[WWW.MSSOY.ORG](http://www.mssoy.org) ⟹ MSPB WEBSITE WITH UP-TO-DATE SOYBEAN PRODUCTION INFORMATION

IRRIGATION WATER CONSERVATION FOR THE MISSISSIPPI DELTA

Soybean producers in Mississippi irrigate the third most acres in the US, second only to Nebraska and Arkansas. The vast majority of these irrigated soybean acres are in the Delta.

The Yazoo Mississippi Delta Joint Water Management District (YMD) estimates number of irrigated acres and amount of irrigation water applied to the major crops grown in the Delta. Most of this water is pumped from the Mississippi River Valley Alluvial Aquifer (MRVAA).

Data for 2010 are shown in the below Table 1. It is obvious that irrigation water applied to soybeans is a significant amount of the total amount of irrigation water applied in the Delta.

Table 1. Estimated irrigation water use by crops in the Mississippi Delta in 2010.

Crop	Estimated Irrigated acres	Estimated water use: Per acre (acre-ft.)	Per crop (acre-ft.)
Corn	297,300	0.8 (9.6 in.)	237,840
Cotton	170,518	0.7 (8.4 in.)	119,363
Rice	308,523	3.4 (40.8 in.)	1,048,978
Soybeans	904,808	1.1 (13.2 in.)	995,289
Aquaculture	38,573	3.0 (36 in.)	115,719
		Total	2,517,189

Data provided by Mark Stiles, YMD, Stoneville, MS.

Each year, the YMD also makes measurements throughout the Delta to estimate water volume changes in the alluvial aquifer. During the 2005-2010 period, the estimated change in the aquifer level averaged a loss of about 234,000 acre-ft/year; the change was negative in 5 of the 6 years. In fact, over the last 24 years that these measurements have been made, 15 years have shown estimated declines in the aquifer level. Obviously, this is a matter of concern.

There are numerous practices and tools [article, video, Pipe Planner] that can be applied to abate this decline in the aquifer and contribute to its sustainability. These include land leveling to zero grade, using PHAUCET/Pipe Planner to ensure uniform watering of irregularly-shaped fields and reduce runoff from irrigated fields, using surge valves to reduce water lost to deep percolation, recapturing runoff irrigation water [tailwater recovery], and using on-farm surface water storage (OFWS video) systems.

Two points about OFWS for irrigation purposes.

- Water captured in impoundment structures for future irrigation use provides positive downstream water quality benefits.
- Impounded water from winter rains can be used for early irrigations, thus reducing the amount of groundwater needed or used for irrigation during the season. This conservation measure is being evaluated to determine just what the savings will be for a given amount of land that is 1) irrigated, and 2) used for impounding water.

There are other options that can be considered for reducing the decline in the MRVAA. First and foremost is the application of less irrigation water to meet crop needs. Consider the following.

- If soybean irrigation in the Delta is cut by 1 acre-inch each year, an estimated 75,666 acre-ft. of water will be conserved.
- If soybean irrigation in the Delta is cut by 2 acre-inches each year, an estimated 151,333 acre-ft. of water will be conserved.
- If soybean irrigation in the Delta is cut by 3 acre-inches each year, an estimated 227,000 acre-ft. of water will be conserved. This amount is essentially equal to the average drop in the aquifer over the last 6 years.

There is over 20 years of irrigation research data from Stoneville to indicate that on average no more than 11.5 in. of irrigation water are required to achieve maximum yield when soybeans are planted before May 1. Also, if plantings are made in the first half of April, it is estimated that an average of about 7.5 in. of irrigation water will be required to achieve maximum yield. Both of these amounts are well below the 13.2 in. of irrigation water estimated to have been applied to soybeans in the Delta in 2010.

So simply managing planting date can minimize the amount of irrigation water needed to irrigate soybeans for maximum yield.

Another less-attractive option is irrigating with limited water. This concept is explained in an article published by Colorado State University. It may be what the future will be if irrigation and crop management practices for water conservation are not widely adopted or are not successful on a wide scale in the Delta during the foreseeable future.

There may be cases where only a limited amount of irrigation water is available, and it is not enough for full reproductive phase irrigation. It can be allocated for use during early reproductive development to establish maximum number of seeds, or to the latter stages of reproductive development to maximize weight of seeds. However, neither of these practices produces the maximum yield that may be required to maximize net returns unless adequate rain is received during periods of no irrigation.

The use of limited irrigation early in the reproductive phase [R3 to R5] can ensure maximum number of pods, and is advantageous if rains are received during the latter stages of reproductive development. The use of limited irrigation only during the seedfill period [R5-R6.5] can be advantageous for ensuring maximum weight of seed, but this approach assumes that adequate rain was received during the R3 to R5 period to achieve adequate podset and number of seed.

The probability of receiving rain during the early reproductive period is greater than the probability of receiving rain during the seedfill period [late July through early September] in regions with a high percentage of irrigated soybean.

Thus, in cases with limited irrigation water, irrigation during the podset and seedfill periods appears to provide the greatest probability for maximizing yield. This appears less risky than irrigating earlier and depending on infrequent late-season rain to enlarge the high number of seed that were set as a result of irrigation during early reproductive development.

This approach assumes that a reasonably high number of pod sites were formed in the absence of irrigation during early reproductive development. In hot and dry years that provide an extremely low yield potential, a single irrigation with a small amount of water—e.g. 1 in.—at any reproductive growth stage is of no consequence toward improving yield to profitable levels.

The estimated dates of stages in Table 2 below can be used as a guide for planning application of limited water later in the growing season. For extremely limited irrigation that is initiated at R5, R5 dates fall roughly halfway between the dates for R3 and R6.

CONCLUSIONS

Several research approaches are needed in the coming years to determine what route to take to reduce the amount of irrigation water applied to soybeans while still maintaining near maximum profitability, and to reduce dependence on water pumped from the MRVAA.

- Determine the yield and economic effects of reducing seasonal irrigation amounts applied to soybeans over the usual irrigation period.
- Determine how and when irrigating with limited water will affect soybean yields and net returns.
- Develop and/or identify new technology and

tools that can be used to increase irrigation efficiency.

- Determine the economic and water savings results from OFWS to offset irrigation water pumped from the MRVAA.
- All of these options and tools must be considered to reduce amount of water used for crop irrigation, and most may be necessary to achieve the long-term sustainability of the MRVAA.

Composed by Larry G. Heatherly, Rev. Dec. 2024,
larryh91746@gmail.com

Table 2. Estimated range of dates for occurrence of R1, R3, and R6 of MG 4, 5, and 6 soybeans planted in central Mississippi during indicated periods of April, May, and June.

		Date range of stage occurrence			Irrigation days	
MG	Planting period	R1	R3	R6	R1-R6	R3-R6
4	Early April	May 15-19	June 2-5	July 23-26	69	51
	Mid-April	May 20-24	June 11-14	July 29-Aug. 1	70	48
	Late April	June 1-5	June 20-23	Aug. 8-11	68	49
	Early May	June 10-14	July 2-5	Aug. 13-16	64	42
	Mid-May	June 20-24	July 12-15	Aug. 21-24	62	40
	Late May	July 1-5	July 20-23	Aug. 30–Sept. 2	60	41
	Early June	July 10-14	July 27-30	Sept. 1-4	53	36
5	Early April	June 1-5	June 24-27	Aug. 16-19	76	53
	Mid-April	June 7-11	July 1-4	Aug. 21-24	75	51
	Late April	June 15-19	July 9-12	Aug. 27-30	72	49
	Early May	June 26-30	July 18-21	Sept. 1-4	67	45
	Mid-May	July 4-8	July 25-28	Sept. 5-8	63	42
	Late May	July 12-16	July 30–Aug. 2	Sept. 10-13	60	42
	Early June	July 20-24	Aug. 3-6	Sept. 12-15	53	40
6	Early May	July 5-9	Aug. 4-7	Sept. 14-17	71	41
	Mid-May	July 14-18	Aug. 11-14	Sept. 19-22	67	39
	Late May	July 20-24	Aug. 15-18	Sept. 20-23	62	36
	Early June	July 30–Aug. 3	Aug. 20-23	Sept. 23-26	55	34