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## Effect of different inter cropping systems on nutrient uptake, yield and profitability in ajwain (*Trachyspermum ammi* Sprague) production

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#### Abstract

A field experiment comprising 10 treatments viz., sole ajwain, sole french radish, sole knolkhol, sole fenugreek, ajwain intercropping with French radish, knolkhol and fenugreek in 1:1 and 2:2 row ratio was conducted in Randomized Block Design with four replications during *rabi* season, 2016-17 at research farm of ICAR-NRCSS, Ajmer. Intercropping of ajwain with French radish in 1:1 row ratio resulted significantly higher land equivalent ratio (1.81), ajwain equivalent yield (3274 kg/ha), gross return (Rs.327388/- ha), net return (Rs.270238/- ha) and BCR (4.72) followed by intercropping of ajwain with french radish in 2:2 paired row ratio. Inclusion of legumes in intercropping system has impacted residual availability of nutrients after harvesting of ajwain. Intercropping of ajwain with fenugreek in 1:1 and 2:2 recorded significantly higher availability of residual N, P, and K after harvesting of crop. Thus, it is inferred that intercropping of ajwain with french radish in 1:1 row ratio is better for realizing higher yield and profitability but higher residual availability of N,P and K after harvesting of crop can realized with inter cropping of coriander and fenugreek in 1:1.

**Keywords:** Ajwain, intercropping, NPK fertilizer, Net returns, LER, yield

#### Introduction

Ajwain (*Trachyspermum ammi* Sprague) generally called as ‘ajwain’ belongs to the Apiaceae family. It is mainly grown in Rajasthan, Gujarat, Madhya Pradesh, Tamil Nadu and Uttar Pradesh. Ajwain is an important seed spice crop of Rajasthan which. Area, production and productivity of ajwain in Rajasthan are 0.06 lakh hectares, 0.04 lakh metric tons, and 680 kg/ha, respectively (Anon - 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) [8]. 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) [5]. 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 different inter cropping systems on nutrient uptake, yield and profitability in Ajwain (*Trachyspermum ammi* Sprage) production 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 100.38 kg/ha, P<sub>2</sub>O<sub>5</sub> 7.76 kg/ha, K<sub>2</sub>O 392.26 kg/ha. The experiment comprising of 10 treatments viz., sole ajwain, sole French radish, sole knolkhol, sole fenugreek, ajwain intercropping with French radish, knolkhol and fenugreek different row ratios (1:1 and 2:2) was laid in randomized block design with four replications. As per technical programme one row of French radish, knolkhol and fenugreek was added between two rows of ajwain in 1:1 intercropping ratio and two rows of vegetable crops were added in a pair of two rows of ajwain (paired row having 25/35cm). A uniform recommended dose of 60 Kg N and 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> and 30 kg K<sub>2</sub>O for sole ajwain, 120 kg N, 60 kg P<sub>2</sub>O<sub>5</sub> and 40 kg K<sub>2</sub>O for sole knolkhol, 100 kg N, 50 kg P<sub>2</sub>O<sub>5</sub> and 40 kg K<sub>2</sub>O for french radish and 20 kg N, 40 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O for fenugreek was applied. In intercropping of ajwain and vegetables 100% NPK of sole ajwain 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 ajwain 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<sup>-1</sup>. Available residual N in soil was determined by alkaline potassium permanganate method (Jackson, 1973) [3], available P<sub>2</sub>O<sub>5</sub> by Olsen *et al.* (1954) [6] and available potassium by flame photometric method (Jackson, 1973) [3]. Yield of component crop was calculated based on proportionate area occupied by them. The yield of ajwain, french radish, knolkhol and fenugreek was converted into ajwain 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

### Effect of intercropping system on residual NPK availability in soil after harvesting of crop

Different intercropping system significantly influenced the N, P and K availability in soil after harvesting of crops. Available N, P and K after harvesting of crops is less in all treatments as compared to initial value. Among different intercropping system available N, P and K after harvesting is more in intercropping of ajwain with fenugreek in both 1:1 and 2:2 ratio followed by intercropping of ajwain with knolkhol in both the ratio. Available N, P and K in all sole crops is higher compared to intercropping with respective vegetable crops. In comparison to respective sole crops, N, P and K availability after harvesting is less under different intercropping system which might be due to more extraction and utilization of these nutrients combinedly by ajwain and respective intercrops. Among intercropping systems, higher N, P and K availability in intercropping of ajwain with fenugreek in both 1:1 row ratio and 2:2 paired row ratio might

be due to more nitrogen fixation in nodules of fenugreek which after utilizing by fenugreek and ajwain, remain soil. Similar result has also been reported by Tanwar *et al.* (2011) [7].

**Table 1:** Effect of intercropping system on available NPK in soil after harvesting of crop

Treatments	Available N	Available P <sub>2</sub> O <sub>5</sub>	Available K <sub>2</sub> O
Sole Ajwain	90.04	6.90	280.36
Sole French radish	89.34	6.85	255.67
Sole knolkhol	88.86	6.81	242.90
Sole fenugreek	91.22	6.97	286.33
Ajwain + French radish 1:1	88.53	6.83	253.65
Ajwain + French radish 2:2	88.38	6.81	250.07
Ajwain + knolkhol 1:1	87.60	6.79	240.10
Ajwain + knolkhol 2:2	87.33	6.77	238.45
Ajwain + fenugreek 1:1	90.09	6.92	282.52
Ajwain + fenugreek 2:2	90.08	6.90	281.20
Initial value	100.38	7.76	392.26
SEm + <sub>-</sub>	3.11	0.44	4.11
CD (P=0.05)	10.14	1.32	12.15

### Yield of main crop and intercrops

Seed yield of ajwain was recorded higher when grown as sole compared to inter cropping. Among intercropping systems, the higher seed yield of ajwain was obtained in intercropping of ajwain with french reddish in both 1:1 and 2:2 ratio. The higher yield of ajwain in sole crop might be due to no competition with other crops resulting in better growth, yield attributes and yield. Yield of intercrops was recorded higher in respective sole vegetable crops as compared to intercropping with ajwain. Further, perusal of data in Table 2 reveals that among different intercropping ratios, the higher yield of intercrops was exhibited in 1:1 ratio. Intercropping of ajwain + 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) also reported higher yield of intercrops in 1:1 row ratio with fennel.

**Table 2:** Effect of intercropping systems on yield of ajwain, inter- crops and ajwain equivalent yield

Treatments	Seed yield of Ajwain (q/ha)	Seed yield of intercrops (q/ha)	Ajwain equivalent yield (q/ha)
Sole Ajwain	13.77	-	13.77
Sole French radish	-	274.30	21.94
Sole Knolkhol	-	138.84	13.84
Sole Fenugreek	-	273.39	21.87
Ajwain + French radish 1:1	12.21	256.61	32.74
Ajwain + French radish 2:2	11.18	254.70	31.56
Ajwain + Knolkhol 1:1	11.90	121.79	24.09
Ajwain + Knolkhol 2:2	10.94	113.76	22.32
Ajwain + Fenugreek 1:1	11.69	246.53	31.42
Ajwain + Fenugreek 2:2	10.63	237.75	29.65
SEm + <sub>-</sub>	4.8	-	0.89
CD (P=0.05)	14.1	-	2.58

**Table 3:** Effect of intercropping systems on gross return, net return, benefit cost ratio and land equivalent ratio

Treatments	Cost of cultivation (Rs/ha)	Gross returns (RS/ha)	Net returns (Rs/ha)	B:C ratio	Ler
Sole Ajwain	53000	137700	84700	1.59	1.00
Sole French radish	61550	219440	157890	2.56	1.00
Sole Knolkhol	64300	138440	74140	1.15	1.00
Sole Fenugreek	66050	218712	152662	2.31	1.00
Ajwain + French radish 1:1	57150	327388	270238	4.72	1.81
Ajwain + French radish 2:2	57150	315660	258510	4.52	1.73
Ajwain + Knolkhol 1:1	58950	240890	181940	3.08	1.73
Ajwain + Knolkhol 2:2	58950	223160	164210	2.75	1.61
Ajwain + Fenugreek 1:1	60038	314224	254186	4.23	1.74
Ajwain + Fenugreek 2:2	60038	296500	236462	3.93	1.63
SEm + <sub>-</sub>	-	-	-	0.05	0.05
CD (P=0.05)	-	-	-	0.15	0.15

**Ajwain equivalent yield and Land Equivalent Ratio**

Ajwain equivalent yield (AEY) and land equivalent ratio (LER) were significantly influenced with different inter cropping system. Significantly higher Ajwain equivalent yield and land equivalent ratio was recorded in intercropping systems as compared to sole cropping (Table 3). Ajwain + french radish in all ratios resulted higher AEY and LER as compared to its intercropping with knolkhol and fenugreek. Further analysis showed that intercropping of Ajwain with all intercrops in 1:1 ratio proved superior resulting in higher AEY and LER over 2:2 ratio. The higher AEY and LER in intercropping system was on account of additional yield of intercrops without much reduction in yield of base crop. The highest AEY and LER in 1:1 ratio with french radish, knolkhol and fenugreek was due to proportionately less reduction in ajwain yield as compared with 2:2 ratio resulting in better yield of intercrop. Ahlawat and Gangaiah (2010) <sup>[1]</sup> reported higher system productivity in chickpea intercropped with linseed over sole chickpea. Thomas *et al.* (2010) <sup>[8]</sup> reported the highest LER of 1.41 in mustard and chickpea Bhati (1992) <sup>[2]</sup> reported higher fennel equivalent yield in intercropping as compared to sole crops. Intercropping over sole crops. Mehta *et al.* (2015) also reported higher fennel equivalent yield and LER in intercropping system over sole cropping.

**Economic analysis**

Gross return, net return and BCR are affected by different intercropping system. Intercropping of ajwain + french radish in 1:1 ratio exhibited significantly higher net return (Rs 270238/ha) and B: C ratio (4.72) which was 219.00 and 196 percent higher, respectively over sole ajwain. Inter cropping of ajwain + 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 intercropping on economics in fenugreek + mustard was reported by Yadav *et al.* (2003) <sup>[9]</sup>. Khurana and Bhatia (1995) <sup>[4]</sup> in intercropping of onion and potato with fennel and Ahlawat and Gangaiah (2010) <sup>[1]</sup> in chickpea + linseed reported similar results.

Thus, it is inferred that intercropping of ajwain with french radish in 1:1 row ratio is better for realizing higher yield and profitability but higher residual availability of N,P and K after harvesting of crop can be realized with inter cropping of coriander and fenugreek in 1:1.

**References**

1. Ahlawat IPS, Gangaiah B. Effect of land configuration and irrigation on sole and linseed (*Linum usitatissimum*) intercropped chickpea (*Cicer arietinum*). Indian Journal of Agricultural Sciences. 2010; 80(3):248-249.
2. Bhati DS. Intercropping in fennel (*Foeniculum vulgare*). Indian Journal of Agricultural-Sciences. 1992; 62(3):218-219.
3. Jackson ML. Soil chemical analysis. Prentice Hall Inc. Engle Cliffs, New Jersey, 1973.
4. Khurana SC, Bhatia AK. Intercropping of onion and fennel with potato. Journal of the Indian Potato Association. 1995; 22(3-4):140-145.
5. Mehta RS, Meena SS, Anwer MM. Performance of coriander (*Coriandrum sativum*) based intercropping system. Indian Journal of Agronomy. 2010; 55(4):286-289.
6. Olsen SR, Col SCW, Wan table FS, Dean LA. Estimation of available phosphorus on soil by extraction with sodium bicarbonate. USDA, Circ, 1954, 939-18.
7. Tanwar SPS, Rokadia P, Singh AK. Effect of row ratio and fertility levels on chickpea (*Cicer arietinum*) and linseed (*Linum usitatissimum*) intercropping system. Indian Journal of Agronomy. 2011; 56(3):217-222.
8. Thomas A, Sharma UC, Thenua OVS, Shivakumar BG. Effect of levels of irrigation and fertility on yield and economics of chickpea (*Cicer arietinum*) and Indian mustard (*Brassica juncea*) under sole and intercropping systems Indian Journal of Agricultural Sciences. 2010; 80(5):372-376.
9. Yadav PC, Makhan Lal, Agarwal P. Intercropping of mustard in fenugreek (*Trigonella foenum-graecum* L) under varying fertility levels. Journal of Farming System Research & Development. 2003; 8(1):110-111.