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Efficacy of pre and post emergence herbicides on bulb yield of onion (*Allium Cepa* L.) in Chhattisgarh plains

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Abstract
The study was conducted in order to identify the weed species in onion fields in Chhattisgarh plain. An experiment was conducted during *rabi* season (October-March) of 2008-2009 to find out the effect of weed management practices on growth and yield of onion, weed dynamics and economics. Onion variety "Nasik Red" was grown as a test crop and transplanted on 20th November 2008 with spacing 15x10 cm. A total of seven weed species belonging to seven family were identified in onion field that were surveyed. The maximum weed density (20.62%) was recorded with *Parthenium hysterophorus* followed by *Cyperus rotundus* (19.35%) and *Cynodon dactylon* (19.00%). The treatment Oxyflourfen @ 0.20 kg ha^{-1} pre-transplanting+ Hand Weeding at 20 DAT resulted in greater plant height, weed control and yield under Chhattisgarh plains situation.

Keywords: Herbicides, Bulb Yield, Onion, Chhattisgarh Plains

Introduction
Onion (*Allium cepa* L.) is one of the most important vegetable crops grown throughout the world with a total production of about 61 million tones (FAO, 2006) [4]. India is the second largest producer of onion in the world and occupies 527,719 hectares area under the cultivation in 2007-08 with a production of 6.66 million tonnes and productivity of 13.3 MT ha^{-1}. Maharashtra is leading state in area and production but in productivity Gujarat is the leading state followed by Haryana, Andhra Pradesh and Madhya Pradesh (Anonymous, 2007) [1]. The area under Chhattisgarh is 8777.00 ha having production of 136743.20 MT. The maximum area of onion is covered under Surguja and production is highest in Durg followed by Raigarh, Raipur, and Jagdalpur district (Anonymous, 2008) [2].

Among the various constraints in onion production, weeds pose serious problem in its cultivation which reduce bulb yield to the extent of 40-80% (Singh *et al*., 1992 and Verma and Singh, 1997) [5]. Weed control predominantly depend on herbicide use since onion has less competition ability and are susceptible to mechanical practices. The very close spacing of the onion transplants and the shallow root system of seedling make the operation of mechanical methods quite ineffective against uprooting of weeds, on the other hand, the seedlings cannot sustain injury. Manual weeding cannot be practiced effectively in short time on a large scale The scarcity of the labourers in the vicinity of cities compel farmers to use herbicides for controlling weeds. Looking to this point an experiment is being conducted during *rabi* season at Research and Instructural Farm of Department of Horticulture I.G.K.V, Raipur (C.G).To find out the effect of weed management practices on growth and bulb yield of onion, weed dynamics and economics.

Materials and Methods
The present experiment was conducted in randomized block design with three replications. A Very popular Onion variety "Nasik Red" was grown as a test crop and transplanted on 20th November 2008 with spacing 15x10 cm. and fertilized with 120, 80 and 60, N_2, P_2O_5 and K_2O kg ha^{-1}, respectively during *rabi* season (October-March) of 2008-09. The experiment was laid out in Randomized Block Design (RBD) with three replications. Data on plant height (cm), number of leaves $plant^{-1}$, Diameter of bulb (cm), weight of onion (g), yield of bulb (q ha^{-1}), weed density, dry matter of weeds (g), weed control efficiency (%) and economics were recorded as per standard procedures with ten treatments comprised of pendimethalin @ 1.25 kg ha^{-1} Pre-transplanting, pendimethalin @ 1.25 kg ha^{-1} Pre-transplanting + Handweeding (HW) at 20 DAT, pendimethalin @ 1.25 kg ha^{-1} post transplanting, oxyfluorfen @ 0.20kg ha^{-1} Pre-transplanting, oxyfluorfen @ 0.20 kg ha^{-1} pre transplanting + Handweeding (HW) at 20 DAT, oxyfluorfen @ 0.20 kg ha^{-1} post-transplanting, butachlor @ 1.2 kg ha^{-1} post transplanting, hand weeding twice at 20 and 40 DAT, weedy check, mechanical weeding thrice

in 20, 30 and 40 DAT.

Results and Discussion

In the experimental field, seven weeds such as *Parthenium hysterophorus, Physalis minima, Chenopodium album, Cyperus rotundus, Cynodon dactylon, Melilotus indica and Alternanthera triandra* were the predominant weeds. At initial period of crop growth, broad leaf weeds contributed more as compared to grasses and sedges. The weed density and dry matter of weeds were found minimum under hand weeding twice at 20 and 40 DAT (Table 1). Whereas, weed control efficiency was found maximum under hand weeding twice at 20 and 40 DAT (Table 2). All the herbicides treatments improved, weed control efficiency, economics and reduced weed density and their dry weight as compared to weedy check. Significantly highest bulb yield of onion (9.03 kg plot^{-1} & 418.2q ha^{-1}) was noted under hand weeding twice at 20 and 40 DAT (table 3), however, it was statistically similar to bulb yield noted under pendimethalin @ 1.25 kg ha^{-1} Pre-transplanting + HW at 20 DAT (8.90 kg plot^{-1} & 412.5 q ha^{-1}) and treatment oxyfluorfen @ 0.2kg ha^{-1} pre transplanting + HW at 20 DAT (8.80 kg plot^{-1} & 412.14 q ha^{-1}) Hand weeding twice at 20 and 40 DAT gave maximum gross return (Rs.2,09,100.00 ha^{-1}), whereas, net return (Rs. 1,40,288.10 ha^{-1}) and benefit cost ratio (2.13) was highest under oxyfluorfen @ 0.20 kg ha^{-1} pre transplanting + HW at 20 DAT. All these economic parameters were found minimum under weedy check.

Table 1: Weed density (m^{-2}) under different weed management practices

S. No.	Weeds	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	T_9	T_{10}
1.	*Parthenium hysterophorus*	10.8	2.16	6.48	4.32	4.32	10.8	6.48	2.16	15.12	0.00
2.	*Melilotus indica*	10.8	0.00	10.8	8.64	0.00	6.48	8.64	0.00	12.96	0.00
3.	*Physalis minima*	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.32	2.14
4.	*Chenopodium album*	4.32	0.00	6.48	2.16	2.16	8.64	4.32	2.16	10.8	0.00
5.	*Cyperus rotundus*	10.8	0.00	6.48	8.64	4.32	4.32	10.8	0.00	12.16	4.32
6.	*Cynodon dactylon*	8.64	2.16	10.8	6.48	0.00	10.8	6.48	0.00	12.96	2.16
7.	*Alternanthera triandra*	2.16	0.00	0.00	0.00	0.00	2.16	0.00	0.00	6.48	0.00
Total		49.68	4.32	41.04	30.24	10.8	43.2	36.72	4.32	74.8	8.62

T_1 -Pendimethalin @ 1.25 kg ha^{-1} pre-transplanting.
T_2-Pendimethalin @ 1.25 kg ha^{-1} pre-transplanting + HW at 20 DAT.
T_3-Pendimethalin @ 1.25 kg ha^{-1} post transplanting.
T_4- Oxyfluorfen @ 0.20kg ha^{-1} pre-transplanting.
T_5-Oxyfluorfen @ 0.20 kg ha^{-1} pre transplanting + HW at 20 DAT
T_6-Oxyfluorfen @ 0.20 kg ha^{-1} post-transplanting,
T_7-Butachlor @ 1.25 kg ha^{-1} post transplanting**.**
T_8-Hand weeding twice at 20 and 40 DAT.
T_9-Weedy check,
T_{10}-Mechanical weeding thrice in 20, 30 and 40 DAT.

Table 2: Weed management practices on weed control efficiency (%)

S. No	Treatment	Weed control efficiency (%)			
		30 DAT	60 DAT	90 DAT	At harvest
1.	T_1 -Pendimethalin @ 1.25 kg ha^{-1} pre-transplanting	111.53	27.2	43.01	44.81
2.	T_2-Pendimethalin @ 1.25 kg ha^{-1} pre-transplanting + HW at 20 DAT	70.57	72.61	77.35	71.92
3.	T_3-Pendimethalin @ 1.25 kg ha^{-1} post transplanting	3.98	30.90	47.16	47.49
4.	T_4- Oxyfluorfen @ 0.20kg ha^{-1} pre-transplanting	56.65	44.22	50.94	51.17
5.	T_5-Oxyfluorfen @ 0.20 kg ha^{-1} pre transplanting + HW at 20 DAT	59.07	70.67	71.69	69.96
6.	T_6-Oxyfluorfen @ 0.20 kg ha^{-1} post-transplanting	5.25	31.35	56.60	50.6
7.	T_7-Butachlor @ 1.25 kg ha^{-1} post transplanting	15.38	36.38	45.28	45.05
8.	T_8-Hand weeding twice at 20 and 40 DAT	81.97	75.70	79.24	78.53
9.	T_9-Weedy check	- -	-	-	-
10.	T_{10}-Mechanical weeding thrice in 20, 30 and 40 DAT	57.03	69.34	69.81	69.83

Table 3: Economics of onion cultivation

S. No	Treatment	Cost of production (Rs ha^{-1})	Bulb yield (q ha^{-1})	Gross return (Rs ha^{-1})	Net return (Rs ha^{-1})	Cost: Benefit ratio
1	T_1 -Pendimethalin @ 1.25 kg ha^{-1} pre-transplanting	67846.70	197.52	98760.00	30913.30	0.45
2	T_2-Pendimethalin @ 1.25 kg ha^{-1} pre-transplanting + HW at 20 DAT	70346.70	412.15	206075.00	135728.30	1.92
3	T_3-Pendimethalin @ 1.25 kg ha^{-1} post transplanting	67846.70	312.49	156245.00	88398.30	1.30
4	T_4- Oxyfluorfen @ 0.20kg ha^{-1} pre-transplanting	63281.90	317.90	158950.00	95668.10	1.51
5	T_5-Oxyfluorfen @ 0.20 kg ha^{-1} pre transplanting + HW at 20 DAT	65781.90	412.14	206070.00	140288.10	2.13
6	T_6-Oxyfluorfen @ 0.20 kg ha^{-1} post-transplanting	63281.90	306.32	153160.00	89878.10	1.42
7	T_7-Butachlor @ 1.25 kg ha^{-1} post transplanting	62498.30	305.55	152775.00	90276.70	1.44
8	T_8-Hand weeding twice at 20 and 40 DAT	70823.30	418.20	209100.00	138276.70	1.95
9	T_9-Weedy check	61823.3	116.82	58410.00	3413.30	0.05
10	T_{10}-Mechanical weeding thrice in 20, 30 and 40 DAT	69323.3	326.65	163325.00	94001.70	1.35

On the basis of results, it can be concluded that hand weeding was the best option for weed management but due to labour expensive and their scarcity, the use of herbicides are effective in controlling weeds and increasing the bulb yields.

Conclusion

The findings revealed that hand weeding (H.W) twice at 20 and 40 DAT (T_8) recorded the highest bulb yield, whereas, net return and cost: benefit ratio were highest under oxyfluorfen @ 0.20 kg ha^{-1} pre transplanting + HW at 20 DAT (T_5) followed by pendimethalin @ 1.25 kg ha^{-1} Pre-transplanting + HW at 20 DAT (T_2). Chopra and Chopra (2006) [3] recorded maximum additional monetary returns (Rs. 42,990 and 36,850 ha^{-1}) and net monetory returns (Rs. 37,350 and 31,750 ha^{-1}) were recorded by oxyfluorfen 0.15 kg ha^{-1} integrated with one HW at 35 DAT and oxyfluorfen 0.30 kg ha^{-1}, respectively for Chhattisgarh plains. All the treatments were comparable with regards to bulb yield, net return and benefit cost ratio.

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