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Nutrient uptake and phytotoxicity study of herbicides as influenced by different treatments in onion seed crop

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ABSTRACT

The experiment on nutrient uptake and phytotoxicity study of herbicides as influenced by different treatments in onion seed crop was laid out in randomised block design with three replications and eight treatments. 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 moderatly rich in available potassium (350.50 kg ha^{-1}). Among the herbicide treatment application of oxyfluorfen @ 0.25 kg a.i. ha^{-1} recorded maximum uptake of nitrogen, phosphorus and potassium, however it was at par with fluchloralin @ 1 kg a.i. ha^{-1} and oxadiargyl @ 0.09 kg a.i. ha^{-1} except uptake of phosphorus in fluchloralin. Use of oxyfluorfen @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 days after planting registered significantly maximum uptake of nitrogen, phosphorus and potassium. However, it was at par with fluchloralin @ 0.75 kg a.i. ha^{-1} and oxadiargyl @ 0.675 kg a.i. ha^{-1} along with one hand weeding at 30 days after planting in respect of uptake of nitrogen. Weed free treatment up to 70 days after planting removed the significant amount of nitrogen, phosphorus and potassium. The application of pre-emergence herbicides oxyfluorfen, fluchloralin and oxadiargyl along with one hand weeding at 30 days after planting are suitable to reduce the nutrient loss from the soil by weeds than herbicide alone. The cost of cultivation of onion seed crop 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 cost of cultivation. There was no sign of phytotoxicity to onion crop, due to herbicides used during investigation.

Key words : Nutrient uptake, Phytotoxicity, Onion yield

INTRODUCTION

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. Onion contains eleven common acids, 100 g of raw onion bulb tissue contains vitamin A, 0.03 mg of thiamin, 0.04 mg of riboflavin, 0.02 mg of niacin and 9 mg of ascorbic acid. It is rich in minerals like phosphorus, calcium and carbohydrates. It is essential to produce fresh seed every year for the next sowing. India is prominent in the world for production and its export. It is increasingly pursued by processing industry for dehydration in the form of onion flakes and powder, which are in great demand in the world market.

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. Amongst the different constraints in the production of onion, management of weeds is one of the most important factor. Weeds compete severely with crop for essential plant nutrients, space, sunlight and moisture. Thus, it reduces the bulb yield from 48 to 85 per cent depending upon the duration of the crop, weed competition, weather condition and intensity of weeds. Adequate supply of high quality seed free from noxious weeds is the basic need for increasing the production of onion bulb. In view of this, the present investigation was carried out on "Nutrient uptake and phytotoxicity study of herbicides as influenced by different treatments in onion seed crop."

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. 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

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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. 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 data recorded were statistically analysed by using technique of analysis of Variance (Fisher, 1970) and significance was determined as given by Panase and Sukhatme (1985) for randomized block design.

RESULTS AND DISCUSSION

The finding obtained from the present study as well as relevant discussion have been presented under following heads:

Nutrient uptake by onion crop :

The nutrient uptake of onion seed crop as influenced by pre-emergence herbicides, weed free and weedy check are presented in Table1. The data in respect of uptake of nitrogen, phosphorus and potassium at harvest by the onion seed crop was influenced significantly. Among the herbicide treatment application of oxyfluorfen @ 0.25 kg a.i. ha^{-1} recorded maximum uptake of nitrogen, phosphorus and potassium, however it was at par with fluchloralin @ 1 kg a.i. ha^{-1} and oxadiargyl @ 0.09 kg a.i. ha^{-1} except uptake of phosphorus in fluchloralin. Use of oxyfluorfen @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 days after planting registered significantly maximum uptake of nitrogen, phosphorus and potassium. However, it was at par with fluchloralin @ 0.75 kg a.i. ha^{-1} and oxadiargyl @ 0.675 kg a.i. ha^{-1} along with one hand weeding at 30 days after planting in respect of uptake of nitrogen. Weed free treatment up to 70 days after planting removed the significant amount of nitrogen, phosphorus and potassium. Weedy check treatment also observed the considerable removal of lower amount of nutrients by the onion seed crop at harvest. The magnitude of removing the nutrients from the soil by the weed free treatment up to 70 days was 66 per cent more than the weedy check. This was might be associated with the higher weed intensity in weedy check. The higher weed population removed the more nutrients than the onion seed crop. The weed plant has inherent property to grow faster than onion crop. Hence, weeds removed more nutrients from soil which reflected in lower values of nutrient uptake by onion seed crop. These results were corroborative with Prasad and Srivastava (1991)

Use of oxyfluorfen (P.E.) @ 0.1875 kg a.i. ha^{-1} + one hand weeding at 30 days after planting is suitable for nutrient uptake by onion seed crop. It was followed by oxadiargyl (PE) @ 0.0675 kg a.i. ha^{-1} and fluchloralin (PE) @ 0.75 kg a.i. ha^{-1} coupled with one hand weeding at 30 days after planting.

Nutrient uptake by weeds :

Nutrient uptake by weeds at harvest as influenced by different treatments are presented in Table 2.Total uptake of nitrogen, phosphorus and potassium by weed

Table 1 : Nutrient uptake (kg ha^{-1}) by onion seed crop at harvest as affected by different treatments

	Treatments	Nutrient uptake (kg ha^{-1})		
		N	P_2O_5	K_2O
T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	58.80	42.10	53.77
T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	56.78	35.14	52.36
T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	55.75	40.15	53.76
T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	70.12	54.10	62.13
T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	66.15	47.10	56.10
T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	67.12	48.10	56.14
T_7 :	Weed free (up to 70 DAP)	79.97	67.50	72.50
T_8 :	Weedy check	30.70	22.17	26.14
S.E. ±		1.59	0.81	1.32
C.D. (P=0.05)		4.82	2.48	4.03
Mean		60.67	54.11	44.54

PE = Pre-emergence DAP= Days after planting

Table 2. Nutrient uptake by weeds (kg ha^{-1}) at harvest as influenced by different treatments

Treatments		Nutrient uptake (kg ha^{-1})		
		N	P_2O_5	K_2O
T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	16.00	2.97	13.42
T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	17.11	3.50	13.47
T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	16.64	3.50	13.45
T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	16.15	2.95	11.00
T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	16.10	3.00	13.00
T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	16.00	2.95	13.14
T_7 :	Weed free (up to 70 DAP)	10.12	1.75	10.00
T_8 :	Weedy check	45.30	7.00	13.05
S.E. ±		0.42	0.41	0.20
C.D. (P=0.05)		1.28	1.25	0.60
Mean		19.17	3.45	12.56

PE = Pre-emergence DAP = Days after planting

at harvest was significant due to different herbicide treatments. The highest nutrient uptake was observed in weedy check. While it was the lowest in weed free check. Among the herbicidal treatments, application of fluchloralin alone @ 1.0 kg a.i. ha^{-1} registered the maximum uptake of nitrogen, phosphorus and potassium, however it was at par with application of oxyfluorafen and oxadiargyl alone and along with one hand weeding at 30 DAP. The variation in the total nutrient uptake by weed was mainly because of weed population and weed biomass from the respective treatments. Thus, the application of pre-emergence herbicides oxyfluorfen, fluchloralin and oxadiargyl along with one hand weeding at 30 days after planting are suitable to reduce the nutrient loss from the soil by weeds than herbicide alone.

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 3. The cost of cultivation of onion seed crop 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 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} + one hand weeding at 30 DAP. The variation in cost of cultivation, gross and net monetory returns was mainly because of cost of herbicide formulations, weeding charges and efficiency of herbicides to control the weeds in the field. Similar results were reported by Bannon *et al.* (1988), Ravinder 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

Table 3 : Economics of different herbicide treatments in onion seed crop

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
	S.E. ±	--	9077.220	9933.744	0.198
	C.D. (P=0.05)	--	27532.570	30130.540	0.602
	Mean		148087.500	97110.750	2.796

PE = Pre-emergence DAP = Days after planting

Table 4 : Phytotoxicity study of herbicides used in onion seed crop an (a) Injury an leaf tips and leaf surface (b) Wilting (c) Vein clearing (d) Necrosis (e) Epinasty (f) Hyponasty

Score	Phytotoxicity		Treatments	Days after application (DAA)		
				1 DAA	7 DAA	15 DAA
0	No Phytotoxicity	T_1 :	Oxyfluorfen (P.E.) @ 0.25 kg a.i. ha^{-1}	0	0	0
1	0-10	T_2 :	Fluchloralin, (P.E.) @ 1 kg a.i. ha^{-1}	0	0	0
2	11-20	T_3 :	Oxadiargyl, (P.E.) @ 0.09 kg a.i. ha^{-1}	0	0	0
3	21-30	T_4 :	Oxyfluorfen, (P.E.) @ 0.1875 kg a.i. ha^{-1} + one HW at 30 DAP)	0	0	0
4	31-40	T_5 :	Fluchloralin, (P.E.) @ 0.75 kg a.i. ha^{-1} + one HW at 30 DAP)	0	0	0
5	41-50	T_6 :	Oxadiargyl (P.E.) @ 0.0675 kg a.i. ha^{-1} + one HW at 30 DAP	0	0	0
6	51-60					
7	61-70					
8	71-80					
9	81-90					
10	91-100					

DAA = Days after application

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:

The application of pre-emergence herbicides oxyfluorfen, fluchloralin and oxadiargyl along with one hand weeding at 30 days after planting are suitable to reduce the nutrient loss from the soil by weeds than herbicide alone.

There was no sign of phytotoxicity to onion crop, due to herbicides used during investigation.

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