Indian Journal of Weed Science **46**(2): 142–145, 2014

Weed management in onion by pre-planting and post-emergence herbicides for seed production

Aniket Kalhapure*, Balasaheb Shete and Madhukar Dhonde
Seed Cell Unit, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra 413 722

Received: 16 March 2013; Revised: 21 April 2014

ABSTRACT

A field experiment was conducted at Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India for two consecutive *Rabi* seasons 2011 and 2012 to find out most suitable and efficient combination of different pre-plant and post-emergence herbicides to control weeds in onion seed production crop. Experiment was conducted in randomized block design with 9 treatments and three replications consisting of pre-plant application of pendimethalin, post-emergence application of oxyfluorfen and quizalofop-ethyl and their different combinations. The pre-plant application of pendimethalin 0.750 kg/ha followed by post-emergence application of oxyfluorfen 0.250 kg/ha mixed with quizalofop-ethyl 0.050 kg/ha resulted in effective control of various broad-leaf and grassy-weeds and recorded lower weed density, weed biomass, weed index and higher weed control efficiency. This treatment also produced higher number of umbels per plant, plant dry matter, number of seeds per umbel, seed weight per umbel, 1000 seed weight and longer flowering stalk, and diameter of umbel. It also produced higher seed yield (439.30 kg/ha), gross return (` 329,475/ha), net return (` 192,450/ha) and B:C ratio (2.40) over all the other chemical weed control treatments.

Key words: Chemical control, Onion seed, Pre-emergence, Post-emergence, Weed management

Onion (*Allium cepa* L.) is an important vegetable crop which used in daily diet of people in the whole world. It becomes a major cash crop with higher market demand and price due to its culinary, dietary and medicinal values. In rainfed area, when protective irrigations are available, the onion crop performs better in monsoon season. It can generate more income than other annual or perennial cash crops within the short duration of 20 to 22 weeks when cultivated for seed production. Weed infestation is the important constraint in onion seed production, which causes reduction in bulb and seed yield to the tune of 40 to 80% (Channapagoudar and Biradar 2007). Onion grown for seed production is slow growing, shallow rooted crop with narrow upright leaves and non-branching habit. Due to this type of growing habit, it can not compete well with weeds. In addition to this, frequent irrigation and fertilizer application allows for successive flushes of weeds in onion. The conventional methods of weed control such as hoeing, weeding, *etc*. are laborious and very expensive. More over weeding during critical growth stages is very difficult due to increased cost of human labors and its scarce availability. Use of pre-plant and post-emergence herbicides may prove as the solution for over dependence on labors in onion weed control, but their proper combination, doses and time of application is more important for better results with low cost. Hence, present investigation was conducted to find out best suitable combination of pre-plant and post-emergence herbicides in seed production onion for effective control of weeds with higher seed yield.

***Corresponding author:** aniketmpkv@gmail.com

MATERIALS AND METHODS

A field experiment in randomized block design was conducted with 9 treatments and three replications at the Breeder Seed Production Farm of Mahatma Phule Krishi Vidyapeeth, Rahuri during two consecutive *Rabi* seasons (2011 and 2012). The experimental site was located at 19^0 47' N latitudes and 74^0 81' E longitudes. The average rainfall is 520 mm however, 421 mm and 445 mm was received as annual of 2011 and 2012, respectively. No rainfall received during the experimental period of *Rabi* season for both the years. The soil of experimental field was deep with silty clay loam in texture, slightly alkaline pH (8.7), medium in organic carbon (0.59%), available P_2O_5 (19.8 kg/ha), K_2O (277.8 kg/ha) and low in available N (252.5 kg/ha). Bulbs of onion variety *'Baswant- 780'* were planted at first fortnight of December for both the years on ridges and furrow of 60 cm wide with plant spacing of 30 cm with seed rate of 5 tone bulbs/ha. Recommended dose of fertilizers (120 kg N/ha + 60 kg P/ha + 60 kg K/ha) was applied

as whole P and K at the time of sowing and N in two split doses as 50 per cent at the time of planting and remaining 50 per cent at 30 days after planting. Treatments consisted of: T_1- pendimethalin 0.750 kg/ha + oxyfluorfen 0.250 kg/ha + quizalofop-ethyl 0.050 kg/ha, T_2- oxyfluorfen 0.250 kg/ha + quizalofop-ethyl 0.050 kg/ha,T_3-pendimethalin 0.750 kg/ha + quizalofop-ethyl 0.050 kg/ha, T_4- pendimethalin 0.750 kg/ha+ oxyfluorfen 0.250 kg/ha, T_5- oxyfluorfen 0.250 kg/ha, T_6- quizalofop 0.050 kg/ha, T_7- pendimethalin 0.750 kg/ha and T_8- weedy check (three hand weeding at 20, 40 and 60 days after planting and one manual uprooting of weeds at 90 days after planting), T_9- weed free check. Crop was infested with blight and anthracnose diseases for both the years which were controlled by alternately spraying of fungicides mancozeb 0.750 kg/ha + carbendezim 0.750 kg/ha, propineb 0.350 kg/ha and tebuconezole 0.200 kg/ha. Three sprayings of insecticides for controlling aphids and thrips were also followed as- first spray of diamethoate 0.150 kg/ha, second spray of acephate 0.600 kg/ha and third spray of imidacloprid 0.040 kg/ha. Regular irrigations were provided to crop generally at 12 to 15 days interval up to 110 days after planting. Regular biometric observations were recorded at specific time intervals by selecting randomly five plants in each treatment. Mature umbels were harvested in three pickings from 125 to 140 days after planting for both the years and yield observations were recorded from net plots. Weed density (no./m^2) and biomass of weeds (g/m^2) were recorded by putting a quadrate of 1 m^2 at two random spots in each plot. Weed control efficiency and weed index was calculated by standard formula.

For economic study, prevailing market prices were used for different outputs and inputs. The trend of observations was same for both the years, hence data were subjected to pooled analysis for interpreting the results.

RESULTS AND DISCUSSION

Effect on weed

The dominant grassy weed species observed in experimental field were *Cynodon dactylon, Dinebra retroflexa, Setaria italica, Digitaria sanguinalis, Echinochloa crusgalli, Cyperus rotundus, Acrachne racemosa* and *Dactyloctenium aegyptium.* The broad-leaved weeds were *Boerhaavia diffusa, Parthenium hysterophorus, Digera arvensis, Alternanthera echinata, Amaranthus viridis, Legascea mollis, Phyllanthus maderaspatensis, Euphorbia* spp. and *Portulaca oleracea*. Different weed parameters in onion seed production crop were significantly affected by application of various pre-plant and post-emergence herbicides (Table 1). Combination of pre-planting application of pendimethalin 0.750 kg/ha with mixed use of oxyfluorfen 0.250 kg/ha and quizalofop-ethyl 0.050 kg/ha as post-emergence recorded lower density of grassy and broad-leaved weeds, weed biomass and weed index and higher weed control efficiency as compared to all the other herbicidal treatments. This might be due to the combined action of pre-planting and post-emergence herbicides used in onion. The primary mode of action of pendimethalin is to inhibit microtubule formation in cells of susceptible monocot and dicot weeds which are an important part of the cell division process. As a result of restricted cell division, growth of the emerging weed seedling is prevented, eventuating in death due to lack of food reserves. Similar results of application of pendimethalin in onion were also reported by Hussain *et al.* (2008). The broad-leaf and grassy-weeds were escaped from action of pendimethalin were controlled up to maximum amount by application of oxyfluorfen and quizalofop-ethyl, respectively at 25 days after planting, when these weeds were at 3-4 leaf stage. Oxyfluorfen disturbs the chlorophyll synthesis pathway of susceptible weeds by inhibiting the enzyme called 'protoporhirinogen oxidase'. It also causes break down the cell membrane of leaf by which weed dies. Ghosheh (2004) has also discussed the effects of post-emergence application of oxyfluorfen for weed control in onion crop. Quizalofop-ethyl inhibit the activity of the acetyl-CoA carboxylase enzyme, which is necessary for fatty acid synthesis in grassy weeds. These effects of quizalofop for controlling weeds in onion are in confirmation with the earlier results reported by Yumnam *et al.* (2009). Highest number of grassy and broad-leaf weeds, weed biomass and weed index and lowest weed control efficiency were observed in control treatment.

Effect on growth and yield

Maximum number of umbels per plant, length of flowering stalk, plant dry matter, number of seeds per umbel, diameter of umbel and seed weight per umbel were recorded in treatment weed free check (Table 2). Considering the chemical treatments, combined application of pre-plant pendimethalin 0.750 kg/ha with post- emergence application of oxyfluorfen 0.250 kg/ha mixed with quizalofop-ethyl 0.050 kg/ha was proved more dominant in respect of these growth and yield attributing characters. However, it was at par with post-emergence mixed application of oxyfluorfen

and quizalofop-ethyl in respect of number of umbels per plant. This might be due to the decreased competition of weed with crop for space, water, air, nutrients and sunlight because of their effective control as a result of application of different pre- and post-emergence herbicides. It provides better environment and other resources in sufficient quantity for the proper growth and development of crop. Kalhapure *et al.* (2013) also reported that the application of pendimethalin as pre- emergence and oxyfluorfen as post-emergence was responsible for better growth and development of onion crop due to the weed free environment. The effect of application of different pre- and post-emergence herbicides was found to be non significant in respect of 1000 seed weight of onion. All the growth and yield attributing characters were found lower in control treatment.

Effect on yield and economics

Significantly highest seed yield of onion (573.60 kg/ha), gross returns (` 4,30,200/ha), net returns (` 2,80,350/ha) and B:C ratio (2.87) were recorded in treatment weed free check as compared to all other treatments. Among weedicide treatments, pre-plant application of pendimethalin 0.750 kg/ha along with post-emergence application of oxyfluorfen 0.250 kg/ha mixed with quizalofop-ethyl 0.050 kg/ha produced significantly higher onion seed yield (439.30 kg/ha), gross returns (` 3,29,475/ha), net returns (` 1,92,450/ha) and B:C ratio (2.40) in pooled analysis as compare to all other treatments (Table 3). Lowest seed yield of onion was recorded in control which was 59.03 kg/ha. Kalhapure and Shete (2013) reported the improvement in yield and economical parameters from combined use of pendimethalin as pre plant and oxyfluorfen as post-emergence in onion.

Table 1. Effect of different treatments on various weed parameters in onion at harvest (pooled data of two years)

Treatment	Weed density/m^2		Weed biomass (g)	Weed control efficiency (%)	Weed index (%)
	Grassy weeds	Broad-leaved weeds			
T_1- Pendimethalin 0.750 kg/ha + oxyfluorfen 0.250 kg/ha+ quizalofop-ethyl 0.050 kg/ha	16.26	8.65	37.74	86.10	23.41
T_2- Oxyfluorfen 0.250 kg/ha+ quizalofop-ethyl 0.050 kg/ha	27.69	12.65	68.52	74.76	36.57
T_3- Pendimethalin 0.750 kg/ha+ quizalofop-ethyl 0.050 kg/ha	19.25	26.15	85.91	68.36	50.32
T_4- Pendimethalin 0.750 kg/ha+ oxyfluorfen 0.250 kg/ha	41.65	16.38	98.34	63.79	50.60
T_5- Oxyfluorfen 0.250 kg/ha	56.61	32.61	131.66	51.52	57.19
T_6- Quizalofop 0.050 kg/ha	28.64	43.98	114.15	57.97	60.37
T_7- Pendimethalin 0.750 kg/ha	72.98	34.63	151.28	44.29	73.41
T_8- Weedy check	97.93	68.27	271.56	00	89.71
T_9- Weed free check	11.65	7.36	19.12	92.96	-
LSD (P=0.05)	3.99	2.17	5.64	-	-

Table 2. Effect of different treatments on various growth and yield attributing characters in onion seed crop (pooled data of two years)

Treatment	Number of umbels per plant at 90 DAP	Length of flowering stalk at 90 DAP (cm)	Plant dry matter at harvest (g)	Number of seeds per umbel at harvest	Diameter of umbel at harvest (cm)	Seed weight per umbel (g)	1000 seed weight (g)
T_1	4.14	79.67	37.59	484.78	7.04	1.91	3.94
T_2	3.68	73.50	33.75	455.24	6.48	1.78	3.91
T_3	3.09	70.63	30.38	442.67	5.96	1.66	3.75
T_4	3.11	68.72	28.77	421.60	5.82	1.64	3.89
T_5	2.78	62.51	25.13	439.22	4.88	1.59	3.62
T_6	2.64	60.44	24.28	417.78	4.64	1.55	3.71
T_7	1.92	54.26	21.90	400.56	4.15	1.43	3.57
T_8	1.25	39.86	16.96	247.82	3.67	0.85	3.43
T_9	4.63	83.39	42.06	553.35	7.52	2.23	4.03
LSD (P=0.05)	0.51	2.72	3.24	12.44	0.42	0.11	NS

(DAP- Days After Planting)

Table 3. Effect of weed control treatments on onion seed yield and economics

Treatment	Seed yield (kg/ha)			Gross returns (x10^3 `/ha)			Net returns (x10^3 `/ha)			Cost of cultivation (x10^3 `/ha)			B:C ratio		
	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Pooled	2011	2012	Mean
T_1	411.4	467.2	439.3	308.5	350.4	329.5	173.0	211.9	192.4	135.5	138.5	137.0	2.28	2.53	2.4
T_2	336.6	391.2	363.9	252.5	293.4	272.9	117.8	155.7	136.8	134.6	137.6	136.1	1.87	2.13	2
T_3	271.5	298.4	285.0	203.6	223.8	213.7	70.1	87.2	78.6	133.6	136.6	135.0	1.52	1.64	1.58
T_4	261.2	305.5	283.3	195.9	229.1	212.5	62.2	92.4	77.3	133.7	136.7	135.2	1.47	1.68	1.57
T_5	224.7	266.5	245.6	168.5	199.8	184.2	35.8	64.1	50.0	132.7	135.7	134.2	1.27	1.47	1.37
T_6	202.4	252.3	227.3	151.8	189.2	170.5	19.0	53.4	36.2	132.8	135.8	134.3	1.14	1.39	1.27
T_7	136.4	168.6	152.5	102.3	126.5	114.4	-28.9	-7.7	-18.3	131.2	134.2	132.7	0.78	0.94	0.86
T_8	51.3	66.7	59.0	38.5	50.0	44.3	-91.8	-83.3	-87.6	130.3	133.3	131.8	0.30	0.38	0.34
T_9	521.4	625.8	573.6	391.1	469.3	430.2	242.7	318.0	280.3	148.3	151.3	149.8	2.64	3.1	2.87
LSD (P=0.05)	24.4	26.6	23.4	14.5	15.7	12.7	10.6	12.6	8.9	6.2	8.2	5.9	-	-	-

Combined application of pre-plant pendimethalin 0.750 kg/ha with post-emergence application of oxyfluorfen 0.250 kg/ha mixed with quizalofop-ethyl 0.050 kg/ha is the best efficient chemical weed management method for controlling important grassy and broad-leaf weeds in seed production onion with higher yield and monetary return.

REFERENCES

Channapagoudar BB and Biradar NR. 2007. Physiological studies on weed control efficiency in direct sown onion. *Karnataka Journal of Agricultural Science* **20**(2): 375-376

Ghosheh HZ. 2004. Single herbicide treatments for control of broad-leaved weeds in onion (*Allium cepa*). *Crop Protection***23**(6): 539-542.

Hussain Zahid, Khan Bahadar Marwat, Syed Ishfaq Ali Shah, Shahnaz A Arifullah and Noor Maula Khan. 2008. Evaluation of different herbicides for weed control in onion. *Sarhad Journalof Agriculture* **24**(3): 453-456.

Kalhapure AH and Shete BT. 2013. Effect of weed management practices on weed dynamics, weed control efficiency, bulb yield and economics in onion. *Journal of Agriculture Research and Technology* **38**(2): 238-240.

Kalhapure AH, Shete BT and Bodake PS. 2013. Integrated weed management in onion (*Allium cepa*). *Indian Journal of Agronomy* **58**(3): 122-125.

Yumnam A, Mandal AR,Thapa U, Maity TK and Bhattacharya SP. 2009. Studies on weed management in onion (*Allium cepa* L.). *Journal of Crop and Weed* **5**(1): 325-326.