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Management of *Cuscuta* spp. in transplanted onion under irrigated condition*

Onion is an important commercial crop in Indian agriculture and grown on large area throughout the country. In India, Karnataka is one of the leading states in the cultivation of onion next to Maharashtra and Gujarat. In Karnataka, it occupies an area of 0.15 m ha with the production of 2.38 m t and productivity of 16.05 t ha^{-1} (Anon., 2011). Being an irrigated crop, it is severely infested by weeds which interfere with the development of onion bulbs. If the weeds are present throughout the crop growth period, there may be complete loss of marketable yield. The reduction in bulb yield varies to the extent of 48 to 85 per cent depending upon the duration, intensity of weed growth and weed competition (Bhalla, 1978). Among the various weed species, *Cuscuta* commonly known as dodder, is an obnoxious parasitic weed. After emergence, the seedlings twine around the leaf or stem and draw nutrients from host plants causing drastic reduction of growth and ultimate economic yield. In recent years, as more number of farmers are reporting troubles due to dodder (*Cuscuta* spp.) infestation in onion and the menace is increasing day by day in the northern region of Karnataka. Hence, managing the weeds meticulously in early stages is an imperative task to get higher weed control efficiency and bulb yield. The research information on proper weed management in general and *Cuscuta* control in particular is lacking and hence, the present study was conducted.

A field experiment was conducted on farmer's field at Muttagi village of Bagewadi taluk, Vijaypur district, Karnataka during *rabi* 2011-12 in transplanted onion under irrigated conditions. The experiment consisted of 10 treatments *viz.,* T_1: Pendimethalin 38.7% CS @ 1.00 kg ha^{-1} as pre-emergence (PE) + one hand weeding (HW) at 40 days after transplanting (DAT), T_2: Oxadiargyl 6% EC @ 0.4 kg ha^{-1} as PE + 1 HW at 40 DAT, T_3: Oxyfluorfen 23.5% EC @ 0.25 kg ha^{-1} as PE + 1 HW at 40 DAT, T_4: Pendimethalin 38.7% CS @ 1.00 kg ha^{-1} as PE followed by oxyfluorfen @ 0.25 kg ha^{-1} as post emergence (POE) at 5 weeks after transplanting (WAT), T_5: Oxadiargyl 6% EC @ 0.4 kg ha^{-1} as PE followed by oxyfluorfen @ 0.25 kg ha^{-1} as POE at 5 WAT, T_6: Oxyfluorfen 23.5% EC @ 0.25 kg ha^{-1} as PE followed by oxyfluorfen @ 0.25 kg ha^{-1} as POE at 5 WAT, T_7 : Oxyfluorfen 23.5% EC @ 0.25 kg ha^{-1} as PE only, T_8: Oxadiargyl 6% EC @ 0.4 kg ha^{-1} PE only, T_9: Weedy check and T_{10}: Weed free check. The experiment was laid out in a randomized complete block design with three replications. Telagi red local variety of onion was used in the experiment. The soil of the experimental site was sandy loam. Onion seedlings of 45 days old were transplanted in the main field at a spacing of 30 x 10 cm. All the cultural practices and plant protection measures were adopted as per the state recommendations.

The weed control efficiency (WCE) in *Cuscuta* at 60 DAT was significantly higher with pendimethalin @ 1.0 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT (42.9%) compared to other treatments, however it was on par with oxadiargyl @ 0.4 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT (19.8 %,) and oxyfluorfen @ 0.25 kg ha^{-1} PE only (16.4%). At 90 DAT, none of the herbicide treatments were effective against *Cuscuta* (Table 1). At 30 DAT, the WCE of all herbicide treatments was 90 per cent or more against annual weeds (Table 1), though WCE was higher with sequential application of oxadiargyl and oxyfluorfen, WCE of herbicide treatments further increased when observed at 60 DAT against annual weeds.

Weed index differed significantly due to different weed management practices. Significantly lower weed index was recorded in weed free check compared to other treatments (Table 1). Among herbicidal treatments, pendimethalin @ 1.0 kg ha^{-1} followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT recorded significantly lower weed index (3.83%) compared to rest of the treatments. Weedy check recorded significantly higher weed index (52.92%) among all the treatments. These results are in accordance with the results of Gill and Vijaykumar (1996).

The highest bulb yield of onion (28.20 t ha^{-1}) was recorded in weed free check which was 112 per cent more than weedy check treatment (Table 2) which recorded significantly lower bulb yield (13.30 t ha^{-1}). Similarly, Khurana *et al.* (1985) recorded 54 per cent yield reduction due to uncontrolled weed growth. Among the different herbicidal weed management practices, significantly higher onion bulb yield (27.10 t ha^{-1}) was recorded in pendimethalin @ 1.0 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT followed by pendimethalin @ 1.0 kg ha^{-1} (PE) + 1 HW at 40 DAT (25.40 t ha^{-1}) and oxadiargyl @ 0.4 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg (POE) at 5 WAT (23.70 t ha^{-1}). Similar results were obtained by Kathiresan *et al.* (2004). The higher bulb yield in weed free check was attributed to weed free environment provided by regular weeding throughout the crop growth period and no competition by weeds for growth resources. Significantly higher bulb yield in pendimethalin @ 1.0 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT and pendimethalin @ 1.0 kg ha^{-1} (PE) + 1 HW at 40 DAT was attributed to the efficacy of the post emergence herbicide and hand weeding at 40 DAT for effective control of broad spectrum weeds during the critical period of crop growth resulting in the better availability of soil moisture and nutrients for crop growth and bulb development. These results are in agreement with the findings of Channappagoudar *et al.* (2001). The individual bulb weight of onion was significantly higher in weed free check (69.33 g) over oxyfluorfen @ 0.25 kg/ ha (PE) followed by oxyfluorfen @ 0.25 kg/ha (POE) at 5WAT (48.70 g), oxyfluorfen @ 0.25 kg/ha PE only (56.13 g) and weedy check (36.46 g). However, it was on par with other treatments. Similarly, the bulb diameter of onion was significantly higher with weed free check (5.86 cm) over oxyfluorfen @ 0.25 kg/ha PE only (4.67 cm), oxadiargyl @ 0.4 kg/ha as PE only (5.45 cm) and weedy check (4.67 cm), but it was on par with rest of the treatments (Table 2).

Net returns was significantly higher in pendimethalin @ 1.0 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT (₹ 89,271 ha^{-1}) followed by weed free check (₹ 84,826 ha^{-1})

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Table 1. Weed index, weed control efficiency and *Cuscuta* infestation as influenced by different weed management practices in transplanted onion

Treatments	Weed index (%)	Weed control efficiency (%)				*Cuscuta* infestation/ plot (%)	
		Cuscuta		Other annual weeds			
		60 DAT	90 DAT	30 DAT	60 DAT	60 DAT	90 DAT
Pendimethalin 38.7% CS @ 1.0 kg/ha (PE) + 1 HW at 40 DAT	9.87	8.64	8.10	89.11	95.01	17.97 (23.79)*	55.56 (48.27)
Oxadiargyl 6% EC @ 0.4 kg/ha (PE) + 1 HW at 40 DAT	25.49	6.68	7.58	94.21	94.40	12.25 (20.45)	49.43 (44.84)
Oxyfluorfen 23.5% EC @ 0.25 kg/ha (PE) + 1 HW at 40 DAT	33.06	14.31	4.82	89.65	96.22	36.76 (36.38)	68.22) (56.79
Pendimethalin 38.7% CS @ 1.0 kg/ha (PE) followed by oxyfluorfen @ 0.25 kg /ha (POE) at 5 WAT	3.83	41.85	5.44	89.60	97.00	11.44 (18.87)	49.02 (44.58)
Oxadiargyl 6% EC @ 0.4 kg/ha (PE) followed by oxyfluorfen 23.5% EC @ 0.25 kg/ha (POE) at 5 WAT	15.91	19.82	5.79	93.68	96.13	37.58 (36.91)	74.35 (61.63)
Oxyfluorfen 23.5% EC @ 0.25 kg/ha (PE) followed by oxyfluorfen 23.5% EC @ 0.25 kg /ha (POE) at 5 WAT	31.49	13.11	3.54	91.18	96.63	42.89 (40.60)	63.73 (55.01)
Oxyfluorfen 23.5% EC @ 0.25 kg/ha PE only	31.51	16.42	1.48	91.36	95.81	36.36 (35.62)	61.68 (53.39)
Oxadiargyl 6% EC @ 0.4 kg/ha PE only	32.51	6.28	7.35	94.06	93.90	40.44 (38.61)	69.44 (58.89)
Weedy check	52.92	0.00	0.00	0.00	0.00	50.65 (45.22)	77.61 (62.83)
Weed free check	0.00	100.00	100.00	100.00	100.00	0.00 (0.00)	0.00 (0.00)
S.Em.±	1.38	11.35	2.07	0.64	0.12	6.95	7.14
C.D. (0.05)	4.11	33.73	6.15	1.91	0.35	20.67	21.21

DAT – Days after transplanting, PE- Pre-emergence, POE – Post-emergence, HW- Hand weeding, WAT-Weeks after transplanting
*Figures in parentheses indicate angular transformed values

Table 2. Bulb yield, yield parameters and economics as influenced by different weed management practices in transplanted onion

Treatments	Bulb yield (t ha^{-1})	Bulb weight (g)	Bulb diameter (cm)	Gross return (₹/ha)	Cost of cultivation (₹/ha)	Net returns (₹/ha)	Benefit cost ratio
Pendimethalin 38.7% CS @ 1.0 kg/ha (PE) + 1 HW at 40 DAT	25.40	63.16	5.83	104140	21594	82546	4.82
Oxadiargyl 6% EC @ 0.4 kg/ha (PE) + 1 HW at 40 DAT	21.00	59.30	5.73	86100	21234	64866	4.05
Oxyfluorfen 23.5% EC @ 0.25 kg/ha (PE) + 1 HW at 40 DAT	18.90	60.44	5.58	77490	22283	55207	3.47
Pendimethalin 38.7% CS @ 1.0 kg/ha (PE) followed by oxyfluorfen @ 0.25 kg /ha (POE) at 5 WAT	27.10	63.70	5.88	111110	21839	89271	5.08
Oxadiargyl 6% EC @ 0.4 kg/ha (PE) followed by oxyfluorfen 23.5% EC @ 0.25 kg/ha (POE) at 5 WAT	23.70	62.93	5.73	97170	22414	74756	4.33
Oxyfluorfen 23.5% EC @ 0.25 kg/ha (PE) followed by oxyfluorfen 23.5% EC @ 0.25 kg /ha (POE) at 5 WAT	19.30	48.70	5.63	79130	22192	56938	3.56
Oxyfluorfen 23.5% EC @ 0.25 kg/ha PE only	19.30	56.13	4.67	79130	20241	58889	3.90
Oxadiargyl 6% EC @ 0.4 kg/ha PE only	19.00	60.96	5.45	77900	21204	56696	3.67
Weedy check	13.30	36.46	4.02	54530	17842	36688	3.05
Weed free check	28.20	69.33	5.86	115620	30794	84826	3.76
S.Em.±	1.62	3.84	0.12	1647	354	1647	0.32
C.D. (0.05)	4.83	11.40	0.36	4890	1128	4891	0.96

DAT – Days after transplanting, PE- Pre-emergent, POE – Post-emergent, HW- Hand weeding, WAT-Weeks after transplanting

compared to other treatments. This can be attributed to better control of weeds in these treatments resulting in increased bulb yield and thereby increased net returns. While, weedy check recorded significantly lower net returns (₹ 36,688 ha^{-1}) over rest of the treatments. This can be attributed to poor crop growth and lower bulb yield because of higher crop weed competition as evidenced by higher number of weeds per m^2 at all the crop growth stages. Benefit cost (BC) ratio was significantly higher (5.08) in pendimethalin @ 1.0 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT over rest of the treatments except pendimethalin @ 1.0 kg ha^{-1} (PE) + 1 HW at 40 DAT (4.82) with which it was on par (Table 2). This was

attributed to lower cost of cultivation and reasonably higher bulb yield of onion in these treatments compared to other treatments. Though weed free check recorded significantly higher bulb yield and gross returns, the BC ratio (3.32) was lower compared to pendimethalin @ 1.0 kg ha^{-1} (PE) followed by oxyfluorfen @ 0.25 kg ha^{-1} (POE) at 5 WAT and pendimethalin @ 1.0 kg ha^{-1} (PE) + 1 HW at 40 DAT. This was mainly attributed to increased cost of cultivation due to more number of hand weedings over other treatments. Whereas, weedy check recorded significantly lower BC ratio over rest of the treatments and this was mainly attributed to significantly lower bulb yield. Similar findings were also reported by Ankur Vermani *et al.* (2001).

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References

Anonymous, 2011, Area production and productivity of onion (*Allium cepa*). Survey Report of Indian Statistical Analysis, New Delhi, pp. 15-19.

Ankur Vermani, Nandal, T. R. and Ravindar Singh, 2001, Nutrient uptake and economic weed management in garlic (*Allium sativum* L.). *Indian J. Weed Sci.,* 33(3-4): 225-226.

Bhalla, P. L., 1978, Weed competition, crop losses and chemical weed control in onion- A Review. *Pestology,* 11(2): 35-39.

Channappagoudar, B. B., Agasimani, C. A. and Biradar, N. R., 2001, Physiological studies on weed control efficiency of different herbicides in direct onion. *First Biennial Conf. in the New Millennium on Eco-friendly Weed Management Options for Sustainable Agriculture,* ISWS, May 23-24, 2001, Bengaluru, Karnataka, India, p. 70.

Gill, G. S. and Vijaykumar, 1996, Weed index: A new method for reporting weed control trials. *Indian J. Agron*., 14: 96-98.

Kathiresan, R. M., Gnanavel, I., Jayakanth, U. V., Arulchezlian, M. P., Anbhazhagon, R. and Pandmapriya, S. P., 2004, Bioefficiency and phytotoxicity of oxadiargyl in onion (*Allium cepa* var. *aggregatum*). *Indian J. Weed Sci.,* 36(3&4): 236-238.

Khurana, S. C., Yadav, A. C. and Pandita, M. I., 1985, Weed control in onion. Abstract in *Annual Conf. Indian Soc. Weed Sci.*, HAU, Hisar, India, p. 19.