

Original Research Article

Effect of Pre-Plant and Post Emergent Herbicides on Chilli Equivalent Yield and Economics of Chilli + Onion + Cotton Intercropping System

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ABSTRACT

Keywords

Pre-plant application,
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intercropping,
Weed index

A field study was conducted during *kharif* 2009 at MARS, Dharwad to study the effect of pre-plant and post emergent herbicides on yield and economics of chilli + onion + cotton intercropping system. Results revealed that, pre-plant application (PPA) of oxyfluorfen 0.15 kg ha⁻¹ + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ HW at 30 and 60 DAT recorded significantly higher chilli equivalent yield 7.43 t/ha than all other treatment combinations including the farmers practice 5.81 t/ha. The chilli equivalent yield was greatly influenced by yield attributing characters *viz.* number of green chilli fruits, onion bulb weight, number of bolls and mean boll weight in cotton. Higher B: C ratio 3.6 and net return Rs.64057 was observed with, pre-plant application (PPA) of oxyfluorfen 0.15 kg ha⁻¹ + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ HW at 30 and 60 DAT over all other treatment combinations including weed free check.

Introduction

In Karnataka, cotton and chilli are the most extensively grown commercial crops in drylands under intercropping systems. Onion is also grown in mixtures in this intercropping system. These three commercial crops chilli, onion and cotton are grown in various combinations. This system is most assured and paying intercropping system of the northern dry zone of Karnataka. Least competition exists among the component crops especially when cotton variety Jaydhar was used (Kumarswamy and Hosmani, 1978). This system is widely adopted in Navalgund, Nargund, Kundgol, Shirahattai, Dharwad, Hubli and Gadag talukas. The area of cotton, chilli and onion in Karnataka 3.16, 1.74 and 1.04 lakh hectares, respectively (Anon.,

2005). Cotton production is 2.64 lakh bales with a productivity of 191 kg/ha. Dry chilli production is 1.44 lakh MT with a productivity of 0.87 MT/ha. Production of onion is also very less (5.88 lakh MT) with low productivity (5.6 MT/ha). Intercropping has long been recognized as a very common practice throughout developing tropics. Intercropping chilli + onion + cotton is well established and remunerative cropping system of transitional tract of Dharwad in Karnataka. The production practices employed for chilli + onion + cotton intercropping system create ecological niches in which weeds flourish. Maintenance of weed free conditions in chilli, onion and cotton is important. Losses due to weeds in cotton vary from 10-90 per

cent (Halemani *et al.*, 2004). The yield reduction in onion due to uncontrolled weeds is as high as 78 per cent in drilled and 53 per cent under transplanted conditions (Westra *et al.*, 1990). Among these three crops onion is 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. In general, weeds are considered to be one of the major production constraints in chilli, onion and cotton. Timely weeding reduces the crop weed competition and leads to higher crop yields. 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 labourers force in time for manual weeding has necessitated the use of chemicals and improved tillage practices for weed control in developing countries like India. In general, information on weed management in intercropping is limited and very little or no work has been done on weed management in chilli + onion + cotton intercropping system in particular. In view of acute need for evolving integrated weed management strategy for rainfed chilli + onion + cotton intercropping system.

Materials and Methods

The field experiment was conducted at Main Agricultural Research Station (MARS), University of Agricultural Sciences, and Dharwad during *kharif* 2009. The soil of the experimental site was medium black belong to the order vertisols. The soil has a pH of 8.00. The experiment was comprised of 11 treatments viz. Pendimethalin (PPA) @ 1.5 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha, pendimethalin (PPA) @ 1.5 kg a.i/ha

+ fenoxypop ethyl (POE) at 70 g a.i/ha, alachlor (PPA) @ 2.0 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha, alachlor (PPA) @ 2.0 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha, oxyfluorfen (PPA) @ 0.15 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha, oxyfluorfen (PPA) @ 0.15 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha, pendimethalin CS (PPA) @ 650 g a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha, pendimethalin CS (PPA) @ 650 g a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha, farmer's practice, weed free check and weedy check. The experiment was laid out in randomized block design (RBD) with three replications. The gross and net plot size was 9.0 m x 6.0 m and 7.2 m x 4.8 m, respectively. The chilli seedlings were transplanted with the spacing of 90cm x 60cm onion seeds were sown 15cm x 15cm and cotton 90cm x 60cm. All the Pre-plant application of herbicides was done on soil surface 5 days well in advance of chilli transplanting and the post-emergence application was sprayed on 45 DAT. The observations on weed dry weight, weed control efficiency was recorded at 30, 60, 90, 120 and at harvest. Number of fruits per plant and fruit weight in chilli and number of bolls (per plant) and mean boll weight (g) in cotton was recorded at different pickings of chilli and cotton, onion bulb weight (g/plant) was recorded at the time of harvesting. Chilli equivalent yield was obtained on the basis of green chilli fruit, onion bulb and seed cotton yield and the yield was expressed in terms of tonnes per hectare basis and net return was calculated Rs. /ha. B: C ratio was calculated on the basis of cost of cultivation and net return.

Results and Discussion

The efficiency of different herbicides used in the experiment in controlling weeds in

chilli + onion + cotton intercropping system. The weed species found in experimental area are grassy weeds observed *Cynodon dactylon*, *Dinebra retroflexa*, *Eleusine indica* and *Setaria italica*. *Cyperus rotundus* was the only weed under sedge category. This weed dominated more than other weeds in entire experimental area because of the excess (95.35 mm) rainfall received in the August 2009 when compared with average of 58 years. Good numbers of weeds were observed under broad leaved weeds (BLW) category. They are *Abutilon indicum* G. Don, *Acanthospermum hispidum* Dc, *Ageratum conyzoides* L. *Alternanthera sessilis* L., *Amaranthus viridis* L., *Borreria sp*, *Cynotis cristata* L., *Convolvulus arvensis* L., *Commenlina benghalensis* L., *Desmodium diffusum* Dc., *Digera arvensis* L., *Euphorbia spp.* L. The similar weed flora was observed by Narasalagi (1999) in drilled onion + chilli and Rajkumara (2009) in onion – chilli – cotton relay inter cropping. Among the above BLW, *Ageratum conyzoides* L., *Convolvulus arvensis* L., *Parthenium hysterophorus* L., *Phyllanthus fraternus* L., *Portulaca oleracea* L. and *Physalis minima* L. were most dominant weeds. All the herbicides significantly reduced the weed biomass.

Among the herbicides treatments, pre-plant application (PPA) of oxyfluorfen 0.15 kg ha⁻¹ + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ (POE) HW at 30 and 60 DAT recorded lower weed dry weight (11.87 g m²) followed by pre-plant application (PPA) of pendimethalin CS 650 g ha⁻¹ + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ HW at 30 and 60 DAT (14.30 g m²). The highest weed dry weight was recorded in weedy check (134.47 g m²). The herbicides studied higher weed control efficiency was observed with pre-plant application (PPA) of oxyfluorfen 0.15 kg ha⁻¹ + post-emergent application

(POE) of oxyfluorfen 0.15 kg ha⁻¹ (POE) HW at 30 and 60 DAT (91.17%) as compared to other herbicides such as pre-plant application (PPA) of pendimethalin CS @ 650 g a.i/ha + post-emergent application (POE) of oxyfluorfen @0.15 kg a.i/ha (89.36%) and farmer's practice (87.52). Pre-plant application (PPA) of pendimethalin @ 1.5 kg a.i/ha + post-emergent application (POE) of oxyfluorfen @ 0.15 kg a.i/ha and pre-plant application (PPA) of alachlor @ 2.0 kg a.i/ha + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ HW at 30 and 60 DAT were found less effective in controlling weeds in chilli + onion + cotton intercropping by recorded significantly lower weed control efficiency (85.72%,83.80% respectively) compared to all other herbicides including farmer's practice. Significant differences were also noticed with regard to yield attributing characters viz, number of green chilli fruits, onion bulb weight, number of bolls and mean boll weight in cotton. Higher number of green chilli fruits, onion bulb weight, number of bolls in cotton and mean boll weight was recorded in weed free check in these three crops. Pre-plant application (PPA) of oxyfluorfen + post-emergent application (POE) of oxyfluorfen, pre-plant application (PPA) of pendimethalin CS + post-emergent application (POE) of oxyfluorfen and farmer's practice recorded higher number of green chilli fruits, onion bulb weight, number of bolls and mean boll weight in cotton. These treatments resulted in better control of weeds and providing weed free condition for longer period of crops growth and resulted in yield parameters. In weedy check, the crop was adversely affected by weeds due to heavy competition with crop for nutrients, moisture, space and light which can be attributed for suppressed crops growth and there by reduction in yield parameters of chilli, onion and cotton.

Table.1 Influence of herbicides on weed dry weight and weed control efficiency in chilli + onion + cotton intercropping

Sl. No	Treatments	Weed dry wt. at harvest (g m ²)	Weed control efficiency (%) at harvest
1	Pendimethalin (PPA) @ 1.5 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	19.20	85.72
2	Pendimethalin (PPA) @ 1.5 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	19.47	85.72
3	Alachlor (PPA) @ 2.0 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	21.77	83.8
4	Alachlor (PPA) @ 2.0 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	22.73	83.09
5	Oxyfluorfen (PPA) @ 0.15 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	11.87	91.17
6	Oxyfluorfen (PPA) @ 0.15 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	12.53	90.68
7	Pendimethalin CS (PPA) @ 650 g a.i/ha + oxyfluorfen (POE)@ 0.15 kg a.i/ha.	14.30	89.36
8	Pendimethalin CS (PPA) @ 650 g a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	15.03	88.82
9	Farmer's practice	16.77	87.52
10	Weed free check	6.87	94.89
11	Weedy check	134.47	0.00
	SEm±	0.44	0.49
	CD(0.05)	1.31	1.45

Note: Treatments 1 to 8 received hand weeding at 30 & 60 days (cotton & chilli rows only), HW-Hand weeding, DAT-Days after transplanting, PPA-Pre-plant application, POE-Post-emergence

Table.3 Influence of herbicides on chilli equivalent yield and economics of chilli + onion + cotton intercropping system

Sl. No	Treatments	Chilli equivalent yield (t/ha)	Net return (Rs/ha)	B:C ratio
1	Pendimethalin (PPA) @ 1.5 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	4.73	29043	2.1
2	Pendimethalin (PPA) @ 1.5 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	4.63	27923	2.1
3	Alachlor (PPA) @ 2.0 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	4.41	26149	2.0
4	Alachlor (PPA) @ 2.0 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	4.29	25024	2.0
5	Oxyfluorfen (PPA) @ 0.15 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	7.43	64057	3.6
6	Oxyfluorfen (PPA) @ 0.15 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	7.28	62584	3.5
7	Pendimethalin CS (PPA) @ 650 g a.i/ha + oxyfluorfen (POE)@ 0.15 kg a.i/ha.	6.58	53599	3.1
8	Pendimethalin CS (PPA) @ 650 g a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	6.51	52866	3.1
9	Farmer's practice	5.81	46482	3.0
10	Weed free check	8.29	66612	3.1
11	Weedy check	0.67	-10560	0.4
	SEm±	0.32	1162	0.09
	CD(0.05)	0.69	3486	0.28

Note: Treatments 1 to 8 received hand weeding at 30 & 60 days (cotton & chilli rows only), HW-Hand weeding, DAT-Days after transplanting, PPA-Pre-plant application, POE-Post-emergence

Table.2 Influence of herbicides on yield parameter of chilli + onion + cotton intercropping system

Sl. No	Treatments	Total fruit weight of chilli (g/plant)	Green chilli fruit yield (tha)	Bulb weight (g)	Onion bulb yield (t/ha)	Total number of bolls in cotton per plant	Mean boll weight (g)	Seed cotton yield (t/ha)
1	Pendimethalin (PPA) @ 1.5 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	102.74	1.22	23.87	3.12	15.33	2.37	0.88
2	Pendimethalin (PPA) @ 1.5 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	102.3	1.20	23.43	3.10	15.00	2.33	0.82
3	Alachlor (PPA) @ 2.0 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	99.93	1.14	22.67	3.02	14.67	2.27	0.73
4	Alachlor (PPA) @ 2.0 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	99.16	1.13	22.38	2.96	14.33	2.13	0.70
5	Oxyfluorfen (PPA) @ 0.15 kg a.i/ha + oxyfluorfen (POE) @ 0.15 kg a.i/ha.	121.04	1.87	31.13	4.22	19.37	3.90	1.83
6	Oxyfluorfen (PPA) @ 0.15 kg a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	120.03	1.83	30.82	4.14	19.27	3.87	1.8
7	Pendimethalin CS (PPA) @ 650 g a.i/ha + oxyfluorfen (POE)@ 0.15 kg a.i/ha.	114.2	1.67	28.45	3.79	18.20	3.30	1.61
8	Pendimethalin CS (PPA) @ 650 g a.i/ha + fenoxypop ethyl (POE) at 70 g a.i/ha.	113.83	1.65	28.28	3.78	18.00	3.07	1.57
9	Farmer's practice	108.6	1.47	26.12	3.44	16.93	2.50	1.39
10	Weed free check	127.57	2.09	33.40	4.54	21.33	4.47	2.09
11	Weedy check	62.6	0.37	11.17	0.24	7.33	0.97	0.17
	SEm±	1.55	0.034	0.71	0.059	0.79	0.12	0.03
	CD(0.05)	4.61	0.105	2.12	0.173	2.32	0.36	0.089

Note: Treatments 1 to 8 received hand weeding at 30 & 60 days (cotton & chilli rows only), HW-Hand weeding, DAT-Days after transplanting, PPA-Pre-plant application, POE-Post-emergence

In the present study, chilli equivalent yield was significantly higher in weed free check (8.29 t/ha) and which was superior over all the treatments. Among the herbicides pre-plant application (PPA) of oxyfluorfen 0.15 kg ha⁻¹ + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ (POE) HW at 30 and 60 DAT and pre-plant application (PPA) of pendimethalin CS 650 g ha⁻¹ + post-emergent application (POE) of oxyfluorfen 0.15 kg ha⁻¹ HW at 30 and 60 DAT recorded significantly higher chilli equivalent yield (7.43 t/ha, 6.58 t/ha, respectively) and B:C ratio, net return was also higher in these herbicide treatments is due to their higher weed suppressing ability and higher weed control efficiency. Kalyanamurthy (2002) reported higher net returns in oxyfluorfen @ 0.09 kg a.i./ha with one hand weeding at 45 DAS. Similarly higher net returns and B: C ratio were observed in the studies conducted at Coimbatore (Anon, 2007), highest net return and B: C ratio was obtained with the pre emergence application of oxyfluorfen @ 0.15 kg a.i./ha in transplanted onion in Coimbatore (Anon., 2004). There by there was increase in all the yield parameters viz. number of green chilli fruits, onion bulb weight, number of bolls and mean boll weight in cotton. Which in turn resulted in higher chilli equivalent yield, net return and B: C ratio.

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