{-1}	139	158	129	140	121.2	133.3	140.6	145.3
	(11.8)	(12.6)	(11.2)	(12.1)	(10.9)	(11.5)	(11.7)	(11.9)
Trifluralin at 0.5 kg ha^{-1} fb 1 HW 45 DAT	82	101	102	122	38.4	45.4	61.6	76.9
	(9.0)	(10.0)	(10.1)	(11.0)	(6.2)	(6.7)	(7.8)	(8.7)
Trifluralin at 0.5 kg ha^{-1} fb 2 HW 30 & 60 DAT	37	48	40	50	14.6	18.4	21.6	26.0
	(6.1)	(6.9)	(6.2)	(7.1)	(3.8)	(4.3)	(4.5)	(5.1)
Oxyfluorfen at 0.2 kg ha^{-1}	144	162	134	153	113.6	119.4	126.1	131.4
	(12.0)	(12.7)	(11.6)	(12.3)	(10.6)	(10.9)	(11.2)	(11.4)
Oxyfluorfen at 0.1 kg ha^{-1} fb I HW 45 DAT	101	118	84	105	39.3	50.8	65.4	84.0
	(10.0)	(10.8)	(9.1)	(10.2)	(6.3)	(7.1)	(8.1)	(9.1)
Oxyfluorfen at 0.1 kg ha^{-1} fb 2 HW 30 & 60 DAT	56	69	48	60	21.3	24.8	23.3	29.2
	(7.3)	(8.2)	(6.9)	(7.7)	(4.6)	(4.9)	(4.8)	(5.4)
Three HW at 20, 40 & 60 DAT	40	56	33	53	11.4	18.0	13.0	33.2
	(6.3)	(7.4)	(5.7)	(7.28)	(3.4)	(4.2)	(3.6)	(5.7)
Unweeded control	214	242	269	284	198.6	219.0	341.2	347.3
	(14.6)	(15.5)	(16.4)	(16.8)	(14.0)	(14.7)	(18.4)	(18.6)
LSD (P=0.05)	1.6	1.6	1.6	1.4	1.1	1.2	2.1	2.1

Figures in parentheses indicate square root transformation.
DAT–Days after transplanting, HW–Hand weeding.

at 80 DAT, fluchloralin at 1.0 kg ha^{-1} followed by two hand weedings at 30 and 60 DAT recorded significantly least weed population. In 2004, significantly minimum weed population at 80 DAT was registered due to three hand weedings at 20, 40 and 60 DAT. However, during both the years at harvesting stage, fluchloralin at 1.0 kg ha^{-1} supplemented with two hand weedings at 30 and 60 DAT recorded significantly minimum weed population. During both the years at 80 DAT, significantly lowest dry weight of weeds (11.4 and 13.0 g m^{-2}) was recorded due to three hand weedings done at 20, 40 and 60 DAT. However, at the harvesting stage, an application of fluchloralin at 1.0 kg ha^{-1} followed by two hand weedings at 30 and 60 DAT produced significantly lowest dry weight of weeds (14.0 and 20.8 g m^{-2}). Similarly, the highest weed control efficiency of 93.6 and 94.0% was recorded with fluchloralin at 1.0 kg ha^{-1} supplemented with two hand weedings at 30 and 60 DAT during both the years of experimentation. An excellent control of annual weeds was observed due to fluchloralin during the initial stages of the crop followed by the physical removal of weeds which emerged late in the season or which were of perennial nature. These results are in conformity with the findings of Warade *et al.* (1995) and Saikia *et al.* (1997). Application of herbicides alone was less effective in reducing the weed density and dry weight of weeds.

Effect on Crop

All the weed management treatments significantly increased the yield of onion bulbs over unweeded control during both the years (Table 2). Fluchloralin at 1.0 kg ha^{-1} supplemented with two hand weedings at 30 and 60 DAT was significantly superior to rest of the treatments by recording the highest yield (72.4 t ha^{-1}) and it was at par with pendimethalin at 0.5 kg ha^{-1} followed by two hand weedings at 30 and 60 DAT (69.9 t ha^{-1}), oxyfluorfen at 0.1 kg ha^{-1} alongwith two hand weedings at 30 and 60 DAT (68.8 t ha^{-1}) and three hand weedings at 20, 40 and 60 DAT (68.0 t ha^{-1}). Superiority of fluchloralin alongwith hand weedings for increasing

Table 2. Yield of onion bulbs as influenced by treatments

Treatment	Yield (t ha^{-1})		
	2003	2004	Pooled mean
Fluchloralin at 2.0 kg ha^{-1}	59.4	61.9	60.6
Fluchloralin at 1.0 kg ha^{-1} fb 1 HW 45 DAT	66.3	66.9	66.6
Fluchloralin at 1.0 kg ha^{-1} fb 2 HW 30 & 60 DAT	72.0	72.8	72.4
Pendimethalin at 1.0 kg ha^{-1}	54.3	59.4	56.8
Pendimethalin at 0.5 kg ha^{-1} fb 1 HW 45 DAT	63.6	64.6	64.1
Pendimethalin at 0.5 kg ha^{-1} fb 2 HW 30 & 60 DAT	69.3	70.5	69.9
Alachlor at 2.0 kg ha^{-1}	51.7	54.9	53.3
Alachlor at 1.0 kg ha^{-1} fb 1 HW 45 DAT	59.4	60.6	60.0
Alachlor at 1.0 kg ha^{-1} fb 2 HW 30 & 60 DAT	63.6	66.6	65.1
Trifluralin at 1.0 kg ha^{-1}	57.3	61.6	59.4
Trifluralin at 0.5 kg ha^{-1} fb 1 HW 45 DAT	60.0	64.4	62.2
Trifluralin at 0.5 kg ha^{-1} fb 2 HW 30 & 60 DAT	64.2	70.2	67.2
Oxyfluorfen at 0.2 kg ha^{-1}	57.0	59.1	58.1
Oxyfluorfen at 0.1 kg ha^{-1} fb 1 HW 45 DAT	63.3	64.7	64.0
Oxyfluorfen at 0.1 kg ha^{-1} fb 2 HW 30 & 60 DAT	67.8	69.9	68.8
Three HW at 20, 40 & 60 DAT	65.8	70.1	68.0
Unweeded control	32.3	31.4	31.9
LSD (P=0.05)	08.4	05.6	04.6

DAT–Days after transplanting, HW–Hand weeding.

yield was also reported by Sonone *et al.* (1982), Warade *et al.* (1995) and Sukhadia *et al.* (2002). This is due to suppression of weed competition by integrated weed control treatments offering efficient and prolonged weed control leading to the higher yield of onion. An application of fluchloralin, pendimethalin, alachlor, trifluralin and oxyfluorfen in combination with one and two hand weedings produced significantly higher yields than the application of these herbicides alone at higher doses.

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