INDUSTRY STUDIES 2000

Agribusiness

ABSTRACT

Agriculture and the related agribusiness industry remain the foundation of U.S. commerce and society. Agribusiness plays a dominant role in both trade and foreign affairs in the United States. Perhaps the most striking aspect of the evolution of agriculture is the globalization of the industry. The United States is finding that it must address agribusiness issues in consonance with other nations. In fact, the nation has a vested interest in helping other countries deal with agribusiness problems and a responsibility to provide leadership in pressing for farming reforms, education, and the introduction of new technologies in growing, harvesting, and processing food. The national security posture of the United States is inextricably linked to global agribusiness. Understanding and appreciating the nuances of that linkage are essential tasks for U.S. national security planners and decision-makers.

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Antinori Vineyards, Badia a Passignano, Italy

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European Commission, Directorate General Agriculture, European Union, Brussels, Belgium

Grain South Africa, Bothaville, South Africa

Infruitec, Jamestown, South Africa

International Fund for Agricultural Development, Rome, Italy

Lindie's Farm, Vierfontein, South Africa

National Department of Agriculture, Pretoria, South Africa

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United Nations World Food Programme, Rome, Italy

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INTRODUCTION

In the United States, agribusiness supports two critical elements of national power—food self-sufficiency and economic security.[i] The first element is a source of great political strength, because the United States need not divert its national energies and foreign policies from its primary political objectives to ensure that its citizens will not starve in time of war.[ii] In addition to ensuring food security, the U.S. agribusiness has augmented the nation's global economic and political power through international trade and food aid programs.

Endowed with vast natural resources, a favorable climate, and fertile soils, the United States has throughout its history been able to produce enough food to feed its citizenry.[iii] Even as the nation evolved from a primarily agrarian society to an industrialized giant in the 20th century, as its population grew significantly, and as the number of farms and farmers decreased steadily, the agriculture industry's ability to feed the populace has remained robust. Similarly, the transition of the United States from the Industrial Age to the Information Age has not diminished the industry's ability to produce sufficient amounts of food to feed the nation; indeed, information technology has actually increased the industry's productivity.

Annual food surpluses resulting from the development and application of technological innovations on the farm have made agribusiness an important source of economic growth. Although the United States is currently the world's leader for agricultural exports, that dominance is slowly eroding. Record world agricultural production and globalization have increased competition from foreign sources, particularly those with lower labor costs. The single most important issue facing the U.S. agribusiness is not international competition, however, but rather the growing concern of international consumers about the safety of genetically engineered foods. The industry's ability to adequately address and alleviate those concerns will determine the future marketability of many U.S. agricultural biotechnology products, including seeds, crops, and processed/packaged foods.

Finally, the United States advances its security interests when it assists nations threatened by famine and undernourishment. Food aid programs and other actions that help nations eliminate the underlying causes for decreased agricultural production can reduce food insecurity, which is often responsible for regional instability and armed conflict.

AGRIBUSINESS DEFINED

Agriculture is among the world's largest industries. It employs nearly 1.3 billion people and annually produces goods worth $1.3 trillion.[iv] While agribusiness obviously involves the production of food, it also includes a complex and diverse chain of industries directly and indirectly required for the production, transformation, and provision of fiber, chemical, and pharmaceutical substrates. Thus, in addition to commodities (e.g., meat, fibrous, aquatic, horticultural, and forestry products),

agribusiness involves the agricultural inputs necessary to produce these products. Such inputs include seed, agricultural chemicals, fertilizer, crop equipment, information on animal genetics, animal health products, feed, equipment for the care of livestock, and support services (e.g., financial, educational, legal, and consulting and advisory services).[v]

CURRENT CONDITION

The overall state of agribusiness is good. Despite significant changes in and challenges to the industry, agribusiness continues to contribute to the economic well-being of U.S. society by generating $1 trillion each year in economic activity. One in six jobs is linked to some aspect of the food and fiber economy, and every U.S. citizen derives a benefit from agriculture. Food prices in real dollars have fallen by two-fifths over the last two decades,[vi] and U.S. consumers now spend only approximately 12 percent of household income on food.[vii] World output of food per person has risen 25 percent during the past 40 years, even though agricultural land use has grown by only 10 percent and the world population has increased by 90 percent.[viii]

Farmers and Their Farms. Dramatic changes in the demographics of U.S. agriculture have occurred in the last 200 years: shifts in land use, a decline in the number of farms, an increase in farm size, variations in operator characteristics, and shifts in the distribution of farm types. In 1790, farmers made up 90 percent of the U.S. labor force. By 1890, that percentage had dropped to 43 percent, and by 1990, farmers had become only 2.6 percent of the labor force.[ix] The continued development and application of technology on farms are increasing efficiency and reducing the need for touch labor. This trend will continue.

Similarly, there has been a precipitous decline in the number of farms. In 1935, there were approximately 6.8 million farms in the United States.[x] In just over 60 years, the number of farms fell by 57.4 percent, leaving only 2.9 million farms in 1997.[xi] Although the actual number of farms continues to fall approximately 1 percent each year, the average size of U.S. farms is rising. Today, 96 percent of the food grown in the United States is grown on farms consisting of 500 acres or more.

Farmers generally supported the 1996 Omnibus Farm Bill that cut farm subsidies, based on the promise that deregulation and increased exports would result in greater rewards. Those expectations were not met. Record world production, as well as worldwide weak economies in general and the Asian financial crisis in particular all directly affected U.S. farmers. Net cash farm income has declined every year for the last 3 years. Prices for corn and wheat plummeted 56 percent and 46 percent, respectively.[xii] In response, Congress has approved funds for emergency relief in 3 of the last 4 years, the most recent amount of which totaled $15.3 billion.[xiii]

Globalization. Improved international transportation and communication networks have helped to create a highly competitive global marketplace, and this globalization of the agricultural market has placed greater pressure on farmers to become more efficient. For example, meat producers in the United States are moving away from operating pasture-oriented facilities and toward confining animals and providing feed supplements to enhance the growth process. In addition, economies of scale are driving the consolidation of farms. Although small farms still make up the vast majority of farms, they are less efficient and account for less than 40 percent of the total value of U.S. farm production. A mere 6 percent of U.S. farms produce 60 percent of all U.S. farm products.[xiv] In some areas, farmers have responded to consolidation by banding together in cooperatives, seeking to give themselves more leverage in the marketplace.[xv]

Agricultural Biotechnology. Modern techniques, such as genetic engineering, allow agricultural scientists to create, improve, or modify plants, animals, and microorganisms. Scientists can now move genes (and therefore desirable traits) with ease and precision.[xvi] They can modify crops to make them resistant to drought, pests, and herbicides; to produce greater yields; to heighten nutrient content; and to enhance flavor. Modifications of future crops will increase protein and vitamin content, as well as pharmacological effects.[xvii] Increased yields and improved nutritional value provided by genetically modified organisms (GMOs) can help meet the rising food demand of the world's flourishing population.

In 1999, genetic engineering accounted for one-third of U.S. corn, 55 percent of its cotton, and more than half of its soybeans.[xviii] The U.S. Department of Agriculture (USDA) already has approved 50 varieties of GMOs.[xix] Currently, one-quarter of all U.S. cropland is used to grow genetically modified crops, and it is likely to be increased as more GMOs are placed into production.

Notwithstanding the growing popularity of GMOs among U.S. farmers, they are facing increasing resistance from consumers. There have been several expressions of concern about their safety and their effect on the environment, for example. Genetically modified organisms have also become the subject of a contentious trade dispute between the United States and the European Union.

Precision Farming. With the use of precision farming, commercial farmers can plan and execute the business of farming at a level of detail that rivals that of traditional manufacturing enterprises. Precision farming combines space-based and terrestrial technologies to help commercial farmers minimize crop inputs and optimize land management. Farmers can employ a variety of satellite systems to perform detailed soil analyses and to locate crops and equipment precisely in the field. Before planting, they can determine nutrient deficiencies, soil pH, salinity levels, and estimated water requirements. They can tailor seed and fertilizer applications to the production capacity of each specific zone with an accuracy of a few feet. During the growing season, farmers can build databases for weed mapping, accurately calculate irrigation requirements, monitor disease and pest infestations, and precisely determine topography and boundaries. The use of high-resolution satellite imagery to monitor crops allows the farmer to "see" problem areas in the field before a physical inspection can reveal such areas, allowing timely intervention to save the crop.[xx] At harvest time, farmers collect real-time yield statistics and compare results to predictions when evaluating future alternatives to increase yields further. Although precision farming is still evolving, it will eventually enable farmers to collect information, analyze and integrate it, and control every aspect of crop production.[xxi]

Farm Investment. Some aspects of the U.S. agribusiness financial picture are

relatively bright. Asset values have risen dramatically while debt has remained stable. Government data reflect a solvent industry.

Despite the generally healthy financial state of agribusiness, the costs of production continue to escalate. Acquiring breeding stock, developing and producing seed, transporting the goods produced, and marketing the products are capital-intensive operations. Farms with limited acreage or small herds typically cannot generate enough profit to pay for the machinery and support systems necessary to compete against larger enterprises. Increasingly, the family farm is becoming a corporation, with both owned and leased land for large fields and sizable herds. Many dairy farmers now have herds in excess of 500 cattle and conduct milking operations 18–24 hours per day. Farms with fewer than 200 acres or fewer than 100 animals in their herds will have difficulty surviving within 10 years. Consequently, the small, independent farm is rapidly disappearing from the U.S. landscape.

CHALLENGES

New technologies, improved transportation, and globalization are placing new demands on farmers. The industry is under increasing pressure to become more efficient, globally competitive, environmentally sensitive, and responsive to consumer needs and demands.[xxii] Thus, numerous challenges face the U.S. agribusiness. Although some experts are confident that a future world of 8 or 10 billion people will be able to feed itself, others share grave concerns about the future sustainability of current agricultural practices, especially in poor, food-deficient countries with growing populations. What impact will the growing food shortage in these poor countries have on U.S. national security interests? The lack of adequate access to food causes malnutrition, starvation, and population migration. In turn, migration causes overcrowding, unsanitary conditions, depletion of limited resources, unemployment, poverty, crime, and poor health. Ultimately, this lack of access to food leads to conflict and competition for resources.

Agricultural Biotechnology

The promise and potential of agricultural biotechnology are extraordinary. Although the technology holds great promise for increased productivity, reduced pesticide use, and improved nutritional benefits, some critics contend that current knowledge is insufficient to determine unequivocally that genetically engineered crops will not harm the environment or human health. Still others believe that wide-scale adoption of genetically engineered crops will shift control of genetic resources away from farmers to large multinational corporations, thereby threatening food security for poorer countries.

The continued viability of biotechnology in agriculture will depend on the industry's ability to demonstrate the safety of genetically modified products. As noted by one commentator, genetically engineered foods have become a lightning rod for a host of modern concerns, such as skepticism about the regulatory process, increasing anxieties about food, patenting of seeds, and consolidation of farms.

Agriterrorism

Sandra O. Sieber

Consolidation and other new practices that have been instituted to achieve increased production have made the agriculture industry vulnerable to a terrorist attack through biological agents (i.e., pathogens or toxins produced by organisms that can be used against people, animals, or crops). Pathogens are naturally occurring, self-replicating microorganisms that cause disease (e.g., bacteria, viruses, fungi, and parasites). Toxins are poisonous chemicals produced by living organisms, but unlike pathogens, they cannot self-replicate. The best known toxins are botulinum and ricin. Directed at agriculture, bioterrorism includes any infection that erodes the rate and efficiency of commodity production. Thus, agriterrorism is the use or threat of biological agents to intimidate or commit violence against an enemy.

Biological warfare against animals and crops is cheap, easy to carry out, and simple to conceal.[xxiii] It is also very difficult to detect since the effect of a biological agent is often indistinguishable from an emerging infectious disease. Some of these biological agents are not lethal or dangerous to humans, and the production, transport, and delivery of such agents is safe. A small amount, if effectively deployed, could cause massive animal injuries and environmental consequences, however. Many Western countries are particularly susceptible to this form of attack because of the integrated and intensive nature by which livestock are bred, transported, and sold, as well as the high degree of genetic homogeneity and concentration found in most main crop regions.

Destroying agricultural animals and crops with biological weapons is far easier and more predictable than directly targeting humans. Farm animals are particularly susceptible to disease because of intensive antibiotic and steroid treatment programs. The increased stress on livestock from modifications (such as de-horning and sterilization) designed to elevate the volume, quality, and value of meat production lowers the animals' natural resistance to viral and bacterial infections. Moreover, animals are vulnerable to many highly infectious agents, and these animal diseases spread extremely quickly because of the vertical integration of modern farming practices.

Sabotaging organic agriculture is almost as easy. Food crops come in a limited number of varieties suited specifically to local soil and climate conditions with differing sensitivities to particular diseases. Terrorists could isolate and disseminate disease strains that effectively damage one or more of a nation's major arable food crops. Additionally, certain biological agents can persist indefinitely in the environment. For example, Gruinard Island, located off the coast of Scotland, remained infected with anthrax spores for more than 40 years after the termination of

biological warfare tests in the 1940s.[xxiv]

A successful agriterrorist attack on a sector of a country's meat or crop base could cause economic devastation. Such an attack would require large-scale culling of livestock, quarantine, land decontamination, customer avoidance, and demand shifts. Local or regional economic instability could result in international isolation and protective trade barriers. Any impact of agriterrorism on the balance of trade can quickly cascade beyond the immediate agricultural community, resulting in long-term economic effects for farm workers, food processors and distributors, transporters, pharmaceuticals, clothing, restaurants, and financial markets.

Foot-and-mouth disease struck Taiwan's swine industry in 1997. Although not caused by an act of terrorism, the incident vividly illustrates the economic devastation that can result from an infectious disease.

Foot-and-Mouth Disease Outbreak in Taiwan

- More than 4 million pigs died from or were slaughtered to contain the disease.
- Taiwan lost its $1.5 billion annual export market for at least 4–5 years.
- Approximately 50,000 people became unemployed.
- Approximately $6.9 billion was lost within swine-related industries.

Relatively little effort is devoted to the empirical study of bioterrorism, and even less attention is spent on biological warfare against agriculture. Most of the sparse research and analysis on the threat of bioterrorism concerns human targets in heavily populated civilian centers. Agriculture is a lucrative economic and psychological target, yet the nature of a biological attack against agriculture generally fails to evoke public outrage and avoids governmental reprisal associated with human casualties.

Alternative Farming Methods

Joe C. Blake

There is great year-round demand in the United States for agricultural products. To meet this demand, supermarkets and food distributors have traditionally purchased off-season products from foreign markets. Now, however, U.S. producers are supplying products year-round by combining technology with ingenuity in alternative farming methods. This approach can best be described as farmers' using all available resources for production rather than relying heavily on purchased inputs. Its primary objectives are profitability, economic viability, social compatibility, and environmental quality.

Hydroponics. The rapidly growing market for hydroponically grown produce, particularly tomatoes, is one result of alternative farming methods. State-of-the-art greenhouses combine science, technology and hands-on attention. This technology enables supermarkets to provide perfect produce year-round at only slightly higher costs.

EcoScience Corporation is the leading domestic producer, marketer, and distributor of high-quality greenhouse-grown fresh vegetables.[xxv] Three subsidiary companies—Village Farms, Agro Dynamics, Inc., and EcoScience Produce Systems Corporation—make up the corporation. EcoScience operates six commercial scale greenhouse facilities with more than 178 acres and more than 7.5 million square feet of production facilities.[xxvi]

EcoScience grows its tomato plants in an inert media called rockwool, which is basalt rock melted to liquid form and then fiberized. A computer-controlled drip-feed system delivers nutrients to each plant individually. The nutrients that each plant receives are identical to those that the plant would obtain from soil.

In addition to the nutrients, EcoScience is able to control the pH and water to obtain the optimum performance from each plant.[xxvii] Computers also regulate the amount of carbon dioxide that each plant receives. Growers even have computers in their homes to monitor climatic conditions inside the facility. The introduction of bumblebees achieves pollination.

Controlling the environment in which plants grow removes the uncertainty that farmers contend with in the field, particularly rain (too much or too little) and pests. Consequently, greenhouses produce 15 to 20 times the yield of a field of the same size. Moreover, the vegetables are virtually flawless in appearance, and they taste delicious. Perhaps one of the most significant aspects of hydroponics is that greenhouses do not require arable land. Because the overall footprint of hydroponics facilities is relatively small and soils are unimportant, successful operations are often built on marginal land and reclaimed industrial sites where traditional farming would be impractical. For instance, EcoScience has located greenhouses on an abandoned, oil-soaked industrial lot in Buffalo, New York, and the arid plains of Texas.

Hydroponics provides an alternate method to meet the demands of U.S. consumers for premium vegetables throughout the year. It also can provide the means to help satisfy the need for food in developing countries that possess only limited amounts of arable land.

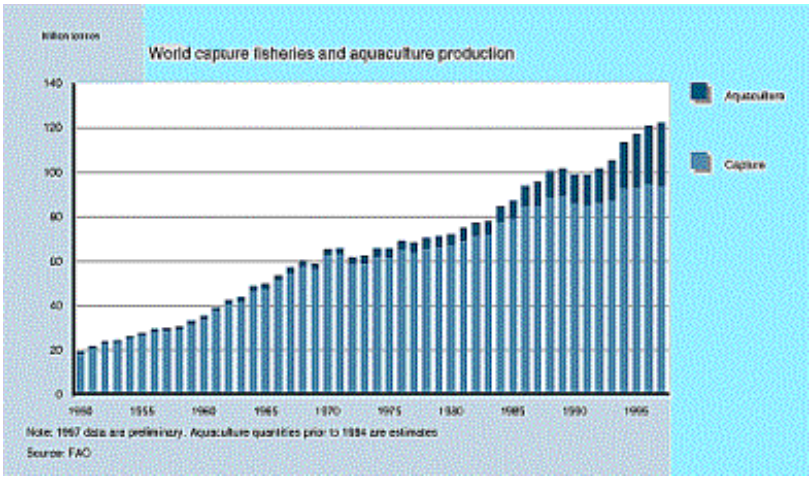
Aquaculture. As the world population grows and consumers worldwide continue to increase their annual consumption of seafood, it is possible that fisheries will be overfished and that certain species will become endangered. To combat this problem, the major seafood-harvesting countries are working closely together to control the annual world harvest. It is estimated that the world sustainable marine harvest is 80 metric tons per year. In 1999, however, 86 metric tons of marine fish and 7 metric tons of freshwater fish were harvested, worth an estimated $70 billion. The forecasted harvest for year 2010 is 110 metric tons of marine fish, with 125 of 200 species harvested at or above natural replenishment rates. Currently, 96 species of

fish are classified as “threatened.”

Another form of alternative farming, aquaculture is the farming of aquatic organisms in natural or controlled marine or freshwater environments. It is divided into two distinct types of fisheries—capture fisheries, which harvest seafood from the wild, and culture fisheries, which grow selected organisms in controlled environments to be harvested and sold commercially (Figure 1). The major farmed fish species in the United States include catfish, trout, salmon, tilapea, ornamental fish, crawfish, and mollusks. The largest quantity farmed by far is catfish, which makes up approximately 50 percent of all U.S. aquaculture. Trout ranks second among the culture fisheries, followed by crawfish, while salmon and oysters dominate marine (capture) aquaculture.

In 1999, catfish sales totaled $488 million, up 3 percent from 1998. The states of Mississippi, Alabama, Arkansas, and Louisiana account for 96 percent of the total U.S. sales. Pond acreage has grown steadily each year and is predicted to increase another 5 percent in 2000.

Figure 1: World Capture Fisheries and Aquaculture Production



Aquaculture is providing the tool to control capture fishing. Successful practices in aquaculture permit replenishment of wild stocks in many areas. Moreover, controversial technical advances, such as transgenics, show tremendous potential to

accelerate growth, increase survival, and result in much higher yields of fish.

U.S. Agricultural Trade

Francis J. Lamir

Technology, together with efficient management, not only has significantly increased U.S. farm productivity to the point that agricultural production far exceeds domestic consumption, but also has enabled the U.S. agriculture industry to remain competitive in the global market. Consequently, the U.S. agricultural industry relies upon foreign markets as an important source of economic growth.

The United States is the world's leading agricultural exporter. Currently, agricultural exports account for more than 25 percent of all U.S. agricultural sales[xxviii] and approximately 8 percent of all exports.[xxix] Since 1960, exports of U.S. agricultural products have consistently resulted in a favorable trade surplus. In fiscal year (FY) 1996, agriculture exports achieved record levels, totaling nearly $60 billion. However, agricultural exports have been steadily declining since then: $57.3 billion in FY 1997, $54 billion in FY 1998, and $49 billion in FY 1999. Several factors, including the depressed Asian economies, increased global competition, record global production, and trade barriers (e.g., export subsidies, high tariffs, import restrictions), are responsible for the decline.

The economic importance of agricultural exports is evident from data supplied by the USDA. Agricultural exports generate an estimated 895,000 full-time jobs, including 562,000 in the non-farm sector. Trade-dependent agricultural jobs pay higher than average wages and support a wide range of professions in both urban and rural communities. Moreover, since nearly every state exports some agricultural commodities, each state shares in export-generated employment, income, and rural development.[xxx] The USDA estimates that each dollar in U.S. agricultural exports generates $1.28 in economic activity in related industries, such as processing, packaging, shipping, and financing. In FY 1998, agricultural exports generated approximately $122 billion in economic activity.[xxxi] The economic importance of maintaining a robust agricultural export market is readily apparent.

Trade with China. **C**urrently, China is the sixth largest market for U.S. agricultural exports. China's high tariffs and other trade barriers effectively closed a great deal of its market to U.S. agricultural producers. China's entry into the World Trade Organization could result in an annual increase of $2 billion in U.S. agricultural export–related growth.[xxxii] As China's economy continues to expand—now at 7 percent annually—it is expected that China's growing middle class will increase its demand for high-value foods, such as poultry and meat products. China cannot meet this demand indigenously and, thus, will have to rely on the global market to satisfy it. The United States is positioned to capture this market.

Trade with the European Union (EU). The second largest market for U.S. agricultural exports is the EU.[xxxiii] The United States currently enjoys an agricultural trade surplus with the EU, with agricultural exports exceeding imports from the EU by almost $2 billion.

Although the EU remains a key market, it has declined in importance for U.S. farm products. In 1982, 30 percent of all U.S. farm exports went to the EU, but since 1995, EU imports have accounted for just slightly more than 15 percent of total U.S. agricultural exports. The proportionate decrease is due in part to the rapid growth of U.S. farm exports to other markets, most notably Canada, Mexico, and East Asia. Of greater concern, however, is the fact that differences in measures adopted by the

EU to protect human, animal, and plant health have affected trade.

Trade Issues. The most contentious trade issue facing the U.S. agriculture industry is its use of biotechnology. For example, the United States believes that measures adopted by the EU on food safety in two areas have unfairly prevented the import of U.S. agricultural products: hormone-fed beef and GMOs.

The EU's ban on hormone-fed beef has been a particular problem. Since 1989, the EU has banned imports of meats produced with growth-promoting hormones. According to the USDA, the ban costs the United States approximately $200 million annually in lost meat exports. The EU has vigorously defended the ban, claiming it is necessary to ensure food safety and consumer health.[xxxiv]

Similarly, the EU has restricted the import of genetically modified foods and crops by requiring segregation of genetically modified crops, instituting a confusing and lengthy regulatory approval process for genetically modified crops, and insisting on the labeling of foods that contain genetically modified products. Furthermore, despite approval by the EU Council of Ministers of three new bioengineered corn varieties cultivated in the United States in 1997, France has blocked their importation and use.

As a result of the current impasse with the EU, the United States is losing billions of dollars in export sales each year. It is essential to resolve this issue expeditiously, as other countries might adopt similar policies and legislation with respect to meat imports and genetically modified foods. For instance, brewers in Japan are not using genetically modified corn, and the government has mandated labeling for 28 different products that contain GMOs. The spread beyond the EU of concern about the safety of biotechnologically altered food could have devastating effects on U.S. agricultural exports. Moreover, some U.S. food processors have resumed buying conventional foods. For example, McDonald's Corp. and Frito-Lay Co. have directed their suppliers to discontinue use of genetically modified potatoes.[xxxv] This not only hurts farmers, but also undercuts the U.S. government's position that the EU's restrictions are just European protectionism.

Resolution of these trade issues will require skilled diplomacy. Although the motivation behind some of the trade barriers to U.S. agricultural exports is no doubt political, it would be a mistake to attribute all these policies solely to politics. The EU's adoption of certain food safety measures originates partly in the cultural preferences, practices, and experiences of its consumers, which are distinct from those of U.S. consumers.[xxxvi] Recognizing these differences is necessary if the United States is to resolve the current trade issues with the EU successfully.

The United States must be able to demonstrate convincingly that it maintains the highest standards of safety for food production. The United States must establish that its testing is rigorous and comprehensive. Moreover, those involved in determining the safety of genetically modified products must at all times be independent from the people who stand to profit from them. The continued independent review of agricultural biotechnology by the National Academy of Sciences should provide the world's scientific community with confidence in U.S. assertions of its products' safety. Finally, the United States should support the proposal of the EU's new president to establish an EU equivalent of the U.S. Food and Drug Administration.

OUTLOOK

The amount of food that a country can produce depends on several factors, including the availability of arable land, water, energy, and fertilizer. The two most important factors are arable land and water. The United States is blessed with plenty of land and appears to have enough water to meet all

future agricultural demands. The nation is currently producing more food than at any time in its history.

In 1955, approximately 23 percent of U.S. consumer expenditures was devoted to food consumed at home. In 1992, only 8 percent of U.S. consumer expenditures went toward food consumed at home.[xxxvii] The quantity, quality, and availability of food for the U.S. consumer have never been better. Ironically, the farming industry is the only business in the United States to have a continual decline in prices over the last 10 years. In certain cases, farmers have seen as much as a 30 percent decline in market prices for products.

Internationally, there has never been a greater demand for U.S. agricultural products, although trade barriers based on health issues might interrupt global trade with countries in Europe and might require continued government intervention as global market competition increases. Competition in the marketplace is healthy, but the farming industry remains at the mercy of the weather and the ability of the federal government to ensure a level playing field in the international marketplace. Barring severe weather patterns or a total collapse of the global market, the U.S. agricultural industry should remain the dominant world food producer.

GOVERNMENT GOALS AND ROLE

Food Self-Sufficiency

Because it is fortunate to have abundant arable land and a temperate climate, the United States has been able to produce enough food not only to feed its own population, but also to export food. Other countries, however, must import needed food items. Thus, the quantity and type of food that the United States exports can play a key role in the food self-sufficiency of its friends and allies. Agriculture and agribusiness is a powerful tool that the United States must protect from harm internally, and use for trade, assistance, and stabilization externally.

The United States and the other developed countries of the world must decide whether to attempt to increase production to meet the food needs of the world's growing population—which could double by the year 2035[xxxviii]—or whether to assist in the development of farming techniques and capabilities in the underdeveloped countries. In 1999, the United States shipped nearly 8 million metric tons of U.S. commodities to about 50 countries under various food aid programs.[xxxix] Although the United States has the capability to expand future production, there is a limit to that capability. Food aid packages must allow food-importing countries both to afford food bills and to rebuild their domestic agricultural production capacities. "The major factors that may limit the growth of food production in developing countries are knowledge and research, the availability of nonfarm inputs at reasonable prices, and the governmental policies that affect incentives."[xl] The United States possesses the expertise and resources to help developing countries establish the programs necessary to feed their people.

Food Safety and Genetically Modified Foods

If the United States cannot ensure the safety of its food supply to the satisfaction of its citizens and the countries that import U.S. food, then the use of food as a tool of self-sufficiency and national power will be less effective. Although appropriate government agencies are in place to regulate and monitor the safety of food grown and processed in the United States, these agencies need additional authority to enforce their rulings. Also, expanded public relations efforts could help increase understanding of the genetically modified food issue.

In late 1998 and early 1999, eating contaminated food produced by the Bil Mar meatpacking plant caused 21 deaths; 100 other people became seriously sick. This tragedy was the most lethal case of food poisoning in 15 years, and it highlighted several weaknesses in government regulations, two of which were particularly serious. First, microbial testing in slaughterhouses (such as the one operated by Bil Mar) is optional. Second, the USDA lacks the appropriate regulatory authority to order and enforce recalls, and to enforce compliance with safety regulations (e.g., Bil Mar had received 45 noncompliance citations). Congress should enact legislation that would give the USDA this authority. Additionally, the USDA should mandate that food processors conduct required microbial testing at all sites rather than making the testing optional.

Three federal agencies regulate genetically engineered foods: the Food and Drug Administration, the Environmental Protection Agency, and the USDA. Additionally, the National Academy of Sciences has conducted an extensive review of genetically modified crops. It found no evidence of unique hazards in the use of bioengineering techniques. Furthermore, it found that the risks from the introduction of biologically engineered organisms are similar to those from other modifications or from the introduction of unmodified organisms. Finally, the National Academy of Sciences concluded that risk assessments should be based on the properties of the organism and its environment—not on the way in which the organism was produced. Although the report found no evidence that foods on the market are unsafe to eat as a result of genetic modification, it did recommend further research and data collection in several areas.[xli]

By and large, U.S. citizens have readily accepted the use of bioengineered foods. They consume these foods in large quantities, generally satisfied with the level of scrutiny that such foods receive from the federal agencies responsible for ensuring their safety. This attitude is in stark contrast to that of European consumers. Primarily because of cultural differences and a poor record of government oversight, Europeans have been less willing to accept genetically modified foods. Their concerns are understandable in view of recent events. In 1999, Belgian farmers were sold animal feed contaminated with toxic polychlorinated biphenyls and furans; chickens, pigs, and cattle were tainted by the feed. The incident cost Belgian farmers $600 million in sales and reduced the public's confidence in the Belgian government. Similarly, the effects of the mad cow disease in Britain were not limited to the $5.5 billion loss in exports and culled herds.[xlii] Public trust in the British government

hit an all-time low.

The foundation of U.S. policy supporting genetically modified foods should include a State Department and Commerce Department campaign designed to address consumer concerns about the safety of these foods. Such a campaign must also inform consumers about the benefits. Simultaneously, the United States should concentrate the State Department's diplomatic efforts on convincing countries to repeal their formal restrictions on genetically modified foods. If these efforts fail, the United States should consider contesting import restrictions before the World Trade Organization.

Urbanization vs. Agriculture

The increasing urbanization of land in the United States is having two major impacts on agriculture. The first is the competition for water use, particularly in the South and the West where it is a precious resource. The second is the conversion of cropland into land used for business, industry, or residences.

Currently, the issues surrounding the shrinking water supplies in various southern and western states revolve around the government policy on the use of that water. Pursuant to the Reclamation Act of 1902, water is available for irrigation at substantially reduced prices. Not only are market forces not employed as an incentive to conserve water, the volume of water used for irrigation is not regulated. In the United States, agriculture uses 78 percent of available water, and irrigation uses one-third of all water. The United Nations has identified shortages of freshwater as the most serious obstacle to producing enough food to feed the world's growing population.

Although there are some incentives to conserve water, there are no standards for an acceptable rate of water use, especially where nonrenewable underground water supplies are concerned. The government should establish standards for the use of nonrenewable resources, provide incentives to states that adopt active conservation measures, gradually reduce water subsidies to individual farmers, employ more market mechanisms in the use of water, and expand research into water conservation technologies for agriculture.

Cropland conversion also warrants government attention. Seven of the 10 states with the highest conversion rates from 1992–1997 are from the South or the West, the very areas where competition for the use of water is increasing. Although agriculture is the dominant use of land in the United States, the conversion of farmland to other uses has doubled since 1982. This conversion raises concerns about the preservation of communities and the quality of life, as well as about the environment. The Clinton Administration's FY 2001 budget includes a significant increase for the USDA's Farmland Protection Program, which provides financial

assistance to state and local governments that enter into voluntary agreements with farmers to preserve farmlands. It is proposed as one way to help control urban "sprawl" and maintain the farm clusters needed to ensure a viable agricultural supply and support network.

Aquacultural Development

The purpose of the National Aquaculture Act of 1980 is to promote and support the seafood industry and to facilitate coordination of the myriad federal programs and policies that affect it. The major programs and resources are the responsibility of the Departments of Agriculture, Commerce, and the Interior. Both those in private industry and those in the government agree that federal involvement in aquaculture is essential for the industry to continue to grow and reach its commercial potential. To be effective, the federal government should continue to facilitate and help accelerate the commercialization of promising aquaculture technologies.

The greatest systemic threat to capture fisheries is the inability to regulate the world harvest so that it remains within sustainable levels. Concentrated animal populations tend to amplify the effects of most anomalies, so the decline of a previously healthy stock can be rapid and irreversible. The Food and Agriculture Organization of the United Nations estimates that worldwide culture fishery production for finfish, crustaceans, and mollusks will approach 40 million metric tons by 2010 while corresponding capture production will level off at around 95–100 million tons. Given that the current carrying capacity around the world is estimated at 80 million tons, it will require discipline, international cooperation and technical improvements to sustain the aquaculture industry at those levels.

The U.S. aquaculture industry has the opportunity to meet a growing domestic and international demand for seafood. As fish farming develops, aquaculture can respond to consumer demands for high-quality, safe, and affordable seafood that is harvested in an environmentally responsible manner while meeting producer requirements for profitability.

Agricultural Sanctions

Agricultural embargoes have had a significant negative impact on the U.S. agribusiness. The USDA estimates that many of the 2,600 farm jobs lost in the mid-1990s resulted from the use of agricultural sanctions as a foreign policy tool. It is now time for the United States to reconsider its policies concerning sanctions. The government should begin a systematic review of all existing sanctions and initiate

efforts to legislate comprehensive sanction reform. Presently, there are a number of proposals before Congress that would significantly revamp past policies.

CONCLUSION

The United States continues to dominate the world in the production and manufacturing of safe, affordable, and high-quality food products. Although enjoying a strategic advantage when it comes to agriculture, the United States cannot become complacent and take that advantage for granted. The most important challenge facing the U.S. agribusiness is the resolution of agricultural trade policy issues. The EU and the United States share the largest investment and trade relationship in the world. China's entry into the World Trade Organization and the decision to pursue a normal trade relations status with China loom on the horizon.

Agriterrorism remains a serious and credible challenge. Terrorism is undeniable, biological agents are feasible weapons, and terrorists have shown that they can generate widespread fear and chaos just by attacking economic targets. Most defense analysts concede that the United States is not adequately prepared to detect, prevent, interdict, or respond to any type of biological weapon attack. Strategic planning, governmental coordination, and funds are being committed. However, we still lack a strategic national vision regarding domestic preparedness to ensure that the country is better able to counter these threats and to respond effectively to the challenges that they present. Given the ease with which such an attack could occur and its devastating economic consequences, the time is ripe to develop a national policy and to establish a program designed specifically to prevent, or at least to limit the effects of, a biological attack against the U.S. agriculture industry.

The potential benefits of biotechnology are extraordinary. Yet, among the various technologies developed to improve the efficiency and productivity of agriculture, biotechnology has proven to be the most controversial. Today, more than 20 bioengineered crops are sold commercially, 50 have been approved, and more are being developed. Considering that the world population is expected to top 9 billion by 2050,[xliii] it is unlikely that the world food demand could be met without the use of genetically modified crops. The United States leads the world in agricultural biotechnology, and the continued export of U.S. agricultural products is an important component of its sustained economic power.

Finally, the challenge of defining and dealing with the problems associated with alternative farming methods remains a key piece of any future agribusiness national strategy. These innovations are key to U.S. farmers keeping the competitive advantage while maintaining the capability to feed the U.S. population and much of the world. To be secure and prosperous, the United States must continue to lead.

[i] Food security is defined as "assured access at all times to enough food for an active healthy life, with no need for recourse to emergency food sources or other extraordinary coping behaviors to meet [one's] basic food needs." U.S. Department of Agriculture (USDA), Economic Research Service, *Measuring Food Security in the United States: Prevalence of Food Insecurity and Hunger by State, 1996–1998* (1999), 1.

[ii] Hans J. Morganthau, *Politics among Nations: The Struggle for Power and Peace* (revised by Kenneth W. Thompson; New York: McGraw–Hill, 1993), 127.

[iii] Although most households in the United States are food-secure, not all are. According to the USDA, 9.7 percent of the total U.S. households did not always have access to enough food to meet basic needs during the period 1996–1998. USDA, *Measuring Food Security*.

[iv] Shereen El Feki, "Survey: Agriculture and Technology," *The Economist*, 25 March 2000, 6.

[v] Purdue University Cooperative Extension Service, *Food System 21: Key Questions for the New Millennium* (February 1998), 30.

[vi] Shereen El Feki, "Survey: Farms & Technology," *The Economist*, 25 March 2000, 3.

[vii] Purdue University Cooperative Extension Service, *Food System 21*, 1.

[viii] Purdue University Cooperative Extension Service, *Food System 21*.

[ix] USDA, Economic Research Service, *A History of American Agriculture*: *1176–1990*.

[x] *Standard & Poor's Industry Surveys: Agribusiness* (January 2000), 2.

[xi] The farming populations in France and Germany have likewise fallen by more than half since 1978. There, too, farms are becoming fewer in number, larger in size, and more productive. Most OECD countries will see an annual 1.5 percent decline in the number of farms. Shereen El Feki, "Survey: Agriculture and Technology," 6.

[xii] Robert E. Scott, *Exported to Death: The Failure of Agricultural Deregulation* (Economic Policy Institute, 1999).

[xiii] Eric Planin and Juliet Eilperin, *Congress Approves Farm Aid Package*.

[xiv] *Standard & Poor's Industry Survey: Agribusiness* (January 2000), 2.

[xv] Dan Glickman, remarks at the 75th Annual Agricultural Outlook Forum, Arlington, VA, 22 February 1999.

[xvi] U.S. Department of Agriculture, Agricultural Biotechnology (Online), at http://www.aphis.usda.gov/biotechnology/faqs.html.

[xvii] For example, rice can now be enhanced with vitamin A through genetic engineering.

[xviii] El Feki, "Survey: Farms & Technology," 4. Approximately 90 percent of Argentina's soybeans were produced with the use of genetically modified seeds.

[xix] Dan Glickman, remarks before the National Press Club, "New Crops, New Century, New Challenges: How Will Scientists, Farmers, and Consumers Learn to Love Biotechnology and What Happens If They Don't?" Washington, DC, 13 July 1999.

[xx] Kory K. Smith, "Feeding a Hungry World," *Imaging Notes* 15, no. 1 (Space Imaging January/February 2000): 15. Imagery is also being used to perform watershed and soil moisture capacity analyses.

[xxi] James Joyce, "The Next Agricultural Revolution," *Imaging Notes* 15, no. 1 (Space Imaging Jan/Feb 2000), 29.

[xxii] El Feki, "Survey: Farms & Technology."

[xxiii] Peter Chalk, unpublished unclassified report derived from classified study (RAND Corporation, undated), prepared for inclusion in "Random and Unpredictable: The 'New Terrorist': Willing to Kill for the Sake of Killing," ABCNEWS.com, online, March 10, 2000.

[xxiv] Leonard A. Cole, "The Specter of Biological Weapons," *Scientific American* 275, no. 6 (December 1996).

[xxv] EcoScience Company Overview, 1.

[xxvi] EcoScience Company Overview.

[xxvii] Peter Buxum, *New Jersey Business News,* 10 November 1997.

[xxviii] Congressional Research Service, *CRS Issue Brief: Agricultural Export and Food Aid Programs* (8 March 2000).

[xxix] U.S. Census Bureau, *U.S. Exports and General Imports in Goods* (1999).

[xxx] Congressional Research Service, *CRS Issue Brief: Agricultural Export and Food Aid Programs* (January 2000), 2.

[xxxi] White House Press Release, *China WTO Accession Deal: A Strong Deal in the Best Interests of U.S. Agriculture* (14 February 2000). Accessed at http://proquest.umi.com.

[xxxii] Dan Glickman, remarks made to the Agricultural Outlook Forum 2000.

[xxxiii] The largest importer of U.S. agricultural products is Japan.

[xxxiv] The United States challenged the European Union's ban on hormone-fed beef in the World Trade Organization (WTO). In August 1997, the WTO ruled that the ban violated the provisions of the Uruguay Round Sanitary and Phytosanitary Agreement, finding that the ban was based neither on scientific evidence nor on any assessment of risk to health. The EU appealed the ruling, and the WTO Appellate Body found that the EU's ban contravened the EU's obligations under the Agreement, but the decision left open the option for the EU to conduct a risk assessment of hormone-treated meat. The EU had until April 1999 to conduct the assessment. As of March 2000, the EU had yet to do so.

[xxxv] "McDonald's to Bar GMO Fries," Reuters (28 April 2000). Other companies that have halted the use of GMOs in their products include Gerber, Heinz, and Nestle. *See* "Seeds of Change," *Consumer Reports* (September 1999), 41.

[xxxvi] Concern about the "mad cow disease" has created a climate in Europe that is unfavorable to resolving the meat hormone issue. The European press has played on the fears of the public, referring to genetically modified foods as "Frankenfood."

[xxxvii] D. Gale Johnson, "Agriculture and the Wealth of Nations," *The American Economic Review* 87, no. 2 (May 1997): 10.

[xxxviii] Leif R. Rosenberger, "Parameters," 27, no. 1 (Spring 1997): 86.

[xxxix] Dan Glickman, *FY 1999 Annual Report of the Secretary of Agriculture*, 3.

[xl] Johnson, *Agriculture and the Wealth of Nations*, 11.

[xli] National Academy of Sciences, *Genetically Modified Pest-Protected Plants: Science and Regulation* (2000).

[xlii] El Feki, *Survey: Farms & Technology*, 6.

[xliii] According to recent United Nations statistics, the world population will grow from 5.7 billion in 1995 to 9.4 billion in 2050, 10.4 billion in 2100, 10.8 billion by 2150, and will stabilize at slightly under 11 billion by 2200.

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