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Bio-Efficacy of Herbicides Against Weeds Complex in Onion (*Allium cepa*)

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Abstract Weeds constitute one of the biggest problems in agriculture that not only reduce the yield and quality of onion but also utilize essential nutrients. Hence, weed control is essential for increasing onion production. A field experiment was conducted to evaluate the bio-efficacy of herbicides applied in combination or independent at different dosage in onion against grassy and broad leaf weeds during *kharif* 2013 at AEEC, Lingsugur, UAS, Raichur. Based on results of the field experimentation, it was found that post-emergence application of Propaquizafop 5% + Oxyfluorfen 12% at higher dose recorded significantly higher bulb yield (15.06 tha-1) due to lower weed biomass (6.0g/0.25m^2) and higher weed control efficiency (80%), which was reflected in higher net returns (Rs 88624) and BC ratio (3.78) compared to rest of the weed control treatment except weed free.

Keywords Herbicide, Onion, Propaquizfop, Oxyfluorfen, Pre and post emergence.

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Introduction

Onion is one of the most important vegetable crops in India for thousand of year. It is mainly used for cuisine and culinary purpose, it also relished in from with meals as salad. Onion is earning valuable foreign exchange for the country. Onion is the second only to tomato in their importance as a vegetable in the tropics. India is next to China in area and production of onion. In India, onion is grown over an area of 1,003.80 thousands hectares with a production of 14,561.80 MT [1]. Among the different states Maharashtra is leading state in terms of area (26.74%) and production (28.44)% with an average yield of 13.94 t ha^{-1}. Other onion major growing states are Karnataka, Gujarat and Bihar.

In Karnataka, it is growing over an area of 190.3 thousands hectares with production of 2, 592.20 MT. The productivity is very low i.e.13.62 t ha^{-1} as compared to potential yield of 25 t ha^{-1}. The low produc-

Table 1. Treatment details.

T. No.	Treatments	Dose ml ha^{-1} a. i.(g)	Formulation
1.	Propaquizafop 5% + Oxyfluorfen 12% EC	37.5 + 90	750
2.	Propaquizafop 5% + Oxyfluorfen 12% EC	43.75 + 87.5	875
3.	Propaquizafop 5% + Oxyfluorfen 12% EC	50 + 120	1000
4.	Pendimethalin 30% EC	1000	3300
5.	Propaquizafop 10 EC	75	750
6.	Oxyflurfon 23.5% EC	200	850
7.	farmer's practice (HW at 25 & 45 DAT)	–	–
8.	Weed free Check	–	–
9.	Unweede Control	–	–

tivity of onion is mainly attributed to lack of knowledge of diseases, pests, weeds and their control measures. Losses caused by weeds have been estimated to be much higher than those caused by insect pests and diseases. Due to frequent irrigation, providing congenial condition for weed growth, weed problem in onion is very serious. Hence reduction in bulb yield of onion was observed due to weeds infection. So weeds pose serious problems due to smaller leaf size, slow growth and very shallow rooted system onions cannot compete well with weeds particularly at early stages of growth [2]. Generally, the bulb yield of onion reducted by 30-60% due to weed infestation. As weeds decrease the profitability of onion crops, therefore, weed must be controlled well in time. A good weed management program is essential for good onion production. This study was therefore conducted duing 2013 at AEEC, Lingsugur with objective to compare the effectiveness of different control methods of weeds in onion crop.

Materials and Methods

Field experiment was conducted to compare various weed management practices in onion during *kharif* 2013 at AEEC, Lingsugur, UAS, Raichur. The experiment was laid out with nine treatments in randomised block design, replicated thrice. The treatments details are presented in Table 1. Onion seedlings of variety Bellary red were transplated with a spacing of 15 × 10 cm. recommended dose of fertilizer of 125 : 100 : 125 Kg N, P_2O_5 and K_2O were applied to all treatments. All other recommended packages of practices were adapted uniformly to all the treatment except weed management practices to raise a good crop. The data on weed biomass and bulb yield were recorded and subjected to statistical analysis. Based on the markettable prices economics was worked out.

Weed control efficiency

Weed control efficiency (WCE) was calculated by the following method.

$$WCE\,(\%) = \left(\frac{WCC - WCT}{WCC}\right) \times 100$$

Where, WCC = Dry weight of weeds in unweeded control plot (g)

WCT = Dry weight of weeds in treated plot (g)

Results and Discussion

Common weed flora observed in experimental site were *Commelina benghalensis, Cyperus rotundus, Parthenium hiysterphorus, Phyllanthus niruri, Euphorbia geniculata* and *Dinebra retroflexa.*

The variability in weed population in different treatments can be attributed to the fact that the herbicides which could effectively kill the most of the weed community were more effective in reducing the weed density as the field was infested by all kinds of weeds. (Table 2). The results of the experiment showed that, significantly higher weed biomass was recorded in unweeded control treatment (30.20 g/ 0.25m^2) compared to all the treatments. Among the herbicide treatments, post emergence application of propaquizafop 5% @ 0.050 kg a.i.ha^{-1} + Oxyfluorfen 12% EC 0.120 kg a.i.ha^{-1} recorded significantly lower biomass (6.0g/0.25m^2) compared to unweeded control and pre-emergence application of Pendimethalin. It indicates that post emergence application of herbicide is very much necessary to

Table 2. Effect of different weed management practices on weed biomass, weed control efficiency, bulb yield and economics of onion cultivation. DAT : Days after transplanting HW : Hand Weeding PRE : Pre-emergence POE : Post-emergence EC : Emulsifiable concentrate.

	Treatment details	Weed biomass ($g/0.25m^2$)	Weed control efficiency (%)	Bulb yield t ha^{-1}	Net returns Rs ha^{-1}	B : C
T_1	Propaquizafop 5% 0.038 kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.090 kg a.i. ha^{-1} (POE)	7.40	75.30	14.65	85556	3.71
T_2	Propaquizafop 5% 0.044 kg a.i.ha^{-1} + Oxyfluorfen 12% EC 0.088 kg a.i. ha^{-1} (POE)	7.60	74.60	14.74	86210	3.72
T_3	Propaquizafop 5% 0.050 kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.120 kg a.i.ha^{-1} (POE)	6.00	80.00	15.06	88624	3.78
T_4	Pendimethalin 30 EC 1.0 kg a.i.ha^{-1} (Pre)	15.80	47.40	13.09	72675	3.27
T_5	Propaquizafop 10% 0.075 kg a.i. ha^{-1} (POE)	9.80	67.60	14.26	82233	3.58
T_6	Oxyfluorfen 23.5 EC 0.2 kg a.i. ha^{-1} (POE)	9.60	68.10	13.74	77657	3.41
T_7	Farmer practice (HW at 25 & 45 DAT)	9.80	67.40	12.91	69184	3.03
T_8	Weed free check	0.00	100.00	16.33	94668	3.63
T_9	Unweeded control	30.20	0.00	8.41	36164	2.16
	SEm±	1.90	1.80	0.40	2922	0.09
	CD at 5%	5.90	5.40	1.10	8761	0.27

control weeds in later stages of crop growth as onion cannot compete with weeds during this period. In contrast to this, significantly higher weed control efficiency was recorded with treatment Propaquizafop 5% 0.050 kg ai ha^{-1} + Oxyfluorfen 12% EC 0.120 kg a.i. kg ha^{-1} (80.0%) compared to T_4 (47.40%), T_5 (67.60%), T_6 (68.10%) T_7 (67.40%) and T_9 (0.00) however at par with T_1 (75.30%) and T_2 (74.60%), which indicates that combined application of post emergence application of herbicide have detrimental effect on weeds compared to application of single molecule of herbicide as well as hand weeding alone. Similar findings of application of propaquizafop 10 EC @ 62.5 g a.i. ha^{-1} could be used for the weed management in onion instead of traditional costly hand weeding [3, 4]. Application of oxyfluorfen (23.5% EC) at 400 g ha^{-1} gave significantly lower total weed density, weed dry weight and higher weed control efficiency at all the intervals [5—7].

The statistical analysis of the data showed that the bulb yield in weed-free check recorded significantly higher (16.33 t ha^{-1}) among the weed control treatments. The higher bulb yield in weed-free check was mainly due to the complete elimination of weed competition for growth resources throughout crop growth which enabled better crop growth. Among the herbicide treatments, Propaquizafop 5% @ 0.050kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.120 kg a.i. ha^{-1} recorded on par bulb yield with T_2, T_1 and T_5 but it was statistically higher (15.06 t ha^{-1}). This is because of lower weed biomass and higher weed control efficiency this helped to utilize the applied inputs during critical period. In unweeded check the competition from weeds prevailed for the entire season and hence reduced the bulb yield (8.41 t ha^{-1}). Similar findings of application of Propaquizafop 5% reduced the weed density and obtained higher yields and it was comparable with Pantera 40 CE [8]. It clearly indicates that combined application of Propaquizafop 5% and Oxyfluorfen 12% will improve the effectiveness of the herbicide. Application of Oxyfluorfen 23.5% EC before planting +quizalofop ethyl 5% EC at 30 days after transplanting recorded highest weed control efficiency and higher marketable bulb yield with cost benefit ratio [9]. The variability is due to effectiveness of weed control methods, which ultimately increased the nutrient availability for the crop. Higher bulb yield in Propaquizafop 5% @0.050 kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.120 kg a.i. ha^{-1} applied treatment obtained significantly higher net returns (Rs 88624) and BC ratio (3.78) compared to T_4, T_6, T_7 and T_9 but it was at par with rest of the herbicide treatments. This was mainly due to lesser cost of cultivation particularly on weed management. Similarly application of oxyflurofen 23.5% EC @ 1.5ml/L before planting and one hand weeding at

40—60 days after onion seedlings transplanting recorded the higher marketable bulb yield 43.5 t ha^{-1}) with maximum weed control efficiency of 78.4%. The same treatment was also recorded higher cost benefit ratio of 1 : 3.06 [6].

Conclusion

The results show that the herbicide Propaquizafop 5% @ 0.050 kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.120 kg a.i. ha^{-1} and weed free treatments were the most effective in weed control and onion yield; however both were almost similar to each other. Moreover, former herbicide treatment did not differ statistically from Propaquizafop 5% 0.044 kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.088 kg a.i. ha^{-1} (POE), Propaquizafop 5% 0.038 kg a.i. ha^{-1} + Oxyfluorfen 12% EC 0.090 kg a.i. ha^{-1} (POE) and Propaquizafop 10% 0.075 kg a.i. ha (POE). Thus Propaquizafop 5%@ 0.050 kg a.i. ha^{-1} + Oxyfluorfen 12%EC 0.120 kg a.i. ha^{-1} as post-emergence herbicide is the best option for chemical weed control in onion crop to gain desirable yields.

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