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Impact of weed and fertilizer management on yield and quality parameters of onion (*Allium cepa* L.) Var. Pusa Red under Lucknow conditions

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Abstract
The present investigation was conducted during rabi session 2015-16 at Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow to find out the impact of weed and fertilizers management on yield and quality parameters of onion (*Allium cepa* L.). Experiment was conducted in randomized block design with 18 treatments along with three replications. The treatment T_5 (Weed free) recorded significantly maximum bulb weight (g), bulb diameter(cm), no of scales/bulb, bulb yield/plot(kg) total bulb yield(q/ha), benefit cost ratio and quality parameters i.e., TSS, ascorbic acid, reducing sugar, non-reducing sugar and total sugars were obtained in the treatment T_5 (Weed free).Therefore, it is concluded that judicial application of herbicide along with fertilizers will produce higher yield along with quality bulbs at low cost of production of onion.

Keywords: *Allium cepa*, bulb yield, bulb quality, economics, weed and fertilizers management

Introduction
Onion (*Allium cepa* L.) is bulbous crop grown in Rabi season and used in daily diet of people in the whole world. Onion is valued for its bulbs having characteristic odour, flavour and pungency, which is due to the presence of a volatile oil – allyl-propyl-disulphide. Bulbs are suited for storage for a long period and for long distance transport. It is used as salad and cooked in many ways in curries, fried, boiled, baked and used in making soups, pickles etc. value addition in onion is done by marketing dehydrated onions and onion flakes. Onion bulb is rich in minerals like phosphorus (50 mg/100 g) and calcium (180 mg/100 g). Onion greens are also used by harvesting crop at pencil thickness. Onion becomes a major cash crop with higher market demand and price due to its culinary; India is the second largest producer of onion in the world, next to China and ranks third in export of onions, next to Netherlands and Spain. Maharashtra is the leading onion producing state in India followed by Karnataka and Gujarat. The crop is grown on extensive scale in Orissa, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Rajasthan and Bihar. The present level of productivity of onion of the country is very low as compared to major producers like USA, China, Netherlands and Korea Republic. Red coloured cultivars are more pungent than silver skinned varieties and keep better in storage. Post-harvest handling is estimated that 60-65% of onion produced in India is consumed internally, 5% exported and 30-40% lost by post-harvest damage. Sprouting and rotting are common problems in storage since bulbs contain high moisture. (Anonymous, 2012) [1]. Mixture of chicken manure and biofertilizer increases the yield of onion and enriched nutrient content in tuber was reported by Shaheen *et al*. (2007) [10]. Weed infestation is the important constraint in onion seed production, which causes reduction in bulb and seed yield to the tune of 40 to 80% (Channapagoudar and Biradar 2007) [2] and Weed competition reduced the bulb yield of onion to the extent of 2.35–61.8 per cent depending upon the duration of crop weed competition and intensity, frequent irrigation and fertilizer application allows for successive flushes of weeds in onion. The conventional methods of weed control such as hoeing, weeding, *etc*. are laborious and very expensive. More over weeding during critical growth stages is very difficult due to increased cost of human labours and its scarce availability. Removal of weeds through hand weeding method is laborious, costly and time consuming. This situation makes it necessary to use herbicides for effective and timely control of weeds. Yield losses due to weeds infestation in onion were as high as 82.2% (Tewari *et al.* 2003) [12]. The importance of urea, triple super phosphate and murate of potas on the growth and yield of vegetable crops is well-known. Thus the present study was conducted to examine the impact of weed and fertilizers management in onion under Lucknow condition.

Materials and methods

The experiment was carried out during *rabi* season at Babasaheb Bhimrao Ambedkar University, Lucknow, U.P. India, during 2015-16. The soil of experimental field was saline with high pH 8.5, electrical conductivity was 0.28, organic carbon 0.29% and sodium exchangeable percentage less than 15. The onion variety used in the experiment was Pusa Red One month old seedlings of uniform growth were transplanted in evening hour at a spacing of 15x10 cm in flat beds. The treatment details were as follows:T_1- Pendimethalin @1.0 kg a.i/ha application before planting, T_2- Oxyfluorfen@0.250 kg a.i/ha pre-emergence, T_3- Fluazipop-p-butyl@0.250 kg a.i/ha, T_4- Hand weeding,T_5- Weed free, T_6- Weedy check, T_7- Pendimethalin+HW,T_8- Oxyfluorfen + Weed free, T_9- Fluazipop-p-butyl+Weed check, T_{10}- Pendimethalin+75% RDF+HW,- T_{11}- Pendimethalin+100% RDF+HW, T_{12}- Pendimethalin+125% RDF+HW, T_{13}- Oxyfluorfen+75%RDF+WF, T-$_{14}$- Oxyfluorfen+100% RDF+WF, T_{15}- Oxyfluorfen+125% RDF+WF, T_{16}- Fluazipop-p-butyl +75% RDF+WC, T_{17}- Fluazipop-p butyl +100%RDF+WC, T_{18}- Fluazipop-p-butyl +125%RDF+WC, These treatment combinations were laid out in randomized block design with having three replications. The herbicides were applied by using hand operated knapsack sprayer fitted with a flat fan type Nozzle was used for spraying the herbicides. All herbicides were applied as per the treatment schedule. For hand weeding, depending upon the weed intensity, weeds were removed manually. The fertilizer applications were done as per the treatment plan. The recommended plant protection measures were taken as and when required. Observations of yield and quality parameters like Bulb weight (gm), Bulb diameter(cm), No of scales/bulb, Bulb yield/plot(kg) Total bulb yield(q/ha), Benefit cost ratio, total soluble solids (0 Brix), ascorbic acid (mg/100g), reducing sugar (%) and non- reducing sugar (%) and total sugars(%)TSS were analysed by Hand Refractrometer, Indophenols method was used for the determination of Ascorbic acid. analysis was performed according to (Schwimmer and Weston, 1961) [9] and total, reducing and non-reducing sugars were analysed by method of (Lane and Eynon, 1923) [4].The data were subjected to statistical analysis to test the level of significance as per method suggested by (panse and sukhatme, 1967) [13].

Results and discussion

Effect on yield

The data presented in Table 1 revealed that all the vegetative parameters of onion significant variations among the treatments. Among the following treatments, the treatment T_5 (weed free) exhibited the better results in terms of Bulb weight (105.35g), Bulb diameter(6.37cm), No of scales/bulb(8.95), Bulb yield/plot(5.48 kg), Total bulb yield(365.33 q/ha) followed by the treatment T_{12} (pendimethalin+125% RDF+HW) for bulb weight(103.20g),bulb diameter(4.01cm), no of scales/bulb(8.63), bulb yield/plot(5.24kg), Total bulb yield(349.33q/ha) weedy check produced lowest bulb weight(68.84g), bulb diameter(6.28cm), No of scales/bulb(5.60), bulb yield/plot(2.83kg), bulb yield/plot(188.67q/ha) These result in respect of yield attributes were in close conformity with the earlier findings of Sukhadia *et.al*. (2002) [11] and Chopra and Chopra (2007) [3]. The reduced crop-weed competition provide better environment for proper development of growth as well as and yield and quality attributes, *viz.* Bulb weight bulb diameter, No of scales/bulb, Bulb yield/plot and Total bulb yield. Ultimately leading to the enhanced bulb yield. This might be due to proper weed management treatments controlled weeds effectively, reduced the competition from the weeds to a greater extent and thus helped in faster growth and development of onion bulb crop, resulting in obtaining higher values of all yield attributing characters. The findings are in closely vicinity of those reported by Warade *et al.* (2006) [14] and Saraf (2007) [8] with respect to onion yield.

Effect on Quality: The data presented in Tables 2 revealed that all the quality parameters of onion significant variations among the treatments. Among the following treatments, the treatment T_5 (weed free) exhibited the better results in terms of Calcium (23.82mg/100g), Phosphorus(35.38mg/100g), Sulphur(0.11mg/100g), Total soluble solid (13.25^0B), Ascorbic acid(10.51), Reducing sugar(8.50), Non reducing sugar(9.75), Total sugar(18.30). These results are in accordance with the findings of Malik *et al* 1982 [5]. Weedy check produced lowest Calcium (18.12mg/100g), Phosphorus (25.32mg/100g), Sulphur (0.10mg/100g), Total soluble solid (11.09^0B), Ascorbic acid (7.34), Reducing sugar(5.48), Non reducing sugar(7.55), Total sugar(14.70).

Effect on Economics

From the economics point of view, the highest net profit of (Rs.158018 /ha) was obtained from treatment T_{12} (Pendimethalin+125% RDF+HW) with the benefit: cost ratio was maximum for 3.82 followed by treatments T_{11} (Rs 148610/ha) and T_{10} (Rs 142400/ha) with the benefit: cost ratio was maximum for values of 3.62 and 3.53, respectively. When weeds in onion were controlled either by herbicides or by hand weeding Though Pendimethalin+125% RDF+HW fetched the higher gross monetary return (Rs 199368/-) over all the other treatments, Whereas, minimum net realization (19250), Gross return (Rs.50230) and B: C ratio (0.62) was recorded with Weedy check (Control). Similar results were reported by Nandal and Singh (2002) [6] and Patel *et al*. (2011) [7].

Conclusion

On the basis of overall findings of the present research study it was concluded that there is wide range of variation in onion for all the characters studied. The treatment T_5 (Weed free) recorded significantly maximum bulb weight (g), bulb diameter (cm), no of scales/bulb, bulb yield/plot (kg) total bulb yield (q/ha), benefit: cost ratio and quality parameters i.e., TSS, ascorbic acid, reducing sugar, non-reducing sugar and total sugars were obtained in the treatment T_5 (Weed free).

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Table 1: Impact of weed and fertilizer management on yield parameters of onion (*Allium cepa* L.) Var. Pusa Red

Treatments	Bulb weight (g).	Bulb diameter (cm)	No of scales/bulb	Bulbyield/plot (kg)	Total bulb yield(q/ha)	Total cost (Rs.ha)	Gross return (Rs. Ha)	Net return (Rs. Ha)	B:C
Pendimethalin @1.0 kg a.i/ha	78.62	4.89	6.66	3.75	250.00	32640	171540	118880	3.64
Oxyfluorfen@0.250 kg a.i/ha	76.29	4.81	6.30	3.70	246.67	55520	115830	60310	1.08
Fluazipop-p-butyl@0.250kg a.i/ha	74.36	4.74	6.20	3.52	234.67	54980	111425	56445	1.02
Hand weeding at 20 DAP	72.56	4.65	6.04	3.23	215.33	33560	70325	36765	1.09
Weed free	105.35	6.37	8.95	5.48	365.33	53690	155690	102000	1.90
Weedy check (Control)	68.84	4.01	5.60	2.83	188.67	30980	50230	19250	0.62
Pendimethalin+HW	80.28	4.93	6.86	3.94	262.67	39780	162010	122230	3.07
Oxyfluorfen+Weed free	82.51	4.95	7.02	4.06	270.67	57530	130250	72720	1.26
Fluazipop-p-butyl+Weed check	70.54	4.46	5.92	3.14	209.33	56840	120120	63280	1.11
Pendimethalin+75% RDF+HW	97.25	5.75	8.09	5.07	338.00	40230	182630	142400	3.53
Pendimethalin+100% RDF+HW	99.44	5.83	8.25	5.11	340.67	40980	189590	148610	3.62
Pendimethalin+125% RDF+HW	103.20	6.28	8.63	5.24	349.33	41350	199368	158018	3.82
Oxyfluorfen+75%RDF+WF	89.40	5.19	7.89	4.73	315.33	63540	143654	80114	1.26
Oxyfluorfen+100%RDF+WF	91.91	5.26	8.03	4.82	321.33	64210	145630	81420	1.26
Oxyfluorfen+125%RDF+WF	95.14	5.40	8.08	4.95	330.00	66560	161054	94494	1.41
Fluazipop-p-butyl +75%RDF+WC	83.38	5.02	7.05	4.25	283.33	58250	126590	68340	1.17
Fluazipop-p-butyl +100%RDF+WC	85.70	5.06	7.120	4.32	288.00	60880	133256	72376	1.18
Fluazipop-p-butyl +125%RDF+WC	88.19	5.13	7.21	4.52	301.33	61220	144110	82890	1.35
SE.m ±	0.350	0.104	0.059	0.014	0.799	-	-	-	
CD at 5%	1.009	0.299	0.170	0.040	2.306	-	-	-	

Table 2: Impact of weed and fertilizer management on quality parameters of onion (*Allium cepa* L.) Var. Pusa Red

Treatments	Calcium (mg/100g)	Phosphorus (mg/100g)	Sulphur (mg/100g)	Total soluble solid (^{0}B)	Ascorbic acid (Vitamin C)	Reducing sugar (%)	Non reducing sugar (%)	Total sugar (%)
Pendimethalin @1.0 kg a.i/ha	20.83	30.51	0.11	11.95	8.72	6.79	8.07	16.51
Oxyfluorfen@0.250 kg a.i/ha	20.49	30.18	0.11	11.75	8.64	6.58	7.95	16.33
Fluazipop-p-butyl@0.250kg a.i/ha	20.22	29.68	0.10	11.52	8.51	6.34	7.81	16.12
Hand weeding at 20 DAP	19.54	29.14	0.10	11.38	8.33	6.15	7.67	15.82
Weed free	23.82	35.38	0.11	13.25	10.51	8.50	9.75	18.30
Weedy check (Control)	18.12	25.32	0.10	11.09	7.34	5.48	7.55	14.70
Pendimethalin+HW	21.08	31.52	0.11	12.14	8.87	6.80	8.15	16.75
Oxyfluorfen+Weed free	21.25	31.92	0.11	12.23	9.16	6.94	8.24	16.93
Fluazipop-p-butyl+Weed check	19.34	28.25	0.10	11.24	8.17	5.96	7.62	15.36
Pendimethalin+75% RDF+HW	23.24	34.52	0.11	12.95	10.12	8.10	9.33	18.08
Pendimethalin+100% RDF+HW	23.75	34.96	0.11	13.04	10.24	8.22	9.54	18.15
Pendimethalin+125% RDF+HW	23.80	35.08	0.11	13.14	10.44	8.44	9.63	18.24
Oxyfluorfen+75%RDF+WF	22.52	33.46	0.11	12.64	9.84	7.74	8.84	17.74
Oxyfluorfen+100%RDF+WF	22.83	33.94	0.11	12.70	9.94	7.84	8.94	17.86
Oxyfluorfen+125%RDF+WF	22.94	34.12	0.11	12.82	10.04	7.95	9.14	17.94
Fluazipop-p-butyl +75%RDF+WC	21.72	32.36	0.11	12.41	9.27	7.04	8.33	17.20
Fluazipop-p-butyl +100%RDF+WC	21.84	32.84	0.11	12.52	9.50	7.23	8.57	17.33
Fluazipop-p-butyl +125%RDF+WC	22.24	33.16	0.11	12.59	9.72	7.64	8.74	17.61
SE.m ±	0.010	0.017	0.001	0.013	0.008	0.016	0.011	0.009
CD at 5%	0.028	0.050	0.002	0.037	0.023	0.046	0.031	0.026

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