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Original article

Answer of the yield and some of its components in soybean cultivars (*Glycine max* (L.) Merril)

Respuesta del rendimiento y algunos de sus componentes en cultivares de soya (*Glycine max* (L.) Merril)

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ABSTRACT: The research was developed in the areas of the Jucaibama's Agricultural Experiment Station perteneciente to Investigaciones's Institute Agricultural Jorge Dimitrov. The objective was to evaluate the behavior of the yield and some of its components, nine cultivars of soybean, in the little rainy epoch on a mellow Fluvisol soil. Nine soybean cultivars were used (IS-36, William-82, Brillante, Vencedora, IS-1, DT-99, Duocrop, IS-27, IS-24), the sow accomplished in the month of December in 0.70 m between furrows and 0.05 m between plants. Plots of land of four furrows of five meters in length, for a total area of 14 m^2 were utilized, in a design at blocks at random with four replies. An analysis of variance of double classification and the multiple comparison of stockings was executed by means of Tukey's test for $p \leq 0.05$. Different answers between cultivars in all the evaluated variables were observed and all cultivars showed superior yields to 1 t ha^{-1}, with values that oscillated between 1.05 and 1.86 t ha^{-1}.

Keywords: variety, pods, variables, grains.

RESUMEN: La investigación se desarrolló en áreas de la Estación Experimental Agrícola de "Jucaibama", perteneciente al Instituto de Investigaciones Agropecuarias "Jorge Dimitrov". El objetivo fue evaluar el comportamiento del rendimiento y algunos de sus componentes en nueve cultivares de soya, en la época poco lluviosa, sobre un suelo Fluvisol mullido. Los cultivares evaluados fueron: IS-36, William-82, Brillante, Vencedora, IS-1, DT-99, Duocrop, IS-27, IS-24; la siembra se realizó en el mes de diciembre en un marco de 0,70 m entre surcos y 0,05 m entre plantas. Se utilizaron parcelas de cuatro surcos de cinco metros de largo, para un área total de 14 m^2, en un diseño en bloques al azar con cuatro réplicas. Se realizó un análisis de varianza de clasificación doble y la comparación múltiple de medias se ejecutó mediante la prueba de Tukey para $p \leq 0,05$. Se observaron respuestas diferentes entre los cultivares en todas las variables evaluadas y todos los cultivares mostraron rendimientos superiores a 1 t ha^{-1}, con valores que oscilaron entre 1,05 y 1,86 t ha^{-1}.

Palabras clave: variedades, vaina, ambiente, granos.

INTRODUCTION

Leguminous plants are a globally important agricultural crop, among which soybean (*Glycine max* L.) stands out for its high protein content, oligosaccharides, high concentration of unsaturated fatty acids, high levels of vitamin E, lecithin and other compounds, and is universally used in human and animal diets (1). It is one of the oldest crops of mankind and is currently a source of oil and vegetable protein of great importance in the world. On average, dry beans contain 20 % oil and 40 % protein (2).

Soybeans have excellent nutritional qualities, making them the most attractive oilseed for the production of industrial products for animal and human consumption (3). The environment defines the growth and development of the crop and, therefore, the productive response of the chosen maturity group (4). The genotype-environment interaction (GxA) is an extremely common phenomenon, fundamental at the time of evaluating: the stability; the specific and general adaptations of cultivars in a certain environment, in which it is intended to be introduced, as well as the productive potentials and limitations of these in the localities (5).

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The response of soybean in different environmental conditions is an aspect to be considered in the choice of cultivars with greater adaptation to the production regions and in the adjustment of crop management practices. It is of utmost importance to study the yield behavior of different cultivars for certain environmental conditions, since these interact with soil and climatic factors (6).

The crop depends on the environmental conditions under which it develops and on the capacity of the varieties to adapt to the conditions offered by the environment. For this reason, in the introduction and validation of new and more productive cultivars, the selection of promising genotypes is of great importance (7).

For the above mentioned, the objective of this work was to evaluate the behavior of yield and some of its components in nine soybean cultivars in the little rainy season in Bayamo municipality, Granma province.

MATERIALS AND METHODS

The experiment was developed in the low rainy season in a mellow Fluvisol soil (8), in areas of the Agricultural Experimental Station of "Jucaibama", belonging to the Agricultural Research Institute "Jorge Dimitrov". Cultivars studied were: IS-36, William-82, Brillante, Vencedora, IS-1, DT-99, Duocrop, IS-27, IS-24.

The chemical characteristics of the soil are presented in Table 1. Soil preparation was carried out with animal traction; the tillage was: plowing, raking, crossing, harrowing and furrowing. Fertilization was organic with worm castings of cow manure at the bottom of the furrow at the time of planting, at a rate of 6 t ha^{-1} (9).

Planting was carried out in the second half of December, at 0.70 m between rows and 0.05-0.07 m between plants, in plots of four rows of five meters long, distributed in a randomized block design with three replications. Four irrigations were applied; at sowing, after germination, flowering and fruiting. Weed control was carried out manually with a hoe, keeping the experiment free of undesirable plants during its execution. There were no significant effects due to the incidence of pests and diseases, so there was no need to apply chemical products.

The variables evaluated and the methodology used are described below:

- Plant height (cm): during harvest, the height of ten randomly selected plants in the calculation area of each plot was measured with a tape measure and the average was estimated.
- Pod length (cm): during harvest, the length of ten randomly selected pods in the calculation area of each plot was measured with a graduated ruler and the average was estimated.
- Pod diameter (cm): during harvest, the diameter of ten randomly selected pods in the calculation area of each plot was measured with a caliper and the average was estimated.
- Seed weight per plant (g): during harvest, the mass of all the seeds of ten randomly selected plants in the calculation area of each plot was weighed with an analytical balance and the average was estimated.
- Weight of one hundred seeds (g): during harvest, the mass of one hundred seeds selected at random in the calculation area of each plot was weighed with an analytical balance and the average was estimated.
- Yield (t ha^{-1}): was calculated on the basis of the two central furrows of each plot, discarding the plant at the ends to avoid the edge effect, expressed in t ha^{-1}.

Statistical processing of the data was carried out using the statistical package (10). A double rank analysis of variance was performed and multiple comparison of means was performed using Tukey's test for $p \leq 0.05$.

RESULTS AND DISCUSSION

Varieties IS-36, IS-27 and William-82 reached the greatest plant heights with values of 61.6, 56.9 and 56.6 cm, respectively, with no significant differences with IS-24 and Vencedora (Table 2). The latter two and the Brillante variety were statistically superior to the IS-1 and DT-99 varieties, which, in turn, showed no significant differences with the Duocrop variety. Duocrop also did not differ from IS-24, Brillante and Vencedora.

The values reached by the varieties IS-36, IS-27 and Williams are higher than the 38 and 42.4 cm of plant height, respectively, referred by other authors in an investigation with *Azospirillum brasilense* in the Ciego de Avila province (11). However, the height reached by the variety IS-27 was slightly lower than that expressed in the spring season, in an experiment developed at the Central University "Martha Abreu" of Las Villas, where a height of 64 cm was measured (12).

The values registered in the varieties IS-24 and IS-27 were lower than 74 and 71 cm, respectively, a criterion supported by the study of soybean varieties in the winter season, in the center of the country (13).

The values expressed by these last two varieties are higher than those referred by some researchers, who indicated in these same varieties values of 8 and 11.8 g, respectively, in an experiment developed in the province of Las Villas (12).

Table 1. Soil chemical characteristics

Depth	pH		OM	P_2O_5	K_2O	Exchangeable cations s				T
(cm)	H_2O	KCl	(%)	(mg 100 g soil)		Ca	Mg	Na	K	CCC
								Cmol kg^{-1}		
0-20	6.4	4.98	3.27	3.82	16.87	13.33	5.20	0.22	0.31	19.27

Table 2. Behavior of plant height, pod length and diameter, and seed mass per plant

Cultivars	PL (cm)	PL (cm)	PD (cm)	SMP (g)
IS-36	61.6 a	4.20 d	0.60 d	8.65 cd
IS-24	54.7 ab	4.31 d	0.40 cd	8.45 cd
Brillante	47.0 b	4.71 ab	0.71 a	14.34 b
IS-27	56.6 a	4.37 d	0.65 bc	11.18 bc
Duocrop	41.2 bcd	4.69 abc	0.69 ab	13.70 b
IS-1	36.4 cd	4.91 a	0.68 abc	9.25 cd
DT-99	31.3 d	4.92 a	0.63 cd	6.06 d
Vencedora	52.7 ab	4.43 cd	0.68 ab	14.34 b
William-82	56.9 a	4.61 bc	0.67 bc	18.13 a
Esx	1.03	0.003	0.49	0.52

PH: plant height, PL: pod length, PD: pod diameter, SMP: seed mass per plant

The weight of one hundred seeds contributes to define sowing norms in any crop and indicates the quantity of seeds and possible plants to achieve in a determined weight (12).

All the cultivars evaluated showed yields higher than 1 t ha-1, with similar behavior among genotypes, except the cultivars Duokrop and DT-99 which were statistically surpassed by the cultivars Brillante, IS-27 and Vencedora. IS-36 was also superior to DT-99.

Yield variability is closely related to the role played by meteorological conditions in the definition of these indicators for a given cultivar, an aspect that explains how some cultivars respond better than others to the edaphoclimatic conditions of a given location (16). Therefore, it is of great importance to study the yield behavior of different soybean cultivars for certain environmental conditions (6).

The yields achieved by the varieties were lower than those obtained in other investigations (17), in the spring season under conditions of the Scientific and Technological Base Unit, Los Palacios, which indicated values higher than 2.88 t ha-1 in other varieties. However, the value expressed by the DT-99 variety was slightly lower than that achieved for this season (17).

El peso de cien semillas contribuye a definir normas de siembra en cualquier cultivo e indica la cantidad de semillas y posibles plantas a lograr en un peso determinado (12).

Yields registered in the varieties IS-36, IS-24, IS-27, IS-1 and William-82 in a Fluvisol soil in cold season, were much lower than those expressed by these same varieties in this experience, in an experiment developed, in the period of January-April in La Victoria farm in Santiago de Cuba, were of 0.97, 1.05 and 1.08 t ha^{-1}, respectively (18). However, the yield of soybean cultivars with greater adaptation to the specific agroclimatic conditions of each locality is considered in Cuba as an important strategy to achieve better productive results (7).

CONCLUSIONS

All cultivars evaluated showed yields higher than 1 t ha^{-1}, with values ranging from 1.05 to 1.86 t ha^{-1}.

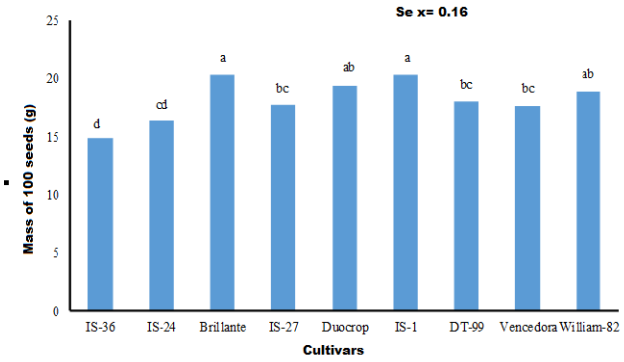

Figure 1. One hundred seed mass behavior of soybean cultivars

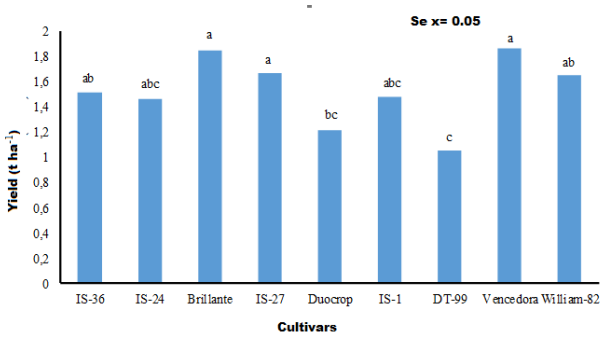

Figure 2. Yield behavior of soybean cultivars

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