Improved animal feed may be just "chicken feed"

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Over 6 billion chickens, 100 million beef cattle, 90 million pigs, 11 million sheep, and 10 million dairy cattle are clamoring to be fed. As a result, 40 million tons of commercial feed are consumed annually in the U.S. by animals of these types. Livestock and poultry in the European Community (EC) devour an estimated 35 million more tons of commercial feed annually. In addition to providing vital protein and energy to the animals' diet, feeds are formulated to optimize essential vitamins and minerals for enhanced nutritional value, weight gain, and short animal-production cycles.

The protein component of feed is the largest and most critical. The protein-rich meals of various oilseeds, specifically soybean, constitute as much as 60 percent of the total volume of commercial feeds. Meals are the solid cakes that remain after the oil is crushed from the oilseed. Indeed, over 46 million tons of soybean meal are blended into commercial feeds.

By any standard, statistics concerning animal feed are impressive, perhaps the makings of a fabulous story in which feed seems a cinch for improvement through biotechnology. And the story gets even better, because soybean is deficient in the essential amino acid, methionine. Most poultry rations are supplemented with crystalline methionine, which represents a material, added cost to the poultry producer. About 70,000 tons of methionine are now added to poultry feed in the U.S., and usage is projected to grow between 4 percent and 5 percent annually through the mid-1990s. It's easy to conclude that a methionine-rich soybean meal for poultry feed is an instinctive, obvious commercial target. Right?

So why is minimal biotech research and development (R&D) under-way to improve feed?

Variations in protein quantity and quality in soybean meal, including methionine deficiency, are well documented in the academic literature. Many of the variants even occur in nature. For instance, Central Soya (Fort Wayne, IN), a subsidiary

of Italy's Ferruzzi Group and a major supplier of soybean meal, has experimented with these natural variants by testing older soybean varieties with high protein contents.

During the 1980s, several agbiotech companies funded R&D flurries in amino-acid enhancement for feed meals. They included Molecular Genetics, a predecessor to MGI Pharma (Minneapolis, MN), Agrigenetics (Eastlake, OH), and BioTechnica (Overland Park, KS).

However, the most serious effort was mounted by the Plant Cell Research Institute (PCRI, Dublin, CA). In the early 1980s, PCRI was owned by ARCO Solar (Los Angeles, CA), which subsequently divested it to the Ferruzzi Group and SRI International (Menlo Park, CA). PCRI isolated a gene from Brazil nuts that encoded a protein rich in methionine. It successfully transformed soybean with this gene and encouraged its expression. In 1991, Pioneer Hi-Bred (Des Moines, IA) acquired this technology. Maybe Pioneer hoped to incorporate increased methionine into their commercial soybean varieties. Pioneer is well equipped to handle a specialty feed soybean through its specialty plant products division. This division is an integrated supplier of improved, identity-preserved commodities.

To this point, everything appears normal. A group of biotechnology companies pursue an excellent profit-making goal. The problems with identity-preserved feed meal lie upstream from the genetic research and the seed companies.

First, owners of large-scale, commercial broiler operations are well versed in the nutritional components of feed. Since production efficiency and low producer prices are the sources of their competitive advantage, feeding operators display interest in new feed meals only if they are cheaper and more plentiful than the meals currently used. In turn, feed manufacturers are reluctant to utilize meals that are available in limited quantity and identity-preserved. Many feed manufacturers favor improvements in meals that are broadly accessible so that dis-

turbances to supply and price are minimized.

Second, the chain of market players, from the genetics company to the finished broiler or beef, is long. Unless premiums are substantial, a new feed meal would not provide sufficient economic incentive for each participant in the chain. In addition to financial incentives for the seed and/or biotechnology company, above-market prices must be available to the contract grower of the specialty soybeans, the elevator operator and transporter who segregate and store the specialty soybeans, the crusher who processes the soybeans, the feed manufacturer, and finally the broiler producer or feedlot operator. Whew! The premiums on the specialty meal would need to be two—or perhaps three—times that of current soybean meal before many in the chain would admit satisfaction.

Soybean-processing companies are particularly demanding. They would incur extra costs to handle, crush, and market a specialty meal. As much as two-thirds of the premium of a specialty meal must flow to crushers to keep the chain of players unbroken. Perhaps companies like Pioneer Hi-Bred might avoid soybean processors by having identity-preserved soybeans grown and crushed on contract. Such a move would meaningfully reduce the total premium expected by market players in the chain.

Finally, many plant scientists are skeptical that a grand increase in methionine would only benefit, and not harm, the soybean plant. Methionine levels in soybean must more than double before the addition of premix methionine to feed is abandoned. Many believe this accumulation of methionine would decrease yield. After all, the energy for added methionine supply must come from somewhere, and the starches and oils within the soybean seed are likely sources.

So identity-preserved oilseeds, which might possess characteristics developed expressly for animal feed, may turn out to be "chicken feed" at that. ///