ICM -- COMPUTER SOFTWARE OF THE FUTURE [1/]

Timothy R. Connell, Jeffrey A. Wyman, Larry K. Binning, Walter R. Stevenson, Keith A. Kelling, Dave Curwen, Paul Karraka, George Rice and Roger Schmidt

Potato production is an important portion of Wisconsin's economy. Although relatively small in acreage (68,000 A), potato production in Wisconsin ranks fourth in the United States and is valued at $120,000,000. The total value to the State in jobs, processing and service industries approaches $350,000,000. Currently, production costs average $1,500 per acre for irrigated potatoes with gross returns of $2,000, which creates a significant net return for growers. Beyond economic concerns, increased environmental pressure is being exerted on growers to ensure that each input is justified and causes little or no risk to the environment.

Wisconsin potato production typically includes intensive use of pesticides, fertilizer and irrigation water. Approximately 98% of the potato acres in the State are treated with one or more herbicide, insecticide and/or fungicide application. In the 1980's a full season potato crop would require close to 20 chemical applications with >27 lbs. of active ingredient (over 50 lbs. of product). Total agrichemical costs exceed $240 per acre per year.

While pesticides have been extremely effective over the years and will continue to play a key role in the future, their use has not been without other "indirect"costs. A majority of potato production in Wisconsin, located in the Central Sands region, is extremely sensitive to groundwater contamination. The Central Sands is sitting on a groundwater aquifer that is at a depth of only 10-20ft in some areas. If used without care, pesticides have a great potential for non-target toxicity. Besides environmental contamination, many target pests throughout the United States have become resistant to pesticides. This has occurred in insects, diseases and weeds.

To address these problems both for the Wisconsin industry, and for production in other areas, a potato research group was formed in the early 1980's. This was a partnership between the University involving the College of Agricultural and Life Sciences (CALS), UW-Extension, and the potato growers of Wisconsin.

[1/] Research Supported by College of Agricultural and Life Sciences and Extension Service, University of Wisconsin, Madison. Wisconsin Potato and Vegetable Growers Association. USDA-CSRS, USDA-ES, North Central Region IPM project, and the Center for Integrated Ag Systems, UW-Madison..

The growers are a key element in such initiatives. In Wisconsin, they have provided significant research support and have been closely involved in the program. The program's inception began with a 2-day grower/researcher seminar where the industry outlined where they wanted to be in 10 years. The goals were simple, the growers wanted to:

-Maintain competitive levels of production.
-Reduce inputs, particularly pesticides.
-Increase sustainability by reducing adverse environmental influences.

Although sounding easy, the process of attaining these goals is far from simple. The basis is to have good disciplinary components. The potato team with pathologists, entomologists, weed scientists, soil scientists, economists and production specialists first developed Best Management Practices for each component of potato production. These components relied upon years of research conducted in each discipline. This is a continuing process of learning and refining to improve the knowledge base for each component. The second phase was to integrate all components into a single system. This system, Potato Crop Management (PCM) is a computer software package designed for grower use. PCM was tested over several years first on experiment stations where it was refined and then on grower fields where practicality was incorporated. The software was released commercially to the industry in 1989.

The software currently in use has evolved from strictly disease management to more sophisticated software that includes modules for predicting and controlling disease, scheduling irrigation, predicting crop emergence, predicting development and managing harmful insects, and managing potato storage. Growers and IPM consultants now report use of the software on approximately 30,000 of Wisconsin's 68,000 potato acres. Use of the program has also spread to neighboring states where growers report using the software on an additional 30,000 acres.

Growers are enthusiastically supporting additional development of computerized decision aids through financial assistance and by playing key roles on advisory committees. Clearly growers are anxious for further software development that addresses and integrates their specialized needs. Development is underway on additional software components covering areas such as record keeping, fertility management, seedpiece decay, crop canopy development and marketing. These developments are backed by extensive field and laboratory research.

The next step in this process is to use this approach to incorporate all crops on the farm. The approach for this goal is similar but greatly expanded:

- First, completing component research for each crop.
- Second, integrating components for each crop to develop a system similar to PCM.

- Third, combine each of the individual crop packages.
- Fourth, test these packages on grower farms.
- Fifth, implement the final package on whole farms.

Although very ambitious, we are now well into phase three and are working on combining individual crop systems into a single program. Use of an expanded program will likely broaden the adoption and use of crop management software in the farming enterprise. The addition of a rural sociologist to the research and extension team is expected to help identify potential barriers to adoption of new technology. This new information will be especially helpful as focus shifts from a single crop to multicrop systems requiring multiple inputs form growers and field personnel employed by vegetable processors.

Wallendal Supply Inc., a highly successful potato and processing vegetable grower in central Wisconsin offered the Potato IPM Team a 25-acre field with center pivot irrigation for long-term field research studies. During 1991, large scale plot was initiated in this field to expand the research focus on potato to include several crops commonly grown in rotation with potato (sweet corn, snap bean, red clover and sorghum sudan). One of the key research objectives was to observe how rotational cropping and potato production affect each other. Information generated from this project, and associated component research is serving as a basis for expanding the PCM program from a one crop to a multi-crop program.

The PCM software is currently undergoing a major facelift as it is being converted from a DOS based format to a WINDOWS platform. This change will simplify the addition of new modules and crops to the program. After the computer integration is completed, the various modules will be validated and refined with on-farm research before release to growers for commercial use.

The results of this research have been very encouraging and the implications are broad. Joint research projects are currently being conducted throughout the United States and the World to modify the PCM program and associated crop modules for use in many different climates. Not only do we have a practical system for growers to use, we have also established a model for use in other cropping systems throughout the world. This is a large undertaking, but it is exciting to be involved in the development stage as the philosophy of crop production is changed.