EXTENSION

Economically Optimal Planting of Dual-Purpose Wheat

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Introduction

Measured in acres, wheat is the largest cash crop grown in Oklahoma, with approximately 4.3 million acres sown annually (USDA-NASS 2021). In 2017, the value of winter wheat was $380 million, ranking it fifth in Oklahoma crops based on value, even before valuing winter wheat grazing stocker cattle (DeVuyst et al. 2018). Stocker grazing significantly adds to the value of Oklahoma's wheat crops, as up to one-half of Oklahoma wheat fields are utilized for winter grazing (OSU 2019).

Winter wheat is planted in early to mid-fall and harvested in late spring to early summer. Grain-only, forage-only or dual-purpose (both grain and forage) are production options for Oklahoma wheat producers. Dual-purpose wheat production, the production system of interest here, involves grazing stocker cattle on the wheat pasture from approximately Nov. 15 to March 1, depending on location and weather. Of the 19.77 million acres of U.S. Southern Plains region, up to 80% of wheat pastures are grazed by stockers (Epplin et al. 2000).

Deciding when to plant wheat is a major issue faced by Southern Plains wheat producers. Planting date significantly impacts forage production and grain yields. Generally, an earlier planting date results in more forage but grain yield decreases (Epplin et al. 2001). In contrast, October-planted wheat has low forage yield but higher grain yield. Forage production, utilization rate by stockers, and gain per head are important in determining stocking rate and generating economic returns. A late planting date results in less forage production, a lower stocking rate, fewer pounds of beef gained and lower returns from stocker grazing, but higher wheat grain returns. Thus, there is an economic tradeoff between forage yield and grain yield. Here, the economic tradeoffs are evaluated from alternative dual-purpose planting dates under varying wheat prices and value of stocker cattle gain.

Economic Model

Utilizing results from Epplin et al. (2000), the optimal wheat planting and seeding rates for Oklahoma was evaluated. Epplin estimated the relationship between planting date, wheat grain and wheat forage yields. Figure 1 shows the inverse relationship between wheat grain and wheat forage yield. Early planted (late August to early September) wheat yields more forage for wheat stocker grazing but at the cost of lower wheat grain. Conversely, delaying wheat planting to later in September results in higher grain yield but lower forage yield.

Using these estimated relationships, the effect of planting on economic returns to dual-purpose wheat was simulated. Wheat grain price was varied from $3.50 to $8 per bushel, in $0.25 increments. The value of stocker gain[1] was varied from $0.50 to $1 per pound of gain, in $0.10 increments. The ratio of wheat forage (dry matter) to gain was varied from 6 to 8 in pound increments. Per Krenzer (1994) and Epplin et al. (2000), wheat grain requires two pounds of nitrogen per bushel of grain. Wheat forage required 60 pounds of nitrogen per ton of wheat forage (DM). Anhydrous ammonia was priced $400 per ton. Seed price was $10 per bushel. It was assumed wheat pasture utilization was 76.11%, based on a two-year study from Pinchak et al. (1996). Stocker feed efficiency was varied from 6:1 (pounds DM wheat forage to one pound stocker gain) to 8:1. The lower end of the range was derived from Pinchak (1996) and Lalman and Richards (2015) and the upper end taken from Epplin et al. (2001).

At a wheat price of $6, VOG of $1 and feed-to-gain of 7, Figure 2 shows the economic impact of alternative planting dates. In this case, the optimal planting date is as early as practicable. The experimental data started with a planting date of Aug. 24, so the model was constrained to plant no earlier than that date. Aug. 24 has the highest returns and the cost of delaying planting declines by about $4 per day per acre. A decrease in the value-of-gain to $0.75 per pound, still has an optimal planting date of Aug. 24 but the decline in returns per day of delayed planting is around $2 per day per acre.

1 Since each additional pound of gain decreases sale price on previous pounds, value-of-gain is defined as the marginal value of an additional pound of gain given the price slide.

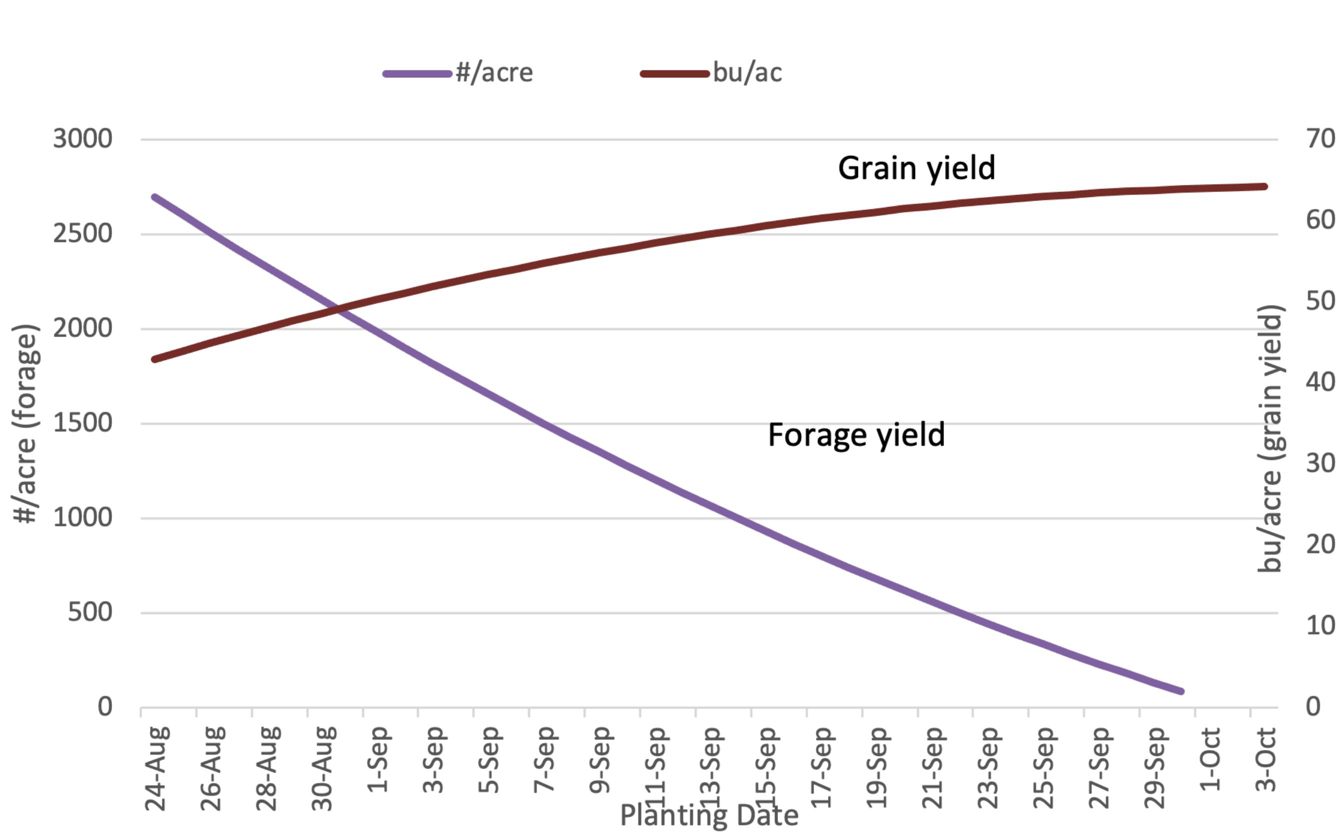

Figure 1. Predicted dual-purpose wheat forage yield and grain yield by planting date. Derived from Epplin et al. (2000).

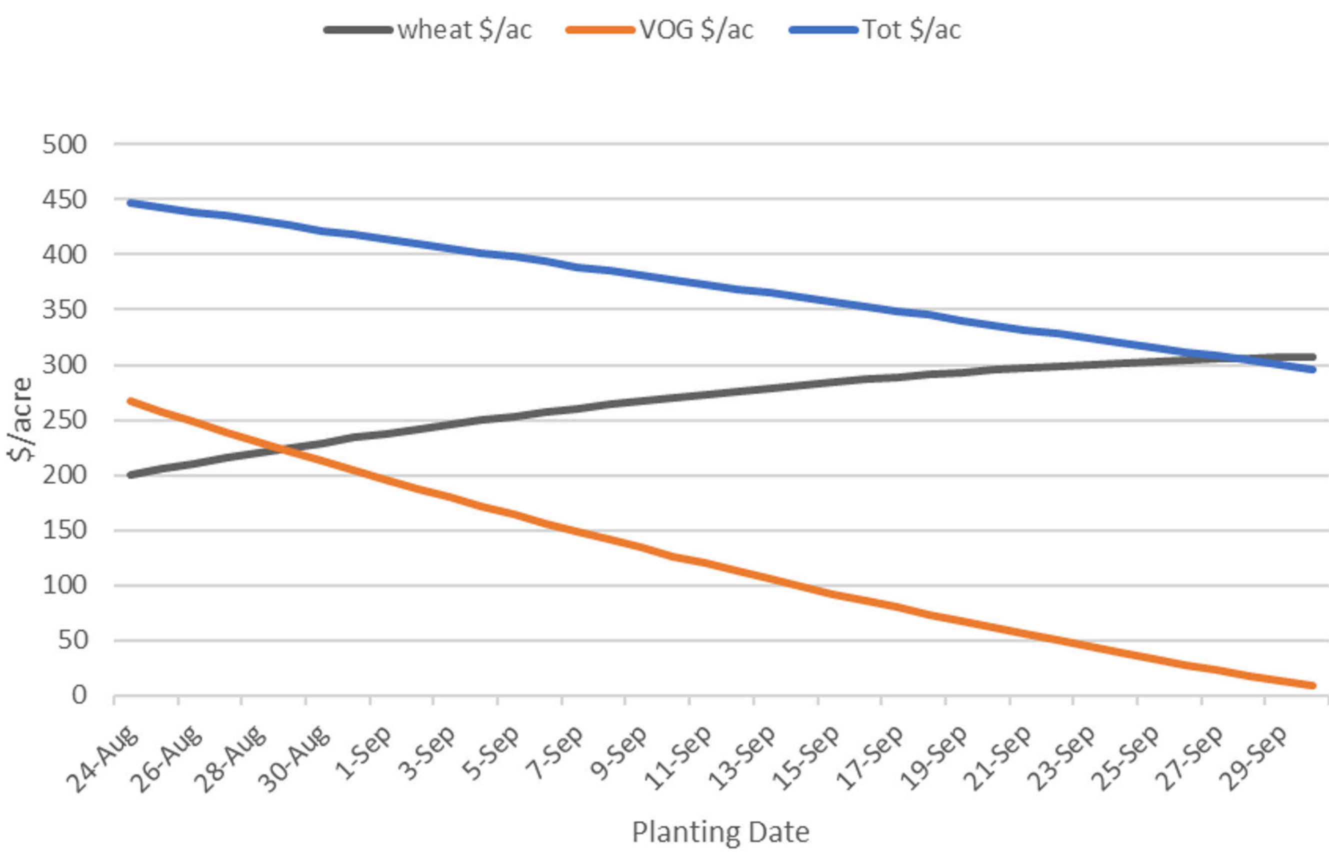

Figure 2. Returns to dual-purpose wheat by planting date with $1 value-of-gain (VOG), $6 wheat grain price and a feed-to-gain ratio of 7.

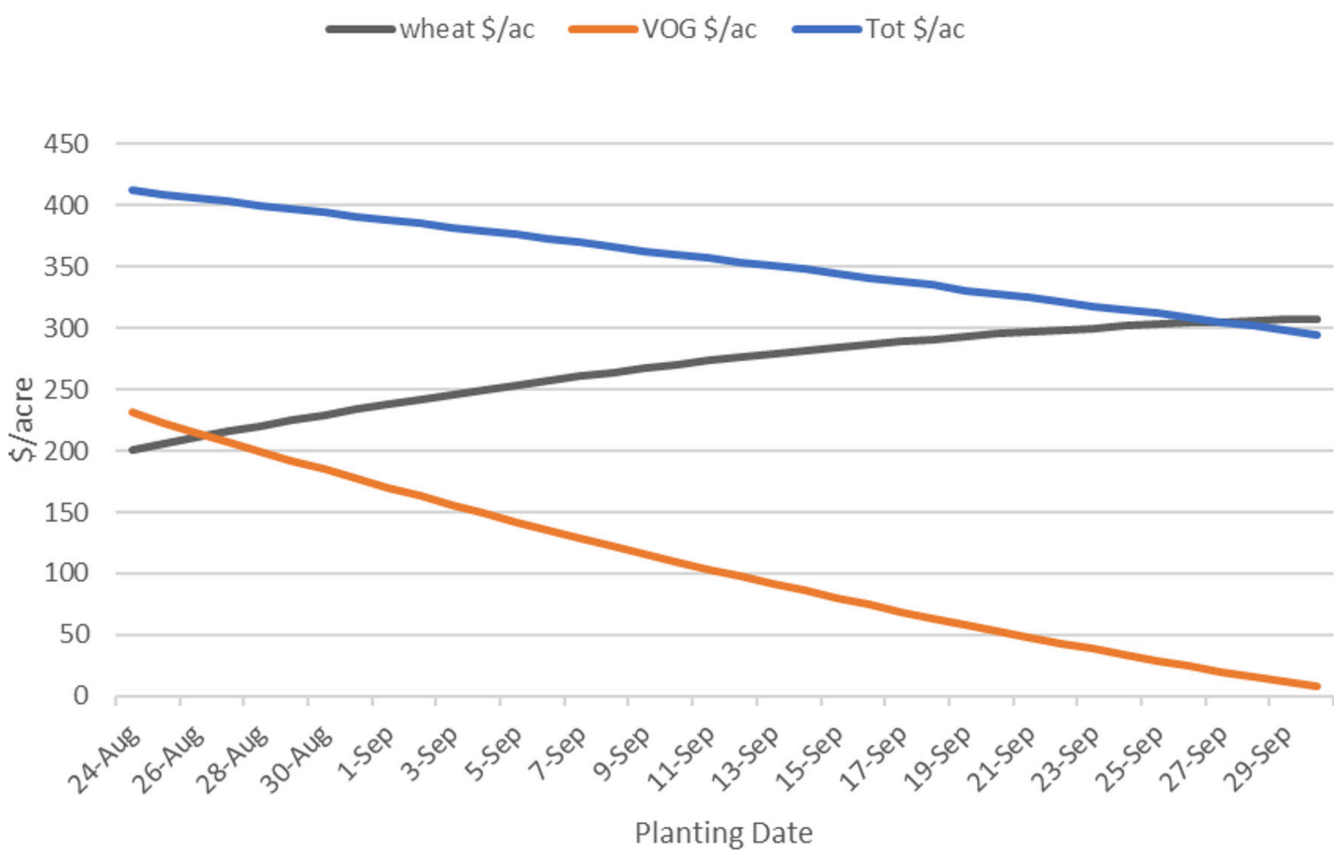

Figure 3. Returns to dual-purpose wheat by planting date with $1 value-of-gain, $6 wheat grain price and a feed-to-gain ratio of 8.

In cold, wet winters, wheat stocker feed efficiency suffers due to increased energy requirements. A 1-pound increase in feed-to-gain from 7 pounds to 8 pounds per pound of gain, flattens the total returns curve significantly, as in Figure 3. With a utilization rate of 76.11% and a feed-to-gain ratio of seven, 8.85 pounds of wheat forage (DM) are required for 1 pound of stocker gain. At a feed-to-gain of eight, 10.11 pounds of wheat forage are needed. While the highest returns are still associated with late August planting, the cost delay is slight. Delaying planting until Sept. 3 reduces returns by about $3 per acre per day as the value of wheat forage diminishes due to the lower feed efficiency, leading to a smaller penalty for delayed planting.

A late-August to early September planting is economically advisable when the ratio of wheat grain price to value of gain is 10 and a feed-to-gain ratio of eight. For example, if wheat price is $6 per bushel and value-of-gain is $0.60, the model shows a large window for planting from Aug. 27 to Sept. 8 with less than a $1 variation in returns. A price ratio of $8 wheat to $0.60 value-of-gain results in planting pushed back to mid-September with a large window 13 days (Sept. 11 to 23) with about a $1 difference in returns.

Conclusions

Current wheat prices and value-of-gain from wheat stockers suggest that late August planting dates have highest economic returns to dual-purpose wheat. However, soil temperature, soil moisture and pests may dictate delayed planting. Recent outbreaks of fall armyworms, for example, mitigate in favor of delayed planting. So, it is recommend planting as soon as dual-purpose wheat environmental conditions allow. Early planted wheat should be scouted frequently to allow for timely rescue pesticide applications if threshold pest levels are detected. Dry, hot soil conditions also mitigate in favor of delayed planting given some wheat varieties are sensitive to high soil temperature. Before seeding, growers should be aware of how environmental conditions impact germination for varieties being seeded. PSS-2256, Factors Affecting Wheat Germination and Emergence in Hot Soils lists recommended planting dates for soil-temperature sensitive wheat varieties.

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