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Short communication

Stability analysis of yield and its component traits in coriander germplasm

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ABSTRACT

Stability analysis were done in 42 coriander genotypes including three check varieties during *rabi* 2010-11 and 2014-15 at TNAU, Coimbatore with *per se* performance. The analysis of pooled data indicated highly significant differences among the genotypes and environments for all the traits. The variance due to genotype and environments were highly significant for all the traits. Highly significant pooled deviation for umbels per plant and seed yield per hectare and highly significant G × E (linear) interaction for pods per plant and seed yield per plant indicated the preponderance of non-linear components of G × E interaction. The genotype CS 245 had shown consistent performance and stability in wider environments for seed yield per plant, whereas CS 14 has shown consistent performance in poor environment for seed yield per plant.

Key words: *Coriandrum sativum*, seed yield, stability, sustainability index.

Coriander (*Coriandrum sativum* L.) commonly known as '*dhania*' belongs to family Apiaceae. Coriander seeds are also used as tonic, carminative, diuretic, stomachic and as an aphrodisiac. Although coriander has got diverse uses the knowledge on the extent and magnitude of genetic variability of agronomic and quality traits is limited. Thus, there is a great scope for crop improvement in coriander for increasing yield and quality potential in order to increase the yield, production, productivity and quality components of this important seed spice. Adequate information is not available with respect to adaptability of coriander genotypes to seasonal and environmental variations. Due to its multipurpose use, cultivation is increasing in the non-traditional areas of the country. The farmers of different states grow the landraces available with them. The majority of coriander varieties were developed from available germplasm and the performance of coriander germplasm at different years is of great importance in respect of screening them for their stability. The G × E interaction shows the differential response of genotypes to different environmental conditions and their consistency in performance over the years. An ideal variety should have a high mean yield combined with a low degree of fluctuations when grown over diverse environments (Arshad *et al.*, 1).

The experimental materials comprising 42 coriander genotypes were grown during five consecutive years (from 2010-11 to 2014-15) at Tamil Nadu Agricultural University, Coimbatore. The experiment was conducted under irrigated conditions in randomized block design with three replications. The size of plot was 2 m × 2 m and seeds were sown at 20 cm × 10 cm. The observations were recorded on number of umbels per plant, number of umbellate per plant and seed yield per plant (g). The data were analyzed statistically for stability parameters based on model (Eberhart and Russel, 2). The sustainability indices (SI) were estimated as per the following formula used by earlier workers (Gangwar and Anand, 4). The sustainability index were divided into five groups, *viz.*, very low (upto 20%), low (21-40%), moderate (41-60%), high (61-80%) and very high (above 80%).

The stability analysis of variance mean data (Table 1) revealed highly significant differences among the genotypes as well as environments for all the traits. Genotype × Environment (G × E) interaction was studied for seed yield per plant and its component characters, *i.e.* number of umbels per plant and number of umbellates per plant. Highly significant mean squares due to environment (linear) for all the traits indicated considerable differences among the environments and their predominant effects on the traits. This was due to variation in climatic conditions during years. Highly significant pooled deviations for number of umbels per plant, number of umbellates per plant and seed yield per plant indicated non-linear response of the genotypes due to environmental changes and greater role of unpredictable components of G × E interaction towards differences in stability of the genotypes. It is reported that both predictable and

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Table 1. Pooled analysis of variance of traits for stability in coriander.

Source of variation	df	Mean square					
		Plant height	No. of primary branches per plant	No. of secondary branches per plant	No. of umbels per plant	No. of umbellates per umbel	Seed yield per plant
Genotype (G)	41	48.03**	0.96**	9.65**	43.63**	0.97*	1.44*
Environment (E)	4	596.64**	24.90**	579.88**	1654.72**	123.67**	51.27**
G × E	164	37.32*	0.67	6.23	35.47*	0.52	0.48*
Env. (linear)	1	2385.92**	99.60**	2319.57**	6618.82**	494.69**	205.09**
G × E (linear)	41	71.15**	0.71	7.05*	45.27*	0.75	0.41*
Pooled deviation	123	25.43**	0.64**	5.81**	31.43*	0.44	0.49*
Pooled error	410	4.03	4.03	0.26	0.91	5.48	1.38

unpredictable components contributed significantly towards the differences in stability of fenugreek genotypes (Mathur and Lal, 5; Gangopadhyay *et al*., 3). However, prediction for unpredictable traits can be made by considering the stability parameters of individual genotypes (Singh *et al*., 6).

The linear regression analysis facilitates identification of genotypes having wider adaptability over a range of environment. The stability analysis was done following the model of Eberhart and Russel (2), which suggested two stability parameters (i) linear regression, and (ii) deviation from such regression. According to them a stable variety will have high mean performance, regression coefficient (b_i) near unity, and deviation from regression (s^2d_i) close to zero. Therefore, all the three parameters, *i.e*., mean, linear regression and non-linear responses seems to be equally important. For the trait umbels per plant, the single genotype CS 221 (25.8, 1.17 and 0.63) recorded high mean value, significant regression coefficient along with non-significant deviation from regression indicating their stability and suitability to favourable environments (Table 2). For the same trait the genotype CS 212 (28.3, 0.93 and 6.83) recorded high population mean, non significant regression co-efficient and deviation from regression and were found stable and suitable for wider environments. Four genotypes, namely, CS 59, CS 240, CS 244 and CS 271 recorded more number of umbellate per umbel than population mean (5.5), significant regression co-efficient and non-significant deviation from regression and were found stable and suitable for favourable environments. High mean value over the population mean (0.66), significant regression co-efficient and non-significant deviation from regression was recorded in the genotype CS 114 for seed yield per plant indicating their stability and suitability to favourable environments (Table 2).

It was reported that the generalization regarding stability of a variety for all the descriptors is rather difficult (Singh and Singh, 7). In the present investigations also, genotypes did not show uniform stability and linear response pattern for all the traits. However, the overall stability may be considered on the basis of compensation pattern of different traits. For seed yield per hectare the sustainability index (SI) for all the genotypes ranged from 71.84% (CS 14) to 94.62% (CS 245). The check CS 105 recorded the highest SI (79.34%) among all the checks (Table 2), indicating low fluctuations in its performance over the locations as compared to checks. Among the seven genotypes identified for wider adaptability, four genotypes, namely, CS 245, CS 46, CS 187 and CS 228 showed high SI, thus indicating that the genotypes would give better performance consistently over the diverse environments. CS 245, which showed suitability for favorable environment also showed high SI indicating consistent performance over years in favourable environment. In case of number of umbels per plant, the genotypes qualified for wider adaptation namely, CS 134, CS 185, CS 46, CS 245 and CS 29 for favourable environment showed very high SI (Table 2). On the basis of above findings, it can be concluded that CS 245 has shown promising and consistent performance in wider environments for seed yield per plant and number of umbels per plant where as the genotype CS 14 has shown promising and consistent performance in poor environment for seed yield per plant.

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Table 2. Stability parameters for number of umbels per plant, number of umbellates per umbel and seed yield per plant in coriander.

Genotype	No. of umbels per plant				No. of umbellates per umbel				Seed yield per plant			
	Mean	b_i	S^2d_i	SI	Mean	b_i	S^2d_i	SI	Mean	b_i	S^2d_i	SI
CS 11 (C)	29.0	1.77	20.37	82.93	4.5	0.50*	0.04*	61.52	2.61	1.39	0.46	77.43
CS 14	27.7	1.73	51.31	78.79	5.0	0.54	1.45	69.09	2.43	1.06	1.55	71.72
CS 29	29.4	1.85	38.03	84.20	4.8	0.53	0.47	66.06	2.48	1.44	0.72	73.31
CS 37	26.1	1.71	2.71*	73.69	5.5	1.15*	-0.04*	76.67	2.50	1.48	0.09*	73.94
CS 46	29.9	0.85	9.88	85.80	5.4	0.93	0.35	75.15	2.99	1.47	0.13	89.50
CS 57	26.8	0.88	27.79	75.92	5.7	1.22	1.01	79.70	2.80	1.01	0.91	83.47
CS 58	24.6	1.11	117.52	68.92	5.5	1.29	0.36	76.67	2.89	1.45*	0.02*	86.32
CS 59	26.5	0.69	21.38	74.97	6.0	1.30*	0.06	84.24	2.57	0.86	0.43	76.17
CS 91	27.3	1.30	11.34	77.52	5.7	1.10	0.09	79.70	2.59	1.22	0.55	76.80
CS 94	25.9	1.76	56.79	73.06	5.6	0.88	0.11	78.18	2.44	1.24	1.26	72.04
CS 101	22.2	1.21	13.30	61.27	5.5	1.07*	-0.02	76.67	2.64	1.25	0.39	78.39
CS 105 (C)	25.7	0.85	26.88	72.42	5.9	1.02	0.26	82.73	2.67	1.28	1.87	79.34
CS 114	22.5	0.64	45.13	62.23	5.6	1.07	1.19	78.18	2.67	1.23*	0.01	79.34
CS 116	31.4	2.17	74.79	90.57	5.8	1.18	0.25	81.21	2.63	1.03	0.22	78.07
CS 119 (C)	24.4	1.14	11.05	68.28	5.0	0.89	0.13	69.09	2.52	1.20*	0.02	74.58
CS 121	26.4	1.58	3.64*	74.65	4.9	1.10	0.19	67.58	2.52	0.48	1.11	74.58
CS 134	31.3	0.65*	0.56*	90.25	5.4	0.65	0.62	75.15	2.59	1.40	0.41	76.80
CS 144	22.8	0.48	37.61	63.18	6.6	0.78	1.53	93.33	2.46	0.98	1.34	72.67
CS 167	23.4	0.87	31.55	65.10	5.0	0.93	0.19	69.09	2.53	1.09	0.08	74.90
CS 170	21.5	1.14	82.93	59.04	5.4	1.37	1.58	75.15	2.48	0.61	0.25	73.31
CS 180	18.6	0.80	36.53	49.81	5.2	1.21	0.31	72.12	2.61	0.60	1.05	77.43
CS 185	30.4	0.61	12.96	87.39	5.3	0.97*	-0.04	73.64	2.73	1.03	0.42	81.24
CS 186	24.3	1.39	53.28	67.96	5.8	1.20	0.11	81.21	2.62	0.53	0.73	77.75
CS 187	23.7	1.26	14.02	66.05	5.1	1.02	0.12	70.61	2.92	0.72	0.56	87.28
CS 210	25.3	0.59	32.42	71.15	5.6	0.76	0.29	78.18	2.70	1.06	0.06	80.29
CS 211	27.7	1.21	17.30	78.79	5.4	1.21	1.17	75.15	2.90	0.74	0.58	86.64
CS 212	28.3	0.93	6.83	80.70	4.8	0.62	0.85	66.06	2.47	0.93	0.46	72.99
CS 215	26.9	1.11	32.28	76.24	5.6	1.32	0.94	78.18	2.52	0.93	0.20	74.58
CS 221	25.8	1.17*	0.63	72.74	5.3	1.12	0.94	73.64	2.52	0.29	0.57	74.58
CS 225	24.5	0.81	19.36	68.60	5.5	0.90*	-0.04*	76.67	2.80	1.27	1.07	83.47
CS 227	29.0	0.71	23.58	82.93	6.6	1.43*	0.03*	93.33	2.53	1.01	0.45	74.90
CS 228	24.6	0.27	7.62	68.92	6.1	1.27	0.20	85.76	2.92	0.87	0.33	87.28
CS 229	24.6	-0.12	9.77*	68.92	5.5	0.82*	-0.04*	76.67	2.48	0.92	0.08	73.31
CS 237	22.5	0.20	16.39	62.23	5.2	1.11*	-0.04	72.12	2.60	0.70	0.15	77.12
CS 238	25.3	0.49	39.16	71.15	5.5	0.91	0.56	76.67	2.48	0.89	0.25	73.31
CS 240	23.5	0.49*	1.01*	65.41	5.7	1.05*	0.01	79.70	2.55	0.85	0.63	75.53
CS 241	23.9	0.71	64.64	66.69	5.8	1.27	0.53	81.21	2.54	0.66*	0.00**	75.21
CS 242	29.5	1.85	21.64	84.52	5.0	0.98*	-0.05	69.09	2.63	1.05	0.06	78.07
CS 244	23.0	0.82	30.39	63.82	5.5	1.18*	0.08	76.67	2.89	0.76	0.21	86.32
CS 245	28.7	1.77	131.42	81.97	5.4	0.89	0.15	75.15	3.15	1.26	0.13	94.58
CS 266	25.0	0.52	10.25	70.19	4.7	0.39	0.15*	64.55	2.57	0.90	0.05	76.17
CS 271	20.1	0.06	16.11	54.59	5.5	0.86*	0.07	76.67	2.52	0.88	0.04	74.58
Population mean	25.71	1.00			5.45	1.00			2.63	1.00		
SE (mean)	2.84	0.45			0.33	0.20			0.35	0.32		

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