

# Soybean Plow Down Nitrogen

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A multi-year study was conducted to determine if soybeans planted after wheat harvest could fix enough nitrogen for a succeeding corn crop to be an economically viable activity. The positive and negative attributes of such an activity would be:

## Positive

- Potentially fix up to 150 lbs. of nitrogen
- Reduced nitrogen cost
- Reduced need for nitrogen stabilizers
- Reduced nitrogen contamination of water resources
- Reduced soil compaction due to nitrogen application
- Reduced weed seed production following wheat harvest
- A potential use for 2.4 million bushels of soybean seed
- Recovery of nitrogen left in soil by the wheat crop
- Potential reduction in succeeding crop weed control cost

## Negative

- Cost of soybean seed
- Cost of herbicides for weed control
- Cost of planting operation

The research project was designed to answer several questions relative to the production and recovery of a maximum amount of nitrogen:

- What relative maturity should the soybean variety have?
- Would more vegetative or reproductive growth be more desirable?
- Should the residue be incorporated or left on the soil surface?
- Would super-nodulating varieties be superior for this purpose?

## Procedure

The study was begun with the no-till seeding of six soybean varieties following wheat harvest in 1993. Maturity Groups 2, 3, 4, and 7 were represented with one of the group 4 and group 7 varieties having the super-nodulating gene. Treatments were replicated four times, and plots were large enough to permit four different tillage systems to incorporate the residue following the death of plants by freezing. Tillage systems included no-till, spring disking, fall chisel/spring disking, and fall moldboard/spring disking.

Within the study, 24 additional plots had herbicides applied but were not planted to soybeans for the purpose of applying varying rates of nitrogen the following spring to produce a yield

response curve for nitrogen rate. Corn yields from the soybean residue plots would be compared to the curve to determine how much corn yield was due to nitrogen supplied by the soybeans. The study was designed for two years and was conducted at two locations (Wood County and Union County) each year.

A soybean seeding rate of 250,000 seeds per acre was applied with a Great Plains No-Till drill 10-feet wide. Planting was planned to immediately follow harvest but was typically accomplished about two weeks after harvest due to rainfall or other reasons. Roundup was used for a burn down and was applied with appropriate residual weed-control materials. Hybrid selection and planting rate were determined by the cooperator.

No nitrogen was applied to the research area with exception of the non-soybean residue plots which received nitrogen at rates of either 0, 50, 100, 150, 200, or 250 pounds of nitrogen per acre as a 28% nitrogen solution to develop the nitrogen response curve. Weed control for the study was accomplished with Roundup and appropriate residual materials.

Of the six attempts to collect meaningful data, only two were successful. This research program raised more questions than it answered as is often the case when attempting to create new technology. The combined results of the two data sets are shown in the accompanying chart on the next page.

Two important questions were answered (see the chart). First: For nitrogen to be recovered from this type of system, tillage will be necessary. Second: Soybean varieties should be of appropriate maturity to be actively filling pods when they are killed. The rate of nitrogen fixation is greatest when the plants are producing protein and depositing it in grain. Both results agree with known biological principles.

Unfortunately, there were not enough observations to determine the amount of nitrogen that can be fixed by this system. Another unknown is what percent of the fixed nitrogen could be recovered the following year by corn and how much would be left for the second following crop. Additional research of this nature should be conducted on soil with lower nitrogen supplying capacities to make the results more definitive and more easily interpreted. If more research is to be conducted on this topic, then the number of treatments can be reduced to those where the soybean variety would be near physiological maturity when killed. The amount of tillage needed for residue incorporation should be refined.

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