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## Summary of Irrigated Soybean Research in Michigan

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Nearly 100,000 acres of soybeans are grown under irrigation in Michigan. Yield increases due to irrigation water applications are common in Michigan. However, the yield increases have been highly variable and lower than expected. This fact sheet summarizes soybean irrigation research conducted in Southwest Michigan from 2001 to 2003. Utilizing this information will help producers improve irrigated soybean yields.

There are several reasons why irrigated soybean yields have been inconsistent and have not met expectations in Michigan. Irrigation water applied during the vegetative stages can lead to excess vegetative growth, lodging and shallow root systems. Irrigation water applied at flowering can increase the incidence of white mold and intensify yield reductions from late-season moisture stress. Inadequate and inconsistent water applications during the critical development stages reduces seed size. Management factors such as soil compaction, variety selection, pest management and soil nutrient management can also limit soybean yields

To address these issues, an irrigated soybean research trial was conducted at the Southwest Michigan Research and Extension Center in Benton Harbor from 2001 to 2003. The objectives of the project were: 1) to determine the irrigation schedule that optimized soybean yield in Southwest Michigan, 2) to evaluate how high-yielding soybean varieties respond to

different irrigation schedules, 3) learn how irrigation affects weed control with glyphosate and 4) learn how irrigation affects soybean aphid populations.

### Materials and Methods

Five irrigation treatments were identified and implemented in each year of the project. The irrigation treatments were based on soybean growth stage and soil moisture levels. Once the growth stage for each treatment was reached, irrigation water was applied before the soil water deficit reached 50%. The treatments are listed below:

- Full season
- Flowering (R1 to R2)
- Pod elongation (R3 to R4)
- Seed fill (R5 to R6)
- Dryland (75% maximum soil water deficit)

Soil moisture was measured weekly using TDR (Time Domain Resonance) technology. The water deficit was never allowed to exceed 75% in the dryland treatment and in any of the irrigated treatments before the crop reached the designated growth stage. No irrigation water was applied after soybeans reached the R7 growth stage.

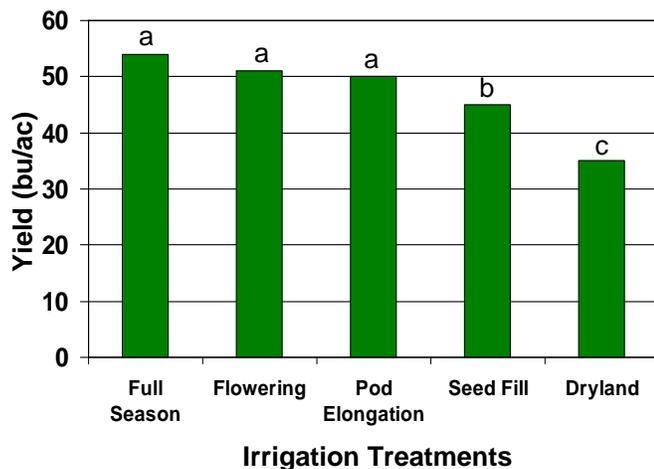
One variety was evaluated in 2001, two varieties were evaluated in 2002, and eight varieties were evaluated in 2003. The varieties were planted in 15" rows with a target population of 180,000 seeds per acre. The plots were planted on April 26 in 2001, June 7, 2002, and May 3 in 2003.



## Results and Discussion

When data from all three years and all varieties were combined, irrigation increased soybean yield 10-19 bu/ac over the dryland treatments (figure 1). Yields from the Full Season, Flowering, and Pod Elongation treatments were essentially equal. Waiting until Seed Fill to begin irrigating cost 5 bu/ac in yield but increased yields significantly compared to the dryland treatment.

**Figure 1. Effect of Five Irrigation Treatments on Soybean Yields in Southwest Michigan**



All eight varieties responded to the irrigation treatments similarly, and average yields were equal between varieties when emergence was good (2003).

**Table 1. Average Irrigation Water Applied and Water Use Efficiency for Five Irrigation Treatments from 2001 to 2003.**

Treatment	Irrigation Applied (in)	Irrigation Use Efficiency (bu/in)
Full Season	7.4	3.5
Flowering	5.3	4.3
Pod Elongation	3.9	6.1
Seed Fill	3.4	4.4
Dryland	1.0	—

In both 2002 and 2003, there was no significant interaction between irrigation treatments and varieties. This is probably because the varieties

were selected based on their performance in the St. Joseph County irrigated variety performance trial.

Two applications of glyphosate significantly improved control of common lambsquarters and large crabgrass when compared to a single application of glyphosate. However, two applications of glyphosate did not increase soybean yield compared to one application.

Soybean aphids were present in large numbers in 2003. However, aphid populations were not significantly different between any of the irrigation treatments.

## Summary

Based on the three years of data, it appears that maximizing soybean yields in Michigan is dependent on maintaining adequate soil moisture beginning at full bloom (R2) or beginning pod (R3), provided that the soil water deficit does not exceed 75% prior to that growth stage. Waiting to irrigate until pod elongation (R3-R4) maximized water use efficiency in two of the three years as long as the soil water deficit never reached 75%. In two of the three years, an emergency irrigation water application was required to prevent the soil water deficit from reaching 75% so waiting until pod elongation may not be recommended in some years. Use data from irrigated soybean variety performance trials to select high-yielding, disease resistant/tolerant varieties that resist lodging to maximize irrigated soybean yields.

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