Development of No-till Pumpkins for the Great Plains

Kimberly Oxley[1], Peter Tomlinson[1], Megan Kennelly[1], Jason Griffin[1], Rhonda Janke[1], DeAnn Presley[1], Richard Wynia[2], Marlin Bates[3], Cary Rivard[1]
[1]Kansas State University, [2]National Resources Conservation Service, [3]University of Missouri

Background & Objectives

Pumpkins are a primary vegetable crop in the Great Plains for producers catering to agritourism markets and represent significant acreage within Kansas and Missouri (>2400 acres).

Soil conservation is of critical concern in the Great Plains, as our soils are highly productive and provide value towards future food production. Unfortunately, pumpkin production utilizing conventional tillage can be highly disruptive to soil health, particularly when significant cultivation is used. This can ultimately lead to severe compaction and erosion as little residue is left to provide cover during winter months.

Cover crops can be utilized to provide high-residue mulches for larger-acreage vegetable production systems like pumpkins. The cover cropped is rolled in the spring and the pumpkins are planted through the mulch residue. Soil health and other environmental benefits include:

- Weed suppression
- Water conservation
- Increases in soil health and aggregate stability
- Crop productivity and/or quality
- Nutrient retention

A collaborative project was initiated in 2012 to demonstrate the viability of no-till systems for pumpkin, snap bean, and sweet corn that is supported by a Natural Resources Conservation Service Conservation Innovation Grant. The results of the 2012 pumpkin trials are shown here. The specific objectives of the overall project are:

1) To demonstrate the effectiveness of no-till production systems for pumpkin, sweet corn, and snap bean through a series of demonstration sites at University and NARCS locations.

2) To provide vegetable growers with "hands-on" experience growing no-till crops by initiating a mini-grant incentive program for vegetable growers to conduct demonstration trials in Kansas and Missouri.

3) To assess the impact of different cover crop species and no-till systems on soil health, yield and profitability of pumpkin, sweet corn, and snap bean.

4) To engage growers and others in university/extension with current knowledge of minimum tillage systems and disseminate the results of this project through established and novel extension networks and outlets.

Figure 2 A) Pumpkins at Clark Farm, **B)** Rolling of hairy vetch cover crop at JCPC

Summary

Pumpkins are a very popular crop in the Midwest since they perform well and have a large market for growers through U-Pick and agritourism sales. Unfortunately, pumpkin production can be highly disruptive to soil health as little residue is left to provide cover during the winter months. In no-till pumpkins, rolled cover crops are used for mulch and the crop is planted through the residue. This can be an effective technique for growers in the Midwest that wish to reduce soil erosion and compaction and increase soil conservation. The objectives in this study to investigate the efficacy of various fall- and spring-planted cover crops for of no-till system pumpkins. Three replicated field trials were conducted at two KSU research stations and one NARCS location. Preliminary data from the first year trial shows that no-till systems are highly successful compared to conventional tillage when proper cover crop mixtures are utilized. At the Wichita that cover crop selection and cultivation is very important, hairy vetch can be hard on planters and nitrogen management could be a critical component to successful no-till systems. One interesting aspect is spring cover crops is still in question on its effectiveness. The roller-crimper did not crimp the plant properly and the window of timing to effectively grow the spring crops is limited. Further research is needed to determine the impact of different crop species and no-till systems on soil health, yield and profitability of large-scale field crops.

Figure 1. A) No-till pumpkin trial at the Olathe Horticulture Research and Extension Center, (Olathe, KS)

Methods

The focus of this study is to determine the impact of different cover crop species and no-till systems on pumpkin production and soil health. The trial was demonstrated at two university locations: The Olathe Horticulture Research and Extension Center (OHREC; Olathe, KS) and the John C. Pair Horticulture Center (JCPC; Wichita, KS), as well as the NARCS Plant Materials Center (Manhattan, KS). The plots included seven different cover crops/mixtures and one conventional tillage plot. Three replicates were utilized in a randomized complete block design. The plots were utilized to assess the effects of no-till vegetable production on crop yield and soil health. Fall cover crops (rye, radish, hairy vetch, pea) were planted October 8 and spring cover crops were planted April 1. Cover crops were rolled at the various sites from June 6-13 at the various sites and a glyphosate was applied (1.5 oz/acre). The pumpkins were planted 10-14 days later via direct-sowing (Wichita) and plugs (Olathe). Plots were treated similar to commercial pumpkin production in the region. All fruit were weighed and counted at Olathe on September 25. At the Wichita location, fruit were counted and 10 randomly-sampled fruit were weighed to determine estimated yield on September 26.

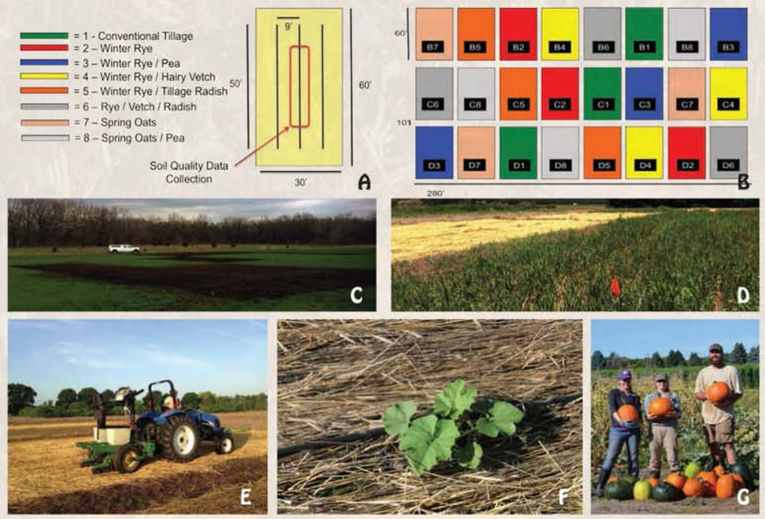
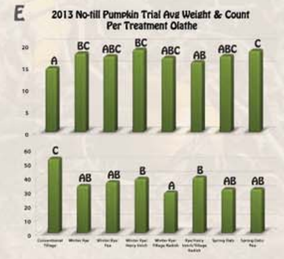


Figure 3. A) List of the treatments, which includes seven different cover crop mixtures as well as a conventional tillage control. **B)** Plot layout used at all locations. **C)** Planting spring cover crops at OHREC. **D)** Spring oats at the NARCS Plant Materials Center. **E)** Planting sweet corn with a no-till planter. **F)** Young pumpkin plant at OHREC. **G)** Harvesting pumpkins at NARCS (pictured left to right: Kimberly Oxley, Lani Myer, and Cary Rivard).

Results



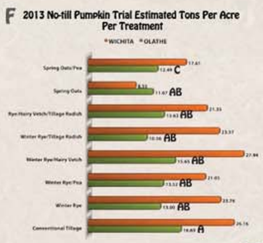


Figure 4. Fruit harvest at **(A)** JCPC and **(B)** NARCS PMC. **C)** Percent marketability of fruit at JCPC and OHREC **D)** Average fruit weight and count at JCPC. **E)** Average fruit weight and count at OHREC **F)** Estimated tons per acre per treatment at JCPC and OHREC.

- At both locations, the cover crop treatment with the highest total fruit yield was winter rye (40 lbs/acre) and hairy vetch (25 lbs/acre) used in combination. Total pumpkin production was 28 and 16 tons per acre in Wichita and Olathe, respectively, and was statistically similar to the conventional tillage treatments.
- In the Wichita trial, fruit size and number were relatively similar among all of the fall-planted cover crop mixtures in comparison to the conventional tillage treatment.
- At the Olathe site, the use of no-till systems significantly increase average fruit size, but reduced total fruit number. Mean average fruit size ranged from 14.6 lbs/fruit in the conventional tillage treatment to 18.8 lbs/fruit in the rye / hairy vetch treatment.
- Fruit marketability (%) was not significantly affected at Olathe, but was reduced in the spring oats treatment at the Wichita location.
- The spring cover crops performed poorly at both locations, possibly due to the late spring, which resulted in little biomass accumulation by the spring cover crops prior to termination. Furthermore, the biomass was not mature enough for the roller-crimper process to occur properly (Fig. 5B).
- Nutrient management of no-till pumpkins is different than conventional tillage systems and nutrient immobilization by the mulch residue may be problematic for growers new to no-till systems.

Hey Growers!

Want to tryout a no-till and/or minimum tillage system at your farm? Participate in a no-till trial and receive a $500 incentive. The trial supplies use of a roller-crimper, high-speed flail mower and cover crop seed in addition to the honorarium. Your site could be selected for "twilight tours" in your growing region. For more information, contact Kimberly Oxley at koxley@ksu.edu.

Discussion & Future Work

The use of no-till systems for pumpkin production in the Great Plains shows significant promise. However, further research is being conducted to verify the viability of these systems in local climates. Although spring cover crops would be useful for growers that are not able plant fall cover crops, our work suggests that they do not perform as well as fall-planted cover crops. Furthermore, trial observations showed that fertilizer management is critical and fertigation is probably ideal for no-till systems. Nitrogen management is a critical component to successful no-till systems. Further work will be conducted in 2014 and 2015 to assess the soil health benefits as well as crop production aspects of no-till and minimum tillage pumpkin production using various cover crop mixtures.

Figure 2. A) Roller-crimper and flail mower available for use during the demonstration on-farm trials **B)** Rolling of spring oats at JCP

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