

2016 Manure Incorporation and Reduced Tillage Corn Trial

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Timely manure incorporation can reduce nutrient losses to the atmosphere and surface runoff. Keeping valuable nutrients, like nitrogen, in the soil can help reduce the purchase of expensive commercial fertilizers. Reduced tillage corn is becoming more common as growers recognize the benefits to soil health and water quality. Some options to implement reduced tillage include no-tillage and vertical-tillage. No-tillage planting uses metal coulters to cut a slot for the seed, rather than tilling the soil. Vertical-tillage lightly tills the top 2-3" of the soil, as the implement is pulled quickly across a field to produce a uniform seedbed without deep tillage.

Little research has been done in the region to assess the combined effects of manure application and reduced tillage practices on silage corn yields and quality. With the increased regional availability of innovative equipment such as manure injectors, aerators, strip tillers, and no-till planters, the University of Vermont Extension's Northwest Crops & Soils Program designed a trial in 2016 to evaluate both manure incorporation and reduced tillage corn planting techniques on corn yield and quality.

MATERIALS AND METHODS

A trial was initiated at Borderview Research Farm in Alburgh, VT in 2016. The experimental design was a randomized complete block with a split plot arrangement and four replications. Main plots were comprised of two reduced tillage methods; subplots consisted of four manure incorporation methods (Table 1).

Table 1. Main plot and subplot treatments of the manure incorporation and reduced tillage corn trial, 2016.

Tillage methods	Manure incorporation methods
No	Aerator
Vertical	Broadcast
Plow	Injection
	Plow

Each plot was 12' x 40' and there were 40' buffers between main plots (Table 2). The soil type at the research site was a Benson rocky silt loam. The previous crop was corn, followed by a cover crop of winter rye. Liquid manure was applied on 17-May at a rate of 6000 gallons ac⁻¹. The manure incorporation methods were applied at the time of manure application (injection) or immediately following application (aerator and plow). Broadcasted manure was left on the surface and not incorporated.

Image 1. John Deere 2623 VT vertical tillage.

Mixtures of true proteins, composed of amino acids, and non-protein nitrogen make up the CP content of forages. The CP content of forages is determined by measuring the amount of nitrogen and multiplying by 6.25. The bulky characteristics of forage come from fiber. Forage feeding values are negatively associated with fiber since the less digestible portions of plants are contained in the fiber fraction. The detergent fiber analysis system separates forages into two parts: cell contents, which include sugars, starches, proteins, non-protein nitrogen, fats and other highly digestible compounds; and the less digestible components found in the fiber fraction. The total fiber content of forage is contained in the neutral detergent fiber (NDF). Chemically, this fraction includes cellulose, hemicellulose, and lignin. Because of these chemical components and their association with the bulkiness of feeds, NDF is closely related to feed intake and rumen fill in cows. Acid detergent fiber (ADF) is used to determine the digestibility and energy derived from a forage crop. ADF is a direct measurement of the cellulose, lignin, silica, insoluble CP, and ash content of a crop. These components are among the least digestible portions of a plant. Due to this, a lower ADF content correlates to higher plant digestibility.

Non-fiber carbohydrates (NFC) are composed of starch, simple sugars, and soluble fibers. Often NFC is

- 1) Equations and calculations are simplified to reduce inputs for ease of use,
- 2) Farm to farm differences exist, and
- 3) Genetic, dietary, and environmental differences affecting feed utilization are not considered.

Yield data and stand characteristics were analyzed using mixed model analysis using the mixed procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and hybrids were treated as fixed. Hybrid mean comparisons were made using the Least Significant Difference (LSD) procedure when the F-test was considered significant ($p < 0.10$).

Variations in yield and quality can occur because of variations in genetics, soil, weather, and other growing conditions. Statistical analysis makes it possible to determine whether a difference among hybrids is real or whether it might have occurred due to other variations in the field. At the bottom of each table a LSD value is presented for each variable (i.e. yield). Least Significant Differences (LSDs) at the 0.10 level of significance are shown. Where the difference between two hybrids within a column is equal to or greater than the LSD value at the bottom of the column, you can be sure that for 9 out of 10 times, there is a real difference between the two hybrids. Hybrids that were not significantly lower in performance than the highest hybrid in a particular column are indicated with an asterisk. In the example at right, hybrid C is significantly different from hybrid A but not from hybrid B.

The difference between C and B is equal to 1.5, which is less than the LSD value of 2.0. This means that these hybrids did not differ in yield. The difference between C and A is equal to 3.0, which is greater than the LSD value of 2.0. This means that the yields of these hybrids were significantly different from one another. The asterisk indicates that hybrid B was not significantly lower than the top yielding hybrid C, indicated in bold.

Hybrid	Yield
A	6.0
B	7.5*
C	9.0*
LSD	2.0

RESULTS

DISCUSSION

Overall, corn yields in this trial, were excellent and averaged over 21 tons per acre. This demonstrates that growers can utilize manure incorporation and reduced tillage strategies without compromising crop yield. Manure incorporation and reduced tillage strategies had some statistical impact on the forage quality indicators, with the plow treatment performing better in some characteristics.

ACKNOWLEDGEMENTS

The UVM Extension Northwest Crops and Soils Team would like to thank Roger Rainville and the staff at Borderview Research Farm for their generous help with the trials. We would like to acknowledge Kelly Drollette, Hillary Emick, Lindsey Ruhl, and