Grain Quality Analysis of Sorghum Cultivars from El Salvador, C.A.

V. R. Calderon[1,2], L. Rooney[1,2] , S. Mason[2,3],C. McDonough[1]

1. Cereal Quality Laboratory, Texas A&M University, College Station, TX, 77843-2474
2. International Sorghum & Millet Collaborative Research Support Program, INTSORMIL, USA
3. Agronomy Faculty.University of Nebraska, Lincoln, NE, 68583-0915

ABSTRACT

Grain quality factors of fourteen sorghum cultivars grown in four different locations in El Salvador were evaluated. The objective was to determine the effect of nitrogen application (0.0 and 20 kg/ha^{-1}) on yield and grain quality of sorghum. Grain yield and true density were significantly affected by nitrogen application for all locations; overall effect on quality grain was minimal. Differences among varieties by location were found and correlations between parameters were studied. In general, the varieties present excellent quality and milling properties and could be used for utilization.

INTRODUCTION

Sorghum is the third most important basic grain crop in El Salvador, usually grown by poor farmers on infertile soils with low fertilizer inputs.Traditionally sorghum has been used largely as poultry and swine feed, but in recent years food uses of white sorghum in bakery products, tortillas and snacks has increased.

The objective of this study was to determine the influence of Nitrogen application on grain yield and quality of 12 experimental varieties compared with two food-grade sorghums grown in El Salvador.

METHODOLOGY

In 2004, fourteen varieties consisting of 12 lines obtained from ICRISAT and two local, commercial food sorghums were grown at four locations: Suchitoto (Cabañas), Barrio Nuevo (Zacatecoluca), San Miguel and Tejutepeque (La Paz). (Table 1).

Table 1. ICRISAT lines and Control varieties

- Soberano (control, Fig.1)
- Jocoro (control)
- ICSVLM-93077
- ICSVLM-90520 (Fig. 2)
- ICSVLM-89513
- ICSVLM-92512 (red pericarp)
- ICSVLM-93076
- ICSVLM-89537
- ICSVLM-93079
- ICSVLM-89524
- ICSVLM-92522 (red pericarp)
- ICSVLM-90510
- ICSVLM-93081
- ICSVLM-93065

Fig. 1 Soberano Sorghum Variety (control)

Fig 2. ICRISAT Sorghum Variety (ICSVLM-90520)

Grain Samples were analyzed in triplicate for physicochemical components like: starch,moisture, protein, density (true and bulk), hardness, pericarp color and milling characteristics.

ANOVA analysis was performed using two treatments established as N1 (0.0 kg/ha^{-1} Nitrogen) and N2 (20 kg/ha^{-1} Nitrogen). Locations were used as replications. Least significant differences at P=0.05 were used to separate location and variety means, and Pearson correlations were calculated to assess association among grain yield and the different quality parameters measured.

RESULTS AND DISCUSSION

◆ 20 kg/ha^{-1} nitrogen significantly increased yield and true density of the grain. Variety by Nitrogen rate interactions were not found.

◆ Significant differences among varieties by location were present for all measured parameters except true density (Table 2.) Environmental conditions affected starch, bulk density, color, hardness, milling properties and grain size.

◆ Important correlations between grain quality parameters were found : between grain yield and protein (R^2 =-0.66), starch-protein (R^2 =-0.91), hardness and milling properties (R^2 =0.75), true density and hardness (R^2 =0.57).

Table 2. Differences Among Varieties (San Miguel location) using Least Significant Difference.

	Yield	Color			Density		Protein	Starch	TADD	(%) SKFT (mm)	
Variety	(Kg/ha)	A	b	L	Bulk	TRUE	%	%	%	Hardness	Diameter
SOBERANO	2895	2.9	17	63.4	55.9	1.41	7.4	80.2	81.4	80.7	2.09
JOCORO	2544	3.2	18	62.1	56.4	1.41	8.8	79.3	85.4	93.4	1.78
ICSVLM-93077	2214	4.5	16	57.9	55.1	1.40	8.9	78.4	80.4	69.9	2.39
ICSVLM-90520	3001	3	16	62.1	55.4	1.40	7.4	80.3	82.1	80.3	2.01
ICSVLM-89513	2652	4.2	18	60.1	55.4	1.38	8.2	78.7	81.2	72.2	2.22
ICSVLM-92512	2275	10.7	14	48	55.6	1.40	9.8	76.8	84.4	80.6	2.17
ICSVLM-93076	2374	3.9	18	59.5	55.8	1.40	7.8	79.6	84.8	89.8	1.96
ICSVLM-89537	2572	4	17	59.9	55.6	1.39	7.8	78.7	83.1	80.7	1.72
ICSVLM-93079	2284	4.1	16	58.8	55.5	1.40	8.5	79.2	83	78.9	2.28
ICSVLM-89524	2533	3.2	17	62.7	55	1.40	7.4	80.5	83.2	82.8	1.92
ICSVLM-92522	2284	10.2	15	48.6	54.6	1.39	8.4	77.6	78.3	75.6	2.05
ICSVLM-90510	2596	3.6	17	61.9	56.7	1.41	7.8	80.1	83.1	88.6	1.83
ICSVLM-93081	2388	4.2	17	58.7	54.8	1.39	9.1	78.5	77.2	74.2	2.3
ICSVLM-93065	1809	4.2	16	58.5	54.3	1.39	9.7	78.4	77.3	75.2	2.41

◆True density is an index of floury and corneous endosperm ratio inside the kernels (Fig. 3) The higher the density the harder the grain. Harder sorghums had the best decortication and milling properties.

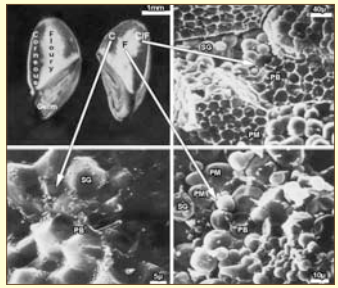

Fig. 3. Photomicrograph of cross-sections of sorghum kernel showing floury and corneous endosperm sections.

◆ Good food sorghum has a white thick pericarp, without a pigmented testa and tan plant color with light color glumes (Fig.5)

Fig. 5. Jocoro (control) sorghum variety (left) with glumes,(right) without glumes

◆ Sorghum pericarp should be easily and efficiently removed by decortication (Fig. 4). Harder kernels with pearly white appearance generally have the best milling properties and highest milling yields.

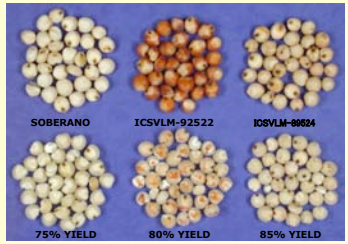

Fig. 4. Sorghum decortications yields

◆ Grain color is determined genetically and may be modified by environmental conditions during/after maturation and storage conditions. (Fig. 6).

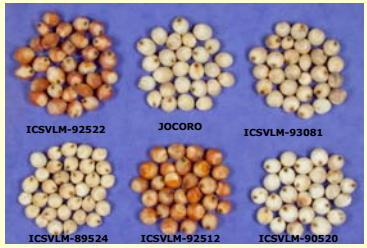

Fig. 6. Differences in pericarp color of ICRISAT lines and control sorghum varieties from San Miguel.

CONCLUSIONS

◆ Nitrogen application of 20 kg/ha^{-1} increased grain yield and true density. Differences in quality parameters among varieties by location were found.

◆ Environmental conditions affected grain quality mainly for starch, bulk density, hardness, decortication properties, grain size and diameter by location.

◆ In general all the varieties had excellent quality.

◆ Most ICRISAT lines had quality similar to Jocoro and Soberano (food-grade sorghums) and could be used for food applications.

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