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Effect of herbicides on chilli (*Capsicum annuum* L.) + onion (*Allium cepa* L.) intercropping systems

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Abstract
A field experiment was carried out in medium deep black soil in farmer's field of Mugali village, Ron taluka in Gadag district during *kharif* 2011 under rainfed condition to find out effect of pre and post emergence herbicides for weed management in chilli + onion intercropping system. The experiment was laid out in a randomized block design with three replications. The experiment consisted of 8 treatments involving five pre emergence herbicides *viz.*, Pendimethalin @ 1.0 kg a.i/ha, Butachlor @ 1.0 kg a.i/ha, Oxadiargyl @ 90 g a.i/ha and Alachlor @ 1.0 kg a.i/ha, Alachlor @ 1.50 kg a.i/ha and One post emergence herbicide Oxyfluorfen 0.15 kg a.i/ha (45 DAS) and compared with Farmers' practice (3 HW at 20 days interval), Weed free and Weedy check. Application of Pendimethalin @ 1 kg/ha fb Oxyfluorfen @ 0.15 kg/ha + hand weeding recorded higher dry chilli and onion bulb yield and also recorded lower total weed count, total weed dry weight and lower weed index compared to farmers' practice.

Keywords: herbicides, intercrop, farmers' practices.

Introduction
In recent decades the predominant weed control method in many parts of the developed world is the use of effective and reliable herbicides (Powles *et al.*, 1997) [7]. Hand weeding, though an efficient method it is laborious, costly, time consuming and unsuitable for large farms. The cost involved in hand weeding and unavailability of labours for manual weeding has necessitated the use of chemicals for weed control in developing countries like India. Onion is a poor competitor to weeds due to its short stature, non branching habit, sparse foliage, shallow root system and extremely slow growth in the initial stages, enabling quick and rapid growth of weeds. Hence, it is necessary to control weeds at the early stages of crop growth to achieve the desired productivity. Shallow root system of onion prevents mechanical weeding. Smothering effect of intercrop in onion is absent due to slow initial growth. Hence, chemical weed control is also difficult due to simultaneous sowing of two or more crops but selective herbicides play a key role in suppression of weeds in intercropping due to simultaneous suppression of weeds by smothering effect (Vilas *et al.*, 2019) [10]. Large stretches of chilli + onion intercropping system in northern dry zone of Karnataka is indicative of its high productiveness and certainly in obtaining the yields. Mechanical weeding is difficult as the onion rows are closely spaced are often planted in both the directions as practiced by farmers of this region. Chilli is also susceptible to weed competition due to their initial slow growth and wider space between two rows. Hand weeding is the most common practice followed by farmers under dry lands though it is tedious. The information is meager on weed management through pre and post emergence herbicides package for chilli + onion intercropping system. The yield reduction in onion due to uncontrolled weeds is as high as 78 per cent in drilled and 53 per cent under transplanted condition (Westra *et al.*, 1990) [11].

Material and Methods
The experiments were conducted in farmer's field of Mugali village, Ron taluka, Gadag district. Gadag situated in the Northern Dry Zone (Zone 3) of Karnataka. The centre is at N $15^0.25^1$ Longitude and E $75^0.42^1$ Latitude and 657.4 m above mean sea level. Onion and chilli were hand drilled simultaneously while, Onion seeds mixed with small quantities of FYM and onion seeds were hand drilled @ 10 kg/ha in shallow rows in criss - cross direction and

distance of the onion row to row 20 cm and plant to plant 15 cm. After every four rows of onion one row of chilli was hand drilled @ 1.25 kg/ha. Distance between two chilli rows was 120 cm and 30 cm for plant to plants. The experiment was laid out in a randomized block design with three replications. The experiment consisted of 8 treatments involving five pre emergence herbicides *viz.,* Pendimethalin @ 1.0 kg a.i/ha, Butachlor @ 1.0 kg a.i/ha, Oxadiargyl @ 90 g a.i/ha and Alachlor @ 1.0 kg a.i/ha, Alachlor @ 1.50 kg a.i/ha and One post emergence herbicide Oxyfluorfen 0.15 kg a.i/ha (45 DAS) and compared with Farmers' practice (3 HW at 20 days interval), Weed free and Weedy check.

Result and Discussion

The weed species in experimental area were grassy weeds i.e *Panicum isachne, Cynodon dactylon* L. and *Dinebra retroflexa. Amaranthus viridis* L., *Convolvulus arvensis* L., *Commelina benghalensis* L., *Desmodium diffusum* Dc., *Digera arvensis* L., *Euphorbia* spp. (L.), *Parthenium hysterophorus* L., *Phyllanthus niruri* L., *Physalis minima* L. and *Portulaca oleracea* L. are the broad leaved weeds. The similar weed flora was observed by Nadagouda (1995) at Belvatagi in drilled onion and Narasalagi (1999) [6] in drilled onion + chilli at Dharwad. These weeds were also prominent under transplanted onion + chilli + cotton intercropping system by Rajkumar (2009) [8] and Kalasare *et al*., (2016) [5].

Table 1: Weed control, phytotoxicity rating (0-10 scale) and weed parameters as influenced by different weed management practices in chilli + onion + cotton intercropping system

Treatments	Weed control rating		Phytotoxicity rating		Total no. of weeds/m^2	Total dry weight of weeds/m^2	Weed control efficiency (%)
	Pre	Post	Pre	Post			
T_1- Pendimethalin (PRE) @ 1 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	8.00	7.00	0.00	0.00	4.66 (21.3)	6.19 (37.9)	53.7
T_2- Butachlor (PRE) @ 1 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	7.50	6.83	0.00	0.00	4.81 (22.6)	6.41 (40.6)	50.5
T_3- Oxadiargyl (PRE) @ 90 g a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	7.50	6.67	0.00	0.00	5.06 (25.2)	6.66 (43.9)	46.3
T_4- Alachlor (PRE) @ 1 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	6.00	6.33	4.00	0.00	5.98 (35.3)	7.65 (58.0)	29.3
T_5- Alachlor (PRE) @ 1.50 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	7.50	6.81	5.00	0.00	5.00 (24.2)	6.72 (45.4)	48.6
T_6- Weedy check	0.00	0.00	0.00	0.00	7.10 (50.0)	9.09 (82.1)	--
T_7- Weed free	10.00	10.00	0.00	0.00	1.76 (2.67)	3.06 (8.92)	89.0
T_8- Farmers' practice	0.00	5.67	0.00	0.00	5.30 (27.6)	7.13 (50.4)	36.0
S.Em ±	-	-	-	-	0.16	0.15	3.21
CD (5%)	-	-	-	-	0.51	0.48	9.02

Treatment 1 to 4 received hand weeding at 45 days after sowing (chilli rows only), PRE - Pre- emergence, POST - Post-emergence, DAS - Days after sowing, fb - Followed by

In general, the weed control rating was higher with application of pre emergence herbicides compared to weedy check and farmers' practice after 2nd weeks after sowing. Among herbicide treatments, pendimethalin @ 1 kg/ha (8.00) recorded significantly higher weed control rating at 2nd weeks after pre emergence herbicide spray and it was on par with butachlor @ 1 kg/ha (7.50) and oxadiargyl @ 90 g/ha (7.50) and allachlor @ 1.50 kg/ha. However lower weed control rating was recorded in weedy check and Farmers' practice (0.0) compared to all other treatments (Table.1). The weed control rating was highest with weed free (10.0) treatments. In general, the weed control rating was higher with application of post emergence herbicides compared to weedy check and farmers' practice after 2nd weeks after sowing. Among herbicide treatments, pendimethalin @ 1kg/ha fb oxyfluorfen @ 0.15 kg/ha (7.00) recorded significantly higher weed control rating at 2nd weeks after spray. The lower weed control rating recorded in alachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha at 2nd weeks after spray (6.33) compared to other herbicide. However, in weedy check treatment there was profuse growth of weeds throughout the crop growth period resulting in suppression of growth and yield of crops. The results are in conformity with the findings of Narasalagi (1999) [6] in onion + chilli intercropping.

Visual observations on crop toxicity ratings (0-10 scale) were recorded at pre emergence application of herbicides after 2nd weeks after sowing and post-emergence herbicides after 2nd weeks after spray. With pre emergence application of pendimethalin @ 1 kg/ha (0.0, 0.0 and 0.00, respectively), butachlor @ 1 kg/ha (0.0, 0.0 and 0.0, respectively) and oxadiargyl @ 90 g/ha (0.0, 0.0 and 0.0, respectively) there was no toxic effect in onion and chilli crops in 2nd weeks after spray. The application of alachlor @ 1 kg/ha & alachlor 1.50 kg/ha caused moderate injury, some loss in crop stand, stunted growth and discoloration of leaves (3.80) in 2nd weeks after spray in chilli and onion crops Similar results were reported by Atre (2001) [3] with 2 kg a.i/ha in drilled onion. Post emergence application of oxyfluorfen @ 0.15 kg/ha did not cause any toxic injury effect in chilli and onion crops in 2nd weeks after spray.

At harvest, the total number of weeds and dry matter of weeds was significantly lower in weed free (1.76 & 3.06/m^2) than all other treatments. Among herbicide treatments, the treatments receiving pendimethalin @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (4.66 & 6.19g/m^2, respectively), butachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (4.66 & 6.41g/m^2, respectively) and oxadiargyl @ 90 g/ha fb oxyfluorfen @ 0.15 kg/ha (5.06 & 6.66g/ m^2, respectively) significantly lower total number of weeds and dry matter of weeds. The total number and dry matter of weeds was significantly lower in alachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (5.98 & 7.65g/m^2, respectively) compared to all other herbicide treatments. The significant reduction in total weed dry weight in pendimethalin @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha was mainly due to significantly lower density of grasses, broad leaved weeds and total weed population at all stages as well as at harvest and significantly higher weed control index due to higher inhibition of root and shoot growth, root elongation, early seedling growth, higher toxicity and persistence of herbicides in soil (Table 1). The similar effects were earlier reported by Anon. (1995) [2], Narasalagi (1999) [6] in transplanted chilli, Tewari *et al.*, (1998) [9] in garlic. Further, the mode of action pendimethalin and oxyfluorfen clearly indicates that these herbicides are mainly absorbed by germinating shoots rather than roots and thus inhibiting the germinating seedlings (Anon. 1987) [1]. The highest weed control efficiency was recorded in weed free plot (89.0%). Among the herbicide treatments, the application of pendimethalin @ 1 kg/ha fb

oxyfluorfen @ 0.15 kg/ha (53.7%) was recorded higher weed control efficiency and which was on par with butachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (50.3%) and lowest weed control efficiency were in allachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (29.3%).

Table 2: Yield and economics as influenced by different weed management practices

Treatments	Dry chilli	Bulb onion	Gross return (Rs./ha)	Net return (Rs./ha)	B:C ratio
T_1- Pendimethalin (PRE) @ 1 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	1279	2201	146752	110114	4.01
T_2- Butachlor (PRE) @ 1 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	1228	2139	141121	105681	3.98
T_3- Oxadiargyl (PRE) @ 90 g a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	1195	2104	136859	101343	3.85
T_4- Alachlor (PRE) @ 1 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	885	1503	100212	64416	2.80
T_5- Alachlor (PRE) @ 1.50 kg a.i/ha fb Oxyfluorfen (POST) @ 0.15 kg a.i/ha	950	1845	118160	80907	3.15
T_6- Weedy check	191	356	23002	-8413	0.73
T_7- Weed free	1448	2763	173462	136046	4.64
T_8- Farmers' practice	1064	1925	122543	88127	3.56
S.Em ±	57	96.0	5647	5647	0.16
CD (5%)	175	295	172402	17402	0.49

Treatment 1 to 4 received hand weeding at 45 days after sowing (chilli rows only), PRE -Pre- emergence, POST - Post-emergence, DAS - Days after sowing, fb - Followed by

The onion yield was significantly higher in the treatments receiving herbicides compared to farmers' practice. The bulb yield was significantly higher with application of pendimethalin @ 1 kg per ha fb oxyfluorfen @ 0.15 kg per ha (2201 kg/ha) which was on par with butachlor fb oxyfluorfen @ 0.15 kg per ha (2139 kg/ha) and oxadiargyl @ 90 g per ha fb oxyfluorfen @ 0.15 kg per ha (2104 kg/ha). This was mainly attributed to lower crop weed competition, weed population and weed dry weight in the early stages enabling to crop establish and to grow well. This was clearly reflected in lower weed index (19.5%) in pendimethalin @ 1 kg per ha fb oxyfluorfen @ 0.15 kg per ha as a result of effective weed control in initial stages, higher dry matter per plant which in turn might be due to increased water, nutrient uptake and photosynthesis. In farmers' practice lower bulb yield (1925 kg/ha) and this was mainly due to higher weed index (29.6%) (Table. 2)

The chilli yield was significantly higher in the treatments receiving herbicides compared to farmers' practice. The dry fruit yield was significantly higher with application of pendimethalin @ 1 kg per ha fb oxyfluorfen @ 0.15 kg per ha (1279 kg/ha) and was on par with butachlor fb oxyfluorfen @ 0.15 kg per ha (1228 kg/ha) and oxadiargyl @ 90 g per ha fb oxyfluorfen @ 0.15 kg per ha (1195 kg/ha). Similarly, Rajkumar (2009) [8] and Kalasare (2010) [4] also reported pendimethalin fb oxyfluorfen recorded higher chilli yield in onion + chilli + cotton intercropping system. The yield increase was mainly attributed to lower crop-weed competition, weed population and weed dry weight in the early stages enabling to crop establish and to grow well. This was clearly reflected in lower weed index (14.1, 16.0 and 19.6%, respectively) weed density and weed dry weight. As a result of effective weed control in initial stages, this treatment produced higher dry matter per plant (Table 14) which in turn might be due to increased water, nutrient uptake and photosynthesis. The yield was lower with farmers' practice (1064 kg/ha). The per cent increase in the yield was (16.81, 15.41 and 10.96, respectively) over farmers' practice. Application of alachlor @ 1 kg per ha fb oxyfluorfen @ 0.15 kg per ha recorded significantly the lower dry fruit yield (885 kg/ha) as compared to all other herbicide treatments. This was mainly due to poor weed and crop injury in the initial stage. The weed index value was also higher (40.3%) when compared to other herbicides.

Net return were significantly higher in weed free (Rs. 1 36,046/ha) compared to all other treatments. Among herbicide treatments, net return was significantly higher in pendimethalin @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha, butachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha and oxadiargyl @ 90 g/ha fb oxyfluorfen @ 0.15 kg/ha (Rs 1, 10,114, 1 05,681 and 1, 01,343/ha, respectively). The net return was significantly lower in alachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (Rs 1, 00,212/ha) compared to other herbicide treatments. B:C ratio was significantly higher in weed free (4.64) compared to other treatments. Among herbicide treatments, B:C ratio was significantly higher in pendimethalin @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (4.01), butachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (3.98), oxadiargyl @ 90 g/ha fb oxyfluorfen @ 0.15 kg/ha (3.85) and farmer's practice (3.56). The lower B:C ratio was recorded in alachlor @ 1 kg/ha fb oxyfluorfen @ 0.15 kg/ha (2.80) compared to other herbicide treatments.

It can be concluded that application of either pendimethalin @ 1 kg/ha or butachlor @ 1 kg/ha or oxadiargyl @ 90 g/ha followed by post emergence application of oxyfluorfen @ 0.15 kg/ha is effective and economical in controlling the total weeds, weed dry matter and producing higher yields of components crops and producing higher net return and B:C ratio in intercropping system and was better than farmers' practice.

Reference

1. Anonymous. The pesticides manual publication by British Crop Protection Council, 8th Ed, 1987.
2. Anonymous. Integrated weed management in chilli. Annu. Rep., of AICRP on weed control, Rajendranagar, Hyderabad, 1995, 21.
3. Atre S. Chemical weed control in onion, M. Sc. (Agri.) Thesis, Univ. of Agric. Sci., Dharwad, Karnaaka (India), 2001.
4. Kalasare RS. Evaluation of pre-plant and post-emergent herbicides in Chilli + Onion + Cotton intercropping system. M. sc. (agri.) Thesis Univ. Agric. Sci., Dharwad (India), 2010.
5. Kalasare RS, Ramesh Babu, Aravind Kumar, Panpatte DG, Shitap M. effect of herbicides in chilli + onion + cotton intercropping system. Bioinfolet. 2016; 13(A1):6-9.
6. Narasalagi VM. Evaluation of herbicides for weed control in direct seeded onion + chilli intercropping system under rainfed condition. M.Sc. (Agri.) Thesis, Univ. of Agric. Sci., Dharwad, Karnaaka (India), 1999.

7. Powles SB, Preston C, Bryans IB, Jutsum AR. Herbicide Resistance: Impact and Management. Advances in Agron. 1997; 58:57-93.
8. Rajkumar S, Palled YB. Weed management in Drilled Onion (*Allium cepa* L.)+chilli (*Capsicum annum* L.)+cotton (*Gossypium herbaceum* L.) Relay intercropping in rainfedvertisols. Indian J. Weed Sci. 2009; 41(3-4):189-194.
9. Tewari AN, Rathi KS, Singh B. Integrated weed management in garlic (*Allium sativum* L.). Indian J. Agric. Sci. 1998; 68:281-283.
10. Vilas D Gasti, Snehasish Chakravorty. Chemical Weed Control in Chilli + Onion Intercropping System. International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Volume 8 Number 01, 2019.
11. Westra P, Pearson CH, Ristan R. Control of venice mallow (*Hibiscus triomus*) in corm and onions. Weed Tech. 1990; 4(3):500-504.