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Effect of weed management on growth and yield of onion (*Allium cepa* L.)

S K SAHOO, [1]S CHAKRAVORTY, L SOREN, C. MISHRA AND [2]B. B. SAHOO

Krishi Vigyan Kendra, Deogarh, Odisha, PIN – 768 119

[1]CIHAB Department, Palli Sikhsha Bhavan, Visva Bharati, Sriniketan, West Bengal

[2]RRTTS (OUAT), Semiliguda, Koraput, Odisha

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ABSTRACT

A field experiment entitled "effect of weed management on growth and yield of onion (Allium cepa L.)" was undertaken during Rabi 2011-12 and 2012-13 in farmer's field of Deogarh district of Odisha. Among the nine treatments taken, the highest weed control efficiency (100%), plant height (60.63 cm), No. of leaves (8.80), leaf area (427.67 sq. cm), average bulb weight (92.65 g), total yield (315.76 q ha^{-1}) and 0% weed control index were observed in weed free check followed by weed control efficiency (75.75%), plant height (58.77 cm), No. of leaves (8.60), leaf area (410.87 sq. cm), total yield (308.52 q ha^{-1}), 2.31% weed control index and highest BC ratio (2.73:1) with application of pre-emergence spray of Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1} + post-emergence spray of ½ dose of (Quizalofop ethyl 5% EC @ 0.05 kg ha^{-1} + Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1}) at 40 DAT.

Keywords: Economics, oxyfluorfen, quizalofop ethyl

Onion (*Allium cepa* L.), is an important species belonging to family Alliaceae. It is an indispensible item in every kitchen as vegetable and condiment used to flavour many of the food stuffs. Therefore, onion is popularly known as 'Queen of the kitchen'. Onion is considered to be the second most important vegetable crop grown in the world next to tomato. In the world, India stands first in area and ranks second to China in production; the total area in India under onion cultivation during 2012-13 was 10.51 lakh hectare with a production of 168.13 lakh tons and productivity of 16 t ha^{-1} (Tiwary, 2014). 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 (Singh *et al.*, 1986). It is an established fact that weeds compete with crop plants for space, nutrients, moisture and light there by reduces the quality and quantity of yield (Moolani and Sachan, 1966). In onion, weeds emerge with transplanting of seedlings and grow along with them. This causes severe competition between the crop and weed (Bhan *et al.*, 1976). 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). 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). Hence, managing the weeds meticulously in early stages is an imperative task to get higher weed control efficiency and bulb yield. Herbicides when used with one or two hand weedings showed improved efficiency in control of weeds. The control of weeds either through herbicide alone or in combination with hand weeding at 45 days after transplanting registered higher net returns/ rupee investment compared to weed free check (Ved Prakash *et al.*, 2000). Spraying of pre-emergence herbicides keeps the crop in weed free conditions during early stages. Then, at later stages hand weeding or application of post emergence herbicides helps to reduce the cost of weeding and keep the weed population below economic threshold level throughout the crop growth period.

MATERIALS AND METHODS

Field experiments were conducted to find out the weed management practices on growth and yield of onion at Malehipada village of Reamal block of Deogarh district of Odisha during *rabi* 2011-12 and 2012-13, which is located at 21° 34' 81" North latitude, 84° 64' 06" East longitude and at an altitude of 220 meters above the mean sea level. The experiment was conducted on medium deep black soil and the texture of the soil was

Email: sukantasahoo@gmail.com

clay loam type. The soil pH of the plots were found to be in the range of 7.32. The average fertility status of experimental site was available N 284 kg ha^{-1}, P 28.3 kg $ha^{-1}$and K 445 kg ha^{-1}. The experiment was laid out in Randomised Block Design. The experiment consist of nine treatments *viz*., T_1 – Control, T_2 - Weed free check, T_3 - Hand weeding at 20, 40 and 60 DAT, T_4 - Pre-emergence spray of Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1} followed by 1 hand weeding at 40-60 DAT, T_5 - Pre-emergence spray of Pendimethalin 30% EC @ 1kg ha^{-1} followed by 1 hand weeding at 40-60 DAT, T_6 - Pre-emergence spray of Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1} + Post-emergence spray of Quizalofop ethyl 5% EC @ 0.05 kg ha^{-1} at 40 DAT, T_7 - Pre-emergence spray of Pendimethalin 30% EC @ 1 kg ha^{-1} + Post-emergence spray of Quizalofop ethyl 5% EC @ 0.05 kg ha^{-1} at 40 DAT, T_8 - Pre-emergence spray of Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1} + Post-emergence spray of ½ dose of (Quizalofop ethyl 5% EC @ 0.05 kg ha^{-1} + Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1}) at 40 DAT, T_9 - Pre-emergence spray of Pendimethalin 30% EC @ 1kg ha^{-1} + Post-emergence spray of ½ dose of (Quizalofop ethyl 5% EC @ 0.05 kg ha^{-1} + Pendimethalin 30% EC @ 1kg ha^{-1}) at 40 DAT. 45 days old onion seedlings of variety, Agrifound Light Red were transplanted in the plot with a spacing of 15 × 10cm. All recommended packages of practices were adopted uniformly to all the treatments except weed management practices to raise a good crop. The data was recorded for vegetative parameters (plant height and number of leaves), yield parameters (average bulb weight and total bulb yield). The observed data were then subjected to statistical analysis (Gomez and Gomez, 1984). The treatment comparisons were made using t-test at 5% level of significance. The economics was calculated on the basis of prevailing local market price of onion bulbs and cost of inputs.

RESULTS AND DISCUSSION

Effect on weed control efficiency

The data presented on weed control efficiency in onion (Table 1) revealed significant variations among the treatments. Maximum weed control efficiency 100 per cent was recorded in weed free check (T_2), whereas, zero weed control efficiency was recorded in T_1 (control). In weed management treatments highest weed control efficiency (75.75%) was recorded with the treatment T_8 and lowest weed control efficiency (38.53%) was recorded with treatment T_3. The present findings corroborated with the findings of Yumnam *et al.* (2009), Ali *et al.* (2011), Meena *et al.* (2011), Yadav *et al.* (2011), Tripathy *et al.* (2013) and Rathod *et al.* (2014).

Effect on growth parameters

The data presented on vegetative parameters in onion (Table 1) revealed significant variations among the treatments. Significantly highest pooled plant height was recorded in T_2 (60.63 cm) followed by T_8 (58.77cm). Significantly shortest pooled plant height of 41.62 cm was observed in control plots (T_1).Similar trend was also recorded in pooled number of leaves/plant, significantly maximum in T_2 (8.80) followed by T_8 (8.60) and minimum in T_1 (6.00). Significant variation was observed in pooled leaf area of year 2011-12 and 2012-13, maximum leaf area found with T_2 (427.67 sq. cm.) followed by T_8 (410.87 sq. cm.), T_6 (407.15 sq. cm.) and T_9 (405.12 sq. cm.). Lowest pooled leaf area was observed with T_1 (280.09 sq. cm.). The results clearly indicated the effect of weed management in onion. Similar results were reported by Verma and Singh (1997), Yumnam *et al.* (2009) and Tripathy *et al.* (2013).

Effect on yield, weed control index and economics parameters

Significant variations were also observed for average bulb weight and total bulb yield in onion (Table 2).The pooled average bulb weight in onion varies from 44.75 g (T_1) to 92.65 g (T_2). Significantly heaviest bulb was recorded in T_2 (92.65 g) than rest of the treatments except T_6 (86.23 g), T_4 (86.19 g), T_8 (85.88 g), T_9 (84.21g) and T_7 (82.82 g), which were statistically *at par*. The results also showed that treatment effect were significant in pooled total bulb yield in onion. Significantly highest total bulb yield was recorded in T_2 (315.76 q ha^{-1}) followed by T_8 (308.52q ha^{-1}), T_9 (302.75q ha^{-1}), T_6 (298.72 q ha^{-1}) and T_7 (290.33 q ha^{-1}) than the rest of the treatments. On the other hand, significantly lowest pooled total yield of 140.22q ha^{-1} was recorded in T_1, the control plot. A perusal of results of weed control index presented in table 2 revealed the significant variations among the treatments during both the years of study Highest weed control index (55.34%) was recorded in control (T_1) followed by 22.76% in T_3 (hand weeding at 20, 40 and 60 DAT). 0% weed control index was recorded in weed free check (T_2). The results are in agreement with Dubey and Moorthy (2005), Chinnusamy *et al.* (2006), Yumnam *et al.* (2009), Tripathy *et al.* (2013) and *Rathod et al.* (2014).

The result on BC ratio (Table 2) showed variability among different weed management applied in onion. The pooled BC ratio estimated in weed management practice over control indicated maximum BC ratio of 2.73 in T_8 followed by 2.64 in T_9 and minimum 1.32 in T_1. Similar results were also reported by Chopra and Chopra (2007), Rajkumara and Palled (2009), Kalhapure and Shete (2012) and Kalhapure *et al.* (2013).

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

Treatment	Weed Control Efficiency (%)			Plant Height (cm)			No. of Leaves			Leaf Area (sq. cm.)		
	2011-12	2012-13	Pool	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
T_1	0.00	0.00	0.00	42.33	40.91	41.62	6.07	5.93	6.00	286.45	273.73	280.09
T_2	100.00	100.00	100.00	61.64	59.61	60.63	8.87	8.73	8.80	434.63	420.71	427.67
T_3	36.99	40.08	38.53	48.93	47.04	47.99	7.20	7.07	7.13	379.49	367.37	373.43
T_4	57.86	57.15	57.50	56.42	54.42	55.42	7.93	7.80	7.87	406.00	385.19	395.60
T_5	53.19	53.44	53.31	50.22	48.92	49.57	7.27	7.13	7.20	400.43	379.77	390.10
T_6	63.38	61.44	62.41	59.32	57.67	58.50	8.40	8.27	8.33	407.24	407.05	407.15
T_7	58.60	57.69	58.15	57.58	54.88	56.23	8.00	7.87	7.93	402.78	396.30	399.54
T_8	78.18	73.32	75.75	59.44	58.11	58.77	8.67	8.53	8.60	412.37	409.37	410.87
T_9	74.78	70.71	72.74	57.34	56.45	56.90	8.13	8.00	8.07	409.53	400.71	405.12
CV(%)	**6.87**	**5.92**	**6.42**	**6.15**	**9.78**	**8.12**	**9.14**	**7.99**	**8.59**	**6.99**	**6.75**	**6.88**
SEm (+)	**2.31**	**1.95**	**1.45**	**1.95**	**3.00**	**1.60**	**0.41**	**0.36**	**0.27**	**15.88**	**14.90**	**10.89**
LSD(0.05)	**6.91**	**5.85**	**4.74**	**5.83**	**8.99**	**5.23**	**1.24**	**1.07**	**0.89**	**47.60**	**44.66**	**35.49**

Table 2 Effect of weed management on yield, weed control index and economics parameters of onion

Treatment	Average bulb weight (g)			Total bulb yield (q ha^{-1})			Weed Control Index (%)			BC ratio		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
T_1	45.41	44.08	44.75	130.17	150.27	140.22	58.90	51.79	55.34	1.19	1.44	1.32
T_2	93.31	91.98	92.65	318.75	312.77	315.76	0.00	0.00	0.00	2.09	1.92	2.01
T_3	68.72	67.39	68.05	248.49	238.69	243.59	21.83	23.70	22.76	2.58	2.34	2.46
T_4	85.85	86.53	86.19	278.45	276.92	277.68	12.48	11.53	12.00	2.58	2.51	2.55
T_5	73.01	71.68	72.35	271.63	269.14	270.39	14.78	14.07	14.42	2.53	2.44	2.48
T_6	86.23	86.23	86.23	303.40	294.04	298.72	4.79	5.99	5.39	2.75	2.47	2.61
T_7	83.49	82.15	82.82	295.16	285.49	290.33	7.44	8.80	8.12	2.62	2.42	2.52
T_8	86.54	85.22	85.88	313.40	303.64	308.52	1.68	2.95	2.31	2.83	2.62	2.73
T_9	84.88	83.55	84.21	307.60	297.90	302.75	3.51	4.80	4.15	2.73	2.55	2.64
CV(%)	**11.85**	**10.83**	**11.36**	**9.35**	**9.17**	**9.26**	**54.95**	**56.14**	**55.54**	-	-	-
SEm (+)	**5.38**	**4.85**	**3.62**	**14.79**	**14.29**	**9.45**	**4.42**	**4.45**	**2.87**	-	-	-
LSD(0.05)	**16.13**	**14.55**	**11.81**	**44.35**	**42.82**	**30.81**	**13.25**	**13.35**	**9.37**	-	-	-

The present study exhibited that weed management practices produced significantly highest weed control efficiency, plant height, No. of leaves, leaf area, average bulb weight, total yield and 0% weed control index in weed free check followed by with application of pre-emergence spray of Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1} + post-emergence spray of ½ dose of (Quizalofop ethyl 5% EC @ 0.05 kg ha^{-1} + Oxyfluorfen 23.5% EC @ 0.25 kg ai ha^{-1}) at 40 DAT along with highest cost benefit ratio.

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