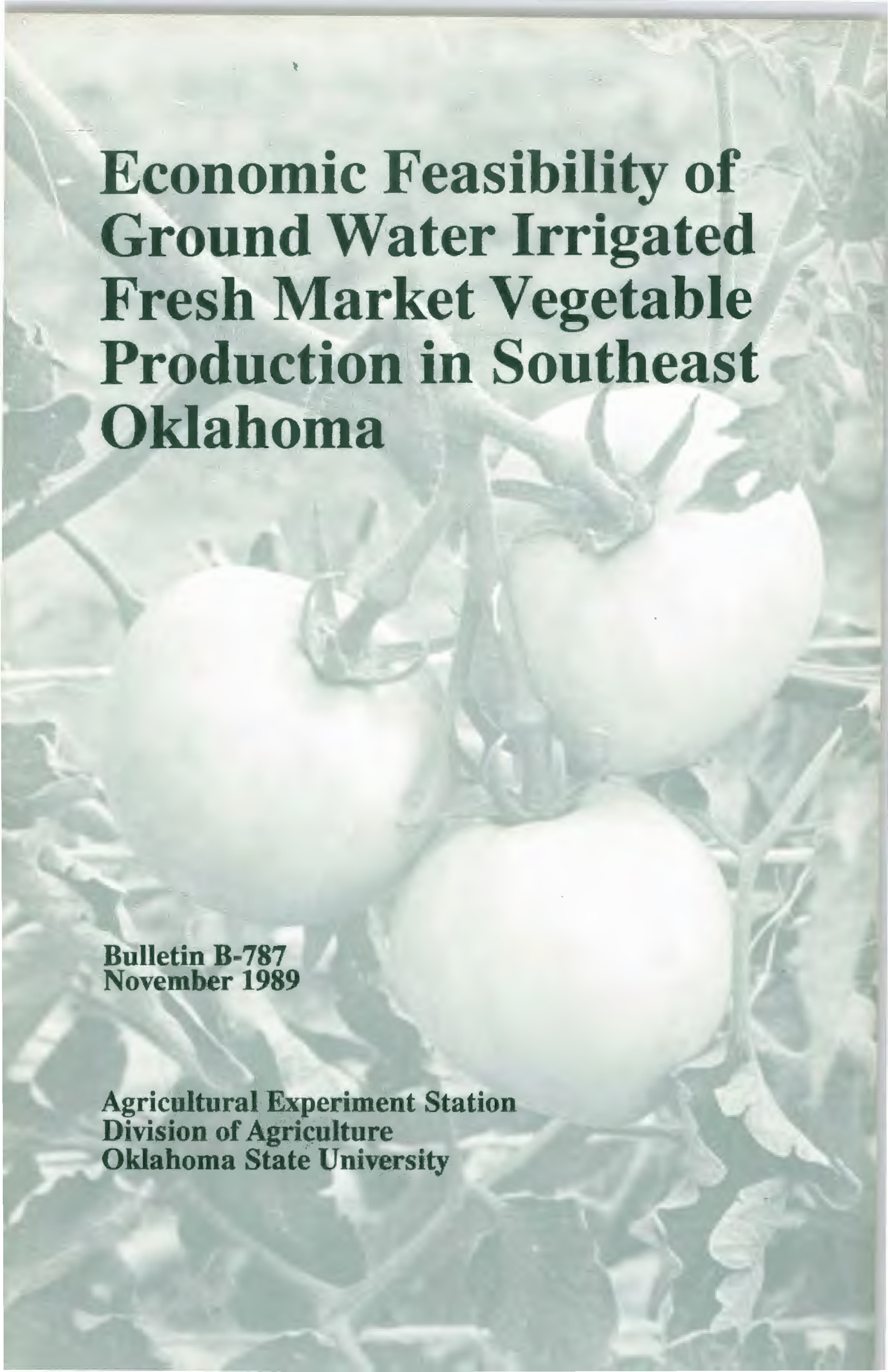
Economic Feasibility of Ground Water Irrigated Fresh Market Vegetable Production in Southeast Oklahoma



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ECONOMIC FEASIBILITY OF GROUND WATER IRRIGATED FRESH MARKET VEGETABLE PRODUCTION IN SOUTHEAST OKLAHOMA

by

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INTRODUCTION

The economy of southeastern Oklahoma relies heavily on agriculture [24]. Most farmers in the area operate relatively small acreages and use low levels of management and technology [27]. In 1982, more than one-third of the farms in the region had less than 100 acres [26]. Nearly 55 percent of the farms had sales less than $5,000, while just 14 percent of the farms had sales greater than $20,000 [26].

In southeastern Oklahoma a transition to a pasture and hay farming pattern from a substantial reliance on row crops began immediately following World War II and accelerated during the 1960's and 1970's [24]. The result was increased unemployment and substantial declines in rural communities.

Part-time farming now predominates among agricultural operations in the region. Approximately 60 percent of farm operators in southeastern Oklahoma have an occupation other than farming. Over one-half of the farm operators spend more than 200 days of the year working off of the farm. The typical operator is between 50 and 53 years of age [26].

The region does have substantial, undeveloped natural resources. Among these are abundant water, fertile bottomland, and a long growing season, favorable for the production of crops. One way that southeastern Oklahoma residents could increase their standard of living is by more fully using these resources to improve the productivity of local agriculture [27]. Opportunities exist for the production of traditional crops and high value vegetable crops on the numerous bottomlands in the region [20].

The introduction or expansion of vegetable enterprises in southeastern Oklahoma depends on irrigation [27]. While the area has relatively high rainfall, timely application of water is necessary to supplement rainfall during part of the growing season [21].

Ground water, water that has percolated downward from the surface to subsurface storage basins (aquifers), is available for irrigation in many locations in southeastern Oklahoma. Major ground water basins, or aquifers, in southeastern Oklahoma are the Antlers Sandstone along the southern border of the area, the Arbuckle Group and the Simpson Group in the western counties of the area, and the Alluvium and Terrace Deposits of the Canadian River in the northern counties of the area. The Antlers Sandstone is a large deposit with average yields of 100-150 gallons per minute. The quality of the water is suitable for irrigation and other uses. The Arbuckle Group has been known to produce large yields (200-500 gallons per minute) of good quality water. Wells in the Simpson Group can yield 100-200 gallons per minute, and the water is good quality at most of its locations [18].

Currently, a lack of information on the economics of irrigation of vegetable crops in southeastern Oklahoma is a major barrier to development of water resources. Emphasis in this study is on evaluating the economics of various ground water irrigation systems in fresh market vegetable production on a representative farm in southeastern Oklahoma.

The study region for this research includes fifteen counties in southeastern Oklahoma (Figure 1). Roughly, the boundaries of the region are Interstate 40, U.S. Highway 177, and the eastern and southern borders of Oklahoma. The study region is not homogeneous. Each county in the region contains different resources, problems, and opportunities. But some potential for irrigated vegetable crop production exists in each county, and in some counties the potential is great [27].

OBJECTIVES OF THE STUDY

The overall objective of this study is to develop a decision framework for farmers to use to determine whether to include irrigated fresh market vegetable crop systems in their farm enterprise mix. More specific objectives are:

1. Estimate the relative costs and returns of irrigated fresh market vegetable crop systems.
2. Estimate the cash flows that result from the introduction of irrigated fresh market vegetable crop systems into farm enterprise mixes.
3. Evaluate the relative economic feasibilities of incorporation of irrigated fresh market vegetable crop systems into a southeastern Oklahoma farm operation.

ANALYTICAL PROCEDURES AND DATA

A representative farm was developed for the study region. The initial crop mix was specified for the representative farm. The associated costs, net returns, and cash flows of the farm were then developed. The representative farm's economic and financial situation were then analyzed for thirty-six irrigated fresh market vegetable systems. These thirty-six systems were developed considering four vegetable acreages (1.0, 2.5, 5.0, and 10.0 acres), three irrigation technologies (furrow, sprinkler, and drip), and three vegetable crop activities.

A computerized financial analysis package, Integrated Farm Financial Statements (IFFS) [9], was used to analyze the possible activities. Personal and family cash inflows and outflows that do not directly relate to farm cash flow were not considered.

OKLAHOMA

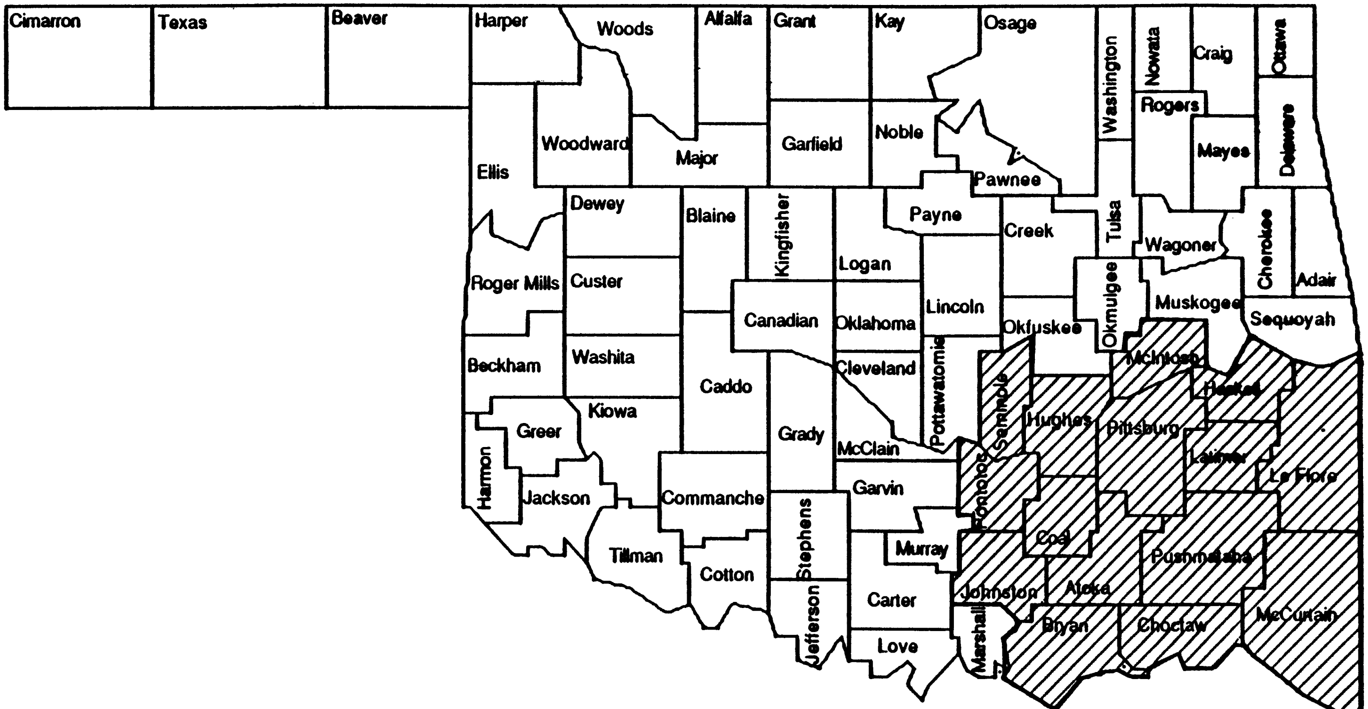


Figure 1. Study Area

Enterprise budgets were developed based on the initial enterprise mix of the representative farm and vegetable crop activities considered in this study. Cash flow information from the budgets was summarized by month with the IFFS financial analysis package.

Budgets selected for vegetable crop activities require irrigation cost information. Irrigation systems were designed, and costs of the components of the systems were determined from irrigation supplier's catalogs [1]; [6]; [15]; [23]. These costs were then included in the vegetable crop budgets used in this study.

Representative Farm

The soil and topography situations of the representative farm were determined from Oklahoma soil surveys of the counties in the study region [25]. The initial enterprise mix of the farm (Table 1) was determined from southeastern Oklahoma information published by the United States Census Bureau [26] and the Oklahoma Department of Agriculture [17], as well as from interviews with Cooperative Extension personnel [7]; [10].

Further information developed for the farm included soil and topography information. Soil survey publications [25] and information from personnel with the United States Department of Agriculture, Soil Conservation Service [11] were used to determine the amount of bottomland and unusable land. The amount of bottomland was determined to be adequate for vegetable crop production in the study region.

TABLE I
DESCRIPTION OF REPRESENTATIVE FARM

Harvested Cropland (acres)		43
Wheat	20	
Soybeans	5	
Alfalfa	5	
Bermuda	13	
Improved Pasture, Bermuda (acres)		20
Native Range, Unimproved (acres)		72
Pastured Woodland (acres)		15
Woodland (acres)		5
Farmstead (acres)		5
Farm size (acres)		160
Beef cows		25

Enterprise Budgets

Nonvegetable enterprise budgets were selected from the OSU Enterprise Budget Book [5] for the representative farm. These budgets contain detailed input and output information for producing crops and livestock. Input information includes units, quantities, and costs. Costs are divided into operating costs and fixed costs. Operating costs include items such as fertilizer, lime and chemicals, rental of machinery, labor, annual operating capital, seeds, plants, other supplies, and variable machinery costs (repairs, fuel, and lube). Fixed costs include items such as interest, depreciation, taxes and insurance on machinery, and taxes on land. Output information contained in the budgets includes items such as production units, quantities, and prices. The budgets contain detailed information on production practices, including dates and levels of required field work, chemicals, supplies, irrigation water, labor, and machinery. The budgets were adapted to climatic and agronomic conditions of southeastern Oklahoma. The appendix contains all budgets used in this study.

The budgets were modified so that the machinery and equipment would represent that for the representative farm considered in this study. It was assumed that machinery and land are owned. The machinery was assumed to be between eight and fifteen years of age. Machinery values were determined from the National Farm and Tractor Implement Blue Book [14], depreciation schedules, and information from local implement dealership personnel [2]. In crop and hay budgets, custom baling and custom harvesting were assumed. Custom work charges were determined from "Oklahoma Farm and Ranch Custom Rates, 1986-87" [16].

Production data comprise a large portion of the data requirements in the vegetable budgets. Production data, including fertilizer, pesticide, seed, and harvesting costs used in this study, are based on crop enterprise budgets developed by Schatzer, Wickwire, Tilley, and Motes [20] (see Appendix).

Many vegetable crop varieties are well adapted to the climatic and agronomic conditions of southeastern Oklahoma. Vegetable activities were selected to be incorporated into the existing farm plan based on projected profits, level of irrigation water usage, level of management required, and marketability. Previous research in these areas was considered [4]; [21]; [22] as well as information from Oklahoma State University Extension Horticulture personnel [12]. Table 2 contains a list of the vegetable crop activities considered in this study.

Management practices contained in the vegetable budgets were reviewed by horticulture specialists [12]. This information included dates for field work and times and amounts of applications of chemicals and irrigation water.

TABLE 2
VEGETABLE CROP ACTIVITIES CONSIDERED

1. Spring broccoli (transplanted) followed by fall spinach

2. Okra, alone

3. Tomatoes followed by fall broccoli (seeded)

The additional machinery used in the vegetable budgets was based on the minimal needs of a farmer on a representative farm adding vegetable enterprises. The farmer may need to purchase machinery such as a cultibedder tiller, a planter, a transplanter, a flatbed trailer, a rototiller, and an additional sprayer. The additional machinery needed will vary, depending on the vegetable crop activities added to the farm plan. Current prices for insecticides, fungicides, nematicides, bactericides, and herbicides were included in the budgets [3]. These prices were based on current prices obtained from chemical suppliers.

For calculating the water needs of vegetable enterprises, irrigation periods were specified on a quarter-month basis. Irrigation water requirements were based on total needs of vegetable crops and expected rainfall by irrigation period. Precipitation amounts were collected by irrigation period from Atoka county reporting station information [13]. This information was collected for a ten-year period and averaged for each irrigation period. Vegetable evapo- transpiration (ET) water requirements were used as the minimum total requirements of water for the vegetable crops considered. Total ET needs of vegetables considered were obtained from horticulture research information [12]. Rainfall per irrigation period was subtracted from the vegetables' total ETs, to estimate the amounts to be added by irrigation. Resulting amounts are shown in Table 3, according to the irrigation period when the amounts are likely to be needed. Actual times and amounts of irrigation water applied will vary from year to year with precipitation.

Post-harvesting expenses such as cooling, packaging, washing, and transportation increase production costs for producers. Transportation costs vary greatly depending on freight supply and demand. Assumed harvesting and marketing costs are shown in the budgets (Appendix). Variability can also occur in prices received for produce. Assumed prices are also shown in the budgets.

TABLE 3

APPROXIMATE SUPPLEMENTAL WATER REQUIREMENTS BY VEGETABLE CROP

Month	Irrig. Period	Fall Broccoli Seeded	Fall Spinach	Okra	Spring Broccoli Transplanted	Tomatoes
March	1					
	2				0.50	
	3				0.50	
	4					
Monthly Total					**1.00**	
April	1					1.00
	2				1.00	0.50
	3				0.50	0.50
	4				0.50	
Monthly Total					**2.00**	**2.00**
May	1			0.50	1.00	1.00
	2					
	3					
	4					
Monthly Total				**0.50**	**1.00**	**1.00**
June	1			0.50		1.00
	2			1.00		1.00
	3			0.50		1.00
	4			0.25		1.25
Monthly Total				**2.25**		**4.25**
July	1			1.00		2.00
	2			1.00		2.00
	3			2.00		2.00
	4			1.00		1.00
Monthly Total				**5.00**		**7.00**
August	1	1.00		0.50		
	2	1.00		0.50		
	3	1.50		1.50		
	4	1.00		1.00		
Monthly Total		**4.50**		**3.50**		
September	1	1.00		0.50		
	2	1.00	1.00	0.50		
	3	1.00		1.00		
	4	1.00	1.00	1.00		
Monthly Total		**4.00**	**2.00**	**3.00**		
October	1	1.00	1.00			
	2	1.00	0.50			
	3	0.50				
	4					
Monthly Total		**2.50**	**1.50**			
November	1					
	2					
	3					
	4					
Monthly Total						
Annual Total		**11**	**3.5**	**14.25**	**4**	**14.25**

Irrigation Costs

Three types of irrigation systems were considered: a furrow system, a sprinkler (hand-move) system, and a drip (biwall pipe) system. Large variation exists in the investment costs of these systems, as well as in their efficiencies of application of irrigation water. Furrow systems generally have the lowest investment costs, followed by sprinkler systems, with drip systems requiring the highest investments. However, drip systems are the most efficient in applying irrigation water, followed by sprinkler systems, and then furrow systems.

Irrigation System Descriptions

With a furrow irrigation system, water is applied through furrows between the rows of plants. Water runs down the furrows and filters into the soil to refill the soil moisture reservoir. This system generally requires a smaller initial investment than other types of systems. Furrow irrigation may have a problem of unsteady, nonuniform flow. A flat terrain and fields of regular shapes are preferred for this type of system. This system is not suitable for sandy soils.

With a sprinkler irrigation system, water is delivered through a main line from the source of water supply to lateral lines. Water is discharged above the crop or soil surface through sprinkler heads on riser pipes attached to the laterals. Each sprinkler head applies water to a circular area with the diameter controlled by nozzle size and pressure [19]. A sprinkler system requires a moderately high initial investment. Erosion can be controlled, and efficient irrigation is possible on sloping soils with this system. More even application of water is possible than with furrow systems. Less interference with other field operations is possible, as is a higher water application efficiency.

With a drip irrigation system, water is applied frequently at a slow rate near the plants. Water is used most efficiently with this system, due to limited evaporation, reduced water runoff, increased ability of the soil to store water from rainfall, and deposition of water near the roots of the plants. This system is sensitive to stoppages and clogging, so filtration is necessary. A relatively high initial investment is required for a drip irrigation system.

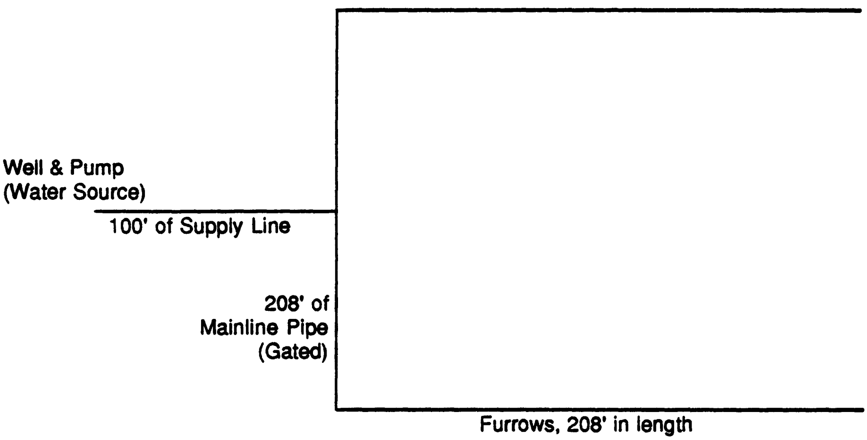
Irrigation System Designs

Potential irrigation system layouts were designed for each of the system types, for each of the acreages of vegetable crop production considered in this study (1.0, 2.5, 5.0, and 10.0 acres). Designs for these systems are contained in Figures 2, 3, and 4.

System costs were calculated by estimating and aggregating costs of individual components. Prices of each component for each

Figure 2. Designs of Furrow Irrigation Systems

1.0 acre (208' x 208')



2.5 acres (330' x 330') 5.0 acres (467' x 467') 10.0 acres (660' x 660')

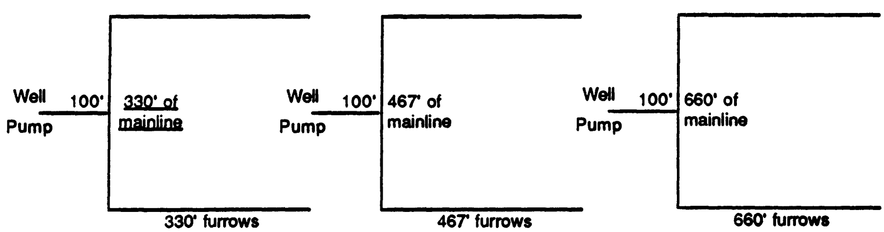


Figure 3. Designs of Sprinkler Irrigation Systems

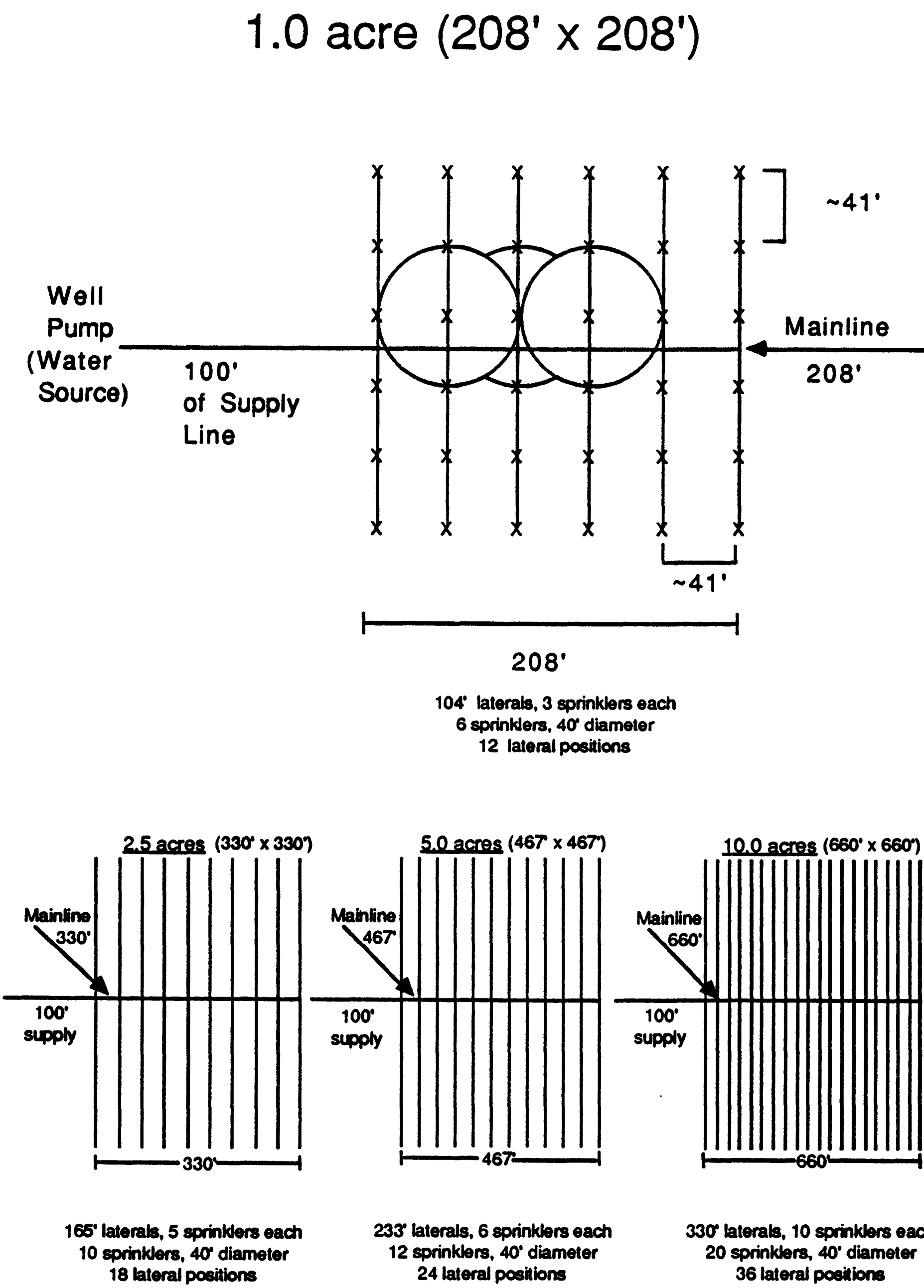
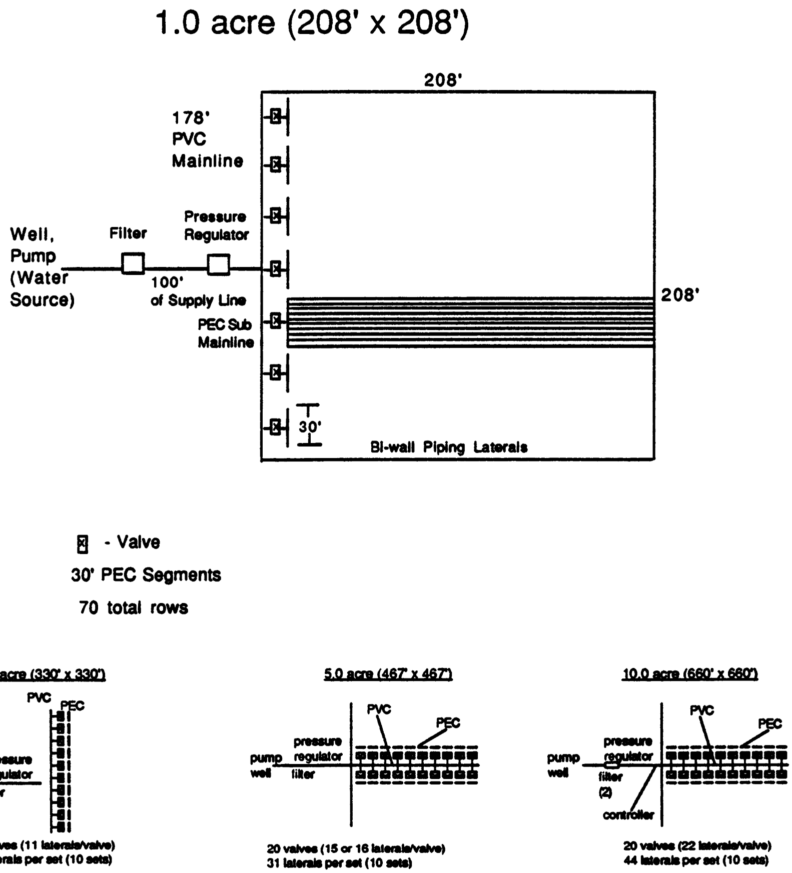


Figure 4. Designs of Drip Irrigation Systems



system for each acreage were determined from current catalogs of irrigation system equipment suppliers [1]; [6]; [15]; [23]. These component costs were aggregated to estimate investment costs of irrigation systems (Table 4).

Special consideration, while designing the systems, was given to efficiencies of the systems in applying water. Efficiencies assumed, based on agricultural engineering information [8], were furrow -- 50 percent; hand-move sprinkler -- 70 percent; and biwall pipe drip -- 90 percent. Special consideration was also given to gallons per minute requirements of the systems to meet the typical needs of vegetable crops.

TABLE 4

INVESTMENT COSTS OF IRRIGATION SYSTEMS BY VEGETABLE SYSTEM ACREAGE

	Total Investment	Total Investment Per Acre
Drip (Biwall Pipe) Systems		
1.0 acre	$3,830	$3,830
2.5 acres	6,143	2,457
5.0 acres	12,088	2,418
10.0 acres	21,156	2,116
Sprinkler (Hand-move) Systems		
1.0 acre	2,269	2,269
2.5 acres	4,031	1,612
5.0 acres	5,281	1,056
10.0 acres	7,478	748
Furrow (Surface) Systems		
1.0 acre	1,733	1,733
2.5 acres	2,143	857
5.0 acres	2,336	467
10.0 acres	3,287	329

Current power costs for the southeastern Oklahoma region were used to calculate charges for electrical power [8].

Specific procedures in the operation of the irrigation systems, such as rotations of laterals in hand-move sprinkler systems, were considered in designing and determining costs of the systems (Figures 2, 3, and 4). Typical application rates and times were also considered in determining the adequacy of components of the systems such as power units and pipe capacities.

Other information was derived from the investment information. The enterprise budgets require cost information for depreciation, interest, insurance, taxes, repairs, and power. Based on the total acre inches required for each of the three vegetable activities considered in this study, per acre inch costs for the above items were calculated. These costs were included in the vegetable budgets used in the study.

The Integrated Farm Financial Statements Package

The Integrated Farm Financial Statements Package (IFFS) was used to analyze various scenarios considered with respect to costs and returns directly related to farm activities, especially irrigation. IFFS includes a net worth statement, a cash flow statement, an income statement, and a debt worksheet. IFFS combines the monthly cash flows obtained from the budgets for the individual enterprises to determine an aggregated cash flow for all farm enterprises.

Key Decision Variables

This study focuses on the changes in cash returns to operations and the changes in cash returns to the family for family living expenses with the introduction of irrigated vegetable production into the farm plan. These changes are important because the family can improve its standard of living by generating increased cash returns to farm operations and cash returns to family from the farm.

Cash returns to operations were calculated as IFFS net cash farm income (assuming all labor was paid a cash wage, whether hired or provided by the family) minus additional principal and interest payments due to investments in irrigation systems and additional machinery needed for vegetable production.

Cash available to the family for family living expenses is larger than cash returns to farm operations if the farm family provides some of the labor for the vegetable crop operation. Some problems with labor shortages may be avoided if available family labor is used, especially in smaller vegetable crop operations. Irrigated vegetable enterprises may provide labor wages to otherwise unemployed or underemployed family members while generating economic returns to land resources and management skills. Returns to labor provided by the family plus cash returns to operations were designated as cash returns to family.

For scenarios considered in this study, labor charges (machinery labor at $4.90/hr., other labor at $4.65/hr.) represent substantial expenses. The maximum amounts of labor assumed to be provided by the farm operator and family in this study are: 20 hours per week during January, February, March, November, and December; 40 hours per week during April, May, September, and October; and 100 hours per week during June, July, and August. Amounts of labor available from November through March are least, because the amount of daylight during these months is less than any other time during the year, and the farm operator and family are likely to have part-time jobs and school obligations. Labor available during April, May, September, and October is greater, because of more daylight hours per day. During the months of June, July, and August, the family will likely have the most time available to supply labor for the operation due to days with many daylight hours and few, if any, outside obligations for time.

RESULTS

The procedures and data discussed above facilitate the estimation of cash returns to operations and cash returns to family for the original farm scenario and for each of the thirty-six alternative vegetable crop production scenarios considered. The original farm scenario represents a farm operation without the introduction of vegetable crop production. On the original farm, cash returns to operations are $942, and total labor charges are $1,826. Since total labor requirements could be met by the family, cash returns to family for the original or base farm scenario are $2,768.

Comparison of Furrow Irrigation System Scenarios to the Original Farm Scenario

The furrow irrigation system scenarios address the economics of irrigated vegetable crop production for an individual vegetable crop producer using furrow irrigation. Results for the furrow irrigation system scenarios are contained in Table 5.

Among the three vegetable activities, tomatoes followed by fall broccoli shows the highest cash returns to operations and cash returns to family. One acre of production of tomatoes-fall broccoli results in an

TABLE 5

RESULTS FOR THE FURROW IRRIGATION SYSTEM SCENARIOS

Vegetable Activity	Acres in Vegetables	Cash Returns to Operations —$—	Change[a] in Cash Returns to Operations —$—	Cash Returns to Family —$—	Change[a] in Cash Returns to Family —$—
No Vegetables (Base Farm)	0	942	0	2,768	0
Spring Broccoli	1	1,261	319	4,235	1,467
Fall Spinach	2.5	3,221	2,279	6,569	3,801
	5	6,076	5,134	10,010	7,242
	10	12,715	11,773	17,137	14,369
Okra	1	221	(621)	3,512	744
	2.5	433	(509)	5,486	2,718
	5	540	(402)	6,698	3,930
	10	1,394	452	8,093	5,325
Tomatoes	1	1,871	929	6,030	3,262
Fall Broccoli	2.5	5,072	4,130	10,930	8,162
	5	10,102	9,160	16,494	13,726
	10	20,988	20,046	27,361	24,593

[a]Change is from base farm results.

increase in cash returns to operations of $929. One acre of production of the spring broccoli-fall spinach double crop results in an increase in cash returns to operations of only $319. A single acre of okra production actually causes a decrease in cash returns to operations (Table 5). This general pattern of changes in cash returns to operations is demonstrated for larger vegetable acreages.

Notable economies of size, because of irrigation investments, are evidenced for all three crop activities considered throughout the acreages considered. For example, one acre of production of spring broccoli-fall spinach results in an increase in cash returns to operations of $319; two and one-half acres results in an increase in cash returns to operations of $2,279 or $912 per acre of vegetable production; ten acres results in an increase in cash returns to operations of $11,773, or $1,177 per acre of vegetable production. The impacts of economies of size cause estimated changes in cash returns to operations for okra to change from being negative at small acreages to being positive for the 10 acre scenario.

For all acreages and crop activities considered, changes in cash returns to family are greatest for tomatoes-fall broccoli and least for okra (Table 5). The tomatoes-fall broccoli double crop results in the highest cash returns to operations and cash returns to family, even though it is the activity that requires the highest amount of irrigation water to be applied. Expected yields and prices cause cash returns from production of the tomatoes-fall broccoli double crop to be much larger than cash returns from production of other vegetable activities considered in this study. Thus the tomatoes-fall broccoli double crop is the most profitable alternative activity considered in this study.

Increases in cash returns to family for the representative farm may be achieved with the addition of vegetable production of any of the three vegetable activities considered in this study. Production of okra may result in lower cash returns to operations than expected with the original farm, while at the same time yielding higher cash returns to family than the original farm, if the family is willing to supply available labor to the vegetable crop operation. The family may receive significant economic benefits from production of any of the vegetable activities considered in this study.

Comparison of Sprinkler Irrigation System Scenarios to Furrow Irrigation System Scenarios

Comparison of results from the sprinkler and furrow irrigation system scenarios facilitates the evaluation of the potential economic benefits to a farm operator from introducing vegetable crop production with the use of a sprinkler technology versus a furrow technology. Results for the sprinkler irrigation system scenarios are contained in Table 6.

TABLE 6

RESULTS FOR THE SPRINKLER IRRIGATION SYSTEM SCENARIOS

Vegetable Activity	Acres in Vegetables	Cash Returns to Operations —$—	Change[a] in Cash Returns to Operations —$—	Cash Returns to Family —$—	Change[a] in Cash Returns to Family —$—
No Vegetables (Base Farm)	0	942	0	2,768	0
Spring Broccoli	1	1,172	230	4,146	1,378
Fall Spinach	2.5	2,932	1,990	6,280	3,512
	5	5,462	4,520	9,396	6,628
	10	11,875	10,933	16,297	13,529
Okra	1	132	(810)	3,423	655
	2.5	149	(793)	5,202	2,434
	5	(213)	(1,155)	5,945	3,177
	10	376	(566)	7,075	4,307
Tomatoes	1	1,779	837	5,938	3,170
Fall Broccoli	2.5	4,794	3,852	10,652	7,884
	5	9,123	8,181	15,515	12,747
	10	19,677	18,735	26,050	23,282

[a]Change is from base farm results.

Among all vegetable activities and acreages considered, cash returns and changes in cash returns are greater for the furrow system scenarios than for the sprinkler system scenarios. Cash returns to operations and cash returns to family for the production of five acres of tomatoes-fall broccoli are $9,160 and $13,726, respectively, using furrow technology, but just $8,181 and $12,747, respectively, using sprinkler technology (Tables 5 and 6).

When comparing the sprinkler system scenarios, within a vegetable activity, production of a larger acreage of vegetables results in larger cash returns to operations and cash returns to family than result with production of a smaller acreage of vegetables. Again, economies of size for the irrigation systems are experienced. The per acre vegetable returns increase as number of acres in vegetable production increases.

As in the furrow system scenarios, within each acreage, the tomatoes-fall broccoli double crop results in the largest cash returns to operations, change in cash returns to operations, cash returns to family, and change in cash returns to family, even though it is the activity that requires the largest amount of irrigation water. The spring broccoli-fall spinach double crop results in the second largest cash returns. The okra activity results in the lowest cash returns. Although negative effects in cash returns to operations are expected with the introduction of okra production, the family may benefit from production of okra due to increased cash returns to family if the family supplies some of the farm labor.

Comparisons of Drip Irrigation System Scenarios to Sprinkler and Furrow Irrigation System Scenarios

Comparisons of results from the drip irrigation system scenarios and the sprinkler and furrow irrigation system scenarios facilitate the evaluation of the potential economic benefits to a farm operator from introducing vegetable crop production with the use of a drip technology versus a sprinkler or furrow technology. Results for the drip irrigation system scenarios are contained in Table 7.

Cash returns to operations, change in cash returns to operations, cash returns to family, and change in cash returns to family are smaller with the use of a drip technology than with the use of a sprinkler technology or furrow technology (Tables 5, 6, and 7). Change in cash returns to operations for one acre of spring broccoli-fall spinach are negative. Within the drip system scenarios, the larger acreages of vegetable production, as expected, result in larger cash returns figures. Also, the tomatoes-fall broccoli double crop shows largest cash returns figures, followed by the spring broccoli-fall spinach double crop, and then the okra activity. Again, okra production may result in negative changes in cash returns to operations but may result in positive changes in cash returns to family.

TABLE 7

RESULTS FOR THE DRIP IRRIGATION SYSTEM SCENARIOS

Vegetable Activity	Acres in Vegetables	Cash Returns to Operations —$—	Change[a] in Cash Returns to Operations —$—	Cash Returns to Family —$—	Change[a] in Cash Returns to Family —$—
No Vegetables (Base Farm)	0	942	0	2,768	0
Spring Broccoli	1	443	(499)	3,417	649
Fall Spinach	2.5	2,629	1,687	5,977	3,209
	5	4,459	3,517	8,393	5,625
	10	9,668	8,726	14,090	11,322
Okra	1	(102)	(1,044)	3,189	421
	2.5	(139)	(1,081)	4,914	2,146
	5	(1,088)	(2,030)	5,070	2,302
	10	(1,675)	(2,617)	5,024	2,256
Tomatoes	1	1,573	631	5,732	2,964
Fall Broccoli	2.5	4,533	3,591	10,391	7,623
	5	8,458	7,516	14,850	12,082
	10	17,853	16,911	24,226	21,458

[a]Change is from base farm results.

SUMMARY AND CONCLUSIONS

Southeastern Oklahoma is a region with small acreages of level cropland suitable for fresh market vegetable production. Many bottomlands in the region have fertile soils, and water is available in adequate quantity and quality for irrigation of vegetable crops.

The region has labor that is underemployed. Little opportunity exists for off-farm employment. Diversification into irrigated fresh market vegetable production is an option for farm operators in the region to increase cash returns to their farm operations.

Three irrigation systems are appropriate for irrigation of fresh market vegetable crops in the region: furrow systems, sprinkler systems, and drip systems. Costs related to use of these irrigation systems are important considerations of farm operators considering the addition of fresh market vegetable production to existing operations.

Assuming the use of such irrigation systems, the economics of incorporating vegetable crops into a representative southeastern Oklahoma crop and livestock farm were evaluated in this study. Three vegetable crop activities (spring broccoli-fall spinach, okra, and tomatoes-fall broccoli) and four vegetable acreages (1.0, 2.5, 5.0, and 10.0 acres) were considered for each type of irrigation system.

Results of this study indicate that the introduction of vegetable crop production into a representative southeastern Oklahoma farm could substantially increase cash returns to operations for some vegetable crops and cash returns to family for all vegetable crops considered. As acreage of vegetables increases, benefits due to introduction of vegetable crops increase.

Differences in results due to use of the various irrigation systems occur because of variations in investment, power, and repair costs of the irrigation systems. Largest economic benefits in estimated producers' cash returns to operations and cash returns to family result with the use of furrow technology, followed by sprinkler technology, and then drip technology, due largely to the amount of investment costs required for the irrigation systems. It is conceivable that diversification of the agricultural sector into fresh market vegetable production could lead to substantial economic development for southeastern Oklahoma.

LIMITATIONS

In this study, to introduce vegetable production on a representative farm, land was assumed to be taken out of production of wheat. Similar increases in cash returns due to introducing vegetable production into an existing operation may be experienced on farms of any size. However, the same increases in cash returns that are reported in this study are expected only if land currently in wheat production on a given farm is used for production of the vegetable crops.

The results of this study indicate that although sprinkler and drip irrigation systems have higher application efficiencies, producers may benefit most from using furrow irrigation systems that require lower investment and operating costs. In this study, vegetable yields and input costs were assumed to be invariate over irrigation systems. These results might have been different if yields or input costs had been allowed to vary over irrigation technologies. Horticulturists suggest that such variations may occur; however, adequate information is not available on the magnitudes of yield and input cost variations that may be experienced with the various irrigation technologies. Also, furrow and sprinkler systems require more water than do drip systems. If water is in sufficiently short supply, furrow and sprinkler systems may not be technically feasible.

The use of family labor in the production of vegetable crops was discussed earlier in this report. Projected cash available to the family for family living can vary significantly, depending on the amount of family labor that can be provided for the vegetable crop operation. Unprofitable enterprises with hired labor may become profitable if part or all of the required labor is supplied by family members to whom other higher paying jobs are not available. In addition, less profitable enterprises may yield higher cash returns to family than more profitable enterprises if the less profitable enterprises have labor requirements that are spread over extended periods of time, instead of labor requirements that occur in a peak period, if family members can more nearly meet the more spread-out labor requirements, and if higher paying jobs are not available.

This study is based on several assumptions that may vary by individual situations, causing differences in actual results. Variation from assumptions in this study may occur in labor charges, yields, prices, and application of chemicals.

As mentioned above, this study does not address yield variations that may occur due to use of various irrigation technologies. Application of chemicals and other production practices may also vary as irrigation technologies vary. Due to variations in methods of application of irrigation water in the production of vegetable crops, severity and types of pest problems may differ in a vegetable field. If this occurs, variations in types and amounts of chemicals to be applied would be necessary, causing additional differences in costs related to use of the different irrigation technologies.

Yield and price variability unrelated to irrigation technologies can be substantial in vegetable production. Sensitivity analyses dealing with changes in yields and prices would provide useful information to producers considering additions of vegetable enterprises. Such information could have significant implications in relation to this study.

REFERENCES CITED

[1] A-Submatic Irrigation Systems, Better Way to Water. 1986-87 Drip Irrigation Catalog. Lubbock, Texas.

[2] Albright, J. Personal interview. Stillwater Equipment, John Deere dealership, Stillwater, OK. 1987.

[3] Criswell, J. Personal interview. Agricultural Extension Entomologist, Oklahoma State University, Stillwater. 1988.

[4] Dale, J. F., R. J. Schatzer, and J. R. Nelson. "Economics of Surface Water Development For Vegetable Irrigation in Southeastern Oklahoma." Bulletin B-785. Agriculture Experiment Station, Division of Agriculture, Oklahoma State University. Stillwater. December 1987.

[5] Farm Management Extension, Department of Agricultural Economics. "Oklahoma Crop and Livestock Budgets." Cooperative Extension Service, Oklahoma State University, Stillwater. 1987.

[6] General Irrigation Catalog and Price List. Carthage, Missouri. 1987.

[7] Hobbs, J. C. Personal interview. Agricultural Extension Economist, Oklahoma State University, Stillwater. 1987.

[8] Kizer, M. Personal interview. Agricultural Extension Engineer, Oklahoma State University, Stillwater. 1987.

[9] Mapp, H. P., R. O. Love, and R. Hesser. Integrated Farm Financial Statements: Lotus 1-2-3 Version. Agricultural Experiment Station, Division of Agriculture. Department of Agricultural Economics, Oklahoma State University. October 1985.

[10] Maxson, Joe M. Personal interview. Agricultural Extension Economist, Oklahoma State University, Stillwater. 1987.

[11] Mosley, J. L. Personal interview. United States Department of Agriculture, Soil Conservation Service, Stillwater, Oklahoma. 1987.

[12] Motes, J. E. Personal interview. Agricultural Extension Horticulturist, Oklahoma State University, Stillwater. 1988.

[13] National Climatic Data Center. Climatological Data, Oklahoma. Ashville, NC. 1976-1985.

[14] National Market Reports, Inc., National Farm and Tractor Implement Blue Book. Volumes 42-47, 1981-86.

[15] Nebraska Plastics, Inc. Equipment Price List. Cozad. 1987.

[16] Nelson, T. R., and D. D. Kletke. "Oklahoma Farm and Ranch Custom Rates, 1986-87." OSU Extension Facts No. 140. Cooperative Extension Service, Division of Agriculture, Oklahoma State University, Stillwater. 1987.

[17] Oklahoma Department of Agriculture. Oklahoma Agricultural Statistics. Oklahoma Crop and Livestock Reporting Service, Oklahoma City. 1984.

[18] Oklahoma Water Resources Board. Oklahoma's Water Atlas. Publication No. 120. Oklahoma City. November 1984.

[19] Rain Bird. "Sprinkler Irrigation Handbook." Tenth edition. 1971.

[20] Schatzer, R. J., M. C. Wickwire, D. S. Tilley, and J. E. Motes. "Costs and Returns for Small Scale Producers." Research Report P875, Agriculture Experiment Station, Division of Agriculture, Oklahoma State University, Stillwater. April 1986.

[21] Schatzer, R. J., M. Wickwire, and D. S. Tilley. "Supplemental Vegetable Enterprises for a Cow-Calf and Grain Farmer in Southeastern Oklahoma." Research Report P874, Agriculture Experiment Station, Division of Agriculture, Oklahoma State University, Stillwater. April 1986.

[22] Tilley, D. S., C. Falk, and R. J. Schatzer. "Wholesalers' Interest in Oklahoma Produce." Current Farm Economics. Vol. 59, Number 2. Pp. 17-25. Agriculture Experiment Station, Oklahoma State University, Stillwater. June 1986.

[23] Transamerica Delaval, Inc.,Berkeley Pump Catalog. Pumptron Division, Berkeley, California. 1987.

[24] U.S. Army Corps of Engineers. "Resource Assessment and Development Strategies-Optimum Economic Development for Southeast Oklahoma." Executive Summary. Washington, D.C. October 1982.

[25] U.S. Department of Agriculture, Soil Conservation Service, in cooperation with Oklahoma Agricultural Experiment Station. "Soil Surveys of Oklahoma." Stillwater. 1979.

[26] U.S. Department of Commerce, Bureau of the Census. 1982 Census of Agriculture: Oklahoma State and County Data. Vol. 1, Part 36. US Government Printing Office, Washington, D.C. 1984.

[27] Williams, R. J. and D. D. Badger. "An Action Plan for Southeastern Oklahoma." Department of Agricultural Economics Paper No. AE 8248. Stillwater. 1982.

APPENDIX

WHEAT BUDGET

WHEAT
SOUTHEAST OKLAHOMA 05/01/89

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
WHEAT SEED	BU.	4.500	1.500	6.75	________
NITROGEN (N)	LBS.	0.170	51.000	8.67	________
PHOSPH (P2O5)	LBS.	0.150	46.000	6.90	________
CUSTOM HARVEST	ACRE	13.710	1.000	13.71	________
RNTFERTSPRD/TON	TONS	4.600	2.000	9.20	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	23.620	3.07	________
LABOR CHARGES	HR.	4.900	1.222	5.99	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			8.85	________
TOTAL OPERATING COST				63.14	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	3.349	________
DEPR.,TAXES,INSUR.	DOL.	3.053	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		6.40	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
WHEAT	BU.	2.700	30.000	81.00	________
PASTURE	AUMS	0.000	0.800	0.00	________
TOTAL RECEIPTS				81.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				17.86	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				11.46	________

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SOYBEANS BUDGET

SOYBEANS, BOTTOMLAND, SOUTHEAST OKLAHOMA

05/01/89

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SOYBEAN SEED	LBS.	0.250	45.000	11.25	________
NITROGEN (N)	LBS.	0.170	32.000	5.44	________
PHOSPH (P205)	LBS.	0.150	48.000	7.20	________
POTASH (K20)	LBS.	0.100	48.000	4.80	________
HERB-SOYBEANS	ACRE	6.750	1.000	6.75	________
BROAD LEAF HERB.	ACRE	2.500	1.000	2.50	________
CUSTOM HARVEST	ACRE	15.490	1.000	15.49	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	4.832	0.63	________
LABOR CHARGES	HR.	4.900	1.775	8.70	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			11.40	________
TOTAL OPERATING COST				74.15	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	5.755	________
DEPR.,TAXES,INSUR.	DOL.	5.490	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		11.25	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SOYBEANS	BU.	5.850	35.000	204.75	________
RETURNS ABOVE TOTAL OPERATING COSTS				130.60	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				119.35	________

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ALFALFA HAY BUDGET

ALFALFA HAY
CUSTOM BALE 05/01/89
SOUTHEAST OKLAHOMA

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
NITROGEN (N)	LBS.	0.170	30.000	5.10	_______
PHOSPH (P2O5)	LBS.	0.150	80.000	12.00	_______
POTASH (K2O)	LBS.	0.100	80.000	8.00	_______
RNTFERTSPRD/ACRE	ACRE	2.000	1.000	2.00	_______
1/5 EST. COST	ACRE	95.000	0.200	19.00	_______
HAY HARVEST EXP	ACRE	16.800	4.000	67.20	_______
ANNUAL OPERATING CAPITAL	DOL.	0.130	2.292	0.30	_______
LABOR CHARGES	HR.	4.811	11.282	54.28	_______
MACHINERY FUEL, LUBE, REPAIRS	ACRE			61.99	_______
TOTAL OPERATING COST				229.86	_______

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	14.493	_______
DEPR., TAXES, INSUR.	DOL.	16.315	_______
LAND			
INTEREST AT 0.0%	DOL.	0.000	_______
TAXES	DOL.	0.000	_______
TOTAL FIXED COSTS		30.81	_______

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
ALFALFA HAY	TONS	65.000	4.000	260.00	_______
RETURNS ABOVE TOTAL OPERATING COSTS				30.14	_______
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-0.67	_______

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BERMUDA HAY BUDGET

BERMUDA GRASS PASTURE & HAY
CONVENTIONAL BALE 05/01/89
SOUTHEAST OKLAHOMA

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
NITROGEN (N)	LBS.	0.170	200.000	34.00	________
PHOSPH (P2O5)	LBS.	0.150	80.000	12.00	________
POTASH (K2O)	LBS.	0.100	120.000	12.00	________
RNTFERTSPRD/ACRE	ACRE	2.000	1.000	2.00	________
CUSTOM BALE	ACRE	16.800	5.000	84.00	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	4.840	0.63	________
LABOR CHARGES	HR.	4.806	13.282	63.83	________
MACHINERY FUEL, LUBE, REPAIRS	ACRE			73.99	________
TOTAL OPERATING COST				282.45	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	15.269	________
DEPR., TAXES, INSUR.	DOL.	17.834	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		33.10	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BERMUDA HAY	TONS	45.000	5.000	225.00	________
PASTURE	AUMS	0.000	1.250	0.00	________
TOTAL RECEIPTS				225.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				-57.45	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-90.55	________

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BERMUDA PASTURE BUDGET

BERMUDA GRASS MAINTENANCE, SOUTHEAST OKLAHOMA

05/01/89

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
NITROGEN (N)	LBS.	0.170	200.000	34.00	________
PHOSPH (P205)	LBS.	0.150	60.000	9.00	________
POTASH (K20)	LBS.	0.100	120.000	12.00	________
RNTFERTSPRD/ACRE	ACRE	2.000	5.000	10.00	________
2,4-D	ACRE	2.500	0.330	0.82	________
ESTAB COST	ACRE	109.730	0.100	10.97	________
HERBICIDE	ACRE	5.500	0.330	1.81	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	39.289	5.11	________
LABOR CHARGES	HR.	4.900	1.060	5.20	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			22.09	________
TOTAL OPERATING COST				111.00	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	2.677	________
DEPR.,TAXES,INSUR.	DOL.	2.504	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		5.18	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
PASTURE	AUMS	0.000	11.600	0.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				-111.00	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				-116.18	________

HERBICIDE IS PARAQUAT, APPLIED EVERY 3 YEARS FOR WINTER ANNUALS. 2,4-D APPLIED EVERY 3 YEARS.

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NATIVE PASTURE BUDGET

NATIVE PASTURE, MAINTENANCE, SOUTHEAST OKLAHOMA

05/01/89

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
2,4-D	ACRE	1.400	0.250	0.35	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	0.041	0.01	________
LABOR CHARGES	HR.	4.900	0.035	0.17	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			0.14	________
TOTAL OPERATING COST				0.67	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	0.151	________
DEPR.,TAXES,INSUR.	DOL.	0.165	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		0.32	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
PASTURE	AUMS	0.000	1.580	0.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				-0.67	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				-0.98	________

2,4-D APPLIED EVERY FOURTH YEAR

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COW CALF BUDGET

COW CALF COST & RETURNS PER COW 25 COW UNIT
SPRING CALVING FEB-MAR 05/01/89
SOUTHEAST OKLAHOMA

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
PRAIRIE HAY	TONS	41.000	1.224	50.18	
26-30% PROT.SUP.	LBS.	0.080	456.000	36.48	
SALT & MINERALS	LBS.	0.090	28.800	2.59	
INSPECTION FEES	DOL.	7.500	1.000	7.50	
ESTAB COST	HD.	3.500	1.000	3.50	
ANNUAL OPERATING CAPITAL	DOL.	0.130	41.304	5.37	
MACHINERY LABOR	HR.	4.900	3.026	14.83	
EQUIPMENT LABOR	HR.	4.650	0.620	2.88	
MACHINERY FUEL,LUBE,REPAIRS	DOL.			14.18	
EQUIPMENT FUEL,LUBE,REPAIRS	DOL.			6.53	
TOTAL OPERATING COST				144.04	

FIXED COSTS		AMOUNT	VALUE		YOUR VALUE
MACHINERY					
INTEREST AT 13.00%		75.32	9.79		
DEPR., TAXES INSURANCE			10.01		
EQUIPMENT					
INTEREST AT 13.00%		522.00	67.86		
DEPR., TAXES INSURANCE			51.26		
LIVESTOCK					
BEEF COW		624.00			
BEEF HEIFER		88.00			
BEEF BULL		27.00			
INTEREST AT 13.00%		739.00	96.07		
DEPR., TAXES INSURANCE			11.90		
LAND					
PASTURE	10.80 AUMS		0.00		
INTEREST AT 0.00%		0.00	0.00		
TAXES			0.00		
TOTAL FIXED COST				246.89	

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
STR CALVES (4-5)	CWT.	102.000	1.935	197.37	
HFR CALVES (4-5)	CWT.	92.000	1.176	108.19	
AGED BULLS	CWT.	58.000	1.365	79.17	
COMMERCIAL COWS	CWT.	49.000	0.160	7.84	
TOTAL RECEIPTS				392.57	

RETURNS ABOVE TOTAL OPERATING COSTS	248.53	
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK,AND MANAGEMENT	1.64	

ASSUME 88% CALF CROP

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FALL BROCCOLI BUDGET

FALL BROCCOLI, SEEDED, SOUTHEAST OKLAHOMA
SANDY LOAM SOILS, IRRIGATED OWNED EQUIPMENT WITH HAND HARVEST 05/01/89
22 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERBICIDE	ACRE	3.130	1.000	3.13	________
15-15-15 FERT	CWT.	9.750	3.000	29.25	________
RNTFERTSPRD/ACRE	ACRE	1.250	3.000	3.75	________
VEGETABLE SEED	LBS.	200.000	1.000	200.00	________
THIN SEEDLINGS	HR.	4.650	6.000	27.90	________
NITROGEN (N)	LBS.	0.170	80.000	13.60	________
INSECTICIDE	ACRE	6.370	4.000	25.48	________
CARTONS	CART	1.020	400.000	408.00	________
HARVEST LABOR	HR.	4.650	120.000	558.00	________
GRADING & MKTG	CART	1.330	400.000	532.00	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	89.101	11.58	________
LABOR CHARGES	HR.	4.819	7.204	34.72	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			37.41	________
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			81.33	________
TOTAL OPERATING COST				1966.16	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	17.725	________
DEPR.,TAXES,INSUR.	DOL.	18.029	________
IRRIGATION			
INTEREST AT 13.0%	DOL.	109.923	________
DEPR.,TAXES,INSUR.	DOL.	270.567	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		416.24	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BROCCOLI		7.010	400.000	2804.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				837.84	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				421.60	________

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FALL SPINACH BUDGET

FALL SPINACH, SOUTHEAST OKLAHOMA
SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 05/01/89
BUSHEL BASKETS, ADJ. DALLAS WHOLESALE PRICE.

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERBICIDE	ACRE	27.500	1.000	27.50	________
15-15-15 FERT	CWT.	9.750	5.000	48.75	________
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	________
SEEDLINGS	LBS.	4.000	15.000	60.00	________
INSECTICIDE	ACRE	1.800	1.000	1.80	________
INSECTICIDE	ACRE	6.370	3.000	19.11	________
FUNGICIDE	ACRE	3.500	3.000	10.50	________
NITROGEN (N)	LBS.	0.170	102.000	17.34	________
BASKETS	BU.	1.020	350.000	357.00	________
HARVEST LABOR	HR.	4.650	175.000	813.75	________
GRADING & MKTG	BU.	1.200	350.000	420.00	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	33.655	4.38	________
LABOR CHARGES	HR.	4.792	7.781	37.29	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			35.54	________
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			91.99	________
TOTAL OPERATING COST				1947.44	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	16.433	________
DEPR.,TAXES,INSUR.	DOL.	16.820	________
IRRIGATION			
INTEREST AT 13.0%	DOL.	148.715	________
DEPR.,TAXES,INSUR.	DOL.	366.074	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		548.04	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
SPINACH	TONS	7.650	350.000	2677.50	________
RETURNS ABOVE TOTAL OPERATING COSTS				730.06	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				182.02	________

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OKRA BUDGET

OKRA, SOUTHEAST OKLAHOMA
SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 05/01/89
18 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERBICIDE	ACRE	3.130	1.000	3.13	________
15-15-15 FERT	CWT.	9.750	2.000	19.50	________
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	________
VEGETABLE SEED	LBS.	1.000	10.000	10.00	________
HOEING LABOR	HR.	4.650	6.000	27.90	________
NITROGEN (N)	LBS.	0.170	20.000	3.40	________
INSECTICIDE	ACRE	5.100	3.000	15.30	________
CARTONS	CART	1.020	500.000	510.00	________
HARVEST LABOR	HR.	4.650	300.000	1395.00	________
GRADING & MKTG	CART	0.580	500.000	290.00	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	12.714	1.65	________
LABOR CHARGES	HR.	4.819	9.894	47.68	________
MACHINERY FUEL, LUBE, REPAIRS	ACRE			44.04	________
IRRIGATION FUEL, LUBE, REPAIRS	ACRE			149.25	________
TOTAL OPERATING COST				2519.35	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	22.220	________
DEPR., TAXES, INSUR.	DOL.	22.371	________
IRRIGATION			
INTEREST AT 13.0%	DOL.	219.051	________
DEPR., TAXES, INSUR.	DOL.	539.224	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		802.87	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
OKRA	CART	5.240	500.000	2620.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				100.65	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD, RISK AND MANAGEMENT				-702.21	________

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SPRING BROCCOLI BUDGET

SPRING BROCCOLI, TRANSPLANT, SOUTHEAST OKLAHOMA
SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 05/01/89
22 LB. CARTONS, ADJ. DALLAS WHOLESALE PRICE.

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERBICIDE	ACRE	3.130	1.000	3.13	________
15-15-15 FERT	CWT.	9.750	3.000	29.25	________
RNTFERTSPRD/ACRE	ACRE	1.250	3.000	3.75	________
TRANSPLANTS	THPL	30.000	14.500	435.00	________
TRANSPLANT LABOR	HR.	4.650	18.000	83.70	________
NITROGEN (N)	LBS.	0.170	80.000	13.60	________
INSECTICIDE	ACRE	6.370	6.000	38.22	________
CARTONS	CART	1.020	350.000	357.00	________
HARVEST LABOR	HR.	4.650	105.000	488.25	________
GRADING & MKTG	CART	1.330	350.000	465.50	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	109.436	14.23	________
LABOR CHARGES	HR.	4.875	8.316	40.54	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			48.56	________
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			66.90	________
TOTAL OPERATING COST				2087.63	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	29.389	________
DEPR.,TAXES,INSUR.	DOL.	30.897	________
IRRIGATION			
INTEREST AT 13.0%	DOL.	108.156	________
DEPR.,TAXES,INSUR.	DOL.	266.236	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		434.68	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
BROCCOLI	CART	7.290	350.000	2551.50	________
RETURNS ABOVE TOTAL OPERATING COSTS				463.87	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				29.20	________

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TOMATOES BUDGET

STAKED TOMATOES, SOUTHEAST OKLAHOMA
SANDY LOAM SOILS, IRRIGATED, OWNED EQUIPMENT WITH HAND HARVEST 05/01/89
30 LB. LUGS, ADJ. DALLAS WHOLESALE PRICE.

OPERATING INPUTS:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
HERBICIDE	ACRE	3.130	1.000	3.13	________
15-15-15 FERT	CWT.	9.750	3.350	32.66	________
POTASH (K2O)	LBS.	0.100	200.000	20.00	________
RNTFERTSPRD/ACRE	ACRE	1.250	2.000	2.50	________
TRANSPLANTS	THPL	50.000	5.000	250.00	________
TRANSPLANT LABOR	HR.	4.650	8.000	37.20	________
STAKES	EACH	0.250	834.000	208.50	________
TWINE	LBS.	1.250	30.000	37.50	________
STAKING LABOR	HR.	4.650	50.000	232.50	________
TIEING LABOR	HR.	4.650	180.000	837.00	________
HOEING LABOR	HR.	4.650	9.000	41.85	________
INSECTICIDE	ACRE	6.690	10.000	66.90	________
BACTICIDE	ACRE	9.940	10.000	99.40	________
FUNGICIDE	ACRE	3.500	4.000	14.00	________
NITROGEN (N)	LBS.	0.170	50.000	8.50	________
FUNGICIDE	ACRE	10.500	6.000	63.00	________
LUGS	LUGS	0.610	700.000	427.00	________
HARVEST LABOR	HR.	4.650	200.000	930.00	________
GRADING & MKTG	LUGS	0.750	700.000	525.00	________
ANNUAL OPERATING CAPITAL	DOL.	0.130	259.340	33.71	________
LABOR CHARGES	HR.	4.833	11.221	54.23	________
MACHINERY FUEL,LUBE,REPAIRS	ACRE			51.30	________
IRRIGATION FUEL,LUBE,REPAIRS	ACRE			91.44	________
TOTAL OPERATING COST				4067.33	________

FIXED COSTS		VALUE	YOUR VALUE
MACHINERY			
INTEREST AT 13.0%	DOL.	26.906	________
DEPR.,TAXES,INSUR.	DOL.	27.347	________
IRRIGATION			
INTEREST AT 13.0%	DOL.	116.964	________
DEPR.,TAXES,INSUR.	DOL.	287.935	________
LAND			
INTEREST AT 0.0%	DOL.	0.000	________
TAXES	DOL.	0.000	________
TOTAL FIXED COSTS		459.15	________

PRODUCTION:	UNITS	PRICE	QUANTITY	VALUE	YOUR VALUE
TOMATOES	LUGS	7.500	700.000	5250.00	________
RETURNS ABOVE TOTAL OPERATING COSTS				1182.67	________
RETURNS ABOVE ALL COSTS EXCEPT OVERHEAD,RISK AND MANAGEMENT				723.52	________

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THE OKLAHOMA

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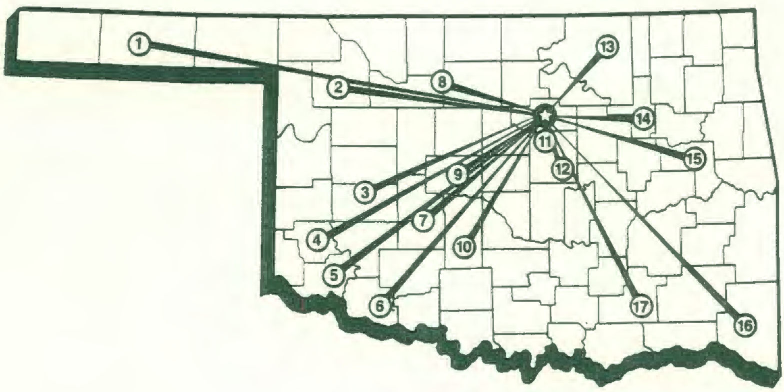

- **Main Station – *Stillwater and Lake Carl Blackwell***
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2. **Southern Great Plains Field Station – *Woodward***
3. **Marvin Klemme Range Research Station – *Bessie***
4. **Sandyland Research Station – *Mangum***
5. **Irrigation Research Station – *Altus***
6. **Southwest Agronomy Research Station – *Tipton***
7. **Caddo Research Station – *Ft. Cobb***
8. **North Central Research Station – *Lahoma***
9. **Forage and Livestock Research Laboratory – *El Reno***
10. **South Central Research Station – *Chickasha***
11. **Agronomy Research Station – *Perkins***
    Fruit Research Station – *Perkins*
12. **Pecan Research Station – *Sparks***
13. **Pawhuska Research Station – *Pawhuska***
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