RISK ISSUES OF BIO-ENGINEERING

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Introduction

Bio-engineered or genetically modified (GM) crops differ from traditional crops because they incorporate foreign genes that provide special traits of value to producers or consumers. For traits such as Roundup Ready (herbicide resistance) and *Bt* (insect resistance), producers have seen the value and have rapidly adopted the new technology. The enthusiastic reception of GM crops by U.S. producers is in contrast to the reluctance shown by some of our overseas trading partners. Critics of GM crops cite new risks associated with human health and the environment, as well as social and ethical risks. Producers perceive risks of lost markets or discounts for GM crops. I will briefly discuss each of these types of risk.

Risk Assessment

Human Health Risks

Health risks of GM crops could include:

1) transfer of antibiotic resistance from GM crops to human or animal disease pathogens
2) production of new toxins or carcinogens
3) transfer of allergens to new crop varieties

Although the probability of antibiotic resistance transfer is considered low, many bio-engineers are now switching away from using antibiotic resistance as a selectable marker. Responsibility for testing for toxins, carcinogens, and allergens rests with the developers and is regulated by the EPA, FDA, and USDA. Regulations are under review to determine whether they need to be strengthened or made more transparent to the public.

Environmental Risks

Several potential environmental risks have been raised including:

1) Escape of GM traits into weedy relatives or to pests or disease pathogens
2) Non-target effects (e.g. monarch butterfly caterpillars affected by GM corn pollen)
3) Buildup of resistance to GM crops (e.g. European corn borer could become resistant to *Bt* toxin)
4) Buildup of GM-related chemicals in environment

Scientists recognize potential escape of GM traits as an important risk. The amount of risk depends on the particular GM trait and the particular recipient crop species. For example, sorghum, sunflower, and canola might be able to pass foreign genes to their wild relatives. Corn and soybeans are low risk because they cannot cross with weedy relatives. Non-target effects are also important to consider, but publicized risks of *Bt* corn to monarch butterflies may have been overstated. Pests may adapt to GM traits just as it they do to conventional pesticides or host resistance, so special management strategies may be needed. There was a recent preliminary report that *Bt* toxin might accumulate in the soil. This work needs to be confirmed and the implications assessed.

Social and Ethical Risks

Some critics contend that GM crops will have detrimental effects on the social or ethical structure of our world. Specific concerns are:

1) Concentration of economic power into a few large multinational companies
2) Erosion of rural communities
3) Loss of biodiversity of agricultural systems
4) "Playing God" with natural species barriers

Some activists are particularly concerned about monopolization of agriculture by certain companies. They see GM crops as a power grab and a threat to the sustainability of rural communities. They also lament the loss of biodiversity as local landraces are replaced by mass produced commercial varieties. Finally, some people have a moral objection to scientists moving DNA from one species to another. Individuals must evaluate these social and ethical issues for themselves.

Marketing Risks

Producers have identified the following marketing risks:

1) There could be a substantial price spread between GM and non-GM grain
2) To capture premiums, non-GM grain may have to be stored on farm
3) Non-GM grain may have to be transported to special collection points
4) There may be legal liability if grain sold as non-GM gets contaminated by GM grain.

In just a few short years, GM corn and soybeans have become standard commodities in the U.S. However, many overseas trading partners still have non-GM commodities as the standard. This may lead to discounts or premiums (depending on your point of view) for GM or non-GM crops. Unfortunately, segregating non-GM grain to capture a premium has its own potential problems.

Conclusions

There are legitimate health, environmental, and social concerns about the risks of bio-engineered crops. However, there are also plenty of irrational fears surrounding GM crops. The scientific method should be used to separate fact from fiction. It is almost impossible to make blanket statements about GM crops since each GM trait and crop is different. Risks must be assessed on a case-by-case basis. Federal agencies are charged with risk assessment.

Producers feel vulnerable to a large number of risks concerning GM crops. One of the main fears is that the rules of the game will change in mid-season when they have already made their planting decisions. It is important to know your customer. Feedlot operators are unlikely to be interested in paying a premium for non-GM grain. Big grain companies will also be buying GM grain. The unknown is the price of GM grain relative to non-GM grain. Growers will have to balance the price risk against the added value of the GM crop in their production system.