

Great Lakes CSA Conference 2008

Tillage Presentation

Tillage Principles – 10 minutes

Whatever type of tillage you do from using hand tools, horsedrawn equipment, walk behind tillers or tractor mounted cultivators, we share common challenges:

- to get these jobs done before the weather changes
- To do no damage to our soil structure and tilth and sometimes, improve our soil health.

Today we are going to talk about our farms and our tool preferences.

But first, I want to talk about some of the best management practices in tillage.

What we mean by tillage:

- opening soil from perennial sod;
- preparing a seed bed appropriate to the needs of the seed;
- controlling weeds between the rows/in rows so that the crop can thrive;

Best Management Practices

- Tillage should not be attempted when the soil is wet:
 - prevent crusting of the surface which can interfere with germination Prevent hardpan which prevents roots from accessing nutrients
 - Soil compaction is often a result of getting on the field too early before the moisture levels have settled. Hardpan (plow pan) develops at the tillage level, resulting from repeated passes with cultivating equipment at the same depth.
- Any tillage which is overused can break down soil tilth:
 - Pulverizing soil particles causes the soil to dry out, biological activity to cease. The disk is often at fault if it is overused in preparing the field for planting.
 - Soil crusting is a result of rapid wetting and drying of overworked seedbed which has a low organic matter content, more than 3 tillage passes; affects crop emergence
 - Loss of oxygen in the soil from compression reduces microbial activity = less nutrients

- Prevent weeds from establishing by:
 - Have a biologically active soil; maintain organic matter soil levels - critical to preserving good soil structure/tilth. Healthy crops grow fast and outcompete weeds.
 - Employ a crop rotation which alters the habitat and discourages weeds: alternating summer crops with spring seeded, using buckwheat as an early summer niche cover crop prior to fall seeding, alternating cover crops with row crops
 - Cover crops grown in the previous season or in niches before a main later crop is sown
 - Mulching: suppresses weeds, offers additional benefits for soil health
 - Not easily adapted to all sizes of operations
 - Organic No-Till (Rodale) in which mulch (rye/vetch) is planted the previous year, rolled in the spring prior to heading out; crop is transplanted or no-till planted into the residue.
 - Using delayed planting to allow time for stale seed bed cultivation
 - Composting manures to kill weed seeds
 - Using plowing as rarely as possible to avoid inverting the soil profile and bringing up buried weed seeds
 - Using Light Tillage, which stirs the top inch of the soil (ie. basketweeders, fingerweeders, spring tooth cultivators, scufflers or spyders).
 - weed seeds are deposited on the surface of the soil where they are affected by light and moisture and often prematurely sprout and die
 - Prevents weed seeds from being brought up to the surface
 - Does not create hardpan
 - Aerates the soil
 - In the spring, cultivation speeds up soil drying
 - Flamers (backpack or tractor mounted) are also in this category.
- Stale Seed Bed preparation: allowing first weeds to emerge, then till before planting the crop
- Pre-emergence Tillage: suitable for potatoes and large seeded crops, involves light harrowing (inverted harrows or fingerweeder) after planting but before emergence of the sprout. Seed

must be placed deep (at 2 in.) to prevent displacement. Allows the crop to surge ahead of the weeds.

- White hair stage of weeds: this is the best time to weed regardless of the tool used.
- Continued passes with tillage tool on a weekly basis or as needed until the crop forms a canopy. If the crop is a poor competitor (onions, carrots) continued weekly tillage is useful.
- Weeds that are special challenges:

Quackgrass: can be controlled through fall plowing, followed by light cultivation in the spring to deposit roots on the surface where they will dry up.

Thistles: can be controlled through rotation out of row cropping into perennial forage. If the thistles are mowed three times during the season, their root reserves are exhausted and they will be winter killed.

Red root pigweed: can be controlled through rotation out of summer annual crops into perennial forage or early spring crops followed by a buckwheat (niche) cover crop prior to cultivation for fall planting.

Weeds can be indicators of soil characteristics. If you have a persistent weed problem, soil testing may be necessary to determine what corrections need to be made.

Tractor Tillage Choices – 15 minutes

Choosing a Tillage Tool

- a. Choose a tillage tool which suits your soil profile
 - Some cultivators are not suited to certain soils. For example, basketweeder do not perform well in rocky or clay-based heavy soils. Fingerweeder can be less effective in soils which have dried out and crusted.
- b. Tillage Action
 - Between the row tillage: most tillage tools deal with weeds which between the crop rows; basketweeder, spring tooth cultivators, sweeps, finger weeder
 - In the row tillage: a few tools deal with weeds which grow between the crop rows as well as in the row; spyders have a light hilling action which buries small weeds growing in between the plants in the row. Disk hillers also bury weeds between the plants in the row. Lilliston cultivators which are gangs of spyders can replace disk hillers in hilling up potatoes.

c. Tillage Tools Can Be Built Or Bought

- Tool Bar Basics: Build your cultivator starting with a tool bar (single or double) set either as a three point hitch or belly mounted attachment. Add tool bar clamps, scufflers, spyders, hillers. Add guidance wheels, crop guards.
- Buy a complete system: basket weeders and fingerweeders can be purchased as complete units ready to go to work either attached to the three point hitch or a belly mount.

Horsepower Requirements

- For light cultivation, less than 20 horsepower is no problem.
- For heavy cultivation, 12 inches of tillage width per 10 horsepower.

Choosing a Tractor

- Age less important, hours on the engine: under 4000 hours, availability of parts.
- Helpful to consider all the type of work the tractor will do and select adequate horsepower.

Maintenance of Tillage Equipment

- Ground driven units usually have grease fittings which require grease at regular intervals to keep moving parts from seizing up
- Unless they are oil bathed, chains should be lubricated with aerosol chain oil at the beginning of the season
- PTO driven gear boxes should be kept topped up with 90-140 wt oil and checked at the beginning of the season
- Some people coat the surface of tillage tools with paint or oil. Otherwise the rust which builds up will begin to clean off as you make the first few passes with the tool.

Resources

Sources of Equipment:

- John C. Graham Co.: source of hillers, spyders, round standards, cultivator sweeps. Leamington, ON 519-326-5051
- Market Garden Implement Co. – source for basket weeders, Williams Tool System fingerweeder – www.MarketFarm.com

- Saukville Tractor Corp. – new cultivating tractors – Newburg, WI - saukville@portsmouthnh.com

To Learn More About Tractor Tillage

- Steel In The Field: A Farmer's Guide To Weed Management Tools, ed. Greg Bowman, Sustainable Agriculture Network
- Vegetable Farmers And Their Weed Control Machines, 1996 dvd from SARE – available from the Canadian Organic Growers library

To Learn More About Organic No-Till

- New Farm – <http://newfarm.rodaleinstitute.org/depts/notill>

To Learn More About Soil Health, Cover Crops

- Soil Management, Best Management Practices Series, OMAFRA
- Managing Cover Crops Profitably, 3rd Edition SARE
- Soil Biology Primer, USDA NRCS