Research Report to the Agriculture Research Foundation for 1997

Title: Automated Yield Monitoring in Vegetable Crops

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Status: Continuing; emphasis changing from development to application

Funding History:

Funding for 1996-1997	$ 15,700
Funding for 1997-98	$ 5,600

Justification:

Precision farming has become a popular topic in the agricultural press. Powerful computers and navigational equipment that can be linked to agricultural machinery are changing agriculture. Although the signal needs to be unscrambled (differential corrections); inexpensive civilian receivers give the public access to military satellites. It is possible to selectively apply herbicides, fertilizers, or other agricultural chemicals to specific locations in a field. However, little if any of this technology is being commercially used in the Oregon vegetable industry. Our goal is to start with computerized record keeping, GPS based sampling systems, and the creation of yield maps. Once this has been done various forms of computer assisted management become possible.

Objectives:

1) Convert a working but still cumbersome prototype yield monitoring system on a bean harvester to a commercially viable unit.

2) Develop a prototype yield monitoring system that can be use on any harvesting system where harvested crops are placed on a trailer that moves through a field.

Progress:

We believe yield mapping should be combined with a computer management program. Commercially available yield mapping devices that weigh product moving along a conveyor, and measure the speed of delivery into the storage bins of agriculture harvest equipment can be purchased for about $10,000. Conveyor based devices have been successfully used for sugar beet and potato cropping systems. However these yield monitors have not been adapted to vegetable crops. Furthermore, even with the purchase of a yield monitor, there are major recurring expenses associated with the personnel costs

required to process the information obtained. We are concerned that yield monitoring costs may be too expensive for practical use for average growers.

We are trying to develop a much less expensive solution. We are building a unit (approximately $2000-$3000) that can be used with any harvest machinery that is equipped with commercially available load cells (installation costs between $400 and $1200). We envision a program where growers could lease a monitoring unit and pay a fixed cost to process the information. Initially the program would involve OSU technicians. In the future private sector consultants would likely provide monitors and process information.

We are much more interested in developing a farm management package than simply providing a yield monitor. Cooperatives, chemical companies, and progressive growers should all start with a computerized mapping and record keeping program and access to a GPS unit. Yield monitoring then becomes the next step. Our program is unique in that we are linking load cells to the storage bin on agricultural harvest equipment. Our system should work equally well on either a home made trailer or a $300,000 harvester.

Although progress on the overall management program has exceeded expectations, and yield monitoring programs with other crops has progressed well, work on the vegetable program has been frustrating. The components work well on other crops, but the specific nuances of the bean harvester we are working on created some unique difficulties. Specific difficulties are described below:

1) The four load cells on the tank are not uniformly stressed when the harvester is empty; some are bearing weight while others are being stretched. As weight is added to the unit, increases are still measured, but much less output voltage per unit added weight is recorded. Without amplification weight can only be accurately measured in 100 pound rather than 10 pound increments.

2) Most amplification circuitry is not compatible with the computer system we selected to link to the load cells. Amplifying the signal results in a floating ground.

3) Neither of these problems (1 and 2) are a factor when the four load cells are all exposed to weight when empty as occurs in berry and hazelnut systems using the same components.

We have continued working on our yield monitor since the harvest season ended, and believe that the problems encountered are solved. Use of the system is planned for the 1998 harvest season. We are encouraged by the successful application of precision agriculture concepts to other crops in the Willamette Valley and believe that once a yield monitor is perfected applications to vegetables will quickly follow.

Future proposals will concentrate on the use of yield monitors to evaluate yield limiting factors in vegetable systems and the use of precision agriculture concepts to enhance profitability. If the OSU system is not workable in the 1998 season we will start to work on making the necessary modifications to more expensive but commercially available machinery.

Initial emphasis will likely be on managing soil pH. We believe that even in well managed fields that have been limed according to current OSU guidelines low pH still reduces profit on parts of the field. This appears to be the case with grass seed and wheat crops and we expect a similar situation for vegetables. We have worked closely with lime application providers to develop a variable-rate lime application program and these services are now commercially available. OSU is now working on the development of sampling protocols to economically make variable-rate lime applications once yield maps suggest pH is a profit limiting factor.