Optimizing Seeding Rate and Grazing Intensity in Dual-use Wheat

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Highlights

- Grazing at 2″ stubble height reduced grain yield by 30% compared to ungrazed wheat.
- While excessive grazing provided greater forage forage yield, it resulted in low forage quality and substantial grain yield losses.
- Effects of seeding rates were compensated by either number of heads or number of seeds per head due to compensatory nature of wheat.
- Yield losses incurred with higher grazing intensity were largely irreversible and could not be compensated later.
- Increased yields at seeding rates lower than the highest applied seeding rate indicate an opportunity for producers to improve cost efficiency.

Producers and ranchers in Texas rely on integrated crop-livestock approach to diversify income, reduce economic risks and increase profitability. Almost 50% of wheat planted in Texas is used for grazing and a wide range of seeding rates and grazing management are practiced by producers. However, it is not well understood how seeding rate and grazing intensity affect wheat forage and grain yield and quality when livestock are removed at different times. In addition, optimizing seeding rate and grazing intensity may provide producers an opportunity to reduce input costs while maintaining or improving forage and grain productivity and quality.

Research trials were conducted over three site-years at Millersview (2019, 2020) and San Angelo (2020), TX. Hard Red winter wheat (TAM 114) was planted in late September at four seeding rates: 44, 65, 88, and 109 lb acre^{-1}. Forage was harvested prior to stem elongation at 2.0-, 2.5-, 3.5-, and 4.0-inches cutting heights (Photo 1) to simulate various grazing intensities and ungrazed plots were maintained as control (Photo 2).

Photo 1: Difference between grazing intensities at 2.0″ (right) and 4.0″ (left) cutting heights.

Photo 2: Mature wheat following maintained ungrazed plots (left) vs grazing at 2.0″ (right) cutting heights.

Forage and grain yields

Forage and grain yields of dual-use wheat were not affected by seeding rate (Figure 1A). This indicates that higher seeding rates may not be beneficial and provide an opportunity to reduce seeding rates and save input costs.

Grazing intensity influenced forage and grain yields (Figure 1B). Ungrazed wheat resulted in the greatest grain yield (2128 lb acre^{-1}) whereas grazing at 2″ stem height resulted in the least (1461 lb acre^{-1}).

Grazing at 4″ stem height produced similar grain yields compared to ungrazed wheat. This indicates that grain yields can be maintained with optimal grazing (Figure 1B) which can be achieved by removing livestock from wheat in a timely fashion.

Higher forage yields were obtained at higher grazing intensity and grazing at 2″ stem height resulted in highest forage yield (1370 lb acre^{-1}).

Intensive grazing resulted in lower grain yields which suggests that excessive grazing may provide similar forage yields but will incur grain yield penalty.

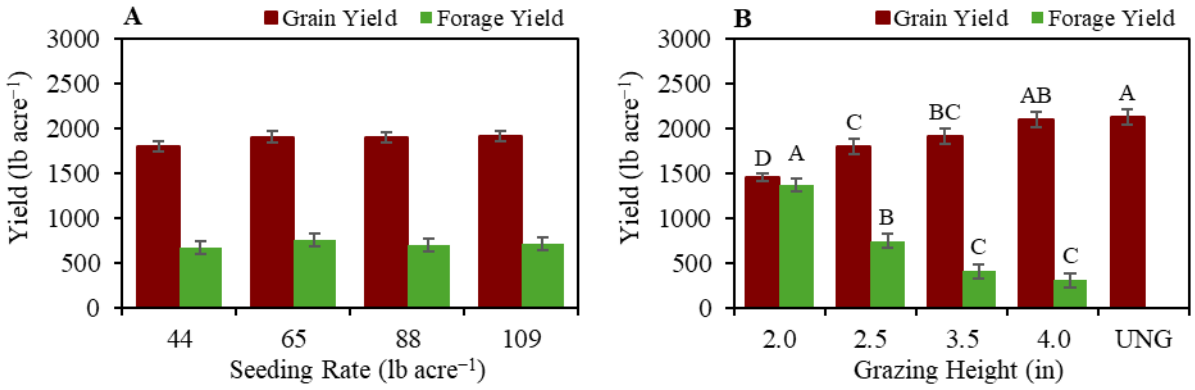

Figure 1: Grain yield and forage yield of dual-use wheat observed under different seeding rates **(A)** and grazing management simulated by cutting heights **(B)**.

Seeding rate and yield components

Higher seeding rate resulted in higher number of heads per acre however, number of seeds per head were reduced with increase in seeding rate (Table 1).

Seeding at 109 lb acre^{-1} resulted in highest number of heads (1.14 million acre^{-1}) whereas seeding at 44 lb acre^{-1} resulted in highest number of seeds per head (28 seeds) (Table 1). 2

Number of heads and number of seeds per head were similar at 65, 88 and 109 lb acre^{-1} seeding rates.

These trends indicate that wheat yield will be compensated if the producers reduce the seeding rate to a threshold and grain and forage yield potential will still be achieved.

Table 1: Effect of seeding rate on yield components of dual-use wheat.

Seeding rate (lb acre^{-1})	Heads (million acre^{-1})	Seeds per head (no.)
44	0.91 b	27.70 a
65	1.04 a	26.65 ab
88	1.04 a	25.04 b
109	1.14 a	24.63 b

Grazing intensity and yield components

Intensive grazing reduced the number of heads and number of seeds per head (Table 2).

Grazing at 3.5″ and 4″ stem heights produced similar number of heads whereas number of seeds per head were similar at 2.5″, 3.5″ and 4″ grazing intensities.

Table 2: Effect of grazing intensity (cutting height) on yield components of dual-use wheat.

Grazing height (in)	Heads (million acre^{-1})	Seeds per head (no.)
2.0	0.88 c	22.95 b
2.5	1.00 b	27.10 a
3.5	1.11 a	26.72 a
4.0	1.15 a	27.24 a

Performance evaluation over site-years

Grain and forage yields varied among the three site years (Figure 2).

Grain yield was highest at Millersview in 2020 (2358 lb acre^{-1}) and lowest at San Angelo in 2020 (1446 lb acre^{-1}).

Forage yield was highest in 2019 (1127 lb acre^{-1}) and lowest in 2020 (266 lb acre^{-1}) at Millersview.

Performance of yield components (Table 3) also varied among three site-years which possibly contribute to differences in yields.

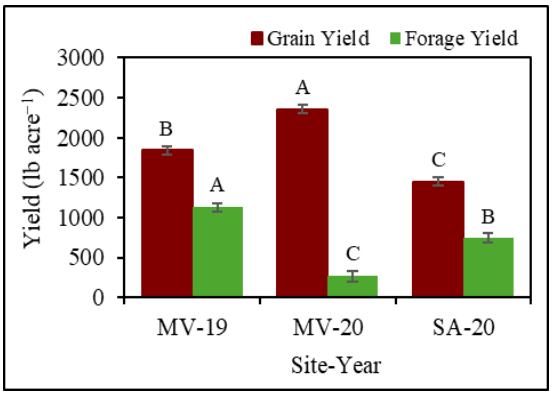

Figure 2: Grain and forage yields of dual-use wheat over three site-years.

Table 3: Performance of yield components including number of heads, seed weight and number of seeds per head over three site-years.

Site-Year	Heads (million acre^{-1})	Seed weight (g)	Seeds per head (no.)
Millersview-19	1.50 a	0.03 a	22.40 c
Millersview -20	0.66 c	0.02 b	26.52 b
San Angelo-20	0.94 b	0.02 b	29.10 a

Forage quality

Neutral detergent fiber (NDF) and Acid detergent fiber (ADF) reduced with taller stubble height (lower grazing intensity) and intense grazing resulted in higher NDF and ADF proportions (Figure 3).

Crude protein and relative feed value (RFV) (Figure 4) increased with low grazing intensity and vice versa.

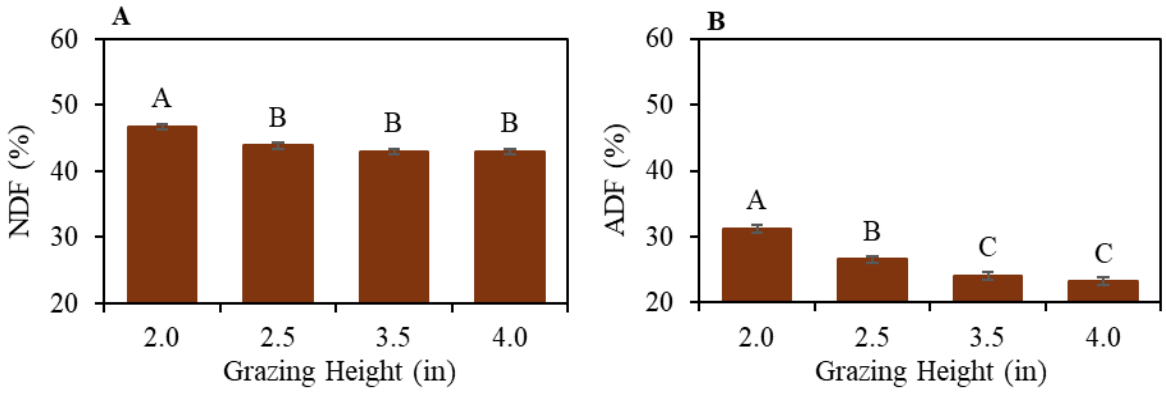

Figure 3: Effect of grazing intensity on forage quality: NDF **(A)** and ADF **(B)** of dual-use wheat.

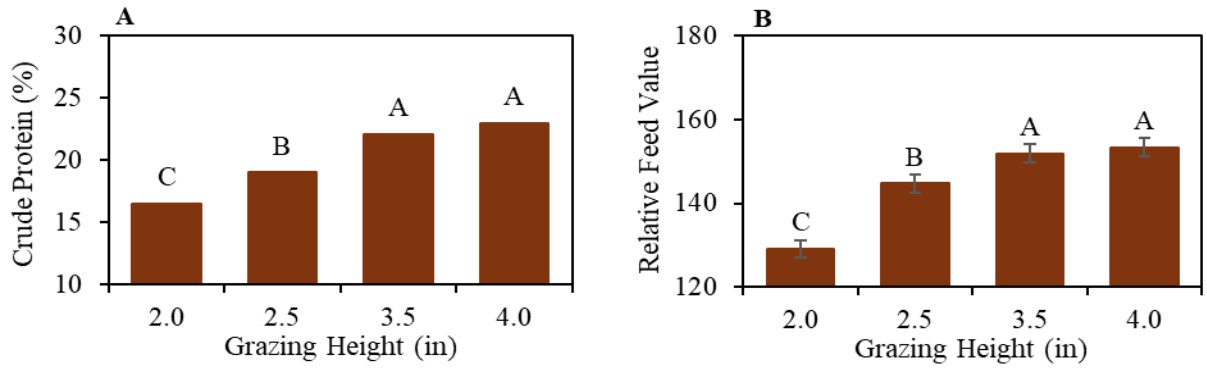

Figure 4: Effect of grazing intensity on forage quality: crude protein **(A)** and relative feed value-RFV **(B)** of dual use wheat.

Implications of producers

Forage and grain yields were not affected by seeding rates were optimized at 80 and 92 lb acre^{-1}, respectively (Figure 5).

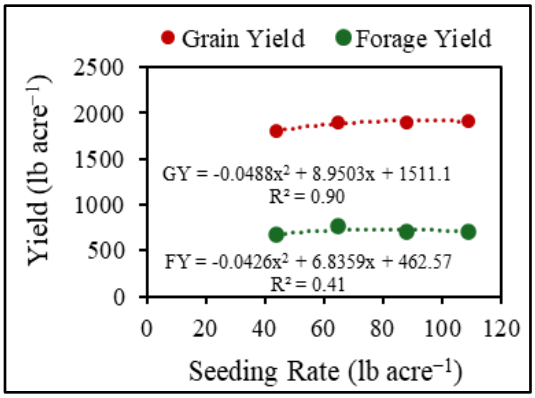

Figure 5: Grain and forage yields of dual-use wheat to applied seeding rates.

Intensive grazing increased NDF and ADF concentrations while reducing crude protein and relative feed value, indicating that intense grazing can compromise forage quality in addition to reducing grain yield.

Producers should consider that intensive grazing may reduce animal performance or milk and weight gains due to higher proportion of stem material in the forage. Similarly, excessive grazing pressure can increase the risk of harvestable yield losses. Maintaining moderate grazing intensity will help balance forage quality, animal gains, and grain yield protection.

Dual-use wheat performance varied across site-years therefore, seasonal and site-specific management strategies are required.

Market trends, livestock needs, and equipment capacity may further influence in-season dual-use management decisions.

Acknowledgement

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