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Studies on weed management practices in onion (*Allium cepa* L.) under central dry zone of Karnataka

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Abstract
A field experiment was conducted to study the efficacy of different weed management practices in onion at Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriyur, Chitradurga during *rabi* 2020-21, having nine treatments replicated thrice in Randomized Complete Block Design. Among the different weed management practices, Hand weeding at 15, 30, 45 and 60 days after transplanting (DAT) recorded significantly maximum growth parameters at 90 DAT *viz.*, plant height (72.47 cm), number of leaves per plant (11.93), collar thickness (15.29 mm) and also yield parameters *viz.*, neck thickness before (13.49 mm) and after curing (12.63 mm), polar (5.69 cm) and equatorial diameter (6.43 cm) of bulb, total bulb yield (32.04 t/ha) and marketable bulb yield (31.70 t/ha). These values are statistically on par with the treatment T_6 (Oxyfluorfen 45 % EC @ 0.75 l/ha 3 DAT + hand weeding at 45 DAT) *i.e.*, plant height (69.73 cm), number of leaves per plant (11.20 mm), collar thickness (14.81) and also yield parameters *viz.*, neck thickness before (12.79 mm) and after curing (12.13 mm), polar (5.25 cm) and equatorial diameter (6.12 cm) of bulb, total bulb yield (31.85 t/ha), marketable bulb yield (31.44 t/ha). Based on the results obtained from the present investigation, hand weeding at 15, 30, 45 and 60 days after transplanting found to be promising for getting higher onion yield. However due to sever scarcity and non-availability of labours, it is not possible to carry out timely weeding operation in onion. So, the economically viable and comparatively effective weed control was observed in T_6.

Keywords: weed management practices, onion, *Allium cepa* L

Introduction
Onion (*Allium cepa L.*), having a chromosome number of 2n=16. It is an important widely grown popular vegetable crop belongs to the family Alliaceae. Onion is considered as the second most important vegetable grown in the world after tomato and most important commercial vegetable crop of India. It is an indispensable item in every kitchen as vegetable used to flavour many food stuffs and also used as salad and pickle. Therefore, onion is popularly referred as 'Queen of the kitchen.' Recently, onion is being employed in processing industry preparing dehydrated onion powder and flakes etc.

India ranks first, second and third in area, production and export of onion respectively in the world. In India, onion is predominantly cultivated during rabi (60 %) followed by each in kharif and late kharif season (20 % each). In India, onion is being grown in an area of 1,434 thousand hectares with the annual production of 26,738 thousand metric tonnes (Anon., 2019-20). Maharashtra, Karnataka, Madhya Pradesh, Gujarat, Rajasthan, Bihar, Andhra Pradesh and Tamil Nadu are the main onion growing states in India.

Though India stands second place concerning the production of onion in the world next to China, the productivity is very low as compared to other developed countries. The higher productivity could be achieved by growing high yield varieties specific to particular region with improved agronomical practices such as balanced nutrition, providing optimum irrigation need based plant protection measures, harvesting and post-harvest handling of the produce *etc.*

In onion, weeds start emerging immediately and grow along with the crop. Weed competition reduces bulb yield of onion to the extent of 40 to 80 per cent depending upon the nature, intensity and duration of weed competition (Verma and Singh, 1997) [16]. Hence, weed control in onion is one of the prime factor to check the yield loss as well as quality of onion. Manual weeding though very effective in controlling weeds, often cumbersome because labour intensive, expensive and time consuming (Warade *et al*., 2006) [6]. Therfore there is need to study the weed management practices to reduce the weed losses. Some dominant weed species observed in the onion feed are *Chenopodium album* L., *Amaranthus viridis* L., *Portulaca oleracea* L., *Parthenium histerophorus* L., *Cyperus rotundus* L., and *Cynodon dactylon* L. Which are need to remove to get higher yield. Crop yield losses due to weeds mainly depends on their intensity as well as on type of weed flora present in the field. The present research was planned to investigate the effect of weed management practices on growth and yield parameters.

Material and Methods
The experiment was conducted at Zonal Agricultural and Horticultural Research Station, Babbur Farm, Hiriyur, Chitradurga district which is situated in Central dry zone (Zone-4) of Karnataka state between 13°57'32" North latitude and 70°37'38" East longitude at 606 meters above Mean Sea Level (MSL). The experiment was carried out with nine treatments and three replications in Randomized Complete Block Design. Treatment were as follows: T_1 – Pendimethalin 30% EC @ 1.0 l/ha 3 DAT, T_2 – Oxyflurofen 45% EC @ 0.75 l/ha 3 DAT, T_3 – Quizalofop ethyl 5% EC @ 0.8 l/ha at 30 DAT, T_4 – Hand weeding at 15, 30, 45 and 60 DAT, T_5 – Pendimethalin 30% EC

@ 1.0 l/ha 3 DAT + Hand weeding at 45 DAT, T_6 – Oxyflurofen 45% EC @ 0.75 l/ha 3 DAT + Hand weeding at 45 DAT, T_7 – Quizalofop ethyl 5% EC @ 0.8 l/ha at 30 DAT + Hand weeding at 60 DAT, T_8 – Mulching with local grass/ stubbles, T_9 – Control.

Method of application

Pre-emergence: The herbicides like Oxyfluorfen and Pendimethalin used in onion for weed control. The pre-emergence application of weedicides was sprayed 3 to 4 days after transplanting instead of before planting to get better results in weed control.

Post-emergence: The herbicides like Oxyfluorfen, Quizalfop-ethyl and Fenoxaprop-p-ethyl were used as post emergence herbicides. Post-emergence was applied 25 DAT to control all types of weeds.

Observations recorded

Five plants were selected randomly in each plot and tagged for recording observations. The observations on growth and yield parameters are Plant height, Number of leaves, Collar thickness, Neck thickness, Polar bulb diameter, Equatorial bulb diameter, Bulb yield, Marketable bulb yield.

Results and discussion

Growth parameters

Results indicated that among the different treatments, T_4 (Hand weeding at 15, 30, 45 and 60 DAT) recorded the maximum plant height (72.47 cm) at 90 days after transplanting. Which was on par with T_6 (Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT + hand weeding at 45 DAT). This might be due to less weed competition during the critical growth period and better availability of nutrients, moisture, sunlight and space for crop growth. Increase in plant height was associated with rapid meristematic activity, probably due to rapid cell division and elongation during the tender growth period. Removal of weeds during early stages of crop growth resulted in reduced weed competition and enabled the crop to grow taller. At all stages of crop growth, control resulted in the plants of short stature, which might be due to competition extended by the weeds. T_4 (Hand weeding at 15, 30, 45 and 60 DAT) recorded the maximum number of leaves (11.93) at 90 days after transplanting. This might be attributed to greater weed management during the early phases of crop growth, which corresponded with a critical crop growth period and weed competition, followed by less competition for nutrients, moisture, and sunshine, which increased crop growth in terms of leaf number per plant. Collar thickness (15.29 mm) also recorded maximum in T_4 (Hand weeding at 15, 30, 45 and 60 DAT). This may be due to better control of weeds during crop growth period in these treatment and also no phytotoxicity effects were observed on the crop which resulted in maximum collar thickness. These findings are in close conformity with those reported by Kalhapure *et al*. (2013) [6, 5], Vishnu *et al*. (2015) [13], Sahoo *et al*. (2017) [8], Sahu *et al*. (2018) [9], Vijayvergiya *et al*. (2018) [12] and Gupta *et al*. (2019) [8] in onion.

Yield parameters

Neck thickness before (13.49 mm) and after curing (12.63 mm) recorded maximum in T_4 (Hand weeding at 15, 30, 45 and 60 DAT). These values are statistically on par with T_6 (Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT + hand weeding at 45 DAT). This was due to lesser crop–weed competition at earlier stage for growth resources, thus providing favourable environment to crop for better expression of growth. Hand weeding at 15, 30, 45, 60 DAT which offers efficient and prolonged weed control and kept the crop weed free during the critical periods of competition.

Hand weeding at 15, 30, 45 and 60 DAT (T_4) was recorded maximum Polar diameter of bulb 5.69 cm and Equatorial diameter of bulb 6.43 cm. Which was on par with T_6 (Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT + hand weeding at 45 DAT). This could be due to that progressive increase in diameter with these treatments was because of the fact that weed population and weed growth remained low from initial crop growth as compared to control which, reduced the crop weed competition and might have provided better environment for proper development of yield attributes viz., bulb diameter (polar and equatorial).

Bulb yield 32.04 t/ha and Marketable bulb yield 31.70 t/ha was observed highest in T_4 (Hand weeding at 15, 30, 45 and 60 DAT). These values are statistically on par with T_6 (Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT + hand weeding at 45 DAT). Increase in bulb yield with these treatments was because of the fact that the weed population and weed growth remain low during the entire crop growth period, which leads to increase in various growth characters of crop which are correlated with the yield characters (Kalhapure *et al*., 2013) [6, 5]. It also may be due to less weed crop competition throughout crop growth period by manual weeding, which in turn maintain the soil fertility status by way of removing less plant nutrients through weeds and ultimately have favourable effect on growth parameters and yield attributes. These results in respect of yield attributes and yield were in close conformity with the earlier findings of Yumnam *et al*. (2009), Zubair *et al*. (2009), Kalhapure and Shete (2013) [6, 5], Vishnu *et al*. (2015) [13], Singh *et al*. (2016) [10], Sahoo *et al*. (2017) [8], Chaurasiya *et al*. (2018), Reddy *et al*. (2018), Vijayvergia *et al*. (2018), Das *et al*. (2019) and Gupta *et al.* (2019) [4] in onion.

Conclusion

Based on the results obtained from the present investigation, hand weeding at 15, 30, 45 and 60 days after transplanting found to be promising for getting higher onion yield. However due to sever scarcity and non-availability of labours, it is not possible to carry out timely weeding operation in onion. So, the economically viable and comparatively effective weed control was observed in treatment with Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT+ hand weeding at 45 days after transplanting.

Table 1: Effect of weed management practices on growth parameters of onion

Treatments	Plant height (cm)	Number of leaves per plant	Collar thickness (mm)
T_1– Pendimethalin 30% EC @ 1.0 l/ha 3 DAT	59.40	8.93	11.92
T_2– Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT	61.53	9.00	12.53
T_3– Quizalofop ethyl 5% EC @ 0.8 l/ha at 30 DAT	62.80	9.60	13.23
T_4– Hand weeding at 15, 30, 45 and 60 DAT	72.47	11.93	15.29

T_5– T_1+ Hand weeding at 45 DAT	66.87	10.53	13.73
T_6– T_2+ Hand weeding at 45 DAT	69.73	11.20	14.81
T_7– T_3+Hand weeding at 60 DAT	65.60	9.93	13.71
T_8– Mulching with local grass/ stubbles	58.40	8.60	11.50
T_9– Control	53.93	7.60	10.49
S.Em ±	1.38	0.35	0.40
C.D @ 5%	4.14	1.06	1.21

Table 2: Effect of weed management practices on yield parameters of onion

Treatments	Neck thickness Before curing (mm)	Neck thickness After curing (mm)	Polar diameter of bulb (cm)	Equatorial diameter of bulb (cm)	Total bulb yield (t/ha)	Marketable bulb yield (t/ha)
T_1– Pendimethalin 30% EC @ 1.0 l/ha 3 DAT	10.77	9.13	4.21	4.92	24.37	23.41
T_2– Oxyfluorfen 45% EC @ 0.75 l/ha 3 DAT	10.94	9.24	4.35	5.34	25.25	24.29
T_3– Quizalofop ethyl 5% EC @ 0.8 l/ha at 30 DAT	11.29	9.77	4.61	5.41	26.96	26.21
T_4– Hand weeding at 15, 30, 45 and 60 DAT	13.49	12.63	5.69	6.43	32.04	31.70
T_5– T_1+ Hand weeding at 45 DAT	11.78	10.67	4.93	5.59	29.77	29.14
T_6– T_2+ Hand weeding at 45 DAT	12.79	12.13	5.25	6.12	31.85	31.44
T_7– T_3+Hand weeding at 60 DAT	11.31	10.13	4.73	5.54	28.83	28.20
T_8– Mulching with local grass/ stubbles	9.81	8.21	3.93	4.50	15.89	14.93
T_9– Control	9.17	7.68	3.63	4.11	10.96	9.56
S.Em ±	0.54	0.45	0.17	0.25	0.41	0.42
C.D @ 5%	1.63	1.35	0.51	0.76	1.23	1.27

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