An Economic Evaluation of CROPPING SYSTEMS on SANDY SOILS in Southwestern Oklahoma

J. F. Tomlinson

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J. F. Tomlinson
Agricultural Economics Department

Sandy cropland soils constitute 24 percent of the total cropland acres in an eleven county area of southwestern Oklahoma. (See Figure 1.) These sandy soils are of major importance for crop production and especially for cotton, grain sorghum, and other summer growing crops.

Sandy soils have characteristics more favorable for crop production under low rainfall conditions than the finer-textured soils. They provide a favorable physical condition for plant root development, have a rapid moisture intake rate which results in little moisture run-off, allow moisture to penetrate deep into the soil, release soil moisture readily to growing crops, and make maximum use of light showers and rains (2).

Research reported herein was made to determine the economic importance of certain fertilizer, tillage and cropping practices on sandy soils in southwestern Oklahoma.

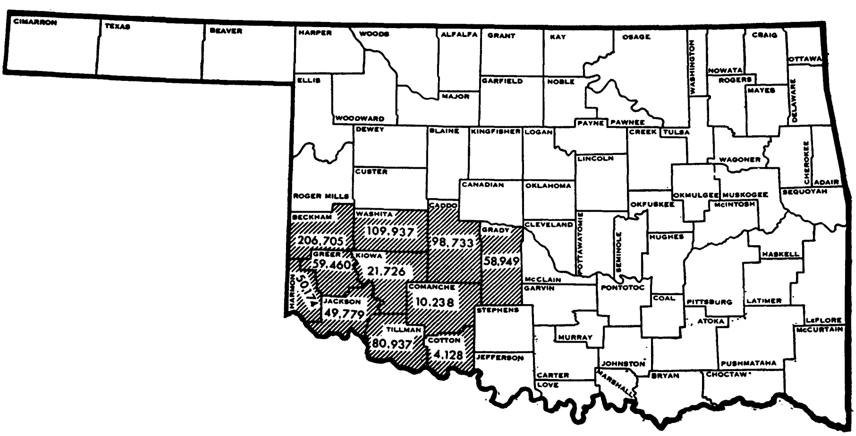

Figure 1. Acres of sandy cropland by counties (total 750,766 acres) in the eleven county area of southwestern Oklahoma covered by this study. Source (1).

Research reported herein was done under Oklahoma Station project number 658.

Soil Resource Specifications

The classification of sandy soils for purposes of this study is based on a grouping of soils according to major physical soil characteristics.

These sandy soils are coarse in texture with permeable subsoils. Soil units 70, 7X, 12, and 12X including Miles, Dill, Pratt, Enterprise, and Brownfield soils or their equivalents are included in the grouping for the study. These sandy soils were further subdivided into four productive classes (designated as S_b, S_c, S_d, and S_e) on the basis of topography, and depth of topsoil (3):

S_b—Deep; level to moderate slope (0 to 3 percent)
S_c—Deep; moderately sloping (3 to 5 percent)
S_d—Sloping (5 to 8 percent)
S_e—Rolling; over 8 percent slope, or less slope with severe erosion or shallow soil and usually not adapted to row crops.

Table 1 shows the distribution by productive classes of the sandy soils from 2,683 sandy land farms of southwestern Oklahoma. Estimated crop yield levels are indicated in the enterprise budgets, Tables 6-12.

Source of Data

The estimates presented in this study were based on results obtained from experiment station research, personal interviews with farmers, esti-

Table 1: Land Resources of 2,683 Sandy Soil Farms in Southwestern Oklahoma, Total Land in the Farms by Soil Productivity Classes, Land and Crop Allotment for an Assumed Farm.

Soil Productivity Classes	Total Acres of 2,683 Farms	Acres for An Assumed Farm	Percent of Cropland
S_b	95,816	35.71	17.8
S_c	283,600	105.71	52.8
S_d	137,311	51.18	25.5
S_e	20,821	7.76	3.9
Total Cropland	537,548	200.36	100.0
Native Pasture	250,648	93.42	--
Total Acres	788,196	293.77	--
Number of Farms	2,683	1.00	
Cotton Allotment		71.00	35.5
Wheat Allotment		29.8	14.9

Source: (1)

mates by scientists, and other primary and secondary sources.

Crop yield responses to the various practices were based on research results from the sandy land research station at Mangum (4) and on Harper's research in Harmon County (5).

The basic input, output and price data used in the budget analysis and the soil groupings were based on data from the Regional Project S-42 study as reported in (1) and (3).

Practices Considered

Deep Plowing

Wind erosion hazards create one of the major problems of crop production on sandy soils. Deep plowing of some sandy soils has been very beneficial in wind erosion control which has helped in establishing stands of crops on these soils.

The original research on deep plowing of sandy soils in Oklahoma was done by Harper in Harmon County in 1957. In connection with this research Harper (5) reported the following:

1. Sandy soils containing less than 8 percent clay in the surface layer are quite susceptible to wind erosion, but a cloddy condition resistant to wind erosion can be produced by cultivation where the surface soil contains more than 8 percent clay.

2. Increasing the clay content of a sandy surface soil also provides a more favorable condition for the growth and development of young plants. The plants obtain nutrients from the soil principally by taking them from the surface of clay particles through absorption by the root hairs.

3. The deep plowing practice is usually applicable on loose sandy soils where a subsoil containing from 10 to 25 percent clay lies near enough to the surface to be reached with special plows.

4. On five areas in southwestern Oklahoma where farmers tried deep plowing in cooperation with the Oklahoma Agricultural Experiment Station the percentage of clay in the sandy top soil was increased from less than 4 percent to a range of 10.3 to 17.7 percent by the deep plowing.

5. The effect of deep plowing should last at least 50 years if the soil is properly managed after being deep plowed.

6. Yields of lint cotton on the deep plowed soil in Harmon County

averaged 182 pounds for three years after the deep plowing compared to 108 pounds for check plots.

7. The clay subsoil of the loose sandy soils is much higher in organic matter than the surface soils. Analysis of soil samples from nine sandy land farms showed the clay subsoils to be almost twice as high in percent of organic matter as the surface soils. The increased yields resulting from deep plowing suggests that plants are being benefited by the organic matter brought up from the subsurface layer.

8. Crop yield can be increased on the sandy soils by use of commercial fertilizers without deep plowing, but the erosion hazard still remains.

A sandyland experiment station was established in Greer County near Mangum in 1952 to further study the management of sandy soils. Deep plowing research results on the Sandy Land Station were very similar to the results obtained by Harper.

Cunningham (4) reported the following results from the deep plowing research on the Sandy Land Experiment Station:

1. Stands of cotton and grain sorghum were obtained on deep plowed soil when failure of stands resulted from wind erosion on the sands that were not deep plowed.

2. Large increases in cotton yields were obtained from deep plowed sandy soil, but the increase diminished each year as the plant nutrients were exhausted from the plowed up clay, but the improved physical condition remained and the increased yields could be maintained by proper management of the deep plowed soils.

3. The average yield of lint cotton per acre for the first four cotton crops after deep plowing was 199 pounds on the deep plowed soil and 99 pounds on the check plots.

Increased cotton yields from the deep plowing practice in Harmon County (5) would increase net cotton returns $37.17 per acre during a three-year period after deep plowing.

The same analysis applied to the Sandy Land Station deep plowing data results in additional net returns of $76.44 per acre for the combined four cotton crops after deep plowing.

Based on a survey of the county agents in nine southwestern Oklahoma counties, Cunningham (6) estimated that deep plowing would be applicable to 362,519 acres of sandy soil. The State ASC office reports that payments for deep plowing were made on 272,000 acres in the 11 southwestern counties of Oklahoma from 1949 through 1962. There has been an estimated 50,000 acres plowed other than the 272,000 acres reported by ASC or a total of 322,000 acres. Most of the 322,000 acres deep plowed have been the S_c and S_d class soils, many of which would be class S_b soils after the deep plowing.

Fertilization

Commercial fertilizers have resulted in increased yields of cotton, grain sorghums, alfalfa and other crops on sandy soils in southwestern Oklahoma (4, 5, 7, and 8). Increases in crop production from commercial fertilizers are usually expected more on the sandy soils than on the finer textured soils in the low rainfall area of southwestern Oklahoma. Harper (5) reported that fertilizers increased average cotton yields 44 percent or 81 pounds of lint cotton per acre on deep plowed sandy soils.

Cunningham's (4) experiments with cotton fertilization at the Sandy Land Research Station showed that fertilizers resulted in a 41 percent increase or an increase of 80 pounds of lint cotton on deep plowed sandy soils. Fertilizers increased net returns $12.99 per acre in Harmon County and $13.47 per acre at the Sandy Land Station. Grain sorghum production responses to commercial fertilization have not been too conclusive. However, Tucker's (7) research on grain sorghum fertility at the Sandy Land Research Station in 1961 and 1962 showed about a 33 percent yield increase due to fertilization. The per acre increase was 622 pounds of grain which amounted to about $2.00 return for $1.00 spent for fertilizer.

Alfalfa fertility research at the Sandy Land Experiment Station by Cunningham (4) indicated very significant increases in alfalfa hay and seed yields from an annual application of 0-45-0 fertilizer per acre on established stands of alfalfa on deep plowed sandy soils. The net returns from hay were about $7.00 for $1.00 spent for fertilizer and a higher return ratio where a combination of hay and seed were harvested.

Recent cotton and grain sorghum fertility research (7 and 8), indicate that the sandy soils at the Mangum Research Station are deficient in potash. Current research is being done to determine the most economical mixture and rate of fertilization.

Winter Cover Crop and Legumes

A winter cover crop of rye in a continuous cotton production program has reduced wind erosion hazards on sandy soils and had a significant effect on cotton yields at the Sandy Land Experiment Station (4, 8). (Table 2) Table 3 shows that the cover crop would give an estimated

Table 2: Cotton Yields, Continuous Cotton With and Without Rye Winter Cover and Methods of Fertilization on Deep Plowed Sandy Soils 1958-1961, Sandy Land Experiment Station, Mangum, Okla.

	Rye Winter Cover				No Winter Cover			
Year	No Fertilizer	Fall Fertilized[1]	Spring Fertilized[1]	Split Fall and Spring Fertilized[1]	No Fertilizer	Fall Fertilized[1]	Spring Fertilized[1]	Split Fall and Spring Fertilized[1]
	Pounds Lint Cotton Per Acre							
1958	384	414	452	448	356	406	413	423
1959	209	261	261	275	105	235	183	222
1960	196	288	235	288	118	209	183	222
1961	353	421	417	355	260	317	324	301
4 year average	286	346	341	341	210	292	276	292
increase	76	54	65	49				

[1] All fertilized plots received fertilizer equivalent to 40-80-40 pounds of fertilizer per acre. Source: (8)

Table 3: Estimated Per Acre Annual Added Requirements, Costs and Returns For a Rye Winter Cover Crop with Continuous Cotton on Deep Plowed Sandy Soils of Southwestern Oklahoma.

Item	Unit	Price or cost per unit	Quantity	Value or Cost
Added Production				
Lint Cotton	cwt.	28.17	.54	15.21
Cotton Seed	cwt.	2.50	.90	2.25
Rye Grazing	AUM	5.00	.4	2.00
Total				19.46
Added Inputs				
Rye Seed	bu.	1.25	1	1.25
Tractor Operating Cost	hr.	.80[1]	.5	.40
Other machinery operating cost	hr.	.30[1]	.6	.18
Labor	hr.	1.00[1]	.6	.60
Annual Operating Capital	dollar	.06	1.50[1]	.09
Specified Preharvest Costs				2.52
Snapping	cwt. seed cotton	2.00	1.26	2.52
Stripping	cwt. seed cotton	.75	.85	.64
Hauling, Ginning & Wrapping	cwt. seed cotton	1.10	2.11	2.32
Total Specified Costs				8.00
Added returns to Land, Risk & Management				11.46

[1] Cost requirements for electric fencing and labor necessary in grazing the cover crop with livestock were assumed in the estimated costs.

added return to land, risk and management of $11.46 per acre.

Table 4 shows that sweet clover had a significant effect on cotton yields at the Sandy Land Research Station.

Cotton yields following alfalfa compared to continuous cotton with a cover crop at the Sandy Land Research Station are presented in Table 5. The cotton yields following alfalfa were significantly higher than continuous cotton yields.

The Enterprise Budgets

In the enterprise budgets specified in Tables 6 through 12 all costs and return estimates have been computed on the basis of four-row farm machinery. These returns are based on a single set of price assumptions, therefore, different prices would give a different set of estimates.

These budgets are assumed and are not designed to fit any particular farm or situation for a specific year. However, adjustments may be made so that the estimates could be applied to a specific set of circumstances.

Table 4: Cotton Yields Following Two Years of Sweet Clover on Deep Plowed Sandy Soils, Sandy Land Research Station, Mangum, Oklahoma, 1955-1958.

Year	Check Plot Continuous Cotton[1]	Sweet-Clover 1953-1954 Cotton 1955-1958[2]	Increase Over Check
		Pounds Lint Cotton per Acre	
1955	374.	433.5	59.50
1956	389.25	525.5	136.25
1957	326.75	387.	60.25
1958	286.25	412.5	126.25
Average	344.	439.6	95.6
Percent increase of lint cotton (4 year average)			27.79

[1] The check plots were continuous cotton with a rye winter cover crop. 100 pounds of 12-24-12 fertilizer was applied with cover crop as seeded. No fertilizer was used on cotton.

[2] Sweet clover received 100 pounds of 0-46-0 fertilizer at seeding time. Cotton following sweet clover received no fertilizer, but the winter cover crop received 100 pounds of 12-24-12.

Source: (4)

Table 5: Cotton Yields, Following Alfalfa in Rotation with Cotton, on Deep Plowed Sandy Soils, Three Year Average Yields at Two Locations, Sandy Land Research Station, Mangum, Oklahoma, 1956-1958.

Location and Cotton Variety	Check Plot[1]	Alfalfa[2] Cotton[3] 1956-58	Increase Over Check
		Pounds Lint Cotton per Acre	
No. 1 Western Stormproof			
3 year average	286	516	230
No. 2 Lankart 611			
3 year average	354	614	260
Average of the three year averages of Location No. 1 and No. 2	320	565	245
Percent increase of lint cotton 3 year average at Locations No. 1 and No. 2			76.5

[1] The check plots were continuous cotton with a rye winter cover crop. One hundred pounds of fertilizer was applied with rye as seeded. No fertilizer was used on cotton.

[2] The stand of alfalfa was on the land when the station was established in 1952. The alfalfa received an annual application of 0-46-0 fertilizer from 1952 through 1955. The alfalfa was plowed down in March of 1956 and cotton was grown on the land from 1956 through 1958.

[3] The cotton following alfalfa was continuous cotton with a winter cover crop of rye. The cotton was not fertilized, but the rye received 100 pounds of 13-39-0 at seeding time.

Source: (4)

In the basic budgets, production requirements and practices assume improved or advanced technology. The basic budgets assume deep plowed sandy soil, use of commercial fertilizer, and a winter cover crop for cotton and grain sorghum. The budget for wheat following cotton,

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Table 6: Estimated Per Acre Annual Requirements, Cost and Returns for Continuous Cotton with A Winter Cover Crop, Hand and Mechanical Harvesting, Contract Hoeing, Snapping, Stripping, and Hauling, Sandy Soils of The Rolling Plains of Southwestern Oklahoma.

Item	Unit	Price or Cost Per Unit	(6.1) S_b Land Qty.	(6.1) S_b Land Value or Cost	(6.2) S_c Land Qty.	(6.2) S_c Land Value or Cost	(6.3) S_d Land Qty.	(6.3) S_d Land Value or Cost
				(dollars)		(dollars)		(dollars)
1. Production								
Lint	cwt.	28.17	3.25	91.55	2.75	77.47	1.50	42.26
Seed	ton	50.00	.272	13.60	.23	11.50	.128	6.40
Rye grazing	AUM	--	.5	--	.40	--	.3	--
Total				105.15		88.97		48.66
2. Inputs:								
Fertilizer	cwt.	4.50	1.00	4.50	1.00	4.50	1.00	4.50
Seed: cotton	lb.	.08	24.00	1.92	24.00	1.92	24.00	1.92
rye	lb.	.022	56.00	1.23	56.00	1.23	56.00	1.23
Power	hr.	1.27	3.15	4.00	3.15	4.00	3.15	4.00
Other machinery	hr.	.366	2.74	1.00	2.74	1.00	2.74	1.00
Insecticide	acre	3.50	1.00	3.50	1.00	3.50	1.00	3.50
Hoeing	acre	2.50	1.00	2.50	1.00	2.50	1.00	2.50
Specified Preharvest Costs				18.65		18.65		18.65
Snapping	cwt. seed cotton	2.00	7.60	15.20	6.50	13.00	3.58	7.16
Stripping	cwt. seed cotton	.75	5.10	3.83	4.30	3.23	2.40	1.80
Hauling, ginning and wrapping	cwt. seed cotton	1.10	12.70	13.97	10.80	11.88	5.98	6.58
Annual Operating Capital	dol.	.06	27.17	1.63	27.17	1.63	27.17	1.63
3. Total Specified Costs				53.28		48.39		35.82
4. Returns to Land, labor, Risk and Management				51.87		40.58		12.84
5. Land Rent (¼ sales — ¼ Fertilizer & Ginning Costs)				22.47		18.89		9.77
6. Returns to Labor, Risk and Management				29.40		21.69		3.07
7. Labor	hr.	1.00	3.45	3.45	3.45	3.45	3.45	3.45
8. Returns to Risk and Management				25.95		18.24		—.38

Table 7: Estimated Per Acre Annual Requirements, Cost and Returns for Four Years of Continuous Cotton With A Winter Cover Crop Following Two Years of Sweet Clover, Hand and Mechanical Harvesting, Contract Hoeing, Snapping, Stripping, and Hauling, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

			(7.1) S_b Land		(7.2) S_c Land		(7.3) S_d Land	
Item	Unit	Price or Cost Per Unit	Qty.	Value or Cost	Qty.	Value or Cost	Qty.	Value or Cost
				(dollars)		(dollars)		(dollars)
1. Production:								
Lint	cwt.	28.17	4.15	116.91	3.51	98.88	1.92	54.09
Seed	ton	50.00	.347	17.35	.294	14.70	.163	8.15
Rye grazing	AUM	--	.5	--	.40	--	.3	--
Total				134.26		113.58		62.24
2. Inputs:	cwt.	4.50	1.00	4.50	1.00	4.50	1.00	4.50
Fertilizer	lb.	.08	24.00	1.92	24.00	1.92	24.00	1.92
Seed: cotton	lb.	.022	56.00	1.23	56.00	1.23	56.00	1.23
rye	hr.	1.27	3.15	4.00	3.15	4.00	3.15	4.00
Power	hr.	.366	2.74	1.00	2.74	1.00	2.74	1.00
Other machinery	acre	3.50	1.00	3.50	1.00	3.50	1.00	3.50
Insecticide	acre	2.50	1.00	2.50	1.00	2.50	1.00	2.50
Hoeing								
				18.65		18.65		18.65
Specified Preharvest Costs	cwt. seed cotton	2.00	9.71	19.42	8.30	16.60	4.57	9.14
Snapping	cwt. seed cotton	.75	6.51	4.88	5.49	4.12	3.07	2.30
Stripping	cwt. seed cotton	1.10	16.22	17.84	13.79	15.17	7.64	8.40
Hauling, ginning and wrapping	dol.	.06	27.17	1.63	27.17	1.63	27.17	1.63
Annual Operating Capital								
3. Total Specified Costs				62.42		56.17		40.12
4. Returns to Land, Labor, Risk and Management				71.84		57.41		22.12
5. Land Rent (¼ sales — ¼ Fertilizer & Ginning Costs)				28.99		24.34		12.82
6. Returns to Labor, Risk and Management				42.85		33.07		9.30
7. Labor	hr.	1.00	3.45	3.45		3.45		3.45
8. Returns to Risk and Management				39.40		29.62		5.85

Table 8: Estimated Per Acre Annual Requirements, Cost and Returns for Four Years of Continuous Cotton With A Winter Cover Crop Following 4 Years of Alfalfa, Hand and Mechanical Harvesting, Contract Hoeing, Snapping, Stripping, and Hauling, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Item	Unit	Price or Cost Per Unit	(8.1) S_b Land Qty.	(8.1) S_b Land Value or Cost	(8.2) S_c Land Qty.	(8.2) S_c Land Value or Cost	(8.3) S_d Land Qty.	(8.3) S_d Land Value or Cost
				(dollars)		(dollars)		(dollars)
1. Production:								
Lint	cwt.	28.17	5.52	155.50	4.67	131.55	2.55	71.83
Seed	ton	50.00	.462	23.10	.391	19.55	.218	10.90
Rye grazing	AUM	--	.5	--	.40	--	.3	--
Total				178.60		151.10		82.73
2. Inputs:								
Fertilizer	cwt.	4.50	.75	3.38	.75	3.38	.75	3.38
Seed: cotton	lb.	.08	24.00	1.92	24.00	1.92	24.00	1.92
rye	lb.	.022	42.00	.92	42.00	.92	42.00	.92
Power	hr.	1.27	3.05	3.87	3.05	3.87	3.05	3.87
Other machinery	hr.	.366	2.64	.97	2.64	.97	2.64	.97
Insecticide	acre	3.50	1.00	3.50	1.00	3.50	1.00	3.50
Hoeing	acre	2.50	1.00	2.50	1.00	2.50	1.00	2.50
Specified Preharvest Costs				17.06		17.06		17.06
Snapping	cwt. seed cotton	2.00	12.92	25.84	11.05	22.10	6.09	12.18
Stripping	cwt. seed cotton	.75	8.67	6.50	7.31	5.48	4.08	3.06
Hauling, ginning and wrapping	cwt. seed cotton	1.10	21.59	23.75	18.36	20.20	10.17	11.19
Annual Operating Capital	dol.	.06	26.05	1.56	26.05	1.56	26.05	1.56
3. Total Specified Costs				74.71		66.40		45.05
4. Returns to Land, Labor, Risk and Management				103.89		84.70		37.68
5. Land Rent (¼ sales — ¼ Fertilizer & Ginning Costs)				39.22		33.08		17.68
6. Returns to Labor, Risk and Management				64.67		51.62		20.00
7. Labor	hr.	1.00	3.45	3.45		3.45		3.45
8. Returns to Risk and Management				61.22		48.17		16.55

Table 9: Estimated Per Acre Requirements, Costs and Returns for Wheat Following Cotton, Hourly Labor, Contract Combining And Hauling Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Item	Unit	Price or Cost Per Unit	(9.1) S_b Land Qty.	(9.1) S_b Land Value or Cost	(9.2) S_c Land Qty.	(9.2) S_c Land Value or Cost	(9.3) S_d Land Qty.	(9.3) S_d Land Value or Cost
				(dollars)		(dollars)		(dollars)
1. Production:								
Wheat	bu.	1.62	15.3	24.79	11.9(14)[1]	19.28(22.68)[1]	6.8	11.02
Grazing	AUM	--	0.32	--	.24	--	0.16	--
Total				24.79		19.28		11.02
2. Inputs:								
Seed	bu.	2.05	.75	1.54	.75	1.54	.75	1.54
Fertilizer	cwt.	5.25	1.0	5.25	1.0	5.25	1.0	5.25
Power	hr.	1.27	1.48	1.88	1.48	1.88	1.48	1.88
Other machinery	hr.	.465	1.35	.63	1.35	.63	1.35	.63
Specified Preharvest Costs				9.30		9.30		9.30
Combining	acre	3.00	1.0	3.00	1.0	3.00	1.0	3.00
Hauling	bu.	.07	15.3	1.07	11.9(14)	.83(.98)	6.8	.48
Capital Requirements:								
Total	dol.	--	17.02	--	17.02	--	17.02	--
Annual	dol.	.06	14.87	.89	14.87	.89	14.87	.89
3. Total Specified Costs				14.26		14.02(14.17)		13.67
4. Returns to Land, Labor, Risk and Management				10.53		5.26 (8.51)		-2.65
5. Land rent (⅓ sales — ⅓ fertilizer cost)				6.51		4.68 (5.81)		1.92
6. Return to Labor, risk and management				4.02		.58 (2.70)		-4.57
7. Labor	hr.	1.00	1.62	1.62	1.62	1.62	1.62	1.62
8. Returns to Risk and Management				2.40		-1.04 (1.08)		-6.19

[1] All figures in parenthesis are returns for wheat following wheat.

Table 10: Estimated Per Acre Requirements, Costs and Returns for Grain Sorghum, Hourly Labor, Contract Combining and Hauling, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Item	Unit	Price or Cost Per Unit	(10.1) S_b Land Qty.	(10.1) S_b Land Value or Cost	(10.2) S_c Land Qty.	(10.2) S_c Land Value or Cost	(10.3) S_d Land Qty.	(10.3) S_d Land Value or Cost
				(dollars)		(dollars)		(dollars)
1. Production:								
Grain Sorghum	cwt.	1.60	17.50	28.00	13.00	20.80	10.00	16.00
Rye cover grazing	AUM	--	.50	--	.4	--	.30	--
Total				28.00		20.80		16.00
2. Inputs:								
Seed: grain sorghum	lb.	.15	6.00	.90	6.00	.90	6.00	.90
rye	lb.	.022	56.00	1.23	56.00	1.23	56.00	1.23
Fertilizer	cwt.	4.50	2.00	9.00	2.00	9.00	2.00	9.00
Power	hr.	1.27	1.76	2.24	1.76	2.24	1.76	2.24
Other machinery	hr.	.43	1.60	.69	1.60	.69	1.60	.69
Specified Preharvest Costs				14.06		14.06		14.06
Combining	acre	3.00	1.00	3.00	1.00	3.00	1.00	3.00
Hauling	cwt.	.10	17.50	1.75	13.00	1.30	10.00	1.00
Annual Operating Capital	dol.	.06	19.39	1.16	19.39	1.16	19.39	1.16
3. Total Specified Costs				19.97		19.52		19.22
4. Returns to Land, Labor, Risk and Management				8.03		1.28		-3.22
5. Land rent (⅓ sales — ⅓ fertilizer cost)				6.33		3.93		2.33
6. Return to Labor Risk and Management				1.70		-2.65		-5.55
7. Labor	hr.	1.00	1.73	1.73	1.73	1.73	1.73	1.73
8. Returns to Risk and Management				-.03		-4.38		-7.28

Table 11: Estimated Per Acre Annual Requirements, Cost, and Returns for a Two Year Sweet Clover Enterprise, Contract Combining and Hauling, Sandy Soils of the Rolling Plains of Southwestern Okla.

Item	Unit	Price or Cost Per Unit	(11.1) S_b Land Qty.	(11.1) S_b Land Value or Cost (dollars)	(11.2) S_c Land Qty.	(11.2) S_c Land Value or Cost (dollars)	(11.3) S_d Land Qty.	(11.3) S_d Land Value or Cost (dollars)
1. Production:								
First Year:								
Sweet clover grazing	AUM	--	.6	--	.5	--	.4	--
Second Year:								
Sweet clover seed	cwt.	10.00	1.1	11.00	1.0	10.00	.9	9.00
Sweet clover grazing	AUM	--	1.2	--	1.0	--	.8	--
Total				11.00		10.00		9.00
2. Inputs:								
First Year:								
Sweet clover seed	lbs.	.10	7.5	.75	7.5	.75	7.5	.75
Fertilizer	cwt.	3.90	.5	1.95	.5	1.95	.5	1.95
Power	hour	1.27	.17	.22	.17	.22	.17	.22
Other machinery	hour	.46	.15	.07	.15	.07	.15	.07
Specified Preharvest Cost				2.99		2.99		2.99
Second Year:								
Combining	acre	5.00	.5	2.50	.5	2.50	.5	2.50
Hauling	cwt.	.15	1.1	.16	1.0	.15	.9	.14
Annual Operating Capital	dol.	.06	6.59	.40	6.59	.40	6.59	.40
3. Total Specified Costs				6.05		6.04		6.03
4. Returns to land, labor, risk and management				4.95		3.96		2.97
5. Land rent (⅓ sales less ⅓ fertilizer cost)				3.01		2.68		2.35
6. Return to Labor, risk, & management				1.94		1.28		.62
7. Labor	hour	1.00	.17	.17	.17	.17	.17	.17
8. Return to risk and management				1.77		1.11		.45

Table 12: Estimated Per Acre Annual Requirements, Costs and Returns for Alfalfa Enterprise, Hay Basis, Hourly Labor, Contract Baling and Hauling, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Item	Unit	Price or Cost Per Unit	(12.1) S_b Land Qty.	(12.1) S_b Land Value or Cost	(12.2) S_c Land Qty.	(12.2) S_c Land Value or Cost	(12.3) S_d Land Qty.	(12.3) S_d Land Value or Cost
				(dollars)		(dollars)		(dollars)
1. Production:								
Hay	ton	24.00	2.5	60.00	2.0	48.00	1.5	36.00
Total				60.00		48.00		36.00
2. Inputs:								
Seed	lb.	.50	20/4	2.50	20/4	2.50	20/4	2.50
Fertilizer	cwt.	4.20	1	4.20	1	4.20	1	4.20
Power	hr.	1.27	3.75	4.76	3.75	4.76	3.75	4.76
Other machinery	hr.	.323	3.40	1.10	3.40	1.10	3.40	1.10
Specified Preharvest Costs				12.56		12.56		12.56
Baling	60 lb. bale	.16	83	13.28	67	10.72	50	8.00
Hauling	60 lb. bale	.06	83	4.98	67	4.02	50	3.00
Annual Operating Capital	dol.	.06	27.24	1.63	27.24	1.63	27.24	1.63
3. Total Specified Costs				32.45		28.93		25.19
4. Returns to Land, Labor, Risk and Management				27.55		19.07		10.81
5. Land rent ⅓ gross sales — ⅓ fert. cost				18.60		14.60		10.60
6. Return to Labor, risk and management				8.95		4.47		.21
7. Labor	hr.	1.00	4.08	4.08	4.08	4.08	4.08	4.08
8. Returns to Risk and Management				4.87		.39		-3.87

Continued from Page 10

Table 9, assumes a 15 percent decrease in wheat yields resulting from the wheat following a summer growing crop rather than wheat following wheat.

Three measures of estimated returns are given for each enterprise budget: (1) returns to land, labor, risk and management; (2) returns to labor, risk and management; and (3) returns to risk and management. These residual profit measures show the estimated returns above the estimated costs as indicated in each budget table. The returns to labor, risk and management differ from the returns to land, labor, risk and management in that an estimated land rent has been deducted as the land cost. The land rent could be considered the return to land. The returns to risk and management have had land and labor costs deducted.

The labor costs represent all labor, whether family, operator, or hired, other than contract labor as indicated in each budget. Contract labor such as cotton chopping and pulling, or labor involved in custom hired operations such as applying insecticides, cotton stripping and hauling, grain combining and hauling and hay baling and hauling is included in costs as such, rather than under labor.

Cropping Systems

While land is only one of the scarce resources used in agricultural production, the cropping program is a good place to begin overall organization of a cropland farm. Some important steps to consider in selecting a cropping program are:

1. Evaluate the economics of production practices to be used for each crop.

2. Appraise the expected per acre returns for each crop.

3. Estimate labor requirements for each crop.

4. Consider the timeliness of resource requirements for each crop, especially the distribution of labor and machinery used.

The cropping program should be consistent with the most profitable uses of other resources such as noncropland, labor, capital, and management.

A given cropping system involving certain crops and certain cropland may be used for only a portion of the cropland of the farm. Thus several cropping systems might make up the overall cropping program for a farm.

Cropping systems should not be loosely recommended. Many errors have resulted in traditional crop rotation recommendations. A suggested cropping system should specify cropping sequence for a particular soil type in a specified climatic area. The effects of a cropping system will likely depend on what practices are used with it in making up the system of soil management.

A large number of technically feasible cropping systems are possible on many sandy land farms of southwestern Oklahoma. To be useful to farmers, new agricultural technology usually must pay. With accurate input-output data economic theory can determine the most profitable cropping system for a given set of resources.

Framework of Analysis

The enterprise budgets in Tables 6 through 12 serve as a basis for selecting and comparing alternative cropping systems. Four cropping systems have been selected for economic analysis in this study. Each cropping system specifies crops for a portion of an assumed 200 acre cropland farm. Table 1 shows the distribution of cropland by soil productivity classes for the assumed farm. The farm has a 71 acre cotton allotment and a 29.8 acre wheat allotment.

Table 13 shows the acres of cropland by soil classes by each crop for cropping systems No. 1 and No. 2. The table also lists the cropland by soil classes not committed to the cropping system. Cropping system No. 1 and No. 2 are alternative systems for the same 124.25 acres of soil resources. They both use all of the S_b soil (35.71 acres), 75.91 acres of the S_c soil and 12.63 acres of the S_d soil. System No. 1 has been commonly used by sandy land farmers in the area. With this system it is a common practice for each crop to be continuous on the same land since cotton following grain sorghum usually yields lower than cotton following cotton, and wheat yields following cotton or grain sorghum are lower than wheat following wheat. With this cropping system each crop competes for the most productive soil according to its profitableness per acre. Cotton is considered the most profitable crop for these sandy soils. Cotton is followed by wheat and grain sorghum in order of profit per acre for these principal crops. Under cropping system No. 1 cotton uses all of the S_b soil and 35.29 acres of the S_c soil to make its 71 acres. Wheat is not included in the 124.25 acre cropping system, but uses 29.8 acres of the S_c soil. Grain sorghum uses the remaining 40.62 acres of S_c soil and 12.63 acres of S_d soil to make the 53.25 total acres of grain sorghum in cropping system No. 1.

Table 13: Cropland Use on A 200-Acre Cropland Farm For Alternative Cropping Systems #1 and #2.

System	Crop	Soil Productivity Classes				Total
		S_b Land	S_c Land	S_d Land	S_e Land	Acres
				——— acres ———		
No. 1	Cotton	35.71	35.29	--	--	71
	Grain Sorghum	--	40.62	12.63	--	53.25
	Acres committed to cropping system	35.71	75.91	12.63	--	124.25
	Cropland not committed to cropping system	--	29.8 (wheat)	38.55	7.76	76.11
	Total cropland on farm	35.71	105.71	51.18	7.76	200.36
No. 2	Cotton	20.41	43.38	7.21	--	71
	Sweet Clover	10.20	21.69	3.61	--	35.50
	Grain Sorghum	5.10	10.84	1.81	--	17.75
	Acres committed to cropping system	35.71	75.91	12.63	--	124.25
	Cropland not committed to cropping system	--	29.80 (wheat)	38.55	7.76	76.11
	Total cropland on farm	35.71	105.71	51.18	7.76	200.36

Estimated returns for cropping system No. 1 are calculated in Appendix Table 1. The per acre measures of estimated returns from the enterprise budgets are applied to the crop acres for each soil productivity class to get the value for the total acres of the crop on each soil class. These crop values by soil classes for each crop are summed to give the value for the total acres of each crop in the cropping system. Appendix Table 1 shows $3,284.35 returns to land, labor, risk, and management from the 71 acres of cotton and $11.32 from the 53.25 acres of grain sorghum for a $3,295.67 return to land, labor, risk, and management from the 124.25 acre cropping system.

Cropping system No. 2 differs from system No. 1 in that sweet clover replaces 35.5 acres of the grain sorghum and each crop uses each soil productivity class according to its proportional acreage share (Appendix Table 2). Cotton no longer has priority on the most productive soils, but uses its proportional acreage share of each soil class. This cropping system consists of 71 acres of cotton, 35.5 acres of sweet clover, and 17.75 acres of grain sorghum. This is a seven year cropping system with a cropping sequence of one year of grain sorghum, one year of first year sweet clover, one year of second year clover and four years of cotton.

The success of this cropping system depends largely on the success with which sweet clover is grown. Higher returns for this system results largely from the higher cotton yields following the sweet clover. Some difficulty has been experienced in obtaining a stand of sweet clover in the area, but the practices used in this cropping plan have been highly successful in getting sweet clover stands when other systems have resulted in failures. After combining the grain sorghum the sorghum stubble is left to be used as a base for seeding the sweet clover the following February or early March. A grain drill is used for seeding the clover on the undisturbed grain sorghum stubble ground. The grain sorghum stalks provide protection against wind erosion for the sweet clover seedlings and the undisturbed soil provides a firm seed bed for the small clover seeds. Some sandy land farmers have used this system for getting a stand of sweet clover for many years and report no failures in obtaining stands. This system resulted in successful stands of sweet clover at the Sandy Land Experiment Station each of the years 1953 through 1958.

Table 14 indicates the acres of cropland by soil classes used by each crop for cropping system No. 3 and No. 4. Cropping systems No. 3 and No. 4 are alternative systems of use for the same 159.75 acres of soil resources. Again cropping system No. 3 is the most commonly used system. It differs from system No. 1 only in that more acres of grain sorghum and part of the wheat acres are included to make it a 159.75 acre cropping

Table 14: Cropland Use on A 200-Acre Cropland Farm for Alternative Cropping Systems 3 and 4.

System	Crop	Soil Productivity Classes				Total Acres
		S_b Land	S_c Land	S_d Land	S_e Land	
		——— acres ———				
No. 3	Cotton	35.71	35.29	--	--	71
	Wheat	--	17.75	--	--	17.75
	Grain Sorghum	--	40.62	30.38	--	71
	Acres committed to cropping system	35.71	93.66	30.38	--	159.75
	Cropland not committed to cropping system	--	12.05 (wheat)	20.8	7.76	40.61
	Total cropland on farm	35.71	105.71	51.18	7.76	200.36
No. 4	Cotton	15.87	41.63	13.50	--	71
	Wheat	3.97	10.40	3.38	--	17.75
	Alfalfa	15.87	41.63	13.50	--	71
	Acres committed to cropping system	35.71	93.66	30.38	--	159.75
	Cropland not committed to cropping system	--	12.05 (wheat)	20.8	7.76	40.61
	Total cropland on farm	35.71	105.71	51.18	7.76	200.36

system. In this system crops are grown continuously on the same land and they compete for the productive soils according to their profitableness. The 159.75 acres in this system consists of 71 acres of cotton, 71 acres of grain sorghum and 17.75 acres of wheat. The cotton uses the 35.71 acres of S_b soil plus 35.29 acres of S_c soil. All the wheat is grown on S_c soil, but only 17.75 acres are included in the system being considered. Grain sorghum uses the remaining 40.62 acres of S_c soil plus 30.38 acres of S_d soil to make its 71 acres. Estimated returns are given in Appendix Table 3.

Cropping system No. 4 differs from system No. 3 in that the 71 acres of alfalfa is grown instead of the 71 acres of grain sorghum and the crops are grown in sequence. Each crop uses its proportional acreage of soil productivity classes. The cropping sequence consists of one year of wheat, four years of alfalfa, and four years of cotton. The wheat is seeded in cotton stalks following the cotton which results in the lower wheat yield. The wheat provides ground that can be prepared for fall seeding of the alfalfa. Stubble mulching is used in preparing the seed bed for alfalfa in order to protect the alfalfa seedlings from wind erosion on the sandy soils.

The most critical aspect of this cropping system might be in obtaining a stand of alfalfa. Alfalfa needs a firm seed bed, so stubble mulched ground will need firming with a cultipacker, gang rotary hoe, or some other implement. Some sandy land farmers have been very successful in obtaining stands of alfalfa by using grain sorghum rather than wheat for the crop preceding alfalfa. Early planted quick maturing grain sorghum leaves a firm seed bed for the alfalfa and the sorghum stalks protect the young alfalfa plants from wind erosion. Estimated returns for cropping system No. 4 are listed in Appendix Table 4.

Interpretation of Returns

The estimates of returns from the different cropping systems presented in Appendix Tables 1 through 4 are based on returns from the enterprise budget (Tables 6-12) applied to the assumed cropping system of a sandy land farm. The purpose here is to compare estimated returns from alternative cropping systems.

The first comparison is between two alternative cropping systems (No. 1 and No. 2) involving 124.25 acres of the 200 acres of cropland on the assumed farm. The returns calculated in Appendix Tables 1 and 2 are shown in Table 15 for the purpose of better comparisons. Table 15 shows $3,295.67 returns to land, labor, risk, and management for the

Table 15: Estimated Returns From Two Alternative Cropping Systems For 124.25 Acres of Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Return Item	Cropping System No. 1 Cotton and Grain Sorghum	Cropping System No. 2 Cotton, Sweet Clover, and Grain Sorghum	Gain From Sweet Clover System
		——(dollars)——	
Returns to Land, Labor, Risk and Management	3295.67	4312.28	1016.61
Land Rent	1658.10	1916.40	258.30
Returns to Labor, Risk and Management	1637.57	2395.88	758.31
Labor	337.07	281.67	-55.40
Return to Risk and Management	1300.50	2114.21	813.71

[1] See Appendix Table 1.
[2] See Appendix Table 2.

cotton and grain sorghum cropping system and $4,312.28 returns to the same factors for the cotton-sweet clover and grain sorghum system. The $1,016.61 higher returns to land, labor, risk, and management for the No. 2 system would be significant for the 124.25 acres involved. For a renter-operator arrangement the added returns from the No. 2 system over the No. 1 system would amount to a $258.30 higher return to land for the land owner, and a $758.31 higher return to labor, risk, and management for the operator.

A comparison of individual crop returns from the two systems (Appendix Tables 1 and 2) shows that a large portion of the added returns from the sweet clover system comes from the higher returns for the 71 acres of cotton due to the increase in cotton yields for the cotton following the sweet clover. The higher returns for the smaller acreage of grain sorghum in system No. 2 is due to the distribution of the crop over the soil productivity classes rather than being confined to S_c and S_d soils.

The second comparison of returns is for two alternative cropping systems (No. 3 and No. 4) involving 159.75 acres of the 200 acres of cropland on the assumed farm. The comparison shows an increase of $3,758.48 in returns to land, labor, risk, and management for the 159.75 acres in favor of the No. 4 system over the No. 3 system. For a renter-operator arrangement the added returns resulting from the No. 4 cropping system would give the owner $1,562.71 higher returns to land and

Table 16: Estimated Returns From Two Alternative Cropping Systems For 159.75 Acres of Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Return Item	Cropping System No. 3 Cotton, Wheat and Grain Sorghum[1]	Cropping System No. 4 Cotton, Wheat and Alfalfa	Gain From Alfalfa System
		——(dollars)——	
Return to Land, Labor, Risk and Management	3389.57	7148.05	3758.48
Land Rent	1802.59	3365.30	1562.71
Return to Labor, Risk, and Management	1586.98	3782.75	2195.77
Labor	396.54	563.39	166.85
Return to Risk and Management	1190.44	3219.36	2028.92

[1] See Appendix Table 3.
[2] See Appendix Table 4.

would give the operator $2,195.77 higher returns to labor, risk, and management.

A comparison of individual crop returns from the two cropping systems (Appendix Tables 3 and 4) shows $2,399.12 higher returns to land, labor, risk, and management for the 71 acres of cotton when it followed four years of alfalfa. The 71 acres of alfalfa gave a $1,422.87 higher return to these same resources than the 71 acres of grain sorghum in system No. 3. The 17.75 acres of wheat in system No. 4 gave $63.51 less returns to land, labor, risk, and management because of lower yields due to its following cotton.

These results should raise the question as to why farmers are not growing alfalfa on these sandy soils instead of grain sorghum. The deep plowing of these sandy soils has made it easier to establish a stand of alfalfa which makes alfalfa a far more feasible crop for these soils. The deep plowing is a relatively new practice and the research data on alfalfa production on these soils as well as the data on yields of cotton following alfalfa is of relatively recent date.

Summary

This publication reports results of a study to evaluate the economics of some cropping practices and cropping systems for sandy soils of southwestern Oklahoma.

Deep plowing of sandy soils resulted in an economical increase in cotton yields and a more favorable soil for cropping and wind erosion control. The added cotton yields resulting from deep plowing gave a per acre net return of $76.44 for the combined four cotton crops after deep plowing the sandy soil at the Sandy Land Research Station.

Commercial fertilizers on deep plowed sandy soil resulted in a 41 percent increase in cotton yields and an added net return of $13.47 per acre at the Sandy Land Research Station.

The growing of a winter cover crop of rye in a continuous cotton program gave added return to land, risk, and management of $11.46 per acre.

A 7-year cropping system of cotton, grain sorghum and sweet clover gave an estimated $1,016.61 annual higher return to land, labor, risk, and management for 124.25 acres of sandy crop land than a cotton-grain sorghum cropping system on the same 124.25 acres. Of this increase $831.83 comes from the higher cotton yields for the cotton following sweet clover in the cropping system.

A 9-year cropping system of cotton-wheat and alfalfa gave an estimated $3,758.48 higher annual return to land, labor, risk, and management for 159.75 acres of sandy crop land compared to a cropping system of cotton-wheat and grain sorghum on the same acres. The higher return was the result of higher cotton yields for the cotton following alfalfa and a higher per acre return for alfalfa over grain sorghum.

These results presented were based on research data available at the time of evaluation. Evaluation of data from current and future research will, no doubt, show more profitable combination of practices and cropping systems for sandy soils of southwestern Oklahoma.

References

(1) Strickland, Percy L., Jr., *Minimum Resource Requirements and Resource Adjustments for Specified Farm Income Levels, Low Rolling Plains of Southwestern Oklahoma,* thesis, Oklahoma State University, 1962.

(2) United States Department of Agriculture, Bureau of Chemistry and Soils, in cooperation with the Oklahoma Agricultural Experiment Station, *Soil Survey of Kiowa County, Oklahoma,* 1931.

(3) Lagrone, William F., Percy L. Strickland, Jr., and James S. Plaxico, *Resource Requirements, Costs, and Expected Returns; Alternative Crop and Livestock Enterprises; Sandy Soils of the Rolling Plains of Southwestern Oklahoma,* Processed Series P-369, Oklahoma Agricultural Experiment Station, November, 1959.

(4) Cunningham, Thomas S., *Sandy Land Research Station, Annual Report,* 1958.

(5) Harper, Horace J., and O. H. Brensing, *Deep Plowing to Improve Sandy Land,* Bulletin B-362, Oklahoma Agricultural Experiment Station, December, 1950.

(6) Cunningham, Thomas S., *Deep Plowing,* Digest of Proceedings of the Industry-Research Conference, Oklahoma State University, Land Grant Colleges, United States Department of Agriculture and Farm Equipment Institute.

(7) Tucker, B. B., Griffin, R. H., II, Webb, B. B., Reed, R. M., *Sorghum Fertilization Research Progress Report,* 1961, Processed Series P-421, Oklahoma Agricultural Experiment Station, June, 1962.

(8) Reed, R. M., Gingrich, J. R., and Tucker, B. B., *Cotton Management and Fertility Research Progress Report, 1961,* Processed Series, P-240, Oklahoma Agricultural Experiment Station, June, 1962.

APPENDIX TABLE 1: Estimated Returns for A 124.25 Acre Cropping System of Cotton and Grain Sorghum, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Return Item		S_b Land Acres	S_b Land Value Per Acre	S_b Land Value	S_c Land Acres	S_c Land Value Per Acre	S_c Land Value	S_d Land Acres	S_d Land Value Per Acre	S_d Land Value	Total Value
			(dollars)			(dollars)			(dollars)		
Returns to Land, Labor, Risk and Management											
Cotton	71	35.71[3]	51.87[1]	1852.28	35.29[3]	40.58[1]	1432.07				3284.35
Grain Sorghum	53.25				40.62	1.28[2]	51.99	12.63[3]	-3.22[2]	-40.67	11.32
Total	124.25	35.71		1852.28	75.91		1484.06	12.63		-40.67	3295.67
Land Rent											
Cotton		35.71	22.47	802.40	35.29	18.89	666.63				1469.03
Grain Sorghum					40.62	3.93	159.64	12.63	2.33	29.43	189.07
Total		35.71		802.40	75.91		826.27	12.63		29.43	1658.10
Returns to Labor, Risk and Management											
Cotton		35.71	29.40	1049.88	35.29	21.69	765.44				1815.32
Grain Sorghum					40.62	-2.65	-107.65	12.63	-5.55	-70.10	-177.75
Total		35.71		1049.88	75.91		657.79	12.63		-70.10	1637.57
Labor											
Cotton		35.71	3.45	123.20	35.29	3.45	121.75				244.95
Grain Sorghum					40.62	1.73	70.27	12.63	1.73	21.85	92.12
Total		35.71		123.20	75.91		192.02	12.63		21.85	337.07
Return to Risk and Management											
Cotton		35.71	25.95	926.68	35.29	18.24	643.69				1570.37
Grain Sorghum					40.62	-4.38	-177.92	12.63	-7.28	-91.95	-269.87
Total		35.71		926.68	75.91		465.77	12.63		-91.95	1300.50

[1] See Table 6.
[2] See Table 10.
[3] See Table 13.

APPENDIX TABLE 2: Estimated Returns for a 124.25 Acre Cropping System of Grain Sorghum, Sweet Clover and Cotton, Sandy Soil of the Rolling Plains of Southwestern Oklahoma.

Return Item		S_b Land			S_c Land			S_d Land			
		Acres	Value Per Acre	Value	Acres	Value Per Acre	Value	Acres	Value Per Acre	Value	Total Value
			(dollars)			(dollars)			(dollars)		
Returns to Land, Labor, Risk and Management											
Cotton	71	20.41[4]	71.84[1]	1466.25	43.38[4]	57.41[1]	2490.55	7.21[4]	22.12[1]	159.49	4116.18
Sweet Clover	35.50	10.20	4.95[2]	50.49	21.69	3.96[2]	85.89	3.61	2.97[2]	10.72	147.10
Grain Sorghum	17.75	5.10	8.03[3]	40.95	10.84	1.28[3]	13.88	1.81	-3.22[3]	-5.83	49.00
Total	124.25	35.71		1557.69	75.91		2590.21	12.64		164.38	4312.28
Land Rent											
Cotton		20.41	28.99	591.69	43.38	24.34	1055.87	7.21	12.82	92.43	1739.99
Sweet Clover		10.20	3.01	30.70	21.69	2.68	58.13	3.61	2.35	8.48	97.31
Grain Sorghum		5.10	6.33	32.28	10.84	3.93	42.60	1.81	2.33	4.22	79.10
Total		35.71		654.67	75.91		1156.60	12.63		105.13	1916.40
Return to Labor, Risk and Management											
Cotton		20.41	42.85	874.56	43.38	33.07	1434.57	7.21	9.30	67.06	2376.19
Sweet Clover		10.20	1.94	19.79	21.69	1.28	27.76	3.61	.62	2.24	49.79
Grain Sorghum		5.10	1.70	8.67	10.84	-2.65	-28.72	1.81	-5.55	-10.05	-30.10
Total		35.71		903.02	75.91		1433.61	12.64		59.25	2395.88
Labor											
Cotton		20.41	3.45	70.41	43.38	3.45	149.66	7.21	3.45	24.87	244.94
Sweet Clover		10.20	.17	1.73	21.69	.17	3.69	3.61	.17	.61	6.03
Grain Sorghum		5.10	1.73	8.82	10.84	1.73	18.75	1.81	1.73	3.13	30.70
Total		35.71		80.96	75.91		172.10	12.63		28.61	281.67
Return to Risk and Management											
Cotton		20.41	39.40	804.15		29.62	1284.91	7.21	5.85	42.19	2131.25
Sweet Clover		10.20	1.77	18.06		1.11	24.07	3.61	.45	1.63	43.76
Grain Sorghum		5.10	-.03	-.15		-4.38	-47.47	1.81	-7.28	-13.18	-60.80
Total		35.71		822.06			1261.51	12.63		30.64	2114.21

[1] See Table 7.
[2] See Table 11.
[3] See Table 10.
[4] See Table 13.

APPENDIX TABLE 3: Estimated Returns for a 159.75 Acre Cropping System Including Cotton, Wheat, and Grain Sorghums, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Return Item		S_b Land			S_c Land			S_d Land			Total
		Acres	Value Per Acre	Value	Acres	Value Per Acre	Value	Acres	Value Per Acre	Value	Total Value
			(dollars)			(dollars)			(dollars)		
Returns to Land, Labor, Risk and Management											
Cotton	71	35.71[4]	51.87[1]	1852.28	35.29[4]	40.58[1]	1432.07				3284.35
Wheat	17.75				17.75	8.51[2]	151.05				151.05
Grain Sorghum	71				40.62	1.28[3]	51.99	30.38[4]	-3.22[3]	-97.82	-45.83
Total	159.75	35.71		1852.28	93.66		1635.11	30.38		-97.82	3389.57
Land Rent											
Cotton		35.71	22.47	802.40	35.29	18.89	666.63				1469.03
Wheat					17.75	5.81	103.13				103.13
Grain Sorghum					40.62	3.93	159.64	30.38	2.33	70.79	230.43
Total		35.71		802.40	93.66		929.40	30.38		70.79	1802.59
Return to Labor, Risk and Management											
Cotton		35.71	29.40	1049.88	35.29	21.69	765.44				1815.32
Wheat					17.75	2.70	47.92				47.92
Grain Sorghum					40.62	-2.65	-107.65	30.38	-5.55	-168.61	-276.26
Total		35.71		1049.88	93.66		705.71	30.38		-168.61	1586.98
Labor											
Cotton		35.71	3.45	123.20	35.29	3.45	121.75				244.95
Wheat					17.75	1.62	28.76				28.76
Grain Sorghum					40.62	1.73	70.27	30.38	1.73	52.56	122.83
Total		35.71		123.20	93.66		220.78	30.38		52.56	396.54
Return to Risk and Management											
Cotton		35.71	25.95	926.68	35.29	18.24	643.69				1570.37
Wheat					17.75	1.08	19.16				19.16
Grain Sorghum					40.62	-4.28	-177.92	30.38	-7.28	-221.17	-399.09
Total		35.71		926.68	93.66		484.93	30.38		-221.17	1190.44

[1] See Table 6.
[2] See Table 9.
[3] See Table 10.
[4] See Table 14.

APPENDIX TABLE 4: Estimated Returns for a 159.75 Acre Cropping System Including Cotton, Wheat and Alfalfa in Rotation, Sandy Soils of the Rolling Plains of Southwestern Oklahoma.

Return Item		S_b Land Acres	S_b Land Value Per Acre	S_b Land Value	S_c Land Acres	S_c Land Value Per Acre	S_c Land Value	S_d Land Acres	S_d Land Value Per Acre	S_d Land Value	Total Value
			(dollars)			(dollars)			(dollars)		
Return to Land, Labor, Risk and Management											
Cotton	71	15.87[4]	103.89[1]	1648.73	41.63[4]	84.70[1]	3526.06	13.50[4]	37.68[1]	508.68	5683.47
Wheat	17.75	3.97	10.53[2]	41.80	10.40	5.26[2]	54.70	3.38	-2.65[2]	-8.96	87.54
Alfalfa	71	15.87	27.55[3]	437.22	41.63	19.07[3]	793.88	13.50	10.81[3]	145.94	1377.04
Total	159.75	35.71		2127.75	93.66		4374.64	30.38		645.66	7148.05
Land Rent											
Cotton		15.87	39.22	622.42	41.63	33.08	1377.12	13.50	17.68	238.68	2238.22
Wheat		3.97	6.51	25.84	10.40	4.68	48.67	3.38	1.92	6.49	81.00
Alfalfa		15.87	18.60	295.18	41.63	14.60	607.80	13.50	10.60	143.10	1046.08
Total		35.71		943.44	93.66		2033.59	30.38		388.27	3365.30
Return to Labor, Risk and Management											
Cotton		15.87	64.67	1026.31	41.63	51.62	2148.94	13.50	20.00	270.00	3445.25
Wheat		3.97	4.02	15.96	10.40	.58	6.03	3.38	-4.57	-15.45	6.54
Alfalfa		15.87	8.95	142.04	41.63	4.47	186.08	13.50	.21	2.84	330.96
Total		35.71		1184.31	93.66		2341.05	30.38		257.39	3782.75
Labor											
Cotton		15.87	3.45	54.75	41.63	3.45	143.62	13.50	3.45	46.58	244.95
Wheat		3.97	1.62	6.43	10.40	1.62	16.85	3.38	1.62	5.48	28.76
Alfalfa		15.87	4.08	64.75	41.63	4.08	169.85	13.50	4.08	55.08	289.68
Total		35.71		125.93	93.66		330.32	30.38		107.14	563.39
Return to Risk and Management											
Cotton		15.87	61.22	971.56	41.63	48.17	2005.32	13.50	16.55	223.42	3200.30
Wheat		3.97	2.40	9.53	10.40	-1.04	-10.82	3.38	-6.19	-20.93	22.22
Alfalfa		15.87	4.87	77.29	41.63	.39	16.23	13.50	-3.87	-52.24	41.28
Total		35.71		1058.38	93.66		2010.73	30.38		150.25	3219.36

[1] See Table 8.
[2] See Table 9.
[3] See Table 12.
[4] See Table 14.

Oklahoma's Wealth in Agriculture

Agriculture is Oklahoma's number one industry. It has more capital invested and employs more people than any other industry in the state. Farms and ranches alone represent a capital investment of four billion dollars—three billion in land and buildings, one-half billion in machinery and one-half billion in livestock.

Farm income currently amounts to more than $700,000,000 annually. The value added by manufacture of farm products adds another $130,000,000 annually.

Some 175,000 Oklahomans manage and operate its nearly 100,000 farms and ranches. Another 14,000 workers are required to keep farmers supplied with production items. Approximately 300,000 full-time employees are engaged by the firms that market and process Oklahoma farm products.

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