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RESPONSE OF INTERCROPPING PATTERNS AND WEED MANAGEMENT UNDER CHICKPEA + CORIANDER (*CORIANDRUM SATIVUM*) INTERCROPPING SYSTEM: YIELD AND ECONOMIC ANALYSIS

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ABSTRACT

A field experiment was carried out to select the best possible chickpea + coriander intercropping ratio in order to suppress maximum numbers of weed growth without having to compromise with the grain yield. The experiment was laid out in split-plot design with four main plot treatments and four sub plot treatments. Lowest densities of grasses (35.52 and 26.57 no./m^2) sedges (5.52 and 5.20 no./m^2) and broadleaf weeds (20.70 and 18.68 no./m^2) at 30 and 50 das was recorded in m_2- chickpea+ coriander (3:1) and s_2- pendimethalin 33% @ 1000 g/ha as pe *fb* one hoeing at 30 das recorded significantly lower weed density of grasses and sedges (25.19 and 3.58 no./m^2) respectively among the weed management practices. M_2- chickpea + coriander (3:1) recorded significantly lower weed dry weight at both 30 (27.01 g/m^2) and 50 das (31.67 g/m^2) and s_2- pendimethalin 33% @ 1000 g/ha as pe *fb* one hoeing at 30 das among the weed management practices at 30 and 50 das (24.41 and 12.64 g/m^2). Weed control efficiency (WCE) was significantly influenced by both, intercropping and weed management practices. M_4- chickpea + coriander (5:2) and m_2- chickpea + coriander (3:1) recorded maximum WCE at 30 and 50 das (16.35 % and 49.81 %) and s_2- pendimethalin 33% @ 1000 g/ha as pe and one hoeing at 30 and 50 das successfully registered maximum WCE at 30 and 50 das (26.97 % and 80.65 %).

Keywords **:** Chickpea, Intercropping, Pendimethalin, Integrated weed management, Weed control efficiency.

Introduction

Known as "The king of pulses", chickpea (*Cicer arietinum* L.) is one of the most eminent pulse crops of the world. It is a major source of protein for humans and as well as for animals. Although India accounts for 75% of world chickpea production, still it is an assured fact that poor weed management is one of the major factors for its reduction in productivity (Rathod *et al.,* 2017). Since chickpea is a poor competitor to weeds, initial 30-60 days after emergence of the crop is most crucial from crop weed competition point of view (Kumar and Singh, 2010). Weeds tend to grow faster than chickpea and therefore has a privilege in utilizing the available space, nutrients and water. Growers generally use an array of herbicides to control these weeds, but excessive and disproportionate use of these chemicals has contaminated the inherent fertility of the soil (Ruuskanen *et al.* 2023). Hand weeding is another effective way to control weeds but, due to its higher cost and un-availability of man power in peak cropping season, hand weeding is less popular method among the farmers. Hand weeding alone incurs 25% of total labor force of the production (Mallu, 2015). Intercropping of chickpea with coriander (*Coriandrum sativum* L.) is preferred in order to suppress weeds and for also keeping the crop safe from infestation of pod borer. Considering all the paramount points, an effective and integrated weed management is necessary which is economically viable and socially acceptable. Therefore, the present study was taken to observe the effects of intercropping and weed management on growth, yield and weed dynamics of chickpea.

Materials and Methods

The experiment was conducted at the *dhab* area research farm of R.P.C.A.U., Pusa (Bihar) during *rabi* (winter) season of 2022-23. It is situated in Indo-Gangetic region, at coordinates 25°98' north latitude and 85°67' east longitude, at an elevation of 52.92 meter above the mean sea level. The experimental soil exhibited consistent fertility level which was sandy-loam in texture with organic carbon (0.37 %), available nitrogen (241.4 kg/ha), phosphorous (18.50 kg/ha), potassium (116.5 kg/ha), EC (0.23 ds/m) and pH (8.23). The experiment was laid out in split-plot design which consisted of three replications. Main plot contained 4 intercropping patterns, *viz.* Sole chickpea (m_1), chickpea + coriander 3:1 (m_2), chickpea + coriander 4:2 (m_3) and chickpea + coriander 5:2 (m_4). In sub plot, weed management practices were done *viz*., application of pendimethalin 33% @ 1000 g/ha as pe (s_1), pendimethalin 33% @ 1000 g/ha as pe *fb* one hand weeding at 30 das (s_2), two hand weeding at 30 and 50 das (s_3) and weedy check (s_4), all together totalling to 48 number of plots. The variety of chickpea taken was '*pusa-3043'* and '*pant haritima'* variety was selected for coriander. At the time of sowing, the recommended doses of n, p, k and boron kg /ha (20:40:20:5) was applied in the field for chickpea and n, p and k kg/ha (60:40:20) for coriander as well. Before sowing the seeds were also treated with phosphate solubilising bacteria (PSB) culture (200 g/10 kg seed), *Rhizobium* culture and thiram (2.5 g/kg seed). Both the crops were sown on 20th of November, 2022 at 30 × 10 cm (r × p) spacing in replacement series and the required dose of pendimethalin was calculated and sprayed after sowing of the crops as pre-emergence herbicide using a knapsack sprayer. As per the treatment hand weeding was done at 30 and 50 DAS on the concerned plots. Chickpea was harvested on 16th of April 2023 whereas coriander was harvested on 7th of April 2023. Weeds were counted by the use of a quadrate of 0.25 square metre (0.5 m × 0.5 m) and the obtained data was expressed as number of weeds/m^2 at 30 and 50 das. The identified weed species were broadly divided into grasses, sedges and broad leaf weeds. For recording of weed biomass, the weeds collected from each quadrate were sun dried and then placed in an oven at 70 ºC for next one week until a constant weight was observed. The samples were then measured in grams (g) and they were expressed in g/m^2. Weed control efficiency was calculated using the formula given by Mani *et al.* (1974):

$$\text{WCE}(\%) = \frac{\text{DWC} - \text{DWT}}{\text{DWC}} \times 100$$

Where,

WCE= weed control efficiency

DWC= dry matter of weeds in control plot

DWT= dry matter of weeds in treated plot

N, P and K depleted by the weeds were analysed using standard laboratory procedures with the prescribed instrument and final calculation of the result was made by multiplying the nutrient content (%) with dry weight of the weeds, expressed as kg/ha.

$$\text{Nutrient depletion (kg/ha)} = \frac{\text{Nutrient \%} \times \text{dry weight (kg/ha)}}{100}$$

Grain yield of chickpea was measured from each plot separately and it was expressed in kg/ha. Analysis of economics was done as per the cost of inputs prevailed during the experimental program and selling price of the output as per the concerning year. Statistical analysis of weed density and weed dry weight was done by converting the data to 1 m^2 and imposed square root transformation with the formula $\sqrt{x+0.5}$. Method given by Gomez and Gomez (1984) was adopted to do statistical analysis. The means were compared using least significant difference test at p = 0.05.

Results and Discussions

Effect on weeds

Cynodon dactylon and *Parthenium hysterophorous* were the major narrow leaf weeds found on the plot. Among sedges, *Cyperus rotundus and Cyperus esculentus* were dominantly present whereas, *Cannabis sativus, Solanum nigrum, Lactuca serriola, Oxalis corniculata, anagallis arvensis* and *Ageratum conizoides* were the prominent broadleaf weed species encountered on the experimental plot. Similar observations were recorded by Bhutada and Bhale (2015) and Kamble *et al.* (2015). Intercropping of chickpea + coriander at 3:1 ratio was successful in recording minimum total weed density and weed dry biomass. The smothering effect created by the height of coriander imparted a shady micro-environment for the low-lying weeds on the ground. This hampered their ability to do photosynthesis and grow to the full

potential. Among the weed management practices, application of pendimethalin @1000 g/ha as pe *fb* one hoeing at 30 das was most efficient in registering least density of weeds as well as dry biomass when compared to other methods of weed control (Table 1 and Fig. 1). It was due to the effect of pendimethalin which restricted germination of weeds at starting and at 30 das the present weeds were manually removed, giving a completely weed free environment for the crops to grow.

Weed density (species wise)

According to the calculated relative density (RD), grasses were the most common weeds present at the experimental plot with 76.45 % rd. Broad leaf weeds followed up at 55.87 % RD whereas sedges were minimum among the weeds with a relative density of only 26.30 %. At 30 das, effect of intercropping was not significant to affect the densities of all the weeds, but the lowest densities of grasses, sedges and broadleaf weeds were recorded under the application of pendimethalin @1000 g /ha as pe *fb* one hoeing at 30 das. Total densities of grasses, sedges and broadleaf weeds were reduced by chickpea + coriander intercropped in 3:1 ratio and among the weed management practices, again spraying of pendimethalin @1000 g /ha as pe *fb* one hoeing at 30 das registered lowest weed densities at 50 das.

Weed dry biomass

All the intercropping patterns and weed management practices significantly reduced weed dry biomass. At 30 and 50 das, chickpea + coriander grown at 3:1 ratio recorded minimum weed dry weight and application of pendimethalin @1000 g /ha as pe *fb* one hoeing at 30 das was the most efficient weed management practice for reducing the weed dry weight at both 30 and 50 DAS compared to other treatments (Table 2 and Fig. 2). Maximum weed dry weight was accounted on sole chickpea plot. It might be due to the fact that absence of intercrop was an advantage for the weeds to utilize all the available natural resources to photosynthesize and expand its biomass.

Weed control efficiency (WCE)

Chickpea + coriander (5:2) intercropping ratio resulted in significantly reduced weed growth and thereby recorded highest weed control efficiency of 16.35 % at 30 das. It was due to higher plant population of taller coriander plants which overshadowed the weeds on the ground, hindering their photosynthesis process and ultimately adversely affecting their growth and development. Highest WCE of 49.81 % at 50 das was registered in chickpea + coriander (3:1). Among the weed management practices, spraying of pendimethalin @1000 g /ha as pe *fb* one hoeing at 30 das recorded highest weed control efficiencies at both 30 das (26.97 %) and 50 das (80.65 %) when compared to other weed management treatments (Table 2 and Fig. 3).

Nutrients uptake by weeds

Intercropping of chickpea + coriander in 3:1 ratio significantly recorded lowest nitrogen uptake by the weeds (5.68 kg/ha) whereas, variations in phosphorous and potassium uptake were not significant. Among the weed management practices, two hoeing at 30 and 50 das recorded minimum uptake of nitrogen (0.34 kg/ha), phosphorous (0.36 kg/ha) and potassium (0.05 kg/ha) from the soil (Table 3 and Fig. 4).

Grain yield of chickpea

Due to highest plant population of chickpea in sole chickpea plot, highest seed yield (1,328 kg/ha) was observed from this plot. Hand hoeing twice at 30 and 50 DAS were most efficient in providing a competition free environment for the crops to grow and produce a better yield, that is the reason why two hoeing at 30 and 50 das recorded highest seed yield (1,316) which was significantly higher up to 78 % in comparison to the yield recovered from weedy check plot (739 kg/ha) (Table 4). Tanwar *et al.* (2011) and Sumit *et al.* (2022) reported similar findings that sole chickpea yielded maximum grain yield than other intercropping patterns.

Economics

Economics calculated based on the prevailing prices of the cropping year revealed that maximum net returns (53,990 /ha) and highest b:c ratio (1.37) was registered in chickpea + coriander (4:2) whereas among the weed management practices, application of pendimethalin @1000 g /ha as pe *fb* one hoeing at 30 das was economically most beneficial with highest net returns (79, 858 /ha) and b:c ratio (1.89). Hand weeding alone is the most expensive weed management practice, therefore one pendimethalin spray added with one hoeing is recommended (Table 4 and Fig. 5).

Table 1 : Effect of intercropping and weed management on weed density of chickpea at 30 and 50 DAS (no./m^2)

Main Plot	Grasses		Sedges		Broad leaf	
	30 DAS	50 DAS	30 DAS	50 DAS	30 DAS	50 DAS
M_1- Sole Chickpea	6.32 (39.5)	5.51 (29.91)	2.70 (6.79)	3.30 (10.37)	5.51 (29.81)	4.67 (21.29)
M_2- Chickpea + Coriander (3:1)	5.98 (35.32)	5.20 (26.57)	2.45 (5.52)	2.64 (6.46)	4.60 (20.70)	4.38 (18.68)
M_3- Chickpea + Coriander (4:2)	6.22 (38.17)	5.21 (26.63)	2.51 (5.79)	2.86 (7.68)	4.61 (20.77)	4.59 (20.45)
M_4- Chickpea + Coriander (5:2)	6.13 (37.05)	5.33 (27.90)	2.61 (6.31)	3.11 (9.19)	5.25 (27.0)	4.66 (21.17)
SEm ±	0.14	0.11	0.04	0.05	0.12	0.09
CD (p=0.05)	NS	0.37	NS	0.18	NS	0.33
Sub Plot						
S_1 -Pendimethalin 33% @1000 g/ha as PE	5.13 (25.81)	5.90 (34.36)	2.05 (3.69)	3.39 (10.97)	4.24 (17.46)	5.13 (25.93)
S_2 -Pendimethalin 33% @1000 g/ha as PE *fb* one hoeing at 30 DAS	5.07 (25.19)	2.81 (7.38)	2.02 (3.58)	1.76 (2.60)	4.48 (19.53)	2.52 (5.86)
S_3 -Two hoeing at 30 and 50 DAS	7.21 (51.44)	3.44 (11.34)	2.97 (8.30)	2.02 (3.58)	5.42 (28.89)	2.54 (5.93)
S_4 -Weedy check	6.99 (48.30)	7.64 (57.94)	3.06 (8.84)	4.13 (16.55)	5.74 (32.46)	6.67 (43.89)
SEm ±	0.18	0.14	0.08	0.08	0.13	0.12
CD (p=0.05)	0.51	0.41	0.22	0.24	0.39	0.36
Interaction (MXS)	NS	NS	NS	NS	NS	NS

Transformed value (√x+0.5.) Original values are given in the parentheses

Table 2 : Effect of intercropping and weed management on weed dry weight (g/m^2) and weed control efficiency

Main Plot	Weed dry weight (g/m^2)		WCE (%)	
	30 DAS	50 DAS	30 DAS	50 DAS
M_1- Sole Chickpea	5.53 (30.13)	5.88 (37.16)	12.67	47.69
M_2- Chickpea + Coriander (3:1)	5.24 (27.01)	5.36 (31.67)	15.23	49.81
M_3- Chickpea + Coriander (4:2)	5.41 (28.75)	5.67 (34.79)	12.48	44.99
M_4- Chickpea + Coriander (5:2)	5.43 (29.06)	5.69 (35.89)	16.35	44.20
SEm ±	0.11	0.11	0.51	1.25
CD (p=0.05)	NS	0.37	1.50	3.78
Subplot				
S_1- Pendimethalin 33% @1000 g/ha as PE	5.01 (24.48)	6.73 (44.82)	26.91	31.35
S_2 -Pendimethalin 33% @1000 g/ha as PE *fb* one hoeing at 30 DAS	4.99 (24.41)	3.61 (12.64)	26.97	80.65
S_3 -Two hoeing at 30 and 50 DAS	5.75 (32.51)	4.13 (16.57)	2.84	74.68
S_4 -Weedy check	5.83 (33.46)	8.12 (65.46)	0.00	0.00
SEm ±	0.12	0.16	0.49	1.86
CD (p=0.05)	0.49	0.45	1.42	5.43
Interaction (MXS)	NS	NS	NS	NS

Transformed value (√x+0.5.) Original values are given in the parentheses

Table 3 : Effect of intercropping and weed management on nutrients (N, P and K) depleted by weeds (kg/ha)

Main Plot	Nutrient depleted by weeds (kg/ha)		
	N	P	K
M_1- Sole Chickpea	6.77	0.94	5.71
M_2- Chickpea + Coriander (3:1)	5.68	0.88	5.35
M_3- Chickpea + Coriander (4:2)	6.28	0.90	5.45
M_4- Chickpea + Coriander (5:2)	6.39	0.92	5.58
SEm ±	0.21	0.04	0.29
CD (p=0.05)	0.73	NS	NS
Sub Plot			
S_1 – Pendimethalin 33% @1000 g/ha as PE	1.40	1.63	0.22
S_2 – Pendimethalin 33% @1000 g/ha as PE *fb* one hoeing at 30 DAS	0.71	0.80	0.11
S_3 – Two hoeing at 30 and 50 DAS	0.34	0.39	0.05
S_4 – Weedy check	19.64	22.27	3.25
SEm ±	0.27	0.29	0.04
CD (p=0.05)	0.79	0.83	0.12
Interaction (MXS)	NS	NS	NS

Table 4 : Effect of intercropping and weed management on seed yield (kg/ha) of chickpea and economics

Main Plot	Seed yield (kg/ha)	Gross Returns (/ha)	Net Returns (/ha)	B:C Ratio
M_1- Sole Chickpea	1,328	76,014	33,528	0.77
M_2- Chickpea + Coriander (3:1)	1,073	91,233	51,503	1.28
M_3- Chickpea + Coriander (4:2)	930	92,702	53,990	1.37
M_4- Chickpea + Coriander (5:2)	983	89,468	50,148	1.25
SEm ±	25.73	1,833	1203	0.02
CD (p=0.05)	90.76	6,467	4164	0.08
Sub Plot				
S_1 – Pendimethalin 33% @1000 g/ha as PE	1,019	82,013	59,866	1.63
S_2 – Pendimethalin 33% @1000 g/ha as PE *fb* one hoeing at 30 DAS	1,240	1,01,879	79,858	1.89
S_3 – Two hoeing at 30 and 50 DAS	1,316	1,05,928	79,207	1.73
S_4 – Weedy check	739	59,598	33,293	0.97
SEm ±	31.58	2,357	1339	0.03
CD (p=0.05)	92.70	6921	3908	0.09
Interaction (MXS)	NS	NS	NS	NS

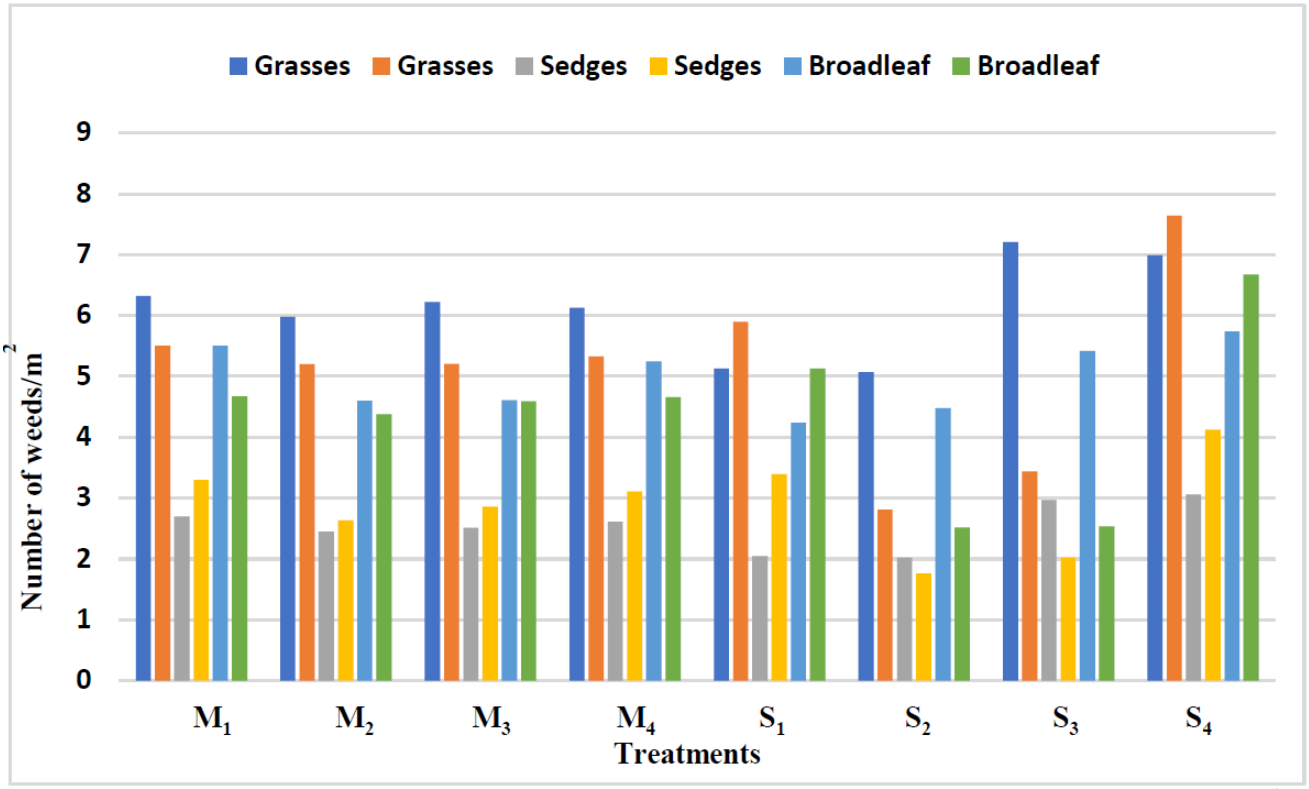

Fig. 1 : Effect of intercropping and weed management on weed density of chickpea at 30 and 50 DAS (no./m^2)

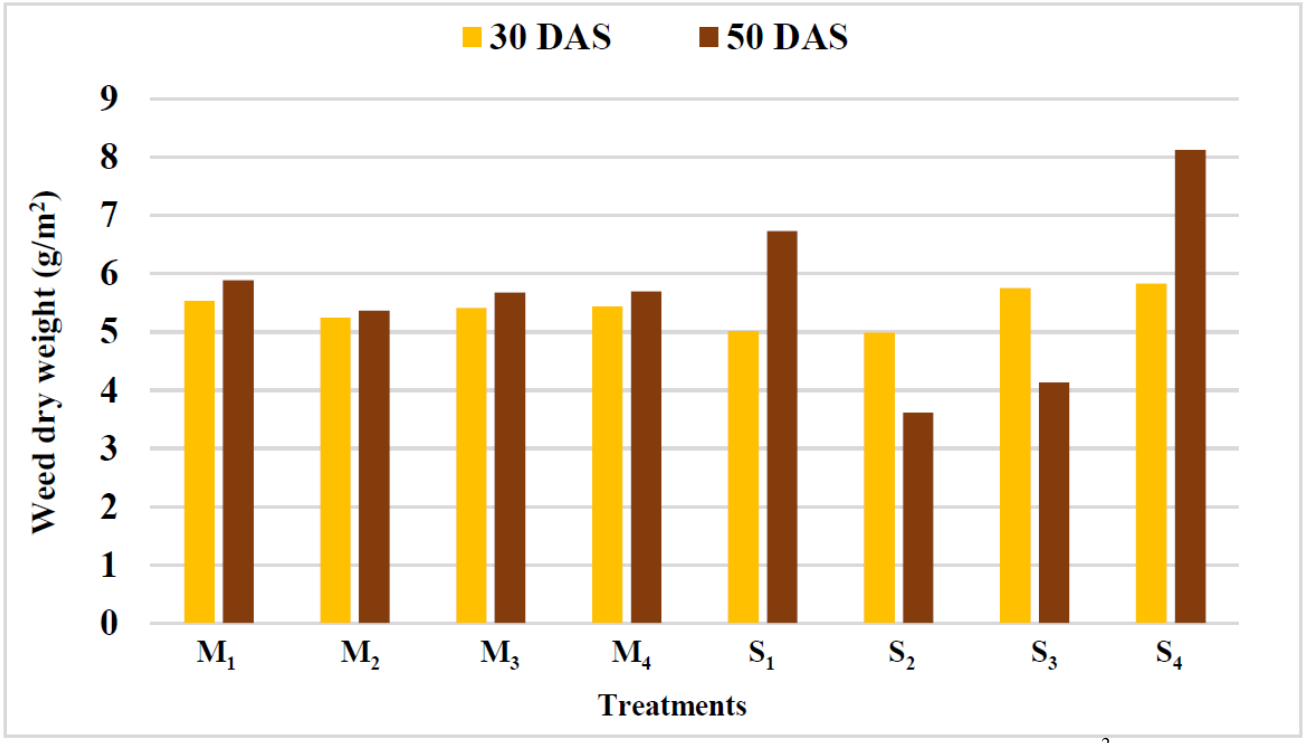

Fig. 2 : Effect of intercropping and weed management on weed dry weight (g/m^2)

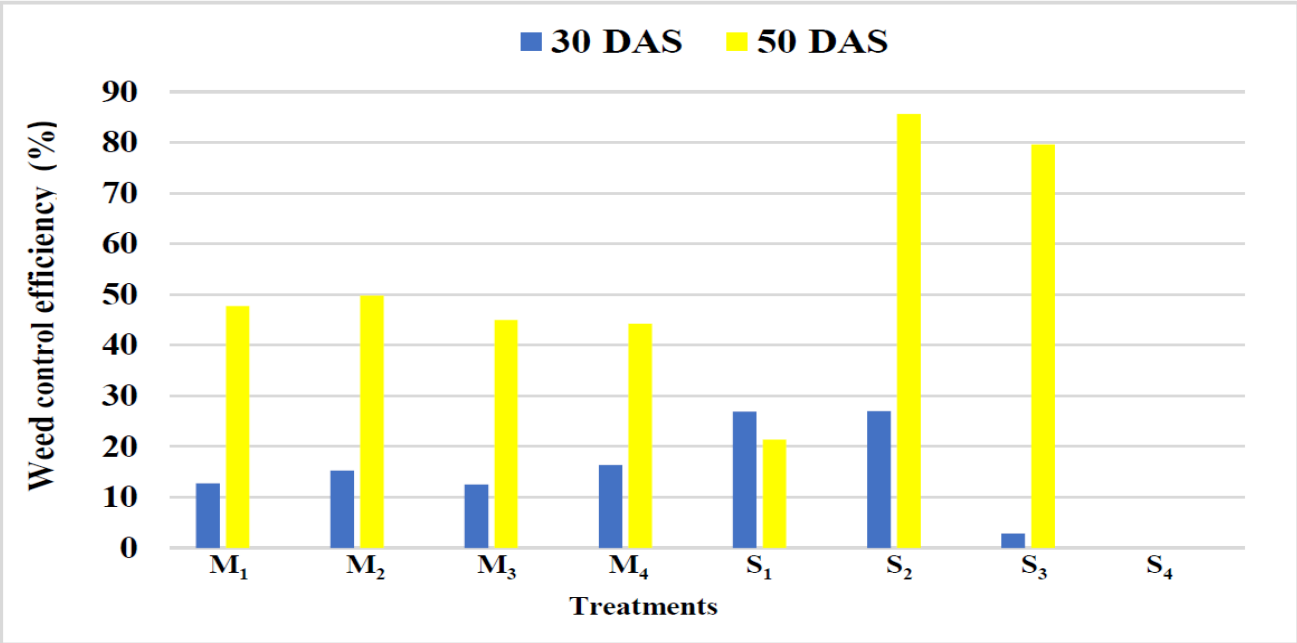

Fig. 3 : Effect of intercropping and weed management on weed control efficiency (%)

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Conflict of interest

The authors declare no known conflict of interests that could have appeared to influence the work reported in this paper.

Conclusion

Chickpea + coriander grown at a ratio of 3:1 and application of pendimethalin @ 1000 g /ha as PE proved to be the best option for controlling overall weed density, weed dry biomass and weed control efficiency in chickpea compared to intercropping patterns of chickpea + coriander sown at 4:2 and 5:2 ratios and weed management methos of applying pendimethalin 33% @1000 g/ ha as PE and two hoeing at 30 and 50 DAS. Maximum seed yield was observed in sole chickpea and two hoeing at 30 and 50 DAS. From economic point of view, chickpea + coriander (4:2) and application of pendimethalin 33% @1000 g /ha as PE *fb* one hoeing at 30 DAS has the highest remunerative returns.

References

Bhutada, P.O and Bhale V.M. 2015. Effect of herbicides and cultural practices on nutrient uptake by chickpea and weed. *Journal Crop and Weed* 11(1):232-235.

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedure for Agricultural Research. 2nd Edition, Willey, Hoboken, 28-192.

Kamble, A. B., Rawan, S.A and Dhonde, M.B. 2015 .Integrated weed management in chickpea under irrigated condition. *Weed Science for Sustainable Agriculture, Environment and Biodiversity*. 230.

Kumar N and Singh K.K. 2010. Weed management in pulses. *Indian Farming* 60(4): 9–12.

Mallu, T.S., Nyende, A.B., Ganga Rao, N.V.P.R., Odeny, D.A. and Mwangi, S.G. 2015. Assessment of Interrelationship among agronomic and yield characters of chickpea. *International Journal of Agriculture and Crop Sciences* 8(2): 128-135.

Mani, V.S., Mala, M.L., Gautam, K.C. and Das, B. 1973. Weed killing chemicals in potato cultivation. *Indian Farming*. 23(1): 17-18.

Rathod PS, Patil DH and Dodamani BM. 2017. Integrated weed management in chickpea (Cicer arietinum L.) under rainfed conditions of Karnataka, India. Legume Research 40(3): 580–585.

Ruuskanen., S., Fuchs., B., Nissinen., R., Puigbo., P., Rainio., M., Saikkonen., K. and Helander., M. 2023. Ecosystem consequences of herbicides: the role of microbiome. *Trends in Ecology and Evolution* 38(1): 35-43.

Sumit, Banjara, G.P., Kumar, S., Amit, Sahu, M., Porte, P. 2022. Yield and economics of chickpea (*Cicer arietinum* L.) as influenced by different chickpea based intercropping system in Chhattisgarh plain. *The Pharma Innovation Journal* 11(10): 849-853.

Tanwar, S.P.S., Rokadia, P. and Singh, A.K. 2011. Effect of row ratio and fertility levels on chickpea (*Cicer arietinum*) and linseed (*Linum usitatissimum*) intercropping system. *Indian Journal of Agronomy* 56(3): 217-222.