

2012 Radish Paired Comparison Preceding Corn

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Introduction:

In fall 2011, a paired comparison of **Graza** radish and **Tillage Radish**[®] was established at the Allison Organic Research Farm (field 3-1) in southern Warren County, IL. The plots were planted to organic corn in 2012 as directly over the preceding radish rows as possible with the intention that the corn roots would benefit from close proximity to the radish root zones. This study analyzed corn yields and how they differed among the 2 radish treatments.

Methods:

Prior to establishing the radish plots, a 10' Howard Rotavator was used on 9/2/11 to incorporate wheat stubble and terminate patchy alfalfa, red clover and weeds. Wheat straw had been baled and removed over a month earlier but a large amount of wheat residue remained due to very dry summer conditions that limited decomposition. The field was rotavated a second time at higher ground speed on 9/8/11 in an attempt to size and distribute residues more uniformly immediately prior to planting radishes. Unfortunately it was only possible to plant replications 1 and 2 due to severe plugging. High levels of undigested wheat residue were the main cause of plugging, but the ridge-till planter configuration was also a contributing factor. Replications 3 and 4 were planted a week later (9/15/11) with significantly less plugging. On both planting dates, radishes were planted on 30" rows using a 4 row Buffalo ridge-till planter with brush-type seed metering units and small milo plates. The intended seeding rate was ~ 4 lbs/a. Stand establishment was delayed by limited soil moisture until a rain fall event occurred ~ 2 weeks after planting.

A 4 row Buffalo high residue row crop cultivator was used to cultivate replications 1 and 2 on 10/25/11. The goal was to eliminate volunteer wheat and winter annual weeds within the inter-rows and promote growth of the radishes. Excessive wheat residue caused plugging between cultivator sweeps and forced us to stop after completing the 2nd replication. One last attempt to cultivate was made on 11/15/11 on the south end of the first plot in replication 3, but plugging occurred quickly and we decided that the best course of action was to leave replications 3 and 4 uncultivated.

The field was rotavated on 5/16/12 to terminate all vegetation (primarily pennycress and volunteer wheat). On 5/29/12, the field was fit for planting corn with a 30' field cultivator. Great Harvest Organics 59R5 hybrid corn was planted on 5/30/12 at 30,000 seeds/a with a 12 row 1760 John Deere vacuum planter. The row cleaners were set aggressively to move residue out of the rows and the planting depth was set to 2.5" to place the seed in moisture. The plots were 1,211' x 20' (8 x 30" rows) (0.556 acre) and were replicated 4 times. Nearly perfectly straight rows were achieved through the use of RTK guidance on the planter tractor.

Stand counts at 20 locations were taken on 6/13/12, with each sample area representing 1/1000 acre. The average corn height was 2.5" at the time of the counts and average corn population estimate was 29,250/acre.

Post plant field operations included rotary hoeing corn on 6/5/12 and row crop cultivation on 6/22/12.

Harvesting took place on 10/30/12 with a John Deere 9510 combine taking 4 rows up and 4 rows back for each plot. Weights of each plot were obtained by a weigh wagon.

Results:

In early December 2011, Tillage Radishes had an average diameter of 3/4" at the shoulder and a storage root length of ~ 9". In contrast, Graza radish had an average diameter of 1/2" at the shoulder and a storage root length of ~ 6". Taproots extended much deeper in both cases. Delayed establishment of radishes due to dry conditions limited their growth. Competition with winter annual weeds in replications 3 and 4 also limited radish growth. All Tillage Radishes winter-killed whereas ~ 1/3 of the Graza Radishes overwintered.

There were no significant differences in corn yield between the 2 radish treatments. The average yield of corn following Tillage Radish was 3 bu/a greater than corn following Graza radish, but a difference of 29.3 bu/a was needed for significance at $\alpha = 0.05$ (table 1).

As reported in table 1, there was a large difference in corn yield between replications 1 and 2 (cultivated and 1 week earlier radish planting) and replications 3 and 4 (uncultivated and 1 week delay in radish planting).

Table 1: Corn yield

Treatment	Avg. Yield of Cultivated Radish Reps	Avg. Yield of Non-Cultivated Radish Reps	Average Yield (Bu/a)
Tillage Radish	120.3	97.3	108.8
Graza radish	122.8	88.9	105.8
			LSD (alpha 0.05) = 29.3

Discussion:

Despite extremely dry conditions and no supplemental N, the corn in this experiment (Great Harvest Organics 59R5) yielded surprisingly well (> 150 bu/a in some parts of the field) and wilted less than any other corn on the farm. Radish growth was less than expected primarily due to dry conditions but N tie-up by wheat residue may also have been an issue. Under these challenging conditions, Tillage Radishes established faster and grew more vigorously than the Graza radishes but both established deep tap roots.

An unexpected finding was the large difference in corn yield between the plots that received fall cultivation. The western plots that were not cultivated supported a thick stand of volunteer wheat and pennycress in spring 2012. The eastern plots that had been cultivated had much less pennycress and wheat. The pennycress had been blooming for almost a month when terminated. The spring vegetation may have depleted water that was

critical for corn growth and the stemmy residues may have resulted in some N tie-up. The fall cultivation may also have accelerated decomposition of wheat residue, shifting the period of N immobilization to before significant N demand by the following corn crop. Weed control during the corn growing season was excellent across all plots, eliminating weed competition as a significant influence on corn yield.

The corn did not receive any supplemental nutrients and as a result depended entirely on the cycling of soil fertility.

Some N was certainly available as a legacy effect of the alfalfa/clover/grass hay stand that was present in 2009 and 2010 but it is also likely that a significant amount of the N and other nutrients acquired by the corn were cycled through the preceding radish cover crop. The corn in all plots had good color during the first half of the season and yellowing of lower leaves later in the season. Additional nitrogen would most likely have been beneficial and may have closed the yield gap between the cultivated and non-cultivated plots but water was probably the most limiting growth factor across all plots.

The corn rows were planted with RTK guidance but the radish rows were not. As a result it is likely that inevitable variation in the corn/radish row locations reduced potential effects of corn/radish row synlocation. The two tillage passes prior to corn planting are also likely to have reduced radish row effects. Potential radish row effects observed in other studies include elevated availability of N, P and K, deeper rooting and greater profile moisture utilization.

It is important to note that in another study evaluating spring planted radish preceding corn and soybeans on the same farm in 2012, we observed poor soybean and corn yields following radish. The spring planted radishes were allowed to grow until ~ 2 weeks before planting of the grain crops and clearly depleted critical soil moisture. In contrast, the fall planted radishes in our paired comparison mostly winter-killed and are unlikely to have caused moisture depletion.

Conclusion:

This was our second study evaluating synlocation of radish and corn rows and provided us with valuable data and observations even though we found no significant effect of radish cultivar on corn yield. Future studies containing a control (no radish) should help improve our understanding of radish row effects. Future research including fall cultivation of wide row cover crops, supplemental N application, additional cover crop species and the use of guidance for both cover and cash crop planting is planned as part of our growing focus on precision cover cropping.

The corn yield and grain quality achieved in this study were very respectable considering the extreme drought conditions in 2012 and the lack of supplemental fertilizer. We plan to include Great Harvest Organics 59R5 (or similar hybrids) in future cover crop/radish studies.

See pictures of study below!



Lining up corn planter with radish rows



Planting conditions on 5/30/12



Approximately 1 month after planting



Corn standing well after high wind in early July