

Soybean seed trait improvements and their effects on human and animal nutrition

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Abstract

Soybean (*Glycine max*) is the number one oil and protein crop in the United States, but the seed contains several anti-nutritional factors that are undesirable to both human and livestock nutrition. Soybean seed is comprised of about 40% protein, 20% oil, and 35% carbohydrate, and modifications in these components could significantly benefit human and livestock productivity. In this research, the undesirable soybean carbohydrate raffinose, an oligosaccharide that is indigestible for monogastric animals, was reduced using RNA interference. Transgenic plant lines were recovered that exhibited dramatically reduced levels of raffinose in mature seed.

Additionally, a soymilk consumer acceptability study was conducted. In this study, several soybean traits – high oleic, low linolenic, lipoxygenase-null, and low raffinose/high sucrose – and combinations thereof were evaluated for their impact on soymilk consumer acceptance. Six soybean varieties representing a control food-grade tofu line and five improved lines were processed into plain soymilk, assayed for nutritional qualities, and subjected to a consumer acceptability panel. Consumers preferred soymilks with increased sucrose and low lipoxygenase, and disliked the high oleic trait.

Finally, a small-scale precision-fed rooster assay was conducted to measure the true metabolizable energy in wild-type and low-raffinose full-fat soybean meal. Low-raffinose soy had a measured TME of 2797 kcal/kg, compared with 2330 kcal/kg for wild-type. As low digestible energy is a major limiting factor in the percent of soybean meal that can be used in poultry diets, these results substantiate the use of higher concentrations of low-raffinose, full-fat soy in formulated diets.