Analysis of Cattle Grazing Effects on Profitability in a Dryland Wheat-Sorghum-Fallow Rotation with an El Nino-La Nina Decision Variable

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Introduction

In the Texas High Plains irrigated land has decreased by 0.55 million ha from 1974 to 2000, partially due to the decline of the Ogallala Aquifer (Figure 1). The lack of sufficient water resources for continued irrigation may begin to impact profitability of operations. In order to enhance profitability, producers incorporate cattle grazing. It has been shown that grazing wheat for forage or dual purpose forage and grain production increased profitability over the corresponding grain-only system. Although cattle grazing intensifies production of the dryland wheat, sorghum, fallow (WSF) rotation (Figure 2) in the United States Southern High Plains, the level of risk associated also intensifies when cattle are introduced. In an attempt to aid producers in their decision making processes, a consistent and thorough analysis of the El Nino-La Nina Decision Variable, and the typical wet or dry weather patterns that accompany it is merited (Figure 3). As forecasts have come to predict the upcoming El Nino-La Nina years, producers can use the information to make more informed dryland management decisions.

Objectives

• To provide a consistent and thorough analysis of the incorporation of El Nino-La Nina years as an intervention when deciding to graze or not graze the dryland WSF rotation in the Southern High Plains.

• To evaluate the viability and subsequent deviation of profitability when cattle grazed are owned as opposed to a more risk-averse approach of leasing out the grazing to another producer.

Materials and Methods

From 1999-2009, the WSF rotation phases were established in duplicate ungrazed and grazed plots in three replicated paddocks in Bushland, Texas. Blocks were randomly assigned to each of the three phases. Each block contained randomly assigned grazed or ungrazed treatments in two 165 meter wide paddocks. Paddocks were then divided into three 55 meter wide plots that were assigned one of three phases in the WSF rotation (Figure 4). Cattle were bought in the first quarter of the year and were contained with electric fences. The target stocking rate for each acre was 1,600 pounds, depending on available forage, which yielded an approximate .25 head per acre (Figure 5). Cattle gain was calculated as the difference between stocking and pull off weights, determined after 1-d shrinkage.

Enterprise budgets generated by the Texas A&M AgriLife Extension Service were used to determine variable and fixed costs for each enterprise. Average monthly cattle prices for the purchase and sale data were generated by collecting sales data from 2004-2017 for the Amarillo, Dalhart, and Tulia Livestock Auctions. Wheat and sorghum grain prices were obtained from the National Agricultural Statistics Service (2017) for the years 2014-2017 and then averaged. The Decision Variable of El Nino-La Nina years was then incorporated into the model. It was determined that grazing would be done in the El Nino years, and no grazing would be done in the typically dryer La Nina years. The phase years were determined from NWS4 Research (2017), with the years '00, '01, '08 and '09 being La Nina, and '02-'07 being El Nino. Once incorporated, the profitability of the separate decisions was determined.

Results and Conclusion

Over the study period, 2000-2009, crop yields when using the El Nino-La Nina decision variable were higher for both sorghum and wheat during the El Nino years. On average, the yields for sorghum were 2.61 bushels per acre greater than the La Nina years, and the wheat was 2.63 bushels greater. For the Amaranth, Dalhart, and Tulia Livestock Auctions, wheat and sorghum grain prices were obtained from the National Agricultural Statistics Service (2017) for the years 2014-2017 and then averaged. The Decision Variable of El Nino-La Nina years was then incorporated into the model. It was determined that grazing would be done in the El Nino years, and no grazing would be done in the typically dryer La Nina years. The phase years were determined from NWS4 Research (2017), with the years '00, '01, '08 and '09 being La Nina, and '02-'07 being El Nino. Once incorporated, the profitability of the separate decisions was determined.

References


Figure 1. Aquifer Water Level Change

Figure 2. Wheat-Sorghum Fallow Rotation

Figure 3. El Nino Southern Oscillation Pattern

Figure 4. Sorghum – Wheat Transition

Figure 5. Cattle on Sorghum Stover

Figure 6. Wheat-Sorghum-Fallow Crop Yield in El Nino Years

Figure 7. Wheat-Sorghum-Fallow Crop Yield in La Nina Years

Figure 8. Wheat-Sorghum-Fallow Crop Profit in El Nino Years

Figure 9. Wheat-Sorghum-Fallow Crop Profit in La Nina Years

Figure 10. Profit by Enterprise with Decision Variable

Figure 11. Profit Summary by System, 2000-2009

Profit Functions

• Sorghum

Profit = Profit\text{Ungrazed} + \text{Fixed Cost}_\text{Total} - \text{Variable Cost}_\text{Total}

• Wheat

Profit = (Price - Cost)\text{Bushels}_\text{Total} - \text{Fixed Cost}_\text{Total} - \text{Variable Cost}_\text{Total}

• Stocker Cattle

Profit = (Sell Price + Grazing Cost) - Cost\text{Total} - \text{Variable Cost}_\text{Total}

• Ungrazed System

Profit = \text{Profit\text{Ungrazed}} + \text{Fixed Cost}_\text{Total} - \text{Variable Cost}_\text{Total}

• Fixed System

Profit = \text{Profit\text{Fixed-D}esk\text{Fixed}_\text{Total} - \text{Variable Cost}_\text{Total}

• Contracting Grazing System

Profit = \text{Profit\text{Fixed-D}esk\text{Fixed}_\text{Total} - \text{Variable Cost}_\text{Total}

• Decision Variable System

Profit Own = \text{Profit\text{Fixed-D}esk\text{Fixed}_\text{Total} - \text{Variable Cost}_\text{Total}

Profit Con = \text{Profit\text{Fixed-D}esk\text{Fixed}_\text{Total} - \text{Variable Cost}_\text{Total}

• Average Annual Profit in El Nino Years

• Average Annual Profit in La Nina Years

• Bar graph showing the change in water level over time.

• Bar graph showing the change in water level over time.

• Line graph showing the change in water level over time.

• Line graph showing the change in water level over time.