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SELECTION AND IMPROVEMENT OF S6 LINES IN WHITE GRAIN SORGE IN SAN PEDRO COMITANCILLO, OAXACA

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Abstract: In Oaxaca, an area of 20,766 hectares of grain sorghum was planted in 2018, with 91.4 % of this area corresponding to the Isthmus of Tehuantepec region. 98% is cultivated with hybrids and the rest with open-pollinated varieties. In order to avoid dependence on improved seeds, at the Technological Institute of Comitancillo, a genetic improvement program has been started through the selection of white grain populations. The production of white grain sorghum represents a great opportunity due to its higher protein content and being a stimulus or condition for a better harvest price compared to red grain sorghum. The objective of this work was to select and characterize lines in S6 of populations of white sorghum, for the creation of open-pollinated varieties or progenitors of hybrids under local conditions. In the spring-summer 2018 agricultural cycle, a total of 114 lines generated in a previous year were evaluated. 26 % of the germplasm presented a grain yield of 3.82 ton/ha, the panicle length ranged from 14.8 to 25 cm, the panicle diameter was 2 to 8.4 cm, in weight of 1000 grains 22.6 to 40 g, grains per panicle from 855 to 2400. It is recommended to increase seeds of the outstanding lines, to carry out yield tests and establish validation plots with regional producers.
Keywords: White Sorghum, Open Pollinated, Germplasm.

INTRODUCTION

In Mexico, sorghum is the second most important annual crop after maize. It occupies 13.5% of the planted area. The states that contribute the largest volume of production are: Tamaulipas, Guanajuato, Michoacán, Sinaloa and Jalisco. In Oaxaca, the area sown to grain sorghum in 2018 was 20,766 ha, with 91.4 % of this area corresponding to the Isthmus of Tehuantepec region and an average yield of 3.15 ton/ha (SIAP, 2018).

Villeda (2014), indicates that the plant is resistant to drought, produces considerably more than corn in regions with low rainfall, it also develops where rainfall is abundant and reaches favorable development in months with an average annual rainfall of 450 to 650mm. The same source mentions that even when the plant produces under an unlimited amount of moisture, it can stop producing under extremely dry conditions.

Although sorghum arrived in Latin America in the 16th century, the crop did not become important until the present century. Until 1950, the genotypes cultivated in the USA were selections of natural and artificial mutations and crosses. Soon after, new hybrids and parental lines were developed and hybrid seed distribution began in 1956, reaching Mexico and Argentina in 1957. Since then, grain sorghum production has been important in Latin America (House, 1982).

MATERIALS AND METHODS

The present work was carried out during the spring-summer agricultural cycle of 2018 in the experimental fields of the Technological Institute of Comitancillo, Oax. The climate of the place is characterized by being warm sub-humid with Awo (w) ig, the driest of the sub-humid, with a rainy regime in summer, isothermal and with the hottest month before the summer solstice. The average annual temperature is 27°C, being the highest in the month of May. The dominant winds that occur in the region come from the northwest, which are identified in the months of October to March reaching speeds of 70 to 90 km/h. The average annual rainfall is 600 mm; the rainy season covers from the second half of May to the first days of October, being quite irregular. The average annual evaporation is 2388 mm. The relative humidity during the rainy season is 57%, in the dry season it is 34%, with an annual average of 43.6%. (DIGEPO, 2015)

The genetic material under study consisted of 114 lines, derived from the selection of the 2017 spring-summer agricultural cycle, which were subjected to homogeneous field management. This selection cycle was not subject to experimental design, the experimental batch was regular, where the lines were located equally. Each line or treatment under study consisted of two furrows. The furrow measured 5 m long and 0.60 m wide. Planting was carried out on July 14, 2018. The number of seeds per linear meter was 15, ensuring that 10 plants were registered at harvest.

In the flowering stage, the bagging of spikes was carried out in an average of 10 plants of each line, in order to avoid outcrossing. The bags must be removed after the flowering period. To avoid harvest losses, care and surveillance strategies were carried out to reduce the damage caused by birds. The harvest and estimation of yields were the relevant activities in this period. The variables of the yield component, important for the achievement of the objectives of the project, such as panicle data, field weight, determination of grain moisture, weight of 1000 grains, number of grains in the panicle, were determined.

Once the variables were captured and ordered, the respective frequency tables were obtained. The analysis was carried out with the statistical package SAS.

RESULTS AND DISCUSSION

1. Grain yield

This variable defines the feasibility of the crop, which is why it is considered one of the most important characteristics to study in a process of genetic improvement. Of the total lines, 29 registered a grain yield of 3.82 ton/ha (Figure 1). It is worth mentioning that lines were reported that reached a yield close to 5 ton/ha, data much higher than what is reported in the region of the Isthmus of Tehuantepec (SIAP, 2018) of 3.15 ton/ha.

2. plant height

The height of the plant obtained from the 114 lines is shown in Figure 2, a minimum value of 80 cm and a maximum value of 146 cm were presented. These data coincide with what Espinosa et al. (2009); who mention a range of 100 - 140 cm of sorghum hybrids recommended for the Tehuantepec Isthmus region, under rainfed and irrigated conditions. The highest frequency (37 lines) presented a height of 126 cm. The highest height (140 cm) was recorded only in 3 lines. Montes et al. (2012), evaluated the RB PALOMA variety, a variety of white sorghum for grain and forage production, in four environments in the state of Tamaulipas, with average data of 188 cm.

With this information, it is determined that a large part of the genotypes under study have good potential for resistance to abiotic factors, specifically, tolerance to lodging caused by strong winds that occurs in the Isthmus region of Oaxaca.

3. Number of days to flowering

Flowering occurred in a range of 73 to 86 days after sowing (Figure 3). Using the frequency table of this variable, it was detected that a large number (33) lines flowered 79.5 days after planting. Earliness was demonstrated in 3 genotypes studied (73 days after sowing), while 2 of them were late (greater than 85 days after sowing).

4. Exercion

The profitability of sorghum cultivation lies in the use of technologies throughout the production process, particularly the harvest must be mechanized, for this activity materials with good exertion are required, to prevent the harvested grain from presenting the least amount of impurities. The variable was absent in 43 lines. In the present study, 25 lines presented a peduncle extension of 0.72 cm. A greater exertion of 6.48 cm was reached

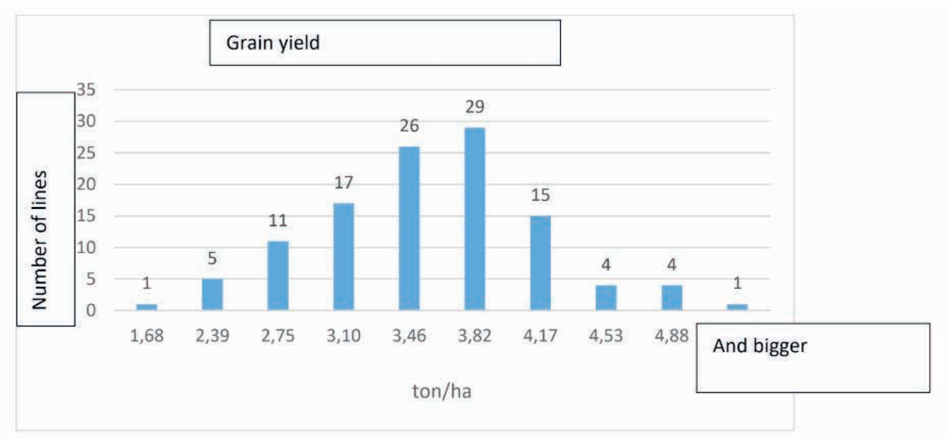

Figure1. Grain yield of 114 lines of white sorghum. SV 2018.

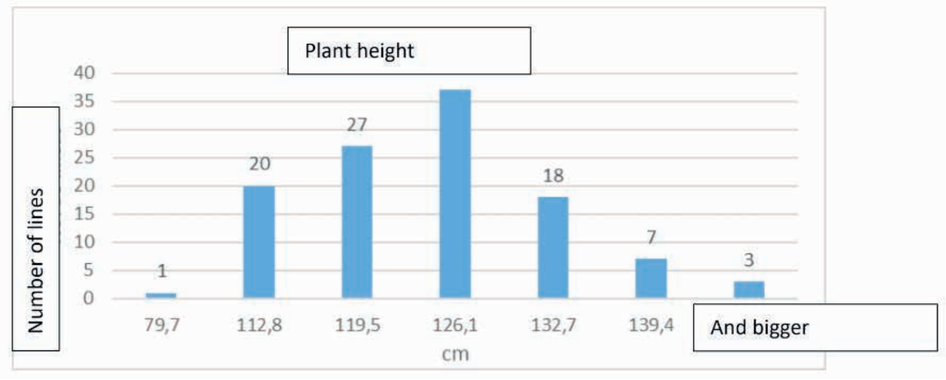

Figure 2. Plant height of 114 lines of white sorghum. PV 2018.

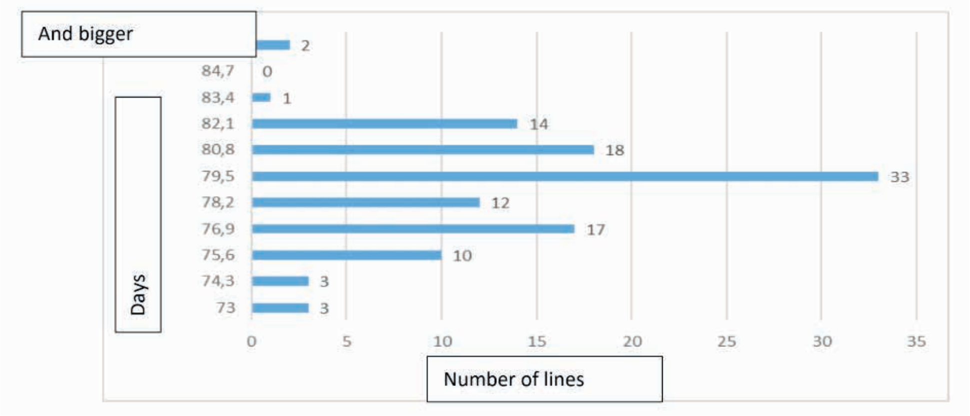

Figure 3. Days to flowering of 114 lines of white sorghum. SV 2018.

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in 3 lines (Figure 4).

5. Panicle length

The length of the panicle is represented in Figure 5, it was found that 36 lines obtained a panicle that measured 22.64 cm long, however, the minimum value was 14.8 cm, while the maximum value recorded was 24.88 cm. The length and type of panicle constitute a determining variable in grain yield.

6. Panicle diameter

The diameter of the panicle (Figure 6), shows that the thickness of the panicle ranged between 2 and 8 cm. The largest number of lines analyzed (28) had a panicle diameter of 6 cm, while only 3 of them obtained low values in this variable and 4 had panicles with a diameter greater than 8 cm. Panicle diameter has a certain relationship with grain yield.

7. 1000 grain weight

The weight of each grain is related to grain yield, although to a lesser extent with the number of grains per panicle; therefore, sorghum genotypes with higher grain weight also contribute to greater yield stability across different environments (Clegg et al., 1983)

The weight of 1000 evaluated grains can be seen in Figure 7. A minimum value of 22.5 g and a maximum value greater than 38 g were recorded. A total of 29 lines obtained a weight of 31 g. The data obtained agree with Compton (1990), who indicates that the weight range of 1000 sorghum grains is from 20 to 40 g.

8. Number of grains per panicle

The number of grains per panicle is represented in Figure 8, 20 lines reached 1847 grains per panicle. The minimum value was 855 grains and a maximum value of 2400 grains per panicle. This variable is related to the length of the panicle. Compton (1990) points out that, depending on the type of panicle, there can be from 800 to 4000 grains in the panicle.

CONCLUSIONS

1. 26 % of the germplasm under study presented a grain yield of 3.82 ton/ha.

2. Performance components were found in the following ranges:

- Panicle length: 14.8 cm – 25 cm
- Panicle diameter: 2 – 8.4 cm
- Weight of 1000 grains: 22.55 g – 40 g
- Grains per panicle: 855 - 2400

3. The height of the plant manifested in 33 % of the lines analyzed was 126 cm

4. 29% of the lines flowered 79 days after sowing.

5. The exertion was presented in 71 lines with values from 0.72 cm to 6.5 cm.

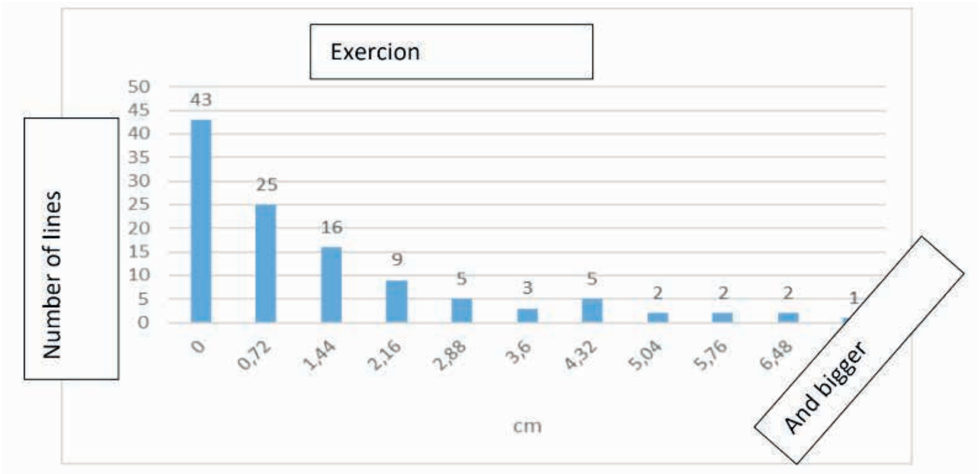

Figure 4. Exertion of the panicle of 114 lines of white sorghum. SV 2018.

Figure 5. Largo de la panoja de 114 líneas de sorgo blanco. PV 2018.

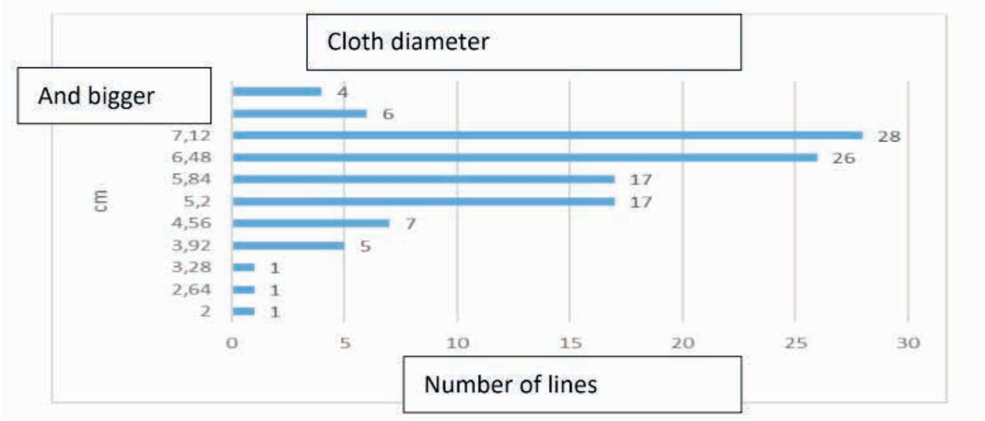

Figure 6. Panicle diameter of 114 lines of white sorghum. SV 2018.

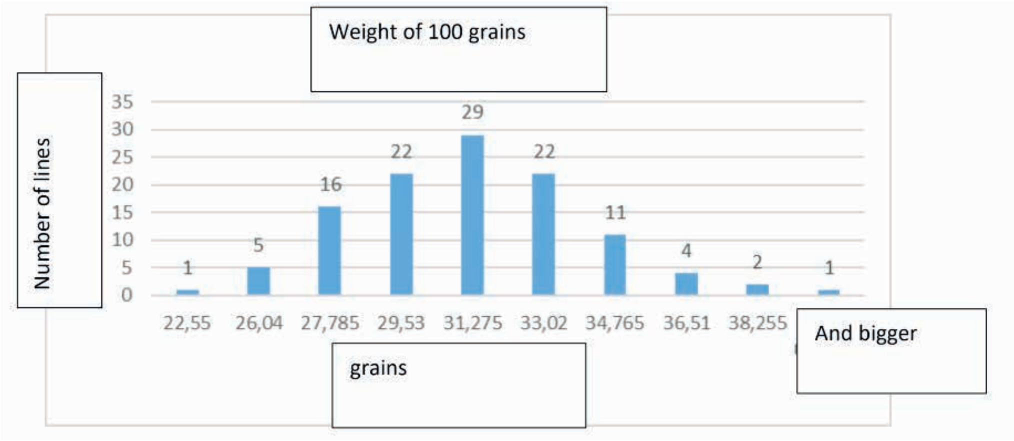

Figure 7. Weight of 1000 grains of white sorghum. SV 2018.

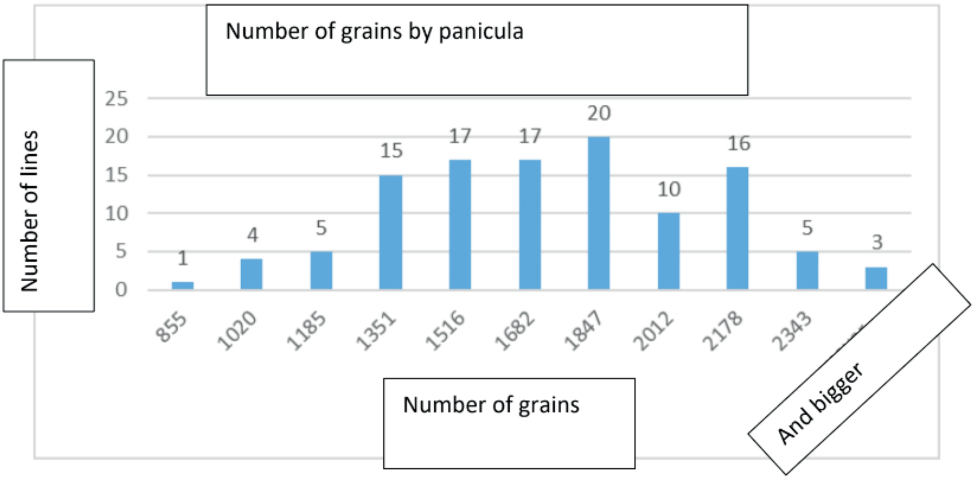

Figure 8. Number of grains per panicle of white sorghum. SV 2018.

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