

Original Research Article

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Chemical Weed Control in Chilli + Onion Intercropping System

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ABSTRACT

Keywords

Chilli + onion intercropping, Weed control treatments and B : C Ratio

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An investigation entitled “Chemical weed control in chilli + onion intercropping system” was carried out at the Vegetable Division in Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot (Karnataka) during *Kharif* season of 2014 and 2015 on well drained red loamy soil to find out the suitable approach (herbicides+cultural practices) for weed management and for improving the productivity of chilli+onion intercropping system. Observations on weed control treatments showed marked difference among weed, growth and yield parameters in chilli and onion. Among the different chemical treatments, pre-emergent application of alachlor @ 1.5 kg ai/ha + 2 HW at 45 and 60 DAT (T_4) recorded the lowest pooled dry matter of weeds (1.97 g), lowest population of monocot (3.68) and dicot weeds (3.11) and thus exhibited the highest weed control efficiency (93.04%). Unweeded check recorded highest weed population (13.16) and weed dry weight (7.47 g). Significantly higher yield per ha of green chilli(253.41 q) and onion (221.26 q), net returns (Rs.2,14,413) and B:C ratio (3.4) was recorded in T_4 followed by pendimethalin @ 1.5 kg ai/ha + 2 HW at 45 and 60 DAT.

Introduction

Weeds are unwanted and undesirable plants that interfere with utilization of land and water resources and thus adversely affect crop production and human welfare. They are often prolific and persistent, interfere with agricultural operations, increase labour cost and reduce the yield (up to 45 %) and quality. The weed flora noticed in the experimental site consisted of grasses, sedges and broad leaved weed category. The important grassy weeds observed are *Cynodon dactylon*,

Dinebra retroflexa, *Eleusine indica*, *Cyperus rotundus* and *Setaria italica*. *C. rotundus* was more dominated than other weeds in entire experimental area. In Karnataka, chilli and onion are the most extensively grown commercial vegetable crops under intercropping systems. Chilli+onion intercropping is of the most assured intercropping system and mitigate the weeds to some extent and increases the yield and is found suitable to northern dry zones of Karnataka. This system is widely adopted in Northern Karnataka (Anonymous, 2017).

In general, weeds are considered to be one of the major production constraints in chilli and onion. 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 labours for manual weeding has necessitated the use of chemicals for weed control in developing countries like India. Information regarding weed management through herbicides in intercropping is limited and very little work has been done on weed management in chilli+onion intercropping system in particular. In view of acute early results to mitigate weeds through chemical weed management strategy for chilli + onion intercropping system, the present investigation was carried out.

Chilli and onion is the most important cash crops of India, playing a key role in economic and social affairs. In intercropping system, fewer weeds are expected than in sole crop because of their better suppression. Some research findings related to weed management reported that weed suppression as a result of intercropping is to the extent of 50 to 75 per cent (Biradar, 1999). However management of weeds in intercropping or mixed cropping system is complicated due to spatial and temporal differences in the arrangement of crops. 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 (Muthusankaranarayanan *et al.*, 1997). 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.

Materials and Methods

The study was carried out at the Vegetable Division in Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot (Karnataka) during *Kharif* season of 2014 and 2015 on a well-drained red loamy soil to find out the effectiveness of chemicals in weed management in intercropping of chilli (Var 'Byadagi')+ onion (Var 'N-53').

The field experiment was laid out in a Randomized Complete Block Design with two replications consisting of fourteen treatments including unweeded check (T₁ . Alachlor (PE)-1.5 kg ai/ha T₂ . Alachlor (PE)-1.0 kg ai/ha T₃ . Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT T₄ . Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT T₅ . Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT T₆ . Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT T₇ . Pendimethalin (PE)-1.5 kg ai/ha T₈ . Pendimethalin (PE)-1.0 kg ai/ha T₉ . Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT T₁₀ . Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT T₁₁ . Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT T₁₂ . Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT T₁₃ . Weed free check T₁₄ . Unweeded check). RDF for chilli is 150:100:125 kg of N: P₂O₅: K₂O with 25 tonnes of FYM (As per package of practices – UHS, Bagalkot Karnataka).

The gross size and net size of the plots were 16.20 m² and 11.80 m² respectively. Four to five weeks old chilli seedlings are transplanted into main field with a spacing of 75cm × 45 cm (As per package of practices -

UHS, Bagalkot) and in between the chilli plants, 2 rows of onion was planted. Basal dose of fertilizer (50 % N and full dose of P and K) was applied to each treatment at the time of field preparation. Remaining dose of N (50 %) was applied at 3 split doses *viz.*, after 30, 60 and 90 days of transplanting. During the course of investigation, observations regarding weed population, growth and yield parameters at 30, 60 and 90 DAT and at the time of harvest were recorded from the randomly selected and tagged plants.

The weed index was calculated by the formula given by Gill and Vijayakumar (1969). Besides fixed cost of cultivation, variable costs on spray, manual weeding and cost of herbicide in each treatment was worked out to obtain total cost of production. The net income was obtained after deducting cost of production from value of produces. The mean data was subjected to the statistical analysis using ANOVA and mean separation (LSD) procedures (Gomez and Gomez, 1984).

Results and Discussion

The results of the study showed that among different chemical treatments, the effect of weed control on monocot weeds (3.68), dicot weeds (3.11) and weed population at harvest (4.82) was found to be significantly less in treatment with pre-emergent application of alachlor-1.5 kg ai/ha + 2HW at 45 and 60 DAT(T₄) over unweeded check ie, T₁₄. This was found to be on par with T₁₀ (Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT) (3.95, 3.26 and 5.12, respectively) (Table 1).

The treatment T₄ recorded lowest dry weight of weeds at harvest (1.97 g), lowest weed index in chilli and onion (11.80 and 6.05, respectively) and thus highest weed control efficiency (93.04 %) (Table 2). The lower dry weight of weeds in these treatments might be

attributed to the less number of weeds. Thus the higher weed control efficiency could be accounted to the lower weed dry weight. These results are of agreement with Ningappa (2013), Shil and Adhikary (2014) and Chaudhari *et al.*, (2017).

Treatment T₄ was found significant for highest plant height (104.88 cm), number of branches/ plant (24.47), dry weight of plant (106.39 g) and number of fruits/plant at harvest (119.34) in chilli (Table 3). The mean analyses showed that highest fruit wt. /plant (1.08 kg) was recorded in T₄ followed by T₁₀ (1.04 kg) and minimum was recorded from the unweeded check, T₁₄ (0.41 kg). Reduced yield from the unweeded plot may be attributed to increased competition for light, soil moisture and nutrients. Fruit yield per ha (253.41 q) of chilli was found highest in T₄ while lowest was found in T₁₄ (101.45 q) (Table 4). Similar findings are reported by Rajakumara (2009), Kalasare *et al.*, (2016) and Ningappa (2013).

Yield and yield components of onion varied significantly among various weed control treatments. Treatment T₄ was found significant for highest plant height (59.60 cm) and number of leaves/plant at harvest (15.29) in onion (Table 5). Weed free check recorded significantly highest dry weight of plant (8.00 g), yield per plant (84.80 g) and yield per ha (235.54 q). Among the chemical treatments, T₄ recorded highest dry weight of plant (7.57 g), yield per plant (79.66 g) and yield per ha (221.26 q) (Table 6).

The increase in plant dry matter and yield per plant in these treatments could be attributed to lower weed count and higher weed control efficiency which ultimately resulted in better crop growth leading to higher productivity. The results are in agreement with Dharmatti *et al.*, (2008), Kalasare (2016) and Urraiya and Jha (2018).

Table.1 Effect of weed control treatments on weed parameters in chilli + onion intercropping

Treatments	Treatment details	Monocot weeds at harvest			Dicot weeds at harvest			Weed population at harvest		
		I year	II year	pooled	I year	II year	Pooled	I year	II year	Pooled
T ₁	Alachlor (PE)-1.5 kg ai/ha	54.15 (7.36)	55.87 (7.47)	55.01 (7.42)	28.35 (5.32)	29.93 (5.47)	29.14 (5.40)	82.50 (9.08)	85.80 (9.26)	84.15 (9.17)
T ₂	Alachlor (PE)-1.0 kg ai/ha	63.25 (7.95)	64.95 (8.06)	64.10 (8.00)	37.15 (6.09)	38.72 (6.22)	37.93 (6.16)	100.40 (10.02)	103.67 (10.18)	102.03 (10.10)
T ₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	37.45 (6.12)	39.16 (6.26)	38.30 (6.19)	17.41 (4.17)	18.99 (4.36)	18.20 (4.26)	54.86 (7.41)	58.15 (7.62)	56.50 (7.52)
T ₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	12.68 (3.56)	14.35 (3.79)	13.52 (3.68)	8.89 (2.98)	10.51 (3.24)	9.70 (3.11)	21.57 (4.64)	24.86 (4.99)	23.21 (4.82)
T ₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	42.15 (6.49)	43.86 (6.62)	43.00 (6.56)	19.38 (4.40)	21.00 (4.58)	20.19 (4.49)	61.53 (7.84)	64.86 (8.05)	63.19 (7.95)
T ₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	28.88 (5.37)	30.56 (5.53)	29.72 (5.45)	10.80 (3.28)	12.37 (3.52)	11.59 (3.40)	39.68 (6.30)	42.93 (6.55)	41.31 (6.43)
T ₇	Pendimethalin (PE)-1.5 kg ai/ha	60.95 (7.81)	62.68 (7.92)	61.82 (7.86)	33.15 (5.76)	34.73 (5.89)	33.94 (5.83)	94.10 (9.70)	97.41 (9.87)	95.75 (9.78)
T ₈	Pendimethalin (PE)-1.0 kg ai/ha	67.15 (8.19)	68.88 (8.30)	68.01 (8.25)	40.18 (6.34)	41.81 (6.47)	40.99 (6.40)	107.33 (10.36)	110.68 (10.52)	109.01 (10.44)
T ₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	45.38 (6.74)	47.10 (6.86)	46.24 (6.80)	20.90 (4.57)	22.51 (4.74)	21.70 (4.66)	66.28 (8.14)	69.61 (8.34)	67.94 (8.24)
T ₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	14.70 (3.83)	16.44 (4.05)	15.57 (3.95)	9.85 (3.14)	11.45 (3.38)	10.65 (3.26)	24.55 (4.95)	27.89 (5.28)	26.22 (5.12)
T ₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	53.58 (7.32)	55.28 (7.44)	54.43 (7.38)	23.98 (4.90)	25.59 (5.06)	24.79 (4.98)	77.56 (8.81)	80.87 (8.99)	79.22 (8.90)
T ₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	31.45 (5.61)	33.40 (5.78)	32.43 (5.69)	12.46 (3.53)	14.04 (3.74)	13.25 (3.64)	43.91 (6.62)	47.44 (6.89)	45.67 (6.76)
T ₁₃	Weed free check	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)
T ₁₄	Unweeded check	106.18 (10.30)	107.89 (10.38)	107.03 (10.34)	65.41 (8.09)	67.01 (8.19)	66.21 (8.14)	171.59 (13.10)	174.89 (13.22)	173.24 (13.16)
Mean		44.14 (6.24)	45.74 (6.37)	44.94 (6.30)	23.42 (4.52)	23.42 (4.52)	24.16 (4.60)	67.56 (7.64)	70.68 (7.88)	69.12 (7.77)
S. Em[±]		0.08	0.08	0.08	0.04	0.04	0.04	0.07	0.12	0.09
C. D. @ 5%		0.24	0.25	0.24	0.16	0.16	0.16	0.28	0.32	0.28

Table.2 Effect of weed control treatments on weed parameters in chilli + onion intercropping

Treatments	Treatment details	Dry weight of weeds at harvest (g)			Weed control efficiency at harvest			Weed index in chilli			Weed index in onion		
		I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
T ₁	Alachlor (PE)-1.5 kg ai/ha	31.60 (5.62)	32.58 (5.71)	32.09 (5.66)	42.75	42.00	42.37	19.15	19.59	19.38	16.25	17.55	16.92
T ₂	Alachlor (PE)-1.0 kg ai/ha	34.19 (5.85)	35.19 (5.93)	34.69 (5.89)	38.15	37.43	37.79	21.30	21.73	21.52	16.82	18.34	17.60
T ₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	22.67 (4.76)	23.67 (4.86)	23.17 (4.81)	58.92	57.86	58.39	15.31	15.78	15.55	13.09	14.48	13.81
T ₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	3.39 (1.84)	4.39 (2.09)	3.89 (1.97)	93.88	92.22	93.04	11.53	12.07	11.80	4.97	7.07	6.05
T ₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	24.34 (4.93)	25.35 (5.03)	24.84 (4.98)	55.88	54.86	55.36	15.75	16.25	16.01	15.17	16.35	15.78
T ₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	10.71 (3.27)	11.70 (3.42)	11.20 (3.34)	80.67	79.23	79.94	13.28	13.82	13.56	7.79	9.40	8.62
T ₇	Pendimethalin (PE)-1.5 kg ai/ha	33.43 (5.78)	34.45 (5.87)	33.94 (5.82)	39.43	38.67	39.05	20.22	20.67	20.45	16.59	18.01	17.33
T ₈	Pendimethalin (PE)-1.0 kg ai/ha	36.54 (6.04)	37.53 (6.13)	37.04 (6.09)	33.88	33.26	33.57	22.79	23.19	22.99	17.27	18.46	17.88
T ₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	28.43 (5.33)	29.44 (5.43)	28.93 (5.38)	48.50	47.59	48.04	16.85	17.29	17.08	15.73	17.00	16.38
T ₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	4.25 (2.06)	5.25 (2.29)	4.75 (2.18)	92.33	90.68	91.50	12.61	13.17	12.89	5.52	7.47	6.53
T ₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	28.66 (5.35)	29.65 (5.44)	29.16 (5.40)	48.16	47.29	47.72	18.26	18.74	18.50	15.96	17.43	16.72
T ₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	14.08 (3.75)	15.07 (3.88)	14.57 (3.82)	74.49	73.17	73.82	14.59	15.14	14.87	9.85	11.53	10.72
T ₁₃	Weed free check	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	100.0 0	100.0 0	100.0 0	0.00	0.00	0.00	0.00	0.00	0.00
T ₁₄	Unweeded check	55.27 (7.43)	56.24 (7.50)	55.76 (7.47)	0.00	0.00	0.00	62.64	63.59	63.12	56.63	56.31	58.66
Mean		44.14 (6.24)	23.40 (4.48)	24.32 (4.59)	23.86 (4.54)	57.65	56.73	57.19	18.88	19.36	15.12	16.39	16.39
S. Em±		0.08	0.10	0.10	0.10	1.79	1.75	1.77	1.67	1.73	3.15	3.04	3.04
C. D. @ 5%		0.24	0.33	0.32	0.32	5.62	5.44	5.53	5.10	5.37	9.42	9.05	9.05

Table.3 Effect of weed control treatments on growth and yield parameters in chilli

Treatments	Treatment details	Fruit weight per plant (kg)			Yield per plot (kg)			Yield per ha(q)		
		I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
T ₁	Alachlor (PE)-1.5 kg ai/ha	0.94	0.95	0.95	35.80	36.18	35.99	221.00	223.35	222.18
T ₂	Alachlor (PE)-1.0 kg ai/ha	0.92	0.93	0.92	34.88	35.26	35.07	215.30	217.65	216.47
T ₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	0.99	1.00	0.99	37.48	37.86	37.67	231.36	233.71	232.53
T ₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	1.08	1.09	1.08	40.86	41.24	41.05	252.24	254.59	253.41
T ₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	0.98	0.99	0.98	37.32	37.70	37.51	230.38	232.73	231.55
T ₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	1.01	1.02	1.02	38.41	38.79	38.60	237.10	239.45	238.27
T ₇	Pendimethalin (PE)-1.5 kg ai/ha	0.93	0.94	0.94	35.35	35.73	35.54	218.23	220.58	219.40
T ₈	Pendimethalin (PE)-1.0 kg ai/ha	0.90	0.91	0.91	34.20	34.58	34.39	211.11	213.46	212.28
T ₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	0.97	0.98	0.97	36.79	37.17	36.98	227.09	229.43	228.26
T ₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	1.03	1.04	1.04	39.16	39.54	39.35	241.70	244.05	242.87
T ₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	0.95	0.96	0.96	36.23	36.61	36.42	223.63	225.97	224.80
T ₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	1.00	1.01	1.00	37.87	38.25	38.06	233.76	236.11	234.93
T ₁₃	Weed free check	1.11	1.13	1.12	42.21	42.97	42.59	260.56	265.25	262.90
T ₁₄	Unweeded check	0.44	0.43	0.41	16.53	16.34	16.44	102.04	100.86	101.45
Mean		0.95	0.96	0.95	35.94	36.30	36.12	221.82	224.08	222.95
S. Em±		0.03	0.04	0.04	1.33	1.44	1.38	8.19	8.87	8.52
C. D. @ 5%		0.09	0.12	0.15	3.65	4.32	4.18	24.90	27.10	26.29

Table.4 Effect of weed control treatments on yield and yield attributes in chilli

Treatments	Treatment details	Fruit weight per plant (kg)			Yield per plot (kg)			Yield per ha(q)		
		I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
T ₁	Alachlor (PE)-1.5 kg ai/ha	0.94	0.95	0.95	35.80	36.18	35.99	221.00	223.35	222.18
T ₂	Alachlor (PE)-1.0 kg ai/ha	0.92	0.93	0.92	34.88	35.26	35.07	215.30	217.65	216.47
T ₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	0.99	1.00	0.99	37.48	37.86	37.67	231.36	233.71	232.53
T ₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	1.08	1.09	1.08	40.86	41.24	41.05	252.24	254.59	253.41
T ₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	0.98	0.99	0.98	37.32	37.70	37.51	230.38	232.73	231.55
T ₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	1.01	1.02	1.02	38.41	38.79	38.60	237.10	239.45	238.27
T ₇	Pendimethalin (PE)-1.5 kg ai/ha	0.93	0.94	0.94	35.35	35.73	35.54	218.23	220.58	219.40
T ₈	Pendimethalin (PE)-1.0 kg ai/ha	0.90	0.91	0.91	34.20	34.58	34.39	211.11	213.46	212.28
T ₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	0.97	0.98	0.97	36.79	37.17	36.98	227.09	229.43	228.26
T ₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	1.03	1.04	1.04	39.16	39.54	39.35	241.70	244.05	242.87
T ₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	0.95	0.96	0.96	36.23	36.61	36.42	223.63	225.97	224.80
T ₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	1.00	1.01	1.00	37.87	38.25	38.06	233.76	236.11	234.93
T ₁₃	Weed free check	1.11	1.13	1.12	42.21	42.97	42.59	260.56	265.25	262.90
T ₁₄	Unweeded check	0.44	0.43	0.41	16.53	16.34	16.44	102.04	100.86	101.45
Mean		0.95	0.96	0.95	35.94	36.30	36.12	221.82	224.08	222.95
S. Em±		0.03	0.04	0.04	1.33	1.44	1.38	8.19	8.87	8.52
C. D. @ 5%		0.09	0.12	0.15	3.65	4.32	4.18	24.90	27.10	26.29

Table.5 Effect of weed control treatments on growth parameters in onion

Treatments	Treatment details	Plant height at 90 DAT (cm)			No. of leaves per plant at 90 DAT		
		I year	II year	Pooled	I year	II year	Pooled
T ₁	Alachlor (PE)-1.5 kg ai/ha	52.20	53.10	52.65	12.88	13.53	13.20
T ₂	Alachlor (PE)-1.0 kg ai/ha	50.70	51.60	51.15	12.43	13.18	12.80
T ₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	56.00	56.80	56.40	13.78	14.33	14.05
T ₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	59.20	60.00	59.60	14.98	15.60	15.29
T ₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	55.40	56.30	55.85	13.53	14.28	13.90
T ₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	57.00	57.95	57.47	14.48	15.08	14.78
T ₇	Pendimethalin (PE)-1.5 kg ai/ha	51.20	52.00	51.60	12.58	13.33	12.95
T ₈	Pendimethalin (PE)-1.0 kg ai/ha	50.50	51.40	50.95	12.08	12.83	12.45
T ₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	53.90	54.80	54.35	13.28	13.78	13.53
T ₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	57.90	58.70	58.30	14.58	15.33	14.95
T ₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	52.70	53.75	53.22	13.11	13.56	13.34
T ₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	56.60	57.50	57.05	14.18	14.93	14.55
T ₁₃	Weed free check	59.80	60.90	60.35	15.43	16.33	15.88
T ₁₄	Unweeded check	48.80	49.55	49.17	11.88	12.33	12.10
Mean		54.42	55.31	54.86	13.51	14.17	13.84
S. Em\pm		2.12	2.13	2.12	0.55	0.52	0.53
C. D. @ 5%		6.01	6.09	6.05	1.63	1.50	1.24

Table.6 Effect of weed control treatments on yield and yield attributes in onion

Treatments	Treatment details	Dry weight of plant at 90 DAT (g)			Yield per plant (g)			Yield per plot (kg)			Yield per ha (q)		
		I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled	I year	II year	Pooled
T ₁	Alachlor (PE)-1.5 kg ai/ha	5.14	5.44	5.29	69.55	71.45	70.50	31.30	32.15	31.73	193.19	198.47	195.83
T ₂	Alachlor (PE)-1.0 kg ai/ha	4.71	5.01	4.86	69.07	70.77	69.92	31.08	31.85	31.46	191.86	196.58	194.22
T ₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	6.14	6.44	6.29	72.16	74.11	73.14	32.47	33.35	32.91	200.44	205.86	203.15
T ₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	7.37	7.77	7.57	78.72	80.59	79.66	35.42	36.27	35.84	218.67	223.86	221.26
T ₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	5.82	5.97	5.89	70.48	72.48	71.48	31.72	32.62	32.17	195.78	201.33	198.56
T ₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	6.70	6.90	6.80	76.58	78.51	77.55	34.46	35.33	34.90	212.72	218.08	215.40
T ₇	Pendimethalin (PE)-1.5 kg ai/ha	4.85	5.15	5.00	69.10	71.10	70.10	31.10	32.00	31.55	191.94	197.50	194.72
T ₈	Pendimethalin (PE)-1.0 kg ai/ha	4.53	4.83	4.68	68.67	70.67	69.67	30.90	31.80	31.35	190.75	196.31	193.53
T ₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	5.68	5.83	5.75	69.94	71.94	70.94	31.47	32.37	31.92	194.28	199.83	197.06
T ₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	7.14	7.44	7.29	78.34	80.22	79.28	35.25	36.10	35.68	217.61	222.83	220.22
T ₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	5.35	5.65	5.50	69.65	71.60	70.63	31.34	32.22	31.78	193.47	198.89	196.18
T ₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	6.42	6.72	6.57	74.71	76.71	75.71	33.62	34.52	34.07	207.53	213.08	210.31
T ₁₃	Weed free check	7.75	8.25	8.00	82.87	86.72	84.80	37.29	39.02	38.16	230.19	240.89	235.54
T ₁₄	Unweeded check	4.21	4.36	4.28	36.02	37.87	36.95	16.21	17.04	15.78	100.06	105.19	102.63
Mean		5.84	6.12	5.98	70.42	72.48	71.45	31.69	32.62	32.09	195.61	201.34	198.47
S. Em±		0.53	0.55	0.54	2.57	2.64	2.60	1.16	1.19	1.21	7.13	7.35	7.23
C. D. @ 5%		1.58	1.64	1.60	7.94	7.87	7.78	3.92	3.57	3.66	20.39	21.30	20.79

Table.7 Effect of weed control treatments on economics feasibility in chilli +onion intercropping

Treatments	Treatment details	Gross returns (Rs)	Cost of cultivation (Rs)	Net return (Rs)	B:C ratio
T₁	Alachlor (PE)-1.5 kg ai/ha	2,67,754	85,300	1,82,454	3.13
T₂	Alachlor (PE)-1.0 kg ai/ha	2,63,611	85,000	1,78,611	3.10
T₃	Alachlor (PE)-1.5 kg ai/ha + 1 HW at 45 DAT	2,78,785	87,300	1,91,485	3.19
T₄	Alachlor (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	3,03,713	89,300	2,14,413	3.40
T₅	Alachlor (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	2,74,623	87,000	1,87,323	3.15
T₆	Alachlor (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	2,91,455	89,000	2,02,455	3.27
T₇	Pendimethalin (PE)-1.5 kg ai/ha	2,65,476	85,075	1,80,401	3.12
T₈	Pendimethalin (PE)-1.0 kg ai/ha	2,60,964	84,850	1,76,114	3.07
T₉	Pendimethalin (PE)-1.5 kg ai/ha+ 1 HW at 45 DAT	2,71,778	87,075	1,84,703	3.12
T₁₀	Pendimethalin (PE)-1.5 kg ai/ha + 2 HW at 45 and 60 DAT	2,97,611	89,075	2,08,536	3.34
T₁₁	Pendimethalin (PE)-1.0 kg ai/ha + 1 HW at 45 DAT	2,69,344	86,850	1,82,494	3.10
T₁₂	Pendimethalin (PE)-1.0 kg ai/ha + 2 HW at 45 and 60 DAT	2,85,713	88,850	1,96,863	3.21
T₁₃	Weed free check	3,19,882	98,400	2,21,482	3.25
T₁₄	Unweeded check	1,32,829	84,400	48,429	1.57
Mean		-	-	-	-
S. Em ±		-	-	-	-
C. D. @ 5%		-	-	-	-

The effect of weed control treatments on economics of chilli +onion intercropping indicated that weed free check recorded highest gross returns (Rs.3,19,882) followed by T₄ (Rs.3,03,713).Cost of cultivation was highest in weed free check (Rs.98,400) followed by T₄ (Rs.89,300). The higher cost of cultivation is due to increased labour charges incurred during hand weeding. Highest B:C ratio (3.40) was achieved by T₄ followed by T₁₀ (3.34) (Table 7). The higher B:C ratio in T₄ is due to higher net returns and lower cost of cultivation in comparison with weed free check. The results are in line with the findings reported by Biradar (1999), Gandolkar *et al.*, (2015) and Chattopadhyay *et al.*, (2016).

In conclusion, the pre emergence application of 1.5 kg of alachlor along with 2 hand weeding at 45 and 60 days after transplanting was found satisfactory in suppressing as well as controlling the weeds and obtaining higher yield of green chilli and onion followed by pendimethalin (PE)@ 1.5 kg/ha + 2 HW under chilli+onion intercropping system.

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