STAFF PAPER

FACTORS INFLUENCING CHANGE IN WESTERN KANSAS IRRIGATED ACRES

ORLAN BULLER*

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*Professor, Department of Agricultural Economics, Kansas State University, Manhattan, KS 66506.

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Factors Influencing Change in Western Kansas Irrigated Acres

by

Orlan Buller
Department of Agricultural Economics
Kansas State University, Manhattan, KS 66506

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Introduction

Irrigation is important to the economy of western Kansas. As the number of irrigated acres change, so do the services directly and indirectly connected to irrigation. In the past two decades, some rather dramatic changes have taken place in irrigated agriculture of western Kansas. From 1960 through 1977, there was a rapid increase in the number of acres irrigated. After 1977, acreage remained fairly constant; however, changes in the crop mix of acres irrigated has occurred. Irrigated crops usually use more labor, fertilizer, pesticides, seed, fuel and oil, and repairs per acre. Therefore, policies or market forces that influence the number of irrigated acres and production inputs will be of concern to irrigators, managers of agribusiness, and merchants in western Kansas. Irrigation development affects the life style of people, the environment, the tax base, the population, and the services infrastructure.

The purposes of this study were to review changes from 1960 to 1990 in total irrigated acres in western Kansas, (i.e., irrigated acres of corn, grain sorghum, and wheat) and evaluate the influence of government programs, crop yield per acre, and diesel fuel price on irrigated acres.

Factors Considered

Irrigated acreage and mix of crops under irrigation were considered in the evaluation of the conservation and use of the Ogallala Aquifer. The amount of water pumped from the aquifer was determined by multiplying acreage irrigated times the amount of water pumped per acre. These variables are controlled by the irrigators of the region, whose choice of crop and acreage is influenced by the net returns earned by resources used.

The cost of energy was a factor considered as influencing changes in

irrigated acres. From 1960 to the mid-1970's, the cost of energy for irrigation was relatively low, and the supply of water seemed plentiful. After the mid-1970's, energy prices began to rise, and there was a growing concern over the supply and use of water and cost of pumping water from the Ogallala aquifer. The rising cost of energy also increased awareness of the role of energy prices in the viability of irrigated agriculture. In the 1980's, energy prices stabilized, and the price of diesel fuel declined. As the profitability of irrigated crops increased, so did the concern regarding the use and conservation of the aquifer.

Rising yields per acre for corn, wheat, and grain sorghum influence the change in net returns, thereby affecting the decision of which crop to irrigate. Differences in yield trend can shift the comparative advantage among crops irrigated.

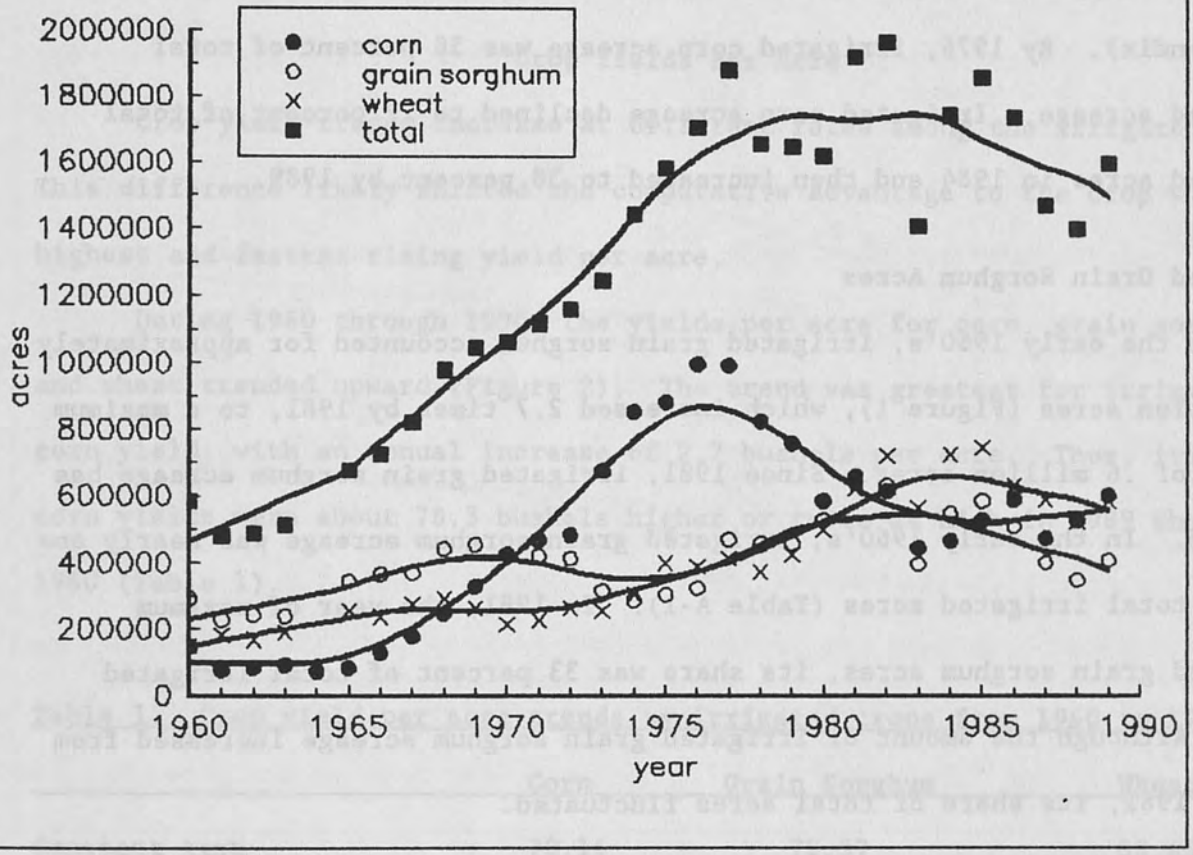
Government farm programs regulated the acreage of crops irrigated. Program regulations changed several times during the 1960-90 period.

Irrigated Acres

Total Irrigated Acres

Total irrigated acres for corn, grain sorghum, and wheat were approximately .5 million in 1960 and reached a peak of nearly 2 million in 1982 (Figure 1). After 1982, total irrigated acres declined to approximately 1.6 million in 1989. Total harvested crop acres (nonirrigated and irrigated) in the three western Kansas crop reporting districts was approximately 6 million throughout 1960-1990 (1). Irrigated crop acres were nearly one-third of total harvested crop acres in 1982.

Figure 1 : Irrigated Acres In Western Kansas



Irrigated Corn Acres

Irrigated corn acreage, in absolute and in percent terms, fluctuated over the period from 1960 to 1990. Irrigated acres of corn increased from nearly .1 million in 1960 to approximately 1 million in 1977 (Figure 1). After 1977, acreage decreased to less than .5 million in 1984. Another increase began in 1985 and continued through 1989. In 1960, irrigated corn acreage was approximately 25 percent or less of total irrigated acres (Table A-1 Appendix). By 1976, irrigated corn acreage was 58 percent of total irrigated acreage. Irrigated corn acreage declined to 27 percent of total irrigated acres in 1984 and then increased to 38 percent by 1989.

Irrigated Grain Sorghum Acres

In the early 1960's, irrigated grain sorghum accounted for approximately .25 million acres (Figure 1), which increased 2.7 times by 1981, to a maximum acreage of .6 million acres. Since 1981, irrigated grain sorghum acreage has declined. In the early 1960's, irrigated grain sorghum acreage was nearly one half of total irrigated acres (Table A-1). In 1981, the year of maximum irrigated grain sorghum acres, its share was 33 percent of total irrigated acres. Although the amount of irrigated grain sorghum acreage increased from 1973 to 1981, its share of total acres fluctuated.

Irrigated Wheat Acres

In the early 1960's, approximately .2 million acres of wheat was irrigated, or about 35 percent of total irrigated acres (Figure 1). Irrigated wheat acreage increased steadily until 1985, when nearly .75 million acres were irrigated. The 1985 acreage was approximately 40 percent of total irrigated acres. The share of irrigated wheat acreage decreased to 19 and 20 percent, respectively, in 1970 and 1971 but increased thereafter.

Summary of Crop Acreage Change

In the early 1960's, grain sorghum was the major irrigated crop and maintained this position until 1971, when it was surpassed by corn. In 1980 and 1981, the three crops had nearly the same acreage. In 1982, wheat was the major irrigated crop and continued to be until 1988, when corn again became the major irrigated crop.

Crop Yields Per Acre

Crop yield trends increase at different rates among the irrigated crops. This difference likely shifted the comparative advantage to the crop with the highest and fastest rising yield per acre.

During 1960 through 1990, the yields per acre for corn, grain sorghum and wheat trended upward (Figure 2). The trend was greatest for irrigated corn yield, with an annual increase of 2.7 bushels per acre. Thus, irrigated corn yields were about 78.3 bushels higher or twice as high in 1989 then in 1960 (Table 1).

Table 1. Crop yield per acre trends by irrigated crops from 1960 to 1990.

	Corn	Grain Sorghum	Wheat
Constant term	70.16	72.37	30.46
Trend coefficient	2.65	.64	.67

The trends for increase in yield per acre were nearly the same for grain sorghum (.64 bushels per year) and for wheat (.67 bushels). The increase for irrigated corn yield was over 4 times that for irrigated grain sorghum.

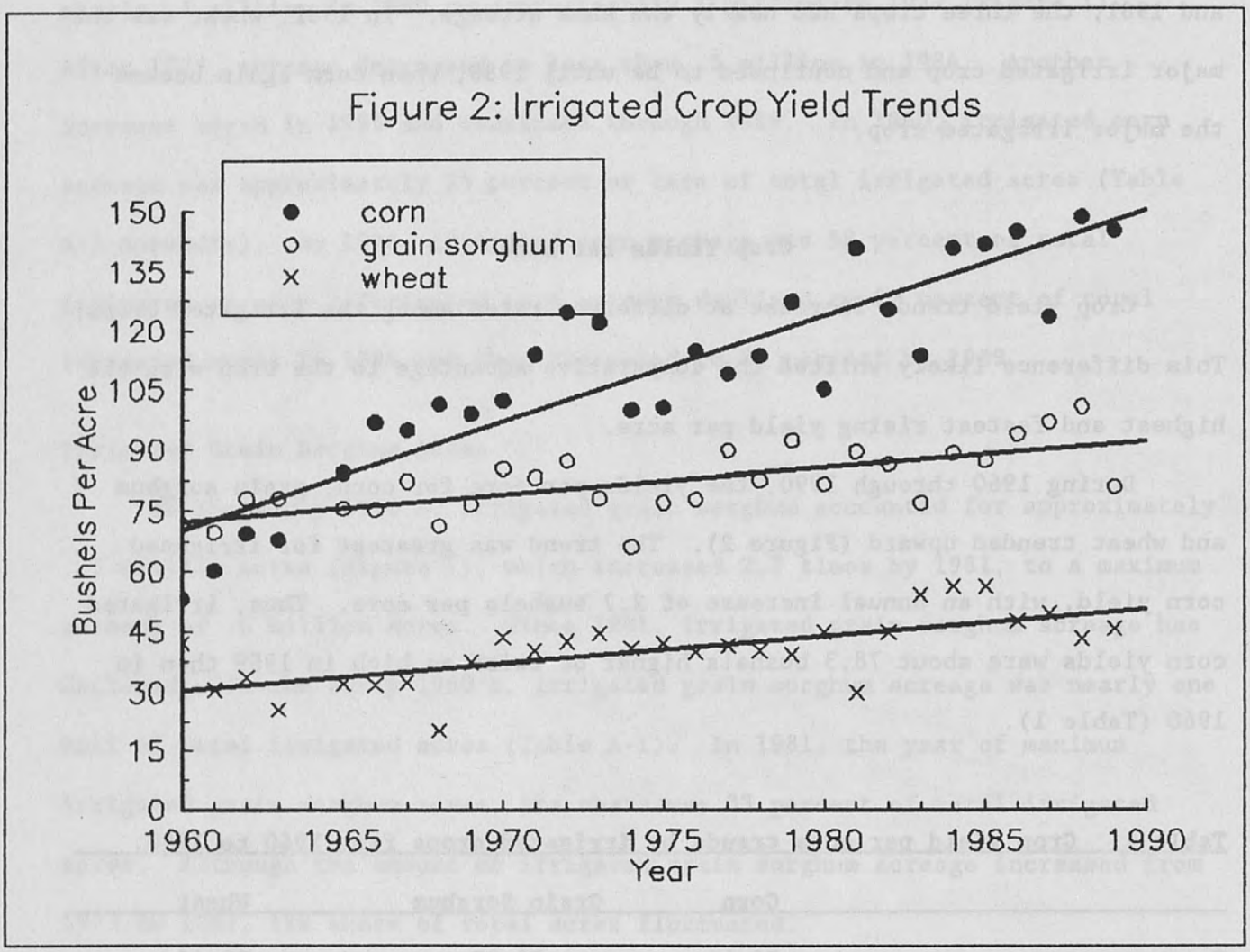


Figure 2: Irrigated Crop Yield Trends
corn
grain sorghum
wheat
Bushels Per Acre
150
135
120
105
90
75
60
45
30
15
0
1960
1965
1970
1975
1980
1985
1990
Year

Government Farm Programs

Government farm programs influence agriculture in many ways. This report examines the influence of government programs on the selection of the crop mix only.

Farm Programs of the 1960's

The 1960's began with large surplus stocks of wheat and feed grains, as a result of the acreage control and price support programs in the 1950s (2). Feed grains and soybeans had no production control provision in 1960. The Agricultural Act of 1961 established specific acreage diversion programs for corn and grain sorghum. The intent was to divert acres to conservation uses. Financial support was through a loan rate and payments for diversion. The program was voluntary, and only participants were provided support. Feed grain acreage was diverted every year to keep carryover stocks from growing into surplus.

The Food and Agricultural Act of 1965 extended the farm program to additional crops. The 1961 and 1965 farm acts, which established acreage allotments and feed grain bases on previous historical patterns, restricted farmers from making crop mix adjustments. This restricted irrigators from shifting irrigated acres to the most profitable crop. As a result, the 1960's ended with surplus stock under control, but the price of the government program was substantial; $1.5 billion in fiscal 1969.

Farm Programs of the 1970's

Two issues addressed in the Agricultural Act of 1970 were payment limitations to operators and flexibility in planting on base acreage. The

concept of set-aside acreage was introduced to provide farmers more flexibility in selecting crop mixes. With set-aside provisions, participants were required to set aside a portion of their allotment or base acreage for conservation uses. They could plant any crop on the remaining acreage except those under a marketing quota.

The Agricultural and Consumer Protection Act of 1973 replaced support prices based on parity with target prices. The Act adjusted target prices based on changes in corn production costs per bushel. Therefore, under the 1977 Act, growth in program crop yields were taken into account in setting target prices. This provision favored irrigated corn over irrigated grain sorghum because corn had a trend for faster rising yield.

The target price for grain sorghum was established at a level that would be "fair and reasonable" in relation to the target price for corn. This meant that the target price for grain sorghum would be fair and reasonable, if based on the same components of production cost that were used for corn. On this basis, the 1978 target price for grain sorghum was set at $2.28 per bushel compared to corn at $2.10. Under the traditional 95 percent feed value relationship, the grain sorghum target price would have been $2.00 a bushel.

The 1977 Act provided that current planted acreage, rather than allotments, would serve as the base for deficiency payments and for any set-aside acreage.

Farm Program's of the 1980's

The 1980's began with farm income in decline. The issues of the Agriculture and Food Act of 1981 concerned adequate levels of price and income supports. There was dissatisfaction with "cost of production" as the adjuster

for target price, and the set-aside programs of the 1970's had not proven effective in reducing crop acreage. The 1981 Act authorized the Acreage Reduction Program (ARP) and paid land diversion in addition to the continuation of the set-aside provision. The ARP and paid land diversion established crop-specific base acreage, and acreage reduction was from that base. The corn and grain sorghum bases were combined into one, and farmers could interchange the crops. The ARP from 1982 to 1984 was implemented to deal with excess supplies.

The cost of the farm program had risen to $18 billion in FY 1985, and the consensus was to bring the cost under control. Deficiency payments (deficiency payment rate was the difference between target price and the larger of market price or loan rate) were based on the average program yields in 1981 through 1985, excluding the highest and lowest yields.

The feed grain programs encouraged irrigation because high prices increased the dollar return to irrigation and also because irrigation was a means of increasing program yields.

Special Rules for Irrigated Feed Grains

Program yields for irrigated corn and grain sorghum were frozen at 1985 levels for the years 1986 through 1990 on irrigation established before 1986. For irrigation established after 1985, there was no authorization to establish irrigated program yields, and non-irrigated grain sorghum yield was the program yield for both irrigated corn and grain sorghum. An irrigated yield could be established for a crop irrigated for the first time after 1985, if the other crop in a combined acreage base had an irrigated yield. The irrigated yield could not exceed that established for the other crop in the

combined acreage base.

The intent of the government program after 1985 was discourage further irrigation development for feed grains.

Diesel Prices

Irrigation is energy intensive, so energy price influences irrigation practices and acreage adjustment. The major energy types used for irrigation are natural gas, diesel, and electricity. Natural gas was used by 67 percent of the irrigators, and about 30 percent used diesel or electricity (3). The difficulty with using natural gas price to evaluate the effect of energy prices on irrigation is that natural gas price varies greatly among irrigators. Many irrigators have long-term price contractual arrangements, so the price they pay for natural gas may be very different than the regulated price. However, diesel price was determined more by demand and supply factors and was more uniform over the region. Thus, for this report, diesel price was used to estimate the effect of energy price on acreage adjustments.

The market price of diesel was fairly stable from 1961 to 1974 at $.15 per gallon, and the real diesel price declined slightly (Figure 3). The market price increased from 1970 until 1982 to $1.10 per gallon. The real price of diesel also increased from 1974 to 1982 as the market price increased more than the rate of inflation. The market price of diesel declined after 1982 to about $.65 per gallon (the market price of diesel does not include state and federal taxes). After 1982, the real price of diesel declined also and, in 1989, reached $.15 per gallon, the same as in 1960.

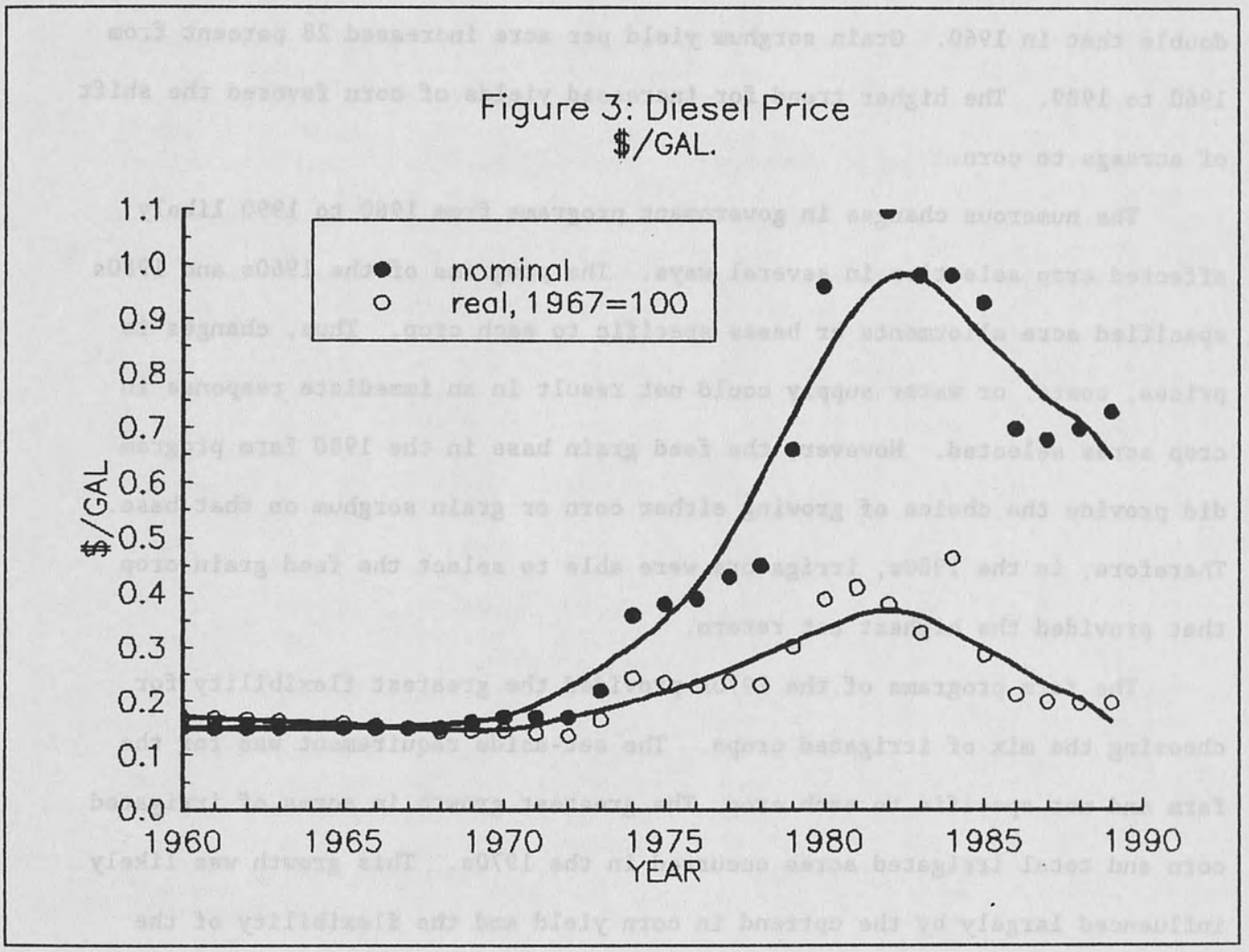


Figure 3: Diesel Price
$/GAL.
nominal
real, 1967=100
$/GAL
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1960
1965
1970
1975
1980
1985
1990
YEAR

Summary

In 1960, irrigated corn and grain sorghum yields were nearly the same in western Kansas. But the trend for increased yields of irrigated corn was more than 4 times that of grain sorghum. Corn yield per acre in 1989 was more than double that in 1960. Grain sorghum yield per acre increased 28 percent from 1960 to 1989. The higher trend for increased yields of corn favored the shift of acreage to corn.

The numerous changes in government programs from 1960 to 1990 likely affected crop selection in several ways. The programs of the 1960s and 1980s specified acre allotments or bases specific to each crop. Thus, changes in prices, costs, or water supply could not result in an immediate response in crop acres selected. However, the feed grain base in the 1980 farm program did provide the choice of growing either corn or grain sorghum on that base. Therefore, in the 1980s, irrigators were able to select the feed grain crop that provided the highest net return.

The farm programs of the 1970s provided the greatest flexibility for choosing the mix of irrigated crops. The set-aside requirement was for the farm and not specific to each crop. The greatest growth in acres of irrigated corn and total irrigated acres occurred in the 1970s. This growth was likely influenced largely by the uptrend in corn yield and the flexibility of the farm programs.

The downturn in total irrigated acres after 1982 was likely influenced by a less flexible government program and the high cost of energy. Irrigated agriculture in western Kansas is more energy intensive then nonirrigated; therefore, it is more sensitive to changes in energy prices and costs.

After 1987, corn was again the major irrigated crop, as it was prior to

1981. This development could have been influenced by: 1) the decline in real cost of energy after 1983 and 2) the government program allowing a shift to corn acres using the feed grain base.

References

1. Kansas Farm Facts, 1960 through 1989. Kansas Agricultural Statistics, Kansas State Board of Agriculture. Topeka.

2. Hoffman, L., editor, Ash, M., Lin, W., Merrier, S. 1990. U.S. Feed Grains, Background for 1990 Farm Legislation. Economic Research Service, United State Department of Agriculture, Agricultural Information Bulletin number 604. Washington, D.C.

3. Thomas, J. G. 1982. 1982 Kansas Irrigation Survey. Engineering Newsletter, Kansas Cooperative Extension Service, Kansas State University, Manhattan.

Appendix

Table A-1. Irrigated acres in western Kansas by crop and by year.

Irrigated Acres					% of Total Acres		
Total (acre)	Corn (acre)	Gr Sorg (acre)	Wheat (acre)	Year	Corn %	Gr Sorg %	Wheat %
583810	144110	291700	148000	1960	24.7	50.0	25.4
480100	73300	226800	180000	1961	15.3	47.2	37.5
488000	79900	242100	166000	1962	16.4	49.6	34.0
513880	88580	237300	188000	1963	17.2	46.2	36.6
M	68140	M	M	1964	M	M	M
677900	79500	345400	253000	1965	11.7	51.0	37.3
727800	127000	365800	235000	1966	17.4	50.3	32.3
819850	176650	370200	273000	1967	21.5	45.2	33.3
979300	244000	443300	292000	1968	24.9	45.3	29.8
1046800	328700	454100	264000	1969	31.4	43.4	25.2
1064800	424900	425900	214000	1970	39.9	40.0	20.1
1117050	469950	422100	225000	1971	42.1	37.8	20.1
1160150	484850	414300	261000	1972	41.8	35.7	22.5
1246500	675000	317500	254000	1973	54.2	25.5	20.4
1443800	853200	288200	302400	1974	59.1	20.0	20.9
1583900	882800	301700	399400	1975	55.7	19.0	25.2
1706600	996000	323100	387500	1976	58.4	18.9	22.7
1882200	993200	472600	416400	1977	52.8	25.1	22.1
1658100	825700	457400	375000	1978	49.8	27.6	22.6
1646800	759700	458600	428500	1979	46.1	27.8	26.0
1616900	586600	529900	500400	1980	36.3	32.8	30.9
1923100	659600	638900	624600	1981	34.3	33.2	32.5
1969500	615000	633400	721100	1982	31.2	32.2	36.6
1409100	445900	397100	566100	1983	31.6	28.2	40.2
1744600	467900	549700	727000	1984	26.8	31.5	41.7
1863200	528200	588200	746800	1985	28.3	31.6	40.1
1738700	592600	514100	632000	1986	34.1	29.6	36.3
1469900	477000	400900	592000	1987	32.5	27.3	40.3
1401800	527700	349000	525100	1988	37.6	24.9	37.5
1599800	601800	411000	587000	1989	37.6	25.7	36.7

Source: (1) Kansas Farm Facts.
"M" denotes missing data.