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Industrial Quality of Bread Wheat in Mexico

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Resumen

México importa anualmente cerca del 50 % del trigo harinero panificable que consume por lo que se deben de liberar variedades de alto mejor rendimiento y calidad, que contribuyan a disminuir su dependencia. El objetivo de la presente investigación fue caracterizar con base en su calidad industrial las variedades y líneas nuevas de trigo harinero, para riego y temporal, que satisfagan las características industriales demandadas para contribuir a la disminución de las importaciones. Se estimaron las variables dureza de grano, fuerza de la masa, relación tenacidad/extensibilidad y volumen de pan. Las variedades nuevas BACOREHUIS F2015, CONATRIGO F2015, DON CARLOS F2015 y VALLES F2015 así como las líneas ND643/2*WBLL1//MUNAL/3/MUNAL#1 y GAVIA/ROM/3/PIRUL/GUI/TEMP/AGR/4/JUCH presentaron grano duro por su valor menor a 47 % asociado con masa fuerte y extensible por sus valores de W mayores a $300x10^{-4}$ J y PL menores a 1.1, respectivamente. Lo anterior se reflejó en volúmenes de pan, cercanos o mayores a 800 ml, similares a las variedades testigo. La producción basada en estas variedades permitirá cubrir la demanda de la industria nacional de la panificación.

Trigo, Calidad industrial, Mejoramiento Genético y Variedades

Abstract

Mexico imports annually about 50% of the consumed bread wheat, in order to reduce this dependence, better varieties in yield and end-use quality are needed. The objective of this research was to characterize the industrial quality of varieties and advanced lines of bread wheat, for both irrigated and rainfall wheat production, in order to identify outstanding genotypes and reduce wheat imports. End use quality estimated parameters were grain hardness, dough strength, dough extensibility and bread volume. The new varieties BACOREHUIS F2015, CONATRIGO F2015, DON CARLOS F2015 and VALLES F2015 as well as lines ND643/2 * WBLL1 / / 3-MUNAL-MUNAL #1 and GAVIA/ROM/3/PIRUL/GUI/TEMP/AGR/4/JUCH showed hard grain for its value less than 47% associated with strong and extensible dough by its W values of over 300 x 10-4 and PL less than 1.1 J, respectively. This was reflected in bread volumes close or over 800 ml, similar to the control varieties. Wheat production based on these varieties will enables meet the needs of national bread industry.

Bread wheat, industrial quality, genetic improvement, varieties

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Introduction

It is now necessary, in addition to increasing wheat wheat production in Mexico, to improve the quality of its irrigated and temporary crops to meet the demand of the national mill industry.

Therefore, in order to favor domestic production, the wheat breeding program of the National Institute for Agricultural and Livestock Forestry Research (INIFAP) must release new varieties, which combine high yield potential, tolerance to foliar diseases (yellow rust and The leaf), efficient in the use of water and with the quality demanded by the industry.

Therefore, the objective of the present investigation was to characterize, based on its industrial quality, the new lines and varieties of flour wheat for irrigation and temporary in Mexico.

Teoretical Framework

During 2014 in Mexico, 3.8 million tons of wheat were harvested; this occurred in 94.4% under irrigation conditions and the rest in temporary conditions (SIAP, 2014).

However, Mexico imported 3.1 million tons of durum wheat and strong bread dough in the United States from North America and Canada, this production is characterized by availability in the market and its harvested lots are homogeneous in its industrial quality is also obtained under temporary conditions, which reduces its production costs (CANIMOLT, 2014).

The quality characteristics of the imported wheats are protein percentages in the flour of 12.6 to 15% associated with gluten strength of 350 to 500 x10-4 J and a tensile / extensibility balanced to extensible ratio of 1.2 to 0.9, which is manifested in obtaining volumes of bread larger than 800 ml (Maghirang et al., 2006).

In such a way that Mexican wheat flour must compete, in price and industrial quality, with imported wheat.

Materials and Methods

The genotypes analyzed in irrigation, as witnesses, were BORLAUG 100, VILLA JUAREZ F2009, ROELFS F2007 and KRONSTAD F2004, as well as the new varieties BACOREHUIS F2015 and CONATRIGO F2015. In addition to the candidate lines for new varieties for irrigation: line 1 or FUERTEMAYO 2016 = ND643 / 2 * WBLL1 // MUNAL / 3 / MUNAL # 1, line 2 or FONSEC F2016 = BECARD / KACHU and line 3 or NORESTE 2016 = ND643 / 2 * WBLL1 / 4 / WHEAR / KUKUNA / 3 / C80.1 / 3 * BATAVIA // 2 * WBLL1. While in temporary the control varieties used were, ALTIPLANO F2007 and TLAXCALA F2000, and the new varieties DON CARLOS F2015 and VALLES F2015. As well as the candidate lines for release as new varieties: line 1 or TEXTOCOF2016 = ZCT / SLM // CHAZ / TEM / 4 / AGA // PVN / PCI / 3 / AGA / 5 / GAV / ROM / 6 / GAL / CMH78A544 / 7 / GAV / ROM / 3 / PIRUL / GUI / TEMP / AGR / 4 / JUCH and line 3 or CIRCE F2016 = TEMP / NORM / 4 / CHLL / ROM / 3 / PRL / VEE # 6 / MYNA / BUL / 5 / TLAX / 6 / BARB / MON / TAW / 3 / INQUILAT / KUKUNA (AltProt "14%").

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Planting of irrigation genotypes was carried out at the Bajío Experimental Field (CEBAJ) of INIFAP, in Celaya, Guanajuato; while the Valle de México Experimental Field (CEVAMEX) of the same institute was established as temporary. In both production, irrigation and temporary conditions, the technological packages recommended by INIFAP were applied.

The industrial quality analyzes were carried out in the Laboratory of Farinology of CEVAMEX. The grain hardness (%) was calculated by the pearl index in 20 g of grain, indicating the facility to partially remove its outer layers, using a standardized abrasion procedure, where values less than 47% are classified as endosperm grains hard.

Using a Brabender mill (Quadrumat Senior, CW Brabender OHG, Germany) and sifting through a mesh of 129 μ in diameter, the refined flour was obtained, which was used to obtain the alveogram, to calculate the force (W) And the tenacity / extensibility ratio (PL) of the mass, using the Chopin Alveograph (Tripette & Renaud, France) using the AACC method 54-30A (2005). The masses were classified by their W and PL. For their W, values greater than 300 × 10-4 J in strong masses, 200 to 300 × 10-4 J in strong socks and less than 200 × 10-4 J in weak. For their PL in balanced masses (PL = 1.1), extensible (PL <1) and tenacious (PL> 1.2). The volume (ml) of bread was made in 100 g of refined flour (Method 10-09, AACC, 2005) using the direct mass method and was determined in a volumetric by displacement of rapeseed (Brassica sp) seeds. The mean and range values for the analyzed variables for each of the analyzed genotypes.

Results and Disscusions

The new varieties, BACOREHUIS F2015 and CONATRIGO F2015, as well as lines 2 and 3, were characterized by grain hardness similar to the control varieties BORLAUG 100 and VILLA JUÁREZ F2009, classified as hard grain. While line 1 was classified as having a semi-hard grain value less than 47% (Table 1).

On the other hand, with the exception of lines 1 and 2 that were classified as having a strong medium mass, for their W can go from 200 to 300, the rest of the genotypes were grouped into strong masses, for their W> 300. Based on their PL, most of the genotypes were classified as extensible, by their PL <1, while lines 2 and 3 and the variety VILLA JUAREZ F2009 presented tenacious masses, by their PL> 1.2, which was associated with volumes Low of bread, contrary to what was observed in the new variety CONATRIGO F2015 who presented the highest bread volume, surpassing the best control variety KRONSTAD F2004 (Table 1). The above agrees with what Sanchez-Garcia et al. (2015) who indicates that in the wheat flour mass, strong and extensible masses, ie low PL values, must be conjugated to favor the volume of bread.

GENOTIPO	DG	R	W	R	PL	R	VP	R
BACOREHUIS F2015	46	50-41	319	425-253	1.0	1.5-0.7	789	830-745
CONATRIGO F2015	46	52-40	381	514-278	1.0	1.6-0.5	847	920-755
Línea 1	52	53-50	211	250-180	0.8	1.1-0.4	830	895-805
Línea 2	47	52-41	322	430-230	1.9	2.1-1.2	720	750-730
Línea 3	46	52-40	289	300-230	1.3	2.0-0.9	765	800-700
BORLAUG 100	46	48-44	334	445-263	1.0	1.6-0.5	840	890-800
VILLA JUAREZ F2009	42	47-38	342	488-237	1.3	2.2-0.8	734	745-720
ROELFS F2007	45	46-43	364	467-247	1.0	1.9-0.5	787	800-770
KRONSTAD F2004	40	45-36	426	550-300	1.0	1.3-0.7	827	855-790

DG = grain hardness (%); W = force of mass (10-4 J); PL = tenacity / extensibility ratio (0-7); VP = volume of bread (ml). R = rank.

Table 1 Mean and range of industrial quality variables of controls, new varieties and candidate lines for irrigated wheat in Mexico.

All genotypes analyzed under time were classified with hard grain, which is desirable since it will avoid germination in the spike when there is presence of rain at its maturity as indicated by Dencic et al. (2013).

The genotypes Valles F2015, line 2, line 3 and ALTIPLANO F2007 were characterized by having strong average masses based on their W of 200 to 300. TLAXCALA F2000 and line 2 presented strong mass, for its W> 300, contrary to what was shown By DON CARLOS F2015 who presented the lowest value of force, W <200, however, due to its extensibility, I presented acceptable bread volume values. Based on its PL, VALLES F2015, it was classified as extendable mass as line 2 and control varieties, TLAXCALA F2000 and ALTIPLANO F2007. Line 1 and 3 presented balanced masses, with less extensibility, so that these genotypes obtained the smaller volumes of bread, contrary to the rest of the genotypes, which associated strong or strong medium masses with excellent extensibility, PL value <0.9, and Presented volumes of bread larger than 800 ml, (Table 2).

Genotipo	DG	R	W	R	PL	R	VP	R
Don carlos f2015	41	44-38	192	233-158	0.6	0.8-0.4	806	860-760
Valles f2015	39	42-36	272	316-239	0.7	0.8-0.6	813	880-760
Línea 1	35	36-34	239	266-212	1.2	1.1-1.2	748	775-720
Línea 2	40	42-37	324	355-280	0.6	0.9-0.4	871	955-790
Línea 3	42	46-38	242	267-217	1.1	1.3-0.9	733	760-705
Altiplano f2007	40	42-38	290	326-231	0.7	0.9-0.5	870	975-775
Tlaxcala f2000	38	41-36	369	397-340	0.8	1.0-0.7	874	930-840

DG = grain hardness (%); W = force of mass (10-4J); PL = tenacity / extensibility ratio (0-7); VP = volume of bread (ml); R = Range.

Table 2 Mean and range of industrial quality variables of controls and candidate lines for temporary wheat in Mexico.

Conclusions

The new irrigation varieties BACOREHUIS F2015 and CONATRIGO F2015 as well as the experimental line ND643 / 2 * WBLL1 // MUNAL / 3 / MUNAL # 1 presented characteristics of grain hardness and mass strength appropriate for the national baking industry. Same behavior showed DON CARLOS F2015, VALLES F2015 and the advanced line GAVIA / ROM / 3 / PIRUL / GUI / TEMP / AGR / 4 / JUCH, which are suitable for temporary production. So its use can contribute to obtain the quality of the harvest demand by the national milling industry.

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