

Effect of intercropping seed spices with vegetable for enhancing system profitability

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Abstract

A field study on effect of intercropping of seed spices with vegetables for enhancing system profitability was conducted at research farm of ICAR-NRCSS, Ajmer (Rajasthan) during *rabi* season of 2011-12 and 2012-13. The experiment comprising of nine treatments viz., pea + fennel, pea + ajwain, pea + coriander, cabbage + fennel, cabbage + ajwain, cabbage + coriander, carrot + fennel, carrot + ajwain and carrot + coriander was laid in randomized block design with three replications. Based on two-year study results exhibited that all the vegetables viz. carrot, cabbage and pea performed better with intercropping of fennel compared to ajwain and coriander and accordingly exhibited higher vegetable yield during 2011-12, 2012-13 and in pool. Intercropping of seed spices with carrot resulted higher grain yield of fennel, coriander and ajwain compared with cabbage and pea during both the years and in pool. Among all the intercropping pattern, fennel with cabbage in 1:1 row ratio resulted the highest fennel equivalent yield (30.59 q ha⁻¹) and net return (₹ 151160/-ha⁻¹) followed by intercropping of carrot with fennel in 1:1 row ratio during 2011-12, 2012-13 and in pool. The highest benefit cost ratio of 4.66 was obtained in intercropping of cabbage with fennel followed by intercropping of cabbage with ajwain (4.16). Thus, it is inferred that inter cropping of fennel with cabbage in 1:1 row ratio is better for realizing higher fennel equivalent yield, net return and BCR followed by cabbage + ajwain.

Key words : Equivalent yield, inter cropping, productivity, system profitability.

Introduction

India has been recognized as a land of spices and at present it is the world's largest producer, consumer and exporter of the seed spices. Coriander, fennel and ajwain are major seed spices which are mainly cultivated in Rajasthan, Gujarat, MP and Karnataka. Gujarat ranks first in area and production in fennel and in coriander and ajwain production, Rajasthan occupy first position in our country. The burgeoning population in the world is a big challenge for future generation and now we are facing great challenge of feeding teeming millions. In the present circumstance it is not possible to increase production by bringing additional area under cultivation. Therefore, there is urgent need to enhancing productivity of system. The system productivity can be increased by using available area through vertical expansion of enterprises. The intercropping system is a very important avenue in this direction which aimed at increasing productivity per unit area per unit time and insurance against total crop failure under aberrant weather conditions (Mullick, *et al.*, 1993). Intercropping is an age-old practice and attracted worldwide attention owing to yield advantage of the crops. Intercropping is one of the most important techniques

which embodies growing of crop under different plant geometry. With the release of early maturing and diverse crop varieties it is proved beyond doubt that such a system, based on sound production principles, will provide greater stability, productivity and profitability. Wide spacing and slow growing nature during initial growth period of fennel and ajwain make possible to raise short duration intercrops in between the rows. Inclusion of vegetables like radish (*Raphanus sativus* L.) and fenugreek (*Trigonella foenum-graecum* L.) as intercrop has been reported to enhance the productivity and profitability per unit area in winter maize (*Zea mays* L.) as compared to its sole cropping (Singh and Kumar, 2002). The system of intercropping not only improves the yield and returns but also reduces the risk of complete crop failure as compared to the sole cropping system (Rao and Singh, 1990).

Material and methods

The field experiment was conducted under AICRP (Vegetable) at research farm of ICAR-NRCSS, Ajmer (Raj) during two consecutive *rabi* season of 2011-12 and 2012-13. The soil of the experimental site was sandy loam with a pH of 8.7 having 0.24 percent organic carbon and 78.0, 53.4, and 245.1 kg per ha available N, P₂O₅ and K₂O per

hectare, respectively. The experiment comprising of nine treatments viz., pea + fennel, pea + ajwain, pea + coriander, cabbage + fennel, cabbage + ajwain, cabbage + coriander, carrot + fennel, carrot + ajwain and carrot + coriander) was laid in randomized block design with three replications. Sowing of fennel using 10 kg seed of fennel (Var. Ajmer Fennel-1), 4.0 kg seed of ajwain (Var. Ajmer Ajwain-1) and 15.0 kg seed of coriander (Var. Ajmer Coriander-1) was done at 50 cm row to row spacing. In between the rows vegetable crops such as pea (Var-Arkel), carrot (Var. Pusa Kesar) and cabbage (Var. F1-Hybrid) were sown as per treatment. As per treatment transplanting of 35 days old seedling was done in afternoon on the same day. The carrot, pea and cabbage were accommodated in between the rows of base crops, keeping population of coriander fennel and ajwain (base crop) as constant. In intercropping system 100 percent recommended dose of fertilizer of bases crops viz fennel, ajwain and coriander and 50 percent of intercrops viz. cabbage, pea and carrot were applied. 1/3rd N and full dose of P and K was applied at the time of sowing of seed spices and vegetable crop and remaining 2/3rd N was applied in two equal splits at 30 and 70 DAS. Second split dose of fertilizer was applied after harvesting of vegetable crops. The standard agronomic practices were applied for raising healthy crop of coriander, ajwain, fennel as well as carrot, cabbage and pea. Irrigation was applied as per requirement of seed spices, which met the demand of intercrops also. The yield of component crop was estimated based on the marketable yield obtained per meter square and converted into yield q/ha. Harvesting of seed spices was done at maturity. The yield of seed spices and vegetables were converted into fennel 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. Statistical analysis was done as per procedure suggested by Panse and Sukmate (1985).

Results and discussion

Yield of vegetables

Marketable yield of all the vegetables was significantly varied with different intercropping system with seed spices during both the years as well as in pool. Intercropping of all the vegetables with fennel in 1:1 row ratio exhibited the higher vegetable yield of respective intercrops compared with ajwain and coriander during both the year as well as in pool. Examination of results further revealed that among vegetables, cabbage exhibited higher marketable yield over carrot and pea in intercropping with fennel, ajwain and coriander (Table 1). The higher yield of

all the vegetables with fennel might be due to initial slow growth and erect growing habit which is enable sufficient availability of sunlight, water and nutrients resulting in higher photosynthates accumulation leading to higher marketable yield. Mehta *et. al.* (2015) reported higher yield of vegetables in intercropping of fennel with vegetable in 1:1 row ratio. Tiwari *et al.* (2002) 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 base crop with intercropping.

Yield of seed spices

Grain yield of all the spices was significantly influenced with different intercropping systems with vegetable crops during both the years as well as in pool. Intercropping of fennel with pea exhibited higher grain yield of fennel followed by carrot. The grain yield of ajwain was obtained highest in intercropping of ajwain with carrot. The intercropping of coriander with cabbage in 1:1 row ratio resulted higher grain yield of coriander over intercropping with pea and carrot during both the years as well as in pool (Table 1) The higher grain yield of fennel with intercropping of pea might be due to supply of additional nitrogen by nitrogen fixation in pea which supplemented the additional nitrogen for fennel because nitrogen requirement of fennel is higher compared to coriander and ajwain. The higher grain yield of ajwain in intercropping with carrot is on account of better compatibility in growth behavior of ajwain and carrot compared to cabbage and pea which helps in reduction of competition for space and sunlight. Tiwari *et al.*, (2002) reported similar results in fennel when intercropped with vegetable crop. Nandekar *et al.*, (1995) also reported similar results.

System productivity

The critical examination of data (Table 1) reveals that system productivity in terms of fennel equivalent yield was significantly influenced with different intercropping system. The higher fennel equivalent yield was exhibited in intercropping of fennel with all vegetables in 1:1 row ratio followed by intercropping of ajwain with vegetables. Intercropping of coriander with vegetables resulted the lowest fennel equivalent yield. Among all the intercropping system, the highest system productivity in terms of fennel equivalent yield was obtained in intercropping of fennel with cabbage in 1:1 row ratio (Table-1). The higher fennel equivalent in intercropping of fennel with different vegetables is on account of higher vegetables yield due to availability of higher vacant space which results very less competition for solar radiation, water and nutrients. Bhati (1992) reported higher fennel equivalent yield in

Table 1. Effect of intercropping of seed spices with vegetables on marketable yield of vegetable, grain yield of seed spices and fennel equivalent yield during 2011-12,2012-13 and pooled.

Sr. No	Treatment	Vegetables (fresh) Yield (q ha ⁻¹)			Grain yield of seed spices (q ha ⁻¹)			Fennel equivalent yield (q ha ⁻¹)		
		2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
1	Pea+ Fennel	32.25	19.67	25.96	16.25	14.25	15.25	21.63	20.81	21.22
2	Pea+ Coriander	28.25	15.99	22.12	8.25	6.85	7.55	11.58	11.04	11.31
3	Pea +Ajwain	30.5	18.06	24.28	7.75	7.12	7.435	15.42	15.51	15.47
4	Cabbage+ Fennel	145.4	135.28	140.34	15.25	11.25	13.25	27.37	33.80	30.59
5	Cabbage +Coriander	118.4	88.93	103.67	9.25	6.12	7.685	17.58	19.92	18.75
6	Cabbage +Ajwain	126.6	115.00	120.80	8.45	6.25	7.35	21.82	27.50	24.66
7	Carrot+ Fennel	110.4	75.57	92.99	17.25	11.50	14.75	26.45	24.09	25.27
8	Carrot +Coriander	92.25	64.87	78.56	9.4	6.45	7.925	15.52	16.19	15.86
9	Carrot +Ajwain	98.25	70.39	84.32	8.75	6.54	7.645	19.85	20.45	20.15
	S.E.m±	3.65	3.07	3.36	0.39	0.30	0.34	0.69	0.79	0.74
	CD(P=0.05)	10.94	9.22	10.06	1.16	0.88	1.02	2.06	2.38	2.22

Selling price: Fennel- [₹] 60 kg⁻¹, Ajwain-80 [₹] kg⁻¹, Coriander- [₹] 50kg⁻¹, Carrot- [₹] 10kg⁻¹, Cabbage- [₹] 10kg⁻¹, Pea- [₹] 20kg⁻¹

Table 2. Effect of intercropping of seed spices with vegetables on gross return, net return and BCR during 2011-12, 2012-13 and pooled

Sr. No	Treatment	Cost of cultivation (₹ ha ⁻¹)			Gross return (₹ ha ⁻¹)			Net return (₹ ha ⁻¹)			BCR		
		2011-12	2012-12	Pooled	2011-12	2012-12	Pooled	2011-12	2012-12	Pooled	2011-12	2012-12	Pooled
1	Pea+ Fennel	26375	30331	28353	129750	124840	127295	103375	94509	98942	3.92	3.12	3.52
2	Pea+ Coriander	24800	28520	26660	69500	66230	67865	44700	37710	41205	1.80	1.32	1.56
3	Pea +Ajwain	22475	25646	24161	92500	93080	92790	70025	67234	68630	3.12	2.60	2.86
4	Cabbage+ Fennel	30075	34586	32331	164200	202780	183490	134125	168194	151160	4.46	4.86	4.66
5	Cabbage +Coriander	28500	32775	30638	105450	119528	112489	76950	86753	81852	2.70	2.65	2.68
6	Cabbage +Ajwain	26175	30101	28138	130900	165000	147950	104725	134899	119812	4.00	4.48	4.24
7	Carrot+ Fennel	27575	31711	29643	158700	144568	151634	131125	112857	121991	4.76	3.56	4.16
8	Carrot +Coriander	26000	29900	27950	93125	97120	95123	67125	67220	67173	2.58	2.25	2.42
9	Carrot +Ajwain	23675	27226	25451	119125	122710	120918	95450	95464	95467	4.03	3.51	3.77
	S.Em±	-	-	-	4124	4254	4435	3195	3711	3446	0.11	0.15	0.11
	CD(P=0.05)	-	-	-	12364	10256	13296	9578	11127	10333	0.34	0.45	0.34

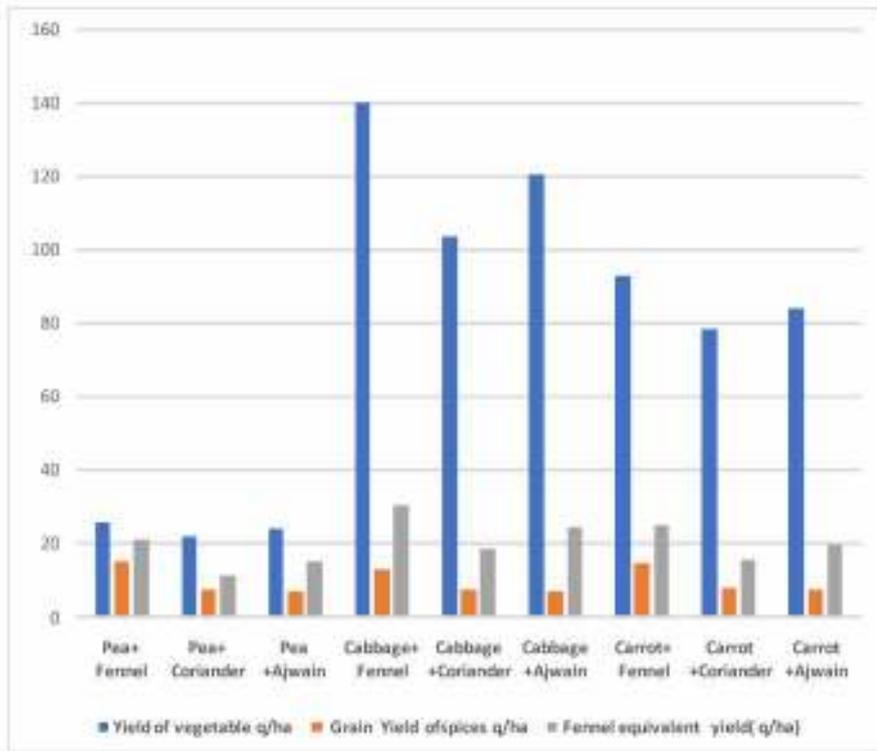


Fig. 1. Effect of intercropping of seed spices and vegetables on vegetable yield, grain yield of spices and fennel equivalent yield in pool

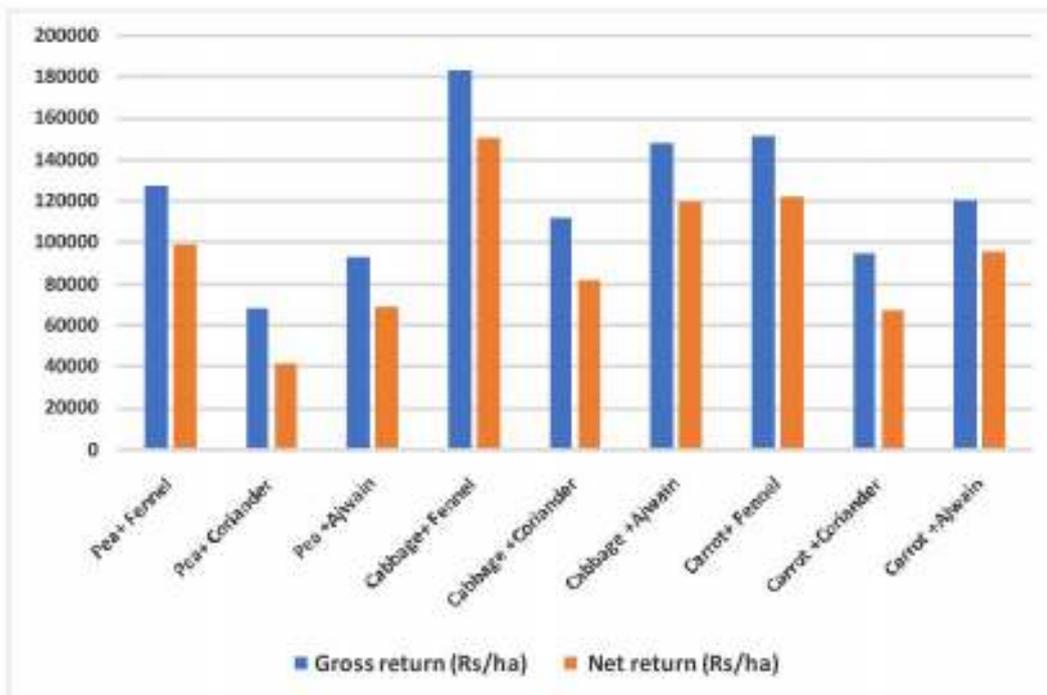


Fig. 2. Effect of intercropping of seed spices and vegetables on gross return and net return in pool

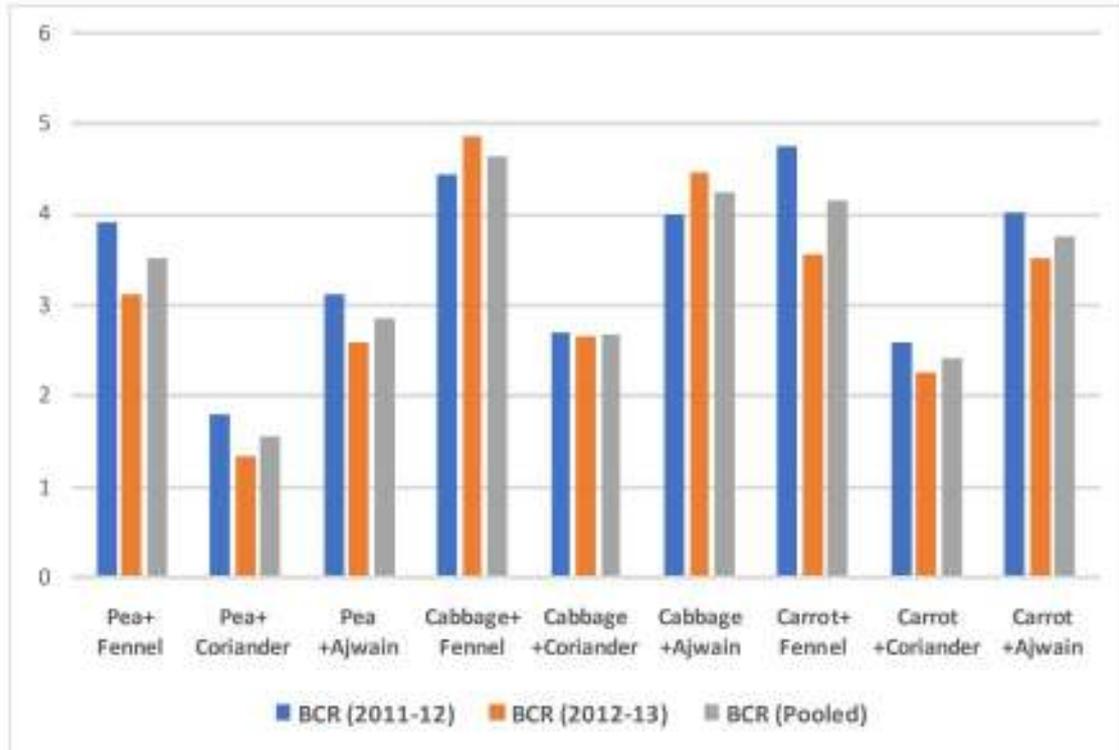


Fig.3. Effect of intercropping of seed spices and vegetables on BCR during 2011-12,2012-13 and in pool

intercropping as compared to sole crops. Similarly, Ahlawat and Gangaiah (2010) also reported higher system productivity in chickpea intercropped with linseed over sole chickpea. The lowest fennel equivalent yield in intercropping of peas with seed spices might be due to creeping effect of pea vine on seed spices which put hinderance for better growth of seed spices.

Economic analysis

Intercropping of seed spices with vegetable crops significantly influenced gross return, net return and BCR. Intercropping of fennel with all vegetable exhibited significantly the higher gross return, net return and BCR followed by intercropping of ajwain with vegetables in 1:1 row ratio. The lowest gross return, net return and BCR was recorded in intercropping of coriander with all vegetables. Among all the intercropping system, the highest gross return, net return and BCR in inter cropping of fennel with cabbage in 1:1 row ratio followed by intercropping of ajwain with cabbage (Table 2). The highest gross return, net return and BCR in intercropping of fennel with cabbage in 1:1 row ratio is due to higher fennel equivalent yield. These results are in conformity with those reported by Mehta *et.al.* (2012) in fennel and Yadav and Lal (2003) also reported that intercropping of fenugreek with mustard resulted higher net return and BCR. Similarly, Khurana, and Bhattia (1995) found that intercropping with

fennel increased net returns. Intercropping of fennel and carrot in 1:1 ratio is better for realizing higher growth yield and profit in fennel based intercropping system. Higher net return in chickpea intercropped with linseed over sole cropping was observed by Ahlawat and Gangaiah (2010).

Thus, it is inferred that inter cropping of fennel with cabbage in 1:1 row ratio is better for realizing higher fennel equivalent yield, net return and BCR followed by intercropping of cabbage with ajwain.

References

- Ahlawat and Gangaiah. 2010. Effect of land configuration and irrigation on sole and linseed (*Linum usitatissimum*) intercropped chickpea (*Cicer arietinum*). *Indian J. Agricultural-Sciences*. 80 (3): 248-49.
- Bhati, D. S. 1992. Intercropping in fennel (*Foeniculum vulgare*). *Indian J. Agricultural-Sciences*. 62: 3, 218-219.
- Khurana, S. C. and Bhatia, A. K. 1995. Intercropping of onion and fennel with potato. *J. the-Indian-Potato-Association*. 22 (3-4) 140-145.
- Mehta, R. S., Malhotra, S. K., Lal, G., Meena, S. S., Singh, R., Aishwath, O. P., Sharma, Y. K., Kant, K. and Khan, M. A. 2012. Influence of intercropping

- systems with varying fertility levels on yield and profitability of fennel (*Foeniculum vulgare* Mill.). *International J. Seed Spices*, 2 (1): 24-27.
- Mehta, R. S., Meena S. S., Lal, G., Aishwath, O. P. 2015. Fennel (*Foeniculum vulgare* mill.). based cropping for higher system productivity *Int. J. Seed Spices* 5 (1): 56:62.
- Mullick, S. P., More, S. M., Deshpande, S. S. and Patil, J. D. 1993. Intercropping for better stability in dryland watersheds. *Indian J. Agron.*38(4):527-530.
- Nandekar, D.N., Sharma, T. R., Sharma, R. C. 1995. Effect of potato based intercropping system on yield and economics. *Journal of the Indian Potato Association.* 22:3-4, 159-161.
- Panse, V. G. and Sukhatme, P.V. 1985. Statistical Methods for Agricultural Workers, ICAR, New Delhi
- Rao, M. R. and Singh, M. 1990. Productivity and risk evaluation in contrasting intercropping system. *Field Crop Research*, 23: 279-293.
- Singh, S.N. and Kumar, A. 2002. Production potential and economics of winter maize based intercropping systems. *Annals of Agricultural Research*, 23 (4): 532-534
- Tiwari, R. S., Ankur, A., Sengar, S. C. and Agarwal, A. 2002. Effect of intercropping on yield and economics of fennel (*Foeniculum vulgare* Mill.). *Crop Research Hisar.* 23(2): 369-374.
- Yadav, P.C. and Lal, M. 2003. Economics and mutual effect as influenced by intercropping of fenugreek (*Trigonella foenum - graecum* L.) with mustard under different fertility levels. *Journal of Farming Systems Research & Development*, 8 (1): 125-126.

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