

Lico: a variety of sweet sorghum for forage production

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Abstract

A steady supply of seeds of useful sweet sorghum varieties is required to meet the demand for forage. The objective was to develop a sweet sorghum variety adapted to irrigation and rainfed conditions to produce high-quality forage. The Lico variety (PED-1m-2m-3u) was developed by mass selection from a heterogeneous population collected in 2008 in Pedriceña, Dgo. This variety exceeded the state average yield (32.7 t ha^{-1}), with an average commercial yield of fresh forage under irrigation of 50.5 t ha^{-1} . The Lico variety, compared to Mercedes, had more days to the emergence of the panicle (86 vs 81 days after sowing: DAS), cut height (286 vs 256 cm), and lower weight of 1000 seeds (15 g vs 17.4 g). Lico is mainly recommended for producing forage (fresh and silage). The caryopsis is reddish-brown and shows a long grain surface covered by the glume. Lico exhibited resistance to the natural incidence of ergot (*Claviceps* spp.), although it occasionally showed lodging. This variety is in the process of technology transfer to establish its adaptability, possibility of adoption, and potential to increase forage yield and quality.

Keywords:

Sorghum bicolor, adaptation, attributes, productivity.



Forage sorghum production is important in Durango as a locally produced rated seed is required to avoid dependence on expensive, low-availability commercial hybrids (Montes *et al.*, 2010). In this state, the area sown with forage sorghum during 2022 was 32 418 ha, with a production of 876 417 t of fresh forage and an average yield of 30 360 kg ha⁻¹ (SIAP, 2023). Locally developed sweet sorghum varieties are preferred by growers due to availability, low cost, and adaptation (Montes *et al.*, 2010).

This type of sorghum produces energy-rich forage, making it an important feed option for cattle during the dry season of the year (Jiménez and Rosales, 2014; Domínguez *et al.*, 2016; Flores *et al.*, 2017). The development of varieties adapted to the conditions of Durango is essential to locally produce rated seed and reduce costs and dependence on imported seed.

It is also necessary to expand the area sown with forage sorghum under irrigated conditions and improve soil fertility to increase the yield and nutritional quality of the forage. In this sense, INIFAP-Durango developed three varieties of sweet sorghum (Mercedes, TOM 3, and Lico) in the process of technology transfer for possible adoption in Durango (Rosales *et al.*, 2010; Jiménez and Rosales, 2014).

Origin and selection

Lico is a variety of sweet sorghum that originated by mass selection applied to a population collected in Pedriceña, Cuencamé, Durango. The objective was to select improved sweet sorghum lines that showed local adaptation, disease resistance, and high values for forage production. The original population was selected for its adaptation to rainfed conditions, robust stems, and intermediate height, with the aim of reducing sorghum lodging. One hundred mature panicles were collected from plants with the aforementioned characteristics and in full competition.

The original population was collected in 2008 in a population that varied in plant height, stem thickness, leaf width, panicle morphology, and grain color. The seed obtained in the original population was sown in 2009 to evaluate its adaptability and continue with the mass selection process.

In 2010, the population was resown in Durango, Durango, in plots paired with commercial hybrids susceptible to ergot. Robust, ergot-free, and vigorous plants were again selected to increase the chances of obtaining lines with high forage production compared to the state yield (SIAP, 2023).

Seed harvested from plants selected in Durango in 2010 was used for mass selection in 2011 (PED-1m-2m). Strips of ergot-susceptible commercial hybrids were included, and panicles were selected from robust, disease-resistant, high-forage-yielding plants. The resulting population, coded as PED-1m-2m-3u, showed uniformity, was characterized morpho-agronomically, and was assigned the trade name Lico (UPOV, 2015).

In 2013, the Lico variety was sown at two sites in Durango to carry out the second characterization cycle and evaluate forage yield. In 2014, commercial lots were established to validate the variety at four sites in the state, applying the agronomic management of the producer and technical recommendations of INIFAP. In that same period, the registration process with the SNICS was initiated, which finally granted it the registration number SOG-257-181114 (SNICS, 2019). In June 2023, the Lico variety received the Breeder's Title 3152 and was recognized as a commercial variety of INIFAP.

Varietal description

The Lico variety shows absent or very weak anthocyanin coloration of the coleoptile and leaf blade. Panicle emergence occurs at 86 DAS, plant height at panicle emergence is 199 cm, and panicle stigmas show a very long length. At cut maturity, the total height of the plant reaches 286 cm, the length of the panicle is medium (25.4 cm), and the branches in the middle third of the panicle were classified as long. The caryopsis has a reddish-brown coloration, a violet coloration of vitreous albumin; the grain had a very low weight (15 g 1 000 seeds) and a very high tannin content.

The Lico variety was evaluated in different irrigated environments to establish its tolerance to environmental factors that reduce the productivity and quality of sorghum forage. The lots were established in the municipalities of Durango (Colonia Hidalgo, Valle del Guadiana Experimental Field), Canatlán (La Soledad), and Lerdo (La Goma). Lico showed an intermediate cycle, allowing it to escape the negative effects of moisture stress and low temperatures recorded from October in Durango.

Lico showed tolerance to natural ergot infestation under irrigated conditions. In addition, an increase in the average yield and quality of sorghum forage obtained in Durango was observed (Nava *et al.*, 2017), so it was decided to establish the adaptability of the Lico variety and the nutritional properties of the forage obtained.

Yield

Lico had high yields under irrigated conditions in the state of Durango between 2010 and 2014, with an average fresh forage value of 50.5 t ha⁻¹ in 2014 (Table 1). Overall, Lico outperformed the Mercedes reference variety, except at one site where late sowing and the presence of yellow aphids (*Melanaphis sacchari* Zehntner) decreased yields. Forage dry weight was higher in Lico (8.2 t ha⁻¹) compared to Mercedes (6.9 t ha⁻¹) (Jiménez and Rosales, 2014).

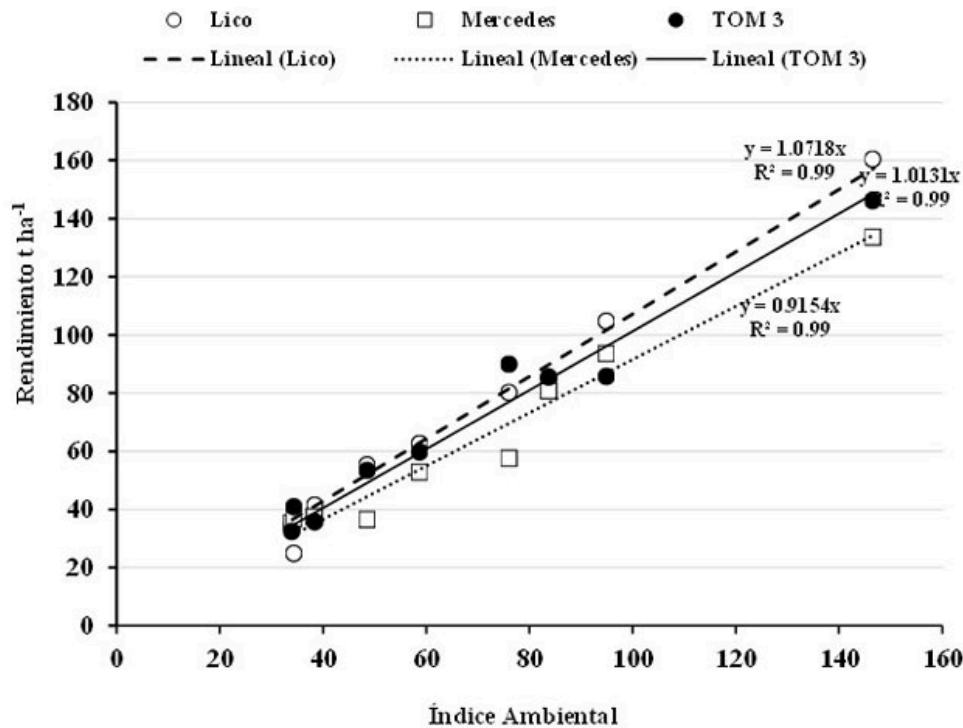
Table 1. Fresh and dry forage yield in two varieties of sorghum grown in different production environments in Durango.

Locality	Year	FF yield (t ha ⁻¹)		DF yield (t ha ⁻¹)	
		Lico	Mercedes	Lico	Mercedes
Colonia Hidalgo	2014	41.5	37.5	6.8	6.1
Durango, Durango	2014	80.3	57.5	13.1	9.4
La Soledad, Durango	2014	55.3	36.5	9	6
La Goma, Durango	2014	24.9	36.8	4.1	6
Average		50.5	42.1	8.2	6.9

The Lico sweet sorghum variety showed acceptable yields in various environments and years compared to other varieties (Figure 1). It had a high potential for forage production in favorable environments, although its yield was lower under unfavorable conditions. Genetic advancement for yield and disease tolerance was observed in sweet sorghum populations grown in Durango.



Figure 1. Response of three varieties of sweet sorghum for the production of fresh forage in several environments in the state of Durango.



In 2022, the varietal description was updated, and in June 2023, the Lico sorghum variety received the definitive registration number 3151 in the name of INIFAP. Once recognized as a commercial variety, Lico can be grown in Durango and other states with similar climates. It can be grown in soils with different textures, preferably well-drained, with a pH of 6 to 8. It is recommended to grow it under irrigated conditions and with an average annual temperature of 17 to 26 °C, with minimums above 13 °C. INIFAP in Durango has the original seed of the Lico variety to produce basic seed and offer it to seed companies and interested producers.

Conclusions

The Lico sorghum variety has potential for use in commercial sowings in Durango due to its outstanding agronomic response and high forage production under irrigated conditions. With proper agronomic management and favorable environmental conditions, high quantities of quality forage can be harvested in Durango.

Technology transfer will begin to evaluate the adoption of the Lico improved variety by producers, traders, and industrialists in the agricultural sector. Its use will contribute to diversifying production in Durango and reducing the forage deficit during the dry season, ensuring feed availability for cattle herds, and keeping them in adequate conditions for production.

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