Evaluation of Pasture Forage and Harvested Forage Types during the Summer Lactation Production Period

Results

The summer lactation production period was 137 days from early June until mid October. The summer lactation production period has nutritional requirements above maintenance. The greater part of the additional nutrients is for the production of milk for the nursing calf, and a smaller amount is for the support of an embryo at the early stages of development. The nutritional quality of the forage during the summer plays a role in maintaining the pregnancy. Cows maintaining or improving body condition have lower rates of embryo loss than cows losing body condition (BCRC 1999). The quantity of milk produced during the summer period declines from peak levels. The nutritional quality of the forage affects the rate of decrease. If the forage quality is at or above the animals' nutritional requirements, cows can maintain milk production near their genetic potential during most of the lactation period (BCRC 1999). Cows with higher milk production produce heavier calves at weaning. Cows grazing pasture treatments with forage quality insufficient to meet animal nutritional requirements have milk production below their genetic potential and produce calves that are lighter at weaning and have higher costs per pound of weight gained. Pasture forage and harvested forage costs and returns after feed costs were determined for a 1200-pound range cow with a calf during the summer lactation production period. A grazing cow with a calf requires an allocation of 30 lbs of pasture forage dry matter per day. The cow requires a daily intake of 27 lbs dry matter (DM) at 9.3% crude protein (CP) (2.51 lbs CP/day).

Pasture Forage Types

Native rangeland managed as a repeated seasonal pasture was evaluated during the summer lactation production period for 137 days between early June and mid October (tables 41 and 45). Native rangeland forage during mid summer has a crude protein content of around 9.6%. Summer native rangeland forage had pasture rent value or production costs of $8.76 per acre, forage dry matter costs of $48.26 per ton, and crude protein costs of $0.25 per pound. A cow grazing during the summer lactation period required 11.32 acres (2.52 acres per month) at a forage cost of $98.64 per production period. Additional roughage or crude protein were not supplemented on this pasture forage type. Total forage feed costs were $98.64 per period, or $0.72 per day (table 46). Calf weight gain was 1.80 lbs per day and 21.78 lbs per acre; accumulated weight gain was 246.60 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $172.62 per calf, and the net returns after pasture costs were $73.98 per cow-calf pair and $6.54 per acre. The cost of calf weight gain was $0.40 per pound (table 47).

Native rangeland managed as a 6.0-month seasonlong pasture was evaluated during the summer lactation production period for 137 days between early June and mid October (tables 41 and 45). Native rangeland forage had pasture rent value or production costs of $8.76 per acre and forage dry matter costs of $77.50 per ton. A cow grazing during the summer lactation period was allotted 18.10 acres (4.04 acres per month) at a forage cost of $158.55 per production period. Additional roughage or crude protein were not supplemented on this pasture forage type. Total forage feed costs were $158.55 per period, or $1.16 per day (table 46). Cow weight gain was 0.14 lbs per day and 1.09 lbs per acre; accumulated weight gain was 19.66 lbs. Calf weight gain was 1.80 lbs per day and 15.63 lbs per acre; accumulated weight gain was 282.87 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $198.01 per calf, and the net returns after pasture costs were $39.46 per cow-calf pair and $2.18 per acre. The cost of calf weight gain was $0.56 per pound (table 47).

Native rangeland managed as a 4.5-month seasonlong pasture was evaluated during the summer lactation production period for 137 days between early June and mid October (tables 41 and 45). Native rangeland forage had pasture rent value or production costs of $8.76 per acre and forage dry matter costs of $54.75 per ton. A cow grazing during the summer lactation period was allotted 12.70 acres (2.86 acres per month) at a forage cost of $111.25 per production period. Additional roughage or crude protein were not supplemented on this pasture forage type. Total forage feed costs were $111.25 per period, or $0.81 per day (table 46). Cow weight gain was 0.34 lbs per day and 3.67 lbs per acre; accumulated weight gain was 46.58 lbs. Calf weight gain was 2.09 lbs per day and 22.55 lbs per acre; accumulated weight gain was 286.33 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $200.43 per calf, and the net returns after pasture costs were

$89.18 per cow-calf pair and $7.02 per acre. The cost of calf weight gain was $0.39 per pound (table 47).

Native rangeland managed as a deferred grazing pasture was evaluated during the summer lactation production period for 92 days between mid July and mid October (tables 41 and 45). Native rangeland forage had pasture rent value or production costs of $8.76 per acre and forage dry matter costs of $42.52 per ton. A cow grazing during the late summer lactation period was allotted 6.70 acres (2.22 acres per month) at a forage cost of $58.26 per deferred grazing period. Additional roughage or crude protein were not supplemented on this pasture forage type. Total forage feed costs were $58.26 per period, or $0.63 per day (table 46). Cow weight gain was 0.32 lbs per day and 4.40 lbs per acre; accumulated weight gain was 29.44 lbs. Calf weight gain was 1.80 lbs per day and 24.73 lbs per acre; accumulated weight gain was 196.50 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $137.55 per calf, and the net returns after pasture costs were $79.29 per cow-calf pair and $11.83 per acre. The cost of calf weight gain was $0.30 per pound (table 47).

Native rangeland managed as a three pasture twice-over rotation system was evaluated during the summer lactation production period for 137 days between early June and mid October (tables 41 and 45). Native rangeland forage had pasture rent value or production costs of $8.76 per acre and forage dry matter costs of $39.02 per ton. A cow grazing during the summer lactation period was allotted 9.00 acres (2.04 acres per month) at a forage cost of $78.84 per production period. Additional roughage or crude protein were not supplemented on this pasture forage type. Total forage feed costs were $78.84 per period, or $0.58 per day (table 46). Cow weight gain was 0.62 lbs per day and 9.44 lbs per acre; accumulated weight gain was 84.94 lbs. Calf weight gain was 2.21 lbs per day and 33.64 lbs per acre; accumulated weight gain was 302.77 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $211.94 per calf, and the net returns after pasture costs were $133.10 per cow-calf pair and $14.79 per acre. The cost of calf weight gain was $0.26 per pound (table 47).

Harvested Forage Types

Crested wheatgrass hay cut late, at a mature plant stage, has a crude protein content of 6.4%. This crested wheatgrass hay has production costs of $28.11 per acre, forage dry matter costs of $34.80 per ton, and crude protein costs of $0.28 per pound. Mature crested wheatgrass hay would be fed at 30.0 lbs DM/day to provide 1.9 lbs CP/day. An additional 0.59 lbs of crude protein per day would need to be provided, at a cost of $24.25 per period. Production of mature crested wheatgrass hay to feed during the summer lactation period (tables 42 and 45) would require 2.57 acres, and the forage would cost $72.34 per period. Total forage and supplement costs would be $96.59 per period, or $0.71 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $95.21 per cow-calf pair and $37.05 per acre. The cost of calf weight gain was $0.35 per pound (table 47).

Crested wheatgrass hay cut early, at the boot stage, has a crude protein content of 14.5%. This crested wheatgrass hay has production costs of $26.50 per acre, forage dry matter costs of $40.80 per ton, and crude protein costs of $0.14 per pound. Early cut crested wheatgrass hay would be fed at 17.3 lbs DM/day to provide 2.5 lbs CP/day. An additional 12.7 lbs of roughage per day would need to be provided, at a cost of $30.42 per period. Production of early cut crested wheatgrass hay to feed during the summer lactation period (tables 42 and 45) would require 1.82 acres, and the forage would cost $47.95 per period. Total forage and supplement costs would be $78.37 per period, or $0.57 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $113.43 per cow-calf pair and $62.32 per acre. The cost of calf weight gain was $0.29 per pound (table 47).

Forage barley hay cut early, at the milk stage, has a crude protein content of 13.0%. This forage barley hay has production costs of $68.21 per acre, forage dry matter costs of $28.80 per ton, and crude protein costs of $0.11 per pound. Early cut forage barley hay would be fed at 19.3 lbs DM/day to provide 2.5 lbs CP/day. An additional 10.7 lbs of roughage per day would need to be provided, at a cost of $25.65 per period. Production of early cut forage barley hay to feed during the summer lactation period (tables 43 and 45) would require 0.56 acres, and the forage would cost $38.36 per period. Total forage and supplement costs would be $64.01 per period, or $0.47 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $127.79 per cow-calf pair and $228.20 per acre. The cost of calf weight gain was $0.23 per pound (table 47).

Forage barley hay cut late, at the hard dough stage, has a crude protein content of 9.2%. This forage barley hay has production costs of $70.35 per acre, forage dry matter costs of $27.40 per ton, and crude protein costs of $0.15 per pound. Late-cut forage barley hay would be fed at 27.3 lbs DM/day to provide 2.5 lbs CP/day. An additional 2.7 lbs of roughage per day would need to be provided, at a cost of $6.47 per period. Production of late-cut forage barley hay to feed during the summer lactation period (tables 43 and 45) would require 0.73 acres, and the forage would cost $52.06 per period. Total forage and supplement costs would be $58.53 per period, or $0.43 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $133.27 per cow-calf pair and $182.56 per acre. The cost of calf weight gain was $0.21 per pound (table 47).

Oat forage hay cut early, at the milk stage, has a crude protein content of 11.5%. This oat forage hay has production costs of $69.17 per acre, forage dry matter costs of $29.60 per ton, and crude protein costs of $0.13 per pound. Early cut oat hay would be fed at 21.8 lbs DM/day to provide 2.5 lbs CP/day. An additional 8.2 lbs of roughage per day would need to be provided, at a cost of $19.66 per period. Production of early cut oat hay to feed during the summer lactation period (tables 43 and 45) would require 0.64 acres, and the forage would cost $45.21 per period. Total forage and supplement costs would be $64.87 per period, or $0.47 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $126.93 per cow-calf pair and $198.33 per acre. The cost of calf weight gain was $0.24 per pound (table 47).

Oat forage hay cut late, at the hard dough stage, has a crude protein content of 7.8%. This oat forage hay has production costs of $74.53 per acre, forage dry matter costs of $26.40 per ton, and crude protein costs of $0.17 per pound. Late-cut oat hay would be fed at 30.0 lbs DM/day to provide 2.3 lbs CP/day. An additional 0.17 lbs of crude protein per day would need to be provided, at a cost of $6.99 per period. Production of late-cut oat hay to feed during the summer lactation period (tables 43 and 45) would require 0.73 acres, and the forage would cost $54.25 per period. Total forage and supplement costs would be $61.24 per period, or $0.45 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $130.56 per cow-calf pair and $178.85 per acre. The cost of calf weight gain was $0.22 per pound (table 47).

Pea forage hay cut at an early plant stage has a crude protein content of 18.9%. This pea forage hay has production costs of $79.96 per acre, forage dry matter costs of $55.00 per ton, and crude protein costs of $0.15 per pound. Early cut pea forage hay would be fed at 13.3 lbs DM/day to provide 2.5 lbs CP/day. An additional 16.7 lbs of roughage per day would need to be provided, at a cost of $40.04 per period. Production of early cut pea forage hay to feed during the summer lactation period (tables 44 and 45) would require 0.65 acres, and the forage would cost $52.06 per period. Total forage and supplement costs would be $92.10 per period, or $0.67 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $99.70 per cow-calf pair and $153.38 per acre. The cost of calf weight gain was $0.34 per pound (table 47).

Pea forage hay cut at a late plant stage has a crude protein content of 14.4%. This pea forage hay has production costs of $86.87 per acre, forage dry matter costs of $37.40 per ton, and crude protein costs of $0.13 per pound. Late-cut pea forage hay would be fed at 17.4 lbs DM/day to provide 2.5 lbs CP/day. An additional 12.6 lbs of roughage per day would need to be provided, at a cost of $30.21 per period. Production of late-cut pea forage hay to feed during the summer lactation period (tables 44 and 45) would require 0.51 acres, and the forage would cost $45.21 per period. Total forage and supplement costs would be $75.42 per period, or $0.55 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $116.38 per cow-calf pair and $228.20 per acre. The cost of calf weight gain was $0.28 per pound (table 47).

Forage lentil hay cut at an early plant stage has a crude protein content of 21.8%. This forage lentil hay has production costs of $59.69 per acre, forage dry matter costs of $71.60 per ton, and crude protein costs of $0.17 per pound. Early cut forage lentil hay would be fed at 11.5 lbs DM/day to provide 2.5 lbs CP/day. An additional 18.5 lbs of roughage per day would need to be provided, at a cost of $44.35 per period. Production of early cut forage lentil hay to feed during the summer lactation period (tables 44 and 45) would require 0.95 acres, and the forage would cost $58.91 per period. Total forage and supplement costs would be $103.26 per period, or $0.75 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $88.54 per cow-calf pair and $93.20 per acre. The cost of calf weight gain was $0.38 per pound (table 47).

Forage lentil hay cut at a late plant stage has a crude protein content of 14.7%. This forage lentil hay has production costs of $71.48 per acre, forage dry matter costs of $37.00 per ton, and crude protein costs of $0.13 per pound. Late-cut forage lentil hay would be fed at 17.1 lbs DM/day to provide 2.5 lbs CP/day. An additional 12.9 lbs of roughage per day would need to be provided, at a cost of $30.93 per period. Production of late-cut forage lentil hay to feed during the summer lactation period (tables 44 and 45) would require 0.60 acres, and the forage would cost $45.21 per period. Total forage and supplement costs would be $76.14 per period, or $0.56 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $115.66 per cow-calf pair and $192.77 per acre. The cost of calf weight gain was $0.28 per pound (table 47).

Oat-pea forage hay has a crude protein content of 12.5%. This oat-pea forage hay has production costs of $95.52 per acre, forage dry matter costs of $37.20 per ton, and crude protein costs of $0.16 per pound. Oat-pea forage hay would be fed at 20.1 lbs DM/day to provide 2.5 lbs CP/day. An additional 9.9 lbs of roughage per day would need to be provided, at a cost of $23.74 per period. Production of oat-pea forage hay to feed during the summer lactation period (tables 44 and 45) would require 0.53 acres, and the forage would cost $52.06 per period. Total forage and supplement costs would be $75.80 per period, or $0.55 per day (table 46). Calf weight gain was assumed to be 2.00 lbs per day; accumulated weight gain was 274.0 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $191.80 per calf, and the net returns after feed costs were $116.00 per cow-calf pair and $218.27 per acre. The cost of calf weight gain was $0.28 per pound (table 47).

Discussion

Pasture Forage Types

Native rangeland forage grazed as a repeated seasonal pasture during the summer lactation production period was moderate-cost forage because the quantities of crude protein captured per acre were moderate and the quantity of forage dry matter available per acre was moderate. The equipment costs, labor costs, land rent per acre, and forage production costs per acre were low. The cost per pound of crude protein ($0.25/lb CP) was moderate because of the moderate quantity of crude protein weight contained in the forage. The forage dry matter cost ($48.26/ton) was high because of the moderate quantity of forage dry matter production. The large land area (11.32 acres) per cow caused the forage costs per period to be high. The total daily forage feed costs ($0.72/day) were high. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($73.98) per cow and in low returns after feed costs ($6.54) per acre. The cost per pound of calf weight gain ($0.40/lb) was moderately high because of the moderate crude protein and moderate forage dry matter yields per acre and the large land area per cow-calf pair.

Native rangeland forage grazed as a 6.0-month seasonlong pasture during the summer lactation production period was high-cost forage because the quantity of forage dry matter available per acre was low and the crude protein content in the forage was low after early August, despite the equipment costs, labor costs, land rent per acre, and forage production costs per acre being low. The forage dry matter cost ($77.50/ton) was very high because the quantity of forage weight per acre was low. The low forage availability per acre and low crude protein content in the forage were major causes of the low cow and calf weight performance per acre. The large land area (18.10 acres) per cow caused the forage costs per period to be high. The total daily forage feed costs ($1.16/day) were very high. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($39.46) per cow and in very low returns after feed costs ($2.18) per acre. The cost per pound of calf weight ($0.56/lb) was high because of the low forage dry matter yields per acre, the low animal weight performance per acre, and the large land area per cow-calf pair.

Native rangeland forage grazed as a 4.5-month seasonlong pasture during the summer lactation production period was high-cost forage because the quantity of forage dry matter available per acre was low and the crude protein content in the forage was low after early August, despite the equipment costs, labor costs, land rent per acre, and forage production costs per acre being very low. The forage dry matter cost ($54.75/ton) was high because the quantity of forage weight per acre was low. The low forage availability per acre and the low crude protein content in the forage after early August were major causes of the low cow and calf weight performance per acre. The large land area (12.70 acres) per cow caused the forage costs per period to be high. The total daily forage feed costs ($0.81/day) were high. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($89.18) per cow and in low returns after feed costs ($7.02) per acre. The cost per pound of calf weight ($0.39/lb) was moderately low because of the low forage dry matter yields per acre, the low crude protein content of the forage during the latter portion of the grazing season, the low animal weight performance per acre, and the large land area per cow-calf pair.

Native rangeland forage managed as a deferred grazing pasture during the summer lactation production period was high-cost forage because the quantity of forage dry matter available per acre was moderate and the crude protein content in the forage was low during the grazing season, despite the equipment costs, labor costs, land rent per acre, and forage production costs per acre being very low. The forage dry matter cost ($42.52/ton) was moderate because the quantity of forage weight per acre was moderate. The low crude protein content in the forage was a major cause of the low cow and calf weight performance per acre. The moderate land area (2.22 acres/months) per cow was achieved because grazing did not start until after peak herbage biomass was produced and a very high proportion of the aboveground herbage was removed by grazing. The total daily forage feed costs ($0.63/day) were high. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($79.29) per cow and in moderate returns after feed costs ($11.83) per acre. The cost per pound of calf weight gain ($0.30/lb) were moderately low because of the low crude protein content in the forage and the low animal weight performance per acre.

Native rangeland forage grazed as a twice-over rotation system during the summer lactation production period was the lowest-cost native rangeland forage because of the increase in herbage production through vegetative reproduction of grass plants and the crude protein content of the forage met the lactating cows requirements for most of the grazing season. The equipment costs, labor costs, land rent per acre, and forage production costs per acre were low. The forage dry matter cost ($39.02/ton) was low because of the stimulated additional herbage production per acre. The greater quantity of forage dry matter available per acre and the greater crude protein content in the forage were the major causes for the greater cow and calf weight performance per acre. The small land area (2.04 acres/month) per cow-calf pair was achieved because of the stimulated vegetative reproduction and the resulting increases in herbage biomass production. The total daily forage feed costs ($0.58/day) were low. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($133.10) per cow and in high returns after feed costs ($14.79) per acre. The cost per pound of calf weight gain ($0.26/lb) was low because of the high forage dry matter yields per acre, the high crude protein content in the forage during the grazing season, the high animal weight performance per acre, and the small land area per cow-calf pair.

Harvested Forage Types

Crested wheatgrass hay cut at a mature growth stage and fed during the summer lactation production period was high-cost forage. The forage dry matter cost ($34.80/ton) was moderate for mature crested wheatgrass hay and lower than the forage dry matter cost per ton for early cut crested wheatgrass hay because greater dry matter weight of the mature crested wheatgrass hay was harvested per acre. The cost per pound of crude protein ($0.28/lb CP) was high for mature crested wheatgrass hay and double the cost per pound of crude protein for early cut crested wheatgrass hay because of the lower crude protein weight in the mature crested wheatgrass hay harvested per acre. The land area (2.57 acres) per cow for mature crested wheatgrass hay was small but greater than the land area required per cow for early cut crested wheatgrass hay because of the greater crude protein weight per acre in the early cut crested wheatgrass hay. The crude protein content of the mature crested wheatgrass forage was below the requirements of a lactating cow making it necessary to provide purchased supplemental crude protein. The total daily forage and supplemental crude protein costs ($0.71/day) were high because of the additional supplemental crude protein costs. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($95.21) per cow and in moderate returns after feed costs ($37.05) per acre. The cost per pound of calf weight gain ($0.35/lb) was moderately low because of the additional supplemental crude protein costs.

Crested wheatgrass hay cut at the boot growth stage and fed during the summer lactation production period was moderate-cost forage. The forage dry matter cost ($40.80/ton) was moderate for early cut crested wheatgrass hay and was greater than the forage dry matter cost per ton for mature crested wheatgrass hay because crested wheatgrass hay cut at the boot stage harvested lower forage dry matter weight per acre than crested wheatgrass hay cut at a mature growth stage. The cost per pound of crude protein ($0.14/lb CP) was low for early cut crested wheatgrass hay and lower than the cost per pound of crude protein for mature crested wheatgrass hay because of the greater crude protein weight in the early cut crested wheatgrass hay harvested per acre. The land area (1.82 acres) per cow for early cut crested wheatgrass hay was small and less than the land area required per cow for mature crested wheatgrass hay because of the greater crude protein weight harvested per acre in the early cut crested wheatgrass hay. The forage cost of early cut crested wheatgrass hay was low but the total daily forage feed cost ($0.57/day) was moderate because about 42% of the ration forage was supplemental roughage which added substantially to the total forage costs. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($113.43) per cow and in high returns after feed costs ($62.32) per acre. The cost per pound of calf weight gain ($0.29/lb) was low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Forage barley hay cut at the milk growth stage and fed during the summer lactation production period was low-cost forage. The production costs per acre were high for early cut forage barley hay because the equipment costs, labor costs, and land rent per acre were high. The forage dry matter cost ($28.80/ton) was low because of the high forage dry matter production. The cost per pound of crude protein ($0.11/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.56 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.47/day) were low because of the low cost of crude protein per pound and the high forage dry matter production. The forage costs for early cut forage barley hay were lower than the forage costs for late cut forage barley hay. However, the total forage feed costs for early cut forage barley hay was slightly greater than the total forage feed costs for late cut forage barley hay because of the greater quantity of supplemental roughage in the forage ration for early cut forage barley hay. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($127.79) per cow and in extremely high returns after feed costs ($228.20) per acre. The cost per pound of calf weight gain ($0.23/lb) was very low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Forage barley hay cut at the hard dough growth stage and fed during the summer lactation production period was low-cost forage. The production costs per acre were high for late cut forage barley hay because the equipment costs, labor costs, and land rent per acre were high. The forage dry matter cost ($27.40/ton) was low because of the high forage dry matter production. The cost per pound of crude protein ($0.15/lb CP) was low because of the high crude protein weight contained in the forage. The cost per pound of crude protein for late cut forage barley hay was greater than the cost per pound of crude protein for early cut forage barley hay because of the lower crude protein weight harvested per acre in the late cut forage barley hay. The land area (0.73 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.43/day) were low because of the low cost of crude protein per pound and the high forage dry matter production. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($133.27) per cow and in very high returns after feed costs ($182.56) per acre. The returns after feed costs per acre were lower for late cut forage barley hay than for early cut forage barley hay because late cut forage barley hay had slightly higher crude protein cost per pound and slightly larger land area per cow than early cut forage barley hay. The cost per pound of calf weight gain ($0.21/lb) was very low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Oat forage hay cut at the milk growth stage and fed during the summer lactation production period was low-cost forage. The production costs per acre were high for early cut oat forage hay because the equipment costs, labor costs, and land rent per acre were high. The forage dry matter cost ($29.60/ton) was low because of the high forage dry matter production. The cost per pound of crude protein ($0.13/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.64 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.47/day) were low because of the low cost of crude protein per pound and the high forage dry matter production. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($126.93) per cow and in extremely high returns after feed costs ($198.33) per acre. The cost per pound of calf weight gain ($0.24/lb) was very low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Oat forage hay cut at the hard dough growth stage and fed during the summer lactation production period was low-cost forage. The production costs per acre were high for late cut oat forage hay because the equipment costs, labor costs, and land rent per acre were high. The forage dry matter cost ($26.40/ton) was low because of the high forage dry matter production. The cost per pound of crude protein ($0.17/lb CP) was low because of the high crude protein weight contained in the forage. The cost per pound of crude protein for late cut oat forage hay was greater than the cost per pound of crude protein for early cut oat forage hay because of the lower crude protein weight harvested per acre in the late cut oat forage hay. The land area (0.73 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The crude protein content in the forage was below the requirements of a lactating cow making it necessary to provide purchased supplemental crude protein. The total daily forage and supplemental crude protein costs ($0.45/day) were moderately low because of the additional cost of supplemental crude protein. The forage costs for early cut oat forage hay were lower than the forage costs for late cut oat forage hay. However, the total forage feed costs for late cut oat forage hay were lower than the total forage feed costs for early cut oat forage hay because of the quantity of supplemental roughage in the forage ration for early cut oat forage hay. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($130.56) per cow and in very high returns after feed costs ($178.85) per acre. The returns after feed costs per acre were lower for late cut oat forage hay than for early cut oat forage hay because late cut oat forage hay had slightly higher crude protein cost per pound and slightly larger land area per cow than early cut oat forage hay. The cost per pound of calf weight gain ($0.22/lb) was very low because of the small land area per cow-calf pair.

Pea forage hay cut at an early growth stage and fed during the summer lactation production period was moderate-cost forage. However, pea forage hay cut at a late growth stage has lower forage feed costs and greater revenue returns after feed costs than early cut pea forage hay. The production costs per acre were high for early cut pea forage hay because the equipment costs, labor costs, seed costs, and land rent per acre were high. The forage dry matter cost ($55.00/ton) was high because of the modest forage dry matter production. The cost per pound of crude protein ($0.15/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.65 acres) per cow was small because of the high crude protein yield per acre. The total daily forage and supplemental roughage costs ($0.67/day) were moderate because of the modest forage dry matter production per acre and the high supplemental roughage costs. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($99.70) per cow and in very high returns after feed costs ($153.38) per acre. The cost per pound of calf weight gain ($0.34/lb) was moderately low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Pea forage hay cut at a late growth stage and fed during the summer lactation production period was low-cost forage. Late cut pea forage hay has lower forage feed costs and greater revenue returns after feed costs than early cut pea forage hay. The production costs per acre were high for late cut pea forage hay because the equipment costs, labor costs, seed costs, and land rent per acre were high. The forage dry matter cost ($37.40/ton) was moderate because of the high forage dry matter production. The cost per pound of crude protein ($0.13/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.51 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.55/day) were low because of the low cost of crude protein per pound and the small land area per cow. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($116.38) per cow and in extremely high returns after feed costs ($228.20) per acre. The cost per pound of calf weight gain ($0.28/lb) was low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Forage lentil hay cut at an early growth stage and fed during the summer lactation production period was high-cost forage. However, forage lentil hay cut at a late growth stage has lower forage feed costs and greater revenue returns after feed costs than early cut forage lentil hay. The production costs per acre were high for early cut forage lentil hay because the equipment costs, labor costs, and land rent per acre were high. The forage dry matter cost ($71.60/ton) was high because of the modest forage dry matter yield per acre. The cost per pound of crude protein ($0.17/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.95 acres) per cow was small because of the high crude protein yield per acre. The total daily forage and supplemental roughage costs ($0.75/day) were high because of the modest forage dry matter production per acre and the high supplemental roughage costs. The total feed costs were lower than the low market value of the accumulated calf weight resulting in high returns after feed costs ($88.54) per cow and ($93.20) per acre. The cost per pound of calf weight gain ($0.38/lb) was moderately low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Forage lentil hay cut at a late growth stage and fed during the summer lactation production period was low-cost forage. Late cut forage lentil hay has lower forage feed costs and greater revenue returns after feed costs than early cut forage lentil hay. The production costs per acre were high for late cut forage lentil hay because the equipment costs, labor costs, and land rent per acre were high. The forage dry matter cost ($37.00/ton) was moderate because of the high forage dry matter production. The cost per pound of crude protein ($0.13/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.60 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.56/day) were low because of the low cost of crude protein per pound and the small land area per cow. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($115.66) per cow and in extremely high returns after feed costs ($192.77) per acre. The cost per pound of calf weight gain ($0.28/lb) was low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Oat-pea hay cut at compromised plant growth stages and fed during the summer lactation production period was low-cost forage. However, seeding oat forage separately on half of the field and cutting it at an early growth stage and seeding pea forage separately on half of the field and cutting it at a late growth stage will result in lower production costs per acre, lower forage dry matter costs per ton, lower costs per pound of crude protein, lower total forage feed costs per day, lower costs per pound of calf weight gain, greater net returns after feed costs per cow, and greater net returns after feed costs per acre than oat-pea forage seeded together and cut at compromised growth stages. The production costs per acre were very high for oat-pea hay because the equipment costs, labor costs, seed costs, and land rent per acre were high. The forage dry matter cost ($37.20/ton) was moderate because of the high forage dry matter production. The cost per pound of crude protein ($0.16/lb CP) was low because of the high crude protein weight contained in the forage. The land area (0.53 acres) per cow was small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.55/day) were low because of the low cost of crude protein per pound and the small land area per cow. The total feed costs were lower than the low market value of the accumulated calf weight resulting in very high returns after feed costs ($116.00) per cow and in extremely high returns after feed costs ($218.77) per acre. The cost per pound of calf weight gain ($0.28/lb) was low because of the low cost per pound of crude protein and the small land area per cow-calf pair.

Table 41. Costs and returns for native rangeland pasture forage types to be grazed by range cows during the 137-day summer lactation production period.

		Native Rangeland Repeated Seasonal	Native Rangeland 6.0-m Seasonlong	Native Rangeland 4.5-m Seasonlong	Native Rangeland Deferred Grazing	Native Rangeland Twice-over Rotation
Days		137	137	137	92	137
Growth Stage		summer	summer	summer	summer	summer
Herbage Weight	lb/ac	1450	906	1280	1649	1794
Forage DM Weight	lb/ac	363	226	320	412	449
Costs/Acre						
Land Rent	$	8.76	8.76	8.76	8.76	8.76
Custom Work	$					
Seed Cost	$					
Baling Costs	$					
Production Costs	$/ac	8.76	8.76	8.76	8.76	8.76
Forage DM Costs	$/ton	48.26	77.50	54.75	42.52	39.02
Crude Protein	%	9.6				
Crude Protein Yield	lb/ac	34.85				
Crude Protein Cost	$/lb	0.25				
Forage Allocation	lb/d	30.0	30.0	30.0	30.0	30.0
Land Area/Period	ac	11.32	18.10	12.70	6.70	9.00
Forage Costs/Period	$/pp	98.64	158.55	111.25	58.26	78.84
Supplementation						
Roughage/Day	lb/d					
Crude Protein/Day	lb/d					
Sup. Cost/Period	$/pp					
Total Feed Cost	$/pp	98.64	158.55	111.25	58.26	78.84
Cost/Day	$/d	0.72	1.16	0.81	0.63	0.58
Accumulated Calf Wt.	lbs	246.60	282.87	286.33	196.50	302.77
Weight Value @$0.70/lb	$	172.62	198.01	200.43	137.55	211.94
Net Return/c-c pr	$	73.98	39.46	89.18	79.29	133.10
Net Return/acre	$	6.54	2.18	7.02	11.83	14.79
Cost/lb of Calf Gain	$	0.40	0.56	0.39	0.30	0.26

Table 42. Costs and returns for perennial grass harvested forage types to be fed to range cows during the 137-day summer lactation production period.

		Crested Wheatgrass Hay	Crested Wheatgrass Hay
Days		137	137
Growth Stage		Mature	Boot stage
Herbage Weight	lb/ac	-	-
Forage DM Weight	lb/ac	1600	1300
Costs/Acre			
Land Rent	$	14.22	14.22
Custom Work	$	5.31	5.31
Seed Cost	$	-	-
Baling Costs	$	8.58	6.97
Production Costs	$/ac	28.11	26.50
Forage DM Costs	$/ton	34.80	40.80
Crude Protein	%	6.4	14.5
Crude Protein Yield	lb/ac	102	189
Crude Protein Cost	$/lb	0.28	0.14
Forage Allocation	lb/d	30.0	17.3
Land Area/Period	ac	2.57	1.82
Forage Costs/Period	$/pp	72.34	47.95
Supplementation			
Roughage/Day	lb/d		12.7
Crude Protein/Day	lb/d	0.59	
Sup. Cost/Period	$/pp	24.25	30.42
Total Feed Cost	$/pp	96.59	78.37
Cost/Day	$/d	0.71	0.57
Accumulated Calf Wt.	lbs	274.0	274.0
Weight Value @$0.70/lb	$	191.80	191.80
Net Return/c-c pr	$	95.21	113.43
Net Return/acre	$	37.05	62.32
Cost/lb of Calf Gain	$	0.35	0.29

Table 43. Costs and returns for annual cereal harvested forage types to be fed to range cows during the 137-day summer lactation production period.

		Forage Barley Hay	Forage Barley Hay	Oat Forage Hay	Oat Forage Hay
Days		137	137	137	137
Growth Stage		Milk	Hard Dough	Milk	Hard Dough
Herbage Weight	lb/ac				
Forage DM Weight	lb/ac	4733	5133	4667	5667
Costs/Acre					
Land Rent	$	22.07	22.07	22.07	22.07
Custom Work	$	16.08	16.08	16.08	16.08
Seed Cost	$	4.69	4.69	6.00	6.00
Baling Costs	$	25.37	27.51	25.02	30.38
Production Costs	$/ac	68.21	70.35	69.17	74.53
Forage DM Costs	$/ton	28.80	27.40	29.60	26.40
Crude Protein	%	13.0	9.2	11.5	7.8
Crude Protein Yield	lb/ac	606	468	535	435
Crude Protein Cost	$/lb	0.11	0.15	0.13	0.17
Forage Allocation	lb/d	19.3	27.3	21.8	30.0
Land Area/Period	ac	0.56	0.73	0.64	0.73
Forage Costs/Period	$/pp	38.36	52.06	45.21	54.25
Supplementation					
Roughage/Day	lb/d	10.7	2.7	8.2	
Crude Protein/Day	lb/d				0.17
Sup. Cost/Period	$/pp	25.65	6.47	19.66	6.99
Total Feed Cost	$/pp	64.01	58.53	64.87	61.24
Cost/Day	$/d	0.47	0.43	0.47	0.45
Accumulated Calf Wt.	lbs	274.0	274.0	274.0	274.0
Weight Value @$0.70/lb	$	191.80	191.80	191.80	191.80
Net Return/c-c pr	$	127.79	133.27	126.93	130.56
Net Return/acre	$	228.20	182.56	198.33	178.85
Cost/lb of Calf Gain	$	0.23	0.21	0.24	0.22

Table 44. Costs and returns for annual legume harvested forage types to be fed to range cows during the 137-day summer lactation production period.

		Pea Forage Hay	Pea Forage Hay	Forage Lentil Hay	Forage Lentil Hay	Oat-Pea Hay
Days		137	137	137	137	137
Growth Stage		Early	Late	Early	Late	
Herbage Weight	lb/ac					
Forage DM Weight	lb/ac	2800	4650	1667	3867	5143
Costs/Acre						
Land Rent	$	22.07	22.07	22.07	22.07	22.07
Custom Work	$	16.08	16.08	16.08	16.08	16.08
Seed Cost	$	23.80	23.80	12.60	12.60	29.80
Baling Costs	$	15.01	24.92	8.94	20.73	27.57
Production Costs	$/ac	79.96	86.87	59.69	71.48	95.52
Forage DM Costs	$/ton	55.00	37.40	71.60	37.00	37.20
Crude Protein	%	18.9	14.4	21.8	14.7	12.5
Crude Protein Yield	lb/ac	526	685	361	567	611
Crude Protein Cost	$/lb	0.15	0.13	0.17	0.13	0.16
Forage Allocation	lb/d	13.3	17.4	11.5	17.1	20.1
Land Area/Period	ac	0.65	0.51	0.95	0.60	0.53
Forage Costs/Period	$/pp	52.06	45.21	58.91	45.21	52.06
Supplementation						
Roughage/Day	lb/d	16.7	12.6	18.5	12.9	9.9
Crude Protein/Day	lb/d					
Sup. Cost/Period	$/pp	40.04	30.21	44.35	30.93	23.74
Total Feed Cost	$/pp	92.10	75.42	103.26	76.14	75.80
Cost/Day	$/d	0.67	0.55	0.75	0.56	0.55
Accumulated Calf Wt.	lbs	274.0	274.0	274.0	274.0	274.0
Weight Value @$0.70/lb	$	191.80	191.80	191.80	191.80	191.80
Net Return/c-c pr	$	99.70	116.38	88.54	115.66	116.00
Net Return/acre	$	153.38	228.20	93.20	192.77	218.77
Cost/lb of Calf Gain	$	0.34	0.28	0.38	0.28	0.28

Table 45. Feed quantity and land area for forage types used during the 137-day summer lactation production period.

Forage Types	Daily Feed per Cow			Summer Lactation Period Feed one Cow for 137 days			
	Forage lb/d	Roughage lb/d	Crude Protein lb/d	Forage lb/pp	Roughage lb/pp	Crude Protein lb/pp	Land Area ac/pp
Pasture Forage Types							
Native Rangeland Repeated Seasonal	30.0			4110.0			11.32
6.0-m Seasonlong	30.0			4110.0			18.10
4.5-m Seasonlong	30.0			4110.0			12.70
Deferred Grazing (92d)	30.0			2760.0			6.70
Twice-over Rotation	30.0			4110.0			9.00
Harvested Forage Types							
Crested Wheat, mature	30.0		0.59	4110.0		80.83	2.57
Crested Wheat, early	17.3	12.7		2370.1	1739.9		1.82
Forage Barley, early	19.3	10.7		2644.1	1465.9		0.56
Forage Barley, late	27.3	2.7		3740.1	369.9		0.73
Oat Forage, early	21.8	8.2		2986.6	1123.4		0.64
Oat Forage, late	30.0		0.17	4110.0		23.29	0.73
Pea Forage, early	13.3	16.7		1822.1	2287.9		0.65
Pea Forage, late	17.4	12.6		2383.8	1726.2		0.51
Forage Lentil, early	11.5	18.5		1575.5	2534.5		0.95
Forage Lentil, late	17.1	12.9		2342.7	1767.3		0.60
Oat-Pea Forage	20.1	9.9		2753.7	1356.3		0.53

Table 46. Summary of feed costs for forage types used during the 137-day summer lactation production period.

Forage Types	Forage Costs $/pp	Roughage Costs $/pp	Crude Protein Costs $/pp	Total Feed Costs $/pp	Daily Feed Costs $/d
Pasture Forage Types					
Native Rangeland Repeated Seasonal	98.64			98.64	0.72
6.0-m Seasonlong	158.55			158.55	1.16
4.5-m Seasonlong	111.25			111.25	0.81
Deferred Grazing (92d)	58.26			58.26	0.63
Twice-over Rotation	78.84			78.84	0.58
Harvested Forage Types					
Crested Wheat, mature	72.34		24.25	96.59	0.71
Crested Wheat, early	47.95	30.42		78.37	0.57
Forage Barley, early	38.36	25.65		64.01	0.47
Forage Barley, late	52.06	6.47		58.53	0.43
Oat Forage, early	45.21	19.66		64.87	0.47
Oat Forage, late	54.25		6.99	61.24	0.45
Pea Forage, early	52.06	40.04		92.10	0.67
Pea Forage, late	45.21	30.21		75.42	0.55
Forage Lentil, early	58.91	44.35		103.26	0.75
Forage Lentil, late	45.21	30.93		76.14	0.56
Oat-Pea Forage	52.06	23.74		75.80	0.55

Table 47. Summary of returns after feed costs for forage types used during the 137-day summer lactation production period.

Forage Types	Gross Return @$0.70/lb $/calf	Net Return per C-C pr $/pr	Net Return per acre $/ac	Calf Gain Cost $/lb
Pasture Forage Types				
Native Rangeland				
Repeated Seasonal	172.62	73.98	6.54	0.40
6.0-m Seasonlong	198.01	39.46	2.18	0.56
4.5-m Seasonlong	200.43	89.18	7.02	0.39
Deferred Grazing (92d)	137.55	79.29	11.83	0.30
Twice-over Rotation	211.94	133.10	14.79	0.26
Harvested Forage Types				
Crested Wheat, mature	191.80	95.21	37.05	0.35
Crested Wheat, early	191.80	113.43	62.32	0.29
Forage Barley, early	191.80	127.79	228.20	0.23
Forage Barley, late	191.80	133.27	182.56	0.21
Oat Forage, early	191.80	126.93	198.33	0.24
Oat Forage, late	191.80	130.56	178.85	0.22
Pea Forage, early	191.80	99.70	153.38	0.34
Pea Forage, late	191.80	116.38	228.20	0.28
Forage Lentil, early	191.80	88.54	93.20	0.38
Forage Lentil, late	191.80	115.66	192.77	0.28
Oat-Pea Forage	191.80	116.00	218.77	0.28