

In the Kansas Flint Hills, maintaining grazable vegetation and maximizing net profit are important emphases for cattle producers. Research at Kansas State University suggests the preferred and most profitable recommendation is implementing annual late spring burning and the use of a two-year rotation of intensive early stocking plus late-season grazing (IES+LSG) with intensive early stocking (IES) in alternate years. That practice gives the greatest net profit and maintains grassland forage productivity and warm-season perennial grass dominance.

A K-State Research and Extension publication, *Summer Grazing Strategies for Stocker Cattle in the Kansas Flint Hills*, MF3232, highlights different grazing strategies for stocker cattle (550- to 600-pound steers) that maintains vegetation stability and increases profitability of tallgrass prairie in the Kansas Flint Hills.

This publication reports the results of a three-year rotation of two consecutive years of IES+LSG followed by one year of growing season-long stocking (SLS) over a nine-year period (Enhanced IES+LSG) and compared that to season-long stocking applied annually (Table 1). Steer gains, forage production, and net profit for the two grazing treatments from 2012 through 2020 were measured. Each grazing treatment was replicated three times for a total of six pastures to determine valid estimates of the results.

**Table 1.** Grazing scheme for a three-year rotation that includes season-long stocking (SLS-R) and two years of intensive-early stocking in addition to late-season grazing (IES+LSG) applied sequentially compared to SLS-C applied annually.

	System*	Continuous
2012	IES+LSG	SLS-C
2013	IES+LSG	SLS-C
2014	SLS-R	SLS-C
2015	IES+LSG	SLS-C
2016	IES+LSG	SLS-C
2017	SLS-R	SLS-C
2018	IES+LSG	SLS-C
2019	IES+LSG	SLS-C
2020	SLS	SLS-C

\* System refers to two consecutive years of IES+LSG grazing followed by one year of SLS.

## Common Grazing Systems for Stockers in the Kansas Flint Hills

**Season-Long Stocking.** In the Flint Hills, the most economically efficient, sustainable grazing system is continuous grazing when stocked at the recommended rate. Stockers remain on the same pasture for the entire grazing period before removal. The length of that stay varies depending on the grazing scheme chosen.

If animals are continuously grazed the entire growing season from the beginning of growth following burning, that is called season-long stocking (SLS-C). Season-long stocking was the primary grazing system for stockers in the Flint Hills following the inception of transient steer grazing in the middle of the 19th century until the mid 1970s. Early studies determined that the optimal grazing rate in the Flint Hills for 500- to 600-pound steers was 4 acres per steer for the May 1 to October 1 growing season. Allotting fewer acres per steer was termed heavy stocking and reduced weight gain in the last half of the growing season by an average of 38 pounds per steer; however, during the first half of the growing season heavy stocking gains were the same as those under moderate stocking.

**Intensive Early Stocking.** IES is a grazing system that takes advantage of the early summer high-quality

<b>EIES + LSG</b>	2 years of IES + LSG followed by 1 year SLS.
<b>IES</b>	intensive early stocking
<b>IES-B</b>	intensive early stocking, burned pasture
<b>IES-R</b>	intensive early stocking rotation
<b>LSG</b>	late-season grazing
<b>SLS</b>	season-long stocking
<b>SLS-B</b>	season-long stocking, burned pasture
<b>SLS-C</b>	season-long, continuous stocking
<b>SLS-R</b>	season-long stocking rotation
<b>SLS-UB</b>	season-long stocking unburned pasture

forage by stocking at twice the normal season-long stocking rate for the first half of the growing season with no grazing during the last half. Steers gain the same during the first half of the grazing season at the increased grazing rate of 2 acres per steer and gain per acre increases by 30% with no additional capital or labor inputs. Forage production and warm-season tallgrass abundance are enhanced by intensive early stocking.

**Intensive Early Stocking + Late-Season Grazing Rotation.** Late-season individual animal gain relies on the quality of the forage consumed. Cattle create grazed patches during the early season and revisit them frequently as the season progresses. They do so because regrowth of previously grazed plants produces higher quality forage. As a plant matures, there is an increase in less digestible fiber components and a decline in nutrient concentrations in part due to mobilization of chemical constituents and storage of those constituents in storage organs (stem bases and rhizomes primarily), which are necessary for regrowth following defoliation or frost.

The regrowth on those patches created by stockers in the early season produces new leaves that have higher nutritional quality than ungrazed plants. Therefore, the proportion of the animals' diet derived from regrowth in the latter half of the growing season will influence their late-season gain. Unfortunately, that practice results in a reduced food reserve necessary for vigorous regrowth the following season. Previous research showed that one season of normal stocking rates of either intensive early stocking or season-long stocking grazing following a year of IES+LSG restored adequate food reserves in

storage organs for vigorous regrowth the following year. The question remained as to whether grazing a pasture at an average of 3 acres per steer using IES+LSG for two consecutive years of IES+LSG following a year of using season-long stocking at 4 acres per steer was sustainable in a three-year rotation.

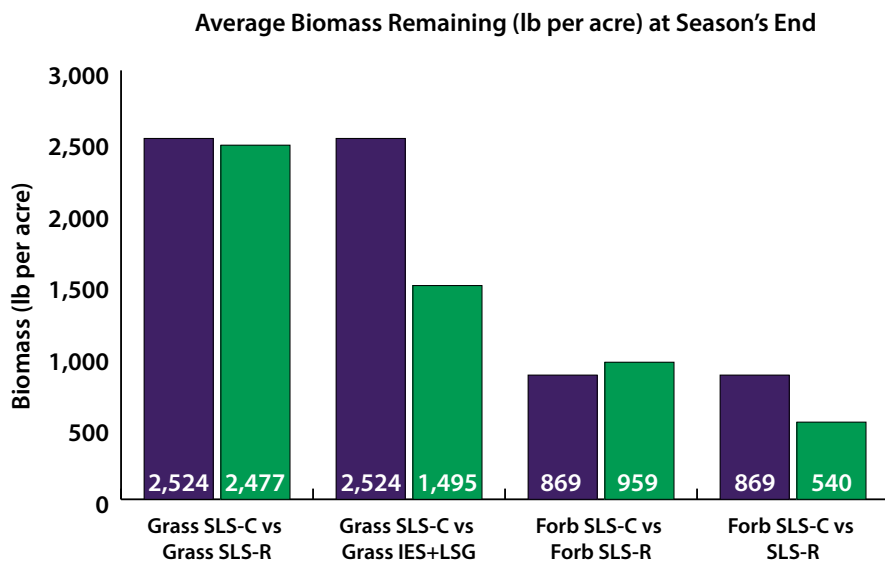
### Enhanced Intensive-Early Stocking + Late-Season Grazing Rotation.

Beginning in the spring of 2012, the treatments listed in Table 1 were applied through the fall of 2020 and replicated three times. All pastures were burned in late April each year.

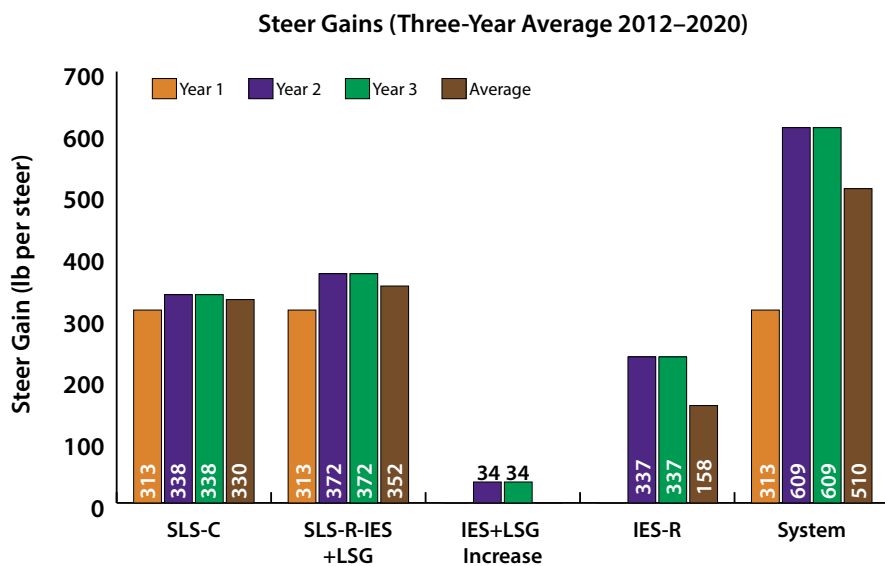
- **SLS-C** - grazed from May 1 each year until October 1 by steers that averaged near 550 pounds at 4 acres per steer. Steers were weighed on removal and a weight gain (pounds per steer) determined for the season. **SLS-R** refers to the year in the system when steers are stocked SLS.
- **IES+LSG** – grazed at 2 acres per 550-pound steer until mid-season when half the steers were removed and those remaining grazed at 4 acres per steer until season's end in early October. Steers were weighed in mid-July and those remaining for late-season grazing are weighed on removal to determine weight gain (pounds per steer) for the season.
- **System** – two consecutive years of IES+LSG grazing followed by one year of SLS.

### Herbage Production

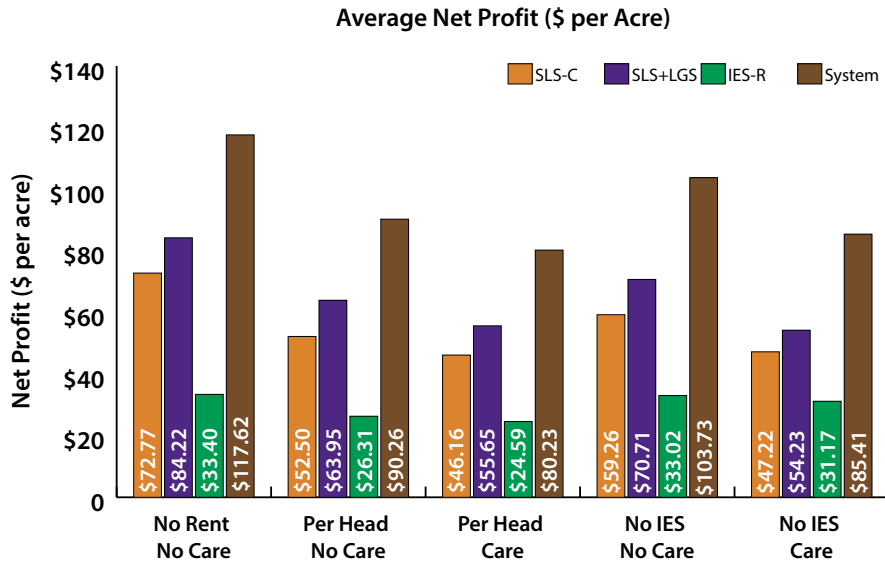
For the system to be sustainable, the pasture that was grazed under SLS-R following two consecutive years of IES+LSG must recover its productive capacity. After three cycles of the system over a nine-year period, grass biomass on the SLS-C pasture was not statistically different from that of the SLS-R pasture. Thus, one year of season-long stocking following two consecutive years of IES+LSG allowed recovery of the grass and forb productive capacity which made the system sustainable (Figure 1). In the years under IES+LSG, there was significantly less grass (-1,029 pounds) and forb (-329 pounds) biomass compared to SLS-C.



**Figure 1.** Average grass and forb biomass remaining at season's end following grazing for years when both grazing schemes were grazed season long continuously (SLS-C) and SLS-R or for two consecutive years of intensive early stocking plus late-season grazing (IES+LSG).



**Figure 2.** Yearly average steer gain (pounds per steer) for steers grazed from May 1 to October 1 annually at 4 acres per steer (SLS-C); for steers grazed at 2 acres per steer until mid-July and then grazed at 4 acres per steer until around October 1 each year (SLS-R); for steers grazed from around May 1 until mid-growing season at 2 acres per steer (IES-R); the system consisted of one year of SLS followed by two years of IES+LSG. System IES was the sum of the two years of IES+LSG divided by 3. System steer gains were the average SLS-R plus system IES gains.



**Figure 3.** Nine-year average net profit (\$ per acre) for steers grazed from May 1 to October 1 annually at 4 acres per steer (SLS-C); for steers grazed at 2 acres per steer until mid-July and then grazed at 4 acres per steer until around October 1 each year (SLS-LSG); for steers grazed from around May 1 until mid-growing season at 2 acres per steer (IES-R); The system consisted of one year of SLS followed by two years of IES+LSG. System IES was the sum of the two years of IES+LSG divided by 3. System steer gains were the average SLS-R plus system IES gains. Lease or ownership arrangements regarding care and per-head or per-acre lease options represent management alternatives. Net profit per acre was determined using individual year market prices in mid-April, mid-July, and early October from 2012 through 2020.

## Average Individual Steer Gains

Average individual steer gains for steers grazed season long following intensive early stocking (SLS-R) were significantly greater (34 pounds) than those grazed that same year season long (SLS-C). That increase was due to the availability of more regrowth forage resulting from an increased grazing density during the first half of the growing season (Figure 2). Since regrowth forage has better forage quality, steer gains were greater during the last half of the grazing season than those under normal SLS-C annual grazing.

During year 1, system steers were grazed at 4 acres per steer from around May 1 to around October 1 (SLS-R) and steer gains were equal for SLS-C and SLS-R treatments; in years 2 and 3, steers were grazed at the normal IES rate of two acres per steer until mid-July and half the steers were removed and the remainder grazed at 4 acres per steer until October 1 (SLS-R). The cumulative gain for the steers in the three-year system averaged 510 pounds each year for 4 acres compared 330 pounds for SLS-C. That meant that annually, over the three years, steer gains were 180 pounds greater using the system compared to SLS-C at a stocking rate of 4 acres per steer.

## Economics of Season-Long Continuous Grazing vs Enhanced IES+LSG Grazing

The enhanced IES+LSG grazing system proved to be sustainable over the nine years of this study and resulted in increased total livestock gain per steer and per acre when compared to yearly season-long grazing

(SLS-C) (Figure 2). Since there was no increased acreage allotted for the system compared to SLS-C for the 4-acre per steer grazing rate, the additional steer gain was due to an increase in stocking rate. As with previous IES+LSG, steers that remained until early October had a higher gain of 34 pounds per steer. The increased stocking rate plus the increased late season enhanced gain under enhanced IES+LSG substantially increased net profit (dollars per acre) compared to SLS-C. (Figure 3).

If the land was owned and the steer owner provided for care of the animals during the grazing season, the net return to capital and labor is 62% greater for EIES+LSG than for SLS-C (Table 2). Typical grazing leases charge a set rate per head. During the period of this study, that rate was \$80 per head for steers grazed from May to October and the stocking rate was fixed at 4 acres per steer. Steers grazed from early May to mid-July under IES+LSG were allotted 2 acres per steer with a per head charge of \$40 per steer. Care for the steers was set at \$25 per steer for SLS-C and \$12.50 per steer for SLS-R. Many long-term lease arrangements are on a simple per acreage figure. During this study, operators that had a \$20 per acre charge would have realized an additional steer gain with no increased cost which would have increased net profit of 75% with a care charge and 81% with no care.

**Table 2.** Percent increase above SLS-C in net profit for the EIES+LSG system under different lease arrangements include: No Rent – No Care; Per Head Rent – No Care; Per Head Rent, + Care; Per Acre Rent – No IES Rent + Care; and Per Acre Rent – No IES Rent – No Care.

Lease Options	Percent increase in net profit (%)	
	SLS+LSG	System
No Rent – No Care	16%	62%
Per Head Rent – No Care	22	40
Per Head Rent + Care	21	75
Per Acre Rent – No IES Rent + Care	19	75
Per Acre Rent – No IES Rent – No Care	15	81

## Conclusions

A three-year grazing rotation of two years of enhanced intensive early stocking + late-season grazing followed by one year of season-long grazing at the normal grazing rate proved to be a sustainable grazing scheme, which greatly increased profitability for stocker grazing in the Kansas Flint Hills region. This system is recommended for stocker grazing in the Kansas Flint Hills. To determine the sustainability of using intensive early stocking as the grazing scheme following the two years of IES+LSG a study will be initiated in 2022 to determine its potential.

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