

Plant Science in the Next Century

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Contemplation of the future of plant agriculture in the next century is exciting. A great many things happened during the 1990s and progress is expected to continue apace in the 2000s. Some of the events that impacted plant agriculture during the 1900s include the rediscovery and application of Mendelian genetics, the change from horse driven to mechanized machinery, the development of hybrid corn, advent of private seed companies, use of fertilizer, use of pesticides, concern about dietary intake, advent of biotechnology, search for new uses of present crops, and search for uses of new crops which may be adapted to the area.

Technology will continue to have a major influence on the direction that agriculture follows. Information will become more critical to farmers and they will need greater access to private and public consultants to help make decisions. Consultants will need up-to-date information regarding varieties or hybrids, planting dates, planting methods, fertilizer recommendations, pesticide application, and pest monitoring to make their recommendations on. The recommendations will be based on information resulting from research by university and private company scientists.

Farmers will need to maintain records on the history of each field, including crop and variety produced, soil fertility level before and after addition of fertilizer, amount and date of any pesticide applied, and yield records. All fertilizer and pesticide applications will need to be cleared through a monitoring agency and the amount applied will be limited by law. Crop rotations will need to be managed to reduce soil erosion as much as possible. These restrictions will reduce the probability that the soil or crop is treated with excess amounts of fertilizer or pesticide, residues of which may end up in groundwater or the food chain.

Plant breeders have been very successful in improving many crop species. These improvements have been related to grain yield, crop maturity, plant height, kernel size and weight, resistance to lodging and shattering, quality, and pest resistance. Quality means different things for different crops, but may include factors like protein content, oil content, starch content,

enzymatic activity, sugar content, loaf volume, storability, product color and palatability, and dough mixing properties. Pests include numerous diseases, insects, and weeds, and breeders work with pathologists and cereal chemists to develop varieties with resistance to diseases, insects, and herbicides. The North Dakota Agricultural Experiment Station is committed to continuation of these programs, utilizing appropriate inputs from traditional plant breeding programs, from biotechnologists, and also from consumers/users.

Plant pests are very adaptive and respond in their own way to efforts to control them. For example, some weed species have developed resistance to certain herbicides. This phenomenon has resulted in changes in how we attempt to control the weed species. Rotation among various herbicides may be necessary to prevent the weeds from building populations that are resistant to any one type of herbicide. Hand weeding small populations of herbicide resistant weeds may be beneficial in preventing spread to other fields. Another example of an adaptive pest is the stem rust organism that attacks wheat and other small grains. The stem rust races are monitored each year so that plant breeders can incorporate resistance to each new rust race into new varieties.

Biotechnology will play a very important role in variety development programs. Biotechnology should increase greatly the number of beneficial genes available for use in plant species of economic importance. Biotechnologists will work in concert with plant breeders to identify genes which control important characteristics. The genes will need to be isolated, attached to a "carrier," and inserted into a crop variety. Several of the procedures to accomplish this series of events still need to be worked out in most of our crops. Plant breeders will incorporate the genes into adapted varieties and test the performance of the "new" plants. Biotechnology will not reduce our need for plant breeders, but should make the variety improvement team of breeders, pathologists, cereal chemists, and now biotechnologists more productive. A discussion of the impact of plant biotechnology on agriculture can be found in the November-December 1990 issue of North Dakota Farm Research.

One of the present thrusts of our biotechnology work is in the area of wheat germplasm enhancement. This is a new area of research at NDSU and is the result of legislation passed by the 1989 North Dakota legislature. One of the first targets of this

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