Himachal Journal of Agricultural Research 34(2):109-112, 2008

Short Note

Efficacy of new herbicides alone and in integration with hand weeding to manage weeds in onion (*Allium cepa*)

N.N. Angiras, Suresh Kumar and S. S. Rana
Department of Agronomy
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur -176 062, India.

Abstract

A field experiment was carried out at Palampur to find out alternative herbicidal/integrated weed management in onion. Oxyfloufen, trifluralin and oxadiargyl were as effective as hand weeding thrice against *P. minor*. Population of *P. annua* was significantly lower owing to oxyflourfen and trifluralin. Trifluralin was most effective against *A. ludoviciana* and *L. temulentum*. The adequate reduction in the population of *rabi* weeds induced the build up of *E. colona*, *P. dichotomiflorum* and *P. alatum* in most of the herbicidal treatments. However, oxyflourfen and oxadiargyl were effective against *P. alatum*. The treatments under evaluation gave 70.4 percent reduction in weed dry matter accumulation with oxadiargyl + hand weeding and 79.6 percent with hand weeding thrice. Hand weeding thrice gave highest bulb yield. This was followed by oxyflourfen + hand weeding and trifluralin + hand weeding. Weeds reduced bulb yield by 79.9 percent. Weed management index, agronomic management index and integrated weed management index were highest with hand weeding thrice followed by trifluralin + hand weeding, oxyflourfen + hand weeding, trifluralin and oxadiargyl.

Key words: Integrated weed management, herbicides, weeds, bulb yield, onion.

Onion is an important commercial crop in Indian agriculture and grown on large area throughout the country. Being a slow growing and irrigated crop, it is severely infested with weeds. Weeds interfere with the development of onion bulb by competing for moisture, nutrients, light and space, thereby reducing bulb yield to the extent of 40-81.2% (Prakash *et al.*, 2000; Verma and Singh, 1996). Hand weeding, no doubt, is effective, but it is time consuming, cumbersome and under many situations becomes uneconomical. Pendimethalin is not effective against all weeds present in the crop. It was therefore, felt necessary to test the alternative new herbicide alone and in integration with hand weeding to manage weeds in onion.

A field experiment was conducted during the *rabi* seasons of 2001 and 2002 at Palampur with ten treatments [pendimethalin 1.5 kg/ha, oxyfluorfen 0.20 kg/ha, and trifluralin 1.0 kg/ha alone and at fifty per cent dose in integration with one hand weeding, oxadiargyl 0.075 kg/ha alone at 2/3rd dose in integration with one hand weeding, hand weeding thrice (30, 60 and 90 DAS) and weedy check (Table 1) in randomized block design with three replications. The soil of the experimental field was silty clay loam in texture, acidic in reaction (pH 5.5), medium in organic carbon (0.7 per cent), low in available nitrogen (228.4 kg/ha), medium in available phosphorus (17.6 kg/ha) and high in available potassium (301.2 kg/ha). Pre-emergence application of pendimethalin, oxyflourfen and trifluralin was made one day before transplanting. Oxadiargyl was applied 3 days after transplanting with knap sack sprayer at spray volume of 700 l ha^{-1}. 'Nasik Red' onion seedlings were transplanted on 17 January 2001 and 5 January 2002. Except weed control, the other management practices were in accordance with the recommended package of practices. Weed count and dry weight was recorded at harvest from two randomly selected spots (0.25 m^2) in each plot and expressed as number and g m^{-2}, respectively. Yields were

Table 1. Effect of treatments on species-wise count of *rabi* weeds

Treatments	Dose (g/ha)	*Phalaris*	*Poa*	*Lolium*	*Avena*	*Coronopus*	*Stellaria*	*Vicia*
Oxadiargyl	75	9.3 (86.6)	3.7 (17.3)	2.8 (13.3)	2.8 (13.3)	1.6 (2.6)	1.0 (0.0)	1.8 (4.0)
Oxadiargyl + HW	50	8.6 (85.3)	3.5 (14.6)	1.8 (4.0)	1.0 (0.0)	3.3 (13.3)	2.1 (6.6)	1.8 (4.0)
Oxyfluorfen	200	5.9 (38.6)	1.0 (0.0)	4.6 (28.0)	3.0 (10.6)	1.6 (2.6)	2.3 (5.3)	2.0 (4.0)
Oxyfluorfen + HW	100	6.1 (37.3)	3.9 (20.0)	1.0 (0.0)	2.0 (5.3)	2.7 (8.0)	1.0 (0.0)	1.6 (2.6)
Trifluralin	1000	8.5 (74.0)	1.8 (4.0)	1.0 (0.0)	1.0 (0.0)	4.3 (20.0)	1.0 (0.0)	3.4 (12.0)
Trifluralin + HW	500	8.0 (65.3)	3.8 (18.6)	3.9 (20.0)	2.0 (5.3)	4.1 (17.3)	1.0 (0.0)	1.4 (1.3)
Pendimethalin	1500	9.9 (102.6)	3.8 (18.6)	2.8 (13.3)	2.3 (8.0)	4.9 (25.3)	1.8 (4.0)	2.9 (8.0)
Pendimethalin + HW	750	8.4 (74.6)	4.6 (26.6)	1.0 (0.0)	1.0 (0.0)	3.0 (10.6)	1.8 (4.0)	1.0 (0.0)
Hand weeding (HW)	-	5.3 (32.0)	3.2 (20.0)	1.0 (0.0)	1.0 (0.0)	2.7 (8.0)	1.6 (2.6)	1.4 (1.3)
Weedy		14.9 (222.6)	6.1 (40.0)	5.9 (37.3)	5.6 (32.0)	4.5 (20.0)	2.4 (9.3)	2.3 (5.3)
LSD (P=0.05)		1.8	1.4	1.3	1.1	NS	NS	0.8

HW – Hand weeding; Data transformed to square root ($\sqrt{x+1.0}$) transformation. Figures in parentheses are the means of original values

harvested from net plot. Treatment efficiency index (TEI), weed management index (WMI), agronomic management index (AMI) and integrated weed management index (IWMI) were determined as per Walia (2003).

The onion was infested both with *rabi* (92.1%) and *kharif* weeds (7.9%). The *rabi* weeds found growing in association with onion were, *Phalaris minor* (60.7%), *Poa annua* (10.9%), *Lolium temulentum* (10.2%) and *Avena ludoviciana* (8.7%) amongst grasses and *Coronopus didymus* (5.5%), *Stellaria media* (2.5%) and *Vicia sativa* (1.4%) among broad-leaved weeds. The *kharif* weeds were, *Polygonum alatum* (80%), *Gallinsoga parviflora* (16.8%) and *Panicum dichotomiflorum* (3.2%). *Echinochloa colona* and *Digitaria sanguinalis* also showed their presence in the experimental field.

All treatments were superior to weedy check in reducing the count of *rabi* grass weeds (Table 1). Oxyflourfen, oxyflourfen + hand weeding and hand weeding thrice significantly decreased the count of *P. minor* over rest of the treatments. Trifluralin and oxadiargyl were as effective as pendimethalin in reducing the count of *P. minor*. Count of *P. annua* was significantly lower owing to oxyflourfen and trifluralin. Effectiveness of oxyflourfen against *P.annua* has also been reported (Singh *et al.*, 1997). Oxyflourfen + hand weeding, trifluralin, pendimethalin + hand weeding, hand weeding thrice and oxadiargyl + hand weeding resulted in significantly lower population of *L. temulentum*. Trifluralin, pendimethalin + hand weeding, hand weeding thrice and oxadiargyl + hand weeding significantly reduced the count of *A. ludoviciana*. However, trifluralin + hand weeding and oxyflourfen + hand weeding were equally effective for decreasing the count of *A. ludoviciana*. Pendimethalin + hand weeding remaining at par with hand weeding thrice, trifluralin + hand weeding and oxyflourfen + hand weeding resulted in significantly lower count of *V. sativa*. Trifluralin and pendimethalin might not be effective against *V. sativa* as count of *V. sativa* was significantly higher due to the former while later was statistically at par with weedy check.

The adequate control of *rabi* weeds owing to herbicidal treatments provided vacant space for *kharif* weeds to come up. This was evident from the data on counts of *E. colona* and *P. dichotomiflorum* (Table 2). The count of these

Table 2. Effect of treatments on species-wise count of *kharif* weeds and total weed dry matter accumulation (*rabi* and *kharif*)

Treatments	Dose (g/ha)	*Echinochloa*	*Panicum*	*Digitaria*	*Polygonum*	*Gallinsoga*	Weed dry weight (g/m^2)		
							2001	2002	Mean
Oxadiargyl	75	5.4 (29.3)	4.8 (4.8)	1.0 (0.0)	2.4 (6.6)	2.4 (6.6)	128.6	192.8	160.7
Oxadiargyl + HW	50	2.5 (6.6)	4.6 (4.6)	2.7 (8.0)	3.6 (17.3)	3.9 (20.0)	189.2	158.3	173.8
Oxyfluorfen	200	5.3 (2.3)	5.0 (5.0)	2.9 (9.3)	1.8 (4.0)	2.7 (6.6)	123.5	210.9	167.2
Oxyfluorfen + HW	100	6.2 (40.0)	6.1 (6.1)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	110.0	180.8	145.4
Trifluralin	1000	5.1 (26.6)	3.4 (3.4)	1.0 (0.0)	3.6 (13.3)	2.7 (8.0)	144.8	187.5	166.2
Trifluralin + HW	500	4.9 (25.3)	4.5 (4.5)	1.0 (0.0)	5.1 (26.6)	1.6 (2.6)	204.3	141.3	172.8
Pendimethalin	1500	4.1 (17.3)	2.0 (2.0)	1.6 (2.6)	4.6 (22.6)	1.6 (2.6)	126.2	129.9	128.1
Pendimethalin + HW	750	3.9 (14.6)	3.7 (3.7)	2.7 (8.0)	2.0 (5.3)	2.0 (4.0)	105.9	151.2	128.6
Hand weeding (HW)	-	6.1 (37.3)	5.0 (5.0)	1.6 (2.6)	3.2 (10.6)	1.0 (0.0)	92.8	147.3	120.1
Weedy		1.0 (0.0)	1.0 (1.0)	1.0 (0.0)	5.0 (25.3)	2.0 (5.3)	438.2	735.9	587.1
LSD (P=0.05)		1.6	1.2	NS	1.6	NS	55.9	75.0	78.5

HW – Hand weeding; Data transformed to square root ($\sqrt{x+1.0}$) transformation. Figures in parentheses are the original values.

weeds was either higher or not significantly different from weedy check. Similarly, the count of *P. alatum* under trifluralin alone and in integration with hand weeding, pendimethalin and oxadiargyl + hand weeding was not significantly different from weedy check. However, oxyflourfen + hand weeding being at par with oxyflourfen, oxadiargyl and pendimethalin + hand weeding resulted in significantly lower count of *P. alatum*.

All treatments were superior to weedy check in curtailing weed dry weed having weed control efficiency values ranging from 70.4% (oxadiargy + hand weeding) to 79.6% (hand weeding thrice). All herbicides were as good as hand weeding thrice in reducing weed dry weight. Herbicides at half rate in integration with hand weeding were as effective as at higher rate alone in reducing weed dry weight. This indicated economization of 50% dose of the herbicides with hand weeding.Weeds in weedy check reduced bulb yield by 86.1 and 77.6% over hand weeding thrice during the first and second year, respectively. Significantly higher bulb yield was recorded with hand weeding thrice (Table 3). However, trifluralin 1.0 kg/ha was equal in bulb yield as hand weeding thrice in the first year. Oxyflourfen + hand weeding and trifluralin + hand weeding were other superior treatments after hand weeding thrice in influencing bulb yield.

Hand weeding thrice had highest treatment efficiency index (19.4). This was followed by oxyflourfen + hand weeding, trifluralin + hand weeding and trifluralin. Weed management index (WMI), agronomic management index (AMI) and integrated weed management index (IWMI) were also the highest for hand weeding thrice, followed by trifluralin + hand weeding, oxyflourfen + hand weeding, trifluralin and oxadiargyl.

Table 3. Effect of treatments on bulb yield of onion, WCE, TEI, WMI, AMI and IWMI

Treatments	Dose (g/ha)	Bulb yield (kg/ha)			WCE (%)	TEI	WMI	AMI	IWMI
		2001	2002	Mean					
Oxadiargyl	75	6777	14604	10691	72.6	8.11	3.06	2.06	2.56
Oxadiargyl + HW	50	2516	13969	8243	70.4	5.01	2.11	1.11	1.61
Oxyfluorfen	200	5681	15238	10460	71.5	7.55	3.01	2.01	2.51
Oxyfluorfen + HW	100	6698	19524	13111	75.2	11.90	3.92	2.92	3.42
Trifluralin	1000	7460	15381	11421	71.7	8.62	3.40	2.40	2.90
Trifluralin + HW	500	5674	21588	13631	70.6	10.55	4.40	3.40	3.90
Pendimethalin	1500	6903	11953	9428	78.2	8.43	2.35	1.35	1.85
Pendimethalin + HW	750	6730	7699	7215	78.1	5.36	1.50	0.50	1.00
Hand weeding (HW)	-	8232	24762	16497	79.6	19.40	4.99	3.99	4.49
Weedy		1085	5556	3321	-	-	-	-	-
LSD (P=0.05)		936	2635	1687					

References

Verma SK and Singh T 1996. Weed control in *kharif* onion *(Allium cepa* L.). Indian J. Weed Sci. **28**: 48-51.

Walia US 2003. *Weed Management*. Kalyani Publishers, Ludhiana.

Prakash V, Pandey AK, Singh RD and Mani VP 2000. Integrated weed management in winter onion (*Allium cepa*) under mid-hill conditions of north-western Himalayas. Indian J. Agron. **45** (4): 816-21.

Singh R, Kohli UK and Nandal TR 1997. Efficacy of some selected weedicides against onion weeds in Himachal Pradesh. J. Hill Res. **10** (2): 200-01.