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Mexican Animal Producers Value U.S. Sorghum as Feed, but Logistics and Policy Support Remain a Challenge

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The United States leads the global sorghum market, exporting \$2.08 billion worth of sorghum in 2021, primarily to China and Mexico (Observatory of Economic Complexity, 2023). In contrast, Mexico faces significant challenges in grain production, including reduced economic support for grain producers (Einstein-Curtis, 2020) and drought conditions in key production areas (Juarez, 2021), which have increased Mexico's reliance on grain imports to meet local demand.

Given these challenges, sorghum's resilience stands out. Its ability to thrive in water-deficient and low-fertility soils with minimal fertilizers makes it a sustainable and resource-efficient option for addressing Mexico's needs in food, feed, and bioenergy production (Rankin, 2021; Tanwar et al., 2023). Sorghum plays a pivotal role in the animal feed market, yet there is a significant knowledge gap regarding Mexican animal producers' willingness to pay (WTP) for sorghum-based feed and the factors influencing their decisions to switch from corn, which accounts for 95% of the feed market. Sorghum and corn share similar nutritional profiles, with studies showing mixed results regarding their interchangeability in animal feed. In fact, corn and sorghum prices in March 2023 (\$4.58 and \$4.40 per bushel, respectively) reflect a narrow gap worth exploring for their potential association with sorghum trade (Benavidez, 2023). While some studies highlight the benefits of sorghum use, others point to challenges such as reduced digestibility or performance in livestock (Torres et al., 2013; Papanikou, 2020; Pan, An and Zhu, 2021). Additionally, price fluctuations, driven by supply levels and global trade, make it harder for farmers to adopt sorghum (Santeramo et al., 2018).

This study combines expert interviews and producer surveys to identify the optimal price that would encourage Mexican grain users to choose U.S. sorghum for animal feed. The interviews provide qualitative insights into industry perspectives, while the surveys quantify animal producers' WTP for sorghum-based feed. By analyzing both perspectives, we uncover key

trends in sorghum pricing, usage, and market potential. These findings offer valuable guidance for U.S. policy makers and grain producers, helping position sorghum competitively in the international feed market.

Industry Expert Interviews: Insights on U.S. Sorghum in Mexican Animal Feed

Method

To understand the role of sorghum in Mexican animal feed, we conducted 23 face-to-face interviews with key industry stakeholders, including traders, producers, feed experts, brokers, veterinarians, and consultants. Seventeen interviews took place at the Export Sorghum Seminar in Houston (June 2023), while six were conducted in Mexico (April 2024), specifically targeting feed processing managers and production experts.

The interviews explored grain preferences, market expectations, and perspectives on Mexican government policies. Participants were asked about their primary grain choices, the reasons behind their preferences, and perceptions of sorghum in terms of price, quality, and suitability as an animal feed ingredient. Those already using sorghum shared insights on its advantages and challenges, particularly when sourced from the United States.

To capture a broad range of industry perspectives, we categorized responses based on stakeholder type. The interview data, originally in Spanish, was translated into English and transcribed. Using a structured set of questions, we identified recurring themes, synthesized common viewpoints, and summarized key insights.

Key Takeaways from Industry Expert Interviews

A central concern among interviewees was the lack of sufficient government support for grain and animal producers in Mexico. Many noted that subsidies and assistance programs had been reduced or eliminated in 2018–2024, with the few remaining programs primarily

benefiting subsistence farmers. Industry experts emphasized the need for stronger policy measures, including free insurance programs, improved logistics, contract farming promotion, and livestock insurance funds to mitigate price risks.

Grain preference was another key theme. Yellow corn emerged as the dominant choice across the industry, followed by sorghum, wheat, and soybeans. Sorghum was particularly prevalent in Tamaulipas due to its regional connections, but, overall, feed producers prioritized customer preferences, which generally leaned toward corn for cattle feed.

Price emerged as the most influential factor in grain purchasing decisions. Interviewees noted that a competitive price differential between corn and sorghum was necessary to incentivize users to switch. The required price gap varied depending on the type of livestock, with poultry producers requiring a smaller differential of around 5%, while livestock producers needed a margin of at least 8%–10% for sorghum to be a viable alternative. An animal feed producer from Nuevo Leon stated,

It is primarily a matter of price. Sometimes, companies change their formulations from sorghum to corn, and this decision is solely based on price. For me to trade more sorghum, the price would need to be more competitive, allowing for a greater profit margin.

Concerns about sorghum's nutritional properties also surfaced in the discussions. Several animal producers cited tannins in sorghum as a challenge, making feed more bitter. They viewed corn as having superior nutritional value. A veterinarian from Jalisco remarked, "The industry has paradigms, like bitterness occurring at over 10% sorghum in feed."

However, agronomic consultants argued that the hesitation to use sorghum was more about limited knowledge of sorghum processing than actual nutritional shortcomings. Quality itself was not a major concern, as grains used in feed manufacturing were classified under the standard grading system, with Grade 2 sorghum being the most common.

Supply chain consistency and logistics also emerged as critical issues. Several respondents stated that U.S. sorghum supply was unpredictable, often arriving only when not sold to China. A more stable and reliable supply chain, similar to that of corn, would encourage greater sorghum adoption among Mexican buyers.

While interviewees acknowledged the presence of sorghum production in Argentina, Brazil, Australia, and India, they reported sourcing exclusively from Mexico and the United States. Feed plant managers noted that they relied on major intermediaries such as Cargill and

Archer Daniels Midland (ADM) rather than purchasing directly from U.S. producers. They also cited high tannin content and logistical hurdles as key reasons for not sourcing sorghum from other countries. Despite these supply concerns, respondents viewed U.S. and Mexican sorghum as comparable in quality, with no significant difference between the two.

Finally, all respondents closely monitored U.S. and Mexican sorghum prices, particularly during the U.S. harvest season. Views on future trends varied, with some expecting stabilization, others predicting declines, and some anticipating a rebound. When asked how U.S. sorghum could be more competitive in the Mexican market, interviewees highlighted key strategies: increasing awareness of sorghum's nutritional value, offering more competitive prices, investing in processing technologies, and strengthening supply chain logistics.

Producer Survey: Mexican Animal Producers' Preferences for U.S. Sorghum

Method

To better understand the end-user preferences for U.S. sorghum in animal feed, we conducted a survey targeting animal producers, who are key grain consumers in feed operations. The survey was randomly distributed through the Qualtrics platform in late 2023, with participation entirely voluntary. The study and survey instruments were approved by the Institutional Review Board to ensure ethical research standards.

Despite reaching out to 100 producers, only 40 agreed to participate, reflecting common challenges in engaging agricultural producers, such as concerns over business confidentiality and time constraints (Pennings, Irwin, and Good, 1999; Ulrich-Schad et al., 2022). While the sample size is smaller than initially targeted, samples of 30 or more are often considered adequate in producer-side research to balance practical constraints with statistical validity (Piepho et al. 2022; USDA-NASS, 1986).

The survey gathered operational details, including the types of animals raised, farm size, monthly feed purchases, feeding costs, and demographic information. Respondents were asked about their awareness of sorghum in feed, its interchangeability with corn, and any concerns about using sorghum-based feed, including whether the U.S. origin of ingredients influenced their purchasing decisions.

To measure WTP for feed made with U.S. sorghum, we used a two-step question—an approach called double-bounded dichotomous questions (Lopez-Feldman, 2013). First, participants were asked whether they would purchase the feed at their current budgeted feed price if it does not affect their product quality. If they declined, they were offered a randomly assigned discount (averaging 5% lower than their current feed price).

Conversely, if they accepted, they were asked if they would still purchase the feed at a premium (5% above their current budgeted feed price). This two-step method helps determine how price sensitive producers are to switching from corn to sorghum. The choice of a 5% discount and premium is based on the historical price difference between corn (approximately \$4.39) and sorghum (\$4.17) in the United States from 2007 to 2017.

Key Takeaways from Animal Producers' Survey

Table 1 presents the characteristics of survey respondents. On average, respondents were 45 years old, with 86% male participation and 31% holding a college degree. Regional representation was highest in the southern and northern regions (28% each), while eastern and central Mexico had relatively lower participation at 8% and 14%, respectively. The survey included producers raising multiple types of livestock, with 21 raising chickens, 14 raising dairy cattle, 10 raising beef cattle, 8 raising pigs, 2 raising sheep, and 1 raising goats. As many producers manage more than one type of livestock, the total count (56) exceeds the number of respondents (40).

The average price per kilogram of feed across all animals was MX\$45.81 (US\$2.67). Half of the producers (50%) purchase all their feed, while 15% rely entirely on self-produced feed, with the rest using a mix of both. Awareness of sorghum in feed is high, with 94.1% of respondents knowing whether their feed contains sorghum. On average, sorghum accounts for 35.6% of the total feed content, making it a sizable but not

dominant ingredient. Additionally, 90% of the respondents recognize that corn and sorghum can be used interchangeably, reflecting an understanding of the flexibility in feed formulations.

More than 60% of the respondents indicated that sourcing ingredients from the United States positively influences their purchase decisions, with 55.6% expressing greater confidence in U.S.-origin sorghum-based feed. However, 44.4% remain neutral on this point, suggesting that for some producers, the country of origin plays a minimal role. When asked about genetically modified (GMO) sorghum, 80% of respondents said they would accept GMO ingredients as long as prices remained unchanged.

Economic and supply concerns emerged as the most important barriers, with 75.62% of respondents citing price volatility, supply uncertainty, and availability challenges. These findings suggest that producers perceive sorghum as a riskier and less consistent feed option compared to alternatives like corn. Concerns about feed quality and animal health were raised by 12.2% of respondents, particularly regarding nutritional value, animal growth, and overall feed effectiveness. Meanwhile, 9.76% highlighted market and awareness barriers, including uncertainty about customer acceptance of sorghum-fed animals and a general lack of familiarity with the feed itself. These insights indicate that addressing supply stability, improving price predictability, and educating producers on sorghum's benefits could enhance its adoption in livestock production.

Table 1: Descriptive Statistics

Variable	Mean	Standard Deviation
Producer characteristics		
Age	45.08	3.974
Sex (0 = Male, 1 = Female)	0.861	0.351
College education (0 = No, 1 = Yes)	0.306	0.467
Total farm area (hectares)	13.90	18.28
Share of sorghum in feed	0.356	0.203
Aware of corn and sorghum substitution (0 = No, 1 = Yes)	0.889	0.319
Share of feed purchased	0.723	0.312
GMO concern (0 = No, 1 = Yes)	0.778	0.422
Preference for U.S. ingredients (0 = No, 1 = Yes)	0.611	0.494
Geographic locations		
South (Chiapas, Oaxaca, Tabasco, Yucatán)	0.278	0.454
West (Michoacán, Jalisco, Aguas Calientes)	0.222	0.422
North (Baja California, Coahuila, Durango, Nuevo León, Sonora, Tamaulipas)	0.278	0.454
Center (Ciudad de México, Querétaro)	0.140	0.346
East (Puebla Veracruz)	0.083	0.280

Note: These results were calculated from a survey of 40 animal producers in Mexico. Geographic locations were adapted from Moye-Holz, Ewen, and Dreser (2018).

Price is a major factor when choosing feed, but it is not the only consideration. If sorghum feed were priced the same as current feed and had no negative effects on animal health, 86.1% of respondents would be willing to switch. However, any perceived risk to animal health deterred producers: even a 5% discount without clear assurances of animal health convinced only 20% to adopt it. On the other hand, nearly half of respondents (48.4%) said they would consider sorghum-based feed even if it were 5% more expensive, as long as there were no concerns about animal health. Some respondents also emphasized the importance of supply reliability, quality, and nutritional benefits. This indicates that price reductions alone may not be enough to drive widespread adoption of U.S. sorghum.

The WTP analysis reveals that Mexican animal producers are willing to pay MX\$48.04 (US\$2.80) per kilogram for feed made with U.S. sorghum, which is about 4.86% more than the current average price of MX\$45.81 (US\$2.67). WTP did not vary by farm operation type (beef, swine, or chicken production), but location and experience with sorghum played a role. For example, producers in southern Mexico were generally willing to pay 9% less than those in the north, likely due to greater familiarity with corn-based feeding and higher transportation costs for sorghum. Additionally, producers already using sorghum in their feed were willing to pay about 0.39% more than the average for each 1% increase in sorghum content in their feed. A small group (8% of respondents) rejected the idea altogether, citing concerns about price fluctuations, uncertain supply, and lack of familiarity with sorghum.

Implications and Concluding Remarks

Feed costs represent the largest expense in livestock production, accounting for 60% to 70% of total costs (Strauch, 2013). Given that grain prices are a primary driver of feed costs, fluctuations in these prices directly impact profitability and cost efficiency for animal producers. This study enhances our understanding of these dynamics by analyzing Mexican animal producers' willingness to pay (WTP) for feed made with U.S. sorghum as an ingredient, in the context of corn-based feed as a dominant alternative.

Price remains the most critical factor in feed selection, outweighing country of origin. While many producers view U.S. sorghum favorably, it is not a decisive factor for all buyers—nearly half remain neutral. Instead, price

volatility, supply instability, and availability concerns make sorghum feel like a riskier option compared to corn. Fluctuations in grain prices stem from transportation costs driven by high fuel prices and supply disruptions caused by unfavorable weather.

Historical trends indicate that corn has typically been about 5% more expensive than sorghum. However, the survey reveals that Mexican producers are willing to pay a 4.86% premium for sorghum-based feed over its current price—bringing it closer to the price of corn. Interview participants, predominantly yellow corn users, stated that sorghum needs to be priced at least 5% lower than corn to be considered a viable alternative. This suggests that if sorghum prices were to approach or exceed corn prices, producers might shift to corn-based feed instead. Despite differences in participant composition—interviews reflecting a broader range of stakeholders versus surveys focusing on animal producers—both sources underscore the importance of maintaining sorghum's price advantage.

Although feed quality and animal performance concerns are less common, they still contribute to hesitation among some producers. Despite this, both surveys and interviews confirm that corn and sorghum are viewed as interchangeable in the feed industry. On average, 89% of survey respondents acknowledged their substitutability, while interview participants emphasized that customers base their decisions on price and availability rather than grain type. However, a lack of awareness and familiarity with sorghum suggests that information and outreach could help build confidence in its use.

Interviews also revealed two additional barriers to adoption. First, Mexican grain and livestock producers receive little government support, as subsidies and assistance programs have been largely reduced or eliminated. This creates an opportunity for U.S. sorghum producers to strengthen their market position by offering a more stable and competitive alternative. Second, logistical challenges and supply inconsistencies limit sorghum adoption—U.S. sorghum is often available only when not sold to China, making supply unpredictable. Addressing these logistical challenges and ensuring a more reliable and consistent supply chain could increase producer confidence and encourage greater adoption of sorghum in Mexican feed formulations.

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