NORTH DAKOTA
Farm Research
Bimonthly Bulletin

Vol. 45, No. 5 March-April 1988

Guest Column

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The Need for Continuing Research on Foliar Diseases of Cereals

Methods of reducing financial inputs into agricultural production and the greater use of biological control of pests on agriculutural crops have high national priorities. Disease resistance, bred into adapted cereal varieties, is the least expensive pest control to the grower as well as being an established method of biological control for crop pests. Currently the expense of developing resistant crop varieties is largely borne by state and federal tax payers whose taxes support state and federal agricultural experiment stations. If the use of the newer biotechnologies and the entrance of private companies expands, the cost of resistant crop varieties developed by these private companies will be passed on to the user and may increase farm operators' costs.

Resistance also results in biological costs. Those plants which have active defense reactions against disease-causing organisms expend energy that might otherwise go into the productions of yield (2). Since there are direct money costs to society as well as biological costs to the crop plant for pest resistance, it is essential that the biological and economic impacts of a disease on a crop's production be thoroughly studied before a major breeding program is initiated.

Disease resistance first must be found, and then its effectiveness tested over time before it can be used. Frequently resistance is not in types of plants suitable for direct use in crop production. Resistance may be found only in a close relative, but not in the germplasm of the crop species itself. Resistance in a variety may be governed by single major genes or by many genes (polygenes) each providing a variety with a slight degree of resistance. In transferring polygene resistance to a desired crop variety, resistance levels may be reduced, because all of the resistance genes were not transferred.

Emerging biotechnological techniques show promise for more readily transfering types of resistance from "alien" sources to commercial varieties. these new techniques hold special promise for some plant diseases caused by viruses and bacteria (1). However, resistance to a parasite obtained from "alien" sources must be tested against populations of that parasite and transferred into commercial varieties that are acceptable to growers and processors. Since crop varieties frequently fall out of use for various reasons, this resistance from "alien" germplasm must be readily transferable within the species of crop varieties under cultivation. After each transfer, candidate varieties must be tested for the desired resistance as well as desired agronomic traits.

All of these systems are used against pathogens that are known to occur on a crop in a given area and whose

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On the Cover: Plant disease researchers Robert Hosford (standing) and James Jordahl use a hand-carried computer to record ratings of tanspot resistance on strains of Chinese spring wheat selected by a CIMMYT plant breeder for their freedom from leaf spot diseases. Photo by Harold Caldwell.

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Farm Research
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Vol. 45, No. 5 **March-April 1988**

A BIMONTHLY progress report published by the
Agricultural Experiment Station, North Dakota State University of Agriculture and Applied Science
Fargo, North Dakota 58105
H. R. Lund
Dean of Agriculture, and Director of Agricultural Experiment Station
EDITOR
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presence each year in the crop production system may be anticipated. But plant diseases are constantly changing like the diseases of animals and man. It should not be surprising, then, to discover that two species of Septoria, previously either not found in North Dakota or found at noneconomic levels, should suddenly appear on our wheat crop under unusual environments.

Diseases on North Dakota crops have appeared and disappeared before. White rust and downy mildew attacked mustard in the Langdon area in the early 1960s and then became scarce. Septoria blotch has waxed and waned on North Dakota barley. While the immediate within-year losses to these diseases were serious, the problem was to determine if they were a continuing economic problem. This could only be answered by field, greenhouse and laboratory studies over time.

No control program was initiated for aster yellows on flax although it caused serious losses in the late 1950s and later ceased to be an economically important factor. However, growers who have had losses to diseases that came and disappeared after a few seasons are understandably demanding that the problem be solved. Solutions to such problems may not be quickly forthcoming, because practical and economic control are not always possible. If the problem is not a lasting one (e.g. aster yellows on flax), reduced budgets and higher priority problems will prevent resources from being assigned to this new problem. Even with good sources of major gene resistance, developing varieties with these additional resistance genes plus good agronomic characteristics takes several years and the fiscal resources that are currently being used on other problems. If the genes for resistance are polygenic, the development of resistant varieties will take longer and be more expensive.

The contest between man with his desired crop varieties and the world of pathogens is an ageless and continuing one that requires continued inputs of money and personnel. These economic inputs are required of public and private crop improvement programs. New technologies offer additional methods of achieving improved crop varieties, but they will not terminate the contest between man's crops and crop diseases.

1. Goodman, R.M. 1988. An agenda for Phytopathology. Phytopathology 78:32-35.

2. Smedegard-Petersen, V., and K. Tolstrup. 1985. The limiting effect of disease resistance on yield. Ann. Rev. Phytopathol. 23:475-490.

Continued from page 12

Soil Survey Staff. 1951. Soil survey manual. USDA Handbook No. 18, U.S. Govt. Printing Office, Washington, DC.

Ulmer, M.G. 1986. Long term yield prediction models for hard red spring wheat and sunflower. Unpublished M.S. Thesis, Library, NDSU, Fargo, ND.

Vasey, E.H. and A.G. Leholm. 1982. CROPPAK: A crop management systems model. Eighth International Symposium on Machine Processing of Remotely Sensed Data. Laboratory for Application of Remote Sensing, West Lafayette, IN 47907.

Young, R.A., J.L. Ozbun, A. Bauer and E.H. Vasey. 1967. Yield response of spring wheat and barley to nitrogen fertilizer in relationship to soil and climatic factors. Soil Sci. Soc. of Am. Proc. 31:407-410.

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extent that cooperatives have a low-cost structure and are free to engage in differential pricing, they are in a relatively favorable position.

Availability of Cost Data

One of the most disappointing and yet not surprising findings was the lack of cost data on which to base differential pricing decisions. Several elevators had detailed cost information but did not have it classified in a way that differential pricing policies could be defended. If accurate cost data is not available, differential prices may not include equal margins. Members have a right to know that one group of patrons is not subsidizing another.

References

Cobia, D.W., W.W. Wilson, S.P. Gunn, and R.C. Coon. 1986. **Pricing Systems of Trainloading Country Elevator Cooperatives.** Agricultural Economics Report No. 214. Fargo: North Dakota State University, Department of Agricultural Economics.

Agricultural Experiment Station
NORTH DAKOTA STATE UNIVERSITY
of Agriculture and Applied Science
University Station
Fargo, North Dakota 58105
Publication

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