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WATER REDUCTION USING WW-B.DAHL PASTURES TO PRODUCE BEEF: POTENTIAL TO RELIEVE AQUUFER IRRIGATION AND SUSTAIN MORE INTENSIVE AGRICULTURE FOR DIVERSE WESTERN RANGELAND CONDITIONS

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High rates of water withdrawal from the Ogallala aquifer threatens sustainability of various agricultural uses. Since rainfall patterns differ across many Western regions where beef grazing and combined beef and crop rotation practices prevail, locating grasses that meet high nutrition standards for beef while dramatically reducing water requirements (from irrigation of rainfall) under normal and drought conditions rises in importance.

We present results of a two year study on 54 hectares using WW-B.Dahl [Bothriochloa bladhii (Retz) S.T. Blake] pasture. For two consecutive summers, we evaluated forage standing crops and the quality of WW-B.Dahl grass under summer grazing conditions subject to three levels of water application in Lubbock County, Texas: dryland conditions, low water applications and high applications. In each category, there was substantive reduction in water withdrawals.

While rainfall in these two years realized a record high, followed by a record low, results unexpectedly allow initial projections that cover a wide range of real conditions.

Performance of WW-B.Dahl suggest that WW-B.Dahl performs well under drought conditions (forming a buffer for ranchers), but also Forage standing crop and quality of WW-B.Dahl grass under dryland conditions, even in the record dry year, appears suitable to support moderate stocking rate (two head/ha) during the summer, suggesting it can be incorporated to beef stocker operations.

Incorporating WW-B.Dahl allows more grazing on less land, drought insurance for non-irrigated producers and substantial reduction in water applications by irrigation. Future work on multi-crop/beef rotation is promising for sustaining more intensive agriculture without aquifer reliance.

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Beef Management Flexibility with WW-B Dahl Pastures: A Conceptual Framework for Water Conservation in Intensive Agriculture in Semi-Arid Regions

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Introduction

There is growing concern about the low recharge rate in the Ogallala aquifer. Long periods of over pumping and limited precipitation are the main sources of stress on this aquifer system. Even with the adoption of existing agricultural practices to reduce water withdrawal, it is imperative to introduce even more novel agricultural alternatives to reduce dependence on the aquifer. Since dryland or very low irrigation cultivation precludes a single crop system, multiple-cropping systems augmented by animal foraging allow for the integration of rangeland practices and modest intensive farming practices. This paper considers several flexible options for cow/calf and for beef-forage production systems that move cattle on and off the range and into crop-forage integrated system as weather conditions or economic conditions change.

One possible solution to implement animal husbandry forage/beef production systems effectively is to use improved warm season grasses brought from Europe and Asia. These grasses have been tested in the Southern High Plains for more than 60 years. Particularly, in the Texas High Plains, Bothriochloa species such as Caucasian, Spar, Plains, and WW-B Dahl have shown promising results. These grasses respond well to limited precipitation stresses for grazing during the growing season by allowing cattle to move between the integrated system and the range and to generous range recovery during high rainfall periods by leaving cattle on the integrated system for most of the production cycle. As a result the use of these grasses for forage/beef production systems offers great flexibility to cattle management under erratic and limited rainfall situations,

Justification

Sustained water withdrawal from the Ogallala aquifer has lowered the water table, obligating producers to pump deeper for water lift. As a result, irrigated crops are slowly losing competitiveness because of the high cost of pumping. Implementation of forage/beef production systems might bring some relief to the aquifer, perhaps replacing irrigated agriculture altogether in the distant future, and at the same time introduce agricultural diversification to the region.

Cow/calf and stocker systems are well established in the region with the use of winter and warm season pastures. However, the existing warm season grasses such as bermudagrass demand high moisture conditions for growth. WW-B Dahl has the advantage that it grows under conditions of soil and water stress. W-B Dahl grass robustness and strong cattle performance has been documented under various irrigation gradients, grazing systems, and summer and winter supplementation (Villalobos et al. 2000), (Villalobos et al.2002), (Bezanilla 2002), and (Ortega 2006). There is also some initial tests in rotational cropping where WW-B Dahl, ryegrass, wheat, sorghum, and native grasses are produced alongside a cotton production system (Allen et al. 2005). These studies suggest that important reduction in underground water use might be accomplished and they also report significant weight gain in cattle.

Conceptual framework

This conceptual framework propounds to reduce underground water withdrawal using WW B Dahl grass to enhance beef production, provide cattle management options and to diversify agricultural activities in the region. The model considers the prevalent beef production systems in the region (cow/calf, stocker, and feedlot operations). Forage resources available in the region are scheduled for use when there is a high forage potential and grazing can proceed without damaging regrowth. The forage resources in the region are native rangeland, WW-B Dahl grass, and winter wheat (Fig. 1). The figure depicts a conceptual framework for flexible forage/beef production with movement from one forage resource to another to best take advantage of bountiful rainfall as it maintains a cattle enterprise in periods of severe drought.

WW-B Dahl Pasture Management

It is recommended to fertilize the pasture in early spring with 120 lbs/acre of ammonia sulfate. If soil moisture conditions are poor, one inch of irrigation is advised. Summer grazing begins in June when plants develop the leaves to support photosynthesis and ends in early September to permit plants to enter their reproductive stage and complete their growth cycle. The stocking rate typically allows grazing at 600 lbs of live weight per acre over the season. If there is a dry spring and summer, recommendations lower the stocking rate and amend the irrigation calendar. Winter grazing begins after the first frost. This allows plants to enter dormancy and protects next season herbage growth. Winter grazing ends, in late winter or early spring when grasses sprout.

Base Cow Herd

The model proposes two options for the cow/calf operation (Fig. 2).

In option one the base cow herd grazes native rangeland during winter and spring. After that, the herd is moved to WW-B. Dahl grass for the summer and the breeding season is programmed for that time. This takes advantage of quality forage and a stocking density to improve conception rates. At the end of summer the herd returns to native rangeland.

The second option illustrated on Figure 2 grazes WW-B Dahl in winter with just weaned heifers. These heifers will be the future dams that will eventually replace culled cows. Moreover, heifers should be fed with a high quality protein supplement during this season to ensure desirable body weight for later breeding. Then heifers are moved to native rangeland during spring and back to WW-B Dahl pasture in summer where they will be exposed to bulls. Finally, heifers return to native rangeland during fall.

Stocker Operation

A highly flexible and dynamic stocker operation is represented on Figure 3. Stocker operations allow four alternatives to use the forage resources available. The first alternative grazes weaned steers or heifers from the cow/calf operation on winter wheat. Stockers graze during winter and

spring in this pasture and are moved to WW-B Dahl grass in summer. After 90 days of grazing in WW-B Dahl pasture, cattle may be sent to the feedlot.
The second alternative places weaned stocker in WW-B Dahl pasture during the winter and feeds them protein supplement to maintain or even gain weight. During the spring stocker are moved to native rangeland where they may receive supplementation if winter moisture conditions were unfavorable. Cattle graze for three month in WW-B Dahl during the summer and are sent to the feedlot in fall.

The third alternative leaves stockers in winter wheat for two seasons (winter and spring) and then grazes them during the summer in WW-B Dahl. Stockers end in the native rangeland in the fall.

The last alternative keeps weaned stockers in native rangeland during the winter and spring. Stockers may receive energy and protein supplements during these seasons. Stockers are moved to WW-B Dahl pasture during the summer and then sent to the feedlot.

Economic and Environmental Implications

In general, the model relies on maximizing forage growth under normal rainfall conditions. The economic outcomes reduce beef production cost due to reduced water and energy costs; diversify agriculture from dependence on monoculture cotton; and increases considerably cattle management options to preserve the base herd under drought conditions. Environmental benefits allow greater deferment and rest of native rangeland which results in less soil erosion, less water use, less air pollution since perennial grasses cover the ground all year around and better wildlife habitat.

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