Short communication

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Weed control in onion with herbicides

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Onion (*Allium cepa* L.) is the most important vegetable spices in the world and top most export commodity among vegetables. The extremely slow growth in the initial stages, non-branching habit, sparse foliage and shallow root system in onion exhibit greater susceptibility to weeds and results into low productivity. Hand weeding is a tedious expensive and time consuming task due to closer spacing. Non-availability of labour during critical period of crop makes hand weeding difficult leading to heavy yield losses. Herbicides when used with one or two hand weeding showed improved efficiency in control of weeds. Therefore, present experiment was conducted to screen different herbicides and to identify their optimum doses alone and in combination for effective control of weeds.

The experiment was conducted at Mahatma Phule Krishi Vidyapeeth, Rahuri, Ahmednagar during *Kharif 20*12. The experiment was laid out in randomized block design consisted of nine weed control treatments, *viz*. weed free, weedy check (control), pendimethalin1.0 kg/ha pre-emergence treatment (PE) *fb* 1 hand weeding (HW) at 45 DAT, oxyfluorfen 0.150 kg/ha (PE) *fb* 1 HW at 45 DAT, as post-emergence (POE) quizalofop-ethyl 0.05 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT, pendimethalin1.0 kg/ha(PE) *fb* oxyfluorfen 0.25 kg/ha at 45 DAT (POE), pendimethalin1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.05 kg/haat 45 DAT (POE), pendimethalin1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 45 DAT and quizalofop-ethyl 0.037 kg/ha+ oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT. The gross and net plot sizes were 3.00 x 4.20 m^2 and 2.40 x 3.80 m^2, respectively. The variety used was '*Baswant-780'*. The soil was low in available nitrogen (181.12 kg/ha), low in available P_2O_5 (18.44 kg/ha) and very high in available K_2O (410.44 kg/ha) and slightly alkaline in reaction (pH 7.8). The seedlings were transplanted at 15 cm x 10 cm spacing on ridges and furrow. The recommended dose of fertilizer *i.e*. 100 kg N/ha, 50 Kg P_20_5/ha and 50 kg K_20/ha was applied. Along with growth and yield parameters, the weed density and biomass were recorded and weed control efficiency and weed index were estimated as measures of weed control efficiency.

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Weed flora

The major weed species observed in the experimental plot were sedges *Cyperus rotundus*, monocot weeds *Cynodon dactylon, Echinochloa crusgalli* and broad-leaf weeds, *Parthenium hysterophorus, Amaranthus spinosus, Convolvulus arvensis, Digera arvensis* and *Euphorbia* sp.

Weed density

The weed density/m^2 at all growth stages was significantly lowest in weed free treatment. Among the herbicide treatment it was lower in application of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb*1 HW at 45 DAT at all days of observations. The results were in conformity with those obtained by Bhutia *et al.* (2005) and Khalid *et al.* (2006).

Weed biomass

In the weed free treatment, there was no weed dry matter due to absence of weeds. The treatment quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT recorded the lowest weed biomass/ha (22 kg/ha). The weedy check recorded the highest weed biomass (194 kg/ha). This might be due to highest weed intensity and its dominance which utilized the sunlight, nutrients, moisture, CO_2 *etc*. over crop plants and resulted into higher growth and ultimately the higher weed biomass in weedy check. Similar results were reported by Warade *et al.* (2006) and Chopra and Chopra (2007).

Weed control efficiency (WCE)

Among the herbicidal treatments, application of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT recorded significantly higher weed control efficiency (88.49%). The weed free treatment was found significantly su-

perior by recording 100% weed control efficiency. The higher WCE in these treatments might be due to the significant reduction in weed biomass because of the effective weed control practices through application of pre-emergence and/or post-emergence herbicides and hand weeding. The results were well collaborating with the findings of Kathiresan *et al.* (2004).

Weed index (WI)

Among the herbicidal treatments, application of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ ha at 21 DAT (POE) *fb* 1 HW at 45 DAT recorded the lower weed index (4.42%). It was at par with sequential application of herbicides *i.e.* pendimethalin 1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 45 DAT (4.86 %). Weed free treatment recorded the lowest weed index (0%) indicating that there was no reduction in bulb yield in this treatment due to weed infestation. The highest weed index (72.16%) was recorded in weedy check (control) as a result of uncontrolled weed growth which lead to higher competition with the crop. The similar results were obtained by Kathiresan *et al.* (2004).

Bulb yield

The onion bulb yield (24.43 t/ha) was recorded significantly higher in weed free treatment and it was at par with the integrated treatment *i.e.* application of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ ha at 21 DAT (POE) *fb* 1 HW at 45 DAT (23.80 t/ha) and the treatment *i.e.* application of pendimethalin 1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 45 DAT (23.50 t/ha). This might be due to vigorous growth of the crop due to the availability of sufficient nutrients, moisture, light and space owing to absence of weeds and/or presence of minimum weed densities because of higher weed control efficiency which would compete for the same.This enabled plants to efficiently utilize sun light and water for photosynthesis which led to higher plant height, increased number of leaves and finally the increase in bulb yield. The lowest onion bulb yield (0.70 t/ha) was recorded in weedy check as the presences of more weeds which interfered with growth and development of the crop and compete for the nutrients, moisture, light and space. These results were in close confirmity with those reported by Warade *et al.* (2006) and Patel *et al.* (2012).

Economics of various treatments

The cost of cultivation (` 77,148/ ha) and gross monetary returns (` 2,44,246/ha) were significantly higher in weed free treatment. It was followed by the application of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT which recorded cost of cultivation ` 70,178 / ha and gross monetary returns ` 2,38,017/ha. While B: C ratio (3.48) was significantly higher in application ofpendimethalin 1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 45 DAT. It was followed by integrated weed management treatment *i.e.* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen

Table 1. Weed density, weed biomass, weed control efficiency (WCE) and weed index (WI) as influenced by different treatments

Treatment	Dose kg/ha	Time of application	Weed density (no./m^2)			Weed biomass at harvest (kg/ha)	WCE (%)	WI (%)
			28 DAT	56 DAT	84 DAT			
Pendimethalin as PE *fb* 1 HW	1.0	45 DAT	1.91 (2)	2.5 (4)	1.91 (2)	53.0	73.3	8.09
Oxyfluorfen as PE *fb* 1 HW	0.150	45 DAT	5.16 (22)	2.5 (4)	3.66 (10)	54.0	65.1	13.21
Quizalofop-ethyl as POE *fb* 1 HW	0.05	21 and 45 DAT	7.43 (48)	2.3 (3)	2.95 (6)	67.0	60.6	16.52
Pendimethalin as PE *fb* oxyfluorfen as POE	1.0 0.25	45 DAT	1.91 (2)	3.33 (8)	3.82 (11)	77.0	72.1	10.35
Pendimethalin as PE *fb* quizalofop-ethyl as POE	1.0 & 0.05	45 DAT	1.91 (2)	3.33 (8)	4.37 (15)	81.0	58.4	22.16
Pendimethalin as PE *fb* quizalofop-ethyl as POE + oxyfluorfen as POE	1.0 & 0.037 0.18	45 DAT	1.5 (1)	2.23 (3)	2.23 (3)	46.0	76.1	4.86
Quizalofop-ethyl as POE + oxyfluorfen as POE *fb* 1 HW	0.037& 0.18	21 and 45 DAT	2.23 (3)	0.7 (0)	2.23 (3)	22.0	88.5	4.42
Weed free	-	-	0	0	0	0.0	100	0
Weedy check	-	-	9.33 (78)	10.3 (96)	10.89 (108)	194.0	0	72.16
LSD (P=0.05)			2.13	1.65	2.33	0.97	0.72	5.44

Figures in parentheses indicate actual values, HW = Hand weeding, *fb* = Followed by, DAT = Days after transplanting, PE = Pre-emergence, POE = Post-emergence

Table 2. Herbicide efficiency and economics as influenced by different treatments

Treatment	Dose kg/ha	Time of application	Bulb yield (t/ha)	Cost of cultivation (x10^3 `/ha)	Gross monetary returns (x10^3 `/ha)	Net monetary returns (x10^3 `/ha)	B: C ratio
Pendimethalin as PE *fb* 1 HW	1.0	45 DAT	22.91	69.98	229.08	159.10	3.27
Oxyfluorfen as PE *fb* 1 HW	0.150	45 DAT	21.62	68.73	216.24	147.50	3.15
Quizalofop-ethyl as POE *fb* 1 HW	0.05	21 and 45 DAT	20.78	69.65	207.83	138.17	2.98
Pendimethalin as PE *fb* oxyfluorfen as POE	1.0 0.25	45 DAT	22.34	66.48	223.44	156.95	3.36
Pendimethalin as PE *fb* quizalofop-ethyl as POE	1.0 & 0.05	45 DAT	19.41	66.93	194.12	127.18	2.90
Pendimethalin as PE *fb* quizalofop-ethyl as POE + oxyfluorfen as POE	1.0 & 0.037 0.18	45 DAT	23.50	67.46	235.04	167.58	3.48
Quizalofop-ethyl as POE + oxyfluorfen as POE *fb* 1 HW	0.037 & 0.18	21 and 45 DAT	23.80	70.17	238.02	167.84	3.39
Weed free	-	-	24.43	77.14	244.25	167.10	3.16
Weedy check	-	-	07.1	62.83	70.63	7.79	1.12
LSD at P=0.05	--	--	01.31	-	13.19	13.19	0.18

HW=Hand weeding, *fb* = Followed by, DAT = Days after transplanting, PE = Pre- emergence, POE = Post-emergence

0.18 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT (3.39). The net monetary returns among weed control treatments was recorded maximum (` 1,67,839/ ha) in integrated weed management, *viz*. spraying of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ ha at 21 DAT *fb* 1 HW at 45 DAT than rest of the weed control treatments (Table 2)

It was concluded that for obtaining higher yields and net monetary returns, onion be planted with the use of quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb*1 HW at 45 DAT for effectively managing weeds in *Kharif* season.

SUMMARY

A field experiment was conducted at PGI farm, M.P.K.V., Rahuri during *Kharif,* 2012. The experiment was laid out in randomized block design with three replications and nine treatments consisted of different weed control treatments, *viz*. weed free, weedy check (control), pendimethalin 1.0 kg/ha (PE) *fb* 1 HW at 45 DAT, oxyfluorfen 0.150 kg/ha (PE) *fb* 1 HW at 45 DAT, quizalofop-ethyl 0.05 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT, pendimethalin 1.0 kg/ha(PE) *fb* oxyfluorfen 0.25 kg/ha at 45 DAT (POE), pendimethalin 1.0 kg/ha(PE) *fb* quizalofop-ethyl 0.05 kg/haat 45 DAT (POE), pendimethalin 1.0 kg/ha(PE) *fb* quizalofop-ethyl 0.037 kg/ha+ oxyfluorfen 0.18 kg/ haat 45 DAT (POE), quizalofop-ethyl 0.037 kg/ha+ oxyfluorfen 0.18 kg/haat 21 DAT (POE) *fb* 1 HW at 45 DAT. The onion, *cv*. '*Baswant-780'*, was transplanted on ridges and furrow. The lowest weed population, weed biomass, weed index and higher weed control efficiency were recorded in weed free check and were at par with application of quizalofop-ethyl 0.037 kg/ha+ oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb* 1 HW at 45 DAT which was followed by spraying of pendimethalin1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 45 DAT. Pendimethalin1.0 kg/ha (PE) *fb* quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 45 DAT proved to be the most remunerative weed control treatment, which recorded the highest benefit: cost ratio (3.48). However, the highest net monetary returns (` 1,67,839/ ha) was recorded quizalofop-ethyl 0.037 kg/ha + oxyfluorfen 0.18 kg/ha at 21 DAT (POE) *fb*1 HW 45 DAT with benefit:cost ratio of 3.39.

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