Rotary Hoe:

A Blind Cultivation Tool for In-Row Weed Control

Expanding organic grain markets have increased interest in mechanical weed control. This publication explains how the rotary hoe may be used to control weeds in large-seeded grain crops like corn and soybean.

A rotary hoe is classified as a blind cultivation tool, meaning that it disturbs 100 percent of the soil surface without regard to crop rows.

Blind cultivators, such as the rotary hoe, are generally the most effective tools used for in-row weed control in organic field crops. Control of weeds in the row is the most difficult aspect of weed management for organic producers. More options exist for between-row weeds and the windows of opportunity for controlling between-row weeds are wider.

How the rotary hoe kills weeds

The rotary hoe pulls up or shatters weed roots, particularly newly germinated weeds (white thread stage). Some emerged weeds are buried by soil and lack enough energy reserves to emerge again. Remember, if you can see the weed from the tractor, it is probably too big to be controlled by the rotary hoe.

Figure 1. Goosegrass at white thread stage.

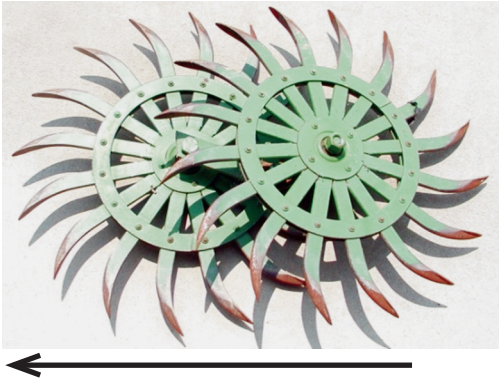

Figure 2. Direction of the rotary hoe pass.

When the rotary hoe is most effective

Hot and sunny weather helps desiccate uprooted weeds. Humid and cloudy days decrease weed desiccation and some dislodged weeds may re-establish. Weeds that have germinated but not emerged are more susceptible to dislodging. A faster rotary hoe pass (10 to 12 miles per hour) dislodges more weeds.

When the rotary hoe is least effective

- Weeds you can see from the tractor are not well controlled by the rotary hoe.
- Weeds that already have true leaves are likely to survive.
- A rotary hoe will dig too deeply in soils with high organic matter.
- Rocky soil may damage the rotary hoe. Worn tips on the wheels of the rotary hoe reduce soil disturbance and movement.

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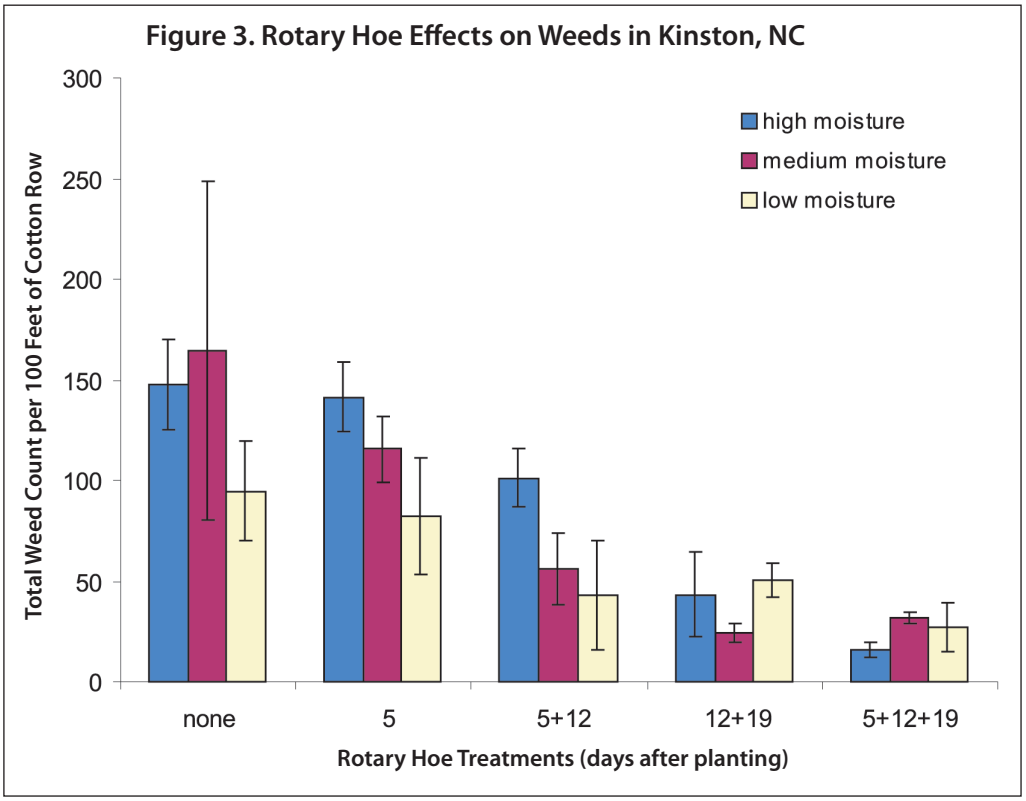
Two years of research at NC State University studied the effectiveness of the rotary hoe following irrigation on a sandy loam soil at Kinston (see Figure 3).

Rotary hoeing in corn was done:

- Following an irrigation event of 1 inch (high moisture), 0.5 inch (medium moisture) and 0 inch (low moisture). Rotary hoeing was always done following an irrigation treatment.
- 0, 1, 2, or 3 times after crop emergence.
- 5, 12, and 19 days after planting (DAP).



Remaining weeds in the corn row were counted in a 10-foot length of the crop row and 4 inches on each side of the crop row. Moisture did not significantly affect the effectiveness of the rotary hoe, however increased hoeing significantly reduced weeds.

To minimize crop damage

Before crop emergence, make sure the crop seed is deeper than the working depth of the rotary hoe. After crop emergence, be sure the crop is more deeply rooted than the weeds. Crops with strong, flexible stems suffer the least damage. Do not rotary hoe soybeans at the delicate "crook" stage following emergence.

NC State University research suggests that multiple rotary hoe passes may result in some yield loss in soybean. Although weed management is improved, multiple passes often reduce soybean population, which reduces canopy height (see Figure 4). An experiment at three locations during 2006 and 2007 investigated the effect of numbers of rotary hoeing on soybean yield and returns. At each location, maximum economic return was seen with one pass, although weed control continued to improve with multiple passes. Weedy conditions were seen in Goldsboro 2006, while Plymouth 2006 had light weed pressures and the Plymouth 2007 location had very few weeds.

Figure 4. Shortened soybean canopy due to multiple rotary hoe passes. The plot on the left received 4 passes while the plot on the right received none after the soybean planting.

Table 1. Relative Net Return[1] Compared to Zero Rotary Hoeing						
Number of Rotary Hoeings	Goldsboro 2006		Plymouth 2006		Plymouth 2007	
	Yield (bushels/acre)	Return ($/acre)	Yield (bushels/acre)	Return ($/acre)	Yield (bushels/acre)	Return ($/acre)
0	36.1	0	23.8	0	44.3	0
1	49.8	190	34.3	145	46.6	30
2	37.4	15	31.3	100	41.6	-42
3	—	—	27.1	39	40.2	-63
4	—	—	27.2	39	39.3	-78

[1]Based on rotary hoe costs estimated at $2.20 per acre (assuming a farm diesel cost of $4 per gallon and labor at $11 per hour) and selling organic soybeans for $14 per bushel.

Recommendations for rotary hoe use

- Use the rotary hoe for controlling small weeds (cannot be seen from the tractor).
- Do not rotary hoe soybeans in the crook stage.
- Rotary hoe in dry, hot weather.

- Limit rotary hoeing in soybeans to maximize profits.

For more information

NC organic grain production guide
http://www.organicgrains.ncsu.edu/

Steel in the Field: A Farmer's Guide to Weed Management Tools
http://www.sare.org/publications/steel/steel.pdf

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