2019 INTERSEEDING COVER CROPS INTO WIDE-ROW CORN SILAGE

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There has been increased interest in interseeding cover crops into corn. Cover cropping is a way to prevent soil erosion, maintain and/or improve soil nutrients, improve soil aggregation, prevent nutrient loss from runoff, and increase water retention. Such soil improvements can promote conditions that add resiliency to a crop, especially in light of extreme weather patterns that may affect yields. Interseeding can be beneficial by providing year round ground coverage and maximizing a short growing season by interseeding early to allow for full cover crop growth. It can be difficult to grow a successful cover crop, given other demands from a farm operation and weather limitations. One challenge that farmers face when trying to implement interseeding is establishing the cover crops into dense rows of corn. Shading by corn plants restricts cover crop growth especially as the season progresses. Traditionally corn is planted in dense 30-in. rows to maximize yields and decrease weed pressure. In 2018, Practical Farmers of Iowa conducted on-farm research trials to study the effect of wide rows (60-inch) on corn grain yields and cover crop biomass, and researchers saw mixed results (Gailans, 2018). This innovative practice may be a viable solution for farmers in the northeast but research needs to be conducted to determine the impact of wide rows on corn silage yield and quality and cover crop biomass. In 2019, the University of Vermont Extension Northwest Crops and Soils Program initiated a trial to examine the impact of corn row spacing on interseeded cover crop success, and corn yield and quality here in the northeast.

MATERIALS AND METHODS

The experimental design was a randomized complete block with split plots and 4 replicates. Main plots were three combinations of row widths and corn populations (Table 1). The subplots were three different types of cover crops interseeded into corn; varietal information and seeding rate are provided in Table 2 below. Plots were 20’ x 30’.

Table 1. Treatment descriptions for wide row corn trial, Alburgh, VT, 2019.

not thinned. Plots consisted of 8 rows of corn 30 inches apart or 4 rows of corn 60 inches apart. Cover crops were interseeded into corn on 5-Jul and 9-Jul.

Table 2. Cover crop information for wide row corn trial, Alburgh, VT, 2019.

Cover crop	Seeding rate lbs ac^{-1}	Species
Cow pea	60	VNS
Summer solar mix	50	cow pea 'Iron Clay', buckwheat 'VNS', sunn hemp ''VNS', Peredovik sunflower
Mix	30	Annual ryegrass, tillage radish, red clover

Photosynthetic Active Radiation (PAR) was measured using a LI-COR LI-191R Line Quantum Sensor equipped with a LI-1500 GPS (Lincoln, NE) enabled data logger. In each plot two readings were taken, one above the corn canopy to capture the total available sunlight, and one under the canopy at approximately ground level in the center of the plot. These two measures were used to calculate PAR canopy infiltration (%). On 27-Sep, cover crop samples were taken, by collecting two 0.25 m^2 quadrats per plot. Samples were weighed and dried to determine yield and dry matter content. On 30-Sep, the corn was harvested with a John Deere 2-row chopper and a wagon fitted with scales. An approximate 1 lb subsample was taken from each plot and dried to calculate dry matter content. The dried subsamples were ground on a Wiley sample mill to a 2mm particle size and to 1mm particle size on a cyclone sample mill from the UDY Corporation. The samples were then analyzed for quality at the University of Vermont Cereal Testing Lab (Burlington, VT) with a FOSS NIRS (near infrared reflectance spectroscopy) DS2500 Feed and Forage analyzer.

Table 3. Wide row corn agronomic and trial information, Alburgh, VT, 2019.

Location	Borderview Research Farm Alburgh, VT

Mixtures of true proteins, composed of amino acids, and non-protein nitrogen make up the crude protein (CP) content of forages. The CP content 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. Recently, forage testing laboratories have begun to evaluate forages for NDF digestibility (NDFD). This analysis can be conducted over a wide range of incubation periods from 30 to 240 hours. Research has demonstrated that lactating dairy cows will eat more dry matter and produce more milk when fed forages with optimum NDFD. Forages with increased NDFD will result in higher energy values and, perhaps more importantly, increased forage intakes. Forage NDFD can range from 20 – 80% NDF. The undigested NDF (uNDF) is the residue after fermentation for a given amount of time, from 30 to 240 hours. 240-hr uNDF is typically used for forages as it represents the indigestible fiber portion of the total DM content.

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 treatments is real or whether it might have occurred due to other variations in the field. Yield data and stand characteristics were analyzed using the PROC MIXED procedure of SAS (SAS Institute, 1999). Replications within trials were treated as random effects, and application treatments were treated as fixed. Treatment mean pairwise comparisons were made using the Tukey-Kramer adjustment. Treatments were considered different at the 0.10 level of significance. At the bottom of each table, a level of significance is presented for each variable (i.e. yield). Treatments that differed at a level of significance >0.10 were reported as being not significantly different. Treatments within a column with
the same letter are statistically similar. In the example, treatment C is
BT/F1 11.04 Tf1 0s

RESULTS

Weather data was recorded with a Davis Instrument Vantage Pro2 weather station, equipped with a WeatherLink data logger at Borderview Research Farm in Alburgh, VT (Table 4). Overall the season began cooler and wetter than normal but became hot and dry in

Cover crop by row spacing interaction

Table 5. Impact of cover crop type on cover crop yield, Alburgh, VT, 2019.

Cover crop ŧ	Dry matter yield lbs ac^{-1}
Cow pea	**1397**[a]Ϟ
Summer Solar mix*	1017[b]
Mix Ϟ	502

difference between the 30-in. rows with a corn population of 30,000 plants ac^{-1} and the rows with 34,000 plants ac^{-1}.

Table7. Impact of row width and population on cover crop yield, Alburgh, VT, 2019.

Treatment	DM yield lbs ac^{-1}
60-25	**1924**^{a}ɥ
30-30	678^{b}
30-34	502^{b}
p value	<.0001
Trial mean	1035

ɥTreatments within a column with the same letter are statistically similar. Top performers are in **bold**.

Row width and plant population significantly impacted corn yields (Table 8). The 30-in. rows with 30,000 plants ac^{-1} had the highest yield at 23.1 tons ac^{-1}, and that was statistically similar to the 30-in. rows of 34,000 plants ac^{-1} (22.3 tons ac^{-1}). This indicates that similar corn silage yields can be obtained with less seed, potentially an economic iss seed, poi:elisimtQ t00000912 0 612 792 reW* nBT/F1 11.04 Tf1 0 0 1 258.89 4

DISCUSSION

In 2019, the interseeded cover crops produced more biomass when planting into wide row corn. Corn planted with 60-in. row-widths had almost 3 times more cover crop biomass by the time the corn was harvested in late September. While all cover crop types in this trial did better with 60-in. spacing, the cow peas had the highest dry matter yield compared to the summer solar and cover crop mix. One of the challenges for farmers of integrating wider row corn, is the potential to decrease corn yields in a given area compared to conventional 30-in. row-widths. Overall, corn yields were higher in the 30-in. rows compared to the 60-in. rows. The corn yields were not impacted by cover crop type. Corn quality was not impacted by row spacing or by cover crop type. When implementing wide row-widths, farmers need to consider some factors when making management decisions. In corn that has been interseeded with cover crops, farmers cannot go through rows to spray or cultivate weeds once cover crops have established or else the plants can get damaged. Wider rows also do not suppress weeds as well as densely packed rows. The light infiltration was higher in the wider rows which may lead to higher weed biomass, but if cover crops establish better in wider rows as was seen in this trial, then the cover crops can be a viable weed control strategy. Farmers may also have to plant corn at a higher seeding rate in 60-in. rows to account for the decrease in rows per acre. Further investigation on other corn row widths should be investigated as yield decline may be less severe in 36 or 42 in rows. These data only represent one year of research at one location. More research, including on farm trials needs to be done for 60-in. row-widths to be a viable option for farmers.

LITERATURE CITED

Gailans, S. 2018. Planting corn in 60-in. row-widths for interseeding cover crops. Practical Farmers of Iowa Cooperators' Program, Ames, IA. https://practicalfarmers.org/research/planting-corn-in-60-in-row-widths-for-interseeding-cover-crops/

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