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Short communication

Bulb yield and nutrient uptake by onion as affected by weed control

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ABSTRACT

A weed control experiment was undertaken on onion cv. Patna Red comprising of hand weeding and application of weedicides, *viz.*, flushmoralin, pendimethalin and metochlor. Application of pendimethalin and fluchloralin each at 1.0 kg/ha along with one hand weeding gave the best result with regard to weed dry matter content, nutrient uptake and depletion. The results were comparable with three hand weeding treatment.

Key words: Bulb yield, nutrient uptake, onion, weed control.

Onion (*Allium cepa* L.) is an important bulbous vegetable crop and is an indispensable item in every kitchen. Onion bulb and green both are rich in minerals, protein and ascorbic acid and India is the second largest producer of onion in the world. Of all 15 vegetable crops listed by FAO onion falls second to tomato in terms of production. Among the various causes for low productivity of onion in India, the weed infestation is a serious problem. The yield as well as nutrient uptake by crop is reduced substantially on account of increased crop-weed competition on a high cost input oriented agriculture system, weed cannot be allowed to grow, consume the costly input and thrives to reduce the crop value and profit. Onion has very poor competitive ability with weeds on account of its inherent characteristics such as short stature, non-branching habit, sparse foliage, shallow root system and extremely slow growth at initial stage. Slow growth of crop is very conductive to quick and rank growth of weeds in the initial stage. Due to accumulations of large weigh of dry matter of weeds containing higher percentage of nutrient in unchecked weed growth in aerable land causes substantial depletion of major plant nutrient NPK both native and added to the soil resulting depressed growth, delayed leaf blades production, fewer and smaller leaves formation that die more rapidly finally very low bulb yield of poor quality. Under weed free plot potato crop removed 153.4 kg/ha N and 29.5 kg/ha P, whereas under unweeded check plot potato removed only 222.06 kg/ha N, 3.66 kg/ha P and 3.66 kg/ha K (Shekhawat and Maliwal, 7). Very scanty information is available regarding nutrient loss in onion due to weed competition. Keeping in view the above, the present study was under taken.

The field experiments were conducted in the vegetable research plot located in permanent experimental area Bihar Agricultural College, Sabour campus of Bihar Agricultural University, Sabour, Bhagalpur. The soil of the experimental plot was sandy loam in texture, neutral in reaction and non-saline in nature having organic carbon 0.45%, total nitrogen 0.046%, available P_2O_5 52.50%, available K_2O 23.1%, electrical conductivity (EC) 0.53 m mhos/cm at 25°C and pH 7.3 (1:25 soil : water ratio). The experiment was conducted in RBD having three replications and the treatment details are

Unweeded control = UWC (Wo), Two hand weedings at 20 and 40 days after transplanting = $HW_2(W_1)$, three hand weedings at 20, 40 and 60 days after transplanting = $HW_3(W_2)$, Pre planting soil incorporation of fluchloralin at 1 kg/ha = Flu (W_3), pre-planting soil incorporation of fluchloralin at 1 kg/ha followed by one hand weeding at 40 days after transplanting = Flu + $HW_1(W_4)$, pre-emergence application of pendimethalin 1 kg/ha = Pendi (W_5), pre-emergence application of pendimethalin 1 kg/ha followed by one hand weeding at 40 days after transplanting = Pendi + $HW_1(W_6)$, pre-emergence application of metolachlor at 1 kg/ha = Met (W_7), pre-emergence application of metolachlor at 1 kg/ha followed by one hand weeding at 40 days after transplanting = Met + $HW_1(W_8)$. Nursery was raised in the month of November and transplanting was done in January in both the year at a distance of 15 cm × 10 cm. both years 'Patna Red' variety was planted. A uniform dose of 100 kg N, 60 kg P_2O_5 and 80 kg K_2O/ha in the form of urea, SSP and MOP, respectively was applied. All improved agronomical practices were adopted to raise the crop.

Weeds and plants enclosed in quadrate of 25 cm × 25 cm placed randomly at two places on both sides of the plot were uprooted and dried in air. These weeds and plants samples so obtained were placed for over drying at 75 ± 5°C for 48 h and dry weight

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were recorded and converted into kg/ha and g/m^2. Chemical analysis of plant and weed samples for nitrogen, phosphorus and potash contents were done after proper drying and grinding. The samples of crop and weeds collected at 90 days after transplanting were used for estimation of NPK. The total N was determined by modified Kjeldahl's method (Jackson, 3). Phosphorus was determined by calorimetriclally by molybdovandlate yellow colour method after digesting and materials in triacid mixture (AOAC, 2) and Triacid digested materials was also used for potassium determination by flame photometer (Jackson, 3). The total NPK update of onion and depletion by weeds were calculated by multiplying dried matter in crop and weeds with the nutrient concentration. The data obtained were statistically analysed for analysis of variance as per method described by (Panse and Sukhatme, 6).

All the weed control treatment affected a significant reduction in dry matter accumulation by weed over control in both the years (Table 1). All the herbicides supplemented with one hand weeding was as good as hand weeding thrice in curtailing the dry matter of weeds in both the years. The maximum dry matter of weed was registered in unweeded plots in both the years. The performance of herbicide plus one hand weeding was as efficient as two hand weeding in reducing the dry matter of weeds during both the years of experiment. The efficiency of herbicides in curtailing the dry matter of weeds in onion have been reported by Kumar *et al*. (4). The best performance of these chemical may be due to better absorption of chemical by merging weed seedlings, leaching of chemical to the greater depth in soil and persisting in soil for greater length of time.

In both the seasons all the weed control treatments reduced significantly the NPK depletion (Table 2) by weeds over unweeded control. Weed removed 23.31 kg N/ha in unweeded control plot while least depletion occurred in the plot treated with fluchloralin at 1.0 kg/ha or pendimethalin at 1.00 kg/ha supplemented with one hand weeding given at 40 days after transplanting which was comparable with three hand weedings in both the years. The range of N depletion in the above treatments varied from 6.81 to 7.86 kg/ha.

Least phosphorus depletion by weeds recorded in the plots treated with either pendimethalin at 1 kg/ha or fluchloralin at 1 kg/ha along with one hand weeding at 40 DAT which was at par with the nutrient depleted by weeds under three hand weeded plots. The potassium depletion under unweeded plot was highest to the tune of 21.76 and 20.69 kg/ha in the first and second year, respectively with mean value of 21.222 kg/ha. The least potassium depletion of 5.29 kg/ha by weeds was from the plot treated with fluchloralin at 1 kg/ha plus one hand weeding at 20 DAT which was at par with three hand weedings and application of pendimethalin at 1 kg/ha plus one hand weeding.

All the weed control treatments significantly increased the dry matter production by crop over unweeded control, which produced 7.76 and 6.62 q/ha with mean value of 6.93 q/ha. Maximum dry matter production was obtained under the plot treated with three hand weeding to the extent 48.31 q/ha and 46.65 q/ha, respectively in the first and second year being at par with fluchloralin at 1 kg/ha plus one hand weeding and pendimethalin plus one hand weeding. Herbicides applied alone being equal to each other were found superior to hand weeding twice in both the year as well

Table 1. Effect of weed control treatment on dry matter of weeds and crop and bulb yield of onion.

Treatment	90 days after transplanting				Yield (q/ha)		
	Dry matter of weeds (g/ m)		Dry matter of crop (q/ ha)				
	1st year	2nd year	1st year	2nd year	1st year	2nd year	Pooled
UWC (W_0)	158.00	171.33	6.22	6.93	35.62	30.98	33.30
HW_2 (W_1)	44.67	48.33	32.19	32.01	214.93	200.33	207.63
HW_3 (W_2)	42.33	40.00	46.65	47.48	254.19	246.90	250.60
Flu (W_3)	61.33	65.33	36.41	38.96	190.65	182.35	186.50
Flu + HW_1 (W_4)	41.00	43.33	43.56	44.29	226.72	217.45	222.08
Pendi (W_5)	60.33	63.00	37.22	37.74	186.33	183.17	184.75
Pendi + HW_1 (W_6)	41.00	41.00	42.82	43.90	220.68	210.37	215.52
Met (W_7)	57.33	61.00	34.54	35.34	176.35	166.80	171.61
Met + HW_1 (W_8)	43.00	42.33	37.66	39.41	217.47	207.53	212.50
CD at 5%	14.60	18.37	3.85	3.60	24.75	12.78	12.19

Table 2. Effect of weed control treatment on NPK-depletion (kg/ ha) by weeds at 90 days after transplanting in onion.

Treatment	N-depletion			P-depletion			K-depletion		
	Ist year	2nd year	Pooled	Ist year	2nd year	Pooled	Ist year	2nd year	Pooled
UWC (W_0)	23.31	21.32	22.31	6.25	5.80	6.03	21.76	20.69	21.22
HW_2 (W_1)	7.24	7.45	7.34	1.86	1.93	1.89	6.64	6.60	6.62
HW_3 (W_2)	7.21	6.65	6.93	1.68	1.68	1.68	5.61	5.39	5.50
Flu (W_3)	10.43	9.89	10.16	3.04	3.03	3.03	10.18	9.93	10.05
Flu + HW_1 (W_4)	6.80	6.82	6.81	1.57	1.63	1.60	5.40	5.17	5.29
Pendi (W_5)	12.89	12.26	12.57	3.59	3.45	3.52	12.21	10.93	11.57
Pendi + HW_1 (W_6)	8.19	7.52	7.86	1.94	1.71	1.84	6.54	5.85	6.19
Met (W_7)	13.96	12.87	13.42	3.41	3.24	3.32	11.69	10.66	11.17
Met + HW_1 (W_8)	9.61	9.23	9.42	1.99	1.87	1.93	7.23	6.76	6.99
CD at 5%	2.32	1.62	1.31	0.54	0.54	0.34	1.88	1.43	1.11

as in pooled analysis. This proved that both chemicals, *i.e.*, pendimethalin and fluchloralin were very selective to onions. The selectivity of pendimethalin at 1 kg/ ha was reported by Anderson and Hox Worth (1). From the perusal of dry matter production by crop and dry matter accumulation by weeds revealed that the maximum dry matter production by crop was observed at three hand weeding, fluchloralin + one hand weeding and pendimethalin + one hand weeding where dry matter production by crop was 47.48, 44.29 and 43.90 q/ha and the corresponding value was lowest in terms of dry matter accumulation by weeds to the tune of 4.12, 4.23 and 4.11 q/ha. Uptake of NPK by crop was significantly affected by weed control treatments at 90 DAT (Table 3). Fluchloralin at 1 kg/ha and pendimethalin at 1 kg/ha each followed by one hand weeding improved the N-uptake by the crop being similar to three hand weedings in both the years. Least NPK-uptake was found in unweeded plot. Two hand weedings was found better than herbicides applied alone for nitrogen uptake by crop. Hence, it is evident that herbicide supplemented by one hand weeding substantially improved the nitrogen uptake by the crop. Pooled analysis indicated that three hand weedings was similar to fluchloralin followed by one hand weeding and pendimethalin followed by one hand weeding in respect of N uptake by crop. The possible reason for the maximum N uptake by crop under fluchloralin followed by one hand weeding and pendimethalin followed by one hand weeding was due to suppression and killing of weeds by the chemical at the earlier stage and at later stage by hand weeding. Thus, in chemically treated plots, weeds were controlled right from transplanting which is evident from lower dry matter accumulation by weeds and higher dry matter production by crop in comparison to unweeded control and twice hand weeding. So far herbicide was utilized by the crop which take higher amount of N in fluchloralin at 1 kg/ ha and pendimethalin at 1 kg/ha followed by one hand weeding in both chemicals. The phosphorus uptake by the crop under chemically treated plots followed by one hand weeding was 22.05 kg/ha whereas from three hand weeding plot crop removed 21.25 kg/ha. Shekhawat and Maliwal reported that vegetable crop like potato removed 29.5 kg P/ha from weed free soil which is similar to this findings.

In the second year three hand weeded plot removed maximum potassium of 67.49 kg/ha being equal to fluchloralin application followed by one hand weeding which also equal to pendimethalin + HW_1. All chemicals applied alone being equal to each other removed 31.84 kg/ha, which was inferior to potassium removal under three hand weeded plots. In both the year as well as pooled least potassium was removed by crop (11.41 kg/ha), under un weeded control. In pooled analysis highest potassium removal to the extent of 69.24 kg/ha was found in three hand weedings which was at par with fluchloralin followed by one hand weeding (67.49 kg/ ha) and pendimethalin followed by one hand weeding. Pendimethalin applied alone removed potassium being equal to two hand weedings. Potassium removal under two hand weeding was equal to fluchloralin or metolachlor applied alone.

All the weed control treatments produced significantly highest bulb yield (Table 2) of onion over unweeded control in both the years of experiments. Three-hand weedings produced the maximum bulb

Table 3. Effect of weed control treatments on NPK-uptake (kg/ha) by onion crop at 90 days after transplanting.

Treatment	N-uptake			P-uptake			K-uptake		
	Ist year	2nd year	Pooled	Ist year	2nd year	Pooled	Ist year	2nd year	Pooled
UWC (W_0)	19.61	23.50	21.55	6.33	5.55	5.94	12.43	10.38	11.41
HW_2 (W_1)	73.26	67.63	70.44	14.93	13.92	14.42	39.80	35.53	37.67
HW_3 (W_2)	91.01	78.99	85.00	21.51	20.98	21.25	70.99	67.49	69.24
Flu (W_3)	63.41	61.34	62.38	11.82	12.62	12.22	36.45	31.70	34.08
Flu + HW_1 (W_4)	86.22	82.56	84.39	21.66	22.01	21.84	71.16	65.19	68.18
Pendi (W_5)	64.86	61.08	62.97	12.22	12.82	12.52	40.16	32.96	36.56
Pendi + HW_1 (W_6)	82.99	81.26	81.87	23.32	21.38	21.85	72.53	64.74	68.64
Met (W_7)	64.54	56.28	60.41	10.88	11.45	11.17	31.53	30.67	31.10
Met + HW_1 (W_8)	67.31	72.26	69.74	21.86	21.48	21.67	67.53	60.10	63.82
CD at 5%	8.06	5.58	7.77	1.61	1.95	1.19	2.62	2.44	3.54

yield to the tune of 254.19 q/ha in the first year and 246.90 q/ha in the second year with mean yield of 250.60 q/ha. In both years and pooled, hand weeding thrice produced the highest yield followed by Flu + HW_1, Met + HW_1 and hand weeding twice. All the three chemicals applied with one hand weeding being equal to Pendi + HW_1 and Met + HW_1 was found inferior to Flu + HW_1. Likewise in the second year next to hand weeding thrice. Flu + HW_1 produced the highest yield of 217.45 q/ha being at par with Pendi + HW_1 and Met + HW_1 and two hand weeding but was found inferior to Flu + HW_1. Pooled analysis indicated that hand weeding thrice produced the highest bulb yield of 250.60 q/ha followed by Flu + HW_1, Pendi + HW_1 and Met + HW_1 and HW_2 being comparable to each other except Flu + HW_1 produced significantly higher yield than two hand weeding. Hand weeding thrice Flu + HW_1 produced significantly higher yield than two hand weeding. Hand weeding thrice Flu + HW_1, Pendi + HW_1, Met + HW_1 and hand weeding twice produced 217.20, 188.78, 182.57, 179.27 and 174.33 q/ha more bulb yield over unweeded control, which yielded 33.30 q/ha. The corresponding increase over unweeded control was 658.48, 566.90, 547.20, 538.13 and 523.51 per cent, respectively. The superiority of above weed control method was also reported by (Singh *et al*., 8).

The higher yield and crop growth observed in the second year compared with the first year were attributed to variations in transplanting time and difference in number of irrigation applied.

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