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Research Note

Quality of seeds of native corn from the Altos de Jalisco region

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Abstract

The loss in physiological quality increases when the temperature and relative humidity in storage are high. Hypothetically, the physiological quality of the seeds of native corn preserved by producers is low. This work aimed to evaluate the physiological quality of native corn seeds collected in the Altos de Jalisco region, Mexico. In May 2022, 21 samples of native corn were collected in the Altos de Jalisco Region. The tests carried out were weight of 100 seeds, germination, analysis of physical integrity, and grain color. In the weight of 100 seeds, the collections belonging to the Elotes Occidentales breed were the highest. Ten of the 21 collections did not exceed 90% germination. None of the mean variables for physical integrity showed significant differences. There were two accessions with white and yellow grain colorations that differ from what has been reported in the literature.

Keywords:

Elotes Occidentales, germination, grain color, physical integrity.

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Introduction

The parameters with which seed qualities are measured were determined in seeds of cultivated species, with some improvement process. Nevertheless, their use in native seeds is not excluded (Magdaleno-Hernández *et al*., 2018). However, due to the way they are produced and stored, they may not meet the established quality standards. Evaluating the quality of native seeds with these standards will contribute to knowing the risk in which they are found and designing strategies for their conservation.

The area planted with native corn in the Altos de Jalisco region, Mexico is low (Castañeda-Zavala *et al*., 2014). Among the corn breeds that are grown, the following stand out: Elotes Occidentales, Pepitilla and Zamorano Amarillo (CONABIO, 2011). The quality of the native seeds used by producers in this region is unknown since, as in other regions of Mexico, the conservation of seeds is done in granaries, warehouses, sacks or in the best of cases, treated with insecticides (Manuel-Rosas *et al*., 2007). In this sense, the hypothesis is that the physiological quality of native corn seeds is low compared to commercial seeds. Therefore, this study aimed to evaluate the quality and diversity of native corn seed collected in the Altos de Jalisco region, Mexico.

Materials and methods

In May 2022, 21 samples of approximately 500 g of native corn seed harvested in spring-summer of 2021 (information provided by producers) were collected in the communities of the municipalities of Acatic (S5), Cañadas de Obregón (S8, S9, S10), Jalostotitlán (S12), San Ignacio Cerro Gordo (S6, S7), San Miguel el Alto (S4), Tepatitlán de Morelos (S1, S2, S3), Valle de Guadalupe (S13) and Yahualica de González Gallo (S11), Jalisco. The altitudes of the collection points ranged from 1 600 to 2 100 m.

The collection sites were random and were reached by asking the inhabitants of the communities for a producer who would sow 'native corn (a term by which the producers of the region know the native corn). In addition to the seed, basic information was obtained, such as the common name, use, geographical reference, etc., with Google Maps® (Google, 2022), and the description of the storage method. The samples were kept in paper bags at room temperature until evaluation.

At the facilities of the Centro Altos de Jalisco Experimental Field, the 'between paper' standard germination test and weight of 100 seeds were performed. For its part, the physical integrity analysis by X-rays was carried out at the National Center for Genetic Resources (CNRG), for its acronym in Spanish. The three variables were measured and recorded according to the procedure indicated by ISTA (2016). For all the quality tests cited above, the seeds of the corn hybrids H-391 and H-392, produced in Santiago Ixcuintla, Nayarit (autumn-winter-20/21) and Arúmbaro, Michoacán (spring-summer-2021), respectively, were used as controls.

The results obtained were used to perform an analysis of variance and comparison of means using the agricolae package (De Mendiburu, 2009) of the R v4.1 software (R Core Team, 2021). Due to the number of collections (13), the color was determined only in samples of the Elotes Occidentales breed. The grains with the predominant color of each sample were placed on a rectangular clay bar trying to simulate an ear of corn (Salinas-Moreno *et al*., 2021). The color in the simulated cobs was measured with a HunterLab 4500 L colorimeter following the procedure described by Salinas-Moreno and Vázquez-Carrillo (2006), which consisted of taking five readings at random, selecting the three readings with the smallest range of variation of the values of Lightness (L), *a* and *b*. Once the three readings were selected, the following formulas were used to determine the hue and chroma coordinates of each sample: $Hue = tan^{-1}\left(\frac{b}{a}\right)$ and $Chroma = \sqrt{a^2 + b^2}$. The readings were verified individually after the calculations were made on a two-plane or two-axis color space graph.

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Results and discussion

The experimental design was completely randomized. Of the 21 samples collected, the following breeds were identified: Elotes Occidentales (EO), Celaya (C), Zamorano Amarillo (ZA) and Pepitilla (P), two by local names (red [R]), one unknown (Unk) and one intervarietal hybrid (VH). The Elotes Occidentales breed was found in a higher proportion than the rest of the materials. According to the CONABIO (2011) database, the number of native corn breeds collected in the same municipalities where this study was conducted varies between periods. Eight breeds were collected in the first period (1944-1952), 11 in the second (1974-1978), and six in the third (2000-2010). The Celaya, Cónico Norteño, Elotes Occidentales and Tabloncillo breeds were collected in all periods. In contrast, the Pepitilla and Zamorano Amarillo breeds are reported for the first time in the region.

The number of breeds collected in this research and historical data suggest that there is a decrease in the diversity of native corn in the region, even when recently introduced breeds are reported. Nonetheless, studies will be required to corroborate what has been proposed and propose alternatives for their conservation. Seed size influenced the weight of 100 seeds, with those belonging to the Elotes Occidentales breed being the heaviest and visibly larger (Table 1).

Table 1. Comparison of means of the weight of 100 seeds and germination.

Site	Breed or common name	Weight 100 seeds	PG	Site	Breed or common name	Weight 100 seeds	PG
S1	C	42.53 ghi	88 abcd	S5	P	44.18 fgh	83 abcd
	EO	49.12 ef	92 abc	S6	EO	48.89 efg	89 abcd
	ZA	45.5 fgh	97 a	S7	C	34.21 j	94 abc
S2	Unk	40.39 hij	97 a	S7	EO	61.56 bc	91 abc
S3	EO	47.71 efg	72 d	S8	EO	47.07 fg	95 ab
S4	EO	57.48 cd	77 bcd	S9	EO	46.12 fgh	92 abc
S4	R	35.4 j	90 abcd	S10	EO	42.82 fghi	78 bcd
	H-391	25.67 k	99 a	S10	P	43.82 fgh	76 cd
	H-392	34.44 j	90 abcd	S11	VH	36.86 ij	98 a
S5	EO	59.42 cd	94 abc	S12	EO	53.66 de	89 abcd
S5	EO	71.61 a	93 abc	S13	EO	46.51 fgh	86 abcd
S5	EO	65.91 ab	89 abcd	MSD	6.43		18.84

Means with the same letter are not significantly different ($p \leq 0.05$). MSD= minimum significant difference; PG= percentage of germination.

The variation in the weight of 100 seeds can be attributed to intra- and interracial genetic diversity (Barrera-Guzmán *et al*., 2020), agronomic management (Ramírez-Díaz *et al*., 2021), and the effect of the environment. Based on the above, the variable 'weight of 100 seeds' will change from one cycle to another due to variations in agronomic management, pollination, and especially the environment, specifically the rainy season.

Ten of the 21 collections do not meet the physiological quality standard established by the SNICS (2020), which is 90% germination. Seven of the ten collections with germinations of less than 90% belong to the Elotes Occidentales breed. The lowest PG values (# to 78%) were from sites 3, 4 and 10, from which four collections were obtained, and of these, three are of the Elotes Occidentales breed. Something similar between the three sites (3, 4 and 10) was that the storage of the seeds was in sacks sheltered in roofed spaces and without walls of any kind. This may have caused changes in temperature and relative humidity during storage time, which, according to Souza *et al*. (2016), are the main factors that cause the deterioration of physiological quality in seeds. Nevertheless, the question remains as to the effect that the agronomic and postharvest management given by the producers could have.

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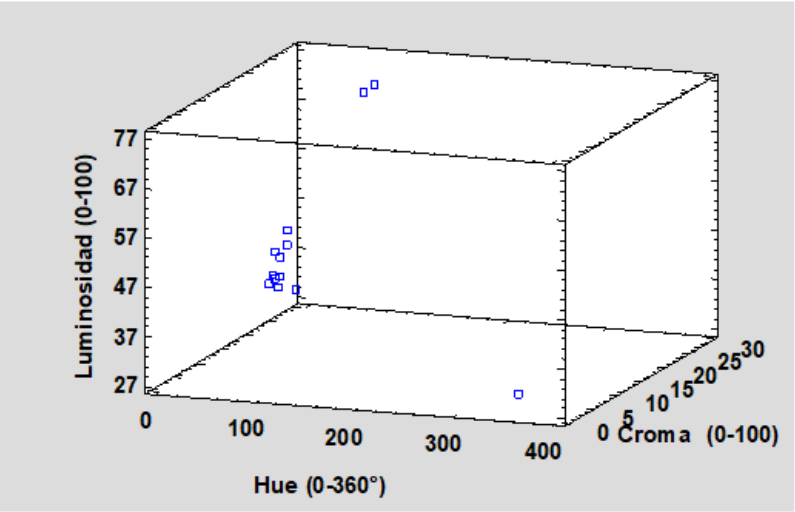
The loss in normal seedling formation capacity that was observed can be attributed to environmental problems during production (Miya *et al*., 2017), including a natural aging process (Ebone *et al*., 2019). To specify the proposal, it will be necessary to evaluate the germinative capacity of the seeds at the time of harvest, the synergy of the loss of viability in storage and the cellular integrity from seed formation to sowing. However, the results obtained demonstrate the risk of losing corn diversity in the region.

The diversity of the Elotes Occidentales breed was reflected in the range of colors of the grains (Figure 1). Ron *et al*. (2006) mentioned that the Elotes Occidentales breed has purple, red, and blue grain colorations due to the presence of anthocyanins in the aleurone layer. In this study, two samples with white-yellow tones were observed, with lightness values of 73.33 and 73.47 (Figure 1). Probably derived from the crossing with other corns and the direct selection made by producers' cycle by cycle.

Figure 1. Dispersion of the color space of Elotes Occidentales. Hue= values of 0-360°; chroma= saturation, values of 0-100.



Conclusions

The conditions of storage, processing, and treatment of the seeds of the native corn collected in the Altos de Jalisco region were not adequate, so the physiological quality of the seed compared to the seeds of improved corn was low. Based on the range of grain colors, a wide richness was observed in the Elotes Occidentales breed.

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