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Original Research Article

Weed Management in Onion by Pre and Post-emergence Herbicides

S.S. Thakare*, P.N. Chirde, P.V. Shingrup, J.P. Deshmukh, S.U. Kakde and A.N. Gholap

Deparment of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra 444104, India
**Corresponding author*

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A B S T R A C T

In order to evaluate various herbicides for weed control in onion, an experiment was conducted at the farm of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the *Rabi* season of 2013-2014. Experiment was conducted in randomized block design with 7 treatments and 3 replications consisting of pre-emergences application of pendimethalin, post-emergence application of Oxyfluorfen , Propaquizafop , Quizalofop ethyl , Fluazifop-p-butyl. The herbicidal treatment Oxyfluorfen @ 0.200 kg a.i./ha recorded lower weed density (20.67/ m^2), weed biomass (8.36 g/m^2), weed index (4.54%) and higher weed control efficiency (91.02%) followed by Pendimethalin @ 1.0 kg a.i./ha PE *fb*1 HW at 30 DAT. The application of Oxyfluorfen @ 0.200 kg a.i./ha proved to be most effective weed control treatment, which was recorded highest bulb yield (280 q/ha), gross monetary returns (Rs.279997/ha), net monetary returns (Rs. 218327/ha) and B:C ratio (4.54) over all other chemical weed control treatments.

Introduction

Onion (*Allium cepa* L.) is the most important vegetable spices in the world and top most export commodity among vegetable. Onion is very poor competitor with weed on accounts of inherent characteristic traits as short stature, extremely slow growth in the initial stages, non branching habit sparse foliage, shallow root system and results low productivity. Weed competition reduced bulb yield of onion to the tune of 40 to 80 % (Channapagoudar and Biradar 2007). The conventional methods of weed control (hoeing and hand weeding) are laborious, expensive and time consuming. Moreover, due to non availability of timely labour, weeds are not controlled at the proper stage. Hence, the present experiment was planned to study the effect of different herbicides on weed, yield of onion and their economics.

Materials and Methods

A field investigation was carried out at the farm of Agronomy Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the *Rabi* season of 2013-2014. The soil of experimental field characterized as clay loam in texture, having slightly alkaline pH (7.8), moderate organic carbon status (0.40%), low nitrogen content (224.27 kg/ha),medium available phosphorus content (17.86 kg/ha), high potassium status (384.25 kg/ha). Onion (Akola safed) was transplanted on 24th January 2014 at 10 x 10 cm^2 spacing with fertilizer dose of

100:50:00 NPK Kg/ha. The crop was harvested on 11th May 2014.The experiment was laid out in randomized block design with seven treatment replicated thrice. The treatments comprised of Pendimethalin @ 1.0 kg a.i./ha PE *fb*1 HW at 30 DAT (T_1), Oxyfluorfen @ 0.200 kg a.i./ha 20 DAT (T_2), Propaquizafop @ 0.100 kg a.i./ha 20 DAT (T_3), Quizalofop ethyl @ 0.075 kg a.i./ha PoE 20 DAT (T_4), Fluazifop-p-butyl @ 0.125 kg a.i./ha PoE 20 DAT (T_5), Weed free (T_6), Weedy check (T_7). Randomly five observations of crop and weed parameters were recorded at 20 DAT, 40 DAT, 60 DAT, 80 DAT and at harvest. Weed density and dry weight were recorded with a quadrate 1 m^2. Economics analysis was done as per prevailing market prices of different outputs and inputs. Weed control efficiency was calculated by standard formula.

$$WCE\ (\%) = \frac{DWC - DWT}{DWC} \times 100$$

Where,

WCE = Weed control efficiency in percent
DWC = Dry matter weight of weed in control plot (gm).
DWT = Dry matter weight of weed in treated plot (gm).

Weed index was calculated by using the following formula.

$$\text{Weed Index (WI)} = \frac{X - Y}{X} \times 100$$

Where,

X = weight of seed yield (q ha^{-1}) in treatment which has highest yield.

Y = weight of seed yield (q ha^{-1}) in treatment for which weed index is to be calculated, it is expressed in percentage.

Results and Discussion

Weed flora

The experimental field was heavily infested with mixed flora of broad-leaved and grassy weeds viz. *Chenopodium album* L., *Portulaca oleracea* L., *Tridax procumbens* L., *Lagasca mollis*, *Euphorbia hirta* L., *Euphorbia geniculata* Orteg., *Alternanathera triandra* L., *Parthenium hysterophorus* L. *Xanthium strumarium* L., *Digera arvensis* L., *Argemone mexicana* L, *Phyllanthus niruri* L., among the dicot weed, and *Cyperus rotundus* L., *Cynodon dactylon*, *Eleusine indica*, among the monocot weed.

Weed density

The weed density/m^2 at all growth stages was significantly lowest in weed free treatment. Among the herbicidal treatment, Oxyfluorfen @ 0.200 kg a.i./ha recorded significantly least number of weeds over other treatment like propaquizafop @ 0.100 kg a.i./ha , Fluazifop-p-butyl @ 0.125 kg a.i./ha , Quizalofop ethyl @ 0.075 kg a.i./ha. This might be due to control of weeds during early growth stage by application of oxyflurofen @ 0.200 kg a.i/ha found to be more effective in controlling weeds, due to inhibition of protoporphyrinogen oxidase (PPO) which leads to accumulation of photodynamic toxicant or protoporphyrin in the cells/plant. The results conformity with those obtained by Bhutia *et.al* (2005) and Sibel Uygur *et al.* (2010).

Weed biomass

In the weed free treatment, there was no weed dry matter due to absence of weeds. The treatment Oxyfluorfen @ 0.200 kg a.i./ha recorded the lowest weed biomass (8.36 g/m^2) and the weedy check treatment

recorded the highest weed biomass (93.16 g/m^2). This might be due to highest weed intensity and its dominance which utilized the sunlight, nutrients, moisture *etc*. over crop plants and resulted into higher growth and ultimately the higher weed biomass in weedy check. Similar results were reported by Saraf (2007) and Rajkumara and Palled (2009).

Weed control efficiency (WCE)

Among the herbicidal treatments, application of Oxyfluorfen @ 0.200 kg a.i./ha at 20 DAT recorded significantly higher weed control efficiency (91.02%) followed by Pendimethalin @ 1.0 kg a.i./ha PE *fb*1 HW at 30 DAT (86.39%), propaquizafop @ 0.100 kg a.i./ha (63.50%), Fluazifop-p-butyl @ 0.125 kg a.i./ha (59.27%), Quizalofop ethyl @ 0.075 kg a.i./ha (56.09%).

The weed free treatment was found significantly superior by recording 100% weed control efficiency. The higher WCE in Oxyfluorfen @ 0.200 kg a.i./ha at 20 DAT treatment might be due to the significant reduction in weed biomass because of the effective weed control practices through application of post-emergence herbicide. These results are in agreement to the finding of Kolse *et al*. (2010), Sable *et al.* (2013) and Shinde *et al.* (2012).

Weed index (WI)

Among the herbicidal treatments, application of Oxyfluorfen @ 0.200 kg a.i./ha at 20 DAT recorded the lower weed index (4.54%).

It was followed by Pendimethalin @ 1.0 kg a.i./ha PE *fb*1 HW at 30 DAT (8.25%), Propaquizafop @ 0.100 kg a.i./ha (29.54%), Fluazifop-p-butyl @ 0.125 kg a.i./ha (33.33), Quizalofop ethyl @ 0.075 kg a.i./ha (34.84%) and Weedy check (50.75%). The 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 (50.75%) was recorded in weedy check as result of uncontrolled growth weed growth which leads to higher competition with crop. These results are in agreement to the finding of Rajkumara and Palled (2009) and Mandeep Kaur Saini and Walia (2012).

Bulb yield

The onion bulb yield (293.33 q/ha) was recorded significantly higher in weed free and it was at par with the herbicidal treatment *i.e* application of Oxyfluorfen @ 0.200 kg a.i./ha at 20 DAT (280 q/ha). This might be due to vigorous growth of the crop due to the availability of sufficient nutrient, moisture, light and space owing to absence of weed 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 leads to higher plant height, increased number of leaves and finally the increase in bulb yield.

The lowest onion bulb yield (144.44 q/ha) was recorded in weedy check as the presences of more weed which interfered with growth and development of the crop and compete for the nutrients, moisture, light and space.

The similar results were reported by Vashi *et al*. (2011), Bharathi *et al.* (2011), Patel *et.al* (2012) and Mandeep Kaur Saini walia (2012).

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

Treatments	Time of application	Weed density/ m^2 at harvest			Weed dry biomass at harvest (g/m^2)	Weed control efficiency (%)	Weed index (%)
		Monocot	Dicot	Total			
T_1- Pendimethalin @ 1.0 kg a.i.ha^{-1} PE *fb*1 HW at 30 DAT	-	4.60 (20.67)	3.39 (11.00)	5.66 (31.67)	3.63 (12.67)	86.39	8.25
T_2- Oxyfluorfen @ 0.200 kg a.i. ha^{-1}	20 DAT	3.48 (11.67)	3.06 (9.00)	4.60 (20.67)	2.97 (8.36)	91.02	4.54
T_3- Propaquizafop @ 0.100 kg a.i.ha^{-1}	20 DAT	5.80 (33.33)	6.21 (39.67)	8.56 (73.00)	5.79 (34.00)	63.50	29.54
T_4- Quizalofop ethyl @ 0.075 kg a.i.ha^{-1}	20 DAT	6.81 (46.00)	7.22 (52.33)	9.93 (98.33)	6.42 (40.90)	56.09	34.84
T_5- Fluazifop-p-butyl @ 0.125 kg a.i.ha^{-1}	20 DAT	6.86 (47.00)	6.32 (40.00)	9.35 (87.00)	6.19 (37.94)	59.27	33.33
T_6- Weed free.	-	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	100.00	-
T_7- Weedy check.	-	12.49 (156.00)	5.91 (34.67)	13.81 (190.67)	9.67 (93.16)	-	50.75
S.E(m)±		0.30	0.43	0.25	0.28	-	-
C.D. at 5%		0.93	1.33	0.77	0.87	-	-

Table.2 Yield and economics as influenced by different treatments

Treatment	Time of application	Bulb yield q/ha	Cost of cultivation Rs./ha	Gross monetary returns Rs./ha	Net monetary returns Rs./ha	B:C ratio
T_1- Pendimethalin PE *fb*1 HW 35 DAT	-	269.11	63817	269107	205290	4.22
T_2- Oxyfluorfen @ 0.200 kg a.i. ha^{-1}	20 DAT	280.00	61670	279997	218327	4.54
T_3- Propaquizafop @ 0.100 kg a.i.ha^{-1}	20 DAT	206.66	61585	206665	145080	3.36
T_4- Quizalofop ethyl @ 0.075 kg a.i.ha^{-1}	20 DAT	191.11	62098	191109	129012	3.08
T_5- Fluazifop-p-butyl @ 0.125 kg a.i.ha^{-1}	20 DAT	195.55	60908	195554	134646	3.21
T_6- Weed free.	-	293.33	66725	293330	226605	4.40
T_7- Weedy check.	-	144.44	59525	144443	84918	2.43
S.E(m)±		8.07	-	8072	8072	-
C.D. at 5%		24.87	-	24872	24872	-

Economics

The gross monetary returns (Rs.2,93,330/ha) and net monetary returns (Rs.2,26,605/ha) were significantly higher in weed free treatment. It was followed by application of Oxyfluorfen @ 0.200 kg a.i./ha 20 DAT which recorded gross monetary returns Rs. 279997/ha and net monetary returns Rs. 218327/ha. Oxyfluorfen @ 0.200 kg a.i./ha recorded highest benefit cost ratio, i.e. 4.54 followed by treatments Weed free i.e.4.40

In conclusion, among the herbicidal treatments, application of Oxyfluorfen @ 0.200 kg a.i./ha recorded the lowest weed density (20.67/m^2), weed biomass (8.36 g/m^2), weed index (4.54%) and higher weed control efficiency (91.02%) followed by application of Pendimethalin @ 1.0 kg a.i./ha PE *fb*1 HW at 30 DAT. whereas, the higher bulb yield was recorded in herbicidal treatment Oxyfluorfen @ 0.200 kg a.i./ha (280 q/ha) except weed free (293.33 q/ha) followed by Pendimethalin @ 1.0 kg a.i/.ha PE *fb*1 HW at 30 DAT (269.11 q/ha). The application of Oxyfluorfen @ 0.200 kg a.i./ha 20 DAT proved to be most effective weed control treatment than other treatment except weed free, which was recorded highest gross monetary returns Rs.279997/ha, net monetary returns Rs. 2,18,327/ha and B:C ratio 4.54 .

It was concluded that for obtaining higher yield (280 q/ha), net monetary returns (Rs. 2,18,327/ha) and B: C ratio (4.54), onion be cultivated with the use of Oxyfluorfen @ 0.200 kg a.i./ha 20 DAT for effective management of weed

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