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Short communication

Effect of weed management practices and nitrogen levels on weed intensity and bulb yield of onion in loamy sand soils

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ABSTRACT

Field experiment was conducted on onion to develop efficient integrated weed management practices under various levels of nitrogen. Two hand weeding at 20 and 40 DAT or application of pendimethalin (PP) + oxadiargyl at 40 DAT or application of pendimethalin (PP) fb 1 HW at 40 DAT combined with 100 kg N ha^{-1} were recorded significantly higher bulb weight, bulb yield and net returns. Thus, either of above integrated weed management practice can be used for *rabi* (winter) season onion in loamy sand soils.

Key words: *Allium cepa*, weed intensity, hand weeding, pendimethalin, oxyflurofen.

Onion (*Allium cepa* L.) is an important biennial bulbous vegetable and spice crop belongs to family *Alliaceae*. It is highly nutritive, diuretic in nature, promotes appetite, lowers blood sugar, reduces cardiovascular problems and relieves heat sensation. In India, onion is cultivated in an area of 1.285 million hectare with a production of 23.262 million tonnes (NHB, 4). Among several factors, weed and fertilizer management are two important aspects for proper growth and yield of the crop. Yield losses in onion due to the weeds have been reported to the extent of 40 to 80 per cent (Kalhapure *et al.*, 3). Removal of weeds time to time from crop enhance supply of nitrogen, leading to its efficient use and consequently increase in plant growth and bulb yield of onion (Patel *et al*., 6). Hence, use of herbicides as pre and post planting and with or without hand weeding as weed management practice under various levels of nitrogen may improve performance of onion crop.

A field experiment was carried out during *rabi* (winter) season of 2016-17 and 2017-18 at the Horticulture Farm of SKN Agriculture University, Jobner (26^0 05' North latitude and 75^0 20' East longitude), located near Jaipur in Rajasthan (India). There were twenty-eight treatment combinations consisting of seven treatments of weed management, *viz*. W_0: weedy check (control); W_1: one hand weeding (HW) at 20 days after transplanting (DAT); W_2: two HW at 20 and 40 DAT; W_3: pre-plant (PP) application of pendimethalin @ 1.0 kg *a.i.* ha^{-1} followed by oxadiargyl @ 0.09 kg *a.i.* ha^{-1} at 40 DAT; W_4: pendimethalin (PP) @ 1.0 kg *a.i.* ha^{-1} followed by 1 HW at 40 DAT; W_5: oxyflourfen (PP) @ 0.125 kg *a.i.* ha^{-1} followed by post plant spray of oxyflourfen @ 0.125 kg *a.i.* ha^{-1} at 20 DAT and W_6: oxyflourfen (PP) @ 0.125 kg *a.i.* ha^{-1} followed by 1 HW at 40 DAT and four treatments of nitrogen levels, *viz*. N_0: control, N_1: 50 kg ha^{-1}, N_2: 100 kg ha^{-1} and N_3: 150 kg ha^{-1}. The weed management treatments were assigned to main plots and the nitrogen doses to subplots under split-plot design with three replications.

Data on weed density and weed intensity were recorded by counting total number of weeds from each plot by putting a quadrate (0.25 m^2) at one random spot at 60 DAT and at harvest. The weed intensity was calculated by following formula

$$\text{WI (\%)} = \frac{\text{Number of particular dominant weed species in unit area}}{\text{Total number of weeds in the same area}} \times 100$$

Observations on onion crop *viz*., neck thickness, number of scales per bulb, average bulb weight, bulb yield and net returns were recorded at harvest of the crop. Data of experiment was statistical analysed by analysis of variance method as suggested by Panse and Sukhatme (5).

Results indicated that two HW at 20 and 40 DAT (W_2), application of pendimethalin (PP) + 1 HW at 40 DAT (W_4) and application of pendimethalin (PP) + oxadiargyl at 40 DAT (W_3) were found the most superior and equally effective treatments that recorded significantly lower weed density of 2.04, 2.21 and 2.34 per 0.25 m^2 at 60 DAT and 3.54, 3.78 and 3.99 per 0.25 m^2 at harvest stage, respectively than rest of the treatments (Table 1). In this way, these treatments reduced the weed count to the extent of 137.00, 121.95 and 110.27 per cent, respectively in comparison to weedy check. Weed intensity of *Chenopodium murale* was also significantly reduced in these treatments. The decrease in weed density and weed intensity under these treatments might be due to interrupted growth of weeds throughout the crop season. Kalhapure *et al.* (3) also observed sharp decline in weed biomass

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Table 1. Influence of weed management practices under nitrogen levels on weed density, weed intensity, neck thickness and number of scales per bulb in onion (pooled mean of two years).

Treatment	Weed density		Weed Intensity (%)		Neck thickness (cm)	No. of scales/ bulb
	60 DAT	At harvest	60 DAT	At harvest	At harvest	At harvest
Weed management – Main plots						
W_0 - Weedy check (control)	7.87 (61.49)	8.39 (69.91)	62.17	64.03	0.76	6.33
W_1 - One hand weeding (HW) at 20 DAT	4.16 (16.86)	6.39 (40.45)	41.12	39.58	0.88	6.51
W_2 - Two hand weeding (HW) at 20 & 40 DAT	2.04 (3.75)	3.54 (12.03)	29.09	28.61	1.42	7.65
W_3 – Pendimethalin (Preplant) + Oxadiargyl at 40 DAT	2.34 (5.09)	3.99 (15.47)	29.66	28.68	1.36	7.40
W_4 – Pendimethalin (Preplant) + 1 HW at 40 DAT	2.21(4.46)	3.78 (13.79)	30.78	30.03	1.38	7.48
W_5 - Oxyfluorfen (Preplant) + Oxyfluorfen at 20 DAT	3.77 (13.72)	5.58 (30.70)	45.89	45.01	1.02	6.87
W_6 - Oxyfluorfen (Preplant) + 1 HW at 40 DAT	3.51 (11.84)	4.38 (18.74)	48.59	49.01	1.18	7.02
SEm$\pm$	0.07	0.08	0.76	0.77	0.02	0.12
CD (P=0.05)	0.20	0.24	2.23	2.24	0.06	0.35
Nitrogen levels (kg/ha) - Sub plots						
N_0 - 0	3.54 (16.07)	4.94 (27.56)	37.33	36.42	1.07	6.76
N_1 - 50	3.66 (16.60)	5.11 (28.50)	38.29	37.74	1.10	6.91
N_2 - 100	3.72 (16.87)	5.20 (29.01)	42.28	43.86	1.18	7.16
N_3 - 150	3.87 (17.41)	5.39 (30.08)	47.12	44.81	1.21	7.31
SEm$\pm$	0.03	0.04	0.33	0.33	0.01	0.06
CD (P=0.05)	0.08	0.12	0.93	0.93	0.03	0.16

*values in parenthesis are subjected to square root transformation.

when pre-emergence application of herbicides was supplemented with one hand weeding in onion.

Progressive increase in level of Nitrogen (N) up to 100 kg ha^{-1} increased the weed density as well as intensity of *Chenopodium murale* significantly at 60 DAT and at harvest stage (Table 1). Increase in population and intensity of weeds might be due to the availability of nitrogen in ample amounts leading to better nutritional environment in the rhizosphere for sustained growth and development of weeds as well as crop plant. These results corroborate with the findings of Ali and Ahmed (1).

Among weed management treatments, two HW at 20 and 40 DAT (W_2) recorded significantly higher neck thickness and number of scales per bulb (Table-1) followed by application of pendimethalin (PP) + 1 HW at 40 DAT (W_4) and pendimethalin (PP) + oxadiargyl at 40 DAT (W_3). Increase in bulb size and neck thickness as well as number of scales per bulb might be due to effective weed control and reduction in competition stress which resulted in better photosynthesis and accumulation of food material under these treatments. Similar findings were also reported by Job *et al*. (2).

Significant response of crop to the increased N fertilization in terms of overall improvement in growth parameters is further supported by fact that the soil of the experimental fields was low in N status and its supply corrected the deficiency and improved the overall growth of crop. Thus, increase in uptake of nitrogen seemed to improve the vegetative growth in terms of neck thickness and number of scales in bulb (Table 1). The findings are in agreement with those of Patel *et al*. (6).

Interactive effect of weed management treatments and N levels was found to have significant influence on average bulb weight, bulb yield and net returns (Table 2). Weed management treatments showed variable response to increasing levels of N in terms of bulb weight, bulb yield and net returns. Significantly higher bulb weight, bulb yield and net returns were recorded in two HW at 20 and 40 DAT, pendimethalin (PP) + 1 HW

Table 2. Interaction effect of weed management practices under nitrogen levels on average bulb weight, bulb yield and net returns of onion (pooled mean of two years).

Weed management – Main plots	Nitrogen levels (kg/ha) - Sub plots											
	Average bulb weight (g)				Bulb yield per hectare (q)				Net returns (Rs/ha)			
	N_0	N_1	N_2	N_3	N_0	N_1	N_2	N_3	N_0	N_1	N_2	N_3
W_0 - Weedy check (control)	14.56	16.21	20.86	27.07	85.01	162.59	162.89	159.35	25837	95390	95042	91139
W_1 - One hand weeding (HW) at 20 DAT	15.46	20.60	23.80	41.86	189.05	228.30	229.66	230.30	116133	150557	151249	151170
W_2 - Two hand weeding (HW) at 20 & 40 DAT	43.72	46.01	50.11	51.08	276.58	286.41	302.44	312.87	190104	198903	212847	221642
W_3 – Pendimethalin (Preplant) + Oxadiargyl at 40 DAT	43.45	45.73	49.71	50.85	271.86	281.71	298.97	302.17	190962	199665	214642	216860
W_4 – Pendimethalin (Preplant) + 1 HW at 40 DAT	44.13	45.28	49.84	50.98	273.65	284.31	300.51	303.55	189349	198768	212807	214876
W_5 - Oxyfluorfen (Preplant) + Oxyfluorfen at 20 DAT	30.34	35.37	40.91	43.24	223.04	231.29	234.18	235.33	148524	155697	157760	158145
W_6 - Oxyfluorfen (Preplant) + 1 HW at 40 DAT	39.68	44.54	45.65	46.87	220.78	252.30	254.45	254.69	143308	171365	172768	172337
For N at same level of W												
SEm±		1.38				6.21			4320			
CD (P=0.05)		3.89				17.47			12150			
For W at same or different levels of N												
SEm±		1.57				7.03			5048			
CD (P=0.05)		5.59				25.07			17754			

at 40 DAT and pendimethalin (PP) + oxadiargyl at 40 DAT in conjunction with 100 kg and 150 kg N ha^{-1} (W_2N_3, W_4N_3, W_2N_2, W_3N_3, W_4N_2 and W_3N_2), being statistically at par with each other. The yield enhancement under these treatments might be attributed to the good crop growth due to better weed control that could reduce the weed-crop competition. Further more, least severe competition occurred throughout the crop season due to restricted weed growth under above treatments which decreased the removal of nutrients and moisture and remained favourable for the crop growth and survival of plant stand at harvest. At the same time, N fertilization coupled with increased photosynthates also led to translocation towards bulb formation having favourable effect on yield attributes which in turn increased the yield to the higher level.

In conclusion, two HW at 20 and 40 DAT alongwith 100 kg N ha^{-1} may be better option if labour is easily available. However, application of pendimethalin (PP) + oxadiargyl at 40 DAT or application of pendimethalin (PP) fb 1 HW at 40 DAT combined with 100 kg N ha^{-1} are another better options for weed management under labour scarce conditions and all these are recommended for *rabi* (winter) season onion crop in loamy sand soils.

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