Replanting Decision Based On Soybean Stand Establishment and Cultivar Maturity

T. C. Helms and **S. S. Hla**

Soybean *(Glycine max L.)* stands with poor emergence often are replanted without considering the yield compensating ability of the plants in the initial stand. The yield of an initial planting at less than full stand must be compared to the yield of the replanted crop to determine if replanting is justified. Replanting costs include seed, tillage and labor. The yield of a replanted crop must be sufficiently greater than the yield of the initial planting to cover the expenses associated with replanting. Risk of fall frost damage to the replanted crop must be considered when deciding the maturity of the cultivar selected for replanting.

Planting delayed past the optimium time can decrease yield (4, 6). Replanting delays maturity of the crop. In the midwest, the average maturity date is retarded approximately one day for each three days delay in planting (8). The genetic maturity differences among cultivars and the date of planting are primary factors affecting date of physiological maturity (1).

A plant population of 125,000 plants per acre has been found to be adequate for maximium yield (7). However, when plant population is less than adequate, yield loss may occur. Soybeans have the ability to partially compensate for gaps in stand and plant population by branching out (3, 5). The plant density within each row influences the potential yield. Increasing the population within the row tends to increase the plant height lodging, and height of the lowest pod (2).

The objectives of this experiment were to compare the yield of replanting with the yield of an initial planting at less than optimium stand establishment and to determine if a full-season or early-maturing cultivar should be replanted.

MATERIALS AND METHODS

McCall and Ozzie soybean cultivars were planted approximately May 15 and June 4 at Fargo, Casselton, and Great Bend in 1989 and 1990. Rates of seeding were 221,000 and 92,000 seeds per acre. Two foot gaps in rows were created before the third trifoliate leaf was fully expanded. Check plots with no gaps and plots with 25 percent and 50 percent of the plot consisting of 2-foot gaps in the stand were factorially combined with the two seeding rates. Plots consisted of four rows spaced 30 inches apart and were 21 feet long. The plots were end trimmed to 16 feet prior to harvest and only the middle two rows of a four row plot were harvested. The outside two rows of a four row plot did not have any gaps in stand and were the same seeding rate as the middle two rows. Grain yield adjusted to 10 percent moisture and physiological maturity were recorded on all plots. Physiological maturity was defined as the calender date when 95 percent of the pods in a plot were the mature plant color.

Weeds were controlled with bentazon (Basagran) plus surfactant (Herbimax) at recommended rates and by hand hoeing. The experimental design was a split-split plot. Whole plots were assigned to planting dates, split plots were assigned to cultivars and split-split plots were a factorial combination of seeding rates and gaps in stand. Three replicates were used at each of the six environments evaluated.

RESULTS DISCUSSION

In this experiment, planting date did not affect grain yield. Averaged over both cultivars, the physiological maturity of the May 15 planting date was September 11 and that of the June 4 planting date was September 18. Grain yield of McCall was less than that of Ozzie. McCall matured earlier than Ozzie (Table 1). The probability of a killing frost one week before physiological maturity is greater for Ozzie than McCall on both planting dates (Table 2).

Decreasing seeding rate from 221,000 to 92,000 seeds per acre reduced yield by the same amount for each gap in stand

Table 1. Yield and physiological maturity (PM) of two cultivars averaged over two planting dates.

Cultivar	Yield	PM
	bu/A	date
McCall	17.4	Sept. 9
Ozzie	21.0	Sept. 20
LSD (0.05)	2.8	4

Helms is assistant professor, Depatment of Crop and Weed Sciences. Hla is former graduate student, Agronomy Division, A. R. I. Yezin Pyinrmana, Union of Myanmar.

Table 2. Probability of a killing frost (28 ° F) for the dates one week before physiological maturity (PM) for two cultivars at two dates of planting.[1]

Cultivar	May 15	June 4
	Probability	
McCall[2]	0%	0%
Ozzie[3]	<5%	<10%

[1] Data provided by Dr. J.W. Enz, Soil Science Department, NDSU.
[2] Dates one week before PM dates of McCall are August 29 and September 6 for May 15 and June 4 plantings, respectively.
[3] Dates one week before PM dates of Ozzie are September 10 and September 16 for May 15 and June 4 plantings, respectively.

treatment. Because the seeding rate by gaps in stand interaction was nonsignificant, seeding rate and gaps in stand were combined into a single treatment which was labeled plant population. Yield decreased as plant population decreased (Table 3).

The three-week difference in the planting dates evaluated in this experiment did not affect yield. If weather conditions delayed replanting by more than three weeks, yield differences between planting dates might exist. Risk of fall frost damage before physiological maturity would increase as planting date was delayed. If replanting was necessary and could be completed by about June 4, the risk of fall frost damage is small.

Ozzie yielded more than McCall but the risk of fall frost damage is greater for Ozzie than McCall, due to the later maturity of Ozzie. If Ozzie was replanted and the crop was completely lost 10 percent of the time due to frost damage, the long term yield average of Ozzie would be 90%(21.0) + 10%(0.0) = 18.9 bushels per acre. The long term average of McCall would be 17.4 bushels per acre. The 18.9 bushels per acre long term average yield of replanted Ozzie would be a minimium because some yield would be produced the 10% of the years that a killing frost occurs before Ozzie matures.

Based on long-term climatological data, a full-season cultivar (Ozzie) would be a superior choice to a short-season cultivar (McCall) provided replanting could be completed prior to June 4. This experiment was conducted in years that were below average in precipitation. When averaged over years of normal precipitation, the long term average yield of McCall would be greater than 17.4 bushels per acre and the long term average yield of Ozzie would be greater than 18.9 bushels per acre. However, regardless of the precipitation amounts in a given year, Ozzie would be expected to yield more than McCall.

The plant population that would economically justify replanting would depend on the costs of seed, tillage, and labor. Cost of replanting would vary, but a stand of less than 76,000 plants per acre would be required to justify replanting costs. Provided gaps in stand were less than 2 feet in length, lack of uniformity in stand establishment would not complicate the decision of when to replant. The lack of a seeding rate by gaps in stand interaction suggests that it is only necessary to count the plants per acre, regardless of how evenly the plants are distributed.

Table 3. Yield of six plant populations averaged over two culivars, two planting dates and six environments.

Plant Population	Yield
plants/A	bu/A
152,000	23.0
114,000	20.7
76,000	18.4
62,000	19.9
47,000	17.9
31,000	15.3
LSD (0.05)	1.3

CONCLUSION

Yield decreased as plant population decreased from 152,000 to 114,000 plants per acre. However, due to costs of replanting, a stand density of less than 76,000 plants/acre would probably be required to justify replanting. If replanting was necessary and could be completed by June 4, a full-season cultivar would be a better choice than a short-season cultivar. Risk of yield loss due to fall frost is greater for Ozzie than McCall. However, averaged over time the increased yield of Ozzie compared to McCall economically justifies the increased risk of frost damage to Ozzie.

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