

Timing Cultivations for Maximum Weed Control

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Effective cultivation is essential for weed management in organic and many diversified vegetable cropping systems. There is a great diversity of cultivation tools in the market place, with some particularly innovative intra-row weeding implements being produced in Europe. Evaluating cultivation practices generally includes measurements of efficacy, i.e., the proportion of weeds killed by the cultivation event; and efficiency or working rate, i.e., acres, beds, or row-feet per hour or minute.

Detailed experiments characterizing cultivator efficacy involve pre- and post-cultivation censuses of weeds at particular locations, generally by species and growth stage. Efficacy may be affected by many, sometimes interacting factors: equipment design and adjustment; speed; soil conditions, especially moisture; and weed factors, including species and growth stage.

We recently conducted a series of experiments measuring cultivation efficacy at a field scale. In each of three years, cultivation efficacy and soil conditions were measured at 70 locations, randomly selected along five corn row transects in 2-4 acre sized fields of silage corn. The cultivator was a common, older model, 3-point-hitch-mounted, 4-row Case International Model 183 with Danish s-tines and 10 cm sweeps and gage wheels. Condiment mustard, 'Idagold,' (*Sinapis alba*) was used as a surrogate weed. Soil surface roughness, soil bulk density and texture were measured, as was soil moisture. Efficacy was even more variable than expected, ranging from 6.7 to 100%, with mean and median values of 67 and 68%, respectively. In one year, soil moisture explained nearly 10% of the variation in efficacy, but in other years, contrary to expectations, soil conditions failed to explain any portion of the considerable variation in efficacy. An important research objective related to improving cultivation is to better characterize and understand the sources of this variability. Moreover, it would be very useful to know if improved designs of conventional sweeps could reduce some of this variability.

Despite knowledge gaps related to variability in cultivation efficacy, research and farmer experience offer several important principles regarding timing of cultivation:

- 1) Efficacy is inversely related to weed size (smaller weeds are easier to kill). In one of our recent experiments, average control of mustard was reduced by 10% with each added leaf. It is also notable that variability in efficacy increases with increasing weed size.
- 2) Targeting very small weeds is more important for "blind" cultivators, i.e., rotary hoes and spring-tine harrows, and for intra-row weeders, i.e., finger and torsion weeders, than for

inter-row weeding tools, typically sweeps, which can provide good control of even relatively large weeds.

- 3) Efficacy is generally better during hot, dry weather and dry soil surface conditions as uprooted weeds more rapidly desiccate.
- 4) Crops with a size advantage can be more aggressively cultivated; establishing and maintaining an initial size advantage is essential. Stale seedbeds, pre-emergence harrowing, or use of transplants are effective ways to establish an initial size advantage to the crop.

Cultivation references:

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