Evaluation of Pasture Forage and Harvested Forage Types during the Dry Gestation Production Period

Results

The dry gestation production period was 32 days during late fall from mid November to mid December. The dry gestation production period has the lowest nutrient requirements because there is no nursing calf or milk production and the developing fetus is still small during middle gestation and does not have high nutrient demands. Heavy cows can lose weight during this period without detrimental future effects on reproduction and production performance. Cows with moderate body condition should maintain body weight because the cost to replace lost pounds is greater during other production periods. Thin cows should gain weight during this period because each pound gained requires less feed and costs less than weight gained during other production periods. Pasture forage and harvested forage costs and returns after feed costs were determined for a 1200-pound range cow during the dry gestation production period. The cow requires a daily intake of 24 lbs dry matter (DM) at 6.2% crude protein (CP) (1.49 lbs CP/day).

Pasture Forage Types

Reserved native rangeland managed as a repeated seasonal pasture was evaluated during the dry gestation production period for 32 days between mid November and mid December (tables 14 and 18). Native rangeland forage during the fall dormancy period has a crude protein content of around 4.8%. Late-season native rangeland forage has pasture rent value or production costs of $8.76 per acre, forage dry matter costs of $97.33 per ton, and crude protein costs of $1.01 per pound. A cow grazing during the dry gestation production period would require 5.33 acres (5.08 acres per month) at a forage cost of $46.75 per production period. The crude protein content of mature native rangeland forage is below the requirements of a cow in the dry gestation stage, and crude protein would need to be supplemented at 0.05 lbs per cow per day at a cost of $0.48 per period. Total feed costs would be $47.23 per period, or $1.48 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after pasture costs were a loss of $29.79 per cow-calf pair and a loss of $5.59 per acre. The cost of calf fetus weight gain was $1.90 per pound (table 20).

Cropland aftermath of annual cereal stubble managed as a seasonal pasture was evaluated during the dry gestation production period for 32 days between mid November and mid December (tables 14 and 18). Cropland aftermath of annual cereal stubble has very low crude protein content and does not meet the requirements of a dry gestating cow. Cropland aftermath forage had pasture rent value or production costs of $2.00 per acre and forage dry matter costs of $29.63 per ton. A cow grazing cropland aftermath pasture would require 7.10 acres (6.63 acres per month) and the forage would cost $14.20 per production period. Additional crude protein was not supplemented even though the forage was below the requirements of a dry gestating cow. Total forage costs during the dry gestation period would be $14.20, or $0.44 per day (table 19). Dry cows lost 1.14 lbs per day and lost 4.82 lbs per acre; accumulated weight loss was 36.48 lbs per period. Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after pasture costs were $3.24 per cow-calf pair and $0.46 per acre. The cost of calf fetus weight gain was $0.57 per pound (table 20).

Spring seeded winter cereal (winter rye) managed as a seasonal pasture was evaluated during the dry gestation production period for 32 days between mid November and mid December (tables 14 and 18). Spring seeded winter cereal forage had production costs of $41.75 per acre and forage dry matter costs of $47.85 per ton. A cow grazing during the dry gestation period was allotted 0.56 acres at a forage cost of $23.41 per production period. Additional roughage or crude protein were not supplemented on this pasture forage type. Total feed costs were $23.41 per period, or $0.73 per day (table 19). Cow weight gain was 1.05 lbs per day and 60.14 lbs per acre; accumulated weight gain was 33.68 lbs. Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after pasture costs were a loss of $5.97 per cow-calf pair and a loss of $10.66 per acre. The cost of calf fetus weight gain was $0.94 per pound (table 20).

Standing corn managed as a seasonal pasture was evaluated during the dry gestation production period for 32 days between mid November and mid December (tables 14 and 18). Standing corn forage had production costs of $126.67 per acre (Nelson et al. 2002) and forage dry matter costs of $65.97 per ton. A cow grazing during the dry gestation period was allotted 0.25 acres. Daily forage utilization averaged 77.7 lbs/cow with 61% to 65% of the forage wasted. Intake and wasted forage would cost $31.67 per production period. An additional 0.54 lbs of crude protein per day would need to be provided at a cost of $7.71 per period (Nelson et al. 2002) (table 19). Total forage and supplement costs would be $39.38 per period, or $1.23 per day (Nelson et al. 2002). Cow weight gain was 3.30 lbs per day and 422.40 lbs per acre; accumulated weight gain was 105.6 lbs. Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after pasture costs were a loss of $21.94 per cow-calf pair and a loss of $87.76 per acre. The cost of calf fetus weight gain was $1.58 per pound (table 20).

Harvested Forage Types

Crested wheatgrass hay cut late, at a mature plant stage, has a crude protein content of around 6.4%. This low-quality perennial grass 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. Late-cut crested wheatgrass hay would be fed at 23.4 lbs DM/day to provide 1.5 lbs CP/day. An additional 0.6 lbs of roughage per day would need to be provided, at a cost of $0.34 per period. Production of late-cut crested wheatgrass hay to feed during the dry gestation production period (tables 15 and 18) would require 0.47 acres, and the forage would cost $13.12 per production period. Total forage and supplement costs would be $13.46 per period, or $0.42 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $3.98 per cow-calf pair and $8.47 per acre. The cost of calf fetus weight gain was $0.54 per pound (table 20).

Crested wheatgrass hay cut early, at the boot stage, has a crude protein content of around 14.5%. This high-quality perennial grass 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 10.3 lbs DM/day to provide 1.5 lbs CP/day. An additional 13.7 lbs of roughage per day would need to be provided, at a cost of $7.68 per period. Production of early cut crested wheatgrass hay to feed during the dry gestation production period (tables 15 and 18) would require 0.26 acres, and the forage would cost $6.72 per production period. Total forage and supplement costs would be $14.40 per period, or $0.45 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $3.04 per cow-calf pair and $11.69 per acre. The cost of calf fetus weight gain was $0.58 per pound (table 20).

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 11.5 lbs DM/day to provide 1.5 lbs CP/day. An additional 12.5 lbs of roughage per day would need to be provided, at a cost of $7.00 per period. Production of early cut forage barley hay to feed during the dry gestation production period (tables 16 and 18) would require 0.08 acres, and the forage would cost $5.12 per production period. Total forage and supplement costs would be $12.12 per period, or $0.38 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $5.32 per cow-calf pair and $66.50 per acre. The cost of calf fetus weight gain was $0.49 per pound (table 20).

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 16.2 lbs DM/day to provide 1.5 lbs CP/day. An additional 7.8 lbs of roughage per day would need to be provided, at a cost of $4.37 per period. Production of late-cut forage barley hay to feed during the dry gestation production period (tables 16 and 18) would require 0.10 acres, and the forage would cost $7.04 per production period. Total forage and supplement costs would be $11.41 per period, or $0.36 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was

$17.44 per calf, and the net returns after feed costs were $6.03 per cow-calf pair and $60.30 per acre. The cost of calf fetus weight gain was $0.46 per pound (table 20).

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 13.0 lbs DM/day to provide 1.5 lbs CP/day. An additional 11.0 lbs of roughage per day would need to be provided, at a cost of $6.16 per period. Production of early cut oat hay to feed during the dry gestation production period (tables 16 and 18) would require 0.09 acres, and the forage would cost $6.08 per production period. Total forage and supplement costs would be $12.24 per period, or $0.38 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $5.20 per cow-calf pair and $57.78 per acre. The cost of calf fetus weight gain was $0.49 per pound (table 20).

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 19.1 lbs DM/day to provide 1.5 lbs CP/day. An additional 4.9 lbs of roughage per day would need to be provided, at a cost of $2.74 per period. Production of late-cut oat hay to feed during the dry gestation production period (tables 16 and 18) would require 0.11 acres, and the forage would cost $8.00 per production period. Total forage and supplement costs would be $10.74 per period, or $0.34 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $6.70 per cow-calf pair and $60.91 per acre. The cost of calf fetus weight gain was $0.43 per pound (table 20).

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 7.9 lbs DM/day to provide 1.5 lbs CP/day. An additional 16.1 lbs of roughage per day would need to be provided, at a cost of $9.02 per period. Production of early cut pea forage hay to feed during the dry gestation production period (tables 17 and 18) would require 0.09 acres, and the forage would cost $7.04 per production period. Total forage and supplement costs would be $16.06 per period, or $0.50 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $1.38 per cow-calf pair and $15.33 per acre. The cost of calf fetus weight gain was $0.64 per pound (table 20).

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 10.3 lbs DM/day to provide 1.5 lbs CP/day. An additional 13.7 lbs of roughage per day would need to be provided, at a cost of $7.67 per period. Production of late-cut pea forage hay to feed during the dry gestation production period (tables 17 and 18) would require 0.07 acres, and the forage would cost $6.08 per production period. Total forage and supplement costs would be $13.75 per period, or $0.43 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $3.69 per cow-calf pair and $52.71 per acre. The cost of calf fetus weight gain was $0.55 per pound (table 20).

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 6.8 lbs DM/day to provide 1.5 lbs CP/day. An additional 17.2 lbs of roughage per day would need to be provided, at a cost of $9.63 per period. Production of early cut forage lentil hay to feed during the dry gestation production period (tables 17 and 18) would require 0.13 acres, and the forage would cost $8.00 per production period. Total forage and supplement costs would be $17.63 per period, or $0.55 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were a loss of $0.19 per cow-calf pair and a loss of $1.46 per acre. The cost

of calf fetus weight gain was $0.71 per pound (table 20).

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 10.1 lbs DM/day to provide 1.5 lbs CP/day. An additional 13.9 lbs of roughage per day would need to be provided, at a cost of $7.78 per period. Production of late-cut forage lentil hay to feed during the dry gestation production period (tables 17 and 18) would require 0.09 acres, and the forage would cost $6.08 per production period. Total forage and supplement costs would be $13.86 per period, or $0.43 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $3.58 per cow-calf pair and $39.78 per acre. The cost of calf fetus weight gain was $0.56 per pound (table 20).

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 11.9 lbs DM/day to provide 1.5 lbs CP/day. An additional 12.1 lbs of roughage per day would need to be provided, at a cost of $6.78 per period. Production of oat-pea hay to feed during the dry gestation production period (tables 17 and 18) would require 0.07 acres, and the forage would cost $7.04 per production period. Total forage and supplement costs would be $13.82 per period, or $0.43 per day (table 19). Calf fetus weight gain was assumed to be 0.78 lbs per day; accumulated weight gain was 24.92 lbs. When calf accumulated weight was assumed to have a value of $0.70 per pound, the gross return was $17.44 per calf, and the net returns after feed costs were $3.62 per cow-calf pair and $51.71 per acre. The cost of calf fetus weight gain was $0.55 per pound (table 20).

Discussion

Pasture Forage Types

Reserved native rangeland forage grazed as a repeated seasonal pasture during the dry gestation production period was high-cost forage because the quantities of crude protein captured per acre were low and the quantity of forage dry matter available per acre was low. Total forage costs for reserved native rangeland pastures was high, even though the equipment costs, labor costs, land rent per acre, and forage production costs per acre were low, because the input costs do not directly regulate livestock forage feed costs. The cost per pound of crude protein ($1.01/lb CP) was very high because the quantity of crude protein captured per acre was very low. The crude protein content of the forage was below the requirements of a dry cow making it necessary to provide purchased supplement crude protein. The forage dry matter cost ($97.33/ton) was very high because the quantity of forage weight per acre was low. The low forage weight per acre made it necessary to use more than double the land area that would have been needed during the summer period to provide a cow with adequate forage dry matter for a month in the same pasture. The large land area (5.33 acres) per cow caused the forage costs per period to be high. The total daily forage and supplemental crude protein costs ($1.48/day) were very high. The total feed costs were greater than the low market value of the accumulated calf fetus weight causing a high loss in returns after feed costs ($-29.79) per cow and a moderate loss in returns after feed costs ($-5.59) per acre. The cost per pound of calf fetus weight gain ($1.90/lb) was extremely high because of the low forage dry matter yields per acre, the low crude protein content in the forage, the large land area per cow, and growth in weight of the fetus was relatively slow.

Cropland aftermath of annual cereal stubble grazed as a seasonal pasture during the dry gestation production period was high-cost forage because of the low quantity of forage dry matter available per acre and the extremely low quantities of crude protein contained in the forage resulting in cow weight loss of greater than a pound per day. The forage dry matter cost ($29.63/ton) was low because the equipment costs, labor costs, and forage production costs per acre were low and the land rent per acre was very low. The low forage weight per acre made it necessary to provide a large land area (7.10 acres) per cow. The total daily feed costs ($0.44/day) were low because the land rent per acre was very low. The total feed costs were not much lower than the low market value of the accumulated calf fetus weight resulting in low returns after feed costs ($3.24) per cow and extremely low returns after feed costs ($0.46) per acre. The cost per pound of calf fetus weight gain ($0.57/lb) was moderately high mainly because of the cost of the large land area required per cow. The cost of the lost cow weight is the major problem from using annual cereal stubble as forage. Cropland aftermath is an excellent place for dry cows to roam during fall and winter,

however, a full ration of harvested forage should be provided.

Spring seeded winter cereal (winter rye) grazed as a seasonal pasture during the dry gestation production period was high-cost forage because the moderate production costs per acre were greater than the low market value of the accumulated calf fetus weight resulting in moderate losses after feed costs per cow and per acre. The winter cereal is seeded during the spring in order for the plants to develop large enough root systems to survive water stress periods during the growing season. On the average, there are two months with water deficiencies great enough to cause water stress in plants each growing season. Only 6% of the past 114 years have not had growing season months with water deficiency. The quantity of herbage available during fall and winter grazing of spring seeded winter cereal pastures is related to the severity and duration of the water stress conditions during the growing season and to the depth of packed snow and ice during the nongrowing season. The forage dry matter cost ($47.85/ton) was moderate because the production costs per acre were moderate. The land area (0.56 acres) per cow was relatively small because greater than 70% of the herbage was consumed as forage, however, the total daily forage costs ($0.73/day) were high because only a modest quantity of herbage biomass was produced as a result of growing season water stress. The total feed costs were greater than the low market value of the accumulated calf fetus weight causing a moderate loss in returns after feed costs ($-5.97) per cow and a moderate loss in returns after feed costs ($-10.66) per acre. The high total forage cost was the cause for the high cost per pound of calf fetus weight gain ($0.94/lb). This seeded forage seasonal pasture strategy would be a low-cost forage and yield positive returns after feed costs during moderate water deficiency years in which the herbage biomass production was 3000 to 3200 pounds or greater per acre.

Standing corn grazed as a seasonal pasture during the dry gestation production period was high-cost forage because of the extremely high production costs per acre and the extremely high quantity of unutilized wasted forage. The forage dry matter cost ($65.97/ton) was high because of the low percentage (38%) of herbage consumed as forage. The land area (0.25 acres) per cow was small because of the high herbage biomass produced during exceptionally good growing season conditions with low water deficiency. Corn herbage biomass production would be expected to be low during growing season conditions with normal water deficiency. The crude protein content of the forage was below the requirements of a dry cow making it necessary to provide purchased supplemental crude protein. The weight gained by the cows was more than three pounds per day. The total daily forage and supplemental crude protein costs ($1.23/day) were very high because of the low crude protein content in the forage and the high cost of forage dry matter per ton. The total feed costs were greater than the low market value of the accumulated calf fetus weight causing a high loss in returns after feed costs ($-21.94) per cow and an extremely high loss in returns after feed costs ($-87.76) per acre. The cost per pound of calf fetus weight gain ($1.58/lb) was extremely high because of the high quantity of wasted forage, the low crude protein content in the forage, and growth in weight of the fetus was relatively slow.

Harvested Forage Types

Crested wheatgrass hay cut at a mature growth stage and fed during the dry gestation production period was moderate-cost forage. Basically, the dry gestation production period is the only period that the nutrient content of mature crested wheatgrass hay meets the dietary requirements of range cows and is the only period that mature crested wheatgrass hay is lower cost, by a few cents, than crested wheatgrass hay cut at the boot stage. 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 (0.47 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 total daily forage cost ($0.42/day) for mature crested wheatgrass hay was low because very little supplemental roughage was needed to be provided. The total feed costs were lower than the low market value of the accumulated calf fetus weight resulting in low returns after feed costs ($3.98) per cow and ($8.47) per acre. The cost per pound of calf fetus weight gain ($0.54/lb) was moderate because the production costs per acre were moderate and mature crested wheatgrass hay met the nutrient requirements of dry range cows.

Crested wheatgrass hay cut at the boot growth stage and fed during the dry gestation 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 (0.26 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 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 ($0.45/day) was moderate because more than half 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 fetus weight resulting in low returns after feed costs ($3.04) per cow and in moderate returns after feed costs ($11.69) per acre. The cost per pound of calf fetus weight gain ($0.58/lb) was moderate mainly because of the additional supplemental roughage costs.

Forage barley hay cut at the milk growth stage and fed during the dry gestation 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 (0.08 acres) per cow was very small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.38/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 fetus weight resulting in low returns after feed costs ($5.32) per cow and in high returns after feed costs ($66.50) per acre. The cost per pound of calf fetus weight gain ($0.49/lb) was moderate because growth in weight of the fetus was relatively slow.

Forage barley hay cut at the hard dough growth stage and fed during the dry gestation 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 (0.10 acres) per cow was very small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.36/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 fetus weight resulting in low returns after feed costs ($6.03) per cow and in high returns after feed costs ($60.30) 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 fetus weight gain ($0.46/lb) was moderate because growth in weight of the fetus was relatively slow.

Oat forage hay cut at the milk growth stage and fed during the dry gestation 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 (0.09 acres) per cow was very small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.38/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 fetus weight resulting in low returns after feed costs ($5.20) per cow and in high returns after feed costs ($57.78) per acre. The cost per pound of calf fetus weight gain ($0.49/lb) was moderate because growth in weight of the fetus was relatively slow.

Oat forage hay cut at the hard dough growth stage and fed during the dry gestation 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 (0.11 acres) per cow was very small because of the high crude protein and high forage dry matter yields per acre. The total daily forage and supplemental roughage costs ($0.34/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 fetus weight resulting in low returns after feed costs ($6.70) per cow and in high returns after feed costs ($60.91) per acre. The cost per pound of calf fetus weight gain ($0.43/lb) was moderate because growth in weight of the fetus was relatively slow.

Pea forage hay cut at an early growth stage and fed during the dry gestation production period was low-cost forage. However, pea forage hay cut at a late growth stage has lower forage 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 (0.09 acres) per cow was very small because of the high crude protein yield per acre. The total daily forage and supplemental roughage costs ($0.50/day) were low because of the low cost of crude protein per pound and the very small land area per cow. The total feed costs were lower than the low market value of the accumulated calf fetus weight resulting in very low returns after feed costs ($1.38) per cow and in moderate returns after feed costs ($15.33) per acre. The cost per pound of calf fetus weight gain ($0.64/lb) was high because of the modest forage dry matter production and the high supplemental roughage costs.

Pea forage hay cut at a late growth stage and fed during the dry gestation production period was low-cost forage. Late cut pea forage hay has lower forage 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 (0.07 acres) per cow was very 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, the high forage dry matter production per acre, and the very small land area per cow. The total feed costs were lower than the low market value of the accumulated calf fetus weight resulting in low returns after feed costs ($3.69) per cow and in high returns after feed costs ($52.71) per acre. The cost per pound of calf fetus weight gain ($0.55/lb) was moderate because growth in weight of the fetus was relatively slow.

Forage lentil hay cut at an early growth stage and fed during the dry gestation production period was low-cost forage. However, forage lentil hay cut at a late growth stage has lower forage 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 (0.13 acres) per cow was very small because of the high crude protein yield per acre. The total daily forage and supplemental roughage costs ($0.55/day) were low because of the low cost of crude protein per pound and the very small land area per cow. The total feed costs were greater than the low market value of the accumulated calf fetus weight causing low losses in returns after feed costs ($-0.19) per cow and ($-1.46) per acre. The cost per pound of calf fetus weight gain ($0.71/lb) were high because of the modest forage dry matter production and the high supplemental roughage costs.

Forage lentil hay cut at a late growth stage and fed during the dry gestation production period was low-cost forage. Late cut forage lentil hay has lower forage 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 (0.09 acres) per cow was very 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, the high forage dry matter production per acre, and the very small land area per cow. The total feed costs were lower than the low market value of the accumulated calf fetus weight resulting in low returns after feed costs ($3.58) per cow and in high returns after feed costs ($39.78) per acre. The cost per pound of calf fetus weight gain ($0.56/lb) was moderate because growth in weight of the fetus was relatively slow.

Oat-pea hay cut at compromised plant growth stages and fed during the dry gestation 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 about the same net returns after feed costs per acre as 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 equipments 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 (0.07 acres) per cow was very 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, the high forage dry matter production per acre, and the very small land area per cow. The total feed costs were lower than the low market value of the accumulated calf fetus weight resulting in low returns after feed costs ($3.62) per cow and in high returns after feed costs ($51.71) per acre. The cost per pound of calf fetus weight gain ($0.55/lb) was moderate because growth in weight of the fetus was relatively slow.

Table 14. Costs and returns for pasture forage types grazed by range cows during the 32-day dry gestation production period.

		Native Rangeland Repeated Seasonal	Cropland Aftermath Seasonal Pasture	Spring Seeded Winter Cereal Pasture	Standing Corn Pasture
Days		32	32	32	32
Growth Stage		Dormant	Post-harvest	Vegetative	Mature
Herbage Weight	lb/ac	725	270	2487	9940*
Forage DM Weight	lb/ac	180	135	1745	3840
Costs/Acre					
Land Rent	$	8.76	2.00	22.07	
Custom Work	$	-		16.08	
Seed Cost	$	-		3.60	
Baling Costs	$	-			
Production Costs	$/ac	8.76	2.00	41.75	126.67*
Forage DM Costs	$/ton	97.33	29.63	47.85	65.97
Crude Protein	%	4.8			
Crude Protein Yield	lb/ac	8.64			
Crude Protein Cost	$/lb	1.01			
Forage Allocation	lb/d	30.0	30.0	30.0	30.0
Land Area/Period	ac	5.33	7.10	0.56	0.25
Forage Costs/Period	$/pp	46.75	14.20	23.41	31.67
Supplementation					
Roughage/Day	lb/d				
Crude Protein/Day	lb/d	0.05			0.54*
Sup. Cost/Period	$/pp	0.48			7.71
Total Feed Cost	$/pp	47.23	14.20	23.41	39.38
Cost/Day	$/d	1.48	0.44	0.73	1.23*
Accumulated Calf Wt.	lbs	24.92	24.92	24.92	24.92
Weight Value @$0.70/lb	$	17.44	17.44	17.44	17.44
Net Return/c-c pr	$	-29.79	3.24	-5.97	-21.94
Net Return/acre	$	-5.59	0.46	-10.66	-87.76
Cost/lb of Calf Gain	$	1.90	0.57	0.94	1.58

*Data from Nelson et al. 2002

Table 15. Costs and returns for perennial grass harvested forage types to be fed to range cows during the 32-day dry gestation production period.

		Crested Wheatgrass Hay	Crested Wheatgrass Hay
Days		32	32
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	23.4	10.3
Land Area/Period	ac	0.47	0.26
Forage Costs/Period	$/pp	13.12	6.72
Supplementation			
Roughage/Day	lb/d	0.6	13.7
Crude Protein/Day	lb/d		
Sup. Cost/Period	$/pp	0.34	7.68
Total Feed Cost	$/pp	13.46	14.40
Cost/Day	$/d	0.42	0.45
Accumulated Calf Wt.	lbs	24.92	24.92
Weight Value @$0.70/lb	$	17.44	17.44
Net Return/c-c pr	$	3.98	3.04
Net Return/acre	$	8.47	11.69
Cost/lb of Calf Gain	$	0.54	0.58

Table 16. Costs and returns for annual cereal harvested forage types to be fed to range cows during the 32-day dry gestation production period.

		Forage Barley Hay	Forage Barley Hay	Oat Forage Hay	Oat Forage Hay
Days		32	32	32	32
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	11.5	16.2	13.0	19.1
Land Area/Period	ac	0.08	0.10	0.09	0.11
Forage Costs/Period	$/pp	5.12	7.04	6.08	8.00
Supplementation					
Roughage/Day	lb/d	12.5	7.8	11.0	4.9
Crude Protein/Day	lb/d				
Sup. Cost/Period	$/pp	7.00	4.37	6.16	2.74
Total Feed Cost	$/pp	12.12	11.41	12.24	10.74
Cost/Day	$/d	0.38	0.36	0.38	0.34
Accumulated Calf Wt.	lbs	24.92	24.92	24.92	24.92
Weight Value @$0.70/lb	$	17.44	17.44	17.44	17.44
Net Return/c-c pr	$	5.32	6.03	5.20	6.70
Net Return/acre	$	66.50	60.30	57.78	60.91
Cost/lb of Calf Gain	$	0.49	0.46	0.49	0.43

Table 17. Costs and returns for annual legume harvested forage types to be fed to range cows during the 32-day dry gestation production period.

		Pea Forage Hay	Pea Forage Hay	Forage Lentil Hay	Forage Lentil Hay	Oat-Pea Hay
Days		32	32	32	32	32
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	7.9	10.3	6.8	10.1	11.9
Land Area/Period	ac	0.09	0.07	0.13	0.09	0.07
Forage Costs/Period	$/pp	7.04	6.08	8.00	6.08	7.04
Supplementation						
Roughage/Day	lb/d	16.1	13.7	17.2	13.9	12.1
Crude Protein/Day	lb/d					
Sup. Cost/Period	$/pp	9.02	7.67	9.63	7.78	6.78
Total Feed Cost	$/pp	16.06	13.75	17.63	13.86	13.82
Cost/Day	$/d	0.50	0.43	0.55	0.43	0.43
Accumulated Calf Wt.	lbs	24.92	24.92	24.92	24.92	24.92
Weight Value @$0.70/lb	$	17.44	17.44	17.44	17.44	17.44
Net Return/c-c pr	$	1.38	3.69	-0.19	3.58	3.62
Net Return/acre	$	15.33	52.71	-1.46	39.78	51.71
Cost/lb of Calf Gain	$	0.64	0.55	0.71	0.56	0.55

Table 18. Feed quantity and land area for forage types used during the 32-day dry gestation production period.

Forage Types	Daily Feed per Cow			Dry Gestation Period Feed one Cow for 32 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		0.05	960.0		1.60	5.33
Cropland Aftermath	30.0			960.0			7.10
Spring Seeded Winter Cereal	30.0			960.0			0.56
Standing Corn	30.0		0.54	960.0		17.28	0.25
Harvested Forage Types							
Crested Wheat, mature	23.4	0.6		748.8	19.2		0.47
Crested Wheat, early	10.3	13.7		329.6	438.4		0.26
Forage Barley, early	11.5	12.5		386.0	400.0		0.08
Forage Barley, late	16.2	7.8		518.4	249.6		0.10
Oat Forage, early	13.0	11.0		416.0	352.0		0.09
Oat Forage, late	19.1	4.9		611.2	156.8		0.11
Pea Forage, early	7.9	16.1		252.8	515.2		0.09
Pea Forage, late	10.3	13.7		329.6	438.4		0.07
Forage Lentil, early	6.8	17.2		217.6	550.4		0.13
Forage Lentil, late	10.1	13.9		323.2	444.8		0.09
Oat-Pea Forage	11.9	12.1		380.8	387.2		0.07

Table 19. Summary of feed costs for forage types used during the 32-day dry gestation 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	46.75		0.48	47.23	1.48
Cropland Aftermath	14.20			14.20	0.44
Spring Seeded Winter Cereal	23.41			23.41	0.73
Standing Corn	31.67		7.71	39.38	1.23
Harvested Forage Types					
Crested Wheat, mature	13.12	0.34		13.46	0.42
Crested Wheat, early	6.72	7.68		14.40	0.45
Forage Barley, early	5.12	7.00		12.12	0.38
Forage Barley, late	7.04	4.37		11.41	0.36
Oat Forage, early	6.08	6.16		12.24	0.38
Oat Forage, late	8.00	2.74		10.74	0.34
Pea Forage, early	7.04	9.02		16.06	0.50
Pea Forage, late	6.08	7.67		13.75	0.43
Forage Lentil, early	8.00	9.63		17.63	0.55
Forage Lentil, late	6.08	7.78		13.86	0.43
Oat-Pea Forage	7.04	6.78		13.82	0.43

Table 20. Summary of returns after feed costs for forage types used during the 32-day dry gestation 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	17.44	-29.79	-5.59	1.90
Cropland Aftermath	17.44	3.24	0.46	0.57
Spring Seeded Winter Cereal	17.44	-5.97	-10.66	0.94
Standing Corn	17.44	-21.94	-87.76	1.58
Harvested Forage Types				
Crested Wheat, mature	17.44	3.98	8.47	0.54
Crested Wheat, early	17.44	3.04	11.69	0.58
Forage Barley, early	17.44	5.32	66.50	0.49
Forage Barley, late	17.44	6.03	60.30	0.46
Oat Forage, early	17.44	5.20	57.78	0.49
Oat Forage, late	17.44	6.70	60.91	0.43
Pea Forage, early	17.44	1.38	15.33	0.64
Pea Forage, late	17.44	3.69	52.71	0.55
Forage Lentil, early	17.44	-0.19	-1.46	0.71
Forage Lentil, late	17.44	3.58	39.78	0.56
Oat-Pea Forage	17.44	3.62	51.71	0.55