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ANIMAL GROWTH BIOTECHNOLOGY: PST PERSPECTIVES WHO BENEFITS?

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Advances in the biotechnology area are leading to the creation of products that will have a significant impact on agricultural production. For the pork sector, the Office of Technology Assessment (OTA) predicts that new technology will increase feed efficiency 12.6 percent and the number of pigs per sow by 27.6 percent between 1982 and 2000. This assumes an 80 percent adoption rate for new technologies.

Porcine somatotropin, PST, is one example of a biotechnology that is currently under development. It is a naturally occurring growth hormone in pigs that increases the rate of gain and feed efficiency of finishing hogs. Although it was discovered in the 1950s, it was not until the arrival of biotechnology that the protein could be manufactured in commercial quantities.

BACKGROUND

Somatotropin is a naturally occurring protein, produced in the pituitary gland of animals and humans, that regulates growth. Each species has its own unique somatotropin which is ineffective in other species. PST, for example, is inactive in humans, monkeys, and birds. Since somatotropins are proteins they are readily digestible and orally inactive. These findings are a plus for food safety because they mean that somatotropins do not pose a health risk in the human food chain.

*What does PST do?* Supplemental PST alters a pig's metabolism so that it converts feed energy to muscle more efficiently. This means that each pound of gain requires less feed and the resulting carcass contains more muscle and less fat.

Meisinger, in a summary of 19 studies, reported improvements in feed efficiency (unit of feed per unit of gain) of **24** percent, increases in rate of gain (units of gain per day) of **15** percent, and reductions in backfat of **25** percent for hogs treated daily with PST.

The implications of these studies are that leaner, heavier hogs can be produced using less feed in the same amount of time. Such an innovation has implications for consumers, packers, hog producers, and feed grain producers.

Porcine somatotropin by itself is size of operation neutral. Differences in response are more likely to be attributable to differences in management ability than size of operation. The benefits have been demonstrated on hogs with diverse genetic make-ups, but better quality animals show greater benefits. Improved nutrition also increases the impact of PST.

In spite of these apparent benefits the public is concerned about the use of somatotropins in general. There are important differences between the economic benefits of PST and BST. Use of PST allows farmers to produce a product that consumers are demanding, leaner meat. Efficiencies in production will be translated into lower consumer prices for leaner pork. BST increases feed efficiency in dairy cows and increases milk production. However, the product produced is not distinguishable from milk from any other cow. The only benefit to BST adoption is that the efficiency of milk production increases. Therefore, the economic implications of the adoption of PST are not readily transferable to the adoption of BST and vice versa.

Improvements in agricultural production have traditionally resulted in lower prices for farmers because costs of production have fallen and there has been little change in demand. Most advances in agricultural production have improved efficiency with no change in the final consumer product. PST is different. It not only increases the efficiency of production but also produces a more desirable consumer product and reduces the cost of processing that product by reducing the amount of fat that must be trimmed.

*What are the benefits to consumers?* The scientific evidence is that PST-treated hogs produce leaner carcasses which means that the retail cuts from treated hogs have less fat (both trim and intramuscular fat) and have fewer calories than untreated hogs. Consumer perceptions play a role in demand. Consumers are concerned about food safety and residues as well as fat and calories. The fact that the National Institutes of Health have declared BST milk to be safe has not stopped consumer concern about BST milk. It is not known how consumers will accept PST.

Two U.S. consumer studies, one done by a market research firm in 1986 and the other done in 1991 at Iowa State University, and a 1989 British study have been analyzed. They yield surprisingly similar results. They show that consumers, given information on the safety of PST, are willing

to pay a premium for the leaner cuts of pork from PST-treated hogs. A survey of over 200 households in the U.K. suggests that the British are generally willing to pay more (as a percentage of retail price) for leaner pork than U.S. consumers. This survey found that urban consumers, smaller families, and consumers at the bottom and top of the income range generally will pay higher premiums for leaner pork.

*What benefits to packers transmit to producers?* The large packers are currently paying premiums for leaner hogs. Cutability tests done by Prusa and Christian found that heavier, leaner carcasses from PST treated hogs yielded an extra \$45.84 worth of retail cuts compared to control carcasses slaughtered at normal weights. Unless packers transmit consumers' increased demand for leaner pork and some of the cost savings in processing leaner pork back to the producer, a large part of the economic incentive for adoption of this new technology will be lost.

Based on the 1986 estimates of consumer demand for leaner meat, packers would be willing to pay 6.5 to 7.5 percent more for leaner carcasses. If hogs are \$50.00 per hundredweight then packers would pay an additional \$3.25 to \$3.75 per hundredweight for leaner PST hogs.

These estimates represent the portion of the premium consumers are willing to pay for leaner meat that will be shared with producers. This sharing is not a result of the benevolence of the packing industry but a direct result of their quest for market share and profits.

*How will PST impact the hog industry?* Lemieux and Wohlgenant developed a model of the hog industry that estimates the impact of the introduction of PST on farm price of hogs, farm quantity of hogs produced, hogs slaughtered, retail price of pork, retail consumption of pork, hog imports, hog exports, economic benefits to producers and the economic benefits to consumers. Based on these relationships the production benefits of PST must be translated into shifts in industry supply.

For this study PST was assumed to increase feed efficiency 24 percent (from a base of 3.87 feed per gain) and the rate of gain increased 15 percent (from a base of 1.7 gain per day).

The improvement in rate of gain means that the control pig gained 100 pounds and was marketed at 240 pounds, while the PST pig gained 115 pounds and was marketed at 255 pounds (assuming a constant 59 day finishing period). This additional gain amounts to an increase in production of 6.3 percent.

Costs of PST treatment must be deducted from the gains. In this study PST cost was assumed to be \$6.00 per animal. With a market hog selling for \$52 per hundredweight, total treatment costs are five percent of the value of the hog.

These results indicate that a typical producer could expect to increase per unit profit between 10.1 percent (19 percent cost decrease less 8.9 percent price decrease) and 11.9 percent (19 percent cost decrease less 7.1 percent price decrease) if 60 percent of the industry adopts PST. This compares with decreases in per unit profits of between 7.1 and 8.9 percent for nonadopters.

The original question was, "How will PST impact the hog industry?" Producers' surplus calculates the net increase in profits for the industry aggregated over adopters and nonadopters and is estimated to increase between 2.5 to 4.4 percent of the total value of hog production. In 1987, the total value of hog production was about \$10 billion indicating increases in the benefits to hog producers would range between \$250 million to \$440 million after five years. The net benefits to consumers ranged between 9 and 11.5 percent of the total value of hog production. The dollar value of these benefits using the 1987 value of hog production is between \$900 million and \$1.15 billion.

These benefit levels are sensitive to adoption rates by producers, length of time of adjustment, and whether demand for pork increases in response to introduction of PST.

*What impact will PST have on individual producers?* To investigate this question, three typical farms were developed for each type of operation (farrow-to-finish and hog only) from information obtained from USDA. These farms feed approximately 700, 1700 and 3,400 hogs per year and reflected average efficiencies within their respective size group.

All farms simulated received at least a 150 percent return on investment. Benefits were larger for producers that had to purchase all their feed than for producers that grew their own feed because the additional income received through increased crop sales on the farrow-to-finish farms was less than the value of feed saved on the hog only farms. The economic benefits of producing leaner carcasses provided the majority of the economic benefits.

## CONCLUSIONS

Benefits this technology provides for the economy as a whole and to individual segments are significant. No real losers can be identified.

Consumers will be able to purchase safe, less expensive, lean pork. When the impact of increased supply and leaner retail products is quantified, the estimated benefits range between \$900 million and \$1.15 billion. Producers will be marketing a product that is in greater demand and will cost less to produce.

Packers will be able to reduce processing costs by buying leaner hogs. Each PST hog will provide greater higher priced retail cuts, such as roasts and hams, increasing the return to the packer for each animal processed. Research on the profitability of PST adoption show that a majority of the benefits of adoption come from this leanness premium.

Producers that adopt PST can produce more with less. Less feed will be needed to produce heavier hogs in the same amount of time that it currently takes.

More than ever, the public seems to mistrust research on the safety of new technologies. Consumer studies show that the identification of a product as a "hormone" causes a significant negative bias. The estimates assume consumers will not respond negatively to PST pork. Unless consumers are educated about the safety of the product and its potential benefits, public concerns could limit the adoption of this technology.

## SUMMARY

PST is a naturally occurring protein that stimulates growth in pigs but is inactive in humans. It has been found to increase rate of growth, improve feed efficiency, and increase leanness in finishing hogs. With PST, consumers will be able to purchase leaner pork at lower prices. When the value of these consumer benefits is calculated the estimates range between \$900 million to \$1.5 billion. Producers will see industry profits increase \$250 million to \$440 million. These benefits will be available to all size producers and profit per pig does not increase with the size of the operation. Use of PST increases profits for all size operations, types of farms, regardless of the farm programs investigated.