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## Intercropping of some vegetables in seed spices a boon to the farmers of Vidarbha with consideration to diversification in cropping pattern

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**Abstract**

An investigation entitled "Intercropping of some vegetables in seed spices a boon to the farmers of Vidarbha with consideration to diversification in cropping pattern" was carried out during the rabi seasons of four consecutive years from 2011-12 to 2014-15. The experiment was laid out in Randomized Block Design (RBD) with eight treatments viz., T<sub>1</sub> –Ajwain sole crop, T<sub>2</sub> –Fennel sole crop, T<sub>3</sub> – Cabbage sole crop, T<sub>4</sub> – Radish sole crop, T<sub>5</sub> – Ajwain + cabbage (1:1), T<sub>6</sub> – Ajwain + Radish (1:1), T<sub>7</sub> – Fennel + cabbage (1:1), T<sub>8</sub> – Fennel + radish (1:1). As a matter of fact, in this experimentation, the sole crop yield in Ajwain, Fennel, Cabbage and Radish as showed in pooled results, were obtained maximum. While, there were slightly decreased trend in respect to yield per hectare of Ajwain and Fennel as a main crop, when intercropped with Cabbage and radish as a sub crop during all the years of experimentations and in pooled results too. But economically, intercropping proved better than sole cropping in respect to B:C ratio, LER in present investigation.

Intercropping trial was undertaken on same site and with same randomization on Broad Bed Furrow (BBF) with drip irrigation system. The varieties of different crops used under the study were, AA-01-19 (Ajwain), AF-101 (Fennel), Golden Acre (Cabbage) and Pusa chetaki (Radish).

Further, it was evident from the pooled results that, significantly the maximum pooled GMR and NMR were obtained from Ajwain + Cabbage intercropping with 1:1 row pattern. Whereas, the maximum (1:2.4) B: C ratio and (1:1.827) LER were recorded with Ajwain + Cabbage and Fennel + Cabbage intercropping (1:1), respectively.

**Keywords:** Intercropping, BBF, LER

**Introduction**

Intercropping is nothing but growing of two or more crops simultaneously on the same piece of land with a definite row pattern. Intercropping was originally practiced as an insurance against crop failure under diversified cropping pattern. At present, the main objective of the intercropping is higher productivity per unit area in addition to stability in the production. Intercropping system utilizes resources efficiently and their productivity increased [6]. The ajwain and fennel are the two important seed spices crop, which are having good scope under the diversification of cropping pattern in Vidarbha region of Maharashtra. However, under the saline tract i.e. part of Amaravati, Buldhana, Akola and Washim districts, these seeds spices crop were taken as a rainfed crop. At present area under seed spices like ajwain (617 ha) fennel (27 ha) and coriander (32 ha) as sole crop has been undertaken [2].

Most of the farmers in the region don't want to waste the fertile land under the seed spice crop individually, due to its higher spacing in between the row and plants. They want to undertake the high valued sub crop like vegetables, comparatively short duration and with minimum requirement of natural resources but less competition with the main crop as a seed spices. Taking into consideration of the need of the farmers and availability of sufficient space in between main crop (seeds spices), one can sow the intercrop of small duration and with high valued like cabbage and radish. Further, to advice the appropriate and economical and diversified pattern of intercropping in Vidarbha region, present investigation was undertaken at field of Chilli and Vegetable Research Unit, Dr. PDKV., Akola during *Rabi* seasons of consecutive four years.

**Methodology**

The experiment was conducted at the field of Chilli and Vegetable Research Unit, Dr. PDKV., Akola, during Rabi seasons of four consecutive years starting from 2011-12 to 2014-15 with Randomize Block Design (RBD). There were eight treatments replicated thrice. The treatment comprises of T<sub>1</sub> –ajwain sole crop, T<sub>2</sub> –Fennel sole crop, T<sub>3</sub> – cabbage sole crop, T<sub>4</sub> – radish

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sole crop, T<sub>5</sub> – ajwain + cabbage (1:1), T<sub>6</sub> - ajwain + radish (1:1), T<sub>7</sub> –fennel + cabbage (1:1), T<sub>8</sub> – fennel + radish (1:1). The spacing in between the main crop i.e. ajwain and fennel were 45 x 45 cm. whereas, the intercrop radish was sown at the spacing of 45 x 15 cm. and cabbage at 45 x 45 cm. The experiment was conducted with broad bed furrow of 1.2 meter breadth and irrigated with the help of drip irrigation. The ancillary and yield as well as qualitative observations had been taken separately. The seed spices i.e. ajwain and fennel were main crop, whereas vegetables viz., cabbage and radish

as sub crop. The experimental site was slightly alkaline with 7.6 pH, 0.15 Ec (dSm-1) and 4.21 gm/kg organic carbon. The available nitrogen, phosphorus, potassium and sulphur in the experimental plot was estimated to be (220 kg/ha, 8.75 kg/ha, 318 kg/ha and 9.48 mg/kg, respectively). The plot size was kept 5.4 m x 3.0 m., wherein two BBF were considered as one plot treatment. The varieties of different crops used in this experiment were ajwain cv. AA-01-19, fennel cv. AF-101, cabbage cv. Golden acre and radish cv. Pusa chetki. The detail layout is depicted in the figure 1.

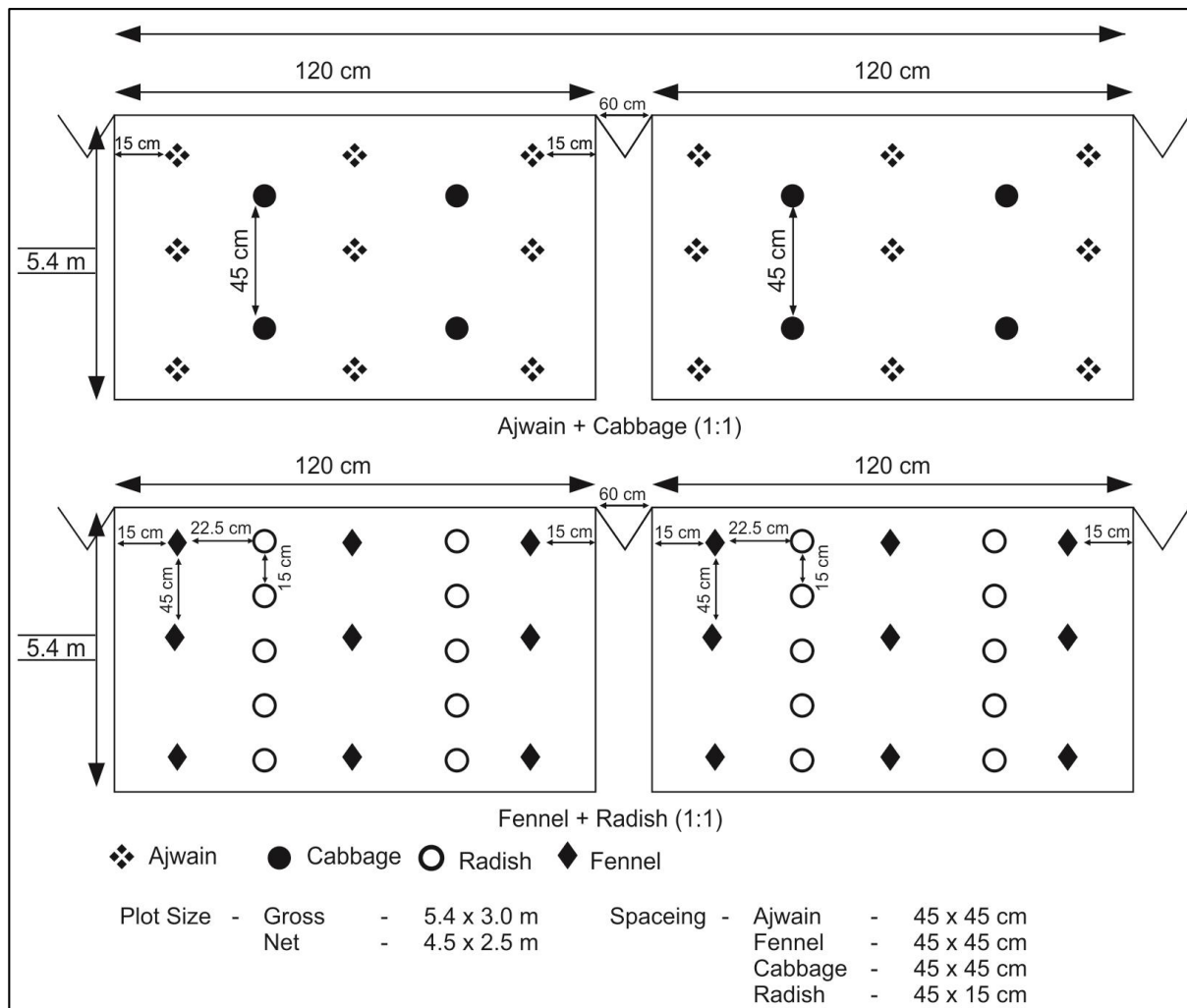


Fig 1: Graphical representation of plan of inter cropping

Results and Discussion

Growth parameters of ajwain and fennel

It is evident from the data presented in (Table 1) that, the maximum plant height (74.4 cm, 109.04 cm, 26.18 cm and 24.86 cm) of main crop ajwain and fennel and intercrop

cabbage and radish, respectively were obtained when they grown as sole crop. However, all these crop attended comparatively reduced plant height, if grown along with Cabbage and Radish as an intercrop

Table 1: Pooled means of the intercropping of cabbage and radish in seed spices on vegetative growth attributes

Sr No	Treatment	Pooled means of plant growth characters (cm)							
		Ajwain		Fennel		Cabbage		Radish	
		Plant height (cm)	Branches (per plant)	Plant height (cm)	Branches (per plant)	Plant height (cm)	Leaves per plant	Plant height (cm)	Leaves per plant
T <sub>1</sub>	Ajwain sole crop	74.40	13.93	--	--	--	--	--	--
T <sub>2</sub>	Fennel sole crop	--	--	109.04	7.39	--	--	--	--
T <sub>3</sub>	cabbage sole crop	--	--	--	--	26.18	16.71	--	--
T <sub>4</sub>	Radish sole crop	--	--	--	--	--	--	24.86	9.72
T <sub>5</sub>	Ajwain + cabbage (1:2)	66.60	12.75	--	--	21.21	13.12	--	--
T <sub>6</sub>	Ajwain + Radish (1:2)	63.78	12.89	--	--	--	--	22.56	8.44
T <sub>7</sub>	Fennel + cabbage (1:2)	--	--	97.04	6.69	22.26	12.40	--	--
T <sub>8</sub>	Fennel + Radish (1:2)	--	--	89.53	6.96	--	--	21.13	7.61

As far as the number of branches produced by the main crop ajwain and fennel were concerned, similar trend of maximum (13.93 and 12.75, respectively) number of branches were obtained as sole crop and reduced down to some extent, if grown as intercrop with cabbage and radish (Table 1).

The reduced plant height and number of leaves in ajwain and fennel grown as intercrop might be due to the fact that, higher nutrients required by cabbage and radish crops at growing stage of main crop on account of competition with the intercrop. Expressed similar results in Fennel crop intercropped with vegetables<sup>[8]</sup>. Similarly <sup>[4]</sup> reported decreased in growth parameters of base crop with intercropping i.e. Fennel as main crop and garlic and carrot as intercrop in (1:1) ratio.

#### Yield attributes and yield of Ajwain and fennel

Significantly, the maximum number of umbels per plant, 1000 seed weight (test weight) and economical yield of ajwain and fennel was obtained in sole cropping treatment over intercropping treatments with cabbage and radish in (1:1) ratio (Table 2). Among the intercropping treatments, ajwain + cabbage (T<sub>5</sub>) resulted maximum number of umbels and test weight. Furthermore, these characters were expressed higher figures in fennel + cabbage (1:1) intercropping (T<sub>7</sub>) over fennel + radish (1:1) treatment (T<sub>8</sub>). The higher yield attributes and yield in 1:1 ratio with both sole grown crops was recorded due to more growth parameters leading to higher translocation of photosynthesis from source to sink and

less competition in between crops for natural resources, as compared to intercropping treatment, in both the crop of present study. These results are in conformity with the findings of <sup>[1-4]</sup> in fennel and coriander crop, respectively.

#### Yield attributes and yield of intercrop

Yield attributes and yield of intercrops in cabbage and radish was recorded maximum in respective sole intercrops as compared to intercropping with main crop i.e. ajwain and fennel (T<sub>3</sub> and T<sub>4</sub>). Further, perusal of data presented in (Table 2) opined that, among different intercropping treatments of cabbage, higher head length, head girth and economical yield was reported in ajwain as main crop (T<sub>5</sub>) than, fennel as main crop (T<sub>7</sub>). In respect to other intercropping treatments, maximum mean root length, root diameter and yield of radish as intercrop was produced with ajwain as main crop (T<sub>6</sub>), than that of fennel as main crop (T<sub>8</sub>). The higher yield attributes and yield of intercrop in sole cropping was on account of less competition for space, sunlight, water and nutrient with other crops resulting, better availability of nutrients, water and space to facilitate growth and development of these crops independently. Also, more number of plant population in 1:1 ratio towards less spacing of intercrop might be another reason for higher yield contributing and yield of intercrops too. These results are in line with the findings of <sup>[3-9]</sup> in seed spices, fenugreek and fennel crop, respectively.

**Table 2:** Pooled means of yield and yield contributing characters of intercropping of seed spices with vegetables

Sr No	Treatment	Pooled means of Yield and yield contributing characters											
		ajwain			fennel			cabbage			radish		
		Number of umbels	Test weight (g) 1000 seed wt.	Yield (Q/ha)	Number of umbels	Test weight (g) 1000 seed wt.	Yield (Q/ha)	Head length (cm)	Head girth (cm)	Yield (Q/ha)	Root length (cm)	Root diameter (cm)	Yield (Q/ha)
T <sub>1</sub>	ajwain sole crop	151.03	3.43	17.16	--	--	--	--	--	--	--	--	--
T <sub>2</sub>	fennel sole crop	--	--	--	11.86	7.36	14.98	--	--	--	--	--	--
T <sub>3</sub>	cabbage sole crop	--	--	--	--	--	--	19.90	18.99	434.50	--	--	--
T <sub>4</sub>	radish sole crop	--	--	--	--	--	--	--	--	--	19.85	3.95	330.74
T <sub>5</sub>	ajwain+cabbage (1:2)	133.09	3.31	15.30	--	--	--	13.60	12.71	325.85	--	--	--
T <sub>6</sub>	ajwain+radish (1:2)	134.39	3.22	14.59	--	--	--	--	--	--	17.76	3.40	307.17
T <sub>7</sub>	fennel+cabbage (1:2)	--	--	--	10.97	7.09	13.22	11.89	11.33	316.69	--	--	--
T <sub>8</sub>	Fennel+Radish (1:2)	--	--	--	10.08	6.93	12.00	--	--	--	15.40	3.28	289.55

#### Economic analysis

Intercropping of ajwain + cabbage in 1:1 ratio exhibited significantly the maximum gross return, whereas, maximum net return was recorded with ajwain + radish intercropping in 1:1 ratio. Further, the equal B:C ratio (1:2.4) were observed in both the intercropping treatment T<sub>5</sub> and T<sub>6</sub>. These findings

confirm the results quoted by <sup>[4]</sup> in an intercropping of fennel with garlic (1:1), fennel with carrot (1:1) and fennel with onion (1:1) resulted higher gross and net return and BCR, over sole cropping experiment conducted by them at Ajmer (Rajasthan) conditions.

**Table 3:** Pooled means of GMR, NMR and LER under intercropping system of seed spices and vegetables

Sr No	Treatment	GMR (Rs ha <sup>-1</sup> )	NMR (Rs ha <sup>-1</sup> )	B:C ratio	LER
T <sub>1</sub>	ajwain sole crop	78739	36039	1.9	--
T <sub>2</sub>	fennel sole crop	76779	33279	1.7	--
T <sub>3</sub>	cabbage sole crop	71381	23379	1.5	--
T <sub>4</sub>	radish sole crop	76948	34333	1.8	--
T <sub>5</sub>	ajwain+cabbage (1:1)	139835	80620	2.4	1.827
T <sub>6</sub>	ajwain+radish (1:1)	138098	80762	2.4	1.785
T <sub>7</sub>	fennel+cabbage (1:1)	133225	73386	2.2	1.820
T <sub>8</sub>	fennel+radish (1:1)	128955	70993	2.2	1.675
	F test	Sig.	Sig.	--	--
	SE (m)±	178.44	202.66	--	--
	CD at 5 %	584.55	608.24	--	--

### System productivity

Intercropping of ajwain+cabbage (1:1) exhibited significantly maximum (1:1.827) land equivalent ratio and was closely followed by fennel+cabbage (1:1) over rest of the sole as well as intercropping treatments in the present study (Table 3). The higher LER with the above intercropping system might be due to the fact that, better spatial and temporal resource utilization of same piece of land might results in higher combined economical yield of base and intercrop. Furthermore, the net return from ajwain + radish and ajwain + cabbage intercropping system (1:1) was about similar, and equal B:C ratio (1:2.4) was also reported with the both intercropping system (1:1) in the present study. In a study of mustard and chickpea intercropping found highest land equivalent ratio of 1:1.41 in mustard and chickpea intercropping over sole crops [7]. Whereas, In coriander based intercropping and highest LER (1.59) in fennel + carrot in 1:1 intercropping ratio followed by fennel + onion in 1:1 intercropping ratio, which are in support to the results obtained towards ajwain + radish 1:1 and ajwain + fennel 1:1 intercropping in present study [3-4].

### Conclusions

Ajwain, fennel are important seed spice crops of Rajasthan and Gujrat states. But the farmers of Vidarbha region took this venture to cultivate these seed spices crop under diversification of cropping pattern. Due to the natural privilege of environmental and agronomical conditions available in the Vidarbha region of Maharashtra in general and saline track of some districts in particular. The total saline track area is about 2.5 lakhs square kilometers, which are highly fertile and shrinking and swelling properties leads to maximum water holding capacity. Present investigation is therefore beneficial to those farmers, who took these crops as a sole crop might be diverted towards intercropping along with high valued vegetables like cabbage and radish.

The results of study would definitely encourage the farmer's community in the region. Since the land equivalent ratio is quite high, it might be double the farmer's income from same piece of land in given duration. Main crop in this cropping pattern viz., ajwain and fennel grow slowly during initial growing stage and at the same time cabbage and radish as short duration, fast growing intercrop gave additional economical return to the farmers.

### Recommendation

Hence, we strongly recommend this kind of intercropping system for immediate benefit to the farmers of region in words like, "The intercropping of ajwain + cabbage (1:1) or ajwain + radish (1:1) is recommended for getting maximum economic returns and LER."

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