Evaluating small grains for late season and early spring forage

Final Report for ONE10-121

Project Type: Partnership
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Region: Northeast
State: New Hampshire
Project Leader:

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Project Information

Summary:

Growing winter cereal grains have strong potential to provide both early and late-season forage for dairy and livestock operations in northern New England, either as mechanically harvested crops or as supplemental pasture. This project set out to evaluate four species of small grains on both a conventional farm, where they were double-cropped with silage corn, and on a certified organic operation, where they were planted for late season grazing and early-season grazing the following year. Results indicate that small grains do fit in with both types of operations. Forage yields ranged from 0.2 to 1.2 tons of dry matter per acre in the double-crop system, and forage quality for grains harvested at the flag leaf stage was comparable to grass. Incorporating small grains in cropping systems does present some challenges, and these will need to be addressed before producers adopt these crops more widely.

Introduction:

Because cattle, sheep, and goats have the ability to utilize the nutrients in forages efficiently, they are the cornerstone of animal-based agriculture in the Northeast. Relying on high-quality farm-grown forages allows producers to reduce the amount of feed they purchase to meet animals' nutritional needs and therefore to reduce input costs. It follows that the more forage a producer can grow on his operation, the greater the potential for the farm to be profitable.

Most pasture-based operations rely heavily on cool season perennial grasses and legumes for grazing and for stored forage for winter feed. These are most productive between mid-May and early October. Practices that allow pastures to be productive beyond that five-month window in late fall or early spring would increase the amount of forage a farm could harvest, improving cropland productivity and possibly farm profitability. However, some of the established practices to address this issue have their shortcomings. Stockpiling grass in late summer for late fall grazing generally provides feed with high enough quality to support beef cattle, dry

cows, or dairy heifers, but not milk production with dairy cattle without supplementing concentrates. Sowing fall Brassicas yields high quality forage, but they are too high in crude protein and too low in fiber to be used as the only forage species. Also, because they are not winterhardy, forage production is limited to fall without additional growth in spring.

Similar challenges exist for producers who grow corn as well, with consequences for soil conservation. Corn is a popular crop because it yields more dry matter per acre than perennial forage crops. This system works best when combined with cover crops to protect an otherwise bare soil surface during late fall and winter. However, many farms in northern New England do not sow cover crops after harvesting corn despite the soil conservation benefits. Farms often grow longer-maturity corn hybrids in an effort to maximize yields and in doing so they harvest the crop too late to establish an effective cover crop. Moreover, some farms do not perceive the value of cover crops as justifying the expense of establishing them. If a cover crop provided high quality forage in addition to protecting the soil surface, then establishing them might be a more widely-adopted practice.

Growing winter cereal grains has strong potential to address these issues. On pasture-based operations, they would provide additional forage through fall and into the following spring . On farms that grow corn, these crops can serve as a cover crop in the fall that would protect the soil over the winter, but they could also be harvested in early spring, to provide additional forage.

There has been research that demonstrates that small grains can provide high quality forage (see Table 1) when harvested at the soft dough stage, and that they can fulfill a dual purpose of a cover crop that yields high quality forage. However, there is still a need to evaluate the winter hardiness, yield potential, and quality of winter grains across a range of soil and management conditions.

- Table 1 Forage analyses for small grains

Project Objectives:

- To evaluate common small grains for yield, forage quality, and winter hardiness.

  To identify ways in which small grains can fit in current forage systems for dairy and livestock operations in New Hampshire

Cooperators

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Research

Materials and methods:

We established four different winter grains – 'Frederick' wheat, and winter rye, triticale, and spelt (varieties not stated) - at two New Hampshire farms. The Britton Farm is a conventional dairy where small grains were broadcast at 150 pounds per acre on Sept 27, 2010 on two fields – triticale, spelt, and rye on one three acre field, then wheat on part of an adjacent field - as a cover crop after harvesting silage corn, with the intention of harvesting forage from the small grains prior to planting corn the following growing season. The Gowdy Farm is a certified organic dairy and beef operation; they sowed the small grains with a seed drill at 150 pounds per acre on Sept 9, 2010 on a 4.5 acre field that was previously in perennial grasses with the intention of using the small grains for fall and spring grazing.

We monitored plant growth and development throughout the fall of 2010 and the spring of 2011. In spring, we evaluated each stand for winter hardiness, noting any reductions in stand density from the previous fall.

The original plan was to mechanically harvest forage on the Britton Farm and graze the forage At the Gowdy Farm. We would measure yields by recording the weight of wrapped baleage taken from the grains, and by measuring the weight of subsamples from the grazing operation, respectively. Unforeseen circumstances, however, necessitated a change in plans.

A miscommunication at the Britton Farm led to an overapplication of manure to the grains just prior to their being ready for harvest, such that most of the forage was contaminated and unfit for harvesting (Photo 1). We were able to estimate yield, however, by collecting forage from a 100ft2 section of a single mower swath and weighing it on a hanging scale when the grains were at or approaching the flag leaf stage. We sent in samples for analysis, and estimated dry matter yield per acre by multiplying the fresh weight by the reported dry matter content.

Gowdys planted small grains on a field adjacent to a small brook, which became considerably bigger over the winter when beavers dammed the brook off, causing extensive flooding on the lower half of the field. This, combined with higher than normal rainfall throughout the month of May, made it largely impossible to bring in cattle to graze in late April, or to mechanically harvest forage flag leaf stage in May (Photo 2). Instead, we had to delay harvest until early July when the stands were in the soft dough stage. Even then, harvesting conditions were difficult enough that we were not able to separate small grain species. After bales fermented for four weeks, we collected samples and submitted samples for analysis.

Analyses on both fresh samples from the Britton Farm and ensiled samples from the Gowdy Farm were carried out by Dairy One Forage Laboratory using basic wet-chemistry forage analyses and 48-hr in vitro dry matter and fiber digestibility.

- Manure contamination
- Wet field conditions, 6/10/2011

Research results and discussion:

All four small grains established well and survived the winter on both farms. Evaluating establishment on both farms in late October 2010, all small grains had germinated, and seedlings were beginning to tiller. Plantings at the Gowdy Farm, which were sown two weeks prior to those on the conventional farm, showed further development, with most seedlings ranging between the three- and four-leaf stages, compared to seedlings being in the two- and three-leaf stages at the Britton Farm (Photos 1 and 2), suggesting earlier planting dates result in greater dry matter accumulation in the fall - an important consideration if small grains are to be grazed in the fall. At the Britton Farm, both rye and wheat exhibited strong seedling vigor and dense growth while spelt showed the least vigor (Photos 3, 4, and 5). While broadcasting seed resulted in acceptable stand density, the more precise seed placement with a seed drill seems to have resulted in more uniform stands (Photos 6 and 7).

There was no winter injury evident when evaluating the stands in April 2011. All species had come out of dormancy and seedlings were continuing to develop; by late April and early May, all stands were at the five-leaf stage and were tillering (Photo 8 and 9).

Yields ranged from 0.2 to 1.2 tons of dry matter per acre on the Britton Farm, with the highest yields coming from wheat and the lowest yields coming from spelt (Fig 1). Wet field conditions at the Gowdy Farm made separating the small grains at harvest difficult, therefore we were unable to obtain accurate yield data. There were a total of 15 bales harvested from the field, with an average weight of 1000 pounds; with an average dry matter content of 62%, the total harvested dry matter yield was approximately 9300 pounds, averaging 1.16 tons per acre.

Forage quality varied with stage of maturity at harvest (Table 1). Where small grains were harvested at the flag leaf stage, forage was higher in crude protein (CP), total digestible nutrients (TDN), net energy (NEl), in vitro dry matter digestibility (IVTD) and fiber digestibility (NDFD), and projected milk yield per ton of dry matter. Harvesting at the soft-dough stage generally resulted in higher neutral-detergent fiber and non-fiber carbohydrate, presumably as kernels filled out with maturity.

It appears that if a farm is to incorporate small grains, harvesting at the flag-leaf stage has an advantage over harvesting at the soft-dough stage, if field conditions permit it. Overall forage quality is better at the flag-leaf stage, as evidenced by higher crude protein, energy, and digestibility, which translates into higher potential milk production. Any advantages of higher starch and sugar accumulation in the forage harvested at the soft-dough stage, as evidenced by %NFC, are countered by lower digestibility. Moreover, since small grains are generally at the flag-leaf stage in mid-May, harvesting at this stage would allow double cropping with corn or with summer annual forage crops, whereas waiting until the soft-dough stage in late June leaves a window in midsummer where it is impractical to establish another forage crop for harvesting in the same season.

- Oct 26, 2010 – triticale seedling six weeks after planting
- Wheat – 4 weeks after planting
- Triticale – established by broadcasting

- Triticale – established with seed drill
- Wheat – April 29, 2011
- Wheat seedling showing extent of tillering – April 29, 2011
- Rye – 4 weeks after planting
- Table 1 Small grain forage analyses
- Figure 1 DM yield (T per acre) for small grains
- Oct 26, 2010 – triticale seedling four weeks after planting
- Spelt – 4 weeks after planting

Research conclusions:

This project adds to other efforts in the region establishing that small grains are a viable forage crop for dairy and livestock farms in the Northeast, and that farmers can successfully double-crop them with corn.
The project also brought to light some of the challenges that occur with integrating small grains in existing cropping systems. The Gowdy Farm was interested in providing late-fall forage for their cattle, but we found a September planting date did not allow for enough growth for fall grazing; an earlier planting date would have remedied this, but any increases in available forage yields would come at the expense of third-cutting perennial grasses, or late-summer grazing. In this case, at least, the opportunity costs outweighed the benefits.
The Britton farm was interested in harvesting forage in spring. Sowing the grains after harvesting silage corn resulted in strong crop yields (at least for wheat and rye), but they found it difficult to include harvesting the small grains with corn planting. Also, they learned that they may need to spend more time preparing fields that they intend to harvest the following spring. While broadcasting seed after a light disking resulted in an acceptable stand, it also left numerous stones on the soil surface that interfered with mowing; a single pass in one field resulted in breaking five mower knives. Both farms continue to see some value in small grains as a forage crop, but their experiences this growing season have led them to take different approaches in the future. Other farms in the region will benefit from these experiences as well.

Participation Summary

Education & Outreach Activities and Participation Summary

PARTICIPATION SUMMARY:

Education/outreach description:

I presented results of the evaluation at a series of crop meetings for NH dairy, livestock, and forage producers in November 2011. Over the course of three meetings, we reached 78 producers. In questionnaires distributed at the end of the sessions, 73% of respondents indicated that the information they received was useful.

Project Outcomes

Project outcomes:

Farmer Adoption

The Britton farm is looking at other ways to double crop small grains with silage corn. Despite the difficulties they had in harvesting the crop, they see value in increasing the amount of forage they harvest. Looking to avoid the problems they experienced with stones damaging their mower, they are looking to use a no-till drill to establish the grains instead of broadcasting seed. They are also interested in continuing to establish small grains on corn fields located close to the barns and have cattle graze them, thereby providing forage in early spring grazing without requiring significantly more labor.
Two additional dairy farms – one certified organic, the other a purchased feed operation – are currently partnering to experiment with double-cropping small grains with field corn. They are will compare 'Frederick' wheat, 'Trical 815' triticale, and rye, looking to compare yield and changes in quality once the grains come out of dormancy in order to find a species that will allow an earlier harvest and interfere the least with corn planting.

Assessment of Project Approach and Areas of Further Study:

Areas needing additional study

Despite the challenges outlined, small grains have strong potential as a forage crop in northern New England. Future efforts should continue to evaluate small grain species, especially cultivars bred for forage production, for performance under varying management practices and soil conditions. In double cropping systems, where interfering with corn planting is a concern, research can focus on the effect of planting and harvesting dates of both small grains and corn has on overall feed yields and quality.