A Systems Approach To Cover Crops In A Rotation

Norfolk SCIA - Tier One Grant Project

Final Report

Cover Crops and their benefits, both economic and environmental, are not a new concept to members and growers in Norfolk and the surrounding region. For decades they have been used on the light sandy soils of the region's sand plain, specifically when tobacco was the primary crop grown here. As tobacco acreage has decreased, some of that void in acreage has been filled by other high value crops such as ginseng and vegetables, which also incorporate the use of cover crops but the majority of that acreage has been replaced by corn and soybeans. With increased land values, input costs, slimmer margins and a growing emphasis being placed on the environmental impacts of agriculture by all levels of government, cover cropping systems can offer the potential to help alleviate farm businesses from these challenges. Based on this members chose the use of cover crops in a cash crop rotation as one of the projects they wanted the NCSIA to further explore. With assistance from a Tier One Grant through the OSCIA and OMAFRA a committee was set up and a 3 year trial project to develop a framework for establishing practical implementation for growers in the area to incorporate cover crops into their existing crop management structure.

Research Project

The growing season of 2015 marked year one of this trial project. The goal for year one was simply to establish timing and cover crop mixes that were effective, efficient and feasible for growers to adapt to. Due to the vast variability of soil types, not just from farm to farm, but also within farms and fields themselves several trial locations were set up to reflect this. Locations included the clay loam in the Port Rowan area, sandy loam near Courtland and straight sand in Houghton. Due to the prominence of the horticulture sector in this area and with limited options for herbicide use in vegetables, much reliance is placed on mechanical and manual cultivation. One trial location was used in Langton to explore further uses of in- season cover crops to reduce the need for mechanical and manual cultivation of weeds and increasing soil structure.

Methods & Findings

For corn trials, 17lbs/ac of annual ryegrass, crimson clover, single cut clover and tillage radish was broadcast, post side-dress, at both the V4-V5 and V7-V8 stage. One site (Courtland) was under an overhead pivot style irrigation system that also incorporated nutrient application with watering. The establishment of the cover crop was far greater when applied at the earlier stage of corn growth and the irrigated plot showed much more growth than the non-irrigated one. Yield results were mixed, showing slight declines on the clay loam soil and irrigated plot on the sandy loam soil. A slight yield increase was measured on the non-irrigated plot where cover crops were established on sandy loam soil. Initial observations show that on land where moisture was not a concern, the cover crops thrived both in establishment and growth, but also lead to a decrease in the yield potential of the primary production crop.

Table 1. Port Rowan (Clay Loam) Cover Crop Trial

	Avg Yield
Check	209 bu/ac
Cover Crop	203 bu/ac

Table 2. Courtland (Sandy Loam) Cover Crop Trial

	Irrigated		Non - Irrigated	
	Cover Crop	**Check**	**Cover Crop**	**Check**
Yield	187 bu/ac	191	159 bu/ac	158/bu/ac
Moisture	23%	21%	23%	27%

One soybean plot was established on light sand (Houghton) where cereal rye was no-till drilled in post- harvest. This was deemed the most practical and feasible option at this site as there is no chance for reduced yield from pre harvest in field traffic and it offers the grower the flexibility to have a grain crop for the upcoming year. No further observations can be noted at this time.

One vegetable plot was established (Langton), where oats were inter-seeded during the last cultivation of each separate crop between July and mid- September. Early seeded oats developed rust and did not survive, while later seeded oats thrived even after post -harvest where both the cover crop and vegetable remains were mowed down to over winter. Complete details for this vegetable trial can be found in appendix A.

Going Forward

As we embark on year two of this project we aim to modify and refine our methodology based on the results of this year`s trials as it pertains to application rates and timing to optimize the growth and establishment of cover crops while minimizing the effects they have on the primary production crop. In turn, we can observe if this will lead to increase in yield potential for those primary crops. More trials inter-seeding cover crops into soybeans are planned at sites where post- harvest seeding is not always feasible. As planting approaches we can observe the effects these cover crops have on pre plant land preparation according to various tillage methods (no-till, strip till, minimum till and conventional till). Year two will also see us incorporate more of these theories into practice into vegetable production to further decrease the need for mechanical and manual cultivation. Moving forward we hope to expand the acres and areas for these trials to even further reflect the unique micro climate and diversity of Norfolk and give growers an accurate framework for adopting this to their current farm plan and conditions based on the environment they`re operating in.

Figure 1. Cover Crop Establishment (Courtland Site –Irrigated)

Figure 2. Cover Crop Establishment (Courtland Site –Non- Irrigated)

Figure 3. Cover Crop Post Harvest (Port Rowan Site)

Figure 4. Cover Crop Post Harvest/Post Fall Tillage (Courtland Site)

Appendix A. Under Seeding Vegetable Crops

Experiments and Observations by Gregory Boyd at Heritage Lane Produce

We grow 30 different vegetable crops on 15 acres without the use of herbicides, insecticides or fungicides. The row crops including broccoli, cauliflower, cabbage, Brussels sprouts, kale, peppers, onion, leek, garlic, beans, peas, and sweet corn are grown on 30" wide rows.

Purpose:

Weeds are controlled using conventional tillage and cultivation throughout the growing season. This is a very destructive practise when it comes to soil structure and health. The goal was to establish a cover crop underneath the actively growing vegetable crop with the idea that the roots from the cover crop would not only help in building soil structure but also absorb excess nutrients that the vegetable crop did not use.

Method:

- Cover crop seed was applied using a John Blue side-dresser on a Farmall C during the last cultivation. For the Brassica and Cole crops, Calcium ammonium nitrate was mixed with the seed as a side dress.
- The seed/fertilizer mix was distributed on the soil surface and then incorporated with the rear cultivators
- Bin run oats was the cover crop seed of choice.
- Inter-seeding took place from the beginning of July until the middle of September

Observations:

Application;

- No precise calculations of seeding rate were taken. An estimate would be approx.3 bu/acre.
- Using bin run oats containing pieces of straw and debris would repeatedly plug the downspout and ribbed hoses (Solution is to replaced the ribbed hose with a smooth hose and install screen on hopper top)

Establishment:

- Was successful in all crops except for cauliflower and Brussels sprouts. These crops completely fill in the rows at 30" spacing and the oats simply withered soon after germination due to the lack of light.
- Variable success was achieved with broccoli for the same reasons mentioned above. Excellent establishment in all of the other row crops mentioned above

Growth;

- All of the cover crop seeded before the middle of August was very susceptible to rust and in most cases the crop died or stopped growing soon after the vegetable crops were harvested.
- Cover crop seeded after the middle of August remained viable and active growth was seen following the vegetable harvest and continued into the fall.

Vegetable harvest;

- All row crops mentioned above with the exception of onions are hand harvested.
- Foot traffic did not hamper the growth of the oats planted after the middle of August (rust free) while it did for the oats that had become diseased.
- In all crops and planting dates, the oats did not impede the growth or quality of the vegetable crops
- With the exception of onions, the oat crop did not impede the harvesting of the vegetable crops (in the case of the onions, the oats did interfere with the diggers performance. Adding coulters to either side of the digger would be the solution).

- The only complaints that were received were from the harvesting crew. The oats would stay wet longer into the day versus the vegetable crop so rubber boots was required rather than work shoes.

Post vegetable harvest;

- In most cases, the vegetable remains were chopped using a brush mower which also chopped the oats. The oats not infected with rust re-grew where as the oats with the rust did not.

Conclusions;

- Aside from the problems mentioned above, the experiment was successful in establishing a cover crop within a growing vegetable crop.

Going Forward;

- In all cases I will be adding white clover with the oats in hopes that it will establish in conditions where the oats did not thrive (cauliflower , Brussels sprouts and broccoli)
- I will be using barley instead of oats for the early seeded cover crops (prior to August 15th) as it is not as susceptible to rust
- I will be inter-seeding the squash crop with a mix of red and white clover at the last cultivation

Figure 5. Cover Crop Inter-seeded In Vegetables (Langton Site)