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"EVALUATION OF SUNFLOWER CULTIVARS IN SOUTH AMERICA"

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SUMMARY

In South America, except in Argentina, the sunflower has not been an economical important crop. The Inter American Institute of Cooperation for Agriculture (IICA) has interest in developing it as an alternative crop; for this reason the SURCOSOL was created, which one of the main task is the evaluation of local cultivars as a way of promoting the development of the crop in South American countries: Brazil, Bolivia, Chile, Paraguay, Uruguay and Argentina. An analysis of adaptability (Eberhart and Russell, 1966) was applied to six sunflower cultivars, three local open pollinated varieties and three hybrids, grown in four replication trials at fourteen environments. The means for oil content and seed and oil yield of all cultivars for each site provided a quantitative description of the environments. The cultivar adaptability was measured as the linear regression of the individual mean on the mean average for each environments. The high oil content hybrid was Cargill S-400 but the most sensible variety to favorable environmental change for this character was Peredovick. The highest yield in seed and oil was reached by the hybrid A 1168 INTA with 2790 and 1187 kg/ha, respectively, showing average stability in all environments.

INTRODUCTION

In South America, except Argentina, the sunflower has not been an economical important crop. The Inter American Institute of Cooperation for Agriculture (IICA) has interest in developing it as an alternative crop; for this reason the SURCOSOL was created, which one of the main task is the evaluation of local cultivars as a way of promoting the development of the crop in South American countries: Brazil, Bolivia, Chile, Paraguay, Uruguay and Argentina.

Finlay and Wilkinson (1963) proposed the used of linear regression of individual cultivar yields on the mean yield of all cultivars in each environment as a measure of yield stability. Eberhart and Russell (1966) proposed a similar regression model with defined stability parameters: cultivar mean, regression coefficient and deviation from regression, that may be used to describe the performance of a cultivar over several environments. A stable variety responds exactly to the environmental changes and does not interact with the environments. A desiderable cultivar has to exhibit a high mean yield, unit regression coefficient, and deviation from regression as small as possible. Stroike and Johnson (1972) and Jowett (1972) used regression analysis to characterize winter wheat cultivars and sorghum respectively.

Comparison of regression coefficients of oil content and seed and oil yield on environmetal index is analyzed in this present paper as a way of characterizing adaptation and potential of six cultivars in South American.

MATERIAL and METHODS

The combined analysis was used to determine the relative magnitudes of variance components,based on the SURCOSOL trial data For the examination of individual cultivar response, locations and years were considered as 14 different environments (Table 1).

Table 1: Geographical Situation of trials

Location	Geographical Situation	
	Latitude	Longitude
La Platina, Chile	33° 34' South	70° 38' West
Balcarce, Argentina	37° 48' South	58° 15' West
Londrina, Brazil	23° 22' South	51° 10' West.
Porto Alegre, Brazil	30° 05' South	51° 39' West
La Estanzuela, Uruguay	34° 50' South	57° 50' West
Manfredi, Argentina	31° 49' South	63° 46' West
Pergamino, Argentina	33° 56' South	60° 33' West
Caacupe, Paraguay	25° 24 South	57° 06' West

The cultivars were three open pollination varieties: Guayacan INTA, Estanzuela Yatay, and Peredovick; two commercial hybrids: Cargill S-400 and Dekalb G-90; and one experimental hybrid: A 1168 INTA. The agronomic data was collected according to standard procedures, even though they may have light differences in methods and time of collecting data, it was assumed they were constant.

The mean of a variety at each environment is regressed upon the environment average to produce two stability parameters for each variety: regression coefficient and a mean deviation from regression. A cultivar with a regression coefficient equal to one responds to favorable conditions as the environmental mean. A cultivar with a regression coefficient greater than one is responds to increasingly favorable conditions as regards environmental mean while a cultivar with a regression coefficient less than one does not.

RESULTS

The analysis of variance for oil content, and seed and oil yield of the six cultivars in fourteen environments is presented in Table 2. Environment, cultivar, and cultivar x environment mean squares were significant at the 1 % level of probability.

Table 2. Analysis of variance for oil percentage and seed and oil yield of 6 sunflower cultivars at 14 environments in South America.

Source	d.f.	Mean Square		
		Oil Content	Yield kg/ha	
			Seed	Oil
Environment	13	125.9 **	14021697 **	254617
Error	42	6.7	360759	63660
Cultivar	5	589.9 **	786757 **	1098353 **
Cultivar x Environment	65	13.1 **	736052 **	148916 **
Error	210	2.7	151833	27033

** Significant at the 0.1 % level of probability.

The significant mean square for environments indicates that the environments differed in potentiality for oil content and seed and oil yield (Table 3). Environmental mean of oil content in the seed ranged from 38.5 % for Londrina 89/90 to 45.6 % for

Porto Alegre 90/91, being the average 41.9 % . The best environment for seed and oil yield was La Platina (Chile) with 3505 and 1546 kg/ha, respectively, while the environment with less potential was Porto Alegre 89/90 (836 and 360 kg/ha respectively).

Table 3: Environmental mean performance for oil percentage and seed and oil yield (kg/ha) at 14 environments.

Environment	Oil Content	Yield Seed	Yield Oil
		kg/ha	
La Platina 90/91	44.1 bc	3505 a	1546 a
La Platina 89/90	43.1 c	2979 bc	1277 b
Balcarce 90/91	40.6 d	2896 bc	1176 bc
Londrina 90/91	40.5 d	2850 bc	1154 bc
Porto Alegre 90/91	45.6 a	2471 d	1131 bc
La Estanzuela 89/90	40.1 d	3094 b	1105 c
Manfredi 89/90	41.1 d	2698 cd	1104 c
Pergamino 90/91	39.8 de	2684 cd	1062 c
Caacupe 90/91	43.2 c	2062 e	895 d
Caacupe 89/90	45.5 ab	1840 ef	841 d
Manfredi 90/91	40.2 d	2095 e	814 d
Pergamino 89/90	40.2 d	1683 f	605 e
Londrina 89/90	38.5 e	2850 bc	465 ef
Porto Alegre 89/90	43.2 c	836 g	360 f
Average	41.9	2348	967
LSD (0.05)	1.5	350	147
C.V.%	3.9	16.6	17.0

* Means followed by the same letter are not significant different at the 5 % level of probability (LSD).

The significant relative magnitude of the cultivar x environment interaction implyes that the cultivars rank differently at the individual environment, which is expected in trials involving a large geographic area (Table 1).

The significant mean square for cultivars indicates that the cultivars differed potentially for oil content and seed and oil yield. The characterization of the six cultivars is presented in the Tables 4, 5, and 6. The highest oil content hybrid was Cargill S-400 (46.2) differing significantly (LSD 0.05) from the other cultivars; but the most sensible variety to favorable environment change for this character was Peredovick . The high yield in seed and oil was reached by the hybrid A 1168 INTA with 2790 and 1187 kg/ha, respectively, showing average stability (

regression coefficient not significantly different from one) in all environments for seed and oil yield, but it had a significantly regression coefficient less than one for oil content indicating it was less responsive to environment change than the performance of all the cultivars making up the environment mean.

Table 4. Mean oil percentage, regression coefficients and deviations from regression for the 6 cultivars across the 14 environments.

Cultivar	Oil Content	Regression Coefficient	Standart Deviation
Cargill S-400	46.2 a [†]	1.256	0.233
Peredovick	43.9 b	1.487 * [2]	0.172
A 1168 INTA	43.3 b	0.847 *	0.215
Dekalb G-90	41.1 c	0.336	0.174
Guayacan INTA	39.4 d	1.102	0.157
Estanzuela Yatay	37.2 e	0.971	0.101
Average	41.9		
LSD (0.05)	0.6		
C.V. %	3.9		

[†] Means followed by the same letter are not significant different at the 5 % level of probability (LSD).
[2] Indicates regression coeficient is significantly different than one at the 5 % level of probability.

Table 5. Mean seed yield, regression coefficients and deviations from regression for the 6 cultivars across the 14 environments.

Cultivar	Seed Yield kg/ha	Regression Coeficient b	Standart Deviation s_d
A 1168 INTA	2790 a [†]	1.084	0.116
Estanzuela Yatay	2632 b	1.125	0.071
Dekalb G-90	2548 b	1.008	0.181
Guayacan INTA	2194 c	0.787	0.164
Cargill S-400	2142 c	1.125	0.162
Peredovick	1782 d	0.872	0.137
Average	2348		
LSD (0.05)	145		
C.V. %	17		

[†] Means followed by the same letter are not significant different at the 5 % level of probability (LSD).

Table 6. Mean oil yield, regression coefficients and deviations from regression for the 6 cultivars across the 14 environments.

Cultivar	Seed Yield kg/ha		Regression Coefficient	Standart Deviations
A 1168 INTA	1187	a [1]	1.075	0.116
Dekalb G-90	1023	b	0.845	0.185
Cargill S-400	993	bc	1.362	0.161
Estanzuela Yatay	961	c	0.973	0.065
Guayacan INTA	850	d	0.722	0.159
Peredovick	787	e	1.022	0.151
Average	967			
LSD (0.05)	61			
C.V. %	17			

1 Means followed by the same letter are not significant different at the 5 % level of probability (LSD).

DISCUSSION and CONCLUSION

The present analysis of plotting oil content and seed and oil yield as a linear function of the environments is a valuable method when it is necessary to make a broad approach of thecultivar potential over a range of environments.

The reduced number of cultivars and environments makes these results as orientation to future breeding programme.

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