Standardization of Disease Assessment and Product Performance Reporting: An Industry Perspective

This letter is written as a follow-up to the discussion session at the 1989 annual meeting on standardization of disease assessment reporting.

Practical, efficient, and accurate assessment of disease intensity (pathometry) has been a concern of plant pathologists since the formative years of the American Phytopathological Society (APS). An APS Committee on Standard Chart for Percentage Estimates of Injury to Diseased Plants existed from 1917 to 1920 (2). Its major contribution was the release of the modified Cobb Scale for assessment of cereal rusts. K. Starr Chester and Clive James were among the pioneers in recognizing the importance of improved pathometry, particularly the measurement of disease impact on crop yield and quality. Unfortunately, progress on measuring disease intensity and its impact on quantity and quality of food and fiber has not kept pace with our knowledge of other areas of plant pathology (6).

Plant pathologists have recently begun to standardize methods of reporting data from product-performance experiments. As a result of the rejection of proposals of the E-35 Pesticides Committee of the American Society for Testing and Materials, two APS books have dealt with standardized testing procedures (7,12), and the New Fungicide and Nematicide Data Committee of APS has adopted standards for the reporting of trial information. However, there is still a need for improving data quality by standardizing the reporting of fungicide rates, application schedules, crop growth stage, and disease levels at each application.

Why should we standardize? Recently, research emphasis on disease forecasting, pathosystem modeling, and crop loss prediction have led to increased interest in, and need for, improvements in pathometry. This emphasis has great impact on, and is welcomed by, industry. Through the use of these techniques, it is possible to evaluate how products can best be utilized, especially in integrated pest management programs. One major improvement in pathometry would be the acceptance of standardized methods for assessing disease intensity and reporting product performance data. From our perspective, there are several reasons why plant pathologists should follow the example of standardization set forth by our colleagues in weed science (9), but we will mention only a few.

Standardization of disease assessment methods would permit industry to compare data from several trials and thus more effectively identify application rates and timings needed for the preparation of a product label for submission to the U.S. Environmental Protection Agency (EPA).

The availability of personal, lap-top, and hand-held computers and software programs for the organization of field trials and collection of data has allowed the creation of an informal electronic network for exchanging data. However, these data cannot be stored and classified in a manner amenable to computer searches, because standardized methods for assessment and reporting have not been employed. An effort is currently under way in the National Agricultural Chemicals Association to provide university cooperators with computer software for use in generating and reporting product performance data. An electronic data storage system would be important for demonstrating the benefits of fungicides to farmers and society. Such demonstrations will become more and more important to EPA and growers with the introduction of Low Input Sustainable Agriculture (LISA), the maturation of integrated pest management programs, and increasing consumer concern over food safety.

Standardization improves communication and interpretation of experimental results among agricultural researchers. The benefits of enhanced communication are recognized by several committees within APS; for example, the Plant Disease Losses Committee is currently attempting to standardize terminology and methods in its area of research.

Finally, standardization of pathometric reporting methods would benefit the research community by increasing the comprehension of research data by their most important customers, the farmers.

Systems of pathometry. Several assessment systems have been utilized by researchers to demonstrate differences between fungicide treatments in field and greenhouse trials. In our opinion, disease assessment in product performance trials should be conducted utilizing standard area diagrams to evaluate disease intensity on a 0–100% scale. The use of standard area diagrams has been shown to be reliable (10), and computer software is available to aid in training people to use these diagrams (11). Pathometry based on the Horsfall-Barratt rating system (1) is not endorsed by us because of the lack of experimental data confirming the Weber-Fechner law of visual acuity under the practical conditions of disease assessment (5). Also, the Horsfall-Barratt scale limits the ability of the researcher to identify effective treatments (1), because some of the most important data in a product performance trial would fall within a range of disease intensity of 0–15%. Category systems (1 = 1–25% of bottom canopy with symptoms, 2 = 26–50% of bottom canopy with symptoms, etc.) should be avoided. Being discontinuous, such systems are too imprecise (4) and restrict assessments to ranges that do not adequately describe differences among pesticide treatments.

Other aspects of pathometry. Experiments involving product evaluations should take into account the crop and the complete epidemic. For example, assessment on a series of dates is more beneficial than a single rating at the end of the growing season. Data from experiments should include information on the intensity of disease at each time of treatment, the crop growth stage at each treatment and assessment date, and the spatial distribution of disease in the experiment. Any benefits resulting from pesticide applications should be measured. Examples of information about benefits would be yield (as it integrates all impacts on the crop) and product quality (e.g., volume weight, fruit size). Apparent qualitative benefits, such as cropping system advantages (earlier harvest, better stubble crop establishment) or increased crop vigor, could also be noted. Finally, the opinion of the experimenter about the products under evaluation is important.

Proposals for standardization. Interaction of APS committees, such as those concerned with New Fungicide and Nematicide Data, Plant Disease Losses, and Industry, could result in flexible, acceptable guidelines to standardize pathometry in product-evaluation trials. Inputs from EPA should also be considered in the development of systems for standardization.

When working with university cooperators, an agribusiness should present the cooperators with a clear protocol and specific goals for each product-evaluation experiment. Generally, work with commercial products proceeds in two phases: research, then development. In the research phase, detailed biological data are of interest, whereas in the development phase, information concerning product benefits becomes more important.

We propose that agribusiness support the development and dissemination of standard area diagrams and computer software designed to help train personnel to utilize them. We also support the reporting of all application rates using metric units for amount of active ingredient (grams a.i./ha, grams a.i./100 L, grams a.i./100 kg of seed) and common English units for amount of formulated product.

Regional trials should be conducted that include products from several companies in a design similar to that of variety (3) and seed-dressing evaluations (8). In these trials the same experimental protocols are followed at several locations.

Conclusion. Standardization should not limit creativity, but it can be a focal point for the improvement of pathometry and communication. It is in the spirit of beginning a dialogue among all interested readers and agribusiness that we present this letter. We welcome comments and suggestions concerning the standardization of pathometry and product performance reporting, with the hope that the Chemical Control, Industry, New Fungicide and Nematicide Data, and Plant Disease Losses committees will discuss this topic further at the 1990 joint meeting of the APS and the Canadian Phytopathological Society.

LITERATURE CITED

1. Berger, R. D. 1980. Measuring disease intensity. Pages 28-31 in: Assessment of Losses Which Constrain Production and Crop Improvement in Agriculture and Forestry. Proc. E. C. Stakman Commemorative Symp., University of Minnesota, Minneapolis.
2. Chester, K. S. 1950. Plant disease losses: Their appraisal and interpretation. Plant Dis. Rep. Suppl. 193:189-362.
3. Coffelt, T. A., ed. 1987. Uniform Peanut Performance Test. Tidewater Res. Cent. Inf. Ser. 211, U.S. Dep. Agric. and Virginia Polytechnic Inst. State Univ. 26 pp.
4. Gaunt, R. E. 1987. Measurement of disease and pathogens. Pages 6-18 in: Crop Loss Assessment and Pest Management. P. S. Teng, ed. American Phytopathological Society, St. Paul, MN.
5. Hebert, T. T. 1982. The rationale for the Horsfall-Barratt plant disease assessment scale. Phytopathology 72:1269.
6. Horsfall, J. G., and Cowling, E. B. 1978. Pathometry: The measurement of plant disease. Pages 119-136 in: Plant Disease. An Advanced Treatise. Vol. 2. How Disease Develops in Populations. J. G. Horsfall and E. B. Cowling, eds. Academic Press, New York.
7. Hickey, K. D., ed. 1986. Methods for Evaluating Pesticides for Control of Plant Pathogens. American Phytopathological Society, St. Paul, MN. 312 pp.
8. Minton, E. B. 1989. Report of the cottonseed treatment committee for 1988. Pages 12-15 in: Proc. Beltwide Cotton Prod. Res. Conf.
9. Patterson, D. T., chairman. 1989. Composite List of Weeds. Weed Science Society of America, Champaign, IL. 112 pp.
10. Shokes, F. M., Berger, R. D., Smith, D. H., and Rasp, J. M. 1987. Reliability of disease assessment procedures: A case study with late leafspot of peanut. Oleagineux 42:245-251.
11. Tomerlin, J. R., and Howell, T. A. 1988. DISTRAIN: A computer program for training people to estimate disease severity on cereal leaves. Plant Dis. 72:455-459.
12. Zehr, E. I., et al, ed. 1978. Methods for Evaluating Plant Fungicides, Nematicides, and Bactericides. American Phytopathological Society, St. Paul, MN. 141 pp.

Greg Watson and Vince Morton
CIBA-GEIGY Corp., P.O. Box 18300
Greensboro, NC 27419

Rob Williams, *CIBA-GEIGY Ltd.*
Dep. Ag 2.8, CH 4002
Basel, Switzerland