



P-ISSN: 2349-8528

E-ISSN: 2321-4902

IJCS 2019; 7(5): 1809-1812

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Received: 16-07-2019

Accepted: 18-08-2019

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## Effect of pre and post emergence herbicides on nutrient removal and uptake in onion Cv. N - 53

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**Abstract**

A field experiment was conducted to find out best weed management practices in onion (*Allium cepa* L.) during rabi 2011-12 and 2012-13. The experiment was laid out in Randomized block design with three replications. The experiment consisted of pendimethalin, oxyflourfen as pre emergence herbicides and Imazethapyr and Quizalofop ethyl as post emergence herbicides and their combination thus forms 10 treatments along with Weedy check. All the weed control treatments significantly influenced the nutrient removal by weeds and Nutrient uptake by Onion plants. Pre emergence herbicides coupled with Quizalofop ethyle found to be on par with Hand weeding. Though Imazethapyr applied as post emergence effectively controls the weeds but found to be extremely toxic to the crop. The maximum yield of onion was recorded with Hand weeding, which is on par with the application of pre emergence herbicides combined with Quizalofop ethyle @ 75g a.i per ha.

**Keywords:** Pendimethalin, oxyflourfen, imazethapyr, quizalofopethyle, nutrient removal and uptake-onion

**Introduction**

Onion (*Allium cepa* L.) is an important bulbous vegetable crop grown in the world after tomatoes and is considered as top most export commodity among vegetables. Onion bulb is rich in minerals, especially calcium and phosphorus besides having fairly good quantities of carbohydrates, proteins and vitamin-C. It forms an indispensable part of many diets of both vegetarian and non-vegetarian as a flavouring agent. It is consumed in raw form and salads regularly in small quantities comparable with that of hot pepper. The outstanding characteristics of onion are the pungency, which is due to a volatile compound known as "Allyl-propyl disulphide", which is sulphur rich compound. It has got the effects of lowering the blood sugar fat and also having good coagulation effect. Because of its importance in cookery, onion is called "Queen of the Kitchen" by Germans. (Vashi *et al.*, 2011) <sup>[10]</sup>

At present, the production share of onion is 10.4 per cent of the total vegetable production with 11.4 per cent of total vegetable area in the country. In India, onion was grown on an area of 10.5 lak hectares with a production of 168.1 lak tonnes and the productivity is 16 tonnes per hectare. The major onion producing states are Maharashtra, Karnataka, Gujarat, Bihar, Madhya Pradesh, Andhra Pradesh, Rajasthan and Haryana. Andhra Pradesh occupies 6<sup>th</sup> place in onion production. Andhra Pradesh covers an area of 0.8667 lakh hectares with a production of 15.60 lakh tonnes and the average productivity is 18tonnes per hectare. Onion accounts 9 percent of total vegetable production in A.P. (Indian Horticultural Database, 2013) <sup>[3]</sup>

Among many causes of low productivity, onion exhibits greater susceptibility to weed competition as compared to other crops due to its inherent characteristics such as slow germination, extremely slow growth in the initial stages, short stature, non-branching habit, sparse foliage and shallow root system. This favours quick and fast growth of weeds in the initial stages and competition thus tends to be severe. Moreover, use of liberal dose of FYM, fertilizers and frequent irrigations creates favourable conditions for weed growth (Rajendra Singh *et al.*, 1986) <sup>[6]</sup>. It is an established fact that weeds compete with crop plants for space, nutrients, moisture and light there by reducing the quality and quantity of yield (Moolani and Sachan, 1966) <sup>[4]</sup>. If the weeds are present throughout the crop growth period, there may be complete loss of marketable yield. The reduction in bulb yield varies to the extent of 48 to 85 per cent depending upon the duration, intensity of weed growth and weed competition (Bhalla, 1978) <sup>[2]</sup>.

Hand weeding in onion is a common practice in India, but it is a tedious expensive and time consuming task due to closer spacing and shallow root system. Non-availability of labourers during critical period of crop makes hand weeding difficult leading to heavy yield losses. The critical period of crop-weed competition in onion lies between 15-60 days after transplanting (Singh and Singh, 1994) [9]. Hence, managing the weeds meticulously in early stages is an imperative task to get higher weed control efficiency and bulb yield. Hence, this is imperative need to screen out suitable herbicides for weed control in combination with manual weeding in onion. Keeping the above mentioned facts, the present investigation was under taken to find out efficacy and selectivity of various herbicides.

### Material and Methods

An experiment was conducted at Horticultural college and Research Institute, Dr. Y.S.R Horticultural University, Venkataramannagudem, Tadepalligudem, West Godavari District, A.P during Rabi season of 2011-12 and 2012-13. The soil was acidic in reaction and medium in NPK availability. The texture of the soil was sandy loam. The experiment was laid out in Randomised block design with three replications in a plot size of 4X3 m<sup>2</sup>.

The seeds of onion cultivar "N-53" was sown for nursery raising and transplanting was done on ridge and furrow system by adopting spacing of 30X10 cm. The ten treatments

consists of T<sub>1</sub>- Pendimethalin @ 0.75 Kg a.i / ha as pre emergence application, T<sub>2</sub>- Oxyfluorfen @ 0.125 Kg a.i / ha as pre emergence application, T<sub>3</sub>- Imazethapyr @ 100 g a.i / ha as post emergence application (20 DAT), T<sub>4</sub>- Quizalofop ethyl @ 75 g a.i / ha as post emergence application (20 DAT), T<sub>5</sub>- Pendimethalin @ 0.75 Kg a.i / ha as pre emergence application + Imazethapyr @ 100 g a.i / ha as post emergence application (20 DAT), T<sub>6</sub>- Pendimethalin @ 0.75 Kg a.i / ha as pre emergence application+ Imazethapyr @ 100 g a.i / ha as post emergence application (20 DAT), T<sub>7</sub>- Oxyfluorfen @ 0.125 Kg a.i / ha as pre emergence application + Quizalofop ethyl @ 75 g a.i / ha as post emergence application (20 DAT), T<sub>8</sub>- Oxyfluorfen @ 0.125 Kg a.i / ha as pre emergence application + Quizalofop ethyl @ 75 g a.i / ha as post emergence application (20 DAT), T<sub>9</sub>- Weed free (Hand weeding) and T<sub>10</sub>- Weedy check.

Forty five days old seedlings were used for transplanting. Upper one third portions of the seedlings were removed at the time of transplanting to reduce the transpiration loss and better establishment of crop. All the package of practices to raise the good crop was done in the experimental field and weed control treatments applied as per the treatments.

### Results and Discussion

**Nutrient removal by weeds (kg ha<sup>-1</sup>):** Nutrient removal by weeds as influenced by weed management practices was presented in the Table-1.

**Table 1:** Nitrogen removal (Kg ha<sup>-1</sup>) by the weeds at different growth stages of Onion as influenced by weed management practices

Treatment Details	Nitrogen (kg ha-1)				Phosphorus (kg ha-1)				Potassium (kg ha-1)			
	60 DAT		90 DAT		60 DAT		90 DAT		60 DAT		90 DAT	
	2011-2012	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13
T <sub>1</sub> Pendimethalin @ 0.75 kg a.i / ha as PE	8.12	8.24	16.45	18.13	2.46	2.35	2.68	2.85	3.14	3.16	7.11	7.17
T <sub>2</sub> Oxyfluorfen @ 0.125 kg a.i / ha as PE	8.82	8.74	17.18	19.43	2.63	2.58	2.76	2.94	3.28	3.29	8.47	7.46
T <sub>3</sub> Imazethapyr @ 60 g a.i / ha as POE (20 DAT)	11.35	11.21	27.62	29.77	3.38	3.39	4.68	5.83	4.19	4.17	14.68	14.82
T <sub>4</sub> Quizalofop ethyl @ 75 g a.i / ha as POE (20 DAT)	9.10	9.12	18.11	21.52	2.76	2.96	2.98	3.14	3.48	3.46	8.63	7.83
T <sub>5</sub> Pendimethalin @ 0.75 kg a.i / ha as PE + Imazethapyr @ 60 g a.i / ha as POE (20 DAT)	9.31	9.27	23.27	24.56	3.18	3.15	4.18	4.97	3.87	3.91	12.56	13.14
T <sub>6</sub> Pendimethalin @ 0.75 kg a.i / ha as PE + Quizalofop ethyl @ 75 g a.i / ha as POE (20 DAT)	5.47	5.28	12.13	11.13	1.52	1.78	2.19	2.27	2.84	2.85	5.71	5.99
T <sub>7</sub> Oxyfluorfen @ 0.125 kg a.i / ha as PE + Imazethapyr @ 60 g a.i / ha as POE (20 DAT)	10.13	10.16	25.84	27.96	3.29	3.26	4.27	5.48	3.93	3.95	13.48	13.78
T <sub>8</sub> Oxyfluorfen @ 0.125 kg a.i / ha as PE + Quizalofop ethyl @ 75 g a.i / ha as POE (20 DAT)	6.95	6.83	13.02	13.79	1.67	1.85	2.25	2.36	2.97	2.95	6.36	6.49
T <sub>9</sub> Weed free (Hand weeding at 20, 40 and 60 DAT)	4.63	4.65	10.26	9.47	1.26	1.12	1.61	1.65	2.72	2.71	4.25	4.52
T <sub>10</sub> Weedy Check	16.28	17.75	30.62	31.24	4.29	5.14	6.44	7.19	5.65	5.78	17.72	18.15
S.Em±	0.80	0.83	1.37	1.84	0.16	0.26	0.23	0.25	0.25	0.24	0.84	0.81
CD (P = 0.05)	2.38	2.48	4.11	5.51	0.48	0.79	0.69	0.75	0.74	0.71	2.50	2.43

### Nitrogen removal by weeds

At 60 and 90 DAT, maximum depletion of nitrogen was observed in the weedy check (T<sub>10</sub>) which was significantly differed from other treatments. In contrast, minimum depletion of nitrogen by weeds was observed in T<sub>9</sub> (weed free -hand weeding at 20, 40, 60 DAT) which did not differed significantly with T<sub>6</sub> (Pendimethalin @ 0.75 kg a.i/ha (PE) + Quizalofop ethyl @ 75g a.i/ha as POE), and T<sub>8</sub> (Oxyfluorfen @ 0.125 kg a.i/ha as PE + Quizalofop ethyl @ 75 g a.i / ha as POE). Similar trend was found in both the years of study.

### Phosphorus removal by weeds

In both the seasons, all the weed control treatments reduced significantly the phosphorus depletion by weeds. Maximum depletion of phosphorus was observed in T<sub>10</sub> (weedy check) treatment, which differed significantly from other treatments.

Lowest phosphorus uptake by weeds was recorded in T<sub>9</sub> (Weed free-hand weeding at 20, 40, 60 DAT) at 30, 60, and 90 DAT, which were statistically on par with T<sub>6</sub>(Pendimethalin @ 0.75 kg a.i/ha (PE) + Quizalofop ethyl @ 75g a.i/ha as POE), T<sub>8</sub>, T<sub>1</sub> and T<sub>2</sub> at 30 DAT. However at 60 and 90 DAT, T<sub>9</sub> (weed free -hand weeding at 20, 40, 60 DAT) was similar to T<sub>6</sub> (Pendimethalin @ 0.75 kg a.i/ha (PE) + Quizalofop ethyl @ 75g a.i/ha as POE) and T<sub>8</sub> (Oxyfluorfen @ 0.125 kg a.i/ha as PE + Quizalofop ethyl @ 75 g a.i / ha as POE).

### Potassium removal by weeds

Removal of potassium by weeds was significantly affected by weed control treatments. Maximum depletion of potassium by the weeds was found in T<sub>10</sub> (weedy check) treatment during various stages of crop growth. T<sub>9</sub> (Weed free-hand weeding

at 20, 40, 60 DAT) was found better in reduction of potassium removal by weeds than chemically treated plots, however it was on par with T6 (Pendimethalin @ 0.75 kg a.i/ha as PE + Quizalofop ethyl @ 75g a.i/ha POE), T8 (Oxyfluorfen @ 0.125 kg a.i/ha as PE + Quizalofop ethyl @ 75 g a.i /ha as POE), T1(Pendimethalin @ 0.75 kg a.i/ha as PE) and T2 (Oxyfluorfen @ 0.125 kg a.i/ha as PE) at 30 and 60 DAT, whereas at 90 DAT, T9 (Weed free-hand weeding at 20, 40, 60 DAT) was similar to T6 (Pendimethalin @ 0.75 kg a.i/ha as PE + Quizalofop ethyl @ 75g a.i/ha POE) and T8 (Oxyfluorfen @ 0.125 kg a.i/ha as PE + Quizalofop ethyl @ 75 g a.i /ha as POE). Similar trend was observed in both the years.

Highest removal of NPK by weeds was recorded in weedy check (T10), treatment because of maximum dry weight of

weeds, which may be due to higher weed population and continuous growth of weeds throughout the crop period. Similar findings were reported by Patel *et al.* (2012) [5].

#### Nutrient uptake by Crop (Kg ha<sup>-1</sup>)

Uptake of NPK by crop was significantly affected by weed control treatments at 90 DAT and the data are presented in Table-2. The NPK uptake of onion was calculated by multiplying dry matter with nutrient concentration. T6 (Pendimethalin @ 0.75 kg a.i/ha as PE + Quizalofop ethyl @ 75g a.i/ha POE) and T8 (Oxyfluorfen @ 0.125 kg a.i/ha as PE +Quizalofop ethyl @ 75 g a.i /ha as POE) treatments improved the NPK uptake by the crop, which were similar to T9 (weed free -hand weeding at 20, 40, 60 DAT) in both the years.

**Table 2:** Nutrient (NPK) uptake (Kg ha<sup>-1</sup>) by the Onion (Bulbs) and Bulb yield (t.ha<sup>-1</sup>) as influenced by weed management practices

Treatment	Nitrogen		Phosphorus		Potassium		Bulb yield (t.ha <sup>-1</sup> )			
	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13	2011-12	2012-13		
T <sub>1</sub>	Pendimethalin @ 0.75 kg a.i / ha as PE		39.64	35.62	5.56	4.90	26.61	21.01	14.42	15.78
T <sub>2</sub>	Oxyfluorfen @ 0.125 kg a.i / ha as PE		35.80	32.41	4.86	4.64	25.63	20.62	13.64	14.92
T <sub>3</sub>	Imazethapyr @ 60 g a.i / ha as POE (20 DAT)		7.67	6.32	2.04	1.95	5.16	4.69	0.54	0.63
T <sub>4</sub>	Quizalofop ethyl @ 75 g a.i / ha as POE (20 DAT)		33.81	29.77	4.87	3.94	21.53	19.07	11.50	12.63
T <sub>5</sub>	Pendimethalin @ 0.75 kg a.i / ha as PE +Imazethapyr @ 60 g a.i / ha as POE (20 DAT)		9.55	7.21	2.22	1.99	5.70	5.42	0.70	0.77
T <sub>6</sub>	Pendimethalin @ 0.75 kg a.i / ha as PE + Quizalofop ethyl @ 75 g a.i / ha as POE (20 DAT)		44.68	41.71	7.88	6.67	34.02	30.56	17.75	18.29
T <sub>7</sub>	Oxyfluorfen @ 0.125 kg a.i / ha as PE+Imazethapyr @ 60 g a.i / ha as POE (20 DAT)		9.64	8.29	2.51	2.15	6.39	5.70	1.04	0.88
T <sub>8</sub>	Oxyfluorfen @ 0.125 kg a.i / ha as PE + Quizalofop ethyl @ 75 g a.i / ha as POE (20DAT)		42.35	39.48	6.54	5.83	30.63	27.04	16.87	17.64
T <sub>9</sub>	Weed free (Hand weeding at 20, 40 and 60 DAT)		45.29	43.24	8.81	7.15	37.70	32.47	18.89	19.67
T <sub>10</sub>	Weedy Check		10.72	9.14	2.78	2.75	8.73	6.42	6.65	7.92
	S.Em±		1.68	1.49	0.49	0.31	1.41	1.06	1.00	1.06
	CD (P = 0.05)		5.04	4.45	1.45	0.93	4.23	3.19	2.99	3.17

PE- Pre emergence

POE- Post emergence

DAT- Days after transplanting

T9 (Weed free-hand weeding at 20, 40, 60 DAT) was found better than the herbicides applied alone as pre emergence for NPK uptake by crop. Hence it was evident that pre-emergence herbicides in combination with post emergence substantially improved the nutrient uptake by the crop.

The results revealed that T9 (weed free-hand weeding at 20, 40, 60 DAT) was similar to T6 (Pendimethalin @ 0.75 kg a.i/ha as PE+Quizalofop ethyl @ 75 g a.i/ha as POE) and T8 (Oxyfluorfen @ 0.125 kg a.i/ha + Quizalofop ethyl @ 75g a.i/ha as POE) in respect of NPK uptake by crop.

The possible reason for the maximum NPK uptake by crop under T6 (Pendimethalin @ 0.75 kg a.i/ha (PE)+ Quizalofop ethyl @75g a.i /ha as POE) and T8 (Oxyfluorfen @ 0.125 kg a.i/ha +Quizalofop ethyl @ 75g a.i/ha as POE) was due to suppression and killing of weeds by the pre emergence chemicals at the earlier stage and at later stage by post emergence herbicides. Thus in chemically treated plots, weeds were controlled right from transplanting which was evident from lower dry matter accumulation by weeds and higher dry matter production by crop in comparison to weedy control. The results of present investigation are also in agreement with the findings reported by Amrutkar *et al.* (2002) [1], Patel *et al.* (2012) [5] and Sangeetha Kumari and Singh (2012) [7].

#### Bulb yield (t.ha<sup>-1</sup>)

All the weed control treatments significantly effected the bulb yield in both the years of experiments and the data are presented in Table-2.

T9 (Weed free hand weeding at 20, 40 and 60 DAT) produced the maximum bulb yield to the tune of 18.89 tonnes/ha and 19.19 t/ha during first and second year respectively. In both the years, T9 (hand weeding at 20, 40 and 60DAT) produced the highest yield followed by T6 (Pendimethalin @ 0.75 kg a.i/ha (PE) + Quizalofop ethyl @ 75g a.i/ha as POE).

T1 (Pendimethalin @ 0.75 kg a.i/ha) and T2 (Oxyfluorfen @ 0.125 kg a.i/ha) treatments applied as pre emergence herbicides were comparable to each other, but were inferior to T6 (Pendimethalin @ 0.75 kg a.i/ha (PE) + Quizalofop ethyl @ 75g a.i/ha as POE) and T8 (Oxyfluorfen @ 0.125 kg a.i/ha+ Quizalofop ethyl @ 75g a.i/ha as POE).

Owing to phytotoxic effect, Imazethapyr @ 60g a.i/ha (T3), T5 (Pendimethalin @ 0.75 kg a.i / ha as PE + Imazethapyr @ 60 g a.i / ha as POE) and T7 (Oxyfluorfen @ 0.125 kg a.i / ha as PE + Imazethapyr @ 60 g a.i / ha as POE) produced the lowest bulb yield of onion.

The highest bulb yield obtained in T9 (weed free-hand weeding at 20, 40, 60 DAT) is comparable to T6 (Pendimethalin @ 0.75 kg a.i/ha (PE) + Quizalofop ethyl @75g a.i/ha as POE) and T8 (Oxyfluorfen @ 0.125kg a.i/ha (PE) +Quizalofop ethyl @ 75g a.i/ha as POE). This is because of the fact that the weed population and weed growth remain

low from initial crop growth as compared to T10 (weedy check).

The reduced crop-weed competition provide better environment for proper growth and development as well as yield attributes viz. bulb diameter, bulb volume and bulb weight ultimately leading to the enhanced bulb yield. This might be due to proper weed management treatments which controlled weeds effectively, reduced the competition from the weeds to a greater extent and thus helped in faster growth and development of onion bulb crop, resulting in higher values of all yield attributing characters, which are positively correlated with yield. The findings are in closely vicinity of those reported by Warade *et al.* (2006) <sup>[11]</sup>, Saraf (2007) <sup>[8]</sup>, Vashi *et al.* (2011) <sup>[10]</sup>, Patel *et al.* (2012) <sup>[5]</sup> and SangeethaKumari and Singh (2012) <sup>[7]</sup>.

### Conclusion

Application of Pre emergence herbicides such as Pendimethalin @ 0.75 kg a.i / ha and Oxyfluorfen @ 0.125 kg a.i / ha coupled with Quizalofop ethyle @75g a.i/ha as POE found to be on par with Hand weeding in good amount of nutrients (NPK) uptake by crop plants and low levels of nutrient removal by the weeds as herbicides are effective in controlling weeds.

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