2021 INTEGRATING SOLAR CORRIDORS IN CORN SILAGE PRODUCTION SYSTEMS TO MEET AGRONOMIC

air planter (Edwardsville, KS). All plots were planted to meet a target population of 30,000 plants ac^{-1}. All plots were interseed with a cover crop mixture of annual ryegrass (60%), red clover (30%) and tillage radish (10%) on 14-Jun. Cover crop biomass was not measured in this trial. On 17-Jun, plots were top-dressed with 24-12-18 at a rate of 400 lbs. ac^{-1}. Light intensity was measured using HOBO® pendant temperature and light sensors from Onset Computer Corporation (Bourne, MA). Sensors were set to log light information every 10 minutes and report light intensity in lumens ft^{-2}. Sensors were placed just above the soil surface between rows of corn. Corn was harvested on 16-Sep using a John Deere 2-row corn chopper and collected in a wagon fitted with scales to weigh the yield of each plot. An approximate 1 lb. subsample was collected, weighed, dried, and weighed again to determine dry matter content and calculate yield. Quality analyses were not conducted on the corn

Jun, at a rate of 20 lbs. ac^{-1}. Prior to corn harvest, cover crop establishment was measured on 14-Sep. A 0.25m^2 quadrat sample was taken between the center two rows of each plot, weighed, dried, and weighed again to determine dry matter content and calculate yield. was not measured. On 22-Sep, corn from Trial 2 was harvested as noted in Trial 1. Then subsamples were ground to 2mm using a Wiley sample mill and then to 1mm using a cyclone sample mill (UDY Corporation). The samples were analyzed at the E. E. Cummings Crop Testing Laboratory at the University of Vermont (Burlington, VT) with a FOSS NIRS (near infrared reflectance spectroscopy) DS2500 Feed and Forage analyzer. The NIR procedures and corn silage calibration from Dairy One Forage Laboratories (Geneva, NY) were used to determine crude protein (CP), starch, lignin, acid detergent fiber (ADF), ash corrected neutral detergent fiber (aNDFom), total digestible nutrients (TDN), net energy lactation (NE_L), undigestible neutral detergent fiber (uNDFom; 30h), and neutral detergent fiber digestibility (NDFD; 30h).

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. Total digestible nutrients (TDN) is a measure of the energy value in a feedstuff. Neutral detergent fiber expressed on an organic matter basis (aNDFom) is used when high ash content leads to ash remaining in the fiber residue. 30-hr uNDFom is the undigestible NDF on an organic matter basis after 30 hours in rumen fluid. This can cause an overvaluation of the NDF and can cause nutritionists to underfeed fiber.Net energy lactation (NEL) is estimated energy value of feed used for maintenance plus milk production during dairy cow lactation or last two months of gestation for dry, pregnant cows.

Table 2. Trial 2 management, Alburgh, VT, 2021.

Location	Borderview Research Farm - Alburgh, VT

Herbicide (ac^{-1})	Roundup Power Max® (1qt.) and Resolve® Q (1.5oz); 2-Jun Roundup Power Max® (1qt.); 14-Jun
Top dress fertilizer (lbs. ac^{-1})	24-12-18 (400); 17-Jun
Date of interseeding	18-Jun
Cover crop harvest date	14-Sep
Corn harvest date	22-Sep

Table 3.

Data were analyzed using a general linear model procedure of SAS (SAS Institute, 1999). Replications

Table 6. Weather data for on-farm trial, St. Albans, VT, 2021.

St. Albans, VT	May	June	July	August	September
Average temperature (°F)	56.7	71.4	68.7	73.6	63.6
Departure from normal	0.72	6.3			

Figure 1. Light intensity at the soil surface by row width in Trial 1, Alburgh, VT, 2021.

Trial 2 – The impact of corn row width on silage productivity and establishment of interseeded forages

Interactions

There was a significant interaction

Figure 2. Cover crop DM yield for each cover crop treatment by corn row width in Trial 2, Alburgh, VT, 2021.

Impact of Row Width

There was a significant difference in harvest population between the treatments (Table 8). The 30 rows had a significantly higher population, 39,122 plants ac^{-1}, than the other row widths. The population of the 40 rows (19,738 plants ac^{-1}) was about half the population of the 30 rows. This is likely due to the different corn planters used and difficulty reaching the target seeding rate at planting in the 40 rows. Silage yields at 35% DM were highest in 30 rows, 33.1 tons ac^{-1}, likely due to that higher population at harvest. Even with the lowest harvest population, had the second highest yields (23.2 tons ac^{-1}) and was statistically higher than the 60 rows (21.4 tons ac^{-1}). The corn hybrid planted (B90R92Q) in this trial was a semi-flex ear variety. Flex ear hybrids are more cost effective when planted at lower seeding rates as they can adjust corn ear size relative to plant population to remain high yielding despite fewer plants. This may high even with such low populations at harvest.

Row width had a significant impact on some of the silage quality characteristics (Table 9). The had the highest TDN content (65.8%) but was statistically similar to the The 30-hr uNDFom was significantly lower than the other row widths. ws also had a 30-hr NDFD content (58.1%) that was statistically greater than the other rows widths. rows had the highest predicted milk yield per ton of dry matter (DM), 3181 lbs. ton^{-1} and that was 3112 lbs. ton^{-1}). When differences in yield are considered, the 30" rows had the highest milk yield per acre (34,235 lbs. ac^{-1}) and was significantly greater than the other row widths. Flex ear hybrids can change the size of ears formed depending on resources available (i.e. populations) and we would expect there to be a higher proportion of ear material compared to the less digestible fiber materials

had little quality diff ,

Table 8. Corn silage yield and population by row width in Trial 2, Alburgh, VT, 2021.

Row width	Harvest population	Yield, 35% DM
	plants ac^{-1}	tons ac^{-1}
30-in.	39122[a]	33.1[a]
40-in.	19738[c]	23.2[b]
60-in.	32384[b]	21.4[c]
LSD (*p*=0.10)	2285	1.78
Trial mean	30415	25.9

Within a column, treatments marked with the same letter were statistically similar (p=0.10).
Least significant difference at p=0.10.

Table 9. Corn silage quality characteristics by row width in Trial 2, Alburgh, VT, 2021.

Row width	CP	ADF	aNDFom	Lignin	Starch	TDN	30-hr uNDFom	30-hr NDFD	NE_L	Milk
	----------------------------------% of DM------------------------------------							% of NDF	Mcal lb^{-1}	

There was a significant difference in forage yield between the treatments (Table 11). The orchardgrass/ alfalfa mix produced the highest yield, 266 lbs. ac^{-1}

Table 13. Corn silage quality characteristics by row width, St. Albans, VT, 2021.

Row width	CP	ADF	aNDFom	Lignin	Starch	TDN	30-hr uNDFom	30-hr NDFD	NE_L	Milk

perform better when planted in a mixture than alone. More research needs to be done on selecting perennial forage species for interseeding into corn silage.

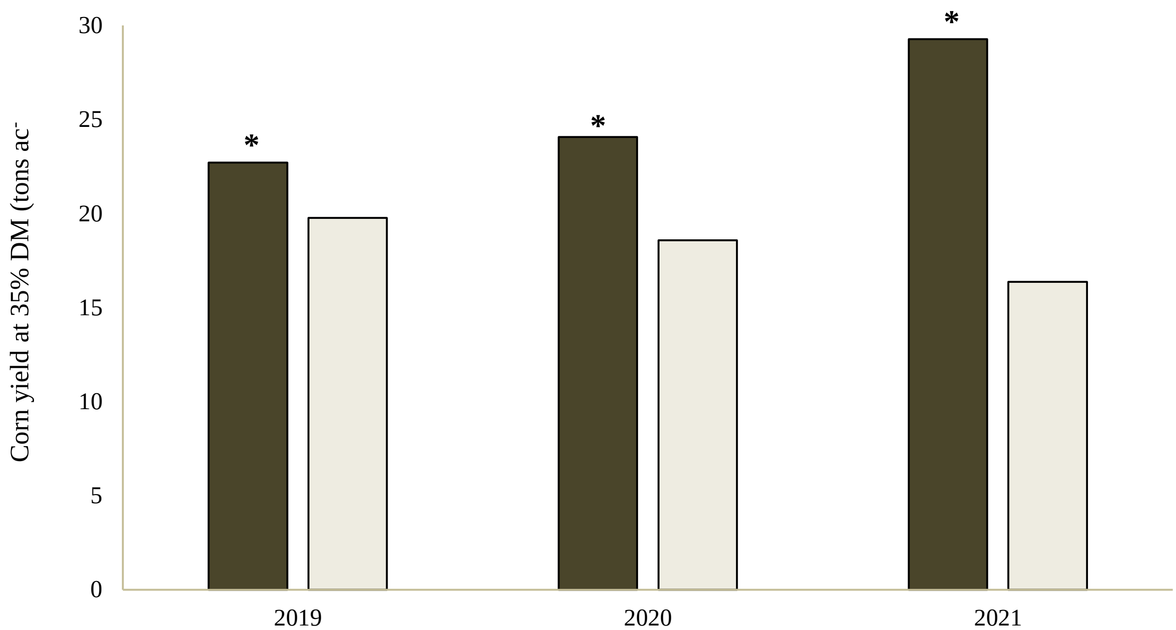

Figure 3. Corn silage yield in 30” and 60” rows by year, Alburgh, VT, 2019-2021. An asterisk (*) indicates a statistically significant (p=0.10) difference between treatments for that year.

Figure 4. Cover crop yield in 30” and 60” rows by year, Alburgh, VT, 2019-2021. An asterisk (*) indicates a statistically significant (p=0.10) difference between treatments for that year.

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