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Efficacy of Chemical Herbicides on Weed Management in Onion (*Allium cepa*)

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ABSTRACT

Weed management is one of the significant challenges of vegetable tuber crops since weeds pose a remarkable threat to crop productivity in South Asian countries, including India. An on-farm trial on efficacy of oxyflurofen and quizalofopethyl herbicides for weeds management in onion was under taken during *rabi* 2015-16, 2016-17and 2017-18 at farmers' field of south-west district of Delhi. Among the respective herbicidal treatment combinations oxyfluorfen 35 g/ha + quizalofop ethyl 37.5g/ha foliar spray at 35 days after transplanting (DAT) recorded significantly lower weed density (39.66/m^2), dry matter (42.22 g/m^2) and higher weed control efficiency (77.61%) followed by farmers' practice (pendimethalin 3.0 L/ha + one hand weeding). The application of oxyfluorfen 35 g/ha + quizalofop ethyl 37.5g/ha foliar spray at 35 DAT prove to be most productive and profitable weed control, which recorded significantly highest bulb yield (277.44q/ha), net return (Rs.1,71, 952 /ha) and B: C ratio (3.77) followed by farmers' practice bulb yield (252.22q/ha), net return (Rs.1,29,276/ha) and B: C ratio (3.01). The increased returns as a result of increased quality and bulb yield of onion with respective herbicides applications will result in more profitability of onion cultivation farmers.

Key Words: Herbicide, onion, weed management, weed density.

INTRODUCTION

Onion is an important bulbus crop among vegetable crop, because of its huge demand all over the World. India is the 2nd largest producer of onion in the world after china, covering an area of 16.53 million ha with a production of 26.55 million tons (NHRDF, 2021). About 70 per cent of its earning comes from foreign exchange in india (Panse *et al,* 2014). Onion is primarily consumed for their nutritional value, unique flavor or for their ability to enhance the flavor of other foods.

The farmers of this region facing various challenges in onion productivity but the main constraint is weed infestation which competes with the crop for nutrients, space and light thus, reducing the yield and quality of the crop resulted increased production and harvesting costs. Losses caused by weeds have been estimated to be much higher than those caused by insect pests and diseases. Depending upon the nature of intensity and duration of weed competition, weed infestation can reduces bulb yield to the tune of 40-80% (Sharma *et al,* 2009; Channapagoudar and Biradar, 2007; Vishnu *et al,* 2014). The conventional method of weed control (hoeing and manual weeding) is very labourious, expensive and insufficient. The herbicides become the vital part of the crop production and its current use is approximately 47 per cent of the world's pesticide consumption. In India, due to acute labor scarcity and boom in cost of weed management, herbicide use has increased by 30- 33% (Janaki *et al*, 2009; Sondhia, 2014). As weeds decrease the profitability of onion crops, therefore, weed must be controlled well in time. A good weed management option is essential for higher productivity & profitability of onion growing farmers. In view of the above facts, conduct on farm trail on efficacy of chemical herbicides on weed management on weed control efficiency and yield of onion and their economics at farmers' field.

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MATERIALS AND METHODS

On-farm trial for weed control in onion (*Allium cepa* L.) was conducted at farmers' fields of south-west district of Delhi during *rabi* 2015-16, 2016-17 and 2017-18, which has semi-arid climatic zone with the annual average rainfall of 730 mm, which is located between 28^0 24' 17'' to 28^0 53' 00'' North latitude and 76^0 50' 24'' to 77^0 20' 37'' East longitude. In view of the problems, a series of adaptive on farm trials were conducted at farmers' fields on same sites to study the efficacy of oxyflurofen 23.5% and quizalofop ethyle 5% EC herbicides for weed control in onion. Five farmers were selected and experiment laid out on 0.4 ha area of each. The soil and irrigation water quality were almost similar for all selected farmers field and all recommended packages of practices were adapted uniformly to all the treatments except weed management practices to raise a good crop. The combination of herbicides oxyfluorfen 35 g/ha + quizalofop ethyl 37.5g/ha foliar spray at 35 DAT and farmers practice *i.e.* Pendimethalin 30EC (After transplanting) + one hand weeding (at 35 DAT) as control at same variety (NHRDF Red) at five different locations (Replication) of same village, respectively. The experiment was conducted on Sandy loam light to medium in texture, low water holding capacity, pH slightly saline with low organic matter content. The experiment was laid out in Randomized Block Design and 45days old onion seedlings of variety, NHRDF Red were transplanted in the plot with a spacing of 15×10 cm. All recommended packages of practices were adapted uniformly to all the treatments except weed management practices to raise a good crop.

Weed flora differ widely in their diversity depending upon environmental and soil conditions and hence the information on the weed spectrum in onion field will be of great use for the formulation of effective weed management practices. The observations on weed density (no./m^2) and dry matter weight of weeds (g./m^2) were recorded at 90 DAT in standing crop by placing a quadrate of 50 cm × 50 cm randomly from three places in each plot. Based on weed biomass, weed control efficiency was calculated using the following formula.

$$WCE\ (\%) = \frac{DMC - DMT}{DMC} \times 100$$

Where, DMC was dry matter weight of weeds in control plot and DMT was dry matter of weeds in treated plots. The observations on crop growth and yield parameters *viz.,* plant height (cm) and bulb yield (q./ha) were recorded from net plot at harvesting and accordingly yield per ha for different treatments in all replications were calculated. Economics analysis was done as per prevailing market prices of different outputs and inputs.

RESULTS AND DISCUSSION

Weed flora

The selected experimental site was a weed prone area with wide diversities of monocot and dicot weeds but dominance of monocot weeds was observed in entire field. Weed flora observed in the experimental field, mainly comprised of *Datura stramonium, Parthenium hysterophorus, Euphorbia hirta L., Commelina benghalensis, Alternanathera triandra, Digera arvensis Forst., Tridax procumbens L., Euphorbia geniculata Orteg., Argemone mexicana L., Xanthium strumarium L., Chenopodium album L.,Phyllanthus niruri L., Portulaca oleracea L., Lagasca mollis* and *Acalypha indica* these were dicot weeds and among monocot *Cyprus rotundus, Cynodon dactylon, Eleusin indica L. and Dactyloctenium aegyptium L.* Among the different weed species, *Datura stramonium* was the most dominant weed, while *Parthenium hysterophorus* was second in weed density and other weeds were followed by them. Similar types of weeds in onion field were also reported by Patel *et al* (2011), Kalhapure *et al* (2014), Gaharwar *et al* (2017) and Thakare *et al* (2018).

Weed density

The data on weed density (No./m^2) were recorded at 60 DAS and at harvest (Table 1). Among the herbicidal treatment, oxyfluorfen 35 g/

ha + quizalofop ethyl 37.5g/ha recorded significantly least number of weeds (39.66/ m^2) over adopted farmers' practice (85.21/ m^2). Early-post emergence application of quizalofop-ethyl at 75 g/ha recorded lower weed density and dry weight which resulted in increased yield of onion under grass dominated field conditions (Dhananivetha *et al,* 2015). These results were in agreement to the finding of Kolse *et al* (2010), Sable *et al* (2013) and Shinde *et al* (2012). Similar results were also reported by Pugalendhi *et al* (2011), Bhutia *et al* (2005) and Uygur *et al* (2010).

Weed biomass

The treatment oxyfluorfen35 g/ha + quizalofop ethyl 37.5g/harecorded the lowest weed biomass (42.32 g/m^2) whereas, farmers' practice recorded the highest weed biomass (89.99 g/m^2) (Table 1). 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. Rahman *et al* (2011) reported minimum dry weed biomass was recorded in plots sprayed with pendimethalin while, maximum dry weed biomass was noticed in weedy check, where weeds were not controlled. The similar trends were also found in total weed dry matter except oxyfluorfen at 0.30 kg/ha fb quizalofop-p-ethyl 0.05 kg/ha, which recorded significantly higher weed biomass than others. These findings were in confirmation with Kumar and Mourya (2006) and Kumar *et al* (2014).

Weed control efficiency

The trends of weed control was fluctuated due to environmental factors and responses of proper weeds management practices was positive. In weed management treatments highest weed control efficiency (77.61%) was recorded with the treatment T_2 and lowest weed control efficiency (48.21%) was recorded with treatment T_1. In onion, pendimethalin at 1.0 kg/ ha + hand weeding and oxyfluorfen at 0.24 kg/ ha recorded higher weed control efficiency of 80.6 and 73.4 per cent (Patel *et al,* 2011). The result on weed control efficiency (WCE) showed variability among different weed management schedules in onion. The WCE of different herbicide treatment varied from 39% (pendimethalin alone) to 57.4% (oxyflorfen fb one hand weeding). Maximum WCE was recorded in weed free followed by oxyflorfen fb one hand weeding at 40-60 DAT (57.5%) and oxyfluorfen + quizalofop-p-ethyl (56.1%). Low weed index in oxyflorfen fb one hand weeding at 40-60 DAT and oxyfluorfen + quizalofop-p-ethyl indicated that competition due to weeds was lowest in these treatments as compared to others. Similar results were also reported by Sinare *et al* (2014).

Bulb yield

Significantly highest plant height 39.55 cm and total bulb yield was recorded in T_2 (277.44 q/ ha) (Table 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). 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 (252.22q/ha) was recorded in farmers practice 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). Higher bulb yield was recorded under early post emergence application of quizalofop-ethyl under grass dominated field as recorded by Dhananivetha *et al* (2015)

Economics

The gross monetary returns (Rs.2,33,952/ ha) and net monetary returns (Rs.1,71,952/ha) were significantly higher in weed free treatment oxyfluorfen35 g/ha + quizalofop ethyl 37.5g/ ha 35 DAT(Table 3). It was followed by farmer's practice (Pendimethalin+ one hand weeding) which recorded gross monetary returns (Rs.1,93,776/

Table.1 Weed density, weed control efficiency and Dry matter weight of weeds as influenced by different treatments

Treatments	Weed density/m²			Mean	Weed dry matter weight (g/m²)			Mean	Weed control efficiency (%)			Mean
	2015–16	2016 –17	2017–18		2015 – 16	2016 – 17	2017 – 18		2015–16	2016–17	2017–18	
T_1- Farmer's Practice	88.66	82.66	84.33	85.21	95.33	89.33	85.33	89.99	44.66	47.66	52.33	48.21
T_2-	38.33	41.33	39.33	39.66	38.66	41.66	46.66	42.32	78.86	76.33	77.66	77.61

Table.2 Growth and Yield as influenced by different treatments

Treatment	Plant height (cm)			Mean	Yield (q/ha)			Mean
	2015 – 16	2016 – 17	2017 – 18		2015 – 16	2016 – 17	2017 – 18	
T_1- Farmer's Practice	33.66	31.33	30.33	31.77	284.00	255.00	217.66	252.22
T_2	40.66	40.33	37.66	39.55	304.00	286.66	241.66	277.44

Table.3 Effect of herbicides on Economics

Treatment	Cost of cultivation (Rs./ha)			Mean	Gross return (Rs./ha)			Mean	Net returns (Rs./ha)			Mean	B:C ratio
	2015–16	2016–17	2017–18		2015–16	2016–17	2017–18		2015 – 16	2016 – 17	2017 – 18		
T_1- Farmer's Practice	63500	65000	65000	64500	218200	196500	166628	1937-	154700	131500	101628	129276	3.01
T_2	61250	62500	62500	62000	229450	216828	255828	233952	168200	154328	193328	171952	3.77

ha) and net monetary returns (Rs.1,29,276/ha.) likewise respective weed control foliar spray at 35 DAT recorded highest benefit cost ratio 3.77 followed by Farmer's Practice 3.01. In onion higher net return (Rs.1,85,600/ha.) was registered with the application of oxyfluorfen (Saini and Walia, 2012). According to Mondal *et al* (2005) higher net monetary returns were obtained with pre-emergence application of oxyfluorfen at 100 g/ ha supplemented with one hand weeding on 25 DAT (33,650/ha) followed by fluchloralin at 750g/ha + hand weeding (31,983/ha), pendimethalin at 750 g/ ha + hand weeding (31,450/ ha) and oxyfluorfen at 200 g/ ha (31,400/ ha).

CONCLUSION

Among the various treatments, in compression of farmers practice the application of oxyfluorfen 35EC g/ha + quizalofop ethylEC 37.5g/ha at 35 days after transplanting recorded highest weed control efficiency and higher marketable bulb yield with cost benefit ratio. Although, the current study suggests that they might be helpful options for weed management and may provide a possible alternative to adopted farmer's practice.

REFERENCES

Bhutia D T, Maity T K and Ghosh R K (2005). Integrated weed management in onion. *J Crop and Weed* **1** (I): 61- 64.

Channappagoudar B B and Biradar N R (2007). Physiological studies on weed control efficiency in direct sown onion. *Karnataka J Agril Sci* **20** (2):375-376.

Dhananivetha M, Amanullah M M and Arthanari P M (2005). Bio-efficacy and phytotoxicity evaluation of quizalofop-ethyl (5% EC) for management of weeds in onion. *Trends in Biosci* **8** (7): 1873-1877.

Janaki P, Meena S and Chinnusamy C (2009). Persistence and degradation of herbicides in Rice, maize and soybean grown vertisols of Tamil Nadu, Southern India. *In Proceedings of the 2nd International Conference on Novel and Sustainable Weed Management in Arid and Semi-Arid agro Ecosystem 2009 Sep* (pp. 7-10).

Kolse R H, Gaikwad C B, Jadhav J D and Yadav S T (2010). Influence of various weed control methods on growth and yield contributing character of onion seed. *Int J Pl Prot* **3** (1): 23- 27.

Kumar U, Prasad B and Chandra G (2014). Effect of different herbicides on growth, yield and weed flora of onion (*Allium cepa* L.). *J Hill Agri* **5** (2): 207-210.

Panse R, Gupta A, Jain P K, Sasode D S and Sharma S (2014). Efficacy of different herbicides against weed flora in onion (*Allium cepa.* Lindeman). *J Crop and Weed* **10** (1): 163- 166.

Patel T U, Patel C L, Patel D D, Thanki J D, Arvadia M K and Vaidya HB (2011). Performance of onion under weed and fertilizer management. *Indian J Weed Sci* **44** (3): 151-158**.**

Rajkumara S and Palled Y B (2009). Weed management in drilled onion (*Allium cepa* L.) + chilli (*Capsicum annuum* L.) + cotton (*Gossypium herbaceum* L.) relay intercropping in rainfed vertisols. *Indian J Weed Sci* **41** (3 and 4):189-94.

Sable P A, Kurbar A R and Hugar A S (2013). Effect of weed management practices on weed control and nutrient uptake in onion (*Allium cepa* L.). *Asian J Hort* **8** (2): 1444-447.

Saini M K and Walia U S (2012). Effect of land configuration and weed management in onion (*Allium cepa*). *Indian J Agron* **57** (3): 275-278.

Saraf R K (2007). Herbicidal weed control in kharif onion. *Asian J Hort* **2** (2): 223-227.

Shinde K G, Bhalekar M N and Patil B T (2012). Weed management in rainy season onion. *Indian J Weed Sci* **44** (4): 264-266.

Shinde K G, Bhalekar M N and Patil B T (2013). Weed management in rabi onion (*Allium cepa* L.). *J Agri Res and Technol* **38** (2): 324-326.

Sondhia S (2014). Herbicides residues in soil, water, plants and non-targeted organisms and human health implications: an Indian perspective. *Indian J Weed Sci* **46**: 66–85.

Sinare B T, Andhale R P and Gautam M (2014). Weed control in onion with herbicides. *Indian J Weed Sci* **46** (2): 192-194.

Uygur S, Gürbüz R and Uygur F N (2010). Weeds of onion fields and effects of some herbicides on weeds in Cukurova region, Turkey. *African J Biotechnol* **9** (42): 7037-7042.

Vashi J M, Patel N K and Desai D T (2011). Evaluation of the different herbicides for controlling weedsin Onion (*Allium cepa* L.). *Veg Sci* **38** (1): 119-120.

Vishnu V, Asodaria K B and Suthar A (2015). Weed management in rabi onion (*Allium cepa* L.). *Agril Sci Digest-A Res J* **35** (2): 130-133.

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