



Herbicides effect on growth, yield and quality of onion

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ABSTRACT

A field experiment was conducted at Birsa Agricultural University, Kanke, Ranchi, during the year 2016-17 to study the effect of herbicides on growth, yield and quality of onion. The treatments comprised of application of oxyfluorfen (0.25 kg/ha) one week before transplanting, oxyfluorfen (0.25 kg/ha) immediately after transplanting, pendimethalin (1.00 kg/ha) one week before transplanting, pendimethalin (1.00 kg/ha) immediately after transplanting, pretilachlor (0.75 kg/ha) one week before transplanting, pretilachlor (0.75 kg/ha) immediately after transplanting, quizolofop-ethyl (1.00 kg/ha) 20 days after transplanting (DAT), hand weeding (HW) and weedy check. Results revealed that highest plant height (66.67 cm), number of leaves (5.98) and neck thickness (4.76 cm) were recorded in hand weeding at all the growth stages, which was at par with pendimethalin immediately after transplanting and pendimethalin one week before transplanting. The increase due to HW was in the tune of 78.88, 55.73 and 59.20% respectively than weedy check whereas, pendimethalin immediately after transplanting of onion recorded 63.94, 52.56 and 51.84% increase over weedy check. Hand weeding recorded 122% more yield (23.71 t/ha) than weedy check (10.68 t/ha). Juice content and TSS was the highest in hand weeding which was at par with pendimethalin immediately after transplanting, application of pendimethalin one week before transplanting and oxyfluorfen immediately after transplanting.

Onion (*Allium cepa*) is the most important crop belonging to family Alliaceae having more demand in domestic market as well as in export market. India occupies 1.05 million hectare with annual production of 16.8 thousand tonnes. Jharkhand accounts for only 322.73 thousand tonnes from 16.39 thousand hectare. The production is low as compared to Maharashtra which accounts for 5361.96 thousand tonnes from 427.93 thousand hectare. Among the various constraints in onion production, weeds pose serious problem in its cultivation which reduce bulb yield to the extent of 40-80% (Verma and Singh 1997). The conventional method of weed control *i.e.*, hoeing and hand weeding is laborious, expensive and insufficient. Moreover, close spacing of the onion transplants and the shallow root system of seedling make the operation of conventional methods quite ineffective against uprooting of weeds. Under such circumstances application of herbicides offer a suitable method of weed control in onion but little information is available. Keeping these factors in

view, the present investigation was carried out to study the effect of herbicides on growth, yield, quality and economics of onion.

The investigation was carried out at Birsa Agricultural University (23°17' north latitude, 85°19' east longitude and at an altitude of 625.00 metres above mean sea level.) during winter season of 2016-17 to study the effect of different herbicides on growth, yield and quality of onion. The crop (variety *Agrifound Dark Red*) was transplanted at 45 days after sowing on 13th October 2016 at 20 X 15 cm spacing with fertilizer 110:40:60 kg N:P:K/ha on a sandy loam soil having medium fertility with a pH of 5.8. Treatments comprised of oxyfluorfen 0.25 kg/ha one week before transplanting, oxyfluorfen 0.25 kg/ha immediately after transplanting, pendimethalin 1.0 kg/ha one week before transplanting, pendimethalin 1.0 kg/ha immediately after transplanting, pretilachlor 0.75 kg/ha one week before transplanting, pretilachlor 0.75 kg/ha immediately after transplanting, quizolofop-ethyl 1.0 kg/ha 20 days

after transplanting (DAT), hand weeding at 25 DAT and weedy check were laid out in randomized block design with three replications. One hoeing at 45 DAT was carried out in order to loosen soils for setting of onion bulbs in all the treatments. Herbicides were applied using hand sprayer. The weed count and dry weight were subjected to square root transformation ($\sqrt{x+1}$) for statistical analysis. The crop was harvested on 15th February 2017. Economics of the treatments was computed based on the prevalent market prices of the inputs used and bulbs produced.

Effect on weeds

Hand weeding caused significant reduction in total weed density compared with other treatments at 30, 60 and 90 DAT while, it was similar with application of pendimethalin at 1.0 kg/ha immediately after transplanting at 120 DAT. Application of pendimethalin immediately after transplanting recorded 60.37% less total weed density as compared to weedy check at 120 DAT. Hand weeding reduced dry weight of total weeds at 30, 60 and 90 DAT being similar to application of pendimethalin immediately after transplanting while, at 120 DAT application of pendimethalin immediately after transplanting or one week before transplanting of onion were similar in reducing weed dry weight, to the tune of 63.50 and 60.11% less than weedy check, respectively. Consequently, application of pendimethalin immediately after transplanting recorded maximum weed control efficiency *i.e.*, 63.45% at 120 DAT followed by application of pendimethalin one week before transplanting *i.e.*, 60.06% and hand weeding recorded 58.64% (Table 1).

Weed index is the indicator of losses in the yield due to presence of the weeds. In respect to hand weeding, minimum yield loss or weed index was recorded by application of pendimethalin immediately after transplanting of onion followed by application of pendimethalin one week before transplanting. Maximum weed index was in weedy check plots due to prominent weed-crop competition. Kolse *et al.* (2010) also reported maximum weed index (57.95%) under weedy check plots.

Effect on onion

Hand weeding at 25 DAT being similar to application of pendimethalin immediately after transplanting recorded higher plant height, more number of leaves per plant and higher plant neck thickness compared to other treatments. The increase was to the tune of 78.88, 55.73 and 59.20%, respectively than weedy check whereas, pendimethalin immediately after transplanting recorded 63.94, 52.56 and 51.84% increase over weedy check (Table 2). Mawalia *et al.* (2016) also reported superiority of weed control treatments over weedy check. Bulb neck thickness in onion was minimum with hand weeding (1.13 cm) and was similar to application of pendimethalin immediately after transplanting (1.16 cm) and pendimethalin one week before transplanting (1.24 cm) while maximum was with weedy check (1.41 cm). Bulb neck thickness is an important character, because it indicates bulb storage ability. The onion with thin neck diameters are better than thick diameter. Similar results were observed by Rahman *et al.* (2012) and Sampat *et al.* (2014).

Table 1. Total weed density, weed dry weight, weed control efficiency and weed index as influenced by weed control methods in onion

Treatment	Total weed density (no./m ²)				Total weed dry weight (g/m ²)				Weed control efficiency (%)120 DAT	Weed Index (%)
	30 DAT	60 DAT	90 DAT	120 DAT	30 DAT	60 DAT	90 DAT	120 DAT		
Oxyfluorfen (0.25 kg/ha) one week before transplanting	4.00(16)	3.15(9.7)	4.84(23)	5.58(31)	2.67(7.1)	2.32(5.4)	2.91(8.3)	3.35(11)	52.89	20.39
Oxyfluorfen (0.25 kg/ha) immediately after transplanting	3.96(15)	3.06(9.0)	4.59(21)	5.20(27)	2.66(6.8)	2.28(4.8)	3.07(9.2)	3.33(11)	53.54	19.4
Pendimethalin (1.00 kg/ha) one week before transplanting	3.69(13)	2.88(8.0)	4.44(19)	5.01(25)	2.43(5.9)	2.23(4.6)	2.69(7.1)	3.09(9.3)	60.06	4.78
Pendimethalin (1.00 kg/ha) immediately after transplanting	3.50(12)	2.76(7.3)	4.28(18)	4.77(22)	2.28(5.2)	2.17(4.4)	2.55(6.3)	2.95(8.5)	63.45	0.84
Pretilachlor (0.75 kg/ha) one week before transplanting	5.33(28)	3.4(11)	5.75(33)	6.41(41)	3.15(9.7)	2.70(7.0)	3.55(12)	3.83(14)	38.44	49.37
Pretilachlor (0.75 kg/ha)immediately after transplanting	4.40(19)	3.25(10)	5.01(25)	5.69(32)	2.82(7.8)	2.47(6.0)	3.13(9.6)	3.56(12)	46.85	49.23
Quizolofop-ethyl (1.00 kg/ha) 20 DAT	4.20(17)	3.17(9.7)	4.87(23)	5.54(30)	2.75(7.4)	2.43(5.7)	3.04(9.0)	3.48(12)	49.34	36.57
Hand weeding	3.14(10)	2.43(5.7)	4.04(16)	5.17(26)	2.09(4.5)	1.98(3.6)	2.42(5.6)	3.14(9.6)	58.64	0
Weedy check	6.54(42)	4.25(18)	6.96(48)	7.54(56)	4.23(17)	3.83(14)	4.61(21)	4.87(23)	-	55
LSD (p=0.05)	0.18	0.15	0.11	0.09	0.28	0.28	0.16	0.14		

Table 2. Growth, quality parameters, yield and economics of onion production as influenced by weed control methods in onion

Treatment	Growth parameter				Quality parameter			Economics		
	Plant height (cm)	No. of leaves/plant	Collar neck thickness (cm)	Bulb neck thickness (cm)	Fresh weight of bulb (g)	Juice content per bulb (ml)	Tss (°brix)	Yield (t/ha)	Net return (x10 ³ /ha)	B:C
Oxyfluorfen (0.25 kg/ha) one week before transplanting	51.20	5.07	3.62	1.31	62.89	6.53	12.00	18.85	129.08	2.17
Oxyfluorfen (0.25 kg/ha) immediately after transplanting	52.13	5.16	3.71	1.30	63.67	9.07	12.00	19.09	131.42	2.21
Pendimethalin (1.00 kg/ha) one week before transplanting	59.94	5.56	4.27	1.24	72.03	9.20	12.07	22.56	165.92	2.77
Pendimethalin (1.00 kg/ha) immediately after transplanting	61.10	5.87	4.54	1.16	73.44	9.60	12.53	23.48	175.14	2.93
Pretilachlor (0.75 kg/ha) one week before transplanting	43.70	4.67	3.01	1.40	44.44	3.80	11.33	11.99	60.38	1.01
Pretilachlor (0.75 kg/ha) immediately after transplanting	45.98	4.51	3.05	1.40	44.03	4.80	11.47	12.03	60.81	1.02
Quizolofop-ethyl (1.00 kg/ha) 20 DAT	49.07	4.96	3.57	1.31	53.69	6.13	11.60	15.03	90.88	1.52
Hand weeding	66.67	5.98	4.76	1.13	74.06	9.73	13.20	23.71	130.24	1.22
Weedy check	37.27	3.84	2.99	1.41	39.51	3.60	11.00	10.68	51.00	0.91
LSD (p=0.05)	11.13	0.45	0.83	0.14	10.10	1.52	1.24	1.14		

Effect on yield

Maximum bulb yield was recorded in hand weeding plots followed by pendimethalin immediately after transplanting of onion which were at par with each other. Hand weeding recorded 122% more yield than weedy check. More yields in hand weeding plots (23.71 tha) seemed to be due to better weed control efficiency which might have created favourable environment by the clean crop culture resulting in more utilization of resources, more photosynthetic rates and higher yield. Among the herbicidal treatments, maximum yield was recorded with pendimethalin immediately after transplanting (23.48 t/ha) followed by application of pendimethalin one week before transplanting (22.56 t/ha) and oxyfluorfen immediately after transplanting (19.09 t/ha) due to their ability to inhibit emerging weeds. Similar results were observed by Tripathy *et al.* (2013) and Vashi *et al.* (2012).

Effect on quality

Hand weeding at 25 DAT being similar to application of oxyfluorfen immediately after transplanting, pendimethalin one week before transplanting and pendimethalin immediately after transplanting of onion recorded maximum juice content (9.73 ml) and total soluble solids (TSS) (13.20 °Brix), which was 170.27 and 20% more than the weedy check, respectively.

Economics

Application of pendimethalin immediately after transplanting of onion recorded higher net returns (70.88%) and B: C ratio (68.94%), followed by

application of pendimethalin one week before transplanting, oxyfluorfen immediately after transplanting and oxyfluorfen one week before transplanting.

It was concluded that application of herbicide is as good as hand weeding in controlling weeds as well as in achieving yield in onion. Application of pendimethalin immediately after transplanting of onion may be recommended for achieving the highest productivity and profitability in onion.

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