IMPROVING GRASSLAND WITH ALFALFA IN THE TEXAS HIGH PLAINS

Madhav Dhakal, Chuck West, Carlos Villalobos, Philip Brown, Paul Green, Rick Kellison, Kathryn Radicke, Jhones Sarturi, and Donna McCallister

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Irrigation has greatly increased crop production in the Texas High Plains since the mid-twentieth century. Large areas of grazing lands that lack irrigation, however, are at low levels of productivity because of water deficit, lack of fertilization, weed encroachment, and overgrazing. Semi-arid grasslands in the High Plains are grazed mostly by beef cow-calf herds, whose protein- and energy-deficient diets are often supplemented with hay and expensive feeds.

The decline in water reserves of the Ogallala Aquifer is forcing some crop producers to reduce or eliminate irrigation on some acres. This prompts producers to seek water-frugal alternative crops, such as perennial grasses for beef cattle production. Example alternatives include improved non-native grasses, such as Old World bluestems, or a mixture of native grasses resembling the prairies that formerly supported bison.

Alfalfa is traditionally managed as an irrigated hay crop and is known for high water requirements to achieve maximum yield. However, alfalfa has a role to play in crop choice where irrigation is limited or even excluded. Alfalfa originated in southwest Asia where heat and drought are common. It can produce a deep taproot and access soil water that is below the reach of most grasses. The valuable protein and energy contents of alfalfa make it an underexploited resource for pastures.

At Texas Tech University, we tested the practicality of interseeding alfalfa into existing grass pastures to enhance nutritive value of the forage mixture. Another motive was to eliminate nitrogen fertilizer application and take advantage of the ability of alfalfa to fix nitrogen from the air. The cost was in purchasing alfalfa seed and devoting machinery, fuel, and labor for establishment. There is risk that alfalfa may intensify soil water extraction and compete with the grass for water, which sets up a possible trade-off between forage improvement and water depletion.

Two hay-type varieties, NuMex Bill Melton and WL 440HQ, and a grazing-type Falcata-Rhizoma blend were interseeded in 14- or 28-inch row spacing into non-irrigated pasture consisting mainly of blue grama, sideoats grama, and green sprangletop. The seeding rates were 11, 14, and 14 lbs. pure live seed/acre for 14-inch spacing, for 5.5, 7 and 7 lbs./acre, for the three varieties, respectively.

Alfalfa plant density, alfalfa ground cover, grass-alfalfa mixture yield, and species composition were recorded multiple times per year. Forage samples were analyzed for nutritive value. Soil water content was monitored down to 3.3 ft. to calculate soil- water usage and forage water-use efficiency. The amount of water used per pound of crude protein and digestible organic matter (similar to total digestible nutrients, or TDN) production was also calculated.

Emerged alfalfa seedlings in March 2016, 5 months after seeding at 28-inch spacing.

One-year-old alfalfa stand at 14-inch row spacing in September 2016.

Three-year-old alfalfa stand in October 2018 at 28-inch spacing.

TEXAS TECH UNIVERSITY College of Agricultural Sciences & Natural Resources

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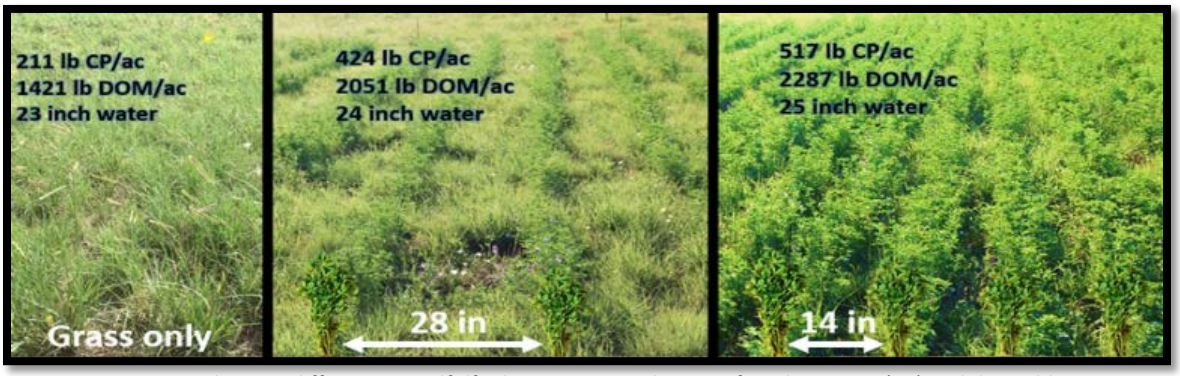

Figure 1: Diagram showing differences in alfalfa density, accumulations of crude protein (CP) and digestible organic matter (DOM), and annual use of water from rain plus soil storage from grass-only to narrow-row spacing.

Alfalfa-grass mixtures produced 36% more forage (3000 vs. 2210 lbs./acre) and 59% greater protein concentration (14.2% vs. 9.2%) than the grass growing without alfalfa. The combination of greater forage yield and richer protein content resulted in a large boost in protein accumulation (470 vs. 210 lbs./acre per year) over grass alone. By the third year, there were no differences between narrow-row and wide-row spacings. There was no effort to control weeds in the plots because we wanted to see the effect of interseeding alfalfa on its competitiveness with weeds. In the first year, alfalfa presence suppressed weed content by 27%, and by the end of the third-year weeds were suppressed by 60% over grass growing without alfalfa.

Interseeding alfalfa increased the digestible organic matter concentration of the harvested forage by 7 percentage points over grass-only (71% vs. 64%). The ratio of digestible organic matter to crude protein was between 4 and 6 for alfalfa-grass mixtures vs. above 6 for grass-only. Lower ratios indicate that growing cattle grazing the mixtures would gain weight without protein supplementation, whereas ratios above 6 indicate needs for protein supplementation.

Wide-row spacing of alfalfa was as effective as narrow-row spacing in improving overall forage nutritional value over the grass without alfalfa at half the seed cost. The amount of water used per year as evapotranspiration was 23, 24, and 25 inches for grass-only, wide spacing, and narrow spacing, respectively (Figure 1). Interseeding alfalfa into native grasses increased water-use efficiency by 25% over the grass-only (150 vs. 118 lbs. dry matter/acre-inch of evapotranspiration). The increase in efficiency was caused by a relatively large increase in forage production compared with a small increase in water use.

Conclusions

Interseeding alfalfa at much lower density than normal, at 5.5 to 7 lbs./acre of live seed in wide rows, can be considered a viable means to improve native grass pastures in the southern High Plains to take advantage of the large increase in forage growth and nutritive value that alfalfa provides. It is not necessary to use a low-growing grazing-type variety. Planting a well-adapted, persistent, hay-type variety exploits the best traits of plant vigor, competitiveness, and likely greater rooting depth. Producers could save seed costs at the lower seeding rate afforded by wide spacing.

Planting alfalfa at wide-row spacing is as effective as narrow rows in improving water-use efficiency for production of forage supply and digestible nutrients for cattle production. Interseeding alfalfa into native grass stands at only 7 lbs./acre enhanced soil water loss by only a small degree over no alfalfa, but with large enough improvements in digestible energy and protein to significantly reduce the need for purchased supplements for cattle. Another reason for low-density planting of alfalfa is to prevent its excessive competitiveness against the grass at high densities when above-average rainfall favors vigorous growth.

This trial only lasted 3 years, so more years would be needed to determine the real persistence of alfalfa under local rainfed conditions. We would expect alfalfa growing with native grasses without irrigation to last no more than 4-5 years, at which time new interseeding would be needed.

A common concern is weed control in alfalfa-grass pastures, because most herbicides that control broadleaf weeds can injure or kill alfalfa. We suggest practicing a strategic weed spraying program of the grass pasture during the year previous to interseeding alfalfa to reduce unpalatable weeds such as thistles, silverleaf nightshade, and marestail. Good soil fertility and proper grazing management help maintain alfalfa and grass competitiveness against weeds.

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Interseeding alfalfa into native grasses using a Tye no-till drill in October 2015.