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Growth and yield response of different coriander (*Coriandrum sativum* L.) based intercropping systems under Semi-arid Eastern Plain Zones of Rajasthan

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Abstract

A field experiment comprising ten treatments of intercropping systems replicated four times was conducted in Randomized Block Design with during *rabi* season, 2016-17. Results indicated that sole coriander exhibited the higher plant height and number of branches per plant 60 DAS, 90 DAS and at harvest as compared to different intercropping system. Further, results showed that sole coriander exhibited significantly highest values of yield attributes *viz.*, number of umbels plant⁻¹, number of umbellate umbel⁻¹, seeds umbellate⁻¹, 1000-seed weight, seed yield plant⁻¹ and seed yield ha⁻¹ as compared to different intercropping system. Sole French radish, sole Knolkhol and sole fenugreek resulted higher plant population, plant height at harvest, number of leaves plant⁻¹, diameter of curd and fresh marketable yield as compared to different intercropping systems. Intercropping of coriander with French radish in 1:1 row ratio resulted significantly higher land equivalent ratio (1.83), coriander equivalent yield (4272 kg ha⁻¹), gross return (Rs.341728 ha⁻¹), net return (Rs.283228 ha⁻¹) and BCR (4.84) followed by intercropping of coriander with French radish in 2:2 paired row ratio. Intercropping of coriander with fenugreek in 1:1 and 2:2 recorded significantly higher N, P, and K availability in soil after harvest of crop. Thus, it is inferred that intercropping of intercropping of coriander with French radish in 1:1 row ratio is better for realizing higher system productivity and economic returns.

Keywords: Coriander, intercropping, Net returns, LER, yield

Introduction

India is the world's largest producers, consumers and exporter of seed spices. Coriander (*Coriander sativum*) generally called as "Dhania" belongs to the Apiaceae family. It is mainly grown in Rajasthan, Gujarat, Madhya Pradesh, Tamilnadu and Uttar Pradesh. Coriander is an important seed spice crop of Rajasthan which is mostly grown in Kota, Bundi, Jhalawar and Baran. Area, production and productivity of coriander in Rajasthan are 2.48 lakh hectares, 1.98 lakh M tonnes and productivity of 680 kg ha⁻¹, respectively (Anonymous, 2015). Ahlawat and Gangaiah (2010) [1] reported higher system productivity in chickpea intercropped with linseed over sole chickpea. Mustard and chickpea intercropping have exhibited higher land equivalent ratio (1.41) over in sole crops (Thomas *et al.*, 2010) [6]. Shortages of vegetables in the country have focused the attention on intercropping systems which have capacity to improve the physical, biological and chemical properties of soil (Mehta *et al.* 2010) [4]. Thus, productivity of system can be enhanced with change in crop configuration for inclusion of other crops in the existing cropping system. Hence the study on effect of coriander based inter-cropping system with vegetable crops was undertaken with an objective to find most efficient inter cropping system for realizing higher system productivity.

Material and Methods

The experiment was laid out at Research farm of ICAR-National Research Center on Seed Spices, Ajmer, Rajasthan, during *rabi* season of 2016-17. The soil of research farm is sandy loam, poor in fertility and water holding capacity, having pH 8.3, and organic carbon 0.23%, available N 68.49 kg ha⁻¹, P₂O₅ 7.05 kg ha⁻¹, K₂O 230.16 kg ha⁻¹. The experiment comprising of 10 treatments *viz.*, sole coriander, sole French radish, sole knolkhol, sole fenugreek, coriander intercropping with French radish, knolkhol and fenugreek in 1:1 and 2:2 row ratio was laid in randomized block design with four replications. As per technical programme one row of radish, Knolkhol and fenugreek was added between two rows of coriander in 1:1

intercropping ratio and two rows of vegetable crops were added in a pair of two rows of coriander (paired row having 25/35 cm). A uniform recommended doses of 60 Kg N and 40 kg P₂O₅ ha⁻¹ and 30 kg K₂O for sole coriander, 120 kg N, 60 kg P₂O₅ and 40 kg K₂O for sole knolkhol, 100 kg N, 50 kg P₂O₅ and 40 kg K₂O for french radish and 20 kg N, 40 kg P₂O₅ and 30 kg K₂O for fenugreek was applied. In intercropping of coriander and vegetables 100% NPK of sole coriander and 50% NPK of respective vegetables were applied. 1/3 N and full dose of phosphorus and potash were applied at the time of sowing and remaining 2/3 N was applied with low pressure drip irrigation through urea at an interval of 8 days. The standard agronomic practices were applied for raising healthy coriander crop as well as French radish, knolkhol and fenugreek. Immediately after sowing irrigation was provided with low pressure drip irrigation having normal operating pressure of 0.1 kg sq cm⁻¹. Each plot has 5 lateral lines of drip, the drippers were fitted on lateral lines at the distance of 30 cm. Each dripper had discharge rate of 1.25 litter hour⁻¹. First irrigation was given just after sowing and subsequent irrigations were provided at four days interval based on 80 CPE. Total 25 irrigations, each four days interval were given to crop starting from sowing to 15 days before harvesting. Yield of component crop was calculated based on proportionate area occupied by them. The yield of coriander, French radish, knolkhol and fenugreek was converted into coriander equivalent yield as per prevailing rates in market and treatment evaluation was done accordingly. Economic analysis of the different treatment was done for drawing conclusion.

Results and Discussion

Growth, yield parameters and yield of coriander

Significantly higher plant heights, number of branches plant⁻¹ at maturity of coriander were recorded in sole coriander over all intercropping systems (Table 1). In respect to intercropping systems, significantly higher growth parameters of coriander were recorded with 1:1 intercropping ratio of coriander and component crops *viz.* French radish, Knolkhol and fenugreek. The higher plant height in sole coriander in 1:1 intercropping ratio was on account of less competition for sunlight, space, nutrient and water as compared to other ratio. Tiwari *et al.* (2002) [7] reported depressing effect on growth and performance of fennel when intercropped with vegetable crop. Similarly Nandekar *et al.* (1995) reported decrease in growth parameters of potato with intercropping. The higher yield attributes and yield of coriander with French radish, Knolkhol and fenugreek intercrops was recorded in 1:1 ratio. Intercropping of coriander with French radish resulted in significantly higher yield and yield attributes of coriander over Khnolkhol and fenugreek inter-cropping (Table 2). The higher yield attributes and yield of coriander in

1:1 ratio with all intercrops might be due to less competition for space, sunlight, water and nutrients between coriander and component crops which gave higher growth parameters resulting in higher translocation of photosynthates from source to sink resulting in higher yield and yield attributes of coriander. Tiwari *et al.* (2002) [7] reported depressing effect on growth and performance of fennel when intercropped with vegetable crop. Similarly Nandekar *et al.* (1995) [5] reported decrease in yield of potato with intercropping.

Yields attributes and yield of intercrops

Yield attributes and yield of intercrops recorded was higher in respective sole crops as compared to intercropping with coriander. Further, perusal of data in Table 2 and 3 revealed that among different inter cropping ratios, the higher yield and yield attributes of intercrops was exhibited in 1:1 ratio. Intercropping of coriander + French radish in all the ratios resulted higher economic yield of French radish as compared to knolkhol and fenugreek. The higher yield of all the intercrops crops in 1:1 ratio was on account of higher plant population due to accommodation of more number of rows in between interspaces as compared to 2:2 ratio. Mehta *et al.* (2012 and 2015) [4] also reported higher yield attributes of intercrops and inter crop in 1:1 intercropping ratio over 2:2 and 1:2 intercropping ratio.

System productivity

Significantly higher coriander equivalent yield (CEY) and land equivalent ratio (LER) of the system was recorded in intercropping as compared to sole cropping (Table 4). Coriander + French radish in all ratios resulted higher CEY and LER as compared to its intercropping with knolkhol and fenugreek. Further analysis showed that 1:1 ratio with all intercrops proved superior resulting in higher CEY and LER over 2:2 ratio. Coriander + French radish in 1:1 ratio exhibited 126 and 83% higher CEY and LER, respectively over sole coriander. The higher CEY and LER in intercropping system was on account of additional yield of intercrops without much reduction in yield of base crop. The highest CEY and LER in 1:1 ratio with French radish, Knolkhol and fenugreek was due to proportionately less reduction in coriander yield as compared with 2:2 ratio resulting in better yield of intercrop. Bhati (1992) [2] reported higher fennel equivalent yield in intercropping as compared to sole crops. Similarly, Ahlawat and Gangaiah (2010) [1] also reported higher system productivity in chickpea intercropped with linseed over sole chickpea. Thomas *et al.* (2010) [6] reported the highest LER of 1.41 in mustard and chickpea intercropping over sole crops. Mehta *et al.* (2015) [4] also reported higher fennel equivalent yield and LER in intercropping system over sole cropping.

Table 1: Effect of intercropping system on growth and yield attributes of coriander at harvest

Treatments	Plant height (cm)	Branches plant ⁻¹	Umbels plant ⁻¹	Umbellates umbel ⁻¹	Seeds umbellate ⁻¹	1000-seed weight (g)	Seed yield plant ⁻¹ (g)
Sole Coriander	107.66	16.70	24.15	15.35	18.25	10.38	8.39
Sole French Radish	-	-	-	-	-	-	-
Sole Knolkhol	-	-	-	-	-	-	-
Sole Fenugreek	-	-	-	-	-	-	-
Coriander + French Radish 1:1	104.34	15.80	23.70	15.20	17.95	10.25	7.54
Coriander + French Radish 2:2	102.19	15.45	23.50	15.00	17.85	10.18	6.94
Coriander + Knolkhol 1:1	103.96	15.75	23.60	14.20	17.95	10.23	7.48

Coriander + Knolkhol 2:2	102.1	15.40	23.45	14.00	17.75	10.16	6.88
Coriander + Fenugreek 1:1	103.5	15.65	23.55	14.10	17.95	10.21	7.30
Coriander + Fenugreek 2:2	102.0	15.15	22.85	13.95	17.85	10.13	6.71
S.Em±	2.74	0.40	0.65	0.44	0.47	0.65	0.24
CD (P=0.05)	NS	1.20	NS	NS	NS	NS	0.72

Table 2: Effect of intercropping system on growth and yield attributes of component crops

Treatments	Plant population	Plant height (cm)	No. of leaves plant ⁻¹	Days to maturity	Days to harvest
Sole Coriander	-	-	-	-	-
Sole French Radish	2.24	46.70	13.80	50.05	52.75
Sole Knolkhol	2.24	33.81	23.50	64.10	-
Sole Fenugreek	2.24	28.44	25.20	-	54.10
Coriander + French Radish 1:1	2.15	42.80	13.05	47.75	50.70
Coriander + French Radish 2:2	1.75	42.25	12.95	47.20	50.00
Coriander + Knolkhol 1:1	2.10	32.08	22.65	63.35	-
Coriander + Knolkhol 2:2	1.80	31.56	21.45	62.85	-
Coriander + Fenugreek 1:1	2.15	28.38	24.75	-	53.30
Coriander + Fenugreek 2:2	1.80	28.22	23.25	-	53.20
S.Em±	-	-	-	-	-
CD (P=0.05)	-	-	-	-	-

Table 3: Effect of intercropping systems on yield of coriander and component crops and system productivity (coriander equivalent yield)

Treatments	Seed yield of coriander (Q ha ⁻¹)	Marketable yield of intercrops (Q ha ⁻¹)	Coriander equivalent yield
Sole Coriander	18.90	-	18.90
Sole French Radish	-	273.62	27.36
Sole Knolkhol	-	137.22	17.15
Sole Fenugreek	-	276.64	27.67
Coriander + French Radish 1:1	16.98	257.36	42.72
Coriander + French Radish 2:2	15.60	253.72	40.98
Coriander + Knolkhol 1:1	16.83	117.75	31.56
Coriander + Knolkhol 2:2	15.42	113.75	29.65
Coriander + Fenugreek 1:1	16.49	246.57	41.15
Coriander + Fenugreek 2:2	15.10	238.28	38.94
S.Em±	0.59	7.98	1.15
CD (P=0.05)	1.76	23.3	3.35

Table 4: Effect of intercropping systems on economics and land equivalent ratio (LER)

Treatments	Cost of cultivation (Rs ha ⁻¹)	Gross returns (Rs ha ⁻¹)	Net returns (Rs ha ⁻¹)	B:C ratio	LER
Sole Coriander	53300	151200	95900	1.73	1.00
Sole French Radish	61750	218896	157146	2.54	1.00
Sole Knolkhol	64500	137220	72720	1.12	1.00
Sole Fenugreek	66250	221312	155062	2.34	1.00
Coriander + French Radish 1:1	58500	341728	283228	4.84	1.83
Coriander + French Radish 2:2	58500	327776	269276	4.60	1.74
Coriander + Knolkhol 1:1	59700	252390	192690	3.22	1.74
Coriander + Knolkhol 2:2	59700	237110	267876	2.97	1.63
Coriander + Fenugreek 1:1	61300	329176	250124	4.36	1.76
Coriander + Fenugreek 2:2	61300	311424	280376	4.08	1.65
S.Em±	-	-	-	-	0.05
CD (P=0.05)	-	-	-	-	0.15

Economics

Intercropping of coriander + French radish in 1:1 ratio exhibited significantly higher net return (Rs 283228/ha) and B: C ratio (4.84) which was 126 and 83% higher, respectively over coriander + French radish (2:2). Coriander + French radish/knolkhol/fenugreek in 1:1 ratio proved superior which resulted in higher net return and B: C ratio over 2:2 ratio. Similar benefits of inter-cropping on economics in fenugreek + mustard was reported by Yadav *et al.*, (2003) [8]. Khurana and Bhatia (1995) [2] in intercropping of onion and potato with fennel and Ahlawat and Gangaiah (2010) [1] in chickpea + linseed reported similar results. It is concluded that intercropping of coriander and French radish in 1:1 ratio is

promising for higher productivity and profitability.

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