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Effect of technological intervention of line sowing on cumin (*Cuminum cyminum* L.) yield in western Rajasthan

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Abstract

An on-farm trial (OFT) was conducted at three farmer's field with three treatments in Lunawas Khara village of Luni Panchayat Samiti in Jodhpur district of Rajasthan during rabi 2011-12 to 2012-13 to assess the impact of line sowing in improving the productivity of cumin (variety GC-4). Technological intervention of line sowing was compared with recommended practice and existing farmers practice for yield maximisation and economic returns from cumin under irrigated condition on sandy loam soil. Results of the study revealed that yield attributes in terms of branches plant^{-1}, umbels plant^{-1}, umblets plant^{-1} and grain yield plant^{-1} increased by 43, 78, 51, and 77%, respectively with technological intervention of line sowing over farmers practice. The grain yield was increased from 458 to 810 kg ha^{-1} during 2011-12 and 502 to 888 kg ha^{-1} during 2012-13 with the technological intervention. The mean grain yield was recorded 77% higher than the farmers practice (480 kg ha^{-1}).

Key words: Cumin, farmers practice, line sowing, net return, yield, yield attributes

Introduction

Cumin (*Cuminum cyminum* L.) is an important seed spice crop of India and country ranks first in terms of acreage and production in the world. It is extensively grown in Gujarat, Rajasthan and some parts of Haryana and Madhya Pradesh during *rabi* season. The climatic conditions found in Rajasthan and Gujarat is more favourable for cumin cultivation than other parts of the country and is becoming more popular due to its profitability, short duration and greater potential to grow on saline soils. During 2012-13, Gujarat and Rajasthan account for 99.67% production of the country (Indian Horticulture Database, 2). In Rajasthan cultivation of cumin is confined to the western districts where climate remains drier during the ripening period of the crop. The districts of Jalore, Jodhpur, Jaisalmer, Barmer, Nagaur and Pali account for 92% of the area 90% of the production in Rajasthan during 2012-13 (Rajasthan Agricultural Statistics, 6). During the corresponding period cumin was grown on 106058 ha area in Jodhpur with an annual production of 44663 tonnes. Average productivity of cumin in the district was lower (421 kg ha^{-1}) than the national average (663 kg ha^{-1}) and Gujarat state (757 kg ha^{-1}) (Rajasthan Agricultural Statistics, 6). Besides agro-climatic constraints, low yield of cumin in the arid regions of Rajasthan attributed to poor spread of the production technology among farmers (Singh, 8). Moreover, farmers of the region are still doing the sowing with conventional practice of broad casting (Lal *et al*., 4) that resulted in lower yield due to poor germination, establishment and difficulty in carrying out inter cultural operations for weeding and pest control. Superiority of line sowing over broadcasting have been reported in literature elsewhere the results of which revealed that inter cultural operations like weeding, hoeing, spraying of agro-chemicals etc. are much easier in line sowing than the broadcast method (Sastry and Muthuswamy, 7). Hence, present study was conducted in the selected villages of Jodhpur district to assess the impact of line sowing in improving the productivity of cumin.

Materials and methods

An On Farm Trial (OFT) was conducted in Lunawas Khara village of Jodhpur district in agro-climatic zone Ia i.e. "Arid Western Plain" of western Rajasthan on three selected farmers' field during *rabi* 2011-12 to 2012-13. The soil of sites was sandy loam in texture with low organic carbon (0.15-0.17%). The available nitrogen, phosphorus and potash were 138-147, 13-17 and 164-204 kg ha^{-1}, respectively. The pH of irrigation water was 8.6 with high electrical conductivity (3.42 dSm^{-1}). The OFT was conducted with three treatments viz., T_1 farmers practice (farmers own seed, broad cast sowing, imbalanced use of fertilizers i.e. no use of FYM and phosphorus), T_2 improved cultivar GC-4, broad cast sowing, 10 t FYM+ 30 kg N+ 20 kg P_2O_5ha^{-1}and T_3

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improved cultivar GC-4, line sowing at 30 cm, 10 t FYM + 30 kg N + 20 kg P_2O_5 ha^{-1}.The 0.40 ha field of each farmer was divided into two strips of equal size for allocation of T_2 and T_3 treatments. The sowing of cumin variety GC-4 was done in the second week of November in both the years using seed rate of 12 kg ha^{-1} in T_2 and T_3 and 15 kg ha^{-1} in T1 (as was used by the farmers). The sowing was done in lines spaced at 30 cm apart in treatment T_3 whereas in T_1 and T_2 seeds were sown by broad cast method. A light irrigation was given just after sowing and second irrigation was given 7 days after the first irrigation. Subsequent irrigations were given at 12, 42, 72 and 90 days after sowing (DAS). Seed treatment was done with carbendazim @ 2 g kg^{-1} seed. The 50% dose of recommended N and full dose of P_2O_5 and FYM were applied just before sowing and mixed thoroughly in to the soil. The remaining dose of N was applied in the standing crop at 35 DAS. The other crop management practices were performed as per standard recommendations of the region. Harvesting of crop was done in the last week of March and grain yield was recorded and converted in to kg ha^{-1}. The yield attributes in terms of plant height, branches $plant^{-1}$, umbels $plant^{-1}$ and grain weight $plant^{-1}$ were recorded from randomly selected five plants in each plot from three places corresponding to three replications. The economic analysis was done taking into account the prevailing cost of inputs and output. The ratio of benefit to cost was calculated by dividing the net return with total cost of cultivation. The Fisher's least significant difference (LSD) was used to compare treatment means at p=0.05 level of significance.

Results and discussion

Yield and yield attributes

The yield attributes increased considerably with the technological intervention of line sowing compared to farmers practice (Table 1). Yield attributes were also recorded significantly higher with recommended practice over farmers practice. The branches $plant^{-1}$, umbels $plant^{-1}$, umblets $plant^{-1}$ and grain yield $plant^{-1}$ increased by 43, 78, 51, and 77%, respectively with technological intervention (T_3) over farmers practice (T_1). Plant height was however recorded 12% lower with T_3 than the farmers practice (30.28 cm). The grain yield was recorded significantly higher with the interventions of line sowing compared to farmers' existing practices. The grain yield increased from 458 to 810 kg ha^{-1} during 2011-12 and 502 to 888 kg ha^{-1} during 2012-13 with the technological intervention (T_3) over farmers practice (T_1). The mean grain yield was recorded 77% higher than the farmers practice (480 kg ha^{-1}). In both the years, recommended practice (T_2) also recorded higher grain yield (57 and 53% during 2011-12 and 2012-13, respectively) than the farmers practice but was found inferior to technological intervention in this regard. The practice of line sowing (T_3) alone recorded 14.11% yield increase over the broadcast method (T_2) of sowing. The improvement in all the yield attributes with line sowing in the trial might be due to better availability of plant space, lesser competition in rhizosphere for moisture and nutrients and better agricultural practices (Mahmood *et al*. 5). These results are in accordance with Tuncturk *et al*. (9), who stated that different agricultural practices affect differently on the branches $plant^{-1}$. Ayub *et al*. (1) and Yadav and Khurana (10) were also documented significant effect of sowing methods on the umbels $plant^{-1}$ in black cumin (*Nigella sativa* L.). The higher number of umbels, umblets and grains $plant^{-1}$ with line sowing thus resulted from better source sink relationship and higher number of branches $plant^{-1}$. Kafi (3) reported that different agricultural practices have different influence on number of seeds per umbels. Ayub *et al*. (1) have also reported that different methods of sowing have significant effect on the number of seeds per umbel. Higher grain yield ha^{-1} with line sowing was attributed to higher number of branches $plant^{-1}$, number of umbels/umblets $plant^{-1}$ and number of seed $plant^{-1}$. These findings are in accordance with the results of Yadav and Khurana (10) who reported improvement in grain yield of fennel to the tune of 38% with line sowing over broadcast sowing.

Economic analysis

Pooled data of economic analysis presented in Table 2 revealed that on pooled basis, an amount of ₹ 69384 ha^{-1} was obtained as net return under trials conducted with technological intervention of line sowing (T_3) which was 96% higher than the farmers practice. The net return of Rs. 10063 alone was obtained from the intervention of line sowing in the study over broadcast method of sowing which is calculated by subtracting the net return obtained from T_3 and T_2. Similarly, highest B:C ratio of 1.89 was also recorded with technological intervention of line sowing. Since economic yield is the function of grain yield and sale price (Mahmood *et al*., 5), higher grain yield with treatment T_3 (Technological intervention) contributed in obtaining of maximum net return as well as B: C ratio over rest of the treatments under the study.

Conclusion

From the study it is inferred that yield of cumin could be increased by sowing the crop in lines that facilitated

Table 1: Effect of different interventions on the yield attributes of cumin at farmers field during *rabi* 2011-12 to 2012-13

Treatments	Plant height			Branches plant^{-1}			Umbels plant^{-1}			Umblets plant^{-1}			Grain weight (mg plant^{-1})		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
T_1	28.72	31.83	30.28	5.17	5.28	5.22	4.19	4.59	4.39	217	220	219	469	459	464
T_2	27.34	30.70	29.02	6.39	6.94	6.67	7.01	7.32	7.17	264	275	270	687	741	714
T_3	24.72	28.28	26.50	7.32	7.58	7.45	7.72	7.90	7.81	319	341	330	759	887	823
SEm±	0.45	0.29	0.27	0.15	0.20	0.12	0.15	0.16	0.11	6	8	5	10	10	18
CD (P<0.05)	1.34	0.86	0.76	0.45	0.59	0.35	0.45	0.49	0.32	19	23	14	29	29	51
Farmer															
F_1	26.81	29.81	28.31	6.08	6.39	6.23	6.11	6.38	6.24	260	270	265	622	682	652
F_2	27.11	30.67	28.89	6.61	6.86	6.73	6.50	6.82	6.66	277	286	281	657	712	684
F_3	26.87	30.33	28.60	6.19	6.56	6.37	6.31	6.61	6.46	263	281	272	637	693	665
SEm±	0.45	0.29	0.27	0.15	0.20	0.12	0.15	0.16	0.11	6	8	5	10	10	18
CD (P<0.05)	NS	NS	NS	NS	NS	0.35	NS	NS	0.32	NS	NS	NS	NS	NS	NS

Where T_1=Farmers practice (farmers own seed, broad cast sowing, imbalanced use of fertilizers), T_2=improved cultivar GC-4, broad cast sowing, 10 t FYM+ 30 kg N+ 20 kg P_2O_5ha^{-1}, T_3 = = improved cultivar GC-4, line sowing at 30 cm, 10 t FYM + 30 kg N + 20 kg P_2O_5ha^{-1} F1=Farm 1, F2=Farm 2 and F3=Farm3.

Table 2: Effect of different interventions on the grain yield and economics of cumin at farmers' field during *rabi* 2011-12 to 2012-13

Treatments	Grain yield (kg ha^{-1})			Gross return (₹ ha^{-1})			Net return (₹ ha^{-1})			Net B: C ratio		
	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled	2011-12	2012-13	Pooled
T_1	458	502	480	57250	62764	60007	32718	38232	35475	1.33	1.56	1.45
T_2	720	767	744	90042	95889	92965	56398	62245	59321	1.68	1.85	1.76
T_3	810	888	849	101208	111000	106104	64488	74280	69384	1.76	2.02	1.89
SEm±	25	27	18	3173	1847	1836	1804	1847	1291	0.06	0.06	0.04
CD (P<0.05)	76	80	53	9513	5538	5288	5410	5538	3719	0.19	0.19	0.13
Farmer												
F_1	643	714	679	80417	89264	84840	48785	57632	53208	1.50	1.80	1.65
F_2	684	722	703	85542	90292	87917	53910	58660	56285	1.67	1.82	1.75
F_3	660	721	691	82542	90097	86319	50910	58465	54687	1.59	1.81	1.70
SEm±	25	27	18	3173	1847	1836	1804	1847	1291	0.06	0.06	0.04
CD (P<0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Where T_1=Farmers practice (farmers own seed, broad cast sowing, imbalanced use of fertilizers), T_2= improved cultivar GC-4, broad cast sowing, 10 t FYM + 30 kg N + 20 kg P_2O_5ha^{-1}, T_3 = = improved cultivar GC-4, line sowing at 30 cm, 10 t FYM + 30 kg N + 20 kg P_2O_5ha^{-1} F1=Farm 1, F2=Farm 2 and F3=Farm3.

plants favourable aerial and below ground environment for their full development. Similarly, lines sowing also make it convenient to carry out many agricultural operations during the crop growth. Thus line sowing is recommended to obtain higher grain yield and economic return from cumin crop along with recommended practices of cultivation in the zone.

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