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Effect of Integrated Weed Management on Growth and Yield of *Kharif* Onion (*Allium cepa*)

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ABSTRACT

The present study was carried out at the KrishiVigyan Kendra, Dewas during *kharif*2015-16, 2016-17 and 2017-18with the objectives to find out practically convenient and economically viable weed management practices on growth, yield and yield attributing characters of *kharif* onion.The experiment was laid out in randomized block design with 9 treatments*viz.,* T_1=control (without hand weeding and chemical herbicides), T_2=three hand weeding at 20, 40 and 60 DAT, T_3=one hand weeding at 20 DAT, T_4=pendimethalin @ 1.0 kg/ha (pre-plant incorporation-PPI), T_5=oxyfluorfen @ 0.250 kg/ha (post emergence-PoE), T_6=pendimethalin @ 1.0 kg/ha (PPI) + one Hand weeding (HW) at 40 DAT, T_7=oxyfluorfen @ 0.250 kg/ha (PoE) + one HW at 40 DAT, T_8=pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @ 0.250 kg/ha (PoE), T_9=pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @ 0.250 Kg/ha (PoE) + one HW at 40 DATwith three replications.All the weed management practices resulted in significantly lower weed density relative to contrast.Highest plant height (59.69 cm), neck thickness (1.11 cm), leaves/plant (8.28) were recorded in hand weeding at 20, 40 and 60 DAT which was statistically at par with pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @ 0.250 Kg/ha (PoE) + one HW at 40 DATbut significantly higher than control.Hand weeding at 20, 40 and 60 DATresulted in significantly higher bulb weight (92.12 g), bulb diameter (6.37 cm) and bulb yield (272.14 q/ha) as compared to rest of the treatments. Among chemical treatments, pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @ 0.250 Kg/ha (PoE) + one HW at 40 DAT resulted in significantly higher bulb weight (88.67 g), bulb diameter (6.14 cm) and bulb yield (267.84 q/ha).Highest net returns (Rs1,77,697/ha) and B:C(4.39) were obtained with the application ofpendimethalin @ 1.0 Kg/ha (PPI) + oxyfluorfen @ 0.250 Kg/ha (PoE) + one hand weeding at 40 DAT making it practically more convenient and economically viable weed management practice.

Key Words: Hand weeding, *Kharif* onion, Oxyfluorfen, Pendimethalin.

INTRODUCTION

Onion is one of the most important commercial vegetable crops grown all over the world.Globally it is considered to be the second most important vegetable after tomatoes. China is the leading country in production of followed by India and then USA. Presently, an annual production of onion is 21,564 thousand MT from an area of about 1270 thousand hectare with a productivity of 17.0 MT/ha (Anon, 2017).Onion exhibits greater susceptibility to weed competition as compared to other crops due to its inherent characteristics such as slow germination, extremely slow growth in the initial stages, short stature, non-branching habit, sparse foliage and shallow root system. Therefore, quick and fast growth of weeds in the initial stages and competition thus tends to be severe. In addition to this, frequent irrigation water and fertilizer application allows for successive flushes of weeds in onion.It has been reported by Channapagoudar and Biradar(2007) that yield loss due to weed infestation in onions to the tune of 40 to 80 per cent. Conventional methods of weed control *i.e.* hand weeding is no doubt effective but it is time consuming, cumbersome, expensive and under many situations becomes uneconomical. Moreover,weeding during critical growth stages is

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very difficultdue to increased cost of human labour and its scarceavailability.

The critical period of crop-weed competition in onion lies between 15-60 days after transplanting. Hence, managing the weeds meticulously in early stages is an imperative task to get higher weed control efficiency and bulb yield. Herbicides when used in combination with one or two hand weedings showed improved efficiency in control of weeds. The control of weeds either through herbicide alone or in combination with hand weeding at 45 days after transplanting registered higher net returns as compared to weed free check (Ved Prakash *et al*, 2000). Spraying of pre-emergence herbicides keeps the crop in weed free conditions during early stages. Then, at later stages hand weeding or application of post emergence herbicides helps to reduce the cost of weeding and keep the weed population below economic threshold level throughout the crop growth period.Hence, an attempt was made to find outthe appropriate combination of cultural and chemical weedmanagement practices for weed control in onion may be practically effective and economically viable for farmers.

MATERIALS AND METHODS

A field experiment was conducted at the KrishiVigyan KendraFarm, Dewasduring *kharif* 2015-16, 2016-17 and 2017-18. The experiment was conducted on medium deep black soil and the texture of the soil was clay loam type. The soil pH of the plots wasfound to be in the range of 7.7. The soil of the experimental site had 0.38%, 247 kg/ha, 20.8 kg/ha, 332 kg/ha organic carbon, available N, P and K, respectively. The experiment was laid out in a randomized block design with three replications.The experiment consist of nine treatments *viz.,* T_1= control (without hand weeding and chemical herbicides), T_2= three hand weeding at 20, 40 and 60 DAT, T_3= one hand weeding at 20 DAT, T_4=pendimethalin @ 1.0 kg/ha (pre-plant incorporation-PPI), T_5=oxyfluorfen @ 0.250 kg/ha (post emergence-PoE), T_6=pendimethalin @ 1.0 kg/ha (PPI) + one HW at 40 DAT, T_7=oxyfluorfen @ 0.250 kg/ha (PoE) + one HW at 40 DAT, T_8=pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @ 0.250 kg/ha (PoE), T_9=pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @ 0.250 Kg/ha (PoE) + one HW at 40 DAT. 45 days old seedlings of onion 'Agrifound Dark Red', were transplanted in the month of August during all the years at a spacing of 20 cm × 10 cm.Pendimethalin was applied before one week of transplanting as PPI, while oxyfluorfen was applied 25 days after transplanting when weeds are at 3-4 leaf stage.Weed density was recorded at 75 days after transplanting of crop by placing a quadrat of 50 cm×50 cm randomly from three places in each plot.The data for vegetative parameters (plant height, number of leaves and neck thickness) was recorded at 75 DAT and yield parameters (bulb weight, bulb diameter and total bulb yield) were recorded at harvest.For economic study, prevailing market price was used for different outputs and inputs. Statistical analysis of the data obtained in different set of experiments was calculated following the standard procedure as stated by Panse and Sukhatme (1989).

RESULTS AND DISCUSSION

Effect on weeds

All treatments showed significant reduction in total weed density as compared to unweeded control during all the 3 years (Table 1). Significantly lower weed density (31.37/m^2) was observed in three hand weedings at 20, 40 and 60 DAT. Highest weed density (140.13/m^2) of weeds was recorded in control plot.These results might be due to the fact thatPre-plant incorporation (PPI) of pendimethalin causes reductionin germination of total weed population during initial period of crop growth, further the application of oxyfluorfen as post emergence herbicide(PoE)might have control to the first flush of broad leaf weeds in onion, when applied at 25 DAT. This wascombined with hand weeding at 40 DAT, be efficient for the control of remaining grassy weeds and second flush of broad leaf weeds. This was also in consonant withWarade *et al* (2006).

Table 1. Weed density, growth and yield attributes of *kharif*onionas affected by weed management practices(Pooled data of 3 years).

Treatment	Weed density (No./m^2)	Plant Height (cm)	Neck thickness (cm)	Leaves/ plant	Bulb weight (g)	Bulb Diameter (cm)
T_1	140.13	42.25	0.94	6.43	61.02	4.41
T_2	31.37	59.69	1.11	8.28	92.12	6.37
T_3	67.31	52.33	1.04	7.47	81.72	5.15
T_4	76.81	49.33	1.00	7.20	78.10	5.13
T_5	70.87	49.88	1.00	7.29	79.85	5.16
T_6	54.79	53.57	1.05	7.72	86.39	5.97
T_7	49.58	54.52	1.06	7.83	86.74	6.01
T_8	63.63	52.15	1.02	7.50	83.51	5.54
T_9	42.16	55.22	1.07	7.93	88.67	6.14
SEm±	3.2	0.9	0.03	0.09	0.89	0.04
LSD (p=0.05)	9.8	3.31	0.12	0.41	2.61	0.17

Effect on crop growth and yield attributes

The data (Table 1) showed significant variations among treatments in respect of all vegetative growth parameters and yield attributes.Highest growth attributes *viz*. plantheight (59.69 cm), neck thickness (1.11 cm), number of leaves per plant (8.28), bulb weight (92.12 g) and bulb diameter (6.37 cm)were observed with three hand weedings at 20, 40 and 60DAT. However application of pendimethalin @ 1.0kg/ha(PPI) + oxyfluorfen @ 0.25kg/ha (PoE) + one handweeding at 40 DAT was at second place in respect of allthese attributes. Whereas, all growth and yield attributes were significantly lowest under control plot.It might be due to less weed crop competition throughout crop growth period by manual weeding, which in turn maintain the soil fertility status by way of removing less plant nutrients through weeds and ultimately have favourable effect on growth parameters and yield attributes. Suppression of weed competition by pre and post emergence herbicide application was furtherenhanced by integrating hand weeding at 40 DAT in weed control treatments, which offers efficient and prolongedweed control and kept the crop weed free during the criticalperiods of competition. These findings were in close conformity with those reported by Chandrika*et al* (2009),Bharathi*et al* (2011), Kalhapure*et al* (2013) and Gandolkar*et al* (2015).

Effecton yield

Significant variations were also observed for bulb yield in onion.The highest bulb yield of 272.14q/ha was obtained underthree hand weedings at 20, 40 and 60 DAT followed bypendimethalin @ 1.0 Kg/ha (PPI) + oxyfluorfen @ 0.250kg/ha (PoE) + one hand weeding at 40 DAT (268.84q/ ha). Lowest bulb yield was recorded in control treatment which was significantly different from rest of the treatments. Increase in bulb yieldwith hand weeding and herbicide can be attributed to reduction in weed density low during the entirecrop growth period leading to increasedgrowth and yield attributes. These results were in close conformity with Chopra andChopra (2007).

Economics

The data related to cost of cultivation, gross return, net return, benefit: cost ratio under various weed management practices are presented in Table 2. The highest net monetaryreturn of Rs 1.78lakh/ ha was obtained with applicationof pendimethalin @ 1.0 kg/ha (PPI) + oxyfluorfen @0.250 kg/ha

Table 2. Effect of weed management practices on bulb yield and economics of *kharif*onion.

Treatment	Bulb Yield (q/ha)	Cost of cultivation (Lakh/ha) (Rs.)	Gross Return (Lakh/ha) (Rs.)	Net Return (Lakh/ha) (Rs.)	B:C
T_1	236.54	0.48	2.03	1.55	4.19
T_2	272.14	0.59	2.34	1.75	3.97
T_3	255.80	0.51	2.20	1.68	4.28
T_4	257.51	0.50	2.21	1.71	4.40
T_5	258.13	0.51	2.22	1.71	4.37
T_6	264.57	0.52	2.27	1.75	4.38
T_7	265.83	0.52	2.28	1.76	4.37
T_8	260.78	0.51	2.24	1.73	4.39
T_9	267.84	0.52	2.30	1.78	4.39
SEm±	0.69	-	-	-	-
LSD(p=0.05)	1.31	-	-	-	-

(PoE) + one hand weeding at 40 DAT withbenefit: cost of 4.41. Though weeds were controlledmore efficiently and bulb yield production was highest in treatment three hand weedings at 20, 40 and 60 DAT, itscost of cultivation was also higher (Rs0.59 lakh/ha) becauseof the higher human labour requirement and their higherwages. The cost of human labours for controlling weedswas reduced with application of pre and post emergenceherbicides in combination with hand weeding, which wasresponsible for reduction in total cost of cultivation, resultingmaximum B:C in treatment pendimethalin @ 1.0kg/ha (PP)+ oxyfluorfen @ 0.250kg/ha (POE) + one handweeding at 40 DAT. Economical parameters of onion inrespect of methods of weed control were also studied byPatel *et al* (2011).

CONCLUSION

From the results, it can be concludedthat application of pendimethalin @ 1.0 kg/ha(PPI) + oxyfluorfen @ 0.250 kg/ha (PoE) + one hand weeding at 40 DAT was more effective, practically convenientand economically viable practice for weed controlin *kharif*onion.

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