Title:

Evaluating Pomace of Pierce's Disease Tolerant Wine Grapes as a Sustainable Cattle Feed Supplement

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Introduction:

As the grape (*Vitis* spp.) and wine industry continues to expand across the United States, the growing interest from vineyard growers and winemakers becomes increasingly apparent, even in areas with limiting factors of harsh climate and Pierce's disease (*Xylella fastidiosa*) prevalence. However, this expansion can generate substantial quantities of underutilized byproducts, creating a significant demand for more sustainable practices in wine grape cultivation and winemaking. One byproduct that presents an opportunity for valorization is grape pomace, consisting of the leftover stems, skins, seeds, and pulp after pressing out the juice that will be utilized for winemaking.

The utilization of grape pomace, frequently designated as a waste product, holds great potential. This underutilized resource is rich in nutritional compounds such as polyphenols and antioxidants, which presents prospects for health benefits and the development of supplements, cosmetics, and functional foods, elevating overall community well-being. Additionally, it allows for product diversification encompassing pomace-based animal feed, organic fertilizers, and biofuels. Among these diversified products, animal feed could greatly benefit the southeast, as livestock production is a notable industry in the region.

When repurposed as feed, grape pomace offers cost savings to livestock farmers, serving as a cost-effective alternative to traditional feeds and contributing to the overall livestock farming economy. Additionally, evidence suggests its nutritional value supports animal digestion, dietary requirements, and overall health. More specifically, cattle, the top livestock animal produced in the region, make great models for studying digestive physiology due to their unique four-compartment stomach.

The overall objective of this project is to evaluate the use of pomace from Pierce's disease tolerant wine bunch grape cultivars currently grown in South Mississippi as a supplemental feed source for beef cattle, assessing its potential as a sustainable byproduct in southern Mississippi and surrounding areas. Specifically, the purpose of this trial was to determine dried grape pomace (DGP) nutrition and the voluntary intake and relative palatability of two DGP inclusion levels when incorporated into a dried distillers grains (DDG) supplement for beef heifers. Establishing the acceptable inclusion level of DGP is necessary to inform formulation decisions for subsequent nutritional and performance trials and to ensure that DGP can be incorporated into beef cattle feeding programs without negatively affecting feed intake.

Materials and Methods:

'MidSouth' grapes were harvested from vines grown in McNeill and Poplarville, MS. They were then crushed and destemmed and frozen in 3.8 L or 7.6 L plastic freezer bags. They were then taken out to thaw at room temperature (~20 °C) before being pressed through a strainer to separate the juice from the pomace. The pomace was then dried in aluminum pans in a forced air oven set at 50 °C. Batches were then ground using a coffee grinder, with each batch being ground for 15 sec to obtain a size of approximately 1 mm. Triplicate DGP samples were then analyzed at the Mississippi State Chemical Laboratory via wet chemistry methods for:

- Acid detergent fiber
- Neutral detergent fiber
- Calcium
- Magnesium
- Phosphorus
- Potassium
- Crude Protein
- Crude Fat
- Moisture
- Ash

Additionally, triplicate DGP samples were used to determine total tannin content using a modified Bate-Smith method. Extracts were prepared by soaking DGP in 70% ethanol (1:20 ratio) for 2 hr at 50 °C. Then, 20 µL of extract, 1.48 mL of water, and 1.50 mL of 37% hydrochloric acid were placed in two tubes, with Tube A in an ice bath and Tube B in a 100 °C water bath. After 30 min, 600 µL of 95% ethanol was added to each tube, and absorbance was read at 550 nm with a Varioskan LUX multimode microplate reader. Tannin content was then calculated using the following equation:

$$\text{Tannins (g/L)} = (\text{TubeB}_{\text{Hydrolysed}} - \text{TubeA}_{\text{Control}}) \times 19.33 \text{ (cyanidin absorptivity coefficient)}$$

Four *Bos indicus*–influenced beef heifers of similar weight were housed in individual pens with ad libitum access to water. Two experimental supplement mixtures were prepared on an as-fed basis: (1) 25% DGP : 75% DDG, and (2) 50% DGP : 50% DDG. Each animal received 0.45 kg (1 lb) of each supplement daily. Feed was offered simultaneously in two identical feeding pans for four consecutive days and left-right placement of treatments was alternated daily in a randomized schedule to prevent positional bias.

Feed intake was determined by weighing orts at 10 min and 30 min post-offer. The following palatability measurements were collected:

- First choice
- Short-term intake (10 min; g/head)
- Total intake (30 min; g/head)
- Preference Index (PI):

$$PI = \frac{Intake_{50:50}}{Intake_{50:50} + Intake_{25:75}}$$

PI > 0.50 indicates preference for the 50% DGP mixture, whereas PI < 0.50 indicates preference for the 25% DGP mixture.

The next step is to determine whether incorporating DGP at the 25% inclusion level influences nutrient utilization and rumen fermentation. To address this, we are currently conducting in vitro digestibility assays using rumen fluid to evaluate:

- Dry matter digestibility
- Neutral detergent fiber (NDF) digestibility

These data will determine whether the preferred inclusion level maintains acceptable digestibility and nutritional value and will guide the design of subsequent in vivo performance and metabolism trials.

Results and Discussion:

Chemical analyses indicated that dried 'MidSouth' pomace nutrient, metal, and tannin content is comparable to that of other reported grape cultivars that have been utilized as feed for steers (Tayengwa et al., 2021) or in vitro digestibility (Chikwanha et al., 2018), suggesting its potential as a viable dietary supplement (Table 1).

The preference study revealed that heifers demonstrated a consistent preference for the 25% DGP : 75% DDG supplement. The mean Preference Index was < 0.50, indicating that a greater proportion of total supplement intake came from the 25% DGP mixture. First-choice selection frequency supported this result, with heifers more frequently initiating consumption of the 25% DGP mixture. Short-term and total intake measurements further confirmed this preference; mean intake of the 25% DGP mixture was higher than that of the 50% DGP mixture. This suggests that palatability decreases as DGP inclusion increases. No abnormal feeding behavior or refusal was observed, indicating that both mixtures were acceptable, though the higher DGP inclusion level likely reduced sensory acceptance (e.g., tannin content, flavor intensity, or texture).

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Table 1. Average (± s.e.) nutrient, metal, and total tannin content of dried 'MidSouth' pomace (2024).

Acid Detergent Fiber (%)	**Neutral Detergent Fiber (%)**	**Calcium (%)**	**Magnesium (%)**	**Phosphorus (%)**	**Potassium (%)**	**Protein, crude (%)**	**Fat, crude (%)**	**Moisture (%)**	**Ash (%)**	**Total Tannin Content (g (+) catechin equivalents per L)**
46.14 ± 1.23	42.76 ± 1.52	0.35 ± 0.01	0.10 ± 0.00	0.20 ± 0.01	1.49 ± 0.09	8.40 ± 0.21	8.20 ± 0.26	6.50 ± 0.09	5.36 ± 0.54	64.02 ± 9.56