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Scientist compares soybeans on flat ground versus beds

David Bennett [1] | Jan 18, 2008

Since the Mid-South largely adopted Roundup Ready technology, farmers have moved to a reduced/no-till mentality. While understandable, it may not be the best approach for maximizing soybean yields.

“I hear, ‘I don't want to till any more than I have to. I want to get by with as little tillage as possible and reduce inputs and save time,’” said Dan Poston, MSU weed scientist/Northwest District soybean specialist, at the annual Tri-State Soybean Forum in Dumas, Ark. “And there's justification for those beliefs.”

Since 2006, Poston and several of his graduate students have been conducting studies to find how much the get-by-as-cheaply-as-we-can approach is costing growers. That's especially important in an area of the country where drainage is such a major issue.

One focus of their research: bedding up soybeans. “Growers say, ‘Yeah, I want to go with a bedding system but can't make it profitable. It costs too much and is too aggravating, and I'm not going back to the tillage business.’ What I hope to accomplish is to provide some real-world numbers on what that mentality is costing us in some Mississippi Alluvial floodplain fields.”

It's estimated that some 85 percent of Mississippi Delta soils are heavy to mixed clay. Those soils are “where we grow most of our soybeans. That means drainage is the number one problem in the state in terms of production constraints.”

Mississippi has widely adopted early soybean production systems. There are years when farmers plant 80 to 90 percent of all soybean fields prior to the first week of May.

Another thing to consider: a lot of Mississippi soybeans are grown in rotation with rice. “Rice farmers tend to plant flat and cascade flood irrigate. A lot of the rice producers are resistant to some sort of bedding system because of equipment constraints.”

To do the research, “we found a grower/cooperator close to the (Stoneville Research Station). He had a 32-acre field that wasn't easy to irrigate. We knew he had drainage issues despite having a two-tenths slope, which is more slope than is found on many of our Delta fields, especially in bean/rice rotations.

“You'd think you could get water on and off this field easily. Basically, he flood-irrigated with polypipe from the top to the bottom of the field, which has heavy to mixed-clay soils.

“The field had been in no-till for at least four years, possibly eight, or more. The farmer couldn't remember if he'd run a land plane four or five year earlier.”

Poston and colleagues divided the field into three areas. One area was a tillage study: no-till, surface-till

and deep-till. The second trial compared raised and flat-plantings where “we hipped up beds. Third, we were looking at some rotation effects.”

Large strip plots were 700 to 800 feet long. “We got by pretty cheaply. We hipped with a disk hipper, which isn't the most popular nowadays. We knocked off the beds in the spring and planted. Keep that in mind as we talk about economics.”

For the flat areas, Poston disked one time in the fall and planted stale in the spring. He elected to disk the flat-planted areas to bury the residue with the disk harrow, because “we didn't want differences in disease pressure (between raised and flat tests) due to inoculum lying on the surface.”

The research team chose two commonly planted varieties: Asgrow 4403, “an old standby that doesn't like wet feet,” and Pioneer 94B73, “a somewhat flood-tolerant bean.”

Four sets with 16 rows of raised beds and 16 flat rows were constructed. “So we set up a comparison between border irrigation and raised beds. And the differences in yields are pretty staggering. But if this was a study on a true, flat-planted area where water meandered across the field, the yield differences might have been even greater.”

The first thing Poston and colleagues found is that plants on beds grew much taller than the flat-planted.

In soybean literature, there are often discussions of leaf area index. That's the “amount of leaf area in a given amount of ground area and relates to the amount of photosynthetic area per given land area.”

The index number needs to approach 3.5 to 4 to be in an optimum zone for yield. “In the flat-planted crop at R-6, the index barely approached 3. Meanwhile, the raised bed index approached 4. So, from a growth and development standpoint, (the bedded crop) reached a far better leaf index.”

Further, the flat-planted test had “a lot of grass coming into the plots. Compare that to the raised beds where there was no grass between the rows. There was enough canopy development and closure that helped eliminate the grass problem.”

At harvest, the raised beds had very little grass. The flat-planted had to be desiccated to harvest the beans.

The grass in the middles also tended to keep moisture levels up around the beans. In such cases, “the plants tend to stay greener and will harbor insects, and the pods never dry like they should.”

In 2006, the flood-susceptible beans made 66 bushels on flat ground versus 77 bushels on raised beds. Even with the flood-tolerant variety, there was an 8-bushel advantage on the raised beds.

In 2007, “there wasn't a lot of difference in varieties, nothing statistically different.” However, averaged across varieties, there was a 17.7-bushel advantage to using a raised bed. With $11 beans, “that would pay for a lot of hippers and planters.”

In 2006, across varieties, there was almost a 10-bushel response, and “we controlled all the irrigation water. We irrigated five to six times, kept up with all the inputs.”

In 2007, the 17.7-bushel advantage came with only two irrigations. “We saved a lot of money by only irrigating once before the July rains and once after.”

Poston said that shows the yield response to raised beds in the Mississippi Delta on mixed to heavy-clay soils is “the real deal. If someone asked what one thing could be done in Mississippi to improve yields, I'd

say, ‘Row up every acre of beans we've got.’ True, some fields don't need it. But looking at a single input that would raise the state's yields, beds could easily be it.”

The team also looked at fungicides and found a 3.5-bushel response in 2006. In 2007, there was zero response.

“In 2006, we planted beans about April 19 and had enough rainfall to get disease pressure. We controlled the disease and saw a yield response.

“In 2007, we planted March 31 and had essentially no rain until July. There was no foliar moisture and that lessened disease pressure. That's the reason for the fungicidal response.”

The figures cited below include “everything — all the variable inputs — except land and overhead costs.”

In 2006, with an April 19 planting, the flood-susceptible variety returned $248 per acre versus the flood-tolerant of $286.

In 2007, “we didn't see that kind of advantage: $375 for the flood-susceptible and $358 for the flood-tolerant. The cold weather this past spring really hurt Pioneer 94B73 — it never really grew out of a bad start. It still did quite well but didn't reach its potential.”

Regardless, averaging both years, “just by choosing the right variety shows a $10 per acre advantage ($312 for the susceptible and $322 for the flood-tolerant) by putting the right variety in the right environment.”

As for bedding, net returns in 2006 provided $239 for the flat-planted versus $295 for the beds.

“That's almost $60 per acre difference. In 2007, the return was $299 for the flat-planted and $434 for the raised bed. That's a big difference and these numbers are above all the costs associated with running a hipper.”

Mississippi Delta farmers may “tell you it will take three trips across the field to get a good bed established. Costs will naturally be higher in that scenario. But even if that's true — say you need to add $20 per acre to get your beds up — these numbers can't be ignored.”

Averaged across both years, the flat-planted returned $269 per acre and the beds returned $365. That's almost $100 per acre difference by using raised beds.

After seeing such returns, says Poston, “if you still think drainage isn't the number one problem in the Mississippi alluvial floodplain, think again.”
