Linear Programming Analysis of Wheat Crop Alternatives[1]

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Introduction

In recent years over 24 million acres of winter wheat have been planted in Kansas, Oklahoma and Texas. Although the primary purpose of the wheat has been grain production, it also provides an important source of livestock feed. Years when top growth is abundant and weather is favorable for grazing nearly one-half of the acreage is pastured during some part of its growing season (Anderson). The use and practice of winter wheat for pasture supplementing grain production is well established in the southern High Plains. With proper management about 120 days of grazing may be available in many years. The relative dryness of many winters and freedom from snow cover often make it feasible for livestock to obtain a major portion of their feed requirements from wheat pasture.

Grain yields generally are not materially reduced if pasturing is managed properly by moderate grazing. If wheat is planted in a well prepared seed bed and adequate soil moisture is available to provide good vegetation growth and not over-grazed or grazed too long in spring then grain yield should not be affected.

In recent years, interest in other uses of winter wheat has increased. This study will compare three other methods of using winter wheat for livestock; as hay, silage or graze-out. A linear programming method is used to compare these alternatives taking into consideration cost, returns, labor requirements and nutrients provided by each.

Wheat Crop Alternative

Wheat Hay: Research at Kansas State University and reported by Kuhl, Oltjen and Bolsen shows that wheat hay is an excellent roughage for starting, growing and finishing cattle. Wheat is reported to be similar to high quality brome hay in nutritional value. Their studies show that the dough stage of kernel maturity provides the best combination of high dry matter yield and maximum hay quality. Quality differences among varieties are not consistently found in research results. Quality of hay is greatly influenced by the maturity at harvest, method of handling, rain damage and amount of protection while in storage. Growing conditions will effect the grain content, quality of the grain, protein and fiber of the forage, and these factors contribute to the quality of the hay.

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Balers, swathers, mowers, etc. generally available are suitable to harvest wheat hay. Round bales or bread loaf stacks show less deterioration caused by rainfall then rectangular bales if not sheltered.

One problem with wheat hay or silage is that it is harvested at a time of highest seasonal rainfall. Late May and early June have the fewest number of field work days as compared to other times of the year. Consequently, the availability of harvesting equipment is critical for the successful harvest of high quality hay.

Wheat Silage: Wheat ensiled in the soft dough stage is comparable in feeding value to high grain forage sorghum and to 80 percent of corn. Wheat silage will have about 2-3 percent more protein than sorghum or corn silage. For highest quality wheat should be ensiled at 60-65 percent moisture if stored in a bunker or upright silo.

For the best combination of quality and quantity of silage, wheat should be ensiled at the soft dough stage. Earlier harvesting will increase the percent crude protein; harvesting later will increase the percent dry matter. Harvest at dough stage should be completed in 10 to 14 days. The same problem of limited number of days for ensiling hold as for harvesting wheat for hay.

Some disadvantages of making wheat silage are (1) a larger investment in harvesting and storage facilities may be needed as compared with harvesting wheat hay, (2) ensiling may require more labor per acre than either hay or grain harvesting, (3) silage nor hay are as liquid an asset as grain. If wheat silage is put in an upright silo, combined harvesting and storage losses may be less than for wheat hay.

Wheat for pasture and graze out: A wheat graze-out system intensively grazes the wheat pasture until about June 1; no grain is harvested. The wheat pasture or graze-out system requires less labor and capital per unit than either the wheat hay or silage method. Some disadvantages of wheat graze-out are the limited duration when the feed supply is available, and the large loss of feed caused by trampling or left ungrazed. It is estimated that 50 to 60 percent of production is harvested if grazed as compared to silage.

Two increased health problems for cattle on wheat pasture are that of grass tetany and bloat. Both can cause serious economic losses if not treated properly and promptly. Providing a high magnesium mineral and salt mix help prevent grass tetany. Feed additives containing bloatgaurd or poloxalene used when rapid growth of vegetation occurs help prevent bloat.

Stocking rate is greatly influenced by location, year, fertilization, moisture and temperature conditions, size of animal and duration of grazing period. Anderson reports that 3 to 7 acres of wheat may be required to carry an adult beef cow in fall: 2 to 4 acres during early spring. Calves in fall require about half and

yearlings about two-thirds the acreage of adult animals. The greatest carrying capacity is normally from mid-April to the end of the month when 1/2 acre will carry an animal unit.

Stocking rates for wheat graze-out systems will be heavier in the spring than specified above. Laudert reports "theoretical stocking time for graze-out wheat occurs after jointing because forage growth is very rapid and nutrient quality declines as the wheat plant matures. Thus, it is important to stock heavy enough so the wheat does not get too far ahead of the cattle".

Crop and Livestock Enterprises Included in Model

A linear programming model is used to evaluate and compare the economics of alternative wheat crop alternatives. The model is based on resources representing a south central Kansas cash crop-livestock farm. Farm Management Association records are used to determine the mix of land, labor and capital available. The farm situation will be descriptive of farm situations in north central Oklahoma as well as south central Kansas.

The resource base is one full-time operator and 600 acres cropland. The crops considered are:

wheat for grain,
wheat for grain and pastured until April 1,
wheat for grain and pastured until May 1,
wheat for hay,
wheat for silage,
wheat graze-out,
grain sorghum,
sorghum silage,

One livestock enterprise is considered; stocker steers purchased October 1, weighing 400 pounds and sold May 1, except for the graze-out situation in which case they are sold June 1. The four different ways considered in handling stocker steers are:

steers on sorghum silage and wheat pasture,
steers on wheat hay and wheat pasture,
steers on wheat silage and wheat pasture,
steers on sorghum silage and wheat graze-out,

Steers are purchased October 1 and put on wheat pasture two weeks later, October 15. The two weeks allow time to dehorn, castrate, vaccinate, implant, deworm and delice if needed. All steer alternatives use wheat pasture beginning October 15 until December 31. These dates must be considered approximate as the grazing periods will vary from year to year and among regions. Northern Oklahoma will likely have longer periods when wheat can be pastured than South Central Kansas.

Some details of the steer alternatives are provided in table 1;

tables 2 and 3 provide cost and return data for the steer and crop alternatives, respectively. Other details about the alternatives in the model are considered next.

Wheat for Grain

Wheat is used for grain only and no steers are allowed to pasture. Wheat is planted about October 1 to reduce hessian fly problems. The data used represents continuous cropping with some rotation with grain sorghum to control cheat.

Wheat for Pasture until April 1

Wheat is planted primarily for grain but some grazing is allowed. Wheat is planted September 15 to allow the stand to grow and become established before grazing begins on October 15. The earlier planting will increase the hessian fly problems and grazing may affect the wheat stand so a heavier seeding rate and amount of fertilizer applied is increased to offset these factors.

Steers are removed from pasture by April 1, before jointing stage to avoid reducing grain yield.

Wheat for Pasture until May 1

This alternative is the same as the previous one except that steers are allowed to graze until May 1. Because the grazing season for native grass begins on May 1, this alternative would allow a continuous grazing program if desired.

Wheat for Hay

Wheat cultural practices are the same as for the wheat pasture alternatives, except that no grazing is allowed after January 1. Wheat is swathed and baled during the soft dough stage. In the model 14 days total are allowed for harvesting,however, in central and east central Kansas, only 7 to 9 field work days are available in the first half of June. Also it was assumed that swathed hay required 1 day for curing so the number of days when haying can be done is 6-8 days in the first two weeks of June. Time available for wheat hay harvesting was limited to this amount in the model.

In the model only the amount of wheat hay needed for feed is harvested and is determined by herd size. Wheat is custom swathed and baled. Because the grain combine is not needed on acres mowed, depreciation, insurance and taxes are reduced. Wheat hay is custom harvested at costs of $7.00 per acre for swathing and $6.50 per 1500 pound bale.

Wheat for Silage

Wheat cultural practices are similar to the wheat pasture alternative except no grazing is allowed after January 1. The same time constraint problems are applied to silage harvesting as for hay

harvesting.

Wheat silage is custom harvested and only the amount needed for feed is cut. The custom rate used is that reported for harvesting rowed crop which is $4.15 per ton. This rate includes labor for cutter, power and machinery for chopping, hauling and filling silo.

Wheat for Graze-Out

Cultural practices are similar to the wheat pasture alternatives. Stocking rate increases in spring to take advantage of the rapid vegetative growth. In the model, because the number of steers in spring are kept the same as in fall, the acreage for grazed-out is reduced, thereby increasing the stocking rate on the acres pastured. The steers are assumed to be off the wheat not for graze-out by April 1. Grain is harvested from those acres not grazed.

Steers on Wheat Pasture

The wheat and steers are managed in such a way as to avoid or minimize damage to wheat. When not grazing, the steers are fed grain sorghum, sorghum silage and protein supplement. When grazing, steers are fed grain sorghum and a mineral salt mixture to avoid grass tetany problems and additives added to control bloat. With these precautions, a death loss should be no greater than 1 percent, which is the loss assumed in the budgets.

For the alternative that allows grazing until April 1, it is assumed that the steers are placed into a drylot after April 1 until May 1.

Steers on Wheat Hay

When not on wheat pasture, the steers are in a drylot fed a ration of wheat hay, grain sorghum and protein supplement. No grazing is allowed after January 1. The number of steers is determined by the amount of wheat available for pasture. The fall stocking rate is 2 acres per steer. While on pasture steers are fed grain sorghum, mineral salt and bloat control additive.

Steers on Wheat Silage

The management practices are similar to the steers on wheat hay alternative except that wheat silage is fed replacing hay while steers are in drylot.

Steers on Wheat Graze-Out

Management practices are similar to that of steers on wheat pasture until April 1 alternative. Acreage for graze out is reduced after April 1 to one acre per steer. Intensive grazing allows better utilization or less waste of the forage. While in drylot, steers are fed grain sorghum, sorghum silage and protein supplement.

The Model

A linear programming model is used to select wheat crop alternatives that provide the highest return to operator labor and cropland. Operator labor and cropland limit the size of the steer and crop enterprises. Labor required and the amount available is specified for each of the 12 months and 4 specialized harvesting periods:wheat hay harvest, wheat silage harvest, wheat grain harvest and grain sorghum harvest.

The number of steers purchased is limited to a maximum of the number that can be pastured on wheat in fall. The stocking rate specified is two acres per steer so that the maximum number of steers possible is one-half the number of wheat acres.

All operating capital needed can be borrowed at an annual cost of 14 percent. It is assumed that all operating capital is borrowed for 6 months.

Part-time labor can be hired for three months during the summer; 518 hours per person for $2640. This would likely be high school and/or college student labor.

Custom harvesting of wheat is allowed. It is assumed that this farm situation has one combine. If more capacity is needed, custom harvestors can be hired for $13.00 per acre. Custom harvesting of grain sorghum is not allowed.

Results

Results of four scenarios are reported in Table 4. Scenario two allows the selection of any combination of alternatives to gain the highest return to land and labor; the other scenarios consider the selection of wheat for grain with one of each of the following; wheat for pasture, wheat for hay, wheat for silage or wheat for graze-out alternatives.

Scenario 1:Wheat for Graze-Out: This alternative is considered first, because the results show several significant points: (1) graze-out does not pay because using one acre for grazing provides $6.99 less return than if it is used for grain production. Consequently the result is cash crop only. (2) comparing the results of scenarios 2, 3,and 4 to this run shows the increase in returns from the steer enterprise.

Results show returns would be increased $33.45 for each acre taken out of wheat and put into grain sorghum. Limiting grain sorghum acreage to 309 acres is based on the time available for harvesting. If farmers in this region can acquire more harvest capacity in fall, they might well consider a higher percentage of their crop acres for grain sorghum. However, the percent of acres in grain sorghum is larger than that reported in farm management association records.

The penalty of $6.99 per acre for graze-out would be removed if the price of wheat were decreased $.21 and all other prices, costs and crop acre limits remain the same.

Scenario 2: Any Combination of Wheat Alternatives: This scenario allows the greatest flexibility in selecting enterprises within upper limits imposed on wheat and grain sorghum harvest time. This scenario, as expected, has the highest return to land and labor, $27,790.

This scenario selects 514 acres of wheat which is grazed until April 1, 257 steers, 35 acres of sorghum silage and 51 acres of grain sorghum. The sorghums are the forage and grain used in the ration. The steers are on pasture from October 15 to December 31 and again from February 15 to April 1. They are in drylot from October 1 to 15, January 1 to February 15 and April 1 to May 1.

No labor is hired as the flexibility to choose enterprises allows those combinations that use the available labor supply most efficiently, however, 222 acres of wheat is custom harvested so at this time labor and combine capacity available is inadequate to meet requirements.

Over 85 percent of the cropland is in wheat. This proportion is probably too high to allow adequate rotation with spring planted crops to avoid cheat problems.

The combination of crops selected by the model are also the combination frequently found on south central Kansas farms. The model selected the wheat pasture until April 1 alternative as providing the highest returns to operator labor and capital. The wheat acreage provides grain for cash market and pasture for 257 steers and the grain sorghum and sorghum silage are needed as livestock feed.

Grain sorghum acreage does not reach the upper limit specified. However, the combination of 35 acres sorghum silage and 51 acres grain sorghum and 257 steers' uses most of the fall labor available.

Scenario 3: Wheat for Hay: This scenario allows selecting wheat for either grain or for hay: the model does some of both. The selection of the crops and number of steers reduces the objective 6 percent below that for scenario 2.

Labor and time available to harvest wheat hay limits the number of acres for hay and consequently the number of steers purchased. In the model, some additional labor is hired to help with wheat hay and grain harvest. A value of $4.46 per hour is imputed to the value of labor for haying. If a manager does not organize activities very efficiently during the haying operation, or if rain frequently interrupts the work, then the returns for this scenario begin to decrease dramatically.

Most of the cropland, 92 percent, is planted to wheat, either for

grain or hay. This specialization in wheat could cause problems in regard to control of cheat or other cool season annuals. Chemicals are available to help control or eliminate some of the weed or grass problems that can arise, but the management of that type of control is different than currently practiced by most farmers in the region.

Scenario 4: Wheat for Silage: This scenario allows selecting either wheat for grain or wheat for silage: the model does some of both. The returns to land and labor decrease 8 percent compared to scenario 2.

Scenario 4 has many similarities with scenario 3. The major difference is that more labor is hired and used mostly to help harvest wheat silage. Harvesting wheat silage has most of the same management problems as harvesting wheat hay. The equipment is different but the urgency and timeliness of the operation is the same as for a haying operation.

Summary

The alternatives of wheat for pasture, hay or silage are very feasible compared with wheat for grain. However, the alternatives represent very different management of crops and livestock and it appears that this is the major and significant difference among them. A wheat graze-out alternative does not seem to fit in except for some situations that require compliance with a government program such as PIK.

The potential for greatly increasing returns to land and operator labor by adding a steer enterprise to utilize a wheat forage seem reasonable if the farmer is a good manager of both, crops and livestock. Assuming good livestock management, the traditional program of utilizing wheat by fall and winter grazing supplemented with grain sorghum and sorghum silage is sound. This combination provides a good distribution of labor use throughout most months.

Two alternatives, wheat for hay or silage appear to provide nearly the same returns to land and labor as wheat pasture. The difficulty with these alternatives is the limited time and the weather problems during the critical 10-14 day harvest. Providing good quality forages, as is assumed in the model, could be a problem in many years. With lower quality wheat hay or silage, the feeding efficiency could be decreased.

Wheat put up for hay has some advantages over pasturing. Wheat land for pasture requires fencing either temporary or permanent; it may be inconvenient or very time consuming to provide supplemental grain, minerals or forages if the pasture is distant from the homestead; the size of the wheat field may be too small to allow pasturing many animals and providing adequate water may be difficult or time consuming. If only small parcels of land are available, then herds of the 200-257 size must be divided into smaller groups and located on several fields further increasing the inconvenience of

watering and supplemental feeding. Wheat haying or ensiling operations can be done on small or parts of fields, although large and regular shaped fields are most desired.

Areas of Needed Research

Research is needed to identify strengths and weaknesses of other livestock alternatives in relation to different ways of using wheat pasture, hay or silage. Combining crop and livestock enterprises increases the complexity of the system. The need of managerial skill increases whenever the number and diversity of enterprises increases. The cash crop-livestock farmers need to do well in both areas to show good returns to the total farm. There are numerous ways that a livestock enterprise can interface with the crop system: there are numerous livestock systems and each with unique technical and management requirements. Models of farms are needed that test combinations of the multitude of crop and livestock enterprises to determine the effect on farm income and resource use.

Feeding wheat hay or silage expands the market for wheat. Research is needed to determine the advantages and disadvantages of these market alternatives. Until the time of hay or silage harvest, the farmer has several alternative ways of marketing the crop. But if the wheat is put up for hay, or silage or kept for grain, the marketing flexibility decreases.

Using wheat for hay, silage or pasture changes the risk element of farming. The extent of increasing or decreasing risk needs to be studied. These uses of wheat change the time when feeds are harvested as compared to the traditional system; it changes the labor use during the year; it changes machinery use; it can change when livestock are marketable and marketed and it can change cropping practices. The challenge will be to describe the elements of the risk involved in a meaningful and operational way to farmers.

References

Anderson, K.L., "Winter Wheat Pasture in Kansas", Kansas Agricultural Experiment Station Bulletin 345, 1956 pp. 1.

Kuhl, G, Scott Laudert, "Wheat for Silage and Hay", Kansas Focus on Feedlots, Department of Animal Science, Kansas State University, April 1983.

Laudert, Scott, "Wheat Pasture Graze Out", Southwest Extension Livestock Specialist at Garden City, Kansas, Kansas State University.

Oltjen, J.W., Keith Bolsen, "Wheat Barley and Oat Silages for Beef Cattle" Kansas Agricultural Experiment Station Bulletin 613R, April 1983, Manhattan, Kansas.

Oltjen, J.W., K. Bolsen, L. Johnson, "Small Grains for Hay or Silage for Beef Cattle", Great Plains Beef Cattle Handbook GPE-2902.

Table 1: Ration, grazing practice, stocking rate and wheat grain and forage production by forage system, for south-central Kansas.

	wheat for grain only	wheat for grain and pasture until April 1	wheat for grain and pasture until May 1	wheat cut for hay	wheat, graze out	wheat, cut for silage
Wheat Planting Time (S.C. Kansas)	Oct. 1	Sept. 15	Sept. 15	Sept. 15	Sept. 15	Sept. 15
Wheat seeding rate, pounds per acre	60	75	75	75	75	75
Fertilizer application						
pounds N	50	67	67	67	67	67
pounds P_2O_5	25	31	31	31	31	31
Yield per acre						
grain, bushel per acre	34	34	30	0	0	0
forage, ton per acre				3.4		
silage, ton per acre (40% D.M. is grain)						8.5
Pasture periods	-	10/15-12/31 2/15-4/1	10/15-12/31 2/15-5/1	10/15-12/31	10/15-12/31 2/15-6/1	10/15-12/31 -
Number of Days on wheat pasture	-	120	150	75	180	75
Date steers purchased	-	Oct. 1	Oct. 1	Oct. 1	Oct. 1	Oct. 1
Date steers placed on wheat pasture	-	Oct. 15	Oct. 15	Oct. 15	Oct. 15	Oct. 15
Date steers removed from wheat pasture	-	April 1	May 1	Dec. 31	June 1	Dec. 31
Date steers sold	-	May 1	May 1	May 1	June 1	May 1
Number of days owned	-	211	211	211	241	211
Beginning weight, pounds	-	400	400	400	400	400
Ending weight, pounds	-	770	770	770	825	770
Rate of gain, pounds per day	-	1.75	1.75	1.75	1.75	1.75
Stocking Rate, head per acre						
Oct 15 - Dec 31	-	.5	.5	.5	.5	.5
Feb 15 - April 1	-	1.3	1.3	-	1.3	-
April 1 - May 1	-	-	1.3	-	1.0	-
May 1 - June 1	-	-	-	-	1.0	-

Table 1, cont'd

Ration						
Oct. 1 - Oct. 15 (15 days)						
grain sorghum (2.4 lbs/steer/day)	-	36	36	36	36	36
sorghum silage (26.7 lbs/steer/day)	-	400	400		400	
wheat hay, pounds	-			160		
wheat silage, pounds						400
protein supplement, pounds	-	23	23	7.5	23	4
Oct. 15 - Dec. 31 (75 days)						
grain sorghum (3 lbs/steer/day)	-	195	195	195	195	195
wheat pasture	-	x	x	x	x	x
Jan. 1 - Feb. 15 (45 days)						
grain sorghum (3 lbs/steer/day)	-	135	135	135	135	135
sorghum silage (34 lbs/steer/day)	-	1530	1530		1530	
wheat hay, pounds				612		
wheat silage, pounds	-					1530
protein supplement, pounds	-	86	86	26	86	9
Feb. 15 - April 1 (45 days)						
grain sorghum (3.2 lbs/steer/day)	-	142	142	142	142	142
sorghum silage	-	(pasture)	(pasture)		(pasture)	
wheat hay (14.0 lbs/steer/day)	-			634		
wheat silage (35.3 lbs/steer/day)						1587
protein supplement, pounds	-			48		13
April 1 to May 1 (30 days)						
grain sorghum (3.4 lbs/steer/day)	-	102	102	102	102	102
sorghum silage (38 lbs/steer/day)	-	1150	(pasture)		(pasture)	
wheat hay (13.6 lbs/steer/day)	-			407		
wheat silage (3.8 lbs/steer/day)	-					1150
protein supplement, pounds	-	66		36		12
May 1 to June 1 (30 days)						
grain sorghum (3.4 lbs/steer/day)	-	(sold)	(sold)	(sold)	102	(sold)
Total feed requirements, per steer						
grain sorghum, pounds	-	610	610	610	712	610
sorghum silage, pounds	-	3080	1930		1930	
wheat hay, pounds				1740		
wheat silage, pounds						4667
protein supplement, pounds	-	175	109	118	109	38

Table 2. Cost and return budgets for wheat crop alternatives

	Wheat for grain	Wheat for grain and pasture(1)	Wheat for grain and pasture(2)	Wheat for hay	Wheat for silage	Wheat graze out	Grain sorghum	Sorghum silage
Yield per acre, bushel	34	34	30				55	
ton				3.4	8.5			12.8
Unit price	3.50	3.50	3.50	-	-		2.50	-
Costs:								
Seed	6.00	7.50	7.50	7.50	7.50	7.50	3.35	3.35
Herbicide	2.50	2.50	2.50	2.50	2.50	2.50	10.00	10.00
Fertilizer	15.00	19.50	19.50	19.50	19.50	19.50	16.60	16.60
Fuel & oil	10.50	10.50	10.50	8.00	8.00	8.00	12.50	12.50
Machinery & equip. repairs	11.00	11.00	11.00	9.00	9.00	9.00	13.00	13.00
Miscellaneous	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Custom Harvest				29.47	35.28			53.26
Real Estate taxes	5.10	5.10	5.10	5.10	5.10	5.10	5.10	5.10
Depreciation on crop machinery	17.85	17.85	17.85	12.85	12.85	12.85	19.65	14.65
Taxes, Insurance on machinery	12.50	12.50	12.50	10.00	10.00	10.00	13.75	11.25
Total	84.45	90.45	90.45	114.92	113.73	78.45	97.95	143.71

1. Hay and silage tonnage based on grain yield: 40 percent of total dry matter comes from grain.
2. Custom harvest rates used: $4.15 per ton for silage, $7.00 per acre for swathing hay and $6.50 per 1500 lb. bale.

Table 3. Cost and returns budgets for stocker steer budgets

	steer on pasture	steer on wheat Hay	steer on silage	steer on graze out
Beginning weight, pounds	400	400	400	400
Purchase price, $ per c.w.t.	71	71	71	71
Selling weight	770	770	770	825
Selling price, $ per c.w.t.	66	66	66	66
Dáily rate of gain, pounds	1.75	1.75	1.75	1.75
Costs				
Mineral salt	3.50	3.50	3.50	3.50
Rumensin	2.95	2.95	2.95	2.95
Grain processing	2.72	2.72	2.72	2.72
Veter., drugs & supplies	8.00	8.00	8.00	8.00
Marketing (3% of gross inc)	15.25	15.25	15.25	16.34
Fuel, oil, repairs	16.00	16.00	16.00	16.00
Death loss (1% of gross inc)	5.08	5.08	5.08	5.45
Depreciation, barns and pens	6.25	6.25	6.25	6.25
Depreciation, hay storage		.98		
Depreciation, silo and equip.	2.55		4.00	
Insurance, taxes	7.92	6.51	9.23	5.63
Total	70.22	67.24	72.98	65.38

Table 4. Returns to land and labor, selection of enterprises and value of additional units by scenario.

	unit	Scenarios			
		1	2	3	4
Return to land and labor	$	20372	27790	26134	25600
Enterprise selection					
Wheat for grain	acre	290	–	477	473
Wheat pasture until April 1	acre	–	514	–	–
Wheat pasture until May 1	acre	–	–	–	–
Wheat for hay	acre	–	–	76	–
Wheat for silage	acre	–	–	–	74
Wheat graze out	acre	($6.99)	–	–	–
Sorghum silage		–	35	–	–
Grain sorghum	acre	309	15	47	52
Number of steers	no	–	257	238	236
Borrow capital	$	16318	98084	85897	84056
Custom harvest wheat	acre	55	222	209	95
Hire labor	no	–	–	.55	2.0
Value of an additional unit					
Grain sorghum	$ per acre	33.45	–	–	–
July labor	$ per hr.	13.54	13.54	13.54	13.54
Wheat hay labor	$ per hr.	–	–	4.14	
Wheat silage labor	$ per hr.	–	–	–	5.86
Cropland	$ per acre	21.19	39.06	37.63	35.58