Research Paper :

Efficiency of chemical weed control methods in onion seed production for controlling weeds and its effect on yield

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SUMMARY

The experiment was laid out, in Randomised Block Design with three replications. Onion seed crop was grown in ridges and furrow layout and in eight treatments. All the herbicides were applied after planting of bulbs after second irrigation. An experimental soil was clayey in texture, low in available N (241.41 kg ha^{-1}), medium in available phosphorus (19.81 kg ha^{-1}) and moderately rich in available potassium (350.50 kg ha^{-1}). The yield contributing characters were influenced by herbicide + hand weeding at 30 DAP and weed free treatment up to 70 days after planting, resulting into significant increase in seed yield as compared to herbicide alone and weedy check treatments. The seed weight per umbel, test weight and seed yield were found to be significantly higher in weed free check followed by oxyfluorfen @ 0.1875 kg ha^{-1} + one hand weeding. Among the herbicide treatments oxyfluorfen @ 0.25 kg ha^{-1} recorded higher seed weight per umbel, test weight and seed yield followed by oxadiargyl @ 0.09 kg ha^{-1}. The gross, net monetary returns and B: C ratio were maximum in weed free check. The integration of oxyfluorfen @ 0.1875 kg a.i. ha^{-1} along with one hand weeding showed higher benefit : cost ratio followed by oxadiargyl @ 0.0675 kg a.i. ha^{-1} coupled with hand weeding. Integrated weed management of oxyfluorfen (PE) @ 0.1875 kg a.i. ha^{-1} in conjugation with one hand weeding at 30 DAP was the most viable proposition in controlling weeds in onion seed crop and increasing the seed yield and net monetary returns, followed by oxadiargyl (P.E.)@ 0.0675 kg a.i. ha^{-1} +one hand weeding at 30 days after planting.

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Onion (*Allium cepa* L.) is one of the most important vegetable cash crops grown for vegetable in green stage as well as for mature bulb. India is prominent in the world for production and its export. The area of onion crop in India is 410.25 thousand ha with production 5451.45 thousand tonnes. Maharashtra has a predominant position in the country in respect of area (65,000 ha) and production (13.75 lakh tonnes). The productivity of onion in Maharashtra was (124.5 q ha^{-1}).

It is essential to produce fresh seed every year for the next sowing. Limited availability of quality seed is due to high incidence of diseases and pests over the seed crop. Purity of seed is less due to its highly cross pollination and the use of self seed saved for raising the onion crop. The bulb yield from 48 to 85 per cent depending upon the duration of the crop, weed competition, weather condition and intensity of weeds (Bhalla, 1978). Adequate supply of high quality seed free from noxious weeds is the basic need for increasing the production of onion bulb. Though hand weeding is the effective measure, but it is not feasible and economic in onion seed production due to narrow spacing and more labourious. Therefore, in recent years herbicides are very commonly used as a means to overcome the farm labour pressure besides its beneficial effects for controlling the competition of weeds with main crop at critical growth stages. Therefore, the present investigation was carried out to study the efficiency of chemical weed in the onion seed production for controlling weeds and its effect on yield.

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MATERIALS AND METHODS

The experiment was conducted during *Rabi* season on Central Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri. Dist. Ahmednagar (Maharashtra). It lies between 19^0 48'N and 19^0 57' N latitude and between 74^0 35' E and 74^0 18'E longitude. The altitude varies from 495 to 569 meters above mean sea level. Climatologically, this area falls in the scarcity zone (semi-arid tropics) with an annual rainfall ranging from 317 to 619 mm. The average annual rainfall is 520 mm. The soil of the

experimental area was well drained with more than 1 m depth. There were eight treatments *viz.*, spraying of oxyfluorfen (PE) @ 0.25 kg a.i. ha^{-1}, fluchloralin (PE) @ 1 kg a.i. ha^{-1} oxadiargyl (PE) @ 0.09 kg a.i. ha^{-1}, oxyfluorfen (PE) @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 DAP, fluchloralin (PE) @ 0.75 kg a.i. ha^{-1} + one hand weeding at 30 DAP, oxadiargyl (PE) @ 0.0675 kg a.i. ha^{-1} + one hand weeding at 30 DAP, weed free treatment (weed free up to 70 days after planting) and weedy check. The gross and net plot sizes were 4.50 x 3.60 m^2 and 3.90 x 2.40 m^2. Good quality bulbs of N-2-4-1 variety of onion was used. The seed bulbs were treated with Bavistin and 0.5 per cent monocrotophos before planting. The one fourth portion of top was cut by sickle before planting. The treated bulbs were planted in ridges and furrows opened at 60 cm apart and spacing between two bulbs was 30 cm. At the time of planting the basal dose of 50 kg N, 50 kg P_2O_5 and 50 kg K_2O ha^{-1} along with 20 t FYM ha^{-1} was applied uniformly. The remaining dose of 100 kg N ha^{-1} was applied in two equal splits at 30 and 60 DAP as top dressing. The various treatments on plant characters the biometric observations were recorded at regular interval of 30 days throughout the life period of onion seed crop. The data recorded were statistically analysed by using technique of analysis of variance (Fisher, 1970) and significance was determined as given by Panse and Sukhatme (1985) for Randomized Block Design.

RESULTS AND DISCUSSION

The results obtained from the present investigation have been presented in the following sub heads :

Weed Intensity studies :

The data in respect of weed intensity at 30, 60, 90 DAP and at harvest as influenced by different weed control treatments are reported in Table 1. The periodical weed intensity in onion seed plot was significantly influenced by different herbicide treatments. It was increased up to 90 DAP and decreased at harvest irrespective of herbicide treatments except weed free treatment. Amongst the herbicide treatments alone, lowest weed intensity was observed in oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1} at 30, 60, 90 DAP and at harvest, respectively. However, it was at par with fluchloralin (P.E.) @ 1 kg a.i. ha^{-1} and oxadiargyl (P.E.) @ 0.09 kg a.i. ha^{-1} at 30, 60, 90 DAP and at harvest, respectively as compared to weedy check. Thus, the results indicate that herbicide alone decrease the weed intensity at early stage of crop growth. Similar results were reported by Randhawa *et al.* (1985).

The weed intensity at early stage of crop growth was further reduced at the later stage of crop growth with application of herbicides along with one hand weeding at 30 DAP. The use of oxyfluorfen (P.E.) @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 DAP was found significantly superior in reducing the weed intensity at 60, 90 DAP and at harvest among the treatments. Fluchloralin (P.E.) @ 0.75 kg a.i. ha^{-1}, and oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} each coupled with one hand weeding at 30 DAP were found next in order. The results indicated that application of herbicides alone is beneficial in reducing weed population at early stage of crop growth, further it can reduce the weed population when herbicides used was coupled with one hand weeding at 30 days after planting. This might be because application of herbicide alone is sufficient to reduce the weed intensity at early stage of crop growth. But at the later stage of crop growth

Table 1 : Periodical mean weed intensity as influenced by different treatments

Sr. No.	Treatments	Weed intensity m^2			
		At 30 DAP	At 60 DAP	At 90 DAP	At harvest
T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	8.33	79.10	91.18	82.95
T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	11.00	85.20	97.92	95.00
T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	11.66	85.00	98.00	87.20
T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	32.10	60.00	68.00	58.27
T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	46.07	60.10	72.16	65.10
T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	53.14	60.20	74.00	66.30
T_7 :	Weed free (up to 70 DAP)	00.00	00.00	21.20	34.00
T_8 :	Weedy check	79.17	105.00	150.29	96.00
S.E. ±		1.24	2.11	2.20	0.91
C.D. (P=0.05)		3.78	6.39	6.67	2.77
Mean		30.18	66.82	84.09	73.10

PE = Pre-emergence DAP = Days after planting

there might be degradation of herbicide or loss of herbicides either by volatization or leaching through soil, hence, there was more weed intensity at 60, 90, DAP in herbicide treatment.

In herbicides coupled with one hand weeding at 30 DAP, the weed intensity was reduced at later stage of crop growth. This might be due to that at 30 DAP almost all the weeds which were emerged were removed by the hand weeding resulting less weed intensity at later stages of crop growth. Similar findings were reported by Randhawa *et al*. (1985) and Singh *et al*. (1998).

Weed control efficiency :

Periodical weed control efficiency as influenced by various herbicide treatments are reported in Table 2. The weed control efficiency of various herbicide treatments was found statistically significant at 30, 60 and 90 DAP. The weed control efficiency of different herbicide treatments were more at 30 DAP than 60 and 90 DAP. The per cent weed control efficiency was significantly more in pre emergence application of oxyfluorfen @ 0.25 kg a.i. ha^{-1} at 30 DAP, 60 DAP and 90 DAP. Whereas, it was at par with pre-emergence application of fluchloralin @ 1.0 kg a.i. ha^{-1} and oxadiargyl @ 0.09 kg a.i. ha^{-1}. The pre emergence application of herbicides along with one hand weeding at 30 DAP recorded significantly lower weed control efficiency by oxfluorfen @ 0.1875 kg a.i. ha^{-1}, fluchloralin @ 0.75 kg a.i. ha^{-1} and oxudiargyl @ 0.0675 kg a.i. ha^{-1} at 30 DAP than herbicides alone. The weed control efficiency was also significantly higher when coupled with hand weeding at 30 DAP by the same treatments at 60 and 90 DAP. Malik *et al*. (1982) and Kolhe (2001). The per cent of weed control efficiency was more at early stage of weed growth by the application of herbicides alone. This might be because of total weeds were controlled by the herbicides. Hence, the weed control efficiency was more at early stage. It was drastically reduced at 60 DAP, this might be because of complete eradication of weeds at early stage. Whereas, it was slightly increased at 90 DAP. The increased weed control efficiency might be associated with increased weed population during the period between 60-90 DAP. These weeds were killed by the remains of residual quantity of herbicides. The results are in confirmity with the findings of Malik *et al*. (1982), Singh *et al*. (1998) and Kathepuri (2003).

Table 2 : Weed index and periodical weed control efficiency as influenced by different treatments

Sr. No.	Treatments	Weed index (%)	Per cent weed control efficiency (%)		
			At 30 DAP	At 60 DAP	At 90 DAP
T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	38.04	89.48	24.41	39.33
T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	48.88	86.09	19.98	34.84
T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	42.00	85.24	18.90	34.78
T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	35.63	59.42	42.81	54.74
T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	37.22	41.86	42.50	51.98
T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	36.04	32.82	42.54	50.75
T_7 :	Weed free (up to 70 DAP)	0.00	100.00	100.00	85.89
T_8 :	Weedy check	57.95	0.00	0.00	0.00
S.E. ±			1.47	2.15	1.47
C.D. (P=0.05)			4.46	6.52	4.46
Mean			61.86	36.39	44.04

PE = Pre- emergence DAP = Days after planting

Yield contributing characters and yield of onion seed:

The data pertaining to yield contributing characters and seed yield of onion as influenced by different treatments are presented in Table 3. The number of umbels per bulb was observed to be non significant due to different treatments of herbicide alone and herbicides + one hand weeding at 30 DAP as well as weed free treatment and weedy check. Numerically, the weed free treatment recorded the higher number of umbels per bulb and lower in weedy check and fluchloralin (PE) @ 0.75 kg a.i. ha^{-1} + one hand weeding at 30 DAP.

Among the treatments of herbicides alone, application of oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1} recorded significantly higher seed weight than fluchloralin (P.E.) @ 1 kg a.i. ha^{-1} and it was at par with oxadiargyl (P.E.) @ 0.09 kg a.i. ha^{-1}. However, application of oxyfluorfen (PE) @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 DAP recorded significantly higher seed weight per bulb than herbicide alone treatment and weedy check but it was at par with oxadiargyl @ 0.09 kg a.i. ha^{-1} and fluchloralin @ 0.75 kg a.i. along with one hand weeding at 30 DAP. Similar findings were reported by Randhawa *et al*. (1985), Semidey and Carabollo (1989) and Singh *et al*. (1998).

Use of oxyfluorfen (P.E.) @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 DAP was found beneficial for

Table 3 : Yield contributing characters and yield of onion seed as influenced by different treatments

Sr. No.	Treatments	Number of umbel per bulb	Diameter of umbel (cm)	Seed weight per bulb (g)	Test weight (g)	Seed yield (q/ha^{-1})
T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	6.26	6.13	9.59	3.69	5.26
T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	6.13	6.06	7.84	3.50	4.34
T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	6.13	6.13	8.80	3.58	4.91
T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	6.53	6.32	10.00	3.78	5.80
T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	5.93	6.18	9.60	3.65	5.33
T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	6.46	6.28	9.86	3.65	5.43
T_7 :	Weed free (up to 70 DAP)	7.00	6.83	14.13	4.80	8.49
T_8 :	Weedy check	5.93	6.03	6.42	3.38	3.57
S.E. ±		0.40	0.190	0.35	0.175	0.41
C.D. (P=0.05)		NS	NS	1.06	0.529	1.25
Mean		6.30	6.24	9.69	3.797	5.35

PE = Pre- emergence DAP = Days after planting NS- Non significant

seed weight per bulb in onion seed crop followed by oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1}. Weed free treatment registered significantly higher test weight of onion seed as compared to rest of the treatments (Table 4). Among the herbicide treatments application of oxyfluorfen @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 DAP recorded significantly higher test weight, however, it was at par with rest of the herbicide treatments. These observations indicate that the application of pre-emergence herbicide oxyfluorfen, fluchloralin and oxadiargyl alone and coupled with one hand weeding 30 days after planting is beneficial. The above findings are in confirmity with the findings of Manjunath *et al.* (1989), Ravinder Singh *et al.* (1998) and Kathepuri (2003). Thus, application of oxyfluorfen (P.E.) @ 0.1875 kg a.i. ha^{-1} or oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one hand weeding 30 days after planting was found beneficial for seed yield of onion.

Economics of weed control treatments:

Cost of cultivation, monetory returns, and benefit : cost ratio (B:C ratio) of onion seed crop as influenced by different herbicide treatments are reported in Table 4. The cost of cultivation of onion seed crop was considerably lower in oxadiargyl (PE) @ 0.09 kg a.i. ha^{-1} followed by fluchloralin (PE) @ 1 kg a.i. ha^{-1}. The remaining treatments were found almost similar in cost of cultivation. Weed free treatment recorded considerably higher gross, net monetary returns and benefit : cost ratio. It was followed by oxyfluorfen (PE) @ 0.1875 kg a.i. ha^{-1}

Table 4 : Economics of different herbicide treatments in onion seed crop

Sr. No.	Treatments	Cost of cultivation (Rs ha^{-1})	Gross monetory returns (Rs ha^{-1})	Net monetory returns (Rs ha^{-1})	B: C ratio
T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	50863	149400	98537	1:2.9
T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	50303	130200	79897	1:2.5
T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	50247	147300	97053	1:2.9
T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	52951	174000	121049	1:3.2
T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	52531	159900	107369	1:3.0
T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	52489	162900	110411	1:3.1
T_7 :	Weed free (up to 70 DAP)	59215	214800	155585	1:3.6
T_8 :	Weedy check	49215	77100	27885	1:1.5

PE = Pre-emergence DAP = Days after planting

^{1} + one hand weeding at 30 DAP Singh *et al*. (1998) and Kathepuri (2003). Thus, keeping the field of onion seed crop weed free up to 70 days after planting was more beneficial and advisible for higher gross and net monetary returns as well as benefit : cost ratio. Amongst the herbicidal treatments the application of oxyfluorfen (PE) @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 days after planting are beneficial and advisable for obtaining maximum gross, net monetary returns and benefit : cost ratio.

Conclusion :

It is concluded that the weed management of oxyfluorfen (PE) @ 0.1875 kg a.i. ha^{-1} in conjugation with one hand weeding at 30 DAP was the most viable proposition in controlling weeds in onion seed crop and increasing the seed yield and net monetary returns, followed by oxadiargyl (P.E.)@ 0.0675 kg a.i. ha^{-1} +one hand weeding at 30 days after planting.

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