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Effect of weed management treatments on weed count, weed dry matter and bulb yield of onion under varying levels of nitrogen

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Abstract
A field experiment was conducted at SKN College of Agriculture, Jobner for two consecutive years during Rabi 2016-17 and 2017-18 to find out the efficient weed management in onion under varying levels of nitrogen. Among the different weed management treatments weed free check i.e. twice hand weeding treatment with 100 kg N/ha recorded significantly lowest weed dry weight and higher bulb yield compared to rest of the treatments except application of pendimethalin (PP) + oxadiargyl at 40 DAT combined with 100 kg N/ha or application of pendimethalin (PP) + 1 HW at 40 DAT combined with 100 kg N/ha, being statistically at par with each other.

Keywords: Weedy check, weed count, weed dry matter, bulb yield, hand weeding, pedimethalin

Introduction
Onion *Allium cepa* L. (2n=16) is one of the most important commercial vegetable crop grown all over the world. In India, the onion crop about an area of 1.27 million ha with a production of 21.564 million tons having average productivity of 16.97 mt/ha (Anonymous, 2017) [1]. The major onion producing states are Maharashtra, Madhya Pradesh, Karnataka, Rajasthan, Gujarat, Bihar, Andhra Pradesh and Haryana. species of *Allium* group. Onion among vegetables has very poor competitive ability with weeds due to its inherent characteristics such as shallow root system, narrow upright leaves and non branching habit. The losses in crop yield has direct correlation with weed competition and has been recorded to the extent of 40 to 80 per cent (Channapagoudar and Biradar, 2007) [2]. The effective weed management involves identification of weed flora and their management through suitable methods by maintaining crop productivity through supply of appropriate dose of nutrients. Keeping the above mentioned facts, the present investigation was undertaken to find out the best method of weed management in onion under varying levels of nitrogen.

Materials and methods
An experiment was conducted at department of Horticulture, SKN College of Agriculture, Jobner (Jaipur) Rajasthan during *rabi* 2016-17 and 2017-18 with plot size of 1.50x1.50 m. and 15x10 cm. spacing in split plot design with three replications. The seeds of onion cultivar RO-252 was sown for nursery raising in the 3rd week of September and the transplanting was done in the 2nd week of December for both years in flat beds. The treatments comprising seven weed management measures [unweeded (control), HW once at 20 DAT, HW twice at 20 and 40 DAT, Pendimethalin (PP) + Oxadiargyl at 40 DAT, Pendimethalin (PP) + 1 HW at 40 DAT, Oxyflourfen (PP) + Oxyflourfen at 20 DAT and Oxyflourfen (PP) + 1 HW at 40 DAT] were assigned to main plots and four levels of nitrogen (0, 50, 100 and 150 kg/ha) in sub plots. All packages of practices to raise good crop was done in the experiment. The treatments of weed management and various levels of nitrogen were applied.
Weed population counts were taken from an area of 0.25 sq.m. quadrant at random spot from each treatment and in each replication at 30, 60 and 90 DAT and at harvest stage, and number of weeds per quadrant was worked out. In order to draw valid conclusion, the weed count data was transformed using $\sqrt{(x+0.5)}$ transformation before subjecting to statistical analysis to make normal distribution and the analysis of variance valid as suggested by Gomez and Gomez (1984) [3]. The weed dry matter production was recorded after counting of weed and removing all weeds from quadrant sun dried for three days and after that oven dried at 65 ^{0}C and then weight of each dried sample was recorded (kg/ha). The observation on weed population, weed dry matter and bulb yield of onion were statistically analysed by using Panse and Sukhatme (1985).

Results and Discussion

The data recorded on total weed population/0.25m2 was depicted in Table 1. Under pooled mean of two years, the maximum number of weed counts were recorded in unweeded plots *i.e.* 7.18, 7.87, 8.32 and 8.39 for 30, 60 90 DAT and at harvest stage, respectively on the contrarily, the minimum number was encountered in the treatment twice hand weeding at 20 and 40 DAT *i.e.* 1.46, 2.04, 3.03 and 3.54 followed by treatment Pendimethalin 38.7% CS @ 1.0./ha (PP) with 1 hand weeding at 40 DAT *i.e.* 1.62, 2.21, 3.19 and 3.78 for 30, 60 90 DAT and at harvest stage, respectively. Under nitrogen levels minimum weed count war recorded in control (0 kg N/ha) *i.e.* 2.64, 3.54, 4.44 and 4.94 for 30, 60 90 DAT and at harvest stage, respectively. Similar results were also reported in onion by Vashi *et.al.* (2011) [10], Mondal *et al.* (2005) [6] and Kalhapure *et al.* (2014) [4].

The weed dry matter (kg/plot) and yield (q/ha) parameters were influenced significantly under interaction effect of weed management and nitrogen treatments at 90 DAT and at harvest stages (Table 2 and 3). The maximum weed dry matter (kg/ha) was recorded in weedy check with 150 kg N/ha (1331.36 and 2857.12 kg/ha) for 90 DAT and at harvest stage in pooled mean, respectively) while it is minimum in pendimethalin + oxadiargyl followed by twice hand weeding and pendimethalin + 1 hand weeding under all the levels of nitrogen. It is suggesting that the herbicides as well as manual weeding alongwith lower levels of nitrogen fertilization are more effectives in controlling the weeds in *rabi* onion.

The yield data was also noted statistically significant as influenced by combined application of weed management and levels of nitrogen in *rabi* onion cv. RO-252. The highest yield was observed in treatment twice hand weeding with 150 kg N/ha followed by twice hand weeding with 100 kg N/ha, pendimethalin + oxadiargyl with 150 and 100 kg N/ha followed by pendimethalin + 1 hand weeding with 150 and 100 kg N/ha as compared to weedy check with 0 kg N/ha (85.01 q/ha). These results are in close agreement with the findings of Patel *et al.* (1983) [8], Rameshwar *et al*. (2002) [9] and Mallik *et al*. (2017) [5].

Table 1: Effect of weed management and nitrogen levels on weed count (per 0.25 m^2) in onion crop (pooled mean of two years)

Treatments **Weed management – Main plots**	**30 DAT**	**60 DAT**	**90 DAT**	**At harvest**
W_0 - Weedy check (control)	7.18 (51.05)	7.87 (61.49)	8.32 (68.78)	8.39 (69.91)
W_1 - One HW at 20 DAT	1.58 (2.01)	4.16 (16.86)	5.37 (28.44)	6.39 (40.45)
W_2 - Two HW at 20 & 40 DAT	1.46 (1.64)	2.04 (3.75)	3.03 (8.71)	3.54 (12.03)
W_3 - Pendi.(PP) + Oxad. at 40 DAT	1.73 (2.50)	2.34 (5.09)	3.43 (11.29)	3.99 (15.47)
W_4 – Pendi.(PP) + 1 HW at 40 DAT	1.62 (2.10)	2.21 (4.46)	3.19 (9.69)	3.78 (13.79)
W_5 - Oxy. (PP) + Oxy. at 20 DAT	2.39 (5.22)	3.77 (13.72)	4.92 (23.72)	5.58 (30.70)
W_6 - Oxy.(PP) + 1 HW at 40 DAT	2.95 (8.24)	3.51 (11.84)	3.99 (15.50)	4.38 (18.74)
SEm±	0.06	0.07	0.08	0.08
CD (P=0.05)	0.18	0.20	0.22	0.24
Nitrogen levels (kg/ha) - Sub plots				
N_0 - 0	2.64 (10.15)	3.54 (16.07)	4.44 (22.87)	4.94 (27.56)
N_1 - 50	2.68 (10.33)	3.66 (16.60)	4.57 (23.51)	5.11 (28.50)
N_2 - 100	2.73 (10.53)	3.72 (16.87)	4.63 (23.85)	5.20 (29.01)
N_3 - 150	2.75 (10.56)	3.87 (17.41)	4.79 (24.69)	5.39 (30.08)
SEm±	0.02	0.03	0.04	0.04
CD (P=0.05)	0.06	0.08	0.11	0.12

Table 2: Combined effect of weed management and nitrogen levels on weed dry matter production (kg/ha) at different stages (pooled mean of two years)

Weed management – Main plots	**Nitrogen levels (kg/ha) - Sub plots**							
	90 DAT				**At harvest**			
	N_0 (0)	**N_1 (50)**	**N_2 (100)**	**N_3 (150)**	**N_0 (0)**	**N_1 (50)**	**N_2 (100)**	**N_3 (150)**
W_0 - Weedy check (control)	1110.23	1131.90	1285.01	1331.36	2347.08	2448.01	2777.33	2857.12
W_1 - One HW at 20 DAT	385.29	392.66	445.84	462.07	652.12	679.99	771.63	793.80
W_2 - Two HW at 20 & 40 DAT	111.93	114.12	129.56	134.23	156.64	163.28	185.35	190.67
W_3 - Pendi.(PP) + Oxad. at 40 DAT	110.31	112.46	127.67	132.28	145.40	151.59	172.04	176.98
W_4 – Pendi.(PP) + 1 HW at 40 DAT	111.42	113.59	128.96	133.61	153.06	159.56	181.10	186.30
W_5 - Oxy. (PP) + Oxy. at 20 DAT	306.26	312.10	354.38	367.30	556.05	580.10	657.99	676.90
W_6 - Oxy.(PP) + 1 HW at 40 DAT	162.78	165.90	188.36	195.22	272.40	283.96	322.31	331.57
For N at same level of W								
SEm±		10.61				21.77		
CD (P=0.05)		29.83				61.23		
For W at same or different levels of N								
SEm±		11.50				23.55		
CD (P=0.05)		41.88				85.86		

Table 3: Combined effect of weed management and nitrogen levels on bulb yield per hectare (q) of onion (pooled mean of two years)

Treatments Weed management – Main plots	Nitrogen levels (kg/ha) - Sub plots			
	N_0 (0)	N_1 (50)	N_2 (100)	N_3 (150)
W_0 - Weedy check (control)	85.01	162.59	162.89	159.35
W_1 - One HW at 20 DAT	189.05	228.30	229.66	230.30
W_2 - Two HW at 20 & 40 DAT	276.58	286.41	302.44	312.87
W_3 - Pendi.(PP) + Oxad. at 40 DAT	271.86	281.71	298.97	302.17
W_4 – Pendi.(PP) + 1 HW at 40 DAT	273.65	284.31	300.51	303.55
W_5 - Oxy. (PP) + Oxy. at 20 DAT	223.04	231.29	234.18	235.33
W_6 - Oxy.(PP) + 1 HW at 40 DAT	220.78	252.30	254.45	254.69
For N at same level of W				
SEm±		6.21		
CD (P=0.05)		17.47		
For W at same or different levels of N				
SEm±		7.03		
CD (P=0.05)		25.07		

Conclusion

From the above findings, it is clear that the twice hand weeding or pendimethalin + oxadiargyl or pendimethalin + 1 hand weeding with 150 and 100 kg N/ha was found effective in controlling the weed population of onion and thereby increasing the yields as compared to weedy check in *rabi* onion. Based on the results on weed population, weed dry matter and onion bulb yield it can be concluded that twice HW at 20 and 40 DAT along with 100 kg N/ha may be better option for *rabi* onion if labour is easily available. However, application of pendimethalin (PP) fb oxadiargyl at 40 DAT combined with 100 kg N/ha or application of pendimethalin (PP) fb 1 HW at 40 DAT combined with 100 kg N/ha are another better options for weed management under labour scarce conditions.

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