Stability and genotype by environment analysis in cassava.

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Introduction

Currently cassava is an important crop in regions at latitude lower than 30° from sea level up to 1800 meters above sea level. Cassava is recognized by its capacity to grow and produce competitively under environmental constraints where few other crops can compete. However, the crop is also distinctive for its remarkable magnitude of genotype by environment interactions. Most breeding programs attempt to produce varieties with temporal stability within considerable spatial and system variability. When varieties are needed for widely different ecosystems or production systems, different genotypes are required because no one variety will serve for all purposes. The objective of this study was to evaluate the yield performance of thirty-eight cassava elites clones in thirteen environments and to analyze their stability of performance across the environments evaluated.

Materials and methods

A group of 38 elite clones adapted and grown in the northern coast of Colombia were evaluated in a uniform regional trial in 13 environments with three replications. Eleven locations (Figure 1) were involved and data from two consecutive years was obtained from two of these locations, thus providing the 13 environments in which the analysis is based. Experimental plots had 25 plants (five rows with five plants each). Only the six central plants were harvested to generate the data analyzed. The stability of performance for fresh root productivity was analyzed following the methodology proposed by Eberhardt and Russell (1966)[1].

Results

Table 1 presents the results of this study. In addition to the average fresh root production across the 13 environments in which this evaluation was performed the standard regression coefficients and deviations from the regression line of Eberhardt and Russell's analysis are provided. The mean yield was above 27 t/ha ranging from 36.2 (SM 1565-17) to 20.9 (SM 1657-14) t/ha of fresh roots, demonstrating the potential of the crop to produce competitively. Other conclusions are:

Clone	Mean	b_i	S^2d_i	Clone	Mean	b_i	S^2d_i
CM 523-7	26.2	1.03	-2.35	SM 1657-14	20.9	0.96	5.02
CM 3306-19	31.4	1.10	17.06	SM 1665- 2	31.2	0.99	6.47
CM 4843-1	28.9	0.34	4.15	SM 1669- 5	27.7	0.80	-8.38
CM 4919-1	31.3	1.25	5.97	SM 1669- 7	26.2	0.83	-11.20
CM 6119-5	25.0	0.88	-3.19	SM 1759-29	25.7	1.24	-5.46
CM 6754-8	28.8	1.14	23.00	SM 1778-45	23.9	0.99	19.84
CM 6758-1	24.0	0.52	17.22	SM 1778-53	26.8	1.11	-11.01
CM 7514-8	27.4	1.16	-4.74	SM 1973-23	28.3	1.42	-3.85
CM 8475-4	22.0	0.84	6.69	SM 1973-25	29.4	1.16	2.47
SB 0216-9	28.2	0.67	31.35	M BRA 384	28.5	1.02	47.45
SGB 765-2	26.5	1.32	1.35	M PER 183	23.1	1.24	0.86
SGB 765-4	25.6	1.32	10.71	M TAI 8	28.6	0.67	0.43
SM 643-17	25.0	0.82	-9.50	M VEN 25	30.6	1.01	17.73
SM 805-15	29.6	1.03	-2.67	CG 1141-1	25.3	0.97	-5.44
SM 1411- 5	31.3	0.96	7.14	CM 3306-4	23.8	1.03	-2.22
SM 1438- 2	26.9	0.79	2.28	MCOL 1505	28.5	0.95	7.23
SM 1511- 6	29.6	1.24	-8.51	MCOL 2215	23.2	1.10	-11.24
SM 1565-17	36.2	1.05	31.35	Maximum	36.20	1.42	47.45
SM 1624-2	22.6	1.16	-10.00	Minimum	20.92	0.34	-11.24
SM 1627-16	25.6	0.93	18.94	St. Deviation	3.14	0.22	13.46
SM 1650-7	27.2	0.97	6.47	Average	27.13	1.00	5.04

Table 1.
Stability analysis (Eberhart and Russell Method) for fresh root productivity of 38 cassava clones evaluated in 13 environments in the Northern Coast of Colombia.

A. Clones SM 1565-17 (36.2 t/ha); CM 3306-19 (31.4 t/ha); CM 4919-1 (31.3 t/ha); SM 1411- 5 (31.3 t/ha); SM 1665- 2 (31.2 t/ha) were the five highest yielding materials.

b. SM 1565-17, SM 1411- 5 and SM 1665- 2 had a good stability with regression coefficients close to one (one of the criteria for identifying stability). With the exception of SM 1565-17, their deviations from the regression line (the second criteria for identifying stability) were also low.

c. Clones SGB 765-2[2] and SGB 765-4[3], which were developed through participatory breeding approach, showed the second and third largest regression coefficients in the entire experiment, suggesting that they are particularly well adapted to high-input or high-productivity environments.

d. Results suggest that it is possible to identify cassava germplasm with high yield potential and stability of production. Other variables analyzed were harvest index and dry matter content in the roots.

[1] Eberhart, S. A. Roussel, W. A. 1966. Stability parameters for comparing varieties. Crop Science. V6, p 36-40.
[2] López M., J.A.; Jaramillo M. 2000. CORPOICA Caribeña: variedad de yuca para consumo fresco e industrial seleccionada por los agricultores de la Región Caribe Colombiana. Publicación de CORPOICA, Código 4.2.3.02.34.00.
[3] López M., J.A.; Jaramillo M. 2000. CORPOICA Rojita: variedad de yuca para consumo fresco e industrial seleccionada por los agricultores de la Región Caribe Colombiana. Publicación de CORPOICA, Código 4.2.4.02.34.00.