

## SUSTAINABLE AGRICULTURE: CAN BIOTECHNOLOGY PLAY A ROLE?

INTERNATIONAL FOOD INFORMATION COUNCIL FOUNDATION

The sustainability of our everyday actions is becoming more important as we plan for a changing global climate and an increasing global population. One area in particular that receives a large amount of attention is agriculture. In fact, Congress first recognized the concept of sustainable agriculture in the 1990 Farm Bill. They defined it as “an integrated system of plant and animal production practices having a site-specific application that will over the long term:

- Satisfy human food and fiber needs
- Enhance environmental quality and the natural resource base upon which the agriculture economy depends
- Make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- Sustain the economic viability of farm operations
- Enhance the quality of life for farmers and society as a whole.”<sup>1</sup>

This informational sheet will look at why sustainable methods of agricultural are so important and how technology can be used to achieve these goals.

### FEEDING THE GLOBAL POPULATION

Agricultural production must be sufficient to feed us now and in the future and with a rising population, growing more food at affordable prices becomes even more important. Currently, the Food and Agriculture Organization (FAO) believes that more than 800 million people in the world do not have enough to eat, causing 24,000 people to die every day from hunger, three-quarters of whom are children under five.<sup>2,3</sup> Additionally, the United Nations Sub-Committee on Nutrition estimates that 33% of children under five in developing countries have experienced stunted height-for-age growth.<sup>4</sup> This suggests chronic undernourishment throughout their childhood, which can hinder overall health as well as their ability to learn.

“Hidden hunger,” or micronutrient deficiencies of iron, iodine, or Vitamin A, is of equal concern. According to the Micronutrient Report, “nearly 20% of the population [in the developing world] suffers from iodine deficiency, about 25% of children have sub-clinical vitamin A deficiency and more than 40% of women are anemic.”<sup>5</sup> The World Bank calculated that the global loss of productivity secondary to malnutrition, in one year alone is the equivalent of 46 million years of productive, disability-free life.<sup>6</sup>

Meanwhile, the world’s population continues to increase. According to the Population Reference Bureau, the world population reached 6.6 billion people in 2006, up from 6 billion in 1999. They project the global population will reach 8 billion by the year 2025 and that 90% of growth will be in developing countries.<sup>7</sup>

In order to meet these needs, the FAO estimates that global food production must increase by 60 percent in developing countries to accommodate the estimated population growth, close nutrition gaps, and meet dietary needs.<sup>8,9</sup>

### FEEDING THE UNITED STATES

Concerns over malnutrition and population growth also apply to developed countries such as the United States. The U.S. population is also growing, by 20 million just since 2000.<sup>10</sup> Even at our current population, U.S. agricultural production does not meet our dietary needs. If everyone were to eat the recommended servings of foods according to the Dietary Guidelines for Americans, we would need an additional 7.6 million acres for fruit production, 6.5 million additional acres for vegetable production and an additional 111 billion pounds of milk per year.<sup>11</sup>

### FOCUSING ON THE ENVIRONMENT

Along with the challenges of feeding a growing population, farmers also need to consider many environmental factors. It is impossible to predict exactly what the future will bring, but global climate change requires consideration of growing food in drought and water-stressed areas, reducing greenhouse gas emissions and protecting against soil erosion. A sustainable approach to agriculture will need to take all these factors into account.

As more food is being grown to feed more people, we will also need to grow more to offset losses from drought and climate change, which many climatologists believe will increase in the years ahead. It has been predicted that two out of three people will live in drought or water-stressed conditions by 2025.<sup>12</sup>

Greenhouse gas emissions’ impact on climate change also continues to be a growing concern. Farming does contribute to green house gas emissions in several ways. In addition to embedded energy in fertilizer and chemicals, fuel use from tractors when farming the land and the land itself



release carbon dioxide. Many farmers till the land to loosen and aerate the soil, to allow deeper penetration of the roots, to help the growth of microorganisms and worms to maintain the fertility of the soil, and to help with weed management, which helps mix nutrients evenly throughout the soil. Despite these advantages, tillage requires more use of fossil fuels by tractors passing over the land, and it actually releases carbon from the land itself. Implementing no-till farming keeps this carbon from being released from the land.<sup>13</sup>

Additionally, implementing these no-till systems can also help reduce soil erosion. Soil erosion is a growing concern and it has intensified with the expansion of human populations. Erosion has the potential to damage soil quality for both farms and surrounding ecosystems, and eroded soil can enter into water supplies, disrupting dams, damaging ecosystems, and contaminating drinking water. Ultimately, eroded soil leads to decreased land, poor plant growth and decreased crop yields.<sup>14</sup>

### **TOOLS IN THE TOOLBOX: BIOTECH CROPS CAN HELP**

Biotechnology can be used to meet the growing demand for food by improving yields, improving the nutritional quality of crops (for more information please visit Benefits of Food Biotechnology Fact Sheet), and reducing the impact on the environment. Using traditional techniques, such as selective breeding, scientists have been working to improve plants and animals for human benefit for hundreds of years.<sup>15</sup> However, it's time consuming, often taking 10 to 12 years to breed plants in the traditional manner. With biotechnology, modern crop breeders can select a specific genetic trait from any plant and move it into another plant with greater ease and precision, selecting for the most beneficial traits.<sup>16</sup> These tools also allow plant breeders to select for traits that wouldn't be possible through traditional breeding.

These beneficial traits can have a major impact on the challenges we are facing. Biotechnology can help grow more food by making crops resistant to pests and disease, preventing the loss of billions of pounds of crops, sometimes by replacing the chemistry of pesticides with a protein in the plant itself. According to experts, enhanced crops in the U.S. alone helped prevent the loss of approximately 8 billion pounds of crop in 2005.<sup>17</sup> In addition to fighting the environmental stresses of disease and pests, researchers in both academia and industry are currently working on developing crops that use water more efficiently to help with growth in drought conditions.

Higher yielding crops can also mean higher income for farmers. In developing nations, agriculture employs nearly half the labor force, and many more are indirectly dependent on it economically. Growing more food means that in addition to having more crops to feed our growing population, incomes for those working in or dependent on agricultural production will rise, which can translate into better diets and health care.<sup>18</sup> In a review of the impact of food biotechnology, Brookes and Barfoot (2006) found a \$5 billion income benefit realized by farmers around the globe, 55 percent of which (or \$2.75 billion) went to farmers in developing nations, even at this early stage of adoption in these countries.<sup>13</sup>



The potential environmental benefits of biotechnology throughout the world are also significant. For example, biotechnology can be used to grow plants that are resistant to herbicide and pesticides, removing the need to till for weed control and reducing the amount of pesticides that need to be used. This can help reduce carbon emissions and soil erosion, thereby reducing the impact that these cause. From 1996-2005, no-till farms reduced fossil fuel use by an estimated 962 million kg of carbon dioxide (CO<sub>2</sub>), equivalent to the CO<sub>2</sub> production of 427,556 average-sized family cars.<sup>13</sup>



The ability to leave crop residue from one year to the next also provides a natural "trap" for CO<sub>2</sub>. Based on the amount of farm land that has been converted from full-till to reduced- and no-till systems, biotech has resulted in an 8,053 million kilogram reduction in CO<sub>2</sub> emissions from agriculture, equivalent to 3,579,298 average-sized family cars.<sup>13</sup>

Understanding and utilizing these benefits is important. According to IFIC *Food Biotechnology: A Study of U.S. Consumer Trends 2008*, over half of consumers have heard "nothing" about the concept of "sustainable food production." Although most people are not aware of the term, the majority of consumers say sustainable food production is important and increasing the world's food supply was seen as the most important aspect of this sustainable production. Using a smart mix of farming techniques, such as biotechnology, can help us as we strive to feed tomorrow's population and reduce the impact of farming on the environment.

### **For More Information on Food Biotechnology, Visit:**

**FDA's Center for Food Safety & Applied Nutrition**  
<http://www.cfsan.fda.gov/>

**USDA's Animal & Plant Health Inspection Service**  
<http://www.aphis.usda.gov/brs/>

**Environmental Protection Agency**  
<http://www.epa.gov>

**Questions And Answers about Food Biotechnology**  
<http://www.ific.org/publications/qa/biotechqa.cfm>

**Food Biotechnology: Enhancing Our Food Supply**  
<http://www.ific.org/publications/brochures/biotechbroch.cfm>

**Fact Sheet: Benefits of Food Biotechnology**



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