

Reduced Tillage in Vegetables (Northeastern United States)

FISH FARM, FARMINGTON, NEW YORK

Location: Farmington, Ontario County, NY

Annual Precipitation: 33 inches

Reduced Tillage Method: Zone Tillage

Crops: Tomatoes, Pepper, Cabbage



Description: 200 acres diversified vegetable farm transitioning to zone tillage starting 2004.

BACKGROUND AND PREVIOUS TILLAGE METHODS

FARM SIZE & CLIMATE

Lynn Fish took over the family farm after his father passed away in 1981. He farms a total of 200 acres which in Farmington, NY. Farmington has a cold temperate climate (USDA Zone 5). Mean average temperature is 45.9 degrees F, ranging from an average low in February of 21.1 degrees to an average high in July of 69.7 degrees. Annual precipitation averages from 33 to 36 inches. The growing season averages 162 days. Cropping season, which includes land preparation normally, starts in April. Lynn has found that seasonal rainfall can exhibit a high variability during the growing season. This has particularly been very problematic in some years.

During very wet springs, he finds it difficult to get into his field for tillage operation on time.
During drought years, his crop suffers from lack of moisture.

SOIL TYPE (CHALLENGES)

Most of the soil on Lynn's farm is Ontario Loam. Some of Lynn's soils are located on relatively steep slopes and are very gravelly. Lynn finds it very challenging to manage his soils to prevent soil degradation. Over the years, he has observed problems with soil drainage, surface crusting and runoff on his farm. The organic matter content of Lynn's farm is very low (<2%). This may be responsible for the crusting of the surface soil observed on Lynn's farm. He found it difficult to build up the soil organic matter despite his yearly practice of planting rye cover crop.

PREVIOUS CROP/SOIL MANAGEMENT BEFORE REDUCED TILLAGE

Lynn's system was based on rye cover cropping in the fall and moldboard plowing in the spring. He disks more than once to create a soil with a nice seed bed condition. He pre-incorporates the herbicide. Lynn has also tried using chisel plow. He found that chisel plowing did not work on some fields especially those with drainage issues. He got good crop yields from extremely sandy fields, which constituted about 30% of his farm. The rest 70% had crop failure. He gave up chisel plow after testing it for 3 years and went back to moldboard plowing. Looking back, he felt that the chisel plowed failed because of the subsurface compaction in those soils where drainage was an issue.

CROPS GROWN AND MARKETS

Sweet Corn: 135ac; Tomatoes: 5-7ac; Peppers: 3ac; Cucumbers: 2ac; Pumpkins: 15ac; Summer Squashes: 3ac; Winter Squashes: 6ac; Cabbage: minor acreage
Tomatoes, Cabbage & Peppers at trial stage for zone tillage

REASON FOR ADOPTING REDUCED TILLAGE & INITIAL EXPERIENCES

Lynn considered changing to reduced tillage system due to low organic matter, low water holding capacity, crusting and compaction of his soils. Increasing losses due to diseases such as Phytophthora was another reason why Lynn wanted to try reduced tillage. Lynn's crops were very susceptible to seasonal variability in weather. He had problems with yields especially in drought years. Lynn tried to set up an irrigation system but this did not work well because he did not have enough water and did not want to spend too much money on water exploration. He finally decided to give up the irrigation scheme. Lynn had previously tried to grow some pumpkins with no tillage. He had good yield in the first year but crop failure the following season using the same tillage method. He attributed the failure to drought and subsurface compaction. Since then, he decided to start out little for a few years and learn about the new method before total adoption. Lynn started experimenting with zone tillage in 2004. He was impressed with the results that he got from this system over the past two years. He decided to put more of his land into zone-till this year. Information from other growers practicing zone tillage with deep ripping around the same area shows that this tillage method can secure crop yields and improve soil quality either during periods of drought or too wet season.

GENERAL APPROACH TO REDUCED TILLAGE

Lynn has been improvising and adapting equipment for reduced tillage. He started slowly with a one-row deep ripper (a mole subsoiler), which he had used over the years to address drainage issues. He prepared his rows with his deep ripper. He went over the ripped rows with hiller disc to prepare small ridges on top of the rows. However, the rows were still very cloddy. He needed to break down the soil further, to create a fine seedbed. To achieve this, he went over the rows with a culti-packer to break the clumps up and used the hiller disk once more to reshape the row ridges. He then used a conventional transplanter to plant the seedlings. If he had a conventional zone builder, he would have been able to save some passes through the field. However, since this was an experiment for him, he was quite satisfied to be able to set up this method of reduced tillage in contrast to full width tillage, which he has done for several years. Recently Lynn has purchases a two-row ripper with zone tillage attachments. This will enable him to reduce field passes and time used for field operations.

ADVANTAGE/DISADVANTAGES

Although Lynn's initial reduced tillage method involved some field passes, he however maintained that it worked faster than the conventional moldboard tillage system. He has become more efficient in field operations with procurement of two-row zone tillage equipment. He is also learning that making the zones in the fall rather than spring can save a lot on timeliness of spring operations.



Figure 1. One row deep ripper (mole subsoiler)



Figure 2. Hiller disks and rolling basket attachments

SPECIFIC CULTURAL PRACTICES USED

EQUIPMENT & OPERATION

Lynn initially has a 100 horsepower tractor, a deep ripper (Figure 1), a set of hiller disks with rolling basket attachments (Figure 2) and a conventional transplanter. In 2005, Lynn purchased a 2-row ripper (Figure 3) and recently a 5-shank ripper (Figure 4) which he intends to modify to 4 rows to fit his field operation. At planting, Lynn usually applies some amount of starter liquid fertilizer. More liquid fertilizer is applied as side-dress later in the season. Lynn measured the depth of the pan layer in his soil by pushing a penetrometer into the profile. He found that the depths were very variable in his field. He found some pan as shallow as 6 inches while some were 8 and 12 inches and below. He then decided to set the depth of ripping to 18 inches.



Figure 3. Two-row ripper and zone builder



Figure 4. Five-row ripper

CROPS, COVER CROPS & ROTATION

Lynn practices continuous vegetable with rye cover cropping usually in the fall. A typical sequence of Lynn's rotation is: Sweet Corn-Rye Cover-Tomato-Squashes- Rye Cover-Cole Crops-Rye Cover-Sweet Corn

RESIDUE MANAGEMENT

Lynn does not have problems with residue. He normally plows them under with a moldboard plow. However, he no longer plows the fields where zone tillage is used. The cover crops are killed with 2,4-D and the rows are established right within the residue mulch by a zone tillage equipment. Lynn is hoping that with more residue left on the soil surface, the organic matter of the soil will increase from its present level.

WEED MANAGEMENT

Lynn controls weed problem with cultivation on most of his vegetables. However, he still uses

herbicides for weed control in cabbage, pepper and tomatoes.

DISEASE AND INSECT MANAGEMENT

Lynn had a serious problem with *Phytophthora Pcapsici* in 2004 which led to a loss of significant quantities of his pepper and tomatoes. Since Phytophthora is water borne infection, a poor soil drainage condition will favor a rapid spread of this pathogen. Lynn hopes that with deep ripping, zone tillage, and the use of resistant varieties, he may be able to prevent a future outbreak of this disease in his farm.

CROP SEEDING STRATEGY

Apart from sweet corn, Lynn transplants most of his other vegetable crops.

REDUCED TILLAGE TRIAL

Lynn set up a trial during 2004 and 2005 comparing the effect conventional and zone tillage systems on the yield of cabbage and tomatoes. In 2004, cabbage yields were equal between conventional and zone-tilled treatments. Tomatoes however, had 50% increases in yield with zone tillage compared to conventional tillage. The tomato plants in zone-till look much bigger and better than those in plow-till. In 2005, Lynn tested the tillage methods on sweet corn. There were no statistically significant differences in yield and plant height of Argent sweet corn variety between both tillage treatments. However, the mean yield and plant height of the ripped and zone-tilled treatments were quantitatively higher than the conventional treatment.

BENEFITS FROM REDUCED TILLAGE

POSSIBILITY OF INCREASING PROFIT

Lynn feels that he has made significant savings on fuel through the reduced field passes and field area he operates his equipment. The zone tillage method is restricted to narrow rows whereas the moldboard tillage covers the entire field. Lynn has also made savings in the number of man-hours needed to prepare the field. Zone tillage also gives his crops better security against extremes of seasonal weather fluctuations.

SOIL QUALITY IMPROVEMENT

Lynn feels that it is too early to see any change in soil quality from reduced tillage in his field. He would be able to answer this question in the coming years. However, penetration results measured

by pushing a penetrometer into the soil profile show the beneficial effect of deep ripping. While the conventional tillage had a penetration resistance of over 300 psi at 12 inches depth, zone till treatment measured about 50% less. A penetration of over 300 psi is considered too hard for vegetable root penetration. This implies that the root were able to push through the soil where the ripping had occurred.

LESSONS LEARNT

CROP ESTABLISHMENT AND SECURITY

Lynn feels that it is too early to be able to assess the reduced tillage method. However, from his trials, things took up faster and looked better in the reduced tillage plot than it did in the conventional. Lynn also noticed that the reduced tillage plot drained faster than the conventional. He was therefore able to get into his reduced till plots after rains earlier than his conventional plots.

FALL VS. SPRING ZONE BUILDING

Lynn did not do fall zone building. He did the zone preparation for his trial in the spring.

Lynn has kept on expanding the land area he uses for reduced tillage. He hopes to transition his whole farm fully to zone tillage soon.

ADVICE FOR NEW FARMERS WILLING TO ADOPT REDUCED TILLAGE

- Stay small at the beginning
- Watch closely and learn how the system works
- Do not overdo it in the first years especially when you are still learning

PLANS FOR THE FUTURE AND CONSTRAINTS

- Lynn is looking forward to transitioning the whole farm to zone tillage.