CROP WATER USE IN THE MISSISSIPPI DELTA

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Irrigation development started on a limited scale in the early 1900s in the Mississippi Delta. Rice was the main agriculture crop utilizing irrigation at that time. There were a few wells installed but poor pump efficiency and low markets for rice stymied growth until about 1948 when there were a few more wells drilled. In 1950, good markets brought rapid development of the rice acreage using both surface and groundwater. Droughts in 1951-1954 made it apparent that surface water was a limited supply, and groundwater was the most dependable source. By 1953, the importance of supplemental irrigation for row crops and pasture was recognized.

Rice irrigation was near 5,000 acres in 1948, and by 1953 it had increased to almost 80,000 acres. In the following years, it stabilized at just less than 60,000 acres. When the acreage controls were dropped in 1975, the acreage almost doubled to about 175,000 acres. Since that time, rice acreage grew to a high of 400,000 acres but has since stabilized to around 200,000 acres annual planting.

By 1954, there were approximately 360 irrigation wells in the Delta. Of the total, about 310 were for rice, and the remaining 50 were on cotton, soybeans, other row crops and pasture. By January 1955, there were 450 wells and for a period of time wells were being installed at the rate of 60-70 per month. At the end of the year in 1955, there were more than 900 irrigation wells; most of the new development had been for cotton and other row crops or pasture.

In 1955, the total irrigated acreage, including rice, was about 155,000 acres. This grew to almost 195,000 acres by 1956 and declined to 169,000 the next year. Over the next decade, irrigation came and went with dry seasons, wet seasons, production problems and lack of good irrigation management technology. By the late sixties, 281,000 acres had the potential for irrigation.

The irrigation system of choice through this time was wild flooding, siphon tubes, and hand move sprinkler systems. The labor requirements and production problems discouraged many producers from further development. The first land leveling demonstration conducted by the Extension Service and SCS was in Holmes County on about twenty acres of land in the late fifties or early sixties. This opened up development for better surface irrigation practices. Various types of sprinklers were also tried, side-roll systems, traveling booms, and an assortment of sprinkler sizes on different systems. The first center pivot was a water drive system installed in the Tunica or Clarksdale area in the mid-fifties. There were also some scattered small scale irrigation systems on vegetable crops all over the state.

Development was very slow during the seventies. In 1975, the estimated acreage was 330,000 with only 6,000 acres utilizing sprinkler systems. In 1984, irrigated acreage had increased to 470,000 with sprinkler irrigation increasing to 12,000 acres.

The greatest development in irrigation has taken place since the late seventies and early eighties (Figure 1) because of droughts, need for increased production, and improved technology. In 1992, it was estimated that there were 1.18 million acres in the state with irrigation capability. Surface systems are still the predominant type, utilizing 788,000 acres and sprinklers, 388,000 acres. Low flow or drip systems are used on about 3,500 acres in the state.

System technology has made great strides since the first irrigation development at the turn of the century. Land forming that was traditionally done with a level and dirt movers is now done with lasers. Precision grades can be put on a field with little effort and done at least cost. Land can even be formed with zero grades if desired. This was almost impossible with early equipment. The electronic and computer age has tremendously improved surface irrigation capability.

Surface irrigation systems have also seen dramatic changes in technology. Systems have gone from wild floods to siphon tubes to gated pipe and now disposable roll-out gated pipe. There is also technology available for automating gated pipe systems to help increase the efficiency of distribution of water on a field. Some of the same weather and management problems that

producers were faced with almost a century ago still plague them today.

The greatest technical change in irrigation systems has been in the area of sprinkler systems. In the late 1940's, most sprinkler systems were hand move systems or some similar types. Side roll systems were an automated hand move on giant steel wheels where the system could be moved all at one time or the tow line which was hand move pipe towed in a string behind a tractor all at one time in a serpentine pattern. Various types of self-propelled travelers then came on the market, traveling boom systems, hose drag travelers, and eventually the hard hose traveler that is used today. The center pivots came on the market in the mid-fifties. The first systems were water drive units with high pressure nozzles on them, then oil, hydraulic, and electric systems were developed. Nozzles were developed to operate at lower pressures; thus, the systems that are predominant in irrigation today. The electric drive low pressure pivot is the predominant sprinkler in Mississippi today. It has grown from a mere 6,000 acres in the early fifties to almost 400,000 acres today. It is usually the preferred system because of its ability to put out prescription amounts of water during operation.

Irrigation has grown tremendously in the past century. Technology has certainly increased its useability and efficiency, yet management is still the key to making it a profitable tool. With the technical advances made, producers still face some of the same decisions and problems that faced the early irrigated producers of this century. Market prices, adverse weather, insects and many other problems that face agriculture during a production year are still the same or very similar to those of almost 100 years ago. Technology has brought production agriculture a long way, yet sometimes it seems as though it hasn't advanced much at all.

In 1993, there were 2 million total acres of soybeans in the state, 1.33 million total acres of cotton, 250,000 total acres of rice, 220,000 total acres of corn, and 70,000 total acres of grain sorghum. This totalled about 3.9 million acres of row crops and rice (Figure 2). Of that, there was about 1.2 million acres of row crops and rice under irrigation in 1993 (Figure 3). Flood irrigation accounted for 435,000 acres, gated pipe systems occupied 363,000 acres, pivots 375,000 acres, other sprinklers 29,000 acres, and low flow (drip) systems were on 3,400 acres.

Irrigation in Mississippi is a supplemental system. The state averages 56 inches of rainfall per year. The reason for irrigation is not lack of water but the poor distribution during the growing season. Rainfall distribution is one of the main factors (Table 1) of water use in the state and Delta. Planting date is another factor in water use. Corn is an example of a crop that is planted in late March or early April in the Delta and sometimes does not need irrigation until grain filling, if at all. Other crops planted later in the spring will require water earlier in the reproductive period because of the lack of rainfall in late June, July, August, September, and October. Along with planting date, the maturity length of a crop will dictate the water use patterns during the growing season. Soil type is a major factor in the amount of water that will need to be supplied supplementally to a crop. Water holding capacity and soil depth are the limiting factors, soil depth more than water holding capacity because some of the soils in the Delta are only 18-24 inches deep and are over a poorly drained clay layer. Soils like this restrict root development and limit available soil moisture reservoirs. Irrigation system efficiency also has an effect on crop water use because of its ability to meet the crop requirement with a fixed volume of water over the entire field or season.

Crop water use in the field is different from actual ET of a crop. The factors that affect water use also affect the efficiency of the system and the gross irrigation requirement. In field water use for rice will average 30-36 inches per acre per year. If flushing is required to establish a stand of rice, the per acre use will increase 3 to 4 inches per year for each flush. Cotton irrigated with a pivot system will average 4 to 6 inches per acre per year, and furrow irrigated cotton will average 6 to 9 inches. Soybeans irrigated with a pivot system will average 4 to 6 inches per acre per year, while the flood and furrow systems will average 3 to 9 inches per year. Corn and grain sorghum will average only 3 to 6 inches per acre per year regardless of the system used. Other crops depending on planting date and length of maturity will average 3 to 9 inches per acre per year depending on the type of system used. Research has shown very similar numbers for water use of different crops (Table 2). Total water use in the state is about 1.2 million acre feet per year. Rice is the largest water user, soybeans are second, cotton third, and other crops follow. Aquaculture water use is not included in this report.

Of the major irrigated crops, about 30 percent of the cotton is irrigated (405,000 acres) (Figure 4), 24 percent of the soybeans (470,000 acres) (Figure 5), 24 percent of the corn (60,000 acres), 11 percent of the grain sorghum (7,800 acres), and about 50 percent of the peanuts (3,000 acres) (Figure 6). These comprise the major irrigation in the state with most of the acreage in the Delta. There are some irrigated vegetables, fruits, nuts, and turf in the Delta and the rest of the state, too.

There are several types of irrigation systems used in the Delta and throughout the state. Flood irrigation makes up 435,000 acres which is predominately used for rice and soybeans in rotation with rice. Center pivot/linear move systems are used on 375,000 acres; this is the preferred system for cotton and used on corn, some soybeans, peanuts, and other row crops. Furrow irrigation is on 363,000 acres; this is gated and roll-out pipe and is used on all row crops including a small acreage of rice. Pivot systems typically use less water because of their efficiency (85 percent), while flood and furrow system efficiency ranges from 40 to 65 percent. Other sprinkler systems make up 29,000 acres; this includes traveling guns, solid set, hand move, and wheel line systems. These systems are used on several different crops. There are 3,400 acres of drip or low flow systems used statewide, predominately on fruits, nuts, and vegetables.

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Table I

Water Use Factors

Supplemental Irrigation

* **Rainfall distribution**
* **Planting Date**
* **Maturity Length**
* **Soil Type**
* **System Efficiency**

Table II

Crop Water Use

Research Based

Crop	Irrig. Range In./ac.	Average Irr. In./ac.	Total Irrig. MS ac./fL
Cotton	0-5"	6	202500
Soybeans	0-20"	9	352500
Rice	12-42"	32	653333
Other Crops	0-6"	4	23600
Total Use			1231933

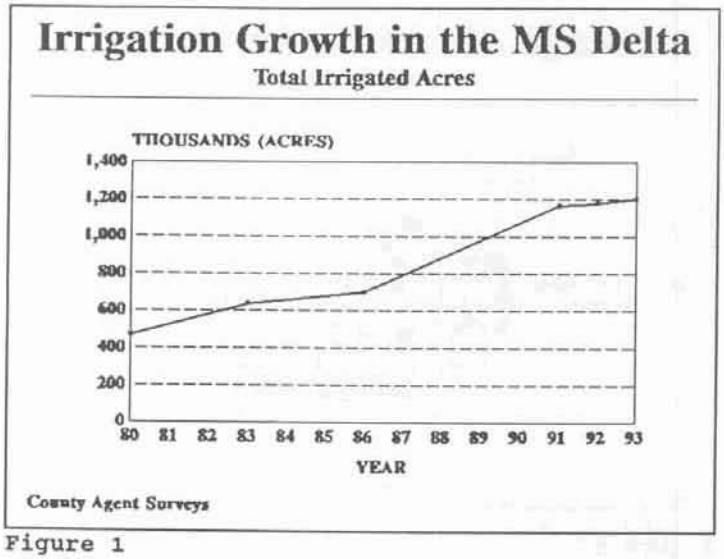


Figure 1

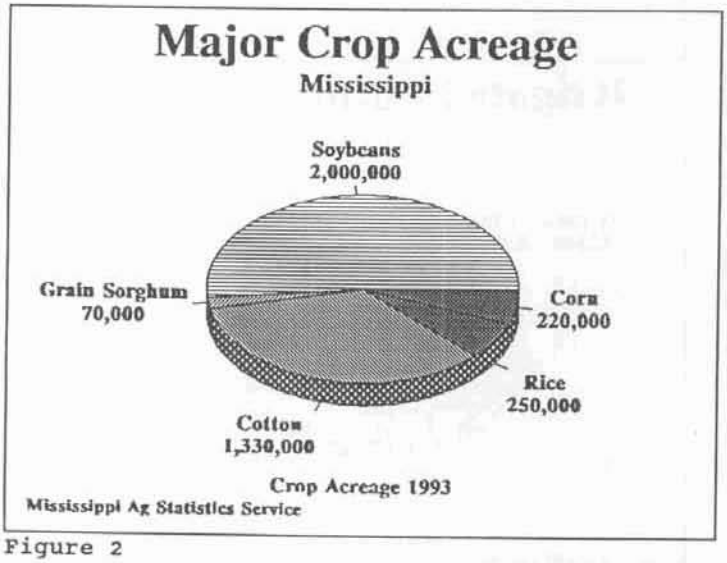
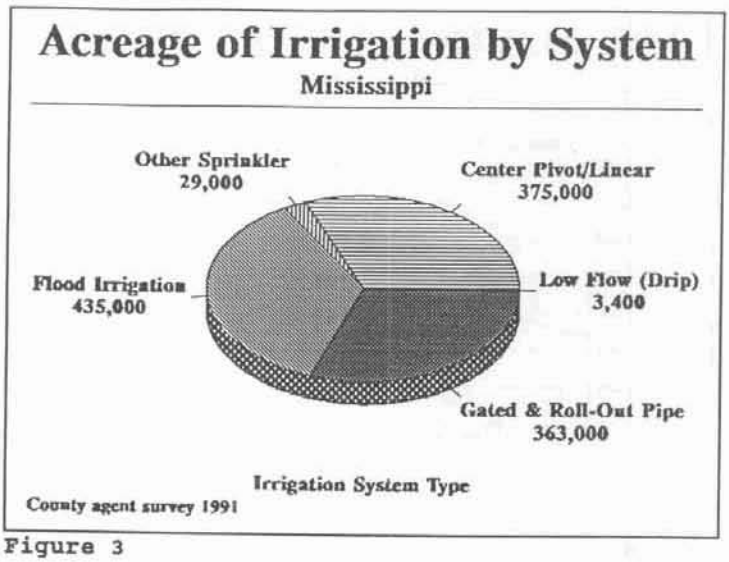


Figure 2



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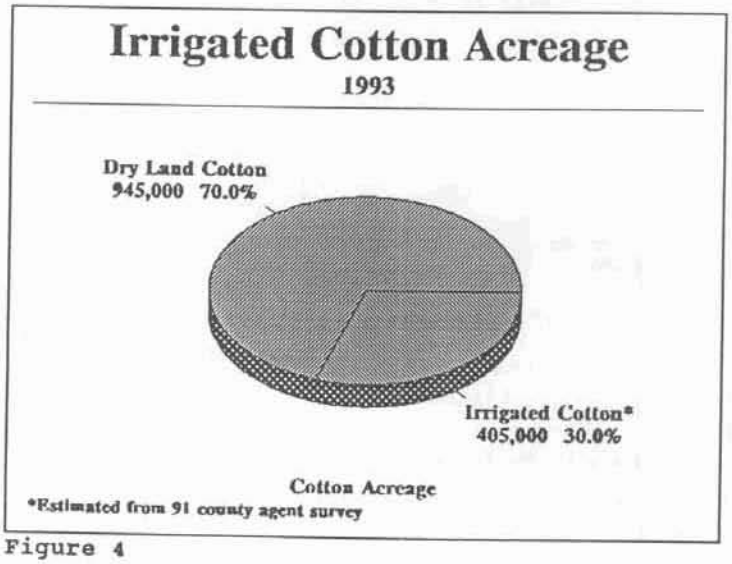

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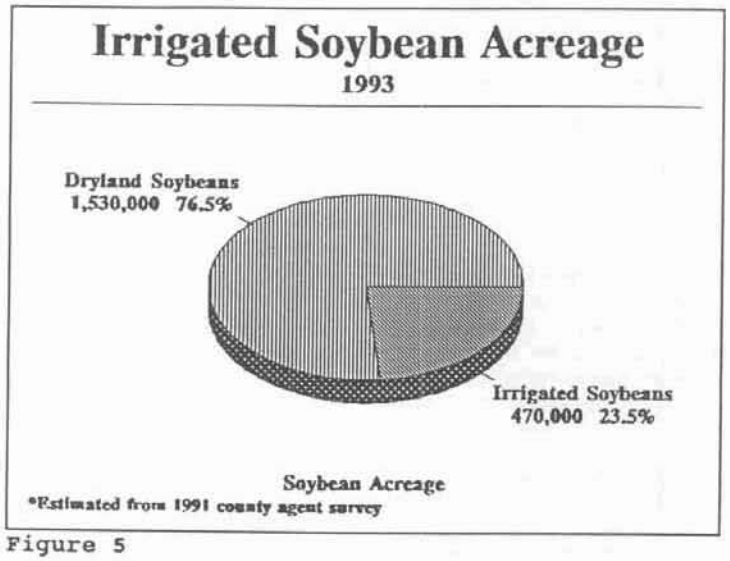

Figure 5

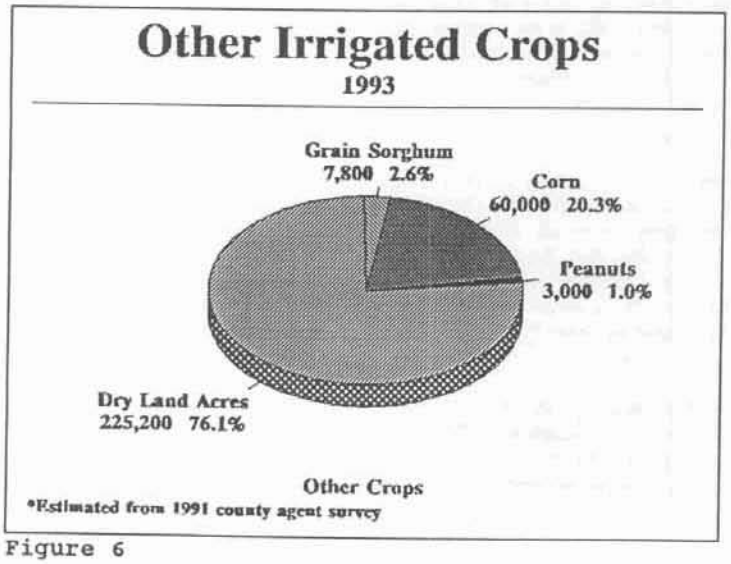

Figure 6