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Effect of weed management on growth and yield of *Kharif* onion

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Abstract
A field trial was conducted in orchard of Horticultural College and Research Institute, TNAU, Coimbatore during *kharif* season (2016 – 2017) to evaluate the effect of cultural and chemical practices for controlling the weeds of onion. The treatment comprised hand weeding, plastic mulching, organic mulching, different herbicides, their combination with hand weeding and weedy check. The treatment was laid out in randomized block design with four replications. The study revealed that effective weed control was recorded under application of Oxyflurofen 23.5% EC application before planting + one hand weeding at 40-60 days after transplanting (T1). The same treatment (T1) recorded significantly highest value for plant height, number of leaves and average bulb weight compared to other treatments. Significantly highest marketable and total bulb yield was recorded in T1 treatments followed by T2. Spraying of pre-emergence herbicides keeps the crop in weed free conditions during early stages. Then, at later stages hand weeding helps to reduce the weed population throughout the cropping period thereby increase the yield.

Keywords: weed management, onion, oxyflurofen, pendimethalin, mulching

Introduction
Onion (*Allium cepa* var. *cepa* L.) one of the important bulbous vegetable crop of economic importance and grown almost all over the world. India is the second largest producer of onion in the world, next to China. Onion has culinary, dietary and medicinal importance in daily life of Indian people and due to its export trade, it is also a major vegetable crop to gain foreign currency. In India, Maharashtra is the leading onion producing state followed by Karnataka and Gujarat. The crop is grown in extensive scale in Orissa, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan and Orissa. Onion is valued for its bulbs having characteristic odour, flavor and pungency. Odour and taste is due to presence of biologically reactive organosulfur compound and pungency is due to presence of a volatile oil – allyl-propyl-disulphide. The productivity of onion mostly affected by pest, diseases and weeds. Onion exhibits greater susceptibility to weed competition as compared to other crops due to slow growing, shallow rooted, upright leaves and non-branching habits of onion crop cannot compete with weeds especially during early stage of crop. Weeds are competing with crop plants for available soil moisture, nutrients, space and light. In addition they serve as alternate host for several diseases and pests. Irrigation along with fertilizer application allows for more weeds in onion during cropping period. Frequent rains during cropping period hinder the cultural practices of weed control. Uncontrolled weed growth reduces the bulb yield upto 40-80 per cent depending upon the nature of intensity and duration of weed competition in onion field. The manual and mechanical methods of weed control in onion is being less effective, expensive and time demand as well as need to be repeated at frequent intervals and also non-availability of labour during critical growth stage of onion crop resulting in production of unhealthy seedlings and bulbs in onion. The critical period of crop weed competition in onion lies between 15-60 days after transplanting (Singh and Singh, 1994). Under such situation, managing the weeds in early stages of onion is a crucial task to get higher weed control efficiency and bulb yield. Spraying of pre-emergence herbicides keeps the crop in weed free conditions during early stages. Use of herbicides alone does not prove effective for weed control due to their spectrum of weed kill. Hence an attempt was made to find out the appropriate combination of cultural and chemical weed management practices for weed control in onion.

Materials and Methods

Field experiment was conducted to compare various weed management practices in onion under All India Network Research Project on Onion and Garlic at College orchard of Horticultural College and Research Institute, TNAU, Coimbatore during the year 2016 to 2017 in kharif season with plot size of 1.2 m x1.2 m and 15 x 10 cm spacing in randomized block design with four replications. The six treatments are presented in Table 1. All recommended packages of practices were adapted uniformly to all the treatment. The data was recorded for vegetative parameters (plant height and number of leaves), yield parameters (average bulb weight, marketable bulb yield and total bulb yield) as well as weed parameters *viz.*, monocot and dicot weed population, fresh and dry weight of weeds per square meter and weed control efficiency from individual plots of each replications were recorded with treatment wise. The observed data were then subjected to statistical analysis (Panse and Sukhatme, 1985) [5].

Result and Discussion

Effect of mulches on weed management

Effect of different treatments for weed management in onion at different stages of crop growth revealed significant variations. Among the monocot weed control treatment use of plastic mulch (T4 - 2.00 in number) practices recorded the lowest weed population followed by spraying of Oxyflurofen 23.5% EC before planting + one hand weeding at 40-60 days after transplanting (T1- 9.67 in number) recorded lowest monocot weed population whereas weedy check (T6) (26.00) recorded the highest weed populations. Among the dicot weed control treatment of plastic mulch (T4 - 2.00) practices recorded the lowest weed population followed by spraying of Oxyflurofen 23.5% EC before planting + one hand weeding at 40-60 days after transplanting recorded lowest monocot weed population. Whereas weedy check recorded the highest weed population of 24.33. The weedy check recorded the highest dry matter of weeds and zero weed control efficiency, where is due to uncontrolled condition favoured luxurious weed growth leading to increased dry matter accumulation. The findings were in conformity with those reported by Bharathi *et al*. (2011) [2], Patel *et al.* (2013) [12] and Kalhapure and Shete (2013) [4].

With reference to fresh and dry weight of monocot and dicot weed control treatments, plastic mulch (T4) practices recorded lowest fresh weight of weeds (76.67 g) whereas weedy check recorded the highest fresh weight of weeds (621.0 g). Among the dicot weed control treatments plastic mulch (T4) practices recorded lowest fresh weight of weeds (57.67 g) whereas organic mulch (Paddy/maize/wheat straw/any other biomass mulch) recorded the highest fresh weight of weeds (408.67 g). The data revealed on dry weight of monocot and dicot weed control treatments, plastic mulch practices recorded lowest dry weight of 25.00 g and 18.33 g respectively, where as weedy check recorded the highest dry weight of monocot (172.67 g) and dicot weeds (131.00 g). 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 dry matter in weedy check. These results are in close confirmity with findings reported by Kumar (2014) [13], Kalhapure *et al*. (2013) [4] and Angadi and Dharmatti (2012) [1].

Weed control efficiency

The data presented on weed control efficiency in onion revealed significant variations among the treatments. In weed management treatments highest weed control efficiency (88.46 %) was recorded with the treatment T4 (Plastic mulch) followed by T1 (41.00 %) (Oxyflurofen 23.5% EC application before planting + one hand weeding at 40-60 days after transplanting) and lowest weed control efficiency (6.42%) was recorded with treatment T3. The higher weed control efficiency in these treatments might be due to the significant reduction in weed dry matter because effective weed control practices through application of pre-emergence and/or post emergence herbicides. Similar results were also reported by Shinde *et al*. (2013) [9].

Effect on crop growth parameters

In weed control treatments, significant variations were observed for growth and yield parameters in onion. For growth parameters, the highest plant height of 56.32 cm was recorded by application of Oxyflurofen 23.5% EC before planting + one hand weeding at 40-60 days after transplanting followed by Oxyflurofen 23.5% EC application before planting + one hand weeding at 30 days after transplanting + Quizalofop Ethyl 5% EC application at 60 days after transplanting. Similarly, highest number of leaves also recorded by application of Oxyflurofen 23.5% EC before planting + one hand weeding at 40-60 days after transplanting followed by Oxyflurofen 23.5% EC application before planting + one hand weeding at 30 days after transplanting + Quizalofop Ethyl 5% EC application at 60 days after transplanting. Taller plant height and higher number of green leaves was due to the effective management of weeds by herbicides and hand weeding at the critical crop weed competition period. The results presented are in conformity with that of Vishnu *et al*. (2015) [14]. Highest bulb weight (70.35 g) was observed in treatment with Oxyflurofen 23.5% EC before planting + one hand weeding at 40-60 days after transplanting and lowest bulb weight of 50.85 g was observed in weedy check treatment. Increase in bulb weight was due to the effective management of weeds by herbicides along with hand weeding at the critical crop weed competition period. The results presented are in conformity with that of Kalhapure *et al*. (2013) [4].

Effect on yield

The total yield and marketable yield was significantly influenced by different weed control treatments. The highest total yield (27.52 t/ha) and marketable yield (25.80 t/ha) was recorded by treatment with Oxyflurofen 23.5% EC application before planting + one hand weeding at 40-60 days after transplanting followed by treatment with Oxyflurofen 23.5% EC application before planting + one hand weeding at 30 days after transplanting + Quizalofop Ethyl 5% EC application at 60 days after transplanting and lowest total and marketable yield was recorded by treatment with weedy check (T6). This may be due to in weedy check treatment weeds compete with crop plants for space, nutrients, moisture and light there by reduces the quality and quantity of yield. These results were accordance with the findings of Tripathy *et al.* (2013) [12] Rathod *et al.* (2014) [6] Singh *et al*. 2016 [7] and Kalhapure *et al.* (2013) [4].

Conclusion

The present study exhibited that weed management practices produced significantly highest weed control efficiency, plant height, number of leaves, average bulb weight, total yield and marketable yield with application of pre-emergence spray of Oxyflurofen 23.5% EC application before planting + one hand weeding at 40-60 days after transplanting.

Table 1: Treatment details

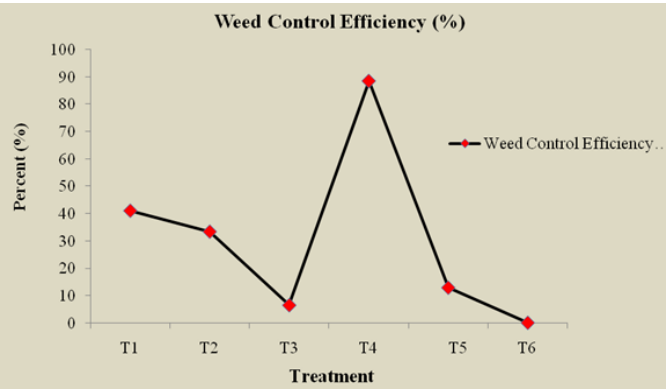
T. No	Treatment
T1	Oxyflurofen 23.5% EC application before planting + one hand weeding at 40-60 days after transplanting
T2	Oxyflurofen 23.5% EC application before planting + one hand weeding at 30 days after transplanting + Quizalofop Ethyl 5% EC application at 60 days after transplanting
T3	Pendimethalin 30 % EC application before planting+ one hand weeding at 30 days after transplanting + Quizalofop Ethyl 5% EC application at 60 days after transplanting
T4	Plastic mulch
T5	Organic mulch (Paddy/maize/wheat straw/any other biomass mulch)
T6	Weedy check

Table 2: Effect of herbicides on yield and yield parameters for onion

Treatments	Monocot/dicot population		Fresh weight (g)		Dry weight (g)		WCE (%)
	Monocot	Dicot	Monocot	Dicot	Monocot	Dicot	
T_1	9.67	5.67	240.33	164.33	111.67	42.67	41.00
T_2	10.33	7.00	295.33	277.00	106.00	77.33	33.35
T_3	15.33	9.00	461.67	377.67	152.33	103.67	6.42
T_4	2.00	1.00	76.67	57.67	25.00	18.33	88.46
T_5	13.33	9.33	416.00	408.67	114.00	115.00	12.85
T_6	26.00	24.33	621.00	358.00	172.67	131.00	0.00
CD (p=0.05)	3.41	2.06	10.35	8.24	7.01	6.38	--
CV (%)	5.34	7.94	11.05	10.38	8.27	9.30	--

Table 3: Effect of herbicides on yield and yield parameters for onion

Treatments	PH(cm)	No. of leaves	AWB (g)	A grade bulb (%)	B grade bulb (%)	C grade bulb (%)	Doubles (%)	TBY (t/ha)	MBY (t/ha)
T_1	56.32	14.70	70.35	26.80	30.00	41.20	1.20	27.52	25.80
T_2	54.51	12.26	67.80	22.36	35.42	40.10	1.75	26.37	24.92
T_3	50.60	11.68	58.94	18.18	36.16	42.96	2.50	21.73	20.25
T_4	51.28	12.91	60.34	19.10	31.74	46.2	2.93	23.50	21.92
T_5	52.98	11.90	55.63	13.45	35.51	48.65	2.06	21.79	19.50
T_6	48.60	9.00	50.85	6.50	26.36	63.05	1.90	19.20	17.54
SED	0.16	0.05	0.06	2.15	1.94	2.09	0.72	3.18	3.49
CD (p=0.05)	0.34	0.13	0.18	4.93	4.03	5.00	1.79	8.06	7.34
CV (%)	4.26	5.25	4.40	11.31	6.23	11.90	10.50	10.54	10.28



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