

Mapping Weeds for Site-Specific Weed Control in Field Crops

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Farmers have been mapping weed locations in their minds and on paper for a very long time. They have used this information to a limited extent to improve weed control. New technologies allow very accurate weed mapping. The locations of individual weeds can be reliably mapped using the global positioning satellite (GPS) system. Computer programs exist to organize and use this geo-spatial information. The difficult part remaining is to determine cost-effective, practical ways of using this information to improve weed control.

Site-specific weed control can currently be done using manual labor. To control weeds with manual labor, a large and very inexpensive workforce must be available. They must be tolerant of doing very boring repetitive work under very poor working conditions much of the time. Most of the world has this kind of labor force. California clearly does not have this kind of work force. However, this is an opportunity for farmers to use technology to continue successfully competing in a world economy. California farmers have effectively incorporated many new technologies during the past 100 years to produce a wide range of reliable, affordable, and high quality agricultural commodities.

Weeds which are difficult and expensive to control in field crops are an obvious place to start with site-specific weed management. Site-specific weed management works best if weeds are in small parts of a field, preferably as individual plants or small patches. There are three weeds which fit this description in many fields in the Sacramento Valley: johnsongrass, nutsedge, and velvetleaf. These weeds clearly have the potential to be widespread and difficult to control weeds in many Sacramento Valley fields. In fields where these weeds are just getting established, there is an opportunity to use weed mapping for site-specific weed control.

Mapping Equipment for Site-Specific Weed Control

GPS equipment of varying accuracies can be purchased for between \$100 to \$50,000. The equipment needed to accurately (within 1.0 meter) locate individual weeds costs around \$5,000. This equipment is a real-time differential correcting global positioning satellite (DGPS) receiver which is accurate within 1 meter. In addition to the satellite reception, it receives a separate radio signal to more accurately locate its position. This same equipment cost \$6,000 last year, and over \$10,000 a couple of years ago. As the price of this equipment continues to decrease, and as uses other than weed control are developed, it should make it affordable for any interested field crop grower or Pest Control Advisor.

The hand held computer to record and view previously mapped weeds is included in the \$5,000 purchase price. This small 32 megabyte hand held PC is running Windows CE (compact edition) and uses a touch sensitive screen instead of a mouse. Since it is a Windows based computer it takes very little time to learn how to use it, if you are already familiar with a Windows operating system.

The software receiving, managing, and displaying the DGPS location is a simple and very easy to use Windows program. It is called SiteMate Scout™, by FarmWorks, and is included in the \$5,000 price. Its most valuable feature is its 3 by 4 inch map display. SiteMate Scouts's™ zooming tools allow viewing hundreds of acres on one screen view or displaying areas as small as a 30 by 40 foot area.

The SiteMate Scout™ program allows the user to easily change the small table of information describing the weeds associated with each weed location in the field. Templates can be used to provide defaults for most of this information with the person doing the mapping only making minor entries with a keyboard on the touch sensitive screen. To further minimize keyboard use, drop down pick lists, common on Windows programs, can be created. These lists also avoid slight variations in spelling which making searching and sorting later very difficult.

Software for Weed Maps

The weed maps are transferred to a desktop PC for storage, viewing, and analysis. The site-specific weed maps are small files. A \$50, 128 megabyte CompactFlash card (typical for digital cameras) would store around 250,000 individual mapping points of weed locations. Each point has a small table with several entries describing the weed, intensity of the weed, date, field name, etc.

ArcView, by a company called ESRI™, is software which conceptually is very similar to the Excel software, by Microsoft. Both programs are Windows programs for storing, managing, and analyzing information in tables. The big difference is ArcView's powerful and flexible ability to display its information as maps on the screen. This view can show the whole earth's surface, without much detail, or can be zoomed in to a few square feet in a particular field in the Sacramento Valley with detailed weed information about that location.

Practical and Cost-Effective Uses in Field Crops Site-Specific Weed Control

If there are only a few individuals of a problem weed in a field, the easiest and most cost effective way to control them is to pull them up. The weed location can be marked with a DGPS to create a map on the small hand held computer. Depending on the crop and weed, one or two well timed trips to the field, using the GPS to get back to the original location, would allow control of any remaining seedlings or plants, and could prevent expensive problems in the years ahead. GPS equipment makes it possible to even find a few weeds hidden in a crop taller than the weeds. Without this kind of equipment it can be very difficult to locate weeds, even if you know the general area to look for them.

If there are just a few patches of weeds in a field, then spot spraying may be the next level of control. An advantage to this would be the ability to use herbicides which might destroy the crop along with the weed, but would only destroy a fraction of an acre when treating many spots.

If a few to 20 percent of the field is infested with weed patches, then the DGPS equipment could be mounted on a tractor sprayer to only spray the patches of weed present, or known to be emerging soon. This weed location knowledge, prior to weed emergence, allows

the use of both pre and post emergence herbicides in these weed patches. Since many herbicides are expensive, this might allow a herbicide costing \$30 per acre to only be used on the 10 percent of the field where it is needed. Thus, the cost of the herbicide is only \$3 per acre, on average, for the field. This may provide many practical uses of expensive herbicides for field crop growers.

Future Directions

The manual mapping of weeds is a combination of low technology (manual weed observations) and high technology. This is something that can be done now. It has the potential to very economically control difficult perennial weeds in field crop production.

In the years ahead, remote sensing for weed mapping in individual fields may be possible. Tractor mounted cameras may also someday be used for mapping of weeds. However, at the present time, a few well timed observations may allow field crop growers to do more cost effective weed control on some particularly difficult weeds.