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Invited Review: Matching forage systems with cow size and environment for sustainable cow-calf production in the southern region of the United States[1]

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ABSTRACT

Due to increasing red meat demand from the projected increase in world population coupled with reductions in available grazing lands, there has been increased interest in intensification of cow-calf production. Mature cow size has increased by over 30% since the mid-1970s, increasing cow ME requirements, reducing pasture carrying capacity, and increasing other input costs associated with cow maintenance. Research from the 1960s and 1970s indicates that in limited resource environments (western plains states for instance), the reduced efficiency of larger cows may be a limiting factor to the economics of production, whereas in less restricted environments (higher rainfall environments such as the humid southern states or in dry-lot feeding systems), mature cow size may not be a significantly limiting factor. Forage management strategies, which include targeted fertilization, stockpiling, and complementary forages, can be incorporated with improved grazing management to reduce reliance on often expensive supplemental feed and stored forages as well as fertilizer and fuel inputs to the enterprise. Integration of multiple management technologies (rotational grazing, stockpiling both cool- and warm-season perennials, and planting cool-season annuals) into a production system has been shown to enable increased stocking rates and calf BW weaned per hectare, while also decreasing the requirement for conserved forages. By intensifying the management of cow herds and pastures, ranch carrying capacity can be increased and thereby increase available stocking rates, offset the effects of increased cow mature size, increase total system productivity, and provide for an economically sustainable cow-calf production system.

Key words: cow-calf, forage systems, management intensification, sustainability

INTRODUCTION

Producers have faced increasing costs of production with increases in costs of fuel, fertilizer, and equipment leading to large increases in the cost of hay production. Decreasing stored feed requirements in beef production has thus received attention (White et al., 1989), yet it has been estimated that hay is commonly fed for over 130 d/yr in the southeastern United States (Troxel et al., 2014). Additionally, there has been a 30% increase in cow mature size over the last 30 yr (McMurry, 2008).

The increased use of the round baler and other hay production technologies since the early and mid-1970s has lowered the labor requirement and increased the convenience of hay production and thus the total amount of hay produced. For instance, hay production per cow (Figure 1) in the southeastern United States (Arkansas) has increased by 136% (USDA NASS, 2016) since 1976. From 1976 (USDA, 1977) to 2015 (USDA NASS, 2015), hay production per cow has increased annually by an average of 51.5 kg/cow, compared with an increase in hay production of 8.8 kg/cow from 1956 to 1976 (Figure 1).

From 1975 (USDA, 1976) to 2015 (USDA NASS, 2015), cow numbers have decreased by 35%, but beef production has been maintained at a level similar to 1975 (11.7 billion kg of beef produced in 2015), thus intensification of beef production has garnered much attention in the industry. In response to the low cow numbers, the need for a level of beef production adequate to meet consumer expectations, and economic conditions, carcass weights have increased

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to over 395 kg (USDA NASS, 2015) and it is doubtful that the smaller cows of 40 yr ago could produce offspring capable of this carcass weight.

There is no doubt that beef production is more efficient because of technology advances in growth promotants, feed milling, and feed additives in the last 30 yr (Johnson et al., 2013; Lusk, 2013) with huge improvements in environmental sustainability (Capper and Hayes, 2012) and economic viability (Lusk, 2013). Due to the increased costs of production, the sustainability of beef production has become an issue, and thus the objective of this review is to provide an overview of forage management strategies for economically sustainable intensification of cow-calf production.

REVIEW AND DISCUSSION

Increasing Mature BW of the United States Cow Herd

McMurry (2008) calculated that average cow slaughter weights have increased from 475 kg in 1975 to 621 kg in 2005. Data (Figure 1) from the USDA-Southern Plains Range Research Station's Southern Plains Experimental Range (**SPRRS**) near Fort Supply, Oklahoma (36°35′N, 99°35′W), indicate that mature cow BW increased (Cow BW, kg = 430.9 + 3.2 × Yr; $P < 0.01$; $R^2 = 0.79$) 3.2 kg/yr from 387 kg in 1954 to 617 kg in 2015. This increase in cow BW is tied to the vast genetic improvement of the cow herd. For instance in the Angus breed (American Angus Association, 2016), the average yearling BW of bulls and heifers has increased by 3.6 and 2.6 kg/yr since 1972 (Figure 2; yearling BW [bull], kg = 391 + 3.6 × Yr, $P < 0.01$; $R^2 = 0.79$ and yearling BW [heifer], kg = 292 + 2.6 × Yr, $P < 0.01$; $R^2 = 0.79$), and selection for genetic improvement in yearling BW and weaning BW have strong positive correlations with mature size (Brinks et al., 1964; Northcutt and Wilson, 1993; Williams et al., 2009). Changes in cow BW are not a recent advent. As the progenitors of modern cattle were domesticated, limited feeding and selection for docility over thousands of years resulted in decreased size relative to the wild aurochs; yet improved husbandry practices and selective breeding during the medieval period increased size until cattle were comparable to their wild ancestors (Specht, 2016).

A 30% larger cow requires 22% more daily maintenance energy (NRC, 1996) and will consume 22 to 28% more forage DM daily, decreasing cow carrying capacity of the farm or increasing input costs associated with pasture management, supplementation, and stored forages. As cow mature BW increased over the years at SPRRS, calf weaning BW (Figure 1) increased by 1.1 kg/yr (calf weaning BW, kg = 225.9 + 1.14 × Yr, $P < 0.01$; $R^2 = 0.46$) and weaning efficiency (kg of calf weaned per 100 kg of cow BW) tended to decline 0.08 units/yr (weaning efficiency = 51.98 − 0.08 × Yr, $P = 0.07$; $R^2 = 0.08$). Gillen and Sims (2002) estimated the economically optimal stocking rate during the 1950s and early 1960s at the SPRRS to be 0.17 animal unit equivalents/ha (5.9 ha/cow at the time). Based on the current mature BW of the cows at SPRRS, the optimal stocking rate should currently be 7.4 ha/cow, a 25% increase in area required per cow. The inability of calf weaning BW to keep up with the increase in cow

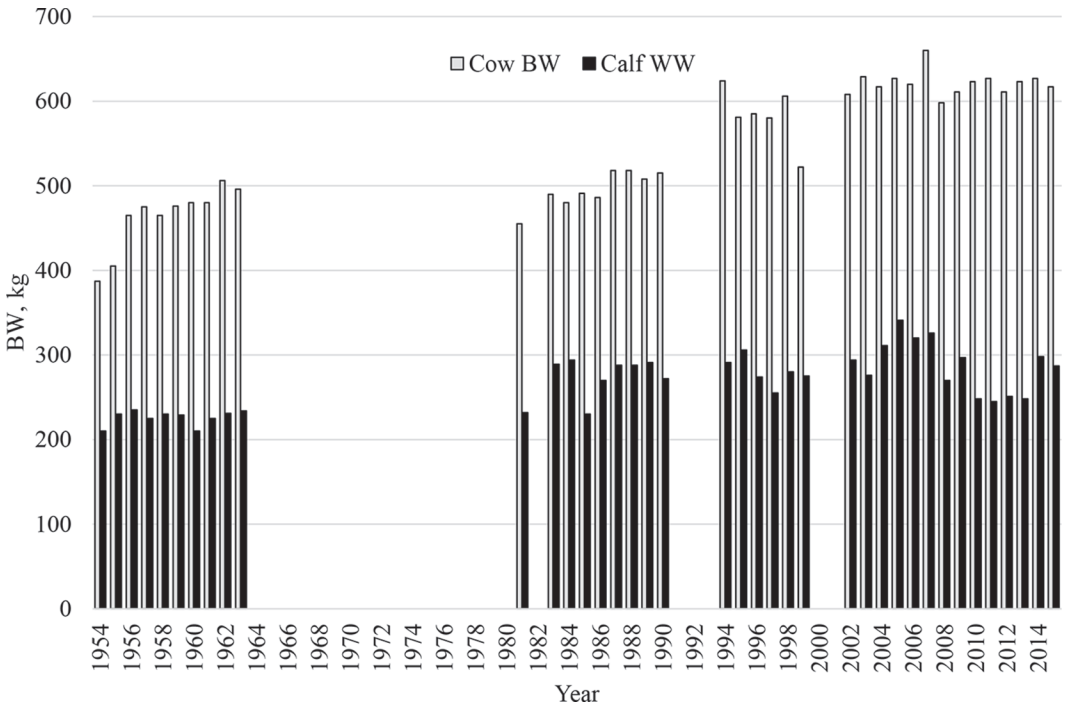

Figure 1. Change in cow mature BW and calf weaning weight (WW) at the USDA-Southern Plains Range Research Station's Southern Plains Experimental Range (Fort Supply, OK) from 1954 to 2014.