

Cooperator

John Gilbert, Iowa Falls

Project Timeline

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Web Link

<http://tinyurl.com/trypsininhibition>

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Low Trypsin-Inhibition soybean demonstration

Written by Sarah Carlson and Amber Anderson

Abstract

Soybeans (*Glycine max*) are an important source of protein in animal diets, fed as soybean meal. Raw soybeans contain trypsin inhibitor (TI), which reduces protein digestion, feed efficiency and limits on-farm feeding of raw, unroasted soybeans to pigs. Because the majority of the soybeans produced in the US are genetically engineered (GE), the soybean meal available for livestock feed is predominately derived from GE soybeans. No sources of non-GE soybean meal are available on the market today. Planting non-GE soybeans with low-trypsin inhibition could reduce the cost of animal feed and allow farmers to use a non-GE soybean source. Normally soybeans need to be roasted, oil extruded, and then returned to the farm as soybean meal before they are suitable to be fed to animals. New varieties of soybeans selected for low concentrations of trypsin inhibitor are being developed by eMerge Genetics, West Des Moines, IA. In 2011, a variety of low TI soybeans grown in North Central Iowa yielded similarly to other varieties from the same farm and had measurably lower levels of TI than commodity soybeans.

About the Cooperator

John Gilbert and his family run a diversified dairy, hog and grain operation near Iowa Falls. When referring to farm expenses, John pointed out, "The only cost you can control is one you don't have." John has compared protein levels of different corn hybrids to be able to reduce the amount of soybean meal fed to his animals. In 2011, he wanted to see how well the low-trypsin inhibition soybeans would yield compared to his farm average and also test their level of trypsin inhibition. The Gilberts conducted this trial to see if they can add this new soybean into their feed processing and substitute 10-20% of the normal soybean meal.

Background

Soybeans are a major source of protein globally, accounting for 63% of protein in animal feed (Cromwell, 1999). A substance contained in raw soybeans inhibits trypsin; a necessary enzyme for animal digestion. Concentrations of TI acceptable for swine

diets range from 5.3 mg/g to 18.6 mg/g (Hansen et al, 1984 and Pontif et al., 1987). Pontif et al. (1987) also found that average daily gain is reduced at concentrations as low as 1.18 mg/g of diet where soybeans are generally 20% of the diet or 5.9 mg/g in the raw soybean. TI concentrations in soybeans are expected to vary depending upon the source (De Schutter and Morris, 1990) and can range from 21.1–31.1 mg/g (Vandergrift et al, 1983). Heating raw soybeans has been shown to effectively decrease TI activity. Soybeans are currently sent to a local cooperative, or elevator, then shipped further away to a soybean processing plant for roasting and oil extruding before the soybean meal is



John Gilbert (above) and his family run a diversified dairy, hog and grain operation near Iowa Falls.

shipped back to farms for utilization in livestock diets.

If a soybean variety with innately low concentration of TI was used on farms for feeding livestock, it could decrease vulnerability to outside feed and transportation costs. Potential contamination from feeds mixed at

facilities sourcing GE or adding antibiotics to feeds raises concerns for farmers raising animals for specialty markets that require antibiotic-free feed or non-GE. Raising low TI soybeans on-farm improves an integrated crop and livestock farmer's niche products and farm profitability.

Method

John Gilbert planted two bags of Schillinger/eMerge 3111, a low TI, non-GE soybean variety. Soybean cost was \$35/bag. Maturity group of these soybeans is 3.1, a later maturity than is normally planted in the Iowa Falls area. This year, the first frost occurred earlier than normal, in mid-September rather than late September, probably reducing yields of this late maturing soybean. Soybeans were planted May 24, 2011. Weed control was obtained through a pre-plant disk and herbicide pass followed by one cultivation pass and herbicide pass after emergence. The crop was combined October 16 - 17, 2011. This project is just a demonstration to observe the soybeans yield compared to other soybean planted on the same farm and to measure the TI activity of the soybean. No replicated plots were planted.

The Agricultural Experiment Station Chemical Laboratories at the University of Missouri tested the grain for TI activity. This lab employs the American Association of Clinical Chemistry official method for testing trypsin-inhibitor activity.

Results and Discussion

Trypsin-inhibitor activity

A composite sample of the harvested, raw soybeans contained 13,599 trypsin inhibitor units/gram or approximately 7.16 mg/g. This level is within the acceptable range for pig diets (5.3-18.6 mg/g) and considerably lower than soybeans on the market today, which range between 21.1–31.1 mg/g. The 3111 soybeans could be expected to cause slower than optimal growth when fed to pigs as compared to roasted soybean

meal because of the level of TI measured. Pontif et al. (1987) found that soybeans with a TI as low as 5.9 mg/g pig gains could be negatively impacted without roasting. As further soybean development and selections occur, TI levels may decrease further to allow direct feeding of raw soybeans without reducing feed efficiency. Soybeans yielded approximately 42 bu/ac. Although yield may have been affected by the early frost these soybeans yielded similarly to other soybeans on John's farm.

Conclusions

Low TI soybeans may be a valuable option for livestock producers who would otherwise feed soybean meal. In 2011, the low-TI variety planted yielded similarly to soybeans on John Gilbert's farm. Additionally it tested within the range acceptable for pig diets, however, was not low enough to be an ideal food source if fed raw. These two factors indicate it may be beneficial enough to plant low TI soybeans as "insurance" against increasing feed and transportation costs of traditional soybean meal. Feeding trials of these and other new soybean varieties will be the next step in this project.

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