Literature Review: Alternative Forages for Organic Dairies


Abstract: Fenugreek is a novel forage crop in Canada that is generating interest as an alternative to alfalfa for dairy cows. To evaluate the value of fenugreek haylage relative to alfalfa haylage, six, second lactation Holstein cows (5668 days in milk), which were fitted with rumen cannulas (10 cm i.d., Bar Diamond Inc., Parma, ID, USA) were used in a replicated three-three Latin square design with 18-day periods. Diets consisting of 400 g/kg haylage, 100 g/kg barley silage and 500 g/kg concentrate on a dry matter (DM) basis were fed once daily for ad libitum intake. The haylage component constituted the dietary treatments: (i) Agriculture and Agri-Food Canada F70 fenugreek (F70), (ii) Crop Development Center Quatro fenugreek (QUAT) and (iii) alfalfa (ALF). DM intake (DMI), milk yield and milk protein and lactose yields were higher (P<0.001) for cows fed ALF than fenugreek (FEN, average of F70 and QUAT). Milk fat of cows fed FEN contained lower concentrations of saturated, medium-chain and hypercholesterolemic fatty acids (FAs; P<0.05) than that of cows fed ALF. Apparent total tract digestibility of DM and nutrients was not affected by treatments. Similarly, individual ruminal volatile FA concentrations and rumen pH (5.9) were not affected by treatments. Rumen ammonia–N concentration was higher for FEN than ALF (P<0.001). Estimates of neutral detergent fiber (NDF) passage rate (P<0.05) and NDF turnover rate (P<0.001) in the rumen were higher for ALF than FEN. Our results suggest that although the digestibility of the FEN diets was not different from that of the ALF diet, fenugreek haylage has a lower feeding value than ALF for lactating dairy cows due in part to lower DMI and subsequently lower milk yield.


Abstract: The objective was to assess the pasture productivity and forage characteristics of 2 fall-grown oat (Avena sativa L.) cultivars, specifically for extending the grazing season and reducing reliance on harvested forages by replacement dairy heifers. A total of 160 gravid Holstein heifers (80 heifers/yr.) were stratified by weight, and assigned to 1 of 10 identical research pens (8 heifers/pen). Initial body weights were 480 ± 43.5 kg in 2011 and 509 ± 39.4 kg in 2012. During both years of the trial, four 1.0-ha pasture replicates were seeded in August with Ogle oat (Schumitsch Seed Inc., Antigo, WI), and 4 separate, but similarly configured, pasture replicates were seeded with Forage Plus oat (Kratz Farms, Slinger, WI). Heifer groups were maintained as units, assigned to specific pastures, and then allowed to graze fall-oat pastures for 6 h daily before returning to the barn, where they were offered a forage-based total mixed ration. Two heifer groups were retained in confinement (without grazing) as controls and offered the identical total mixed ration as pasture groups. During 2011, available forage mass increased with strong linear and quadratic effects for both cultivars, peaking at almost 9 Mg/ha on October 31. In contrast, forage mass was not affected by evaluation date in 2012, remaining ≤2,639 kg/ha across all dates because of droughty climatic conditions. During 2012, Ogle exhibited greater forage mass than Forage Plus across all sampling dates (2,679 vs. 1,856 kg/ha), largely because of its more rapid maturation rate and greater canopy height. Estimates of energy density for oat forage ranged from 59.6 to 69.1% during 2011, and ranged narrowly from 68.4 to 70.4% during 2012. For 2011, responses for both cultivars had strong quadratic character, in which the most energy-dense forages occurred in mid-November, largely due to accumulation of water-soluble carbohydrates that reached maximum concentrations of 18.2 and 15.1% for Forage Plus and Ogle, respectively. Across the 2-yr trial, average daily gain for grazing heifer groups tended to be greater than heifers remaining in confinement (0.85 vs. 0.74 kg/d), but both management strategies produced weight gains within reasonable proximity to normal targets for heifers in this weight range. Fall-grown oat should be managed as stockpiled forage for deferred grazing, and good utilization of fall-oat forage can be accomplished by a one-time removal of standing forage, facilitated by a single lead wire advanced daily to prevent waste.

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Abstract: Tall fescue [Schedonorus phoenix (Scop.) Holub] is a widely used and important cool-season forage grass in the eastern United States. Reduced forage production during hot, dry, mid- to late-summer periods and animal toxicities associated with the presence of a fungal-endophyte limit the utility of tall fescue for some producers. We investigated interseeding teff [Eragrostis tef (Zucc.) Trotter], a warm-season annual grass, into established fescue stands as a means to improve summer forage production and potentially reduce fescue toxicities. Teff established rapidly regardless of seeding method (broadcast or no-till) or seed-coating treatment (with or without a commercial polymer coating), but its abundance varied from year to year. Teff contribution to the swards was twice as great in the warmer season of 2010 (40%) than in the cooler seasons of 2008 and 2009. Significant contributions from teff were associated with greater dry matter yields, lower protein, and higher fiber contents relative to the non-interseeded control plots. Reduced forage quality may be related to rapid reproductive development of teff when other species were vegetative and the high fiber content of warm-season species. Overseeding teff may benefit producers by reducing relative forage content and increasing dry matter production of fescue-dominated swards during hot summer periods.


Abstract: Pasture-based automatic milking systems (AMS) require cow traffic to enable cows to be milked. The interval between milkings can be manipulated by strategically allocating pasture. The current experiment investigated the effect of replacing an allocation of grazed pasture with grazed soybean (Glycine max) with the hypothesis that incorporating soybean would increase voluntary cow traffic and milk production. One hundred and eighty mixed age, primiparous and multiparous Holstein-Fresian/Llilawarra cows were randomly assigned to two treatment groups (n=90/group) with a 2x2 Latin square design. Each group was either offered treatments of kikuyu grass (Pennisetum clandestinum Hoach ex Chiov.) pasture (pasture) or soybean from 0900 h to 1500 h during the experimental period which consisted of 2 periods of 3 days following 5 days of training and adaptation in each period with groups crossing over treatments after the first period. The number of cows trafficking to each treatment was similar together with milk yield (mean = 18 l/co/d) in this experiment. For the cows that arrived at soybean or pasture there were significant differences in their behavior and consequently the number of cows exiting each treatment paddocks. There was greater cow traffic (more cows and sooner) exiting pasture allocations. Cows that arrived at soybean stayed on the allocation for 25% more time and ate more forage (8.5 kg/cow/d/allocation) relative to pasture (47 kg/cow/d/allocation). Pasture cows predominantly preplaced eating time with rumination. These findings suggest that replacing pasture with alternative grazeable forages provides no additional incentive to increase voluntary cow traffic to an allocation of feed in AMS. This work highlights the opportunity to increase forage intakes in AMS through the incorporation of alternative forages.

Hancock, D.W. and R.G. Durham. 2011. Overseeding alfalfa with rye and/or annual ryegrass can improve forage distribution and total production. Forage and Grazinglands, 9(1).

Abstract: A forage system based on alfalfa (Medicago sativa L.) that provides winter productivity without sacrificing summer or autumn forage production could be beneficial to the dairy, beef, and equine industries in the southeastern USA. The objectives of this research were to characterize the effect of a single instance of drilling or broadcasting rye, annual ryegrass, or a combination of the two into existing stands of alfalfa. A small-plot trial was conducted over three years on mature alfalfa stands with new stands chosen each year. Treatments consisted of overseeding with cereal rye (Secale cereale L., CR), annual ryegrass (Lolium multiflorum Lam., AR), or a combination of rye and annual ryegrass (CR-AR) using either a broadcast or drilled planting method and an untreated control arranged in a randomized complete block design (four replications). Over the three years, the total forage yield of the forage system was increased (P < 0.001) by 2700 lbs. DM/acre (34%) by overseeding with CR or CR-AR and by 1400 lbs. DM/acre (16%) when overseeded with AR, compared to the control. Planting method did not have a consistent effect (P > 0.10). Overseeding species or planting method had no effects on summer and autumn alfalfa yields nor on stem count in any of the three years. Alfalfa can be overseeded with rye and/or annual ryegrass by drilling or broadcasting to increase total yield without reducing alfalfa production during the summer or autumn or hastening stand decline.


Abstract: Winter rye (Secale cereale L.) is a common cover crop in the Upper Midwest United States with potential as a forage crop; but little is known about the effect of maturity on its spring forage yield and quality. Our objective was to determine the forage yield and quality of three winter rye cultivars at six different maturities in four environments. The yield response to increased maturity was quadratic and variable over environment with ranges at boot (Zadok 41) of 1.2 to 2.7 tons/acre, at heading (Zadok 51) 1.4 to 4.2 tons/acre, and at dough (Zadok 81) of 4.4 to 9.5 tons/acre. Forage crude protein (CP), neutral
detergent fiber digestibility (NDFD), and digestible dry matter (DDM) decreased with maturity while neutral detergent fiber (NDF) increased. Average NDF digestibility decreased linearly from 82.5% at tillering to 44.1% at soft dough. Rye cultivars had similar forage yield and quality except for CP. Vitallo had lower CP levels than Rymin or Spooner. Producers can maximize yield by harvesting at dough (Zadok 81) or forage quality by harvesting at tillering (Zadok 21). Rye provides good yield and high quality forage at many environments and maturities.


Abstract: Warm-season annual grasses may be suitable as forage crops in integrated weed management systems with reduced herbicide use. A 2-year field study was conducted to determine whether tillage system and nitrogen (N) fertilizer application method influenced crop and weed biomass, water use, water use efficiency (WUE), and forage quality of three warm-season grasses, and seed production by associated weeds. Tillage systems were zero tillage and conventional tillage with a field cultivator. The N fertilization methods were urea broadcast or banded near seed rows at planting. Warm-season grasses seeded were foxtail (Setaria italica L.) and proso (Panicum miliaceum L.) millets, and sorghum–sudangrass (Sorghum bicolor (L.) Moench × Sorghum sudenense Stapf.). Density of early emerging weeds was similar among treatments, averaging 51 m⁻². Millets exhibited higher weed density and weed biomass than sorghum–sudangrass. At harvest, sorghum–sudangrass produced significantly greater biomass and N accumulation than either millet. Water use (157 mm) and WUE (25.1 kg mm⁻³ ha⁻¹) of total biomass did not vary among treatments or grass entries. Weed seed production by redroot pigweed and green foxtail was respectively 93 and 73% less in sorghum–sudangrass than proso millet. Warm-season grasses offer an excellent fit in semiarid cropping systems.

**Angadi, S., Contreras-Govea, F.E., Lauriault, L.M., Marsalis, M., and Puppula, N. 2009. Performance of forage sorghum-legume mixtures in southern high plains, USA. Forage and Grazinglands. 7.**

Forage sorghum [Sorghum bicolor (L.) Moench] and sorghum & sudangrass (S. bicolor var Sudanese) hybrids may produce as much dry matter yield as corn (Zea mays L.) for silage but with less water. Planting sorghum forage with annual legumes could increase digestibility and crude protein (CP) concentration, making the mixture more suitable for dairy cow rations. The objective of this study was to assess dry matter (DM) yield and nutritive value of brown midrib (BMR) sorghum forage grown as a monoculture or in combination with selected annual legumes. BMR100 (a forage sorghum) and PS210BMR (a photoperiod sensitive sorghum & sudangrass) were planted with four annual legumes: cowpea [Vigna unguiculata (L.) Walp.], lablab (Lablab purpureus L.), soybean (Glycine max L.), and tepary bean (Phaseolus acutifolius A. Gray). Lablab was most complementary with sorghum for forage. The lablab-sorghum mixtures contained more CP with no consistent effect on neutral detergent fiber (NDF) and acid detergent fiber (ADF) compared to monoculture sorghums. This finding opens another possibility to produce good quality forage that could be used as an alternative forage crop to corn in the Southern High Plains.


Teff [Eragrostis tef (Zucc.) Trotter] is an annual C₄ grass native to Ethiopia. It has potential as an emergency hay, pasture, or silage crop in the United States. Our objective was to determine the optimum N rate for single and multiple cut systems evaluating both dry matter (DM) yield and forage quality. Eight N-rate studies (0, 50, 75, and 100 lb./acre) were conducted over 2 years (four as single-cut systems and two each as 2- or 3-cut systems). Yields ranged from 0.8 to 2.4, 3.3 to 3.6, and 4.8 to 4.9 ton/acre for the 1-, 2- and 3-cut systems, respectively. Nitrogen application increased yield at all but two sites which had manure or rotation nutrient inputs. Only at one site was there a yield benefit from applying > 50 lb. N per acre. Crude protein levels of 1st cutting increased 3.3% units when 50 lb. per acre was added with similar trends for 2nd and 3rd cuttings. For multiple-cut systems, an application of 50 lb. N per acre per cut reduced forage neutral detergent fiber (NDF) while NDF digestibility was not impacted. We conclude Teff grown under New York growing conditions needs 50 lb. N per acre per cut for maximum DM yield.


The objective of this study was to quantify the nutritive characteristics of 6 grain crops and 4 herb forages over 4 seasons, when all species were grown at the same site, under the same climatic and edaphic conditions, and with soil moisture and nutrient availability being non-limiting to growth. The forages grown were maize (Zea mays), sorghum (Sorghum bicolor), millet (Pennisetum americana), wheat (Triticum aestivum), triticale (Triticum×secale), oats (Avena sativa), fodder radish (Raphanus sativa), rape (Brassica rapa), chicory (Cichorium intybus) and plantain (Plantago lanceolata). The in sacco degradation characteristics of organic matter (OM) and crude protein of herbage were measured in the rumen of cannulated sheep in order to calculate the availability of effective rumen degradable protein (ERDP), rumen by pass protein, metabolisable protein (MP) and the synchrony index (Is), which describes the efficiency of utilization of degradable nitrogen (N) and OM for microbial
protein synthesis (MPS) in the rumen. In this study, all grain crops except maize had a ERDP/fermentable metabolizable energy (FME) ratio varying from 14 for millet to 23 for wheat, well above the ratio of 11 required for optimum MPS in the rumen of dairy cows. In contrast, maize had the lowest ERDP/FME ratio of 3, indicating that ERDP would be limiting MPS in the rumen. The availability of MP varied from 58 g/kg DM in maize to 153 g/kg DM in wheat and all forage species except maize were able to meet the MP requirement of high-producing dairy cows (30 L/milk/day) provided they were able to consume 11 to 13 kg DM/cow/day of the forage. The availability of MP from herbs varied from 95 g/kg DM in fodder radish to 163 g/kg DM in plantain, which would be sufficient for high-producing cows, however, most dairy cows could not consume sufficient forage to achieve these high levels of production due to very high nitrate content in rape (mean of 11.1 g/kg DM) and fodder radish (mean of 8 g/kg DM).


Organic dairy farmers need high yielding, quality forages with low weed pressure. A four-year study was conducted in Maine to evaluate yield, quality and weed biomass of spring and winter small grains double cropped with brown midrib sorghum-sudan grass (SS). Double crops included spring barley/SS, winter barley/SS (WB/SS), winter triticale/SS (WT/SS), and winter wheat/SS (WW/SS). These were generally compared to organic open-pollinated corn silage grown adjacent to the study. Forage quality measures included crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), total digestible nutrients (TDN), and non-fiber carbohydrates (NFC). Corn was cultivated four times (two tine and two row cultivations); double crops received essentially no cultivation. Yield of WT/SS and WW/SS (10,710 and 9.695 lb./acre) was significantly higher than WB/SS or SB/SS (8590 and 7372 lb./acre) and were similar to corn silage (10,505 lb./acre). Double crop weed biomass was four times less (1 to 4% of DM yield) than corn (11.8% DM yield). Low manure N efficiency likely affected forage quality particularly CP, TDN, and NFC values. Significant nutrient yield differences (> 1200 lb./acre) were found between double crops, but corn NFC yield was almost twice that of any double crop. Supplemeting high energy feeds can help balance double crop rations.


A challenge in managing chicory (Cichorium intybus L.) as a forage is dealing with bolting of flower stalks in spring. Cultivars of chicory with reduced bolting potential, used mainly for root and sugar production (root types), are available. An experiment was conducted at Rock Springs, PA, to compare forage cultivars and European root-type cultivars of chicory for yield, bolting, and persistence under clipping. ‘Grasslands Puna,’ ‘Lacerta,’ and ‘Forage Feast’ forage cultivars and ‘Dagerrad,’ ‘Halle,’ and ‘Katrein’ root-type cultivars were sown in April 1999. Plots were cut every 4 week during May to August 2000 and 2001. Dry matter (DM) yield was determined at each harvest and bolting was estimated visually. Stand densities were determined periodically from October 1999 to June 2002. The cultivars did not differ in DM yield in 2000 (average DM of 6700 lb./acre). Grasslands Puna and Lacerta yielded more DM than other cultivars in 2001. More than 80% of Lacerta and Puna plants bolted at the first harvest in both years, whereas only 30 to 40% of Forage Feast and the root cultivars bolted. There was < 10% bolting in Forage Feast and the root-type cultivars after the first harvest in 2000 and during all harvests of 2001. Lacerta suffered a 52% loss of plants in 2000 and a cumulative loss of 90% by June 2002. In June 2002 Lacerta had 2 plants/ft², whereas the other cultivars averaged 6 plants/ft². Reduced bolting would be a useful characteristic of forage chicory cultivars provided that yield and persistence were not compromised.


I thought maybe this would be interesting to note that as these alternative crops become used more crop nutrient needs and removal rates will need to be established if they have not been already as this will be particularly important to organic growers who already have a challenging nutrient cycling system. It is also important from a herd health perspective as similar health concerns can be observed as with other grasses.

For the long-term sustainability of the dairy industry in the Northeastern USA, manure nutrient application rates should not exceed crop nutrient removal once above optimum soil fertility levels are reached. Dairy producers have shown a growing interest in brown midrib (BMR) forage sorghum (Sorghum bicolor (L.) Moench.) · sudangrass (Sorghum sudanense Piper) hybrids (S x S) as a more environmentally sound alternative to maize (Zea mays L.) but data on S x S nutrient removal rates are scant. Our objectives were to determine N, P, K, Ca and Mg removal with harvest as impacted by N application rate, using six N rate studies in New York. One of the six sites had a recent manure history. Although site-to-site differences existed, N application tended to decrease P and K and increase N, Ca and Mg concentrations in BMR S x S forage. Nutrient removal and yield were highly correlated for all sites except one location that showed a K deficiency. The crop removed large amounts of P and K in the manured site, suggesting that BMR S x S is an excellent scavenger of these nutrients. If manure is applied mid-season, forage K levels are likely too high for feeding to non-lactating cows.

The botanical composition of complex forage mixtures can be unstable and may require frequent re-establishment to maintain the desired mixture. We used a whole-farm model (Integrated Farming System Model, IFSM) to simulate the costs and returns of establishing five types of pasture with stand lives of 3, 5, or 10 years. We compared four mixtures [two, three, six, or nine species of grasses, legumes, and chicory (Cichorium intybus L.) and an orchardgrass (Dactylis glomerata L.]+N (150 lb./acre) pasture with a 10-year stand life. The whole-farm economic returns of these five pasture types were estimated for a representative 100-cow dairy farm based on actual costs of establishment and pasture production from two published studies. Planting grass-legume or grass-legume-chicory mixtures increased net returns per cow compared with the orchardgrass+N pasture. The increase in net return ranged from $57/cow for the two-species mixture to $191/cow for the six-species mixture with a 3-year stand life. Corresponding values for a 5-year stand life were $107 and $225, respectively, and for a 10-year stand life were $136 and $246, respectively. The greater forage yields of the mixture compared with orchardgrass+N reduced purchased feed inputs and in some instances increased the income from forage sold off the farm. Production risk due to weather influences was up to 24% less for the forage mixtures compared with orchardgrass+N and risk decreased with increased stand life. Even with a shorter stand life, the grass-legume-chicory mixture was more profitable compared with a long-lived and lower-yielding orchardgrass+N pasture.


Fertility regimes for sorghum-sudangrass [Sorghum bicolor (L.) Moench] that include broiler litter and that can produce similar forage yield and quality to inorganic fertilizer while reducing nutrient loading have not been fully investigated. Unfortunately, many producers still apply broiler litter and other animal manures on a nitrogen basis and thereby over-apply phosphorus which can lead to potential pollution problems. This research focused on identifying fertility programs utilizing broiler litter applied based on plant P requirement but which would still produce forage yield and quality comparable to that produced using inorganic fertilizer. Our results show that lower rates of broiler litter, applied based on the P requirement of the crop and supplemented with inorganic N, can produce forage with similar nutritive value to that fertilized with inorganic fertilizer only or broiler litter applied to meet crop N requirements.

Griggs, T.C. 2006. Fall and spring forage production and quality of winter cereals seeded at three fall dates. Forage and Grazinglands. 4.

This is in Utah but again I guess it shows that some work is being done but not necessarily in the northeast or with organic dairies in mind.

Irrigated perennial pasture growth is negligible during November through March in northern Utah. Winter cereals including barley (Hordeum vulgare L.), triticale (× Triticosecale Wittmack), and wheat (Triticum aestivum L.) may provide supplemental pasture during this period. This study evaluated fall and spring forage production and quality of cereal cultivars seeded on 22 or 27 August, 11 or 19 September, and 1 or 11 October in 2001-2002. Forage production declined by 53 to 69 kg/ha in fall, and by 42 to 85 kg/ha in spring, for each day that seeding was postponed beyond 22 or 27 August. Herbage mass for August seeding dates ranged from 1740 to 3730 kg/ha in November and from 1160 to 5810 kg/ha in April. Forage quality levels in November and April differed only slightly among cultivars and seeding dates, and ranged from 163 to 339 g/kg crude protein (CP), 691 to 948 g/kg neutral detergent fiber digestibility (NDFD), and 922 to 977 g/kg in vitro true dry matter digestibility (IVTD). When seeded in August, Stephens and Utah-100 wheat, and Forerunner and a TRICAL 102/2700 triticale blend, produced the most spring and total forage, averaging 6790, 6150, 6830, and 6180 kg total forage per ha, respectively, across years. Early-seeded winter cereals can extend pasture availability during mid-November to mid-April in the Intermountain West.

Kallenback, R.L. and Smith, L.B. 2006. Overseeding annual ryegrass and cereal rye into soybean as part of a multifunctional cropping system: II. Forage yield and nutritive value. Forage and Grazinglands. 4.

Annual ryegrass (Lolium multiflorum Lam.) and cereal rye (Secale cereale L.) are two forages that could fit well into mixed row-crop/livestock operations because they can be used both as a cover crop and as a source of winter pasture. Yet few researchers have studied how to integrate these forages in a soybean [Glycine max (L.) Merrill]-winter pasture-corn (Zea mays L.) rotation. An experiment was conducted where these forages were overseeded at different stages of soybean development over two years. All treatments yielded over 2,250 lb. of forage per acre each year (with the best treatments yielding over 3,000 lb./acre), which would supply much needed pasture for winter grazing. While all treatments provided adequate amounts of forage, overseeding into soybean at the R 6.5 stage (at leaf drop) consistently produced the greatest yields for both annual ryegrass and cereal rye. Forage nutritive value from annual ryegrass was slightly better than for cereal rye, but both had crude protein concentrations of more than 17% and neutral detergent fiber of less than 56%. The results show that livestock operations in the
lower Midwest could use cereal rye and annual ryegrass overseeded into soybean as part of a row crop-winter pasture-row crop rotation.


The use of alternative temperate forages to improve the sustainable productivity of grazing ruminants, relative to grass-based pastures, is reviewed. Particular emphasis is placed upon forages containing secondary compounds for sustainable control of internal parasites, for increasing reproductive rate in sheep, reducing bloat risk in cattle and for reducing methane production as a means of lowering greenhouse gas emissions. Of the forages reviewed, the herb chicory (Chicorium intybus) and the condensed tannin-containing legumes Lotus corniculatus L. and sulla (Hedysarum coronarium) offered the most advantages. Chicory and sulla promoted faster growth rates in young sheep and deer in the presence of internal parasites, and showed reduced methane production in other studies. L. corniculatus was not as effective as chicory and sulla in promoting growth of lambs in the presence of internal parasites. Grazing on L. corniculatus was associated with increases in reproductive rate in sheep, increases in milk production in both ewes and dairy cows and reduced methane production, effects that were mainly due to its content of condensed tannins (CT). Grazing ewes on L. corniculatus during mating and very early pregnancy may also reduce lamb mortality. However, there are no data on the effect of mating ewes, which are grazing chicory on their reproductive performance, an important omission. Risk of rumen frothy bloat in cattle grazing legumes is reduced when the forage contains 5 g CT/kg dry matter (DM) or greater. Gene transfer techniques aimed at achieving this for lucerne (Medicago sativa) have made progress, but CT concentration needs to be further increased from calculated values of 0.75–1.25 g CT/kg DM in the transformed plants. Bloat control may be achievable in genetically transformed legumes before increased amino acid absorption, as the concentration of CT required for bloat control is lower (5 versus 30–40 g/kg DM) than that required to cause increased amino acid absorption and is not affected by differences in CT structure. Key plant characteristics for improved sustainable productivity are a high ratio of readily fermentable: structural carbohydrate and the presence of CT and certain other secondary compounds. Taking into account both nutritional and agronomic considerations, chicory is considered one of the best emerging plants for grazing livestock, with L. corniculatus being more suitable for areas with dry summers and warm winters. Some of the agronomic limitations of L. corniculatus and sulla could be reduced by mechanical harvesting and their inclusion as a component in total mixed rations (TMR), instead of grazing.

Drake, D.J. and Orloff, S.B. 2005. Simulated grazing effects on triticale forage yield. Forage and Grazinglands. 3:

Field trials were conducted in 2001 and 2002 to evaluate the effect of simulated grazing on the yield of autumn-seeded triticale (*Triticosecale* spp). Grazing was simulated with a flail-type harvester. In Trial 1, defoliation was initiated at four starting maturities in spring and repeated at 2-week intervals. In Trial 2, defoliation was initiated at pre-jointing and repeated at intervals of 1, 2, 3 or 6 weeks. Yields were obtained at each simulated grazing. Following the simulated grazing, the triticale was allowed to mature to the flower stage when it was cut a final time to simulate a cutting for hay. Maximum total production, 9.5 tons/acre, occurred with a single clipping at 6 inches of growth, which was similar to no clipping and only hay production, 9.0 tons/acre. Delaying the initial defoliation from 6 inches to 12 inches increased forage for grazing by 0.73 ton/acre. Increasing the number of defoliations increased the amount of forage for grazing by 0.20 ton/acre for each clipping, but reduced subsequent hay yields and total combined yield. The increase in forage for grazing was small compared to the reduction in hay yield. A single early simulated grazing resulted in the highest overall combined forage yield, but managers should select the maturity at initial grazing and frequency of grazing based on their relative needs for grazable forage versus hay.


Forage production in midsummer is a challenge for grazers in the northeastern USA. Domesticated cultivars of chicory (Cichorium intybus L.) and English plantain (Plantago lanceolata L.) are available in the USA as perennial herbs for pastures. These species have been touted as having good summer production and relatively high nutritive value. We conducted two field-plot experiments at Rock Springs, PA, during 1997 to 2001 to evaluate the nutritive value of chicory and plantain under clipping. ‘Grasslands Puna’, ‘Lacerta’, and ‘Forage Feast’ chicory and ‘Ceres Tonic’ and ‘Grasslands Lancelot’ grazing plantain were sown in field plots in May 1997 and 1999 and harvested multiple times in 1998 (Exp. 1) and 2000 (Exp. 2). Herbage from three harvests in 1998 and two harvests in 2000 was analyzed for in vitro true digestibility (IVTD); neutral detergent fiber (NDF); and the minerals P, K, Ca, Mg, Mn, Cu, B, and Zn. Averaged for cultivars, chicory had 11% higher (P < 0.05) IVTD and 6 to 20% lower (P < 0.05) NDF than plantain. Concentrations of all minerals, except for Ca, were 17 to 48% higher (P < 0.05) in chicory than in plantain. There were few meaningful differences in nutritive value among cultivars within chicory or plantain. Chicory and plantain are of relatively high nutritive value and could enhance the nutritional profile of mixed species pastures. The nutritive value benefits, however, must be balanced against the lack of persistence of chicory and plantain.

The annual grasses pearl millet [Pennisetum glaucum (L.) R. Br.] and sorghum-sudangrass [Sorghum bicolor (L.) Moench] are alternatives to warm-season perennials in forage systems for lactating dairy cows (Bos Taurus) in the southern USA. Large fluctuations in forage production during a short growing season, however, make their management difficult. During 2 yr., seedling date and cultivar effects on dry matter (DM) yield, yield distribution, and nutritive value of these grasses were measured, and treatments were replicated four times. There were four seeding dates in 1996 starting on 10 May and six in 1997 starting on 20 March. Seeding dates were 3 wk. apart. Three millet (‘GK 600’, ‘Millex 32’, and ‘Tifleaf 2’) and two sorghum (‘Hygraizer’ and ‘SX 15’) cultivars were tested. Soils were a loamy, siliceous, thermic Grossarenic Palequult and a hyperthermic Grossarenic Paleudult. Total DM yield, averaged across cultivars, decreased from 7.4 to 5.6 Mg ha\(^{-1}\) from the first to the fourth seeding date in 1996 and from 7.4 to 4.4 Mg ha\(^{-1}\) from the first to the sixth seeding date in 1997. Leaf percentage generally was above 70% and often greatest for Tifleaf 2. Seasonal distribution of DM was affected by planting date but not by cultivar. In conclusion, choice of species or cultivar had less impact on the responses measured than did planting date. Seeding at two dates approximately 3 to 6 wk. apart is a good strategy for improving yield distribution of these cultivars and providing high nutritive value forage for nearly 5 months.

Additional notes:
The plots in the above study were irrigated as needed during the first month after seeding to ensure establishment. If rainfall was <25mm wk\(^{-1}\) irrigation was added so that the sum of weekly rainfall plus irrigation was 25mm.


Two grazing trials conducted with Friesian cows in mid lactation showed milk yields were higher on birdsfoot trefoil (Lotus corniculatus)-dominant pasture (19.8 and 16.7 l/cow/day) than on white clover dominant (17.8 and 15.4 l/cow/day) or ryegrass-dominant (13.0 and 11.7 l/cow/day) pastures. Increased milk production on the Lotus and clover was attributed to the higher nutritive value of the legume-based pasture compared with the ryegrass, and to higher dry matter intakes. Cows grazing Lotus also had improved feed conversion efficiency compared with those grazing either ryegrass or clover, indicating that the presence of condensed tannins in the Lotus may have contributed to the improved efficiency. Milk protein concentration was consistently higher on the Lotus (3.36 and 3.35%) than on the ryegrass (3.15 and 3.21%) or clover (3.30 and 3.21%) in both experiments, while milk fat levels were lower in Experiment 1. While Lotus increased milk yield and milk protein concentration, its potential as a forage legume for dairy cows also depends on annual herbage production and the determination of how best to utilize it in a farm system.


Kemp investigated oats and annual ryegrass for forage production in Australia during the winter months when pastures, typically dominated by tropical grasses, tend to slow in production and cannot meet feed demands in terms of quantity or quality for cattle. This situation is similar to the decline in production observed in cool-season grasses during summer months in the northeastern U.S. In the subtropical region of Australia where the study was executed, Kemp found that the growth rates of the two species differed vastly with oats growing much more rapidly earlier than the ryegrass; ryegrass took 2-4 weeks longer than oats to reach 1st grazing. This early rapid growth rate of oats led to greater yields for oats than ryegrass. However after the 1st grazing growth rates were similar between species. In addition to these general species differences cultivars were also investigated for that region. These types of studies are crucial as there can be a wide range of varietal difference in growth characteristics especially in different locations. These factors are important to consider when selecting species and cultivars that not only meet production and quality requirements but also fit into the farmer’s system and address his specific needs and goals.

SARE project reports:


The study includes 13 annual forage species and three annual forage crop mixtures. The “summer-available” species and associated mixture are warm-season annual grasses and forbs including BMR sorghum-sudangrass, teff, millet, oats, buckwheat, and chickling vetch. The “fall-available” species included forage radish, oats, rape, wheat, triticale, and sunn hemp. The “spring-available” species included wheat, triticale, barley, cereal rye, and hairy vetch. No fertilizers or pesticides were applied during the study however the site received compost prior to establishment of the study. At another location the
performance and grazing potential of these species and mixtures, as well as the impact of tillage on establishment and productivity will be assessed. From a survey conducted at the Northeast Organic Dairy Producers Alliance Field Days and Annual Meeting, 8/11 of the organic dairy farmers surveyed said they had experience with alternative forage crops such as oats, turnips, sorghum, sorghum sudangrass, and millet fed as pasture and/or baleage/haylage.


BMR sorghum, a warm season annual, was planted on 4 farms followed by a small grain cover crop. In 2014 the only farm that successfully established a cover crop planted triticale. The sorghum appeared to be a reasonable substitute for corn silage offering similar yields at a lower cost and an equally efficient harvest as a single chop system. The final report will evaluate whether this cropping combination was cost effective and the performance of the crop’s yield and feed quality.


This project attempted to test the practice of sowing two different types of brassicas into small grains. In the spring of 2014, eight acres of grain were sown—four of wheat (Glenn hard red spring wheat) and four of oats (Kame oats). The small grains were intersown with one of two types of brassicas—kale and forage turnips (Kestrel Kale and Appin forage turnips). This project attempted to use intersowing to create two crops in one season; the cash crop of small grains followed by a forage crop of grain residue and brassicas. Overall, the project was an attempt to increase the economic viability of dairy farms in the northeast through the testing of an innovative intercropping idea. The results of this project showed that forage turnips performed better than kale when intersown with small grains. The brassicas performed similarly in both wheat and oats. Forage turnips performed somewhat better when sown at the same time as the small grains; when the forage turnips were sown after a ten day interval, the performed somewhat worse. In general, however, the brassicas did not perform particularly well as a crop that could be green chopped in grain residue, as was intended. Instead, the brassicas showed potential as a crop that could be grazed when intersown with small grains (after grain harvest). In addition, this project indicated that brassicas intersown with small grains may serve a useful purpose in preparing ground for subsequent crops.

Additional notes:
Weeds were a problem for establishing the brassicas, the kale more so than the turnips.


Abstract: Warm-season grasses (WSG) can supply badly needed forage in summer when cool-season grasses (CSG) are often unproductive. This study was conducted from 2005–2007 in central Illinois to compare annual and perennial WSG pasture types integrated into a CSG grazing system. The objective was to compare summer herbage mass, forage nutritive value, cattle (Bos taurus) performance, and variable costs between CSG systems integrated with either annual (AWSG) or native, perennial warm-season grass (NWSG) pastures. The AWSG pastures were established with sorghum-sudangrass cultivars [Sorghum bicolor (L.) Moench], and eastern gamagrass [Tripsacum dactyloides (L.) L.] dominated NWSG pastures. Beef cow–calf groups were moved between CSG and WSG pastures during summer based on forage availability. Both WSG pasture types averaged 61% more herbage mass (493 g m⁻²) in mid-summer compared with CSG pastures (204 g m⁻²). Except for one sampling date, herbage mass on NWSG pastures either exceeded (P < 0.05) or was equal to AWSG pastures. The nutritive value of AWSG forage was consistently higher than NWSG (P < 0.05), but cow and calf performance was similar on both pasture types. A simple cost analysis showed that AWSG pastures were more expensive to maintain even though establishment costs of NWSG pasture were much higher. Our results suggest NWSG pastures may be the better option for livestock producers seeking a longer-term solution to summer forage deficits associated with CSG.


As farmers in the northeast are faced with an ever mounting pressure (and desire) to protect water quality, increase soil health, and maintain productive and sustainable farms; they are increasingly turning to cover crops as a way to accomplish these goals. By far the most common cover crop utilized by dairy and forage crop farmers in Vermont is winter rye seeded after corn silage. With our short growing seasons, winter rye has become a dependable cover crop to provide good erosion control and nutrient cycling. However, as more producers become aware of alternative cover crop species and mixtures of species, they are asking to know more about their choices and what the potential benefits may be to planting these alternative crops. This study is evaluating whether the addition of forage radish to a winter rye cover crop could augment and enhance the performance over winter rye by itself. In addition, it will quantify the economic impacts of this combination and basic agronomic
recommendations for seeding rates and establishment methods. This field experiment will occur on two farms over the course of two seasons. Plots will be no-till drilled or broadcast after timely corn silage harvest and then receive one application of liquid dairy manure immediately after planting. Measurements will occur the fall after planting and the subsequent spring. Results will be shared with farmers and ag service providers in Vermont and around the northeast. There is a large Extension/outreach component to this project. This project is part of a larger USDA-NIFA project.


The goal of this Agroecosystems project is to develop sustainable dairy cropping systems that minimize environmental impacts and off-farm inputs; and are productive, and profitable. To achieve this, we designed the NESARE Sustainable Dairy Cropping Systems Farm to produce all the forage, feed, and fuel for a 65 cow, 240 acre dairy farm, while conserving soil, nutrients, biodiversity, and energy. In spring 2010, we initiated two diverse, 6-year crop rotations that include legumes, perennials, green manure and cover crops, no-till, and canola, and a straight vegetable oil tractor using farm-scale equipment at 1/20th scale on 12 acres of Penn State’s Agronomy Research Farm. Within each crop rotation we are evaluating innovative management practices to address key issues: i. manure management with shallow-disk manure injection; and ii. weed management with reduced herbicide use, with cultural and mechanical integrated weed management practices. We are also evaluating strategies for canola production, and insect and slug pest management, and included a conventionally managed, corn-soybean rotation on 2 acres for research comparisons. Using the crop yield and quality, and a dairy nutrition model, we simulate the dairy herd’s milk production. To identify system benefits, trade-offs, and opportunities to improve practices, we are evaluating multiple performance indicators: crop yield and quality, soil health, nutrient conservation, greenhouse gas emissions, weed and insect populations; energy use and production, and farm profitability. We have identified system benefits and opportunities to improve them and new research hypothesis to test. For instance, in the case of the green manure crop comparison and strategy to sustain mycorrhizae in canola, we have gathered multiple performance indicators and can conclude which are most successful. In the winter of 2013 we met with the project Advisory panel and proposed some cropping system changes. Based on the Advisory panel feedback we initiated a number of changes in spring 2013. We have leveraged this project for additional research and education funds, including a AFRI CAP grant and two CIG NRCS grants. The CIG grants have facilitated farmer adoption and on-farm demonstrations of manure injection, cover cropping practices, and the cover crop crimper-roller. We hosted field days in 2011 and 2012, numerous group tours (farmer groups, educators, private sector, students etc.) at the NESARE Sustainable Dairy Cropping Systems Farm. Our team members have presented project results in extension programs, written extension fact sheets, and articles for the regional agricultural newspaper. We also created and maintain a website that links to numerous educational resources, and have helped organize and host an annual research symposium with other cropping systems research projects at PSU.


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. One challenge was that if fall grazing was desired, September planting did not allow for growth for fall grazing. Earlier planting would have come at the cost of late summer grazing or a third cutting of perennial grasses and thus in this situation these costs seemed to outweigh the benefits. Another challenge encountered was that, although broadcasting seed after disking resulted in an acceptable stand, stones were left on the soil surface that interfered with mowing. Therefore it became apparent to the farmer that the adoption of these alternative forage production practices may require other management changes to ensure timely, easy harvest of quality forage.


The most consistent and potentially useful observation in the variety trials was noting a distinction between varieties with storage organs (i.e. turnips with bulbs, swedes, and marrowstem kales) and those without significant carbohydrate storage capacity (i.e. the rapes, some kales, and the bulbless “grazing turnips” like Hunter, Pasja, and T-Raptor). Varieties with storage organs had the highest dry matter yields and the most favorable energy to protein ratios for lactating dairy animals or finishing meat animals. Turnip and swede bulbs had energy concentrations comparable to ear corn. Presumably the biological explanation for the higher yield potential of storage varieties is that these varieties have a “bank” into which they can sequester carbohydrates as they photosynthesize. In contrast, the bulbless varieties can only put carbohydrates to work in making new
leaves, but as the new leaves shades the old leaves, the older leaves die and fall off, leading to little net accumulation of biomass past a certain level of growth. These bulbless varieties are commonly sold with a suggestion that they can be grazed multiple times, regrowing well in between. If they are regrown at an optimal interval and to the appropriate residual level so that there is little “idling” of photosynthetic capacity, it may be possible for the yields of these varieties to compete with those of the bulbing varieties. However, given these crops’ sensitivity to overgrazing and trampling, achieving this would require very careful management and probably good luck. The disadvantage of the bulbless crops is that the bulb may be difficult to utilize fully. It was observed that the regrowth potential of most of these crops, but especially rapes, are extremely sensitive to the extent of grazing. When Bonar and Winfred were grazed by sheep in 2009, the sheep left the stems and bit off the leaves. It was noted that grazed plants regrew much better than those that had been hand-harvested (in quadrats) by cutting 3 inches above the ground. Appin Turnip is notable in a number of respects. It consistently had among the highest yields in any trial. The seed is relatively easy to source. It has a sizeable bulb and it has multiple shoots on a bulb, giving it a unique capacity for leafy regrowth compared to most other bulb turnips. In order to make use of the regrowth potential, care must be taken not to allow overgrazing. There was no apparent difference between establishment success in conventional tillage with or without a nurse crop of oats, but the oats provided some additional biomass. Vinegar gave a short term impression of complete vegetation control (leaf necrosis), but perennial grasses and clovers quickly grew out of the damage. Establishment was an almost complete failure in the no-till plots, regardless of vinegar applications. Although brassicas are much lower yielding than summer annual grasses to address the summer slump, they may be useful as a rotational crop to break pest and disease cycles in the grasses as well as extending the grazing season. Care should be taken to avoid feeding lactating animals a diet too high in brassicas as they can suffer a variety of ailments and off flavors may be produced in milk.


Alternative Continuous Cover Forages 2 (ACCF2) is a unique cropping system based on soil health management designed to produce good yields of high quality forages for dairy cattle. It is designed as an alternative to the traditional crop rotation of silage corn for 3 or more years without use of cover crops. The traditional rotation has become more challenging for the small dairy farm as labor and environmental constraints become more severe on these farms. The ACCF2 system is designed to provide more crop production options to dairy farmers that allow them to harvest dairy quality feed with greater planting and harvest timing flexibility as well as cropping systems which provide greater soil cover and nutrient retention benefits. Under the ACCF system, the crop sequence, species utilized (winter small grains and summer annuals) and harvest timing all contribute to achieving increased soil organic matter levels, enhanced crop uptake of nutrients, weed control and retention of soil and its nutrients. The unique aspect of ACCF is the combination of its facets as a whole system approach. The soil is never bare for more than 3 weeks, every crop grown produces desirable forage, pesticide use is minimized, the harvest system is flexible (suitable for either grazing or mechanical means) and traditional equipment is employed. ACCF crops include winter rye or triticale grown alone or in combination with a summer annual such as corn or sorghum sudangrass. The ACCF crop sequence can begin in late summer/early fall with winter grain planting in corn stubble or plowed ground that was an unproductive sod. The following spring, the winter grains are in the vegetative stage and are either grazed throughout May and into early June, or mechanically harvested for silage or for straw. Either after straw harvest or anytime in June the field is plowed and fitted, followed by reseeding to perennial forage or planting to annuals such as Brown Midrib Sorghum-sudangrass (BMRSS), or corn. BMRSS can be grown either as a grazing crop or for harvest mechanically (silage). BMRSS may be interseeded with perennial clover and grass or planted alone followed by another season of winter grain or a late summer seeding of perennial forages. The end goal of the ACCF system is to establish a perennial stand that initially establishes with less weed pressure and greater plant vigor and persists for seven to eight years of intensive production.


There are so few annual forage crops that can be grown in the Northeast with the superior forage qualities of silage corn. This project evaluated the potential for fenugreek (Trigonella foenum-graecum L.) to be used as an alternative annual forage crop in the Northeast. Fenugreek is an annual legume that is similar in quality to alfalfa. The objective of this study was to evaluate the performance of fenugreek in the Northeast by measuring yield and quality of five fenugreek varieties. The project was conducted from 2004 to 2006 in Alburgh, Vermont. The experimental design of the variety trial was a randomized complete block design. The main plots were five fenugreek varieties. Growth, development, yield and quality (protein, fiber content, and digestible fiber) were measured in 2004 and 2006. In 2005, there was a complete crop loss. Fenugreek produced yields and quality similar to an average alfalfa crop in the Northeast. However, disease and weed pressure limited yields, quality, and harvest management under Northeast growing conditions. At least 6 farmers in Vermont, Maine, and Wisconsin seeded the crop in 2004 and had little success due to weed pressure.

Large acreages of fine textured soils, developed from clayey lake sediments, are located in major agricultural regions of northern New York with limited areas in eastern New York and the Hudson Valley. Many of the available forage crop species are not well adapted to the heavy clay soils and these particular growing environments. Corn production on these soils is limited due to marginal yields that result in lower economic returns on investment. The farms that do not grow corn often have limited options for reestablishing sod crops (grasses, legumes). Most farmers on these heavy soils currently use tillage to terminate forage stands. Recent interest has recently developed in growing winter cereal grains to protect the soil, take up residual leftover nitrogen and store it until spring. The winter cereal crops are then harvested as either forage or pre-cut straw in late spring, creating open periods in these fields. This cropping system presents itself for the successful use of summer annual crops, like the warm season grasses. Some farmers have successfully established Brown Mid Rib sorghum sudangrass (BMR SS) in these open spaces in the crop rotation cycle. Until recently this was considered a minor use crop, but now the adoption of BMR SS is widely accepted throughout the heavy clay soil regions of New York State. With good management BMR SS has the potential to produce good yields of highly digestible forage. This summer annual crop is best suited for use as ensiled, high moisture forage. This project explores the potential use and production of teff as a summer annual cover crop for forage. After two growing seasons teff continues to show promise as a very high quality forage crop. Teff is a warm season annual grass native to Ethiopia. It is adapted to environments ranging from drought stressed to water logged soil conditions. The teff plant can also be used as a livestock forage or pasture crop.


The goals of this project were to examine the efficacy of growing winter barley in Maine, extend the grazing season through early season grazing of the barley, determine grazing effects on the time of harvest and yield of the barley, and assess the health benefits gained from the increased energy supplied to the winter feed program. The project was initiated on an organic dairy with a milking herd of approximately 50 Jerseys and 100 acres of pasture, hay land, and small grain production. Rising costs of imported grains have precipitated local grain production. Due to the early planting dates of spring grains when fields can be difficult to access winter grains may offer a more suitable alternative. Two field sections each approximately 4 acres were no-till seeded with winter barley variety Penncro. Despite quite germination after timely fall seeding disappointing winter survival was observed. After multiple years without success with winter barley we have become cooperators on another project with Extension Educator Rick Kersbergen and have been experimenting with other winter grains including wheat and spelt. Winter barley continues to be pursued as an alternative forage crop although we did not see success with it in north central Maine (Zone 4).


Silage corn is a popular crop among New Hampshire dairy producers since it has the potential to produce high yields of digestible dry matter. However, silage corn production often requires significant inputs, and many NH dairy farms are not located in areas well-suited for growing the crop. Planting corn in these areas compromises both farm profitability and farm sustainability by using farm resources inefficiently, or by degrading them. There may be other crops better suited to these farms that will allow for efficient forage production without degrading soil and water resources. Brown midrib sudangrass-sorghum hybrid (BMRSS) is one crop with the potential to provide high yields of high-quality feed. An annual crop, it gives producers flexibility in rotating crops, and it is planted to form a dense ground cover that minimizes soil erosion and runoff. Initial investigations in Cheshire County in 2003 show that dry matter yields of up to six tons per acre are possible, with a forage quality profile similar to that of cool-season grasses. This project set out to evaluate BMR-SS as a possible alternative to silage corn on NH farms.


Chris was interested in multicropping alternative forage species, with the principal aim of extending his grazing season further into the fall. He also wanted to find species that would suppress the growth of weeds, so that he could replant the following spring without first having to apply herbicide. Chris planted Triticale and field peas on six acres in late April, and harvested two months later. After harvesting he went over the field with a disc harrow, then sowed turnip seed at the rate of 10 lbs/acre. The turnips came up among the regrowth of Triticale and peas, giving a mixed forage. The turnip proved, upon analysis, to be 86% water. Protein content on a dry matter basis was quite high, at 26%. Total digestible nutrients (TDN) tested at 76%. By way of comparison, silage made from the Triticale and pea forage was 68% water, with crude protein and TDN content (dry matter basis) 19% and 64% respectively. Chris reports that the mixed forage of Triticale, peas, and turnips succeeded in both suppressing weeds and extending the grazing season. Before he turned cattle loose to graze in the experimental area the mixture was dominated by the turnips, because the Triticale and peas were more severely affected by drought. However, once the area was opened to grazing, maintaining the mixed stand became something of a problem, because the cattle loved the...
turnips, pulling them up roots and all. For this reason Chris says that, though he likes the idea of using Brassicas to extend the grazing season, next time he intends to try other species, perhaps kale or swede.


Due to a short growing season often coupled with wet springs and falls it can be difficult to have enough time to remove a corn crop from the field and establish a decent cover crop prior to winter. As a result some farms are looking for alternative systems to typical rotations including corn silage. Sorghum/soybean forage mixtures could be an alternative to such a system. A forage sorghum/soybean mixture that was commercially available was obtained. Prior to seeding manure and fertilizer were applied to a total rate of 20-20-20 per acre which were chisel plowed into the soil. The soil was then disked and stones removed. The seed was then drilled with a grain drill and rolled with a cultipacker. The sorghum began heading out in early August, 55 days after germination. Some lodging was observed. Harvest began on 16-Aug but was prolonged due to a tropical storm. Winter rye was established after this crop at the end of September by broadcasting seed at a rate of 2 bu./acre. After four weeks the stand was fully established and provided 100% soil coverage. The sorghum/soybean mixture exhibited rapid growth and establishment and successfully outcompeted weeds. Since this initial trial this mixture has been used on this farm for three year with mixed results. The crops rely on warm weather conditions which we do not always observe in the Northeast. In cool years the growth is slow and the DM yields can be disappointing. In addition, the lengthy nature of this crop can cause difficulty harvesting especially if lodging occurs. The large quantity of biomass that can be produced may be too much for smaller equipment to deal with. Overall, however, the sorghum/soybean forage mixture yielded similarly to corn silage, at a reasonable cost, without the use of herbicides, and was harvested in time for a successful cover crop to be established. Unfortunately the forage quality was not always optimal and rocky soil made harvest quite difficult.

Other potentially useful resources:


The Alternative Continuous-Cover Forage system (ACCF) was developed to offer a range of high quality forage production options, comparable to traditional cropping systems that offer growers flexibility, season extension, and address increasing forage production at times when it is typically low. Options beyond the standard forage rotations of corn and alfalfa/grass mixes include forages such as winter rye, oats, triticale, and brown midrib sorghum sudangrass (BMRSS). Growers can adopt a variety of management practices including various types of tillage or no-till planting methods, offering flexibility in adoption as well as adaptation over time. Providing year-round coverage for the soil improves soil health and quality while limiting erosion. In addition, the ability to produce high quality feed throughout the season allows growers to decrease costs of purchasing off-farm produced feeds which leave farmers subject to volatile grain prices. In one of the case studies presented, the ACCF system increased the net farm income by $531 per acre. The fact sheet outlines potential rotations and their implementation as well as the environmental and economic benefits that accompany them. The crops outlined in this bulletin include winter rye, BMRSS, oats and spring triticale.


Although alfalfa is generally recognized as the best choice for long term high quantity and quality forage production. In addition, corn silage will likely be implemented where farm topography and other considerations allow. Alternatives to these staples are often annual crops. Small grains, including winter rye, winter/spring wheat, winter/spring triticale, barley, and oats, can be utilized for high quality forage or fodder. Some of these grains, such as wheat and triticale, can be planted in the spring or late summer in the year prior to grazing/harvest. Although when planted in the late summer some biomass will accumulate that year, it is not advised to graze or harvest this material as it may impact the ability for the crop to overwinter thereby compromising spring forage. In the northeast U.S. oats may winterkill and therefore can be seeded in late summer and grazed in the fall to extend the grazing season into October and November. Small grain crops should be harvested in the boot stage for lactating dairy cows, and at early heading for other livestock as these stages provide optimal forage quality without severely compromising yield. It is also common to seed these small grains in mixtures containing peas as they are highly palatable and may serve as a nurse crop to the small grain. Summer annual grasses can also be utilized including forage or grain sorghum, sudangrass, and sorghum/sudangrass hybrids. These grasses have higher drought and temperature tolerance compared to perennial and cool-season alternative. They will not, however, perform well in cool summers. Summer annual grasses should
be harvested at 3 feet of height allowing for 2 to 3 cuttings per season. Fewer cuttings will result in later maturity and therefore decreased forage quality. Soybeans can also be utilized in a variety of ways including grazing or for haylage/baleage. The high oil content of soybeans causes issues when ensiling so it is recommended to mix them with grasses. There is a handy table outlining the variety of crops and their planting and harvest times as well as quality parameters.


This is a pretty good guide addressing the five categories of forage brassicas: forage rape (B. napus), leafy turnips and hybrids (B. campestris), kale (B. oleracea), turnips (B. rapa), and swedes (B. napobrassica). It has a lot of more technical information about planting dates, seeding rates, pests, and health concerns for grazing that will be helpful for the factsheets.


This is quite an extensive guide covering the potential use of a very wide range of crops and products/feeds. I’m not sure what you may be interested in using from this but I figured it may be of use as it is an extension resource addressing alternative feed sources.


Many alternatives to traditional alfalfa, corn silage, or perennial grasses are annual forages. These crops do well serving as emergency production after winterkill of perennial species, during periods of drought, or when flooding delays or causes crop failure in spring plantings. They are also an alternative when land resources are not suited to traditional forages and cropping systems. Annual forages can offer flexibility in pasture based systems by filling in production gaps and extending the grazing season. Multiple studies have investigated the nutritive qualities of these alternatives and the feasibility of providing adequate nutrition and DMI to lactating dairy cows. Small grains are among the most used alternative forages. They can be planted in pure stands, as part of a double-cropping system, or to provide forage early in the spring or late fall. When harvested in a timely manner (at the boot stage) these forages can have crude protein levels comparable to corn silage. Grazing these crops should be done carefully as these crops may be prone to causing tetany and nitrate poisoning. These risks are greatly reduced with proper management including not pasturing hungry animals on these lush crops and providing some dry hay. Small grains are also commonly planted with peas to increase the protein content of the feed and provide a nurse crop for the establishing small grain. Summer annual grasses such as sorghum, millet, and sudangrass can be used during the summer when cool-season grasses and other forages become dormant and exhibit low production. These grasses have a higher drought and heat tolerance and therefore can often outperform corn. However it is important to note that these grasses will not perform well in cool summers. Prussic acid content can be an issue with these grasses except for millet. It is in highest concentration in new growth (<2 feet) and regrowth after frost damage. This risk can be greatly mitigated by management in avoiding the aforementioned situations or through ensiling. Forage brassicas can also be utilized as they are highly digestible, have high crude protein content, and provide a useful rotational crop to break pest and disease cycles in rotation with grasses and cereals. Care should be taken when grazing lactating animals on brassicas as if the animals consume too high of a ration portion from brassicas, off flavors may be imparted in the milk. It is recommended not to exceed 5-11 lbs. DM/cow/day from brassicas. Health issues are of concern with using brassicas although they may be avoided similarly to the other crops. Soybeans are also a viable option in the case of failed perennial or spring plantings. They fit well into current systems as current equipment and seed is widely available. Perennials such as chicory and cup-plants may also be used as alternatives that do not require as intensive annual maintenance.