

# Sustainable Agriculture – A Modern Perspective

By B.C. Darst

What is sustainability? What do we mean when we talk about sustainable agriculture? Webster's II New Riverside University Dictionary defines sustainability as *keeping in existence; maintaining; enduring; withstanding*. Sustainable agriculture encompasses all the above. It includes considerations for future food adequacy and also addresses such issues as resource use efficiency, profitability for farmers, and impact on the environment. In order for agriculture to sustain, to meet today's world food needs as well as those in the future, it must protect and improve air, soil and water quality; that is, it must be environmentally friendly. It must also do a better job of communicating with its clientele...world food consumers.

## Agriculture Must Produce More Food per Unit of Land

In early 2000, world population stood at 6.0 billion people. It is projected to reach 8.0 billion by 2025, a 33 percent increase in only 25 years. During that period, little change in total arable land available for food production is expected. In fact, arable land per person continues to shrink, forecast to fall from slightly more than 1.1 acres in 1965 to about 0.5 acre by 2025. If agriculture is to be sustainable, it must feed a growing world population. Higher yields must happen and will be the result of improved management. Their production will include:

- Higher input and resource use efficien-

cies, including nutrient balance, nutrient application rates, and land use;

- Adequate crop protection, including an appropriate mix of cultural practices, judicious use of pesticides, and genetically enhanced crops;
- Advanced genetics, including traditional plant breeding and products of biotechnology;
- Crop management practices which minimize soil erosion;
- Enhanced soil productivity, including improved tillage and biological components;
- Improved water quality and irrigation management.

Sustainable agriculture is not a new concept. Sustainable systems have evolved over thousands of years... employing new knowledge, experience and understanding and implementing new technology as it is proven beneficial.

## Is Today's Production Agriculture Efficient and Sustainable?

If one selects today as the point of comparison, then looks back a few years in time, it becomes obvious that agriculture in the U.S. has been sustainable. The trends we see also give us hope that future sustainability is within our grasp. Improvement in nutrient use efficiency is one important reason why. Consider that:

- Nutrient use efficiency has been increasing. During the last 25 years, nitrogen (N) use efficiency by corn farmers in the U.S., that is, corn produced per pound of N applied, has gone up by more than 30 percent and continues to rise.
- During the 1960s and 1970s, U.S. farmers generally applied more phosphorus (P) and potassium (K) than crops

removed. Soil fertility levels were often built into high and very high ranges to support the production of higher crop yields. However, some state nutrient budgets are now showing that more nutrients, particularly P and K, are being removed than are being replaced. Farmers need to monitor their crop nutrient requirements on a site-specific basis, then provide them in order to sustain the continuing increases in crop yields that will be required to feed the growing world population.

- There are soils that have received heavy nutrient loads, especially through the application of animal manures and biosolids. Care must be taken to develop nutrient management plans for such soils that meet agronomic requirements, but do not exceed safe levels from an environmental standpoint. Site-specific nutrient management recommendations are being developed for much of the U.S. that help to avoid the potential negative environmental implications of both excessive and inadequate nutrient application. These guidelines are leading to an improved use efficiency of both manufactured mineral fertilizers and organic waste, such as animal manure and sewage sludge, resulting in improved crop utilization of nutrients.
- During the Dust Bowl days, U.S. farm land was being eroded at a rate of 30 to

40 tons per acre. After the Dust Bowl, with contour plowing, terracing, and other conservation practices, erosion rates dropped to less than 15 tons per acre. Progress has continued. Soil loss by wind and water erosion is now about 4.5 tons per acre per year and decreased by 35 percent from 1987 to 1997. Conservation tillage...now used on more than one-third of U.S. crop land or about 100 million acres...and other sound management practices are primary factors in lowering erosion rates.

As a result of the above and other improvements in production management, average crop yields in the U.S. have nearly tripled since 1940 and continue to rise. In fact, if the crop we produced in 1990 had been grown using 1940 technology, an additional 470 million acres of crop land of similar productivity would have been required.

It should be noted that agriculture has not solved all the challenges associated with long-term sustainability. The above examples show how far agriculture has progressed in the U.S. However, in the U.S. and in the rest of the world as well, much remains to be done to help ensure sustainability in the future. As farmers continue to achieve higher and higher yields per unit of land farmed, it is incumbent upon them to leave the land more fertile and productive than they found it so that future generations can be fed. To do so will require the adoption and use of production technologies based on the latest in scientific research. In order to remain dynamic...responding to the growing world demand for its products...agriculture must be aggressive in moving forward, with emerging technologies as a primary driving force.

### Agriculture Must Address Several Challenges to Remain Sustainable

Sustainable agriculture requires the efforts of all the world's farmers. Large scale enterprises and small holder agriculture have a role to play in the increasingly intensive business of growing crops. To sustain both large and small farmers, the public must continue to provide infrastructure to move agricultural inputs and outputs, the educational



**During the Dust Bowl** days in the U.S. in the 1930s, farmland was being eroded at the rate of 30 to 40 tons/A each year.

resources for knowledge generation and transfer, and the regulatory framework to assure a stable business climate. This includes development of mechanisms to assure consumers that food will be safe and of high quality.

Ultimately, successful implementation of sustainable crop production practices will involve adaptation to local soil and management practices specific to each region...and each farm, even every field...and include the innovation of those farmers with a strong commitment to land stewardship. Here are some of the challenges agriculture must address in the future.


- Pressures from so-called experts to cut back on purchased inputs, activities of certain environmental groups, low crop prices, and other factors often influence the farmer to use less and less inputs such as fertilizers, but still expect more at harvest time. Residual fertility will not last forever. Farmers who indiscriminately cut back on fertilizer use should understand that they cannot sustain production as they will be able to do if they follow science-based, site-specific management principles.
- Genetic diversity is narrowing for many food crops while remaining broad for crop pests. Reduction in the number of products available for crop protection and opposition to genetically enhanced crops will make meeting expanding world food requirements more difficult. The global public must be educated to this fact.



**Conservation tillage** practices are now used on about 100 million acres, or one-third of U.S. farmland.

- The economic viability of farmers and the agribusiness firms which serve them is impacted by low crop prices, poor return on capital investment and labor, government policies...including low food costs for consumers, rising costs of goods and services, changing technologies, marketing challenges, regulations, and other factors. Agriculture must address these issues more effectively. If farmers cannot achieve acceptable profitability, agriculture will not be sustainable.
- Environmental concerns and restrictions on input use will likely become more difficult and expensive in the future. In most cases, doing a better job of protecting the environment will add costs to farming operations and will require improved management in other areas to compensate for these costs.
- Farmers and farm numbers will continue to decline, making efficiency of production even more critical to the sustainability of agriculture. It is critical that there be meaningful research and education programs to address the changing agricultural environment, yet support for such programs is on the decline.
- Consumer awareness of the workings of agriculture remains low, while suspicions of the overuse of inputs, especially fertilizers and crop protection chemicals, continue to be significant. Agriculture must find a more effective way to address this issue.

### Summary

Discussion on the issues that affect the sustainability of agriculture is healthy. However, we can't continue to debate whether or not modern technology should be a part of food production systems unless we are willing to accept increased starvation. The world moves on and so must agriculture...producing more food per acre, doing it efficiently and in a manner that is more profitable for farmers while remaining environmentally friendly. 

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