COVER CROP PROGRAM

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Growing no-till pumpkins in a killed cover crop mulch system

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Winter annual cover crops can be planted in late summer/early fall and then rolled down to form a killed-mulch for no-tilling vegetable crops into the following year. This system combines the benefits of two BMP's (Best Management Practices) **1:** Using winter-annual cover crops and **2:** No-till planting.

Using a no-till planter pumpkin seeds can be direct no-till seeded and pumpkin transplants can be planted using a modified no-till transplanter. Pumpkins growing in a rolled down cover crop killed-mulch will reduce dirty pumpkins at harvest, the mat will provide weed suppression and minimize fruit rot by providing a barrier between the fruit and the soil.

Both organic and conventional growers can use this system although management is slightly different for each system. Cultivation between rows is usually not an option in no-till systems therefore growers should consider the weed pressure in their fields and choose fields carefully for no-till pumpkin production.

Avoid fields with heavy weed populations of yellow nutsedge or broadleaf weeds that may be difficult to control. Organic and conventional growers may want to manage a stale seedbed letting a weed flush and cultivating to kill the weed flush before planting the cover crops in the fall.

There are several benefits from growing the cover crop including preventing soil erosion by having the soil covered with a living crop from late summer continuing over winter and into spring. This is during the period of time when most vegetable rotation fields are left fallow and prone to erosion. Unseen; the cover crop roots recycle nutrients, add organic matter to the soil and act as host sites for numerous beneficial microorganisms.

The added benefit of the cover crop is that in late spring it can be rolled down to form a weed suppressing mulch-mat which the pumpkins can be no-till planted into. This mulch-mat provides soil cover and weed suppression through the growing season. The pumpkins growing on the cover crop residue are cleaner and much more desirable for growers.

Soil Fertility: Start with the soil - Managing soil fertility for this system comes from the understanding that you are growing two crops in succession; first the cover crop (which will be rolled down) and second the pumpkin crop. Soil nutrient management needs to take this two crop sequence into consideration.

In **typical rotations utilizing cover crops that are not rolled down**, a winter annual cover crop such as winter cereal rye, is often grown to "scavenge' or 'recycle' nutrients (primarily nitrogen, because N is easily leached). In the spring the cover crop is then killed with herbicides or turned under in its immature vegetative stage as a green manure in the spring. **In contrast this killed-mulch no-till system utilizes a cereal rye cover crop grown to near maturity to grow a straw mulch mat.** In essence with this system you are growing your straw in place to be used as rolled-

down mulch. **Hairy vetch**, another winter annual cover crop, which is a legume, is often grown in combination with the winter cereal rye. The hairy vetch will fix nitrogen while growing and after it is rolled down much of this nitrogen will be available for the pumpkin crop as the hairy vetch leaves decompose.

Before planting the cover crop start with a soil test. Adjust the pH if needed, the optimum pH for growing pumpkins is 6.5 to 6.8, adjust the ph for pumpkins because the cereal rye will tolerate a wider range (5.0 to 7.0) so the pH is more important for the pumpkins than the cereal rye.

For this type of system a soil test analysis in the optimum levels is desirable. Remember you are growing two crops. Soil fertility needs to be adequate.

The amount of cereal rye straw you can grow will vary from year to year and will be dependent on the soil fertility, time of planting and rainfall in any given year. You should be planning on growing anywhere from 5000 to 8000 lbs/acre of dry matter cereal rye straw. 1 ton (2000 lbs) of rye straw can contain up to 10 lbs N, 6 lbs P_20_5 and 17 lbs K_20 on a dry matter basis. So for a range of 5000 to 8000 lbs of cereal rye straw dry matter you will need a range of 25 to 40 lbs of N, 15 to 24 lbs of P_20_5 and 42.5 to 68 lbs of K_20. That is just for the cover crop. Most of these nutrients will remain tied up in the plant tissue of the rye straw during the growing season of the pumpkins and therefore they are not readily available for the pumpkins, some of the potassium may be leached out of the rye straw later in the season. These nutrients in the straw will eventually be recycled into the soil after the straw is incorporated back into the soil and decomposes. This straw is beneficial in building up soil organic matter in the long term. **A common mistake is to not manage to have adequate N for the rye cover crop, and therefore an inadequate mat is formed.**

Nitrogen for pumpkins; fertility recommendations are usually 50 to 100 lbs of N/Acre (Total). Different options to supply this amount are used.

In a conventional setting we usually apply a portion of this pre-plant and then side dress by broadcasting 40 to 80 lbs of dry N (This will depend on if you have hairy vetch included or not and the nitrogen contribution of the hairy vetch) The side-dressing is done three to six weeks after planting.

Some growers will apply a foliar feed. Also some growers also use drip tape with fertigation. Organic growers may apply compost tea or fish emulsion as a fertilizer drench or as a foliar feed.

If hairy vetch is grown along with the rye cover crop then the hairy vetch will usually supply the entire nitrogen requirement for the pumpkins. If nitrogen deficiency symptoms appear before the fruit appears then you should top dress with 20 to 30 lbs of N /acre. The nitrogen taken up by the rye will not be released quickly and therefore will not be available for the pumpkins. Conventional no-till growers prefer ammonium sulfate fertilizer. The sulfur is often needed and added with this product and this has a low volatility rate as well.

If available both organic and conventional growers are encouraged to apply leaf compost, composted manure or manure in the fall before planting the cover crop, these will amend the soil with beneficial nutrients for both the cover crop and the following pumpkin crop. Nutrients that are in the organic form such as compost and manures with bedding are beneficial in this system because they will become available slowly over time through the process of mineralization and therefore benefit the pumpkin crop with nutrients released the following year.

Phosphorous for pumpkins is recommended depending on soil test levels. Soils with **Low** soil test Phosphorous levels should have 150 lbs P_20_5 per acre. Soils with **Medium** soil Phosphorous test levels should get about 100 lbs P_20_5 per acre and soil with **Optimum** levels should have about 50 lbs P_20_5 per acre applied. This is in addition to the 15 to 24 lbs per acre needed for the rye cover crop.

Potassium for pumpkins is recommended depending on soil test levels. Soil with **Low** soil test Potassium levels should have 200 lbs K_20 applied per acre. Soils with **Medium** soil Potassium test levels should get about 150 lbs K_20 per acre and soils with **Optimum** soil test levels should have about 100 lbs K_20 per acre. This is in addition to the 42.5 to 68 lbs per acre of needed for the rye cover crop.

Planting the cover crop: Apply lime to adjust pH if needed and apply fall fertilizer as needed by soil test. Tillage is recommended for organic growers, plowing, disking and cultipacking before drilling the cover crop. This is typically needed for late summer and winter annual weed control. If compost or manures are applied incorporation is recommended.

In conventional scenarios no-till drilling of the cover crop can be accomplished after a burn-down herbicide application**.** Phosphorous and Potassium can be applied to the soil surface before planting the cover crops. Plant the rye about ½ to 1 inch deep, never deeper than 2 inches.

Seeding rate: Winter cereal rye planted alone should be seeded heavy at 2.5 to 3.6 Bushel per acre. (140 to 200 lbs/acre). If hairy vetch is mixed with the cereal rye then a mix of hairy vetch (25 lbs/acre) and cereal rye (40 to 50 lbs per acre) does well as a mix. The rye-vetch mixture will give 40 to 50 lbs of Nitrogen to the pumpkins (primarily from the hairy vetch). Crimson clover can be added to the mix of cereal rye and hairy vetch at a seeding rate of 8 to 12 lbs/acre.

My experience using both hairy vetch and crimson clover is that rolled down hairy vetch will create the best mat due to the viny growth habit of hairy vetch. It will do a better job at creating an entangled- entwined mulch mat. The crimson clover has a growth pattern with upright stems and doesn't form as effective a mat as compared to hairy vetch. Crimson mixed in with hairy vetch and cereal rye is an option that works.

A straight stand of hairy vetch planted at 25 to 30 lbs per acre will give 75 to 100 lbs of Nitrogen per acre.

Specifically for pumpkins straight stands of hairy vetch tend to break down quicker compared to the stands with cereal rye in them and do not do as good a job at keeping the weeds suppressed and the pumpkins clean. Cereal rye used alone works well but as noted above you need to apply more Nitrogen to have enough to grow both the rye and the pumpkins.

Seeding date: Winter cereal rye can be planted from late August until mid October. September dates seem to work best for establishing a good cover crop stand. Earlier planting dates result in earlier flowering dates in the spring. Also earlier planting dates will insure better growth before winter for a more effective soil cover over winter.

Rolling the cover crop: In the spring the cover crop can be rolled down to make a killed cover crop mulch-mat. Equipment used to roll down the cover crop includes a Buffalo rolling stalk chopper (typically used to chop corn stalks), a cultipacker or a roller-crimper. Other types of field rollers can be utilized. If you are using a cultipacker often times a double pass is needed.

Conventional farmers use a small application of glyphosate to the cover crop and then roll a day or two later. Typically ½ to 1 pint of Glyphosate is applied to standing rye and then it is rolled two days later.

Organic farmers must wait until the crop is in full bloom (rye forming yellow pollen – called dehiscence, and/ or the hairy vetch in full purple flower bloom). At this stage the roller will give adequate mechanical kill. Double-rolling the cover crop gives better control and kill. In essence what you are doing with a roller is mechanical lodging of the cover crop, if the cover crop has already flowered it will begin to die in a few days when rolled, if you roll it before flowering it will re-grow in an attempt to flower and reproduce. Conventional growers can roll earlier with herbicide use.

It is beneficial to roll the cover crop parallel to the direction of planting the next crop. If the cover crop lodges before rolling it is very difficult to plant into if the rye stems are lying perpendicular to the direction of rolling and no-till planting.

Cover crop Roller Info: Rollers come in varying widths; 8ft wide, 10.5 ft wide, 15.5 ft wide and up to 40 ft wide available on request. The rollers are available from I & J Manufacturing, 5302 Amish Road, Gap, PA 17527. Telephone: 717-442-9451 email: ijmfg@epix.net, website www.farmingwithhorses.com and www.croproller.com

Also front mount three point kits are available through Buckeye tractor at http://www.buctraco.com/FrontHitches.htm

And also at http://www.fronthitch.com/v3/pages/equipment.cfm

Weed Control: If a thick cover crop mulch is established most of the herbicides can be eliminated. Organic growers can successfully use a heavy mulch-mat to accomplish organic no-till.

Cereal rye is known for its allelopathic characteristics. Cereal rye produces chemicals that inhibit the germination and growth of many of the grass and broadleaf weeds. These plant chemicals and their breakdown products act to suppress the weeds as the rye residue decays on the soil surface. The thick mat of rye blocks the sunlight from reaching the soil surface and suppresses the soil temperature; these factors also contribute to suppressing weed growth.

Organic farmers rely solely on the thick mat for weed suppression. Mulches may still allow a certain percentage of the sunlight to leak through to the soil surface. Depending on how thick the mat is hand weeding or clipping may be needed to control weeds that break through the mulch-mat later in the season.

Conventional farmers use a selective herbicide called ‘strategy’ (which is a broad spectrum systemic pre-emergent herbicide for control of grasses and broadleaves in cucurbits, melons, pumpkins, squash and watermelons.) It can be applied between rows and let the rain incorporate it or it can be applied as a banded-spray between rows after crop emergence or transplanting. For grasses that break through the mat a post emergent herbicide called ‘select’ is often used. If pigweeds are a problem in the field another herbicide ‘sandea’ will control pigweeds but not lambs quarter. The herbicide ‘sandea’ will hold back the pumpkins about 1 week, even if used pre-emergence.

Evaluating the stand: For organic growers in the spring before rolling if you can look through the cereal rye, across the drill rows at about a 45 degree angle and see soil in through the standing cereal rye plants then most likely that stand is not thick enough for successful weed control in an **organic no-till situation**. At that point I recommend plowing and going with the plow-till scenario for organic growers because weeds will be a problem, Organic growers don’t have the rescue weed control options of herbicides that conventional growers do.

No-till Planting: Seed to soil contact is critical! Modify, adjust, and add weights where needed to get the seed into the ground at the proper depth and obtain good seed furrow closing.

A modified no-till planter can be utilized to direct seed the pumpkins. One such common piece of equipment is a Kinze no till planter with Monosem row units and a vacuum air seeder. Use heavy coulters such as a ‘Rawson’ coulter such as a (13 wave 1 inch wide coulter) to cut through the thick rolled down mat, apply 130 to 150 lbs of extra weight as ballast per each planting unit on the frame above and to the front of the double disk openers. This extra ballast helps the double disk openers to cut down through the mat and into the soil.

Adjust the depth gage wheels to be certain you are cutting deep enough into the soil. The depth gauge wheels are riding on an inch to two inches of cover crop residue so therefore they need to be adjusted appropriately to compensate for this.

Some famers use 'Martin spading closing wheels' to help close the seed furrow, others replace the hard rubber closing wheels with cast iron closing wheels to apply the extra ballast to close the seed furrow underneath the rolled mat.

Plant the pumpkin seeds 1 to 1½ inch deep in the soil. The goal is to have enough weight and cutting action to cut down into the mat and place the seed but not to disturb the mat too much so that there is not too much soil showing in the row. **The area that is disturbed in the row and opened up is the area where the weeds will germinate and grow first.**

No-till transplanters can also be modified with bigger coulters, deeper knives and heavier closing wheels to be utilized in this same system to transplant seedlings. With the heavy-duty no-till transplanter pumpkin seedlings or other crops (peppers, tomatoes, squash, and watermelon) can be transplanted into the mulch-mat.

An RJ Equipment carousel no-till planter can be modified for transplanting pumpkin seedlings, adapt the spring loaded 20-inch turbo coulter to cut through the mat followed by a double-disk opener and a short shoe to place the transplant in. Angled press wheels are used to firm the soil around the transplant. Weight may have to be added depending on soil moisture conditions.

To see a video of Dr. Ron Morris's (SST-T) Sub-Surface Tiller-Transplanter see The Pennsylvania State university website at http://www.extension.org/article/18422/print/ and watch the U-tube video at that site.