

# Weed Mapping for Site Specific Herbicide Application

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## Introduction

Site specific weed management deals with precise application of chemicals only to infested areas of the field and with relation to weed infestation densities. Benefits of this technology include decreased usage of herbicides, reduction in the volume of spray and the cost of herbicide, reduced soil compaction, less non-target spraying, reduction of potential environmental risks, and more flexibility in timeliness of operations (Felton, 1995). Site specific herbicide application may be a very effective tactic in dealing with herbicide resistant weeds since a whole field herbicide application is likely to encourage herbicide resistance (Maxwell, 1992). The ability to manage weed infestations in a spatially precise manner relies on efficient methods of obtaining information about weed distributions (Colliver et al. 1996). Accurately recorded weed infestation and spatial analysis of weed populations precedes the development of weed maps. Prescription of herbicide rates is based on interpolated weed map and is loaded into on-board computer of a variable rate applicator before the site specific treatment.

## Materials and Methods

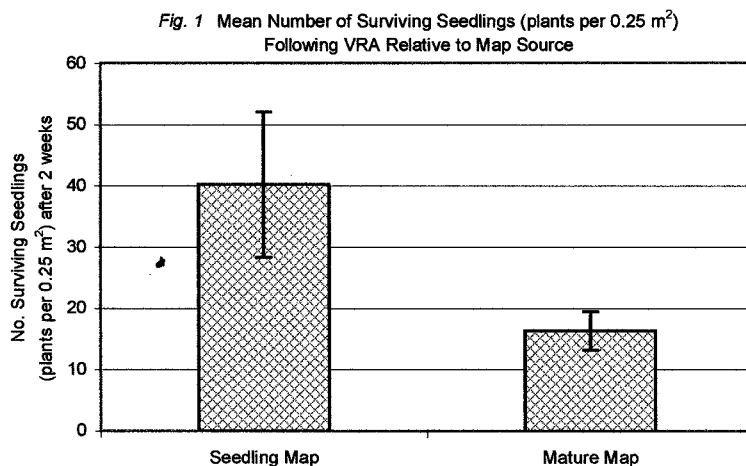
Weed populations were sampled in two following years, in commercial fields with processing tomatoes. Weeds were sampled at seedling stage in spring and in mature stage in the time of the crop harvest. Weed densities were recorded by field sampling using a hand held data logger with a Differential Global Positioning System. Methods of spatial statistics (geostatistics) have been developed to describe variation, create maps, and improve sampling of weed populations. Reclassified weed maps were used for developing herbicide treatment maps for the experiment to evaluate the effectiveness of the variable rate application of the preemergence herbicide. A portion of the field was selected where the greatest gradient in weed infestation was observed and a split-plot experiment was set up. The main effect was the type of the weed sampling used to create a treatment map (two levels: a map based on seedling counts and a map based on mature weeds), and the secondary effect being the herbicide rate - zero, half, and full dose of the recommended rate of ethalfluralin (Sonalan, 360 g ai/L), full dose = 1.5 lb ai/a. A prototype variable rate applicator traveled at the speed of 8 km/h. The application rate was varied by changing the duty cycle of the nozzles with the response time of about 0.1 second. The variable rate herbicide application was evaluated by density measurements of weeds that survived the treatment. Initial measurements were made two weeks after the application, and twice more at two weeks intervals. Measurements included estimation of the total weed cover for each subplot and weed seedling counts in a 0.25 m<sup>2</sup> placed randomly ten times per herbicide level in each replication.

## Results and Discussion

Two weed species accounted for approximately 80 % of the total weed counts in both years 1998 and 1999. More abundant species are less aggregated and their spatial pattern approaches the random distribution. Within high density areas the plants were spatially related within 60 ft. At larger scale, within the range of 650 ft, 85 % variation in weed density could be explained by the distance between points. The area of weed-free sites reached 30 % in 1998 and

40 % in 1999. About 50 % of the field had less than 10 weed plants per square meter in both years. About 17 % of the field had no weeds in both subsequent years.

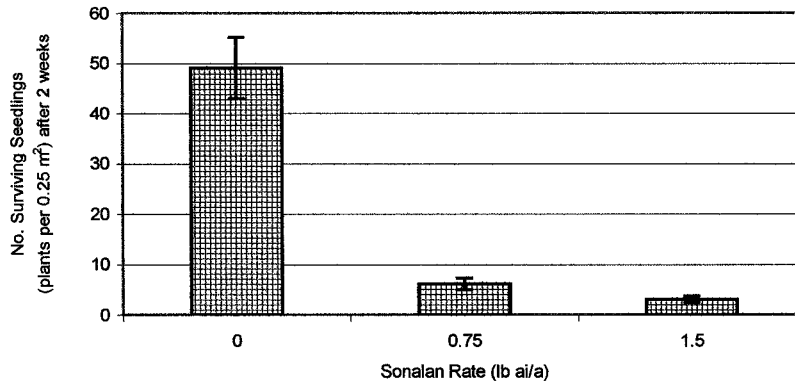
Based on seedling emergence two weeks after application, overall weed control was significantly better when maps were based on mature weeds than on seedlings (Fig. 1). Weed control was significantly better when treatments were based on a mature weed map for the zero and 0.75 lb/a herbicide rate. There was no significant difference between map source for the high 1.5 lb/a herbicide rate treatment. Weed cover averaged less than 10% for both maps two weeks after the application. After four weeks, weed cover in plots where the seedling map approach was used exceeded 10 %. Six weeks after the application there was no significant difference in weed control between the map source, weed cover exceeded 10% for both sources.



There was a significant difference in weed control after each herbicide rate (Fig. 2). In plots receiving application of reduced rates, there was higher survival of weed seedlings compare to full rate. A significant difference in numbers of surviving seedlings after zero and medium treatment was observed. The zero herbicide plots had the highest number of seedlings, in average 49 plants per 0.25 m<sup>2</sup> two weeks after the treatment. The average of surviving seedlings in the medium rate plots was significantly lower, 6.2 plants per 0.25 m<sup>2</sup>. All plots receiving medium or high herbicide rates had weed seedling weed cover below 10 % 2 to 6 weeks after application.

A 48 % reduction in herbicide use was achieved with the seedling map approach when compared to a uniform full-rate application. Reduced rates were applied to 79 % of the experimental area. A 36 % reduction in herbicide use was achieved with the variable rate application based on a mature plant weed map when compared to a uniform full-rate application and 50 % of the experimental site received a reduced herbicide treatment.

Fig. 2 Mean Number of Surviving Seedlings (plants per 0.25 m<sup>2</sup>) Following VRA



## Conclusion

Fields can be separated into sites with no weed infestation and sites with related weed densities. The edges of the fields are more weedy than areas inside the field under conventional herbicide treatments. The results from this experiment documented a decrease in the total amount of herbicide use. Weed control was comparable with the grower standard uniform application for the medium and high herbicide rates. Map-based site specific weed control with three rates performed better with a mature weed map. Reduced herbicide rates gave the same weed control at most of the sites as the uniform one rate.

## References

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