

INTEGRATING GRAZING BEEF CATTLE AND CROP PRODUCTION IN THE SOUTHERN HIGH PLAINS

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ABSTRACT

Agricultural intensification during the past century resulted in specialization of crop and livestock in monoculture systems that captured economies of scale and contributed to increased production. Today, concerns are growing over the ability to maintain long-term intensive monoculture agriculture. Increasingly, these systems are recognized as extracting non-sustainable environmental costs. Such systems are more vulnerable to issues of biosecurity and create dependence on costly infrastructure. Integrating grazing livestock with cropping systems can improve system resilience, diversify income, and decrease dependence on non-renewable resources and energy. The Texas High Plains exemplifies these challenges where cotton (*Gossypium hirsutum* L.) and cattle in monoculture systems represent major agricultural enterprises. Agriculture here is dependent on water extracted from the Ogallala at rates that have exceeded recharge for many years. The decline in water resources, escalating energy costs, and anticipated changes in farm programs are driving dramatic changes in this region. In 1998, long-term systems research was initiated to compare the cotton monoculture typical of the region with an integrated cotton-beef cattle system. At the end of five years, the integrated system lowered irrigation water applied by 23%, decreased nitrogen fertilizer by 40%, and improved profitability by about 90%. Additional benefits were increased soil organic carbon, improved soil microbial activity, decreased soil erosion, improved plant growth, and diversification of income sources. Increasing cotton yields through improved genetics and management can increase profitability in the short term but longer term sustainability of the natural resource base depends on benefits captured by the integrated system.

SUMMARY

Use of land is intensifying as global populations continue to increase and demands for food, feed grains, and fiber expands. With this global increase in need for food and feed production, crop farming intrudes increasingly into traditional grazing lands resulting in over grazing of remaining lands and increasing pressure on natural resources. Declining water resources, soil fertility, air quality, wildlife habitat, and loss of resilience of ecosystems are becoming critical issues.

Worldwide, a key feature of agricultural intensification has been specialization in crop and livestock production, resulting in fewer crop and/or livestock species that are maintained together. Agriculture in the 21st century will increasingly be asked to continue providing an abundant supply of safe and wholesome food and fiber at a reasonable cost and which is environmentally benign and assures the future economic and social sustainability of rural areas. The most scientifically sound and objective way to accomplish this will be by fully exploiting the many advantages and benefits of production systems which are well integrated and are

diverse. The concept of integrated systems must be viewed not only on an individual farming entity basis but from a landscape perspective where the mosaic of crop and livestock systems contribute to the diversification of the regional system as well.

The Texas High Plains exemplifies the challenges and opportunities of agricultural production, natural resource management, and economic stability. In 1998, a long-term comparison of two irrigated systems began that includes an integrated crop-livestock system and a cotton monoculture typical of the region. A primary objective of this research is to identify agricultural strategies that conserve water resources and to provide economic viability through inclusion of the grazing animal within the cropping system. Begun in 1997, two large-scale replicated systems compare water use, productivity, and economics of a cotton monoculture and an integrated 3-paddock system that includes cotton in a 2-paddock rotation with grazed wheat (*Triticum aestivum* L.) and rye (*Secale cereale* L.) and the perennial 'WW-B. Dahl' old world bluestem [*Bothriochloa bladhii* (Retz) S.T. Blake]) in the third paddock for grazing and seed production. Angus crossbred beef steers (*Bos taurus* L.; initial BW 249 kg; SD= 26 kg) sequence graze dormant bluestem, rye, wheat, and spring-growth of bluestem from January to mid-July when they enter the feedyard for finishing. Both systems are irrigated by a subsurface drip system (Netafim, Tel Aviv, Israel 64922).

Over the first five years of this research, the integrated system used 23% less irrigation water, 40% less nitrogen fertilizer, and fewer other chemical inputs than the monoculture cotton. Cotton yields in both systems averaged about 1050 kg ha⁻¹. Steers gained about 0.82 kg d⁻¹ from January to July when they then entered the feedyard for finishing. Cattle gained about 1.6 kg d⁻¹ during the 125-d finishing period and 54% graded USDA Choice. Profitability was 90% greater for the integrated system at this yield level and with a 90-m pumping depth for irrigation water, the actual depth to water at the research site and a representative depth for the region. Income sources were diversified in the integrated system to include cattle, cotton, grass seed, and potentially hay and small grains. In the continuous cotton system, alternative crop strategies were severely limited in the event of a crop failure due to time and herbicides already applied.

With the decline in water resources in this region, alternative strategies are essential if productivity of crops and livestock are sustained. This will likely require a return of significant areas to dryland systems. As the world's attention focuses increasingly on the need for a safe, economical, and adequate food supply for a growing global population, there must be equal concern for the sustainability of that food production and the protection of our natural resources and environment. The grazing animal will likely play a key role in achieving these objectives and contributing to resilience of these ecosystems. The Texas High Plains is but a case study for the challenges that are unfolding across this country and around the world.

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