Modified Intensive-Early Stocking on Shortgrass Rangeland

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Beef production on western Kansas rangelands is primarily dominated by mature beef cows and their calves. In order to have management flexibility during years of low precipitation, producers also should include in their livestock program young stocker animals that can be marketed at any time to enable them to destock and restock rangelands without liquidating their main breeding herd. Intensive-early stocking (IES), a practice that stocks young animals at greater densities for the first half of the growing season and then removes the animals for the last half of the growing season, effectively utilizes early season vegetation at its highest level of nutrition. On shortgrass rangeland in western Kansas, individual animal gain during the early growing season, and beef production on a land area basis, is similar between animals stocked at 2X IES, or twice the season-long stocking (SLS) density, and animals stocked at a normal SLS density. Also in western Kansas, when implementing a modified IES system, which stocked at a 2X IES rate during the early season and then removed half of the animals at mid-season (2X + 1 IES), early season animal gains were 15% lower than for SLS in two out of four years, and full season individual animal gains were 25% lower for the 2X + 1 IES system in three of four years. It was hypothesized that by reducing the density of animals early in the season to less than the 2X IES density, and then removing the heaviest animals at mid-season, that maximum early season gain per animal could be retained and gain per acre could be increased. Removal of the heaviest animals, rather than random selection, results in a uniform set ready for placement into a feedlot. This study was performed to compare a 1.6X + 1 IES system to continuous SLS for animal performance and resulting changes in vegetative characteristics.

The study site was located at the Kansas St. University Agricultural Research Center near Hays, KS. Pastures consisted mostly of loamy upland range sites with small inclusions of limy upland and loamy lowland range sites. Dominant grass vegetation included blue grama, buffalograss, side-oats grama, western wheatgrass, and Japanese brome, while the key forb species was western ragweed. Angus and Angus X Hereford steers were withheld from feed and water for 6-12 h and weighed. Animals were assigned to treatments and pastures and implanted with Synovex-S®. Animals were stocked at a recommended moderate stocking rate for the study pastures for the early May through early October SLS system. The IES 1.6X + 1 system stocked animals at 1.6 X the stocking density of SLS from May through mid-July, and then stocked at a 1 X rate the remainder of the grazing season. In mid-July, animals were again held without feed or water and were weighed. The heaviest animals from each IES 1.6X + 1 pasture were removed and placed in the feedlot to achieve a 1 X stocking density the remainder of the season. All other animals returned to pasture. Animals on pasture were then fed a 0.2 lb crude protein/steer/day supplement. In early October, animals were again withheld from feed or water for 6-12 hours and weighed. Animals were then placed directly into a feedlot. Stocking comparisons were made from 2002 to 2008. General linear models of SAS were used for statistical analysis of average individual animal performance and of land area productivity.

Average daily gains (1.71 vs. 1.54 lb/day) and total gains per animal (128 vs. 115 lb) were different (P=0.042) between the SLS animals and the IES 1.6X + 1 animals the first half of the grazing season (Fig. 1). No difference (P=0.67, P=0.64) was found between average daily gains (1.35 vs 1.37 lb/day) and total gains per animal (106 vs. 107 lb) for the SLS and 1.6X + 1 systems during the last half of the season (Fig. 1). Animals from the more densely stocked IES system had slightly lower gains half-way through the season, and had similar daily gain and total gain as animals from SLS system during the last half of the season. Total individual animal gain (234 vs. 222 lb) (Fig. 2) and average daily gain (1.53 vs. 1.45 lb/day) was not different (P=0.15) between the SLS and the 1.6X + 1 system for animals on pasture the entire grazing season. Each year, total gain on a land area basis (86 vs. 69 lb/ac) was greater (P=0.008) for the IES system with greater animal densities (Fig. 3). After initial costs of purchase and interest on grazing animals, return per acre was greater three of seven years for the 1.6X + 1 system (P=0.0035) and equal the remaining four years, and averaged $11.74/ac greater across all years (Fig. 4).

Animal data were also applied to historic market pricing for the 25 years prior to the start of this study, from 1977 to 2001. The 1.6X + 1 system returned an average of $6.05 more per acre than the SLS system during that 25 year span. Both systems had one year of negative returns, and the 1.6X + 1 system had 22 of 25 years with a greater return than the SLS system. Returns per acre ranged from -$3.65 to $58.82 for the SLS, and from -$9.19 to $76.74 for the 1.6X + 1 system during those 25 years.

Animals from the modified 1.6X + 1 system had lower gains during the early season compared to the SLS system. Animals from double stocked IES systems have historically had similar early season gains as animals from SLS, so the results in the early season gains from the 1.6X + 1 system were somewhat unexpected. Further, animals that remained on pasture season long from the 1.6X + 1 system had similar total season gain as animals from the SLS system. In a previous trial at this location, late season gains were 25% lower three of four years for a 2X + 1 system than for a SLS system. Therefore, lowering the density early in the season to a 1.6X rate allowed enough quantity and quality of forage late in the season for animals to maintain expected individual performance. Total gain per acre increased for the 1.6X + 1 system as a result of the greater early stocking density. Net returns per acre were greater for the 1.6X + 1 system than for the SLS system three out of seven years. Years in which the 1.6X + 1 system did not return more dollars than the SLS system were a matter of start and mid-season market price relationships rather than animal performance.

Vegetation trends have been analyzed from this experiment from fall 2001 to fall 2008. Thus far, western wheatgrass, blue grama, and sideoats grama composition changes have not differed between the 1.6X + 1 and SLS strategies. Western wheatgrass composition was reduced and other botanical shifts occurred in a previous trial with annual use of a modified 2X + 1 system. Also, end of season standing dry matter has been similar in the 1.6X + 1 and SLS treatments (Fig. 5), and annual changes in end of season biomass have paralleled each other due to yearly differences in precipitation (Fig. 6-8). It was hypothesized that less desirable vegetation would eventually increase from annual use of the 1.6X + 1 system because of the greater total season stocking rate. These changes have not yet occurred, but still may do so with many more consecutive years of implementing the 1.6X + 1 system on the same pasture. With little evidence so far that the 1.6X + 1 system is altering vegetation, it may be useful as a stocking strategy to implement during short term consecutive seasons, or in a rotation of years with other systems stocked at a moderate rate, but has yet to be analyzed in western Kansas when used in a sequential rotation manner. Since several years of rangeland condition and vegetative composition data are required to assess long term sustainability, it is not known how long rangelands can support annual use of this practice without any adverse effects. After seven years, adverse vegetation effects are not yet evident.

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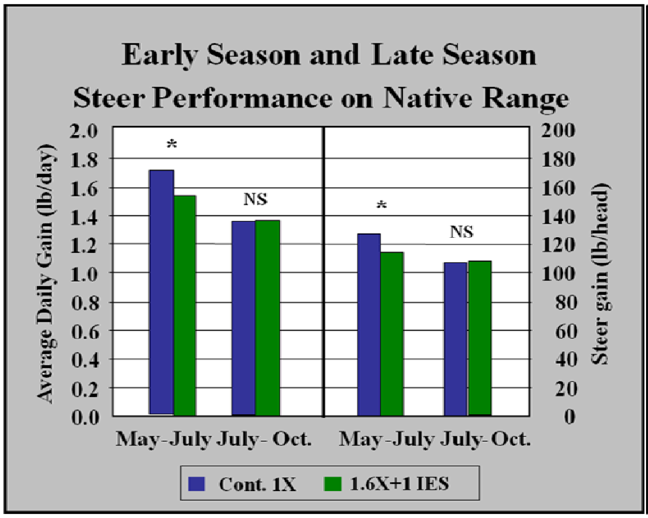

Fig. 1. Early and late season individual animal performance from continuous season-long stocking (SLS) and 1.6X + 1 intensive early stocking (IES) systems. NS = not significant. * = significant at P<0.05.

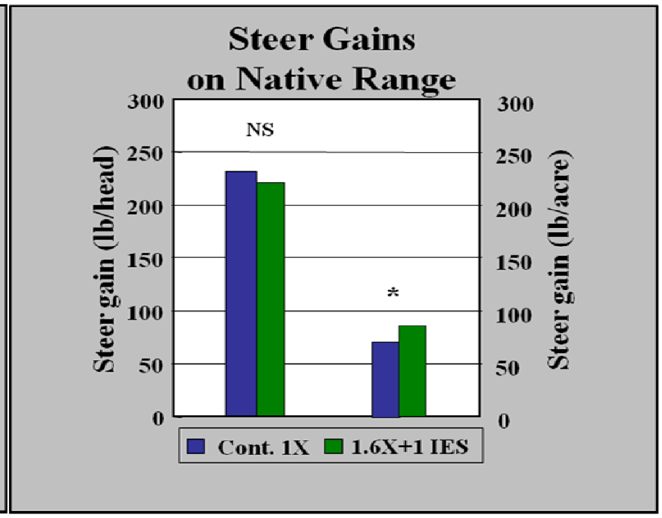

Fig. 2. Full season individual animal gain and total steer gain lb/acre from a continuous season-long stocking (SLS) system and cattle remaining on pasture from a 1.6X + 1 intensive early stocking (IES) system. NS = not significant. * = significant at P<0.05.

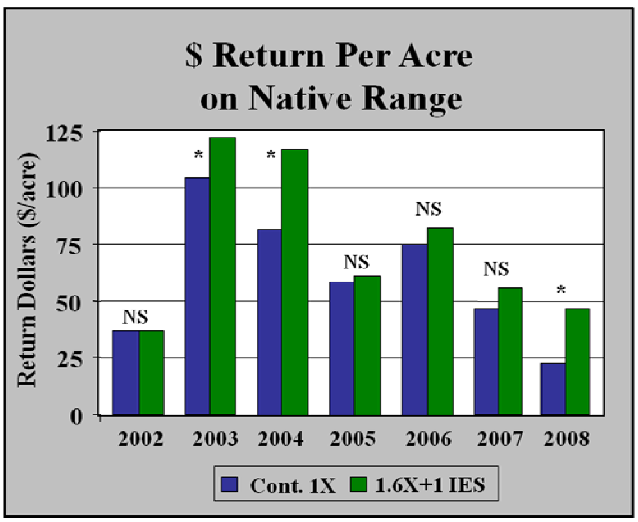

Fig. 4. Net return per acre after purchase and interest costs of animals from a continuous season-long stocking (SLS) system and a 1.6X + 1 intensive early stocking (IES) system. NS = not significant. * = significant at P<0.05.

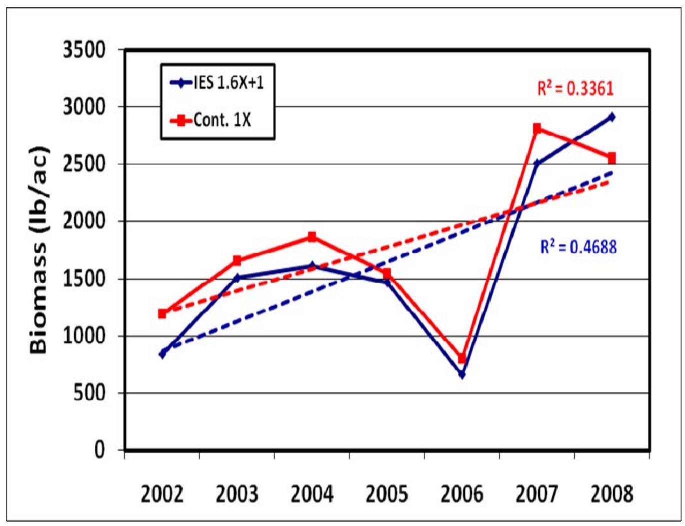

Fig. 5. End of season biomass from a continuous season-long stocking system (SLS) and from a 1.6X + 1 intensive early stocking (IES) system. * = significant at P<0.05 within a year.

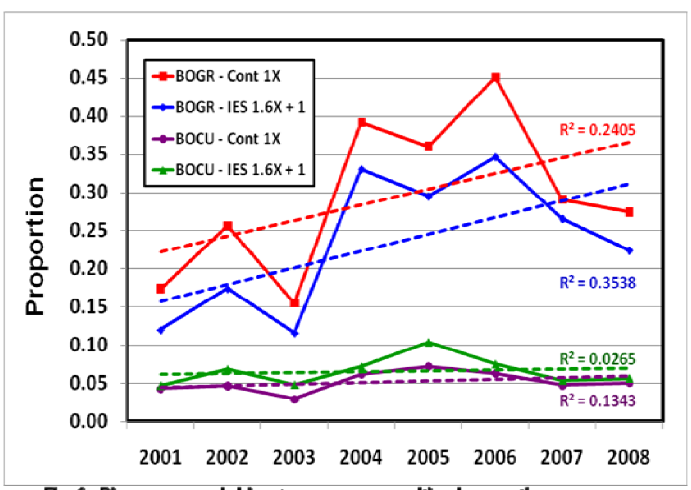

Fig. 6. Blue grama and sideoats grama composition in a continuous season-long stocking (SLS) system and a 1.6X + 1 intensive early stocking (IES) system. * = significant at P<0.05 for a year X stocking system interaction.

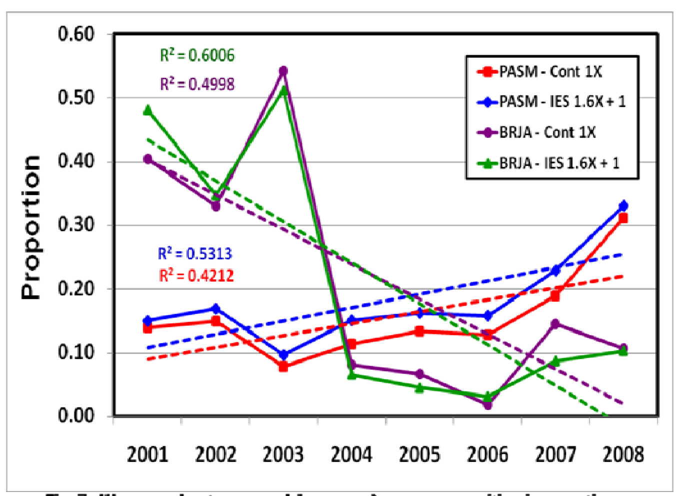

Fig. 7. Western wheatgrass and Japanese brome composition in a continuous season-long stocking (SLS) system and a 1.6X + 1 intensive early stocking (IES) system. * = significant at P<0.05 for a year X stocking system interaction.

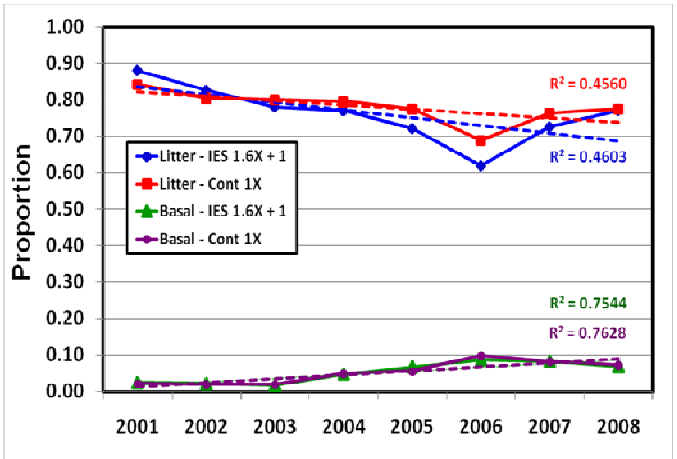

Fig. 8. End of season litter cover and basal cover from a continuous season-long stocking system (SLS) and from a 1.6X + 1 intensive early stocking (IES) system. * = significant at $P<0.05$ within a year.

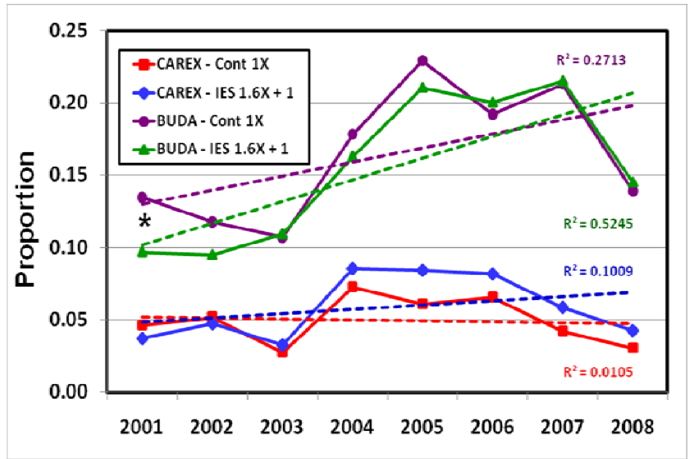

Fig. 9. Buffalograss and sedge composition in a continuous season-long stocking (SLS) system and a 1.6X + 1 intensive early stocking (IES) system. * = significant at $P<0.05$ for a year X stocking system interaction.