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Feasibility of ajwain as intercrop in cumin (*Cuminum cyminum* L.)

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Abstract

Intercropping is a multiple cropping practice involving growing two or more crops in proximity. The most common goal of intercropping is to produce a higher yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. Cumin is short duration crop whereas, ajwain is long duration tropical seed spice crops of arid and semi arid regions of Gujarat and Rajasthan. The practice of intercropping of cumin with ajwain not only reduce the risk factor for cumin production but also increases income with minimum use of scare and costly inputs. A field experiment was done to study the possibility of ajwain as intercrop in cumin during 2010-11 to 2013-14 at SSRS, SDAU, Jagudan, Gujarat. The experiment was replicated thrice with different eight treatments considering cumin and ajwain as sole crops, cumin + ajwain in row ratios of 2:1,3:1 and 4:1 with cutting of ajwain at 30 and 45 DAS in each row ratio. Effect of different treatments on cumin equivalent yield was significant during the period of investigation and on pooled data also. Growing of ajwain by 4:1 row arrangement and cutting the crop at 45 DAS gave the maximum cumin equivalent yield. The lowest cumin equivalent yield was obtained with sole cumin and was at par with sole ajwain. The mean maximum LER of system was recorded under Cumin + Ajwain (4 : 1) with cutting of ajwain at 45 DAS.

Key words : Ajwain, cumin, equivalent yield, intercropping, LER.

Introduction

Growing of two or more crops simultaneously on the same land, makes efficient use of limited arable land. Traditionally, intercropping has been practiced most widely in developing countries (Francis and Decoteau, 1993). However, the advantages of intercropping, particularly the potential for increasing sustainability (Coolman and Hoyt, 1993), have stimulated interest in the practice in the United States and other developed countries. Intercropping is an excellent system of cropping which ensure better utilization of resources and inputs if the selection of crops were made appropriately (Singh *et al.*, 2014a). Efficient intercropping not only improves the productivity but also sustain soil fertility status (Singh *et al.*, 2013). Besides these farmers also secured with assured income from any crop against collapse of anyone. Cumin (*Cuminum cyminum* L.), locally known as 'zeera', is an important seed spice crop of western India. Cumin is valued for its typical pleasant aroma from its essential oil, which ranges between 2.5-3.5 per cent in indigenous collections and upto 5.5 per cent in exotic ones. Cumin is short duration major seed spice crop of arid and semi arid regions of Gujarat and Rajasthan and more cost effective than other *rabi* crops due to fewer requirements of costly inputs but slight fluctuation in climatic condition may failure the crop therefore, it is known as risky crop. As compared to other *rabi* crops, ajwain is long duration robust minor seed spice crop and higher gainful. Ajwain also known as carom seed (*Trachyspermum ammi* L.) belongs to the family apiaceae which is a native from Egypt and popular seed spice crop in India. Plant parts usually consumed are herb, volatile oil and seeds. Seeds contain medicinal values specially for curing indigestion, stomach pain and elements concerning digestive system (Meena *et. al.*, 2010). Ajwain contains 2.5 to 4.0 per cent volatile oil which is yellow brownish in colour used in many ayurvedic medicines and industries of which 'thymol' is main constituent. Farmers grow the ajwain as mixed crop with cumin occasionally and produced cumin and ajwain seed under limited irrigated condition under North Gujarat region. These practices not only reduced the risk factor for cumin production, but increased income with minimum use of scare and costly inputs. Growth habit and crop duration of both the crops are different and may not suitable for inter cropping. Eventhough ,this intercropping system is adopted conventionally by farmers of these regions. The scientific information on this aspect with definite row pattern is not available. Hence, an experiment was done to study the feasibility of inter crop of ajwain with cumin.

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Material and methods

An experiment was done for four consecutive years from 2010-11 to 2013-14 at Seed Spice Research Station, Sardarkrushinagar Dantiwada Agricultural University,Jagudan (Gujarat). The soil was loamy sand in texture, neutral in soil reaction (7.8 pH), with low in organic carbon (0.14), medium in available phosphorus (28 Kg P_2O_5 ha^{-1}) and potash (240 kg K_2O ha^{-1}). The experiment was laid out in RBD with three replications comprising of different eight treatment combinations as sole cumin and ajwain crops, 2:1,3:1 and 4:1 row ratios of cumin : ajwain with cutting of ajwain at 30 and 45 DAS for each row ratio. The seeds of variety *Cv.* Gujarat Cumin 4 and Gujarat Ajwain 1 were sown manually at uniform depth in furrow at 30 cm and as per treatments with seed rate of 12 and 2.5 kg ha^{-1}, respectively for cumin and ajwain on the same day. The cutting of ajwain crop was made in each intercrop treatments at 30 and 45 DAS. All the cultural operations were carried out as per need of crop and as per recommendation for both the crops. Observations on growth attributes, yield components and yield were recorded for cumin and ajwain at harvest. The data have been analyzed for individual years as well as pooled as per standard procedure.

Results and discussion

Growth and yield attributes of cumin and ajwain

Growth and yield attributes of cumin (Table 1) were not differ significantly due to different row arrangement with cutting management except, plant height and number of umbels per plant. The tallest plants and maximum number of umbels per plant were recorded under sole cumin and was at par with treatments T_5 and T_8 but appreciably superior over rest of treatments. Singh and Singh (2014) proved that gladiolus yield attributes were improved under intercropping with coriander, fenugreek and soya as compare to sole cropping system. The results are also in conformity with findings reported by Jahani *et al.,* (2008) for 1000-seed weight, number of seed per umbel of cumin as affected by different intercropping and Mehta *et al.,* (2010) for growth parameters of coriander under coriander + intercrops (garlic, onion and carrot) in 1:1 ratio. All the growth and yield attributes of ajwain were significantly affected by different treatments except plant height and test weight (Table 2). The maximum growth and yield attributes were recorded under T_8 and was at par with treatment T_7, but significantly superior over rest of the treatments. Better growth, yield and yield attributes under the treatment T_8 and T_7 is due to more space available to crop during active growth period under wider spacing. Intercropping of fenugreek with cumin led to significantly higher plant height and number of seeds per pod in sole cropping of fenugreek were observed by Moghaddama *et al.,* (2014).

Cumin equivalent yield

Different treatments significantly influenced the cumin equivalent yield during the period of investigation and on pooled basis also (Table 3). During 2010-11, treatment T_3 gave the maximum cumin equivalent yield and was at par with treatments T_6, T_2, T_7,T_4 and T_8, but significantly superior over rest of the treatments. All the intercrop treatments were at par and recorded significantly higher cumin equivalent yield over sole crops, except treatment T_3 in the year 2010-11. During the third year, sole ajwain recorded the maximum yield and was at par with treatments T_7, T_4, T_3 and T_8, but significantly superior over rest of the treatments. In the year 2013-14, treatment T_8 gave the higher yield and was at par treatment T_7, but significantly superior over rest of the treatments. In pooled data all the intercrop treatments were at par in respect of cumin equivalent yield (T_3 to T_8). Cutting of ajwain at 45 DAS (T_6, T_7 and T_8) gave the higher cumin equivalent yield than that of with 30 DAS (T_3, T_4 and T_5).Growing of ajwain by 4:1 row arrangement and cutting the crop at 45 DAS gave the maximum cumin equivalent yield (T_8). The lowest cumin equivalent yield was obtained with sole cumin and was at par with sole ajwain (T_2). Thus, cutting of ajwain crop at 45 DAS found better than 30 DAS. Wider spacing of ajwain as intercrop found more beneficial than intercrop grown at closer spacing. Intercropping system caused an increase in seed yield components of cumin compared with sole cropping (Moghaddama *et al.*, 2014). Simultaneously, Jahani *et al.,* (2008) also reported that economic and biological yield of cumin was affected by different intercropping and there was a decreasing trend in these parameters from intercropped to the sole crop, similar trend as also observed by Nomana *et al.,* (2012) for mustard equivalent yield (2311.5 kg ha^{-1}) and Mehta *et al.,* (2010) for coriander seed yield.

Economics

The maximum gross and net realizations (Table 4) were recorded with treatment T_8, which was closely followed by when cumin + Ajwain grown at row arrangement of 3 : 1 with cutting of ajwain at 45 DAS (T_7).However, the maximum BCR was recorded when ajwain grown as sole crop (T_2). Nomana (2013) reported that mustard + two rows of coriander recorded the highest gross return and benefit-cost ratio,the similar trend was also observed by Mehta *et al.,* (2010) with highest net return (` 50,701 ha^{-1}) and B:C ratio (2.16) for 1:1 ratio followed by 2:2 ratio of coriander + carrot intercropping.

Table 1 .Growth,yield and quality attributes of cumin crop as influenced by different cumin:ajwain intercropping sequence (Pooled data)

Treatments	Plant height (cm)	No. of tranches Plant^{-1}	Number of umbelsplant^{-1}	Number of umbellate umbel^{-1}	No. of seeds umbalates^{-1}	Test weig ht (g)	Volatile oil (%)
T1 : Sole cumin	25.6	5.3	26.3	5.4	5.2	4.2	4.5
T2 : Sole ajwain	-	-	-	-	-	-	-
T3 : Cumin + Ajwain (2 : 1) - cutting of ajwain at 30 DAS	23.1	4.7	24.1	5.0	4.9	4.1	4.5
T4 : Cumin + Ajwain (3 : 1) - cutting of ajwain at 30 DAS	23.4	4.9	23.3	5.0	5.0	4.2	4.5
T5 : Cumin + Ajwain (4 : 1) - cutting of ajwain at 30 DAS	24.7	5.2	25.5	5.0	5.1	4.3	4.6
T6 : Cumin + Ajwain (2 : 1) - cutting of ajwain at 45 DAS	23.7	4.9	23.9	5.1	4.9	4.2	4.5
T7 : Cumin + Ajwain (3 : 1) - cutting of ajwain at 45 DAS	23.6	5.2	24.8	5.2	5.3	4.3	4.6
T8 : Cumin + Ajwain (4 : 1) - cutting of ajwain at 45 DAS	24.7	5.3	25.1	5.3	5.5	4.4	4.7
S. Em. ±	0.51	0.16	0.67	0.13	0.14	0.10	0.13
C.D. at 5 %	1.4	NS	1.91	NS	NS	NS	NS
CV%	6.36	9.99	8.20	7.78	8.56	7.31	8.63
Y x T	NS	NS	NS	NS	NS	NS	NS

Table 2. Growth, yield and quality attributes of ajwain crop as influenced by different cumin : ajwain intercropping sequence(Pooled data)

Treatments	Plant height (cm)	No. of tranches plant^{-1}	Number of umbel splant^{-1}	Number of umbellate umbel^{-1}	No. of seedsumb alates^{-1}	Test weight (g)	Volatile oil (%)
T1 : Sole cumin	-	-	-	-	-	-	
T2 : Sole ajwain	98.15	5.72	14.2	27.90	13.10	0.82	3.46
T3 : Cumin + Ajwain (2 : 1) - cutting of ajwain at 30 DAS	95.19	5.64	13.32	29.52	15.04	0.89	3.48
T4 : Cumin + Ajwain (3 : 1) - cutting of ajwain at 30 DAS	92.73	5.29	13.69	29.54	15.73	0.82	3.43
T5 : Cumin + Ajwain (4 : 1) - cutting of ajwain at 30 DAS	91.44	5.47	13.27	28.94	15.38	0.86	3.48
T6 : Cumin + Ajwain (2 : 1) - cutting of ajwain at 45 DAS	92.13	5.82	13.09	30.44	15.36	0.89	3.47
T7 : Cumin + Ajwain (3 : 1) - cutting of ajwain at 45 DAS	91.38	6.29	15.22	32.27	17.33	0.89	3.53
T8 : Cumin + Ajwain (4 : 1) - cutting of ajwain at 45 DAS	90.50	6.64	15.31	33.34	17.66	0.92	3.54
S. Em. ±	2.64	0.17	0.56	1.03	0.54	0.03	0.05
C.D. at 5 %	NS	0.49	1.60	2.05	1.53	NS	NS
CV%	8.53	8.95	10.78	10.21	10.42	4.60	4.66
Y x T	NS	NS	NS	NS	NS	NS	NS

Table 3. Effect of different intercropping treatments on cumin equivalent yield(Kg/ha)

Treatments	Cumin equivalent yield (Kg ha^{-1})				
	2010-11	2011-12	2012-13	2013-14	Pooled
T1 : Sole cumin	515	494	356	456	455
T2 : Sole ajwain	811	434	473	438	539
T3 : Cumin + Ajwain (2 : 1) -cutting of ajwain at 30 DAS	878	590	419	546	608
T4 : Cumin + Ajwain (3 : 1) -cutting of ajwain at 30 DAS	791	623	431	571	605
T5 : Cumin + Ajwain (4 : 1) -cutting of ajwain at 30 DAS	761	616	394	606	594
T6 : Cumin + Ajwain (2 : 1) -cutting of ajwain at 45 DAS	868	617	390	600	619
T7 : Cumin + Ajwain (3 : 1) -cutting of ajwain at 45 DAS	796	631	449	688	641
T8 : Cumin + Ajwain (4 : 1) -cutting of ajwain at 45 DAS	774	631	417	769	648
S. Em. ±	36	34	23	35	36
C.D. at 5 %	108	100	67	103	106
CV%	9.49	11.71	11.01	11.94	8.30
Y x T	-	-	-	-	NS

Table 4. Effect of different intercropping treatments on economics and LER of cropping system (Mean)

Treatments	Equivalent yield (Kg ha^{-1})	Gross realization (Rs ha^{-1})	Cost of cultivation (Rs ha^{-1})	Net realization (Rs ha^{-1})	BCR (Rs ha^{-1})	LER of cropping system
T1 : Sole cumin	455	56912	33033	23879	1.7	1.0
T2 : Sole ajwain	539	67348	26398	40951	2.6	1.0
T3 : Cumin + Ajwain (2 : 1) - cutting of ajwain at 30 DAS	608	76030	33547	42483	2.3	1.26
T4 : Cumin + Ajwain (3 : 1) - cutting of ajwain at 30 DAS	604	75512	35516	39996	2.1	1.26
T5 : Cumin + Ajwain (4 : 1) - cutting of ajwain at 30 DAS	594	74267	35978	38289	2.1	1.25
T6 : Cumin + Ajwain (2 : 1) - cutting of ajwain at 45 DAS	619	77331	33547	43784	2.3	1.29
T7 : Cumin + Ajwain (3 : 1) - cutting of ajwain at 45 DAS	641	80107	35516	44591	2.2	1.33
T8 : Cumin + Ajwain (4 : 1) - cutting of ajwain at 45 DAS	648	80975	35978	44997	2.3	1.35

Selling price : Ajwain ` 120 kg$^{-1}$ and cumin ` 120 kg^{-1} should be given ?

Land Equivalent Ratio

The mean maximum LER (Table 4) of system was recorded under T_8 followed by T_7, T_6, T_4, T_3 and T_5. Thus, cutting of ajwain at 45 DAS with 4:1 and 3:1 row arrangement recorded more or less similar LER and were higher over rest of the treatments. Thus, association of cumin with ajwain found beneficial to each other. In other word, more land area is required by sole cropping systems to produce the equal amount of seed yield recorded under intercropping systems. The results are in conformity with results reported by Moghaddama *et al.*, (2014), Jahani *et al.*, (2008) and Islam *et al.*, (1992).

Conclusion

Thus, it is concluded that intercropping of cumin with ajwain in 1:4 row arrangement with cutting of ajwain at 45 DAS is better for realizing higher cumin equivalent yield, gross return and net return.

References

Coolman, R. M., Hoyt, G. D. 1993. Increasing sustainability by intercropping. *Hort Technology*, 3:309–312.

Francis, R., Decoteau, D. R. 1993. Developing an effective southernpea and sweet corn intercrop system. *Hort Technology*, 3:178–184.

Islam, K. M. M., Samad, M. A., Sarker, M. A. R., Khan, M. N. H., Rahman, M. L.1992. Intercropping of spices and pulse crop with winter jute seed crop. Abstract of research compiled under agricultural research on jute.123-26.

Jahani, M., Koocheki, A., Mahalati, M. N.2008. Comparison of different intercropping arrangements of cumin (*Cuminum cyminum*) and lentil (*Lens culinaris*). In : Proceedings of the Second Scientific

Conference of the International Society of Organic Agriculture Research (ISOFAR), held at Consorzio ModenaBio in Modena, Italy, 18-20 June, 2008 pp. 592-59.

Meena, S. S., Lal, G., Mehta, R.S., Kant, K. and Anwer, M. M.2010. Seed spices for home remedies. *Indian Hort*. (July-Aug.):6-8.

Mehta, R. S., Meena, S. S., Anwer, M. M. 2010. Performance of coriander (*Coriandrum sativum*) based intercropping systems. *Indian J. Agronomy*, 55(4):286-89.

Moghaddam, and Rooholla Moradib, Hamed Mansoori. 2014. Influence of planting date, intercropping and plant growth promoting rhizobacteria on cumin (*Cuminum cyminum* L.) with particular respect to disease infestation in *Iran. J. Applied Research on Medicinal and Aromatic Plants* 1:134–143.

Noman, M. S., Malequeb, M.A., Alamc, M. Z., Afrozd, S. and Ishiie, H. T. 2013. Intercropping mustard with four spice crops suppresses mustard aphid abundance, and increases both crop yield and farm profitability in central Bangladesh. *International journal of pest management*.59(4): 306-313.

Singh, A. K., Singh, K. A., Bharati, R. C. and Chadra, N. 2013. Response of intercrops and nutrient management on the performance of tobacco based intercropping system and assessment of system sustainability. *Bangladesh J. Bot*. 42(2): 343-348.

Singh, K. M. P. and Singh, D. 2014. Performance of Coriander, Fenugreek and Soya as intercrop under Gladiolus based intercropping system *J. Agri Search* 1(4): 246-250.

Singh, S. S., Singh, A. K. and Sundaram, P. K. 2014 a. Agro-technological options for upscaling agricultural productivity in eastern indo gangetic plains under impending climate change situations: A review. *J. Agri. Search* 1 (2): 55-65.

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