UMass Extension

Crops, Dairy, Livestock & Equine Newsletter

SUMMER 2014

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Inside this issue:

Editor,

Masoud Hashemi

Upcoming Events:

September 12th: Green Pasture Dairy farmer of the year presentation at the Eastern States Exposition

September 12th-28th: Eastern States Exposition

September 19th: Sustainability for Massachusetts Dairies: Grazing , Raw Milk, and Organic Certification.

For more information on upcoming events visit: https://extension.umass.edu/cdle/events

Announcements:

The search for a Director for The Center of Agriculture, Food and the Environment is underway. Public presentations for each candidate will be held this September:

Dr. Fred Servello Tuesday, September 9th from 10:00-11:30am

Lincoln Campus Center, Room 168

Dr. Jody Jellison Monday, September 15th 10:00-11:30am

Lincoln Campus Center, Room 168

Dr. Pat Colyer Wednesday, September 17th 10:00-11:30am

Lincoln Campus Center, Room 168

Mr. Dave Andrews, September 23rd 10:00-11:30am

Lincoln Campus Center, Room 803

Announcements continued...

Agricultural Field Day

UMass Extension and the Center for Agriculture Food and the Environment hosted an Agricultural Field Day at the Animal and Crop Research Center in South Deerfield, Massachusetts. Those in attendance were guided through walking and hay wagon tours of over eighteen current research projects covering a breadth of topics, including: integrated pest management, improving soil fertility, innovative intercropping systems, sustainable farming methods and crop trials. If you missed this event but would like to learn more you can view the program which has descriptions of all of the projects visit: https://extension.umass.edu/cdle/sites/extension.umass.edu.cdle/files/field_day_2014_web.pdf

Susan Scheufele and Ruth Hazzard of the Vegetable Extension Program presenting on their Evaluation of Conventional and OMRI-Approved Insecticides to Reduce Cabbage Root Maggot Damage

Congratulations to our graduate students Emily Cole, Julie Stultz-Fine, and Fatemeh Etemadi for receiving Sustainable Agriculture Research and Education (SARE) grants to help fund their current research projects.

Emily Cole: The physiochemical and soil biota response to biochar in agricultural soils.

Julie Stultz-Fine: Integrating no-till and forage radish cover crops for sustainable early sweet corn production.

Fatemeh Etemadi : Fava Beans: A new multipurpose crop for New England.

Announcements continued...

New Horses at the Hadley Horse Farm

Bay State Justice

Foaled Saturday, June 14, 2014 - 104 lbs

Bay State Justice is a Morgan colt by Ulenfield Elation (UVM Elite x Ulenfield Chelsea) out of HR Clearly Legal (Clearview Commander x Indian Creek Legally Wild). Justice has quite the personality and may be on his way to becoming the next resident UMass stallion! The sire is generously leased to the university by Josh Merritt of Meadowmere Farm (VT), and the dam is generously leased to the university by Harry & Carolyn Sebring of Sebring Stables (MA).

Floretta UM

Foaled Wednesday, June 18, 2014 - 104.5 lbs

Hanoverian filly by Wetherson out of Alessandra Q. Wetherson is a successful FEI dressage stallion by Werther out of the States Premium mare Walesca by Waldhorn. This gorgeous filly has tremendous potential and a sweet disposition. A special thank you to Suzanne Quarles of Someday Soon Farm (MD) for her extremely generous donation of Alessandra Q and breeding to Wetherson, what a beautiful cross!

Bay State Jewel

Foaled Sunday, May 4 at the UMass Hadley Farm Equine Center. 62 lbs! Bay State Jewel is a Morgan filly by RNH How Do U Like Me Now out of Bay State Notorious (Windcrest Highlander x Bay State Winsom). This filly can trace her government bloodlines back to U S Panez and original government mare Narcissa.

Growing Wheat in New England? An Investigation into Timing of Nitrogen Fertilization

Sarah Weis, John Spargo, Reza Keshavarz Afshar, Masoud Hashemi, Ruth Hazzard.

New England's share of wheat production in the US has been declining since the early 1800's. Wheat can be grown at least expense on large tracts of level, rock free land in more arid regions. A crop can be produced with as little as 23-24 inches of seasonal rainfall (or irrigation) (Ref. 1). With the Chicago Board of Trade wheat price under $8.00/ bu (3/10/2014), even with average yield over 50 bu/ acre at 13.5 % moisture (Ref. 2), it is not reasonable to imagine that New England will ever be the nation's "breadbasket". A multi-year study based at the University of Vermont demonstrated some hard red winter wheat yields in excess of 60 bu/ acre (Ref. 2), whereas the national average is less than 50 bu/ acre (Ref. 3). The interest in growing wheat in Massachusetts is for the local market where growers can expect more than the grain elevator prices of $8.00/ bu. With renewed interest in locally grown food, there can be a place for locally grown wheat in New England, especially when wheat is locally processed into value-added flour and baked goods. Since growing conditions in central New England differ from other wheat production areas, research is needed to optimize production methods. Our initial research at the University of Massachusetts on agronomic factors for successful wheat production focused on two varieties grown on several nitrogen fertilizer regimes. This research was funded in part by a grant from the Massachusetts Society for Promoting Agriculture.

Varying Time of Nitrogen Application Influence on Wheat Crop:

Here at the University of Massachusetts, we grew approximately one acre of winter wheat during the 2012-2013 season on an organic certified plot at the University's research farm in South Deerfield, MA. This was an experiment to study the effect of varying amounts and timing of nitrogen fertilizer application. Nitrogen source was chicken litter (3-2-3). We grew 2 varieties of hard red winter wheat, Zorro (a commercially available variety from Canada that is currently grown in New England) and Red Llamas (a New England heritage wheat obtained from a local grower). The wheat was planted during the third week of September, 2012. Chicken litter was applied at three times and at different rates according to Table 1 below, once in the Fall and up to twice in the Spring at two different growth stages for a total of 13 treatments. Application rates (lb N ac^{-1}) were made assuming 50% plant-available N out of the total N content of the fertilizer would be available to the crop. Each treatment was applied to each of the 2 wheat varieties, and the experiment was replicated 4 times in the field. Each of the 26 plots was 16 ft. x 16 ft. Yields are reported in bushels per acre in Table 1, with a bushel of wheat weighing 60 lbs at 13.5% moisture. Protein percentages of the two varieties were combined because there was no variety difference and are reported in Table 1.

Results:

First, we looked at the effect of total nitrogen fertilization on wheat yields in the two varieties. Figure 1 depicts the relationship between nitrogen added and wheat yield. From the graph it appears that while 'Zorro' responded positively to addition of nitrogen up to around 100 lb N per acre, 'Red Llamas' yield actually declined. This decline in 'Red Llamas' yield was not statistically significant and there was no demonstrated effect of nitrogen application on yield of this variety. These data were actually not too surprising. 'Zorro' is a relatively modern variety bred to respond positively to nitrogen and to yield well without lodging, while 'Red Llamas' is a heritage New England variety which was not selected to respond to external inputs (e.g. nitrogen). Nitrogen, in addition to

Table 1. Rate of chicken litter application (lb N ac^{-1}), Yield (bu ac^{-1}), and percent protein

Treat	1	2	3	4	5	6	7	8	9	10	11	12	13
			chicken litter application (lb N ac^{-1})										
Fall[z]	0	0	0	0	0	0	30	30	30	30	30	30	90
GS25[y]	0	0	0	45	45	45	0	0	0	45	45	45	0
GS30[x]	0	45	90	0	45	90	0	45	90	0	45	90	0
Total N	0	45	90	45	90	135	30	75	120	75	120	165	90
			Yield (bu ac^{-1})										
Red Llamas	30.2	35.7	26.1	32.6	30.4	26.2	32.0	32.5	32.4	31.6	26.8	19.8	24.3
Zorro	21.3	61.6	49.7	40.5	66.9	59.6	34.8	61.1	64.7	58.1	54.0	57.7	53.8
			Percent Protein										
Overall	11	11	12	12	13	13	14	14	15	15	16	16	17

[z] Fall treatment applied just prior to planting, during the second week of September, 2012.
[y] Growth Stage 25 (GS 25) treatment applied at spring green-up on April 2, 2013.
[x] Growth Stage 30 (GS 30) treatment applied at jointing on April 24, 2012.

being a key component in growth and development of the plant, is a major component of protein. We found that nitrogen applied at any of the three times we applied the fertilizer increased protein concentration of the grain. 'Zorro' and 'Red Llamas' did not differ in protein concentration or response to the amount or timing of nitrogen fertilizer. However, in a University of Vermont Winter Wheat Trial (Ref 2) with 25 wheat varieties, including Zorro, there were significant differences in protein content. Figure 2 shows effect of increasing nitrogen fertilizer on grain protein content in our study.

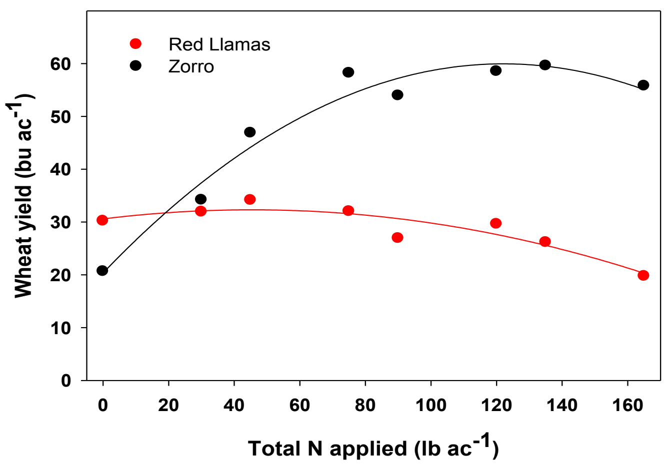


Figure. 1. Effect of total applied nitrogen on yield of 'Red Llamas'

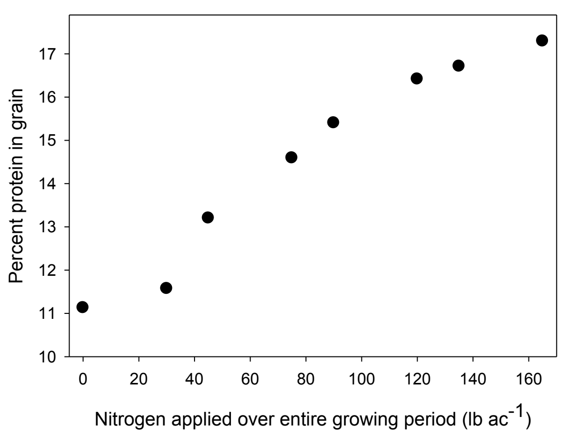


Figure 2. Effect of nitrogen fertilization on protein concentration of grain.

Lodging, Nitrogen, and Variety:

Heavy nitrogen application encourages vegetative growth. Too much vegetative growth can lead to taller plants with less rigid stems, which then make it easier for the plants to lodge (or tip over permanently). Modern wheat is bred to be shorter and have rigid, strong stems in order to allow heavier yields and still avoid lodging. Lodging was not a problem in the 'Zorro' wheat. Part of the 'Red Llamas' poor yield response to nitrogen was undoubtedly due to lodging. Essentially all the 'Red Llamas' plots suffered some degree of lodging; however there were not enough lodging data to show that the higher N plots lodged more. It should be noted that while the 'Zorro' yielded significantly more grain than the 'Red Llamas', this was not the case when there was no nitrogen fertilizer applied. Without any applied nitrogen, the 'Red Llamas' produced 30 bushels of grain per acre while Zorro produced only 20. For a farm looking to sell heritage wheat and save on nitrogen inputs, this could be a good thing.

Effect of timing of N fertilization on 'Zorro' yield:

The treatments were designed to test effects of different combinations of fertilizer application timing on the two wheat varieties. Since N fertilizer did not influence 'Red Llamas' yield, the N timing analysis was confined to 'Zorro'. Figure 3 shows influence of timing of N fertilization on Zorro grain yield. The highest yield was obtained using a split application of 45 lb N at GS 25 and an additional 45 lb N at GS 30 without a Fall N application. Applying 90 lb N in the fall only or at GS 30 only, yielded less grain than applying 45 lb N at GS 30 only. Interestingly, however, a single application of 45 lb N at GS 30 only appeared to increase yield relative to a single application of 45 lb N at GS 25. Data from the plots which received 30 lb ac^{-1} N did not show consistent trends in yield. Statistically, applying 30 lb ac^{-1} of N in the fall, did not influence grain yield (data not graphed). Overall, results suggest that fall nitrogen application was not as beneficial as spring application, and that a split application at GS 25 and GS 30 produced highest yields. To maximize yield, the recommendation would be for a split application of nitrogen in the spring and none in the fall unless a field had very low nitrogen availability.

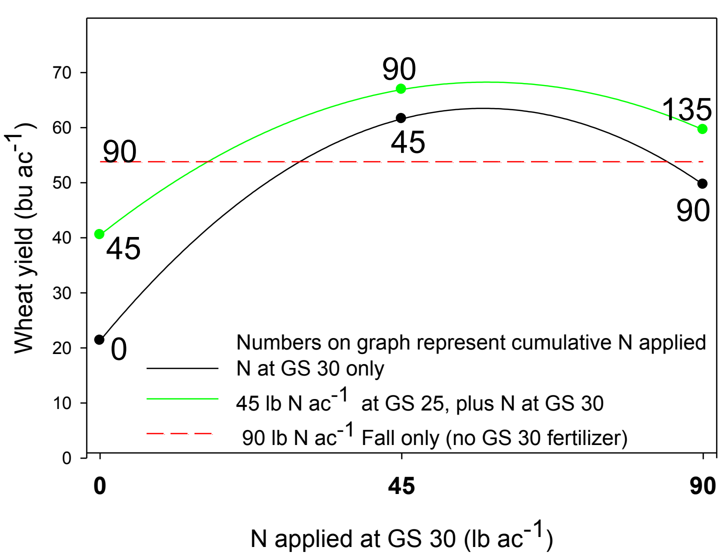


Figure 3. Influence of N fertilization on grain yield of 'Zorro' wheat. Numbers on the graph represent total cumulative N.

Wheat and Disease:

For this initial foray into wheat growing, we did not diagnose any of the symptoms of wheat pathogens seen. We strongly suspect that our wheat contained mycotoxins that would have made it unfit for milling. It is important to have wheat tested for diseases which may affect human health such as *Fusarium* or Ergot (*Claviceps purpurea*). Our wheat yields in this study may be higher than those of drier climates, but we also have humid conditions favorable to bacterial and fungal diseases to contend with. In the Vermont Extension 2013 Organic Winter Wheat Variety Trial Report (Ref. 2), the variety Zorro had among the lowest foliar symptoms of disease severity. However, all of the 25 winter wheat varieties trialed were above the FDA's 1ppm limit for the vomitoxin called deoxynivalenol (DON) primarily associated with *Fusarium* head blight. Zorro contained more than 8 ppm of DON and was unfit for human consumption. Red Llamas was not trialed in the Vermont Organic Winter Wheat Variety Trial.

Molly Bajgot, Sarah Weis and Neev Blume harvesting wheat

We would like to thank the Massachusetts Society for Promoting Agriculture for helping to fund this project.

References on next page

Wheat continued...

Ref 1. Al-Kaisi, M.M and J.F. Shanahan. Irrigation of Winter Wheat no. 0.556. Colorado State University Cooperative Extension. 6/99. www.colostate.edu/Depts/CoopEx

Ref 2. Darby, Heather, UVM Extension Agronomist, and Erica Cummings, Conner Burke, Hannah Harwood, and Susan Monahan, UVM Extension Crops and Soils Technicians. 2013. Organic Winter Wheat Variety Trial Report. UVM Extension. http://www.uvm.edu/extension/cropsoil/wp-content/uploads/2013_WWVT-Report.pdf

Ref 3. USDA National Agricultural Statistics Service. US winter wheat yield, by year, 1983 – 2013.

Resources for more information on wheat growing in New England:
Northern Grain Growers Association,
http://northerngraingrowers.org/

University of Vermont, Northwest Crops and Soils Program.
http://www.uvm.edu/extension/cropsoil/grains

University of Maine Cooperative Extension, *Growing Organic Cereal Grains in New England*,
http://umaine.edu/publications/2207e/

Establishing a Cost Efficient Seeding Rate for Hairy Vetch as Cover Crop

Masoud Hashemi, Sarah Weis

Rationale:

Hairy vetch is a winter hardy, annual legume, and its ability to fix nitrogen makes it very useful in vegetable crop rotations. Although the inclusion of hairy vetch in a crop rotation could be advantageous to a farmer, seed cost can exceed $2.50 per pound. Due to the high cost of seed we wanted to identify the optimal seeding rate to ensure that farmers would be maximizing rate of return on investment in vetch cover cropping.

Research Goals:

We are currently conducting research on hairy vetch in order to identify the optimal seeding rate for economic benefit in nitrogen contribution, as well as to measure the decomposition rate to determine when the contributed nitrogen is likely to become available to subsequent crops.

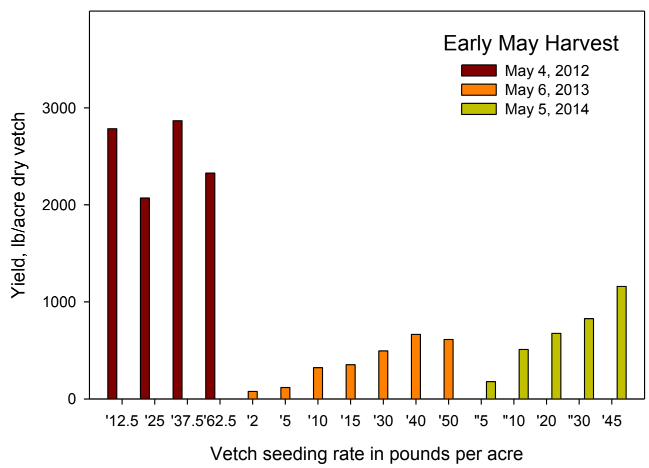
Treatments:

In September of 2011, 2012, and 2013 we planted hairy vetch at seeding rates varying from 2 pounds to 62.5 pounds per acre. In 2012 and 2013 we had several dates of planting, however these did not influence spring yields. We collected samples of the vetch in early and late May of the spring following planting. Harvested vetch was then analyzed for influence of seeding rate on yield and nutrient content.

After sample collection the vetch was flail mowed, disced under the soil surface, and corn was planted. In 2014 we collected soil samples from each plot when the corn reached approximately 12 inches, and we analyzed those to find the amount of nitrogen available to the corn relative to the amount of vetch that had been planted.

Results:

Figure 1 shows vetch yields in 2012, 2013, and 2014 from vetch plantings in fall 2011, 2012, and 2013. Note the growth that took place between early and late May, especially -in 2013 and 2014. This growth contributed greatly to dry matter and to total nitrogen. Nitrogen comprises about 3% of the dry weight of vetch. Figure 2 shows the fertilizer dollar value of the nitrogen (valued at $1.00 per pound N) contributed by the vetch at the harvest times shown, and compares this value to the cost of the vetch seed at $2.50 per pound used to plant the area. Only where the "value of vetch" line is above the red-dotted "cost of seed" line is there a positive return in nitrogen cost. In 2012 the vetch biomass was much greater than in the following two years; however it did not vary significantly among seeding rates, and even when harvested in early May, 2012, the 30 lb/acre seeding rate netted more nitrogen value than the cost of the seed. In 2013 and 2014 the early harvest never netted more nitrogen "value" than the cost of seed. Our data suggests that allowing the vetch to grow longer is a positive action. The data also suggests that the added expense of planting as much as 15 pounds of vetch had a positive financial benefit in all three years. Caveat: No cost is assigned to the actual planting of the vetch as it is assumed that some cover crop will be planted, and costs for the planting process will be similar for different cover crops. We also collected soil samples for the corn Pre-sidedress soil nitrate test (PSNT) when the corn was about one foot tall. The results from this test are shown in figure 3. There was significantly more nitrogen available for the 2014 corn crop in the plots which had vetch growing prior to corn, note that rates from 5 to 45 lb/acre did not yield statistically significant differences in contribution to soil nitrate. If the corn sidedress fertilizer recommendation is 150 lb/acre for the "b" group and 125 lb/acre for the "a" group the vetch cover crop would save $25.00 an acre in sidedress nitrogen cost in 2014, covering up to 12.5 lb of vetch seed. Not all of the vetch nitrogen is made available to plants in the year it is harvested. Some nitrogen will likely be available in later years. Within this study, we are also researching the rate of decomposition of vetch to find the speed at which the vetch-nitrogen will be available to the following crop. Contribution of the vetch to soil organic matter has not been considered in this analysis. Don't forget this is an unaccounted benefit!



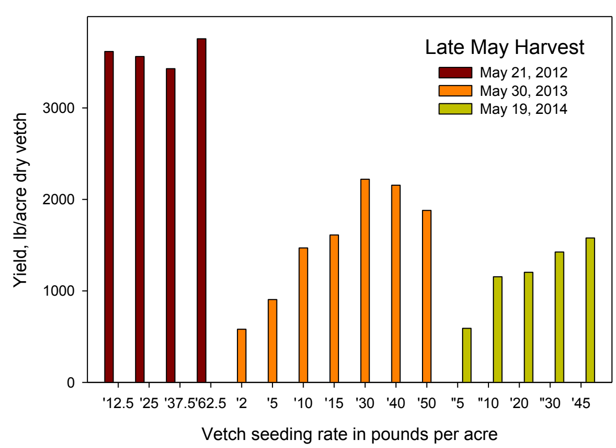


Figure 1.1 & 1.2 Yields of vetch harvested in 2012, 2013, and 2014 from 2011, 2012, and 2013 plantings

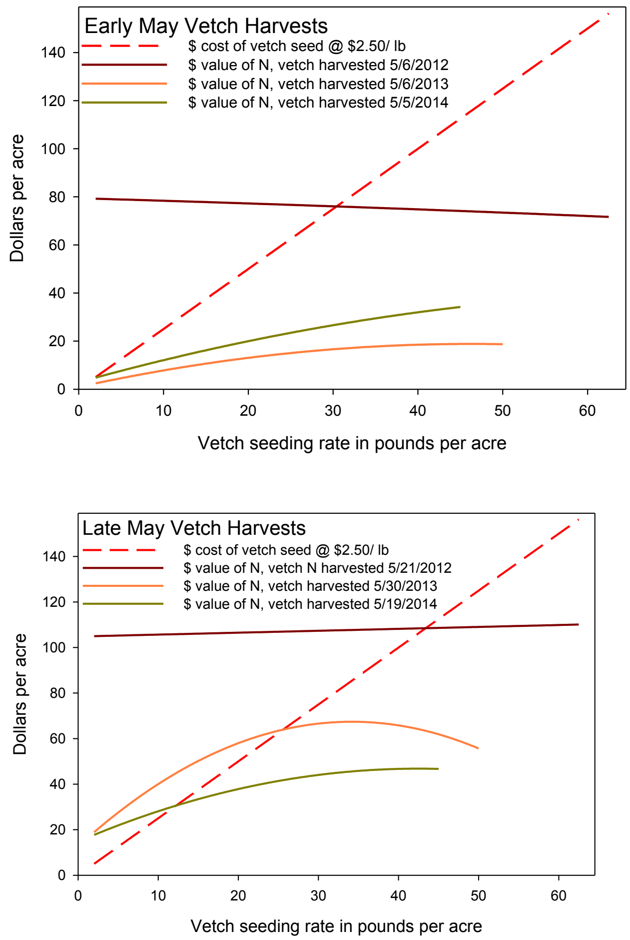


Figure 2.1 & 2.2 Seed cost vs nitrogen contribution of vetch

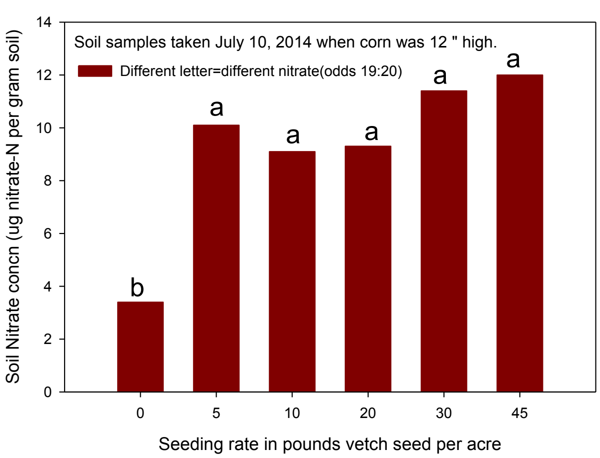


Figure 3. Nitrate availability for 2014 corn influenced by fall 2013 planted vetch

Forage Management; Perennial Forage Species for Pasture and Hay

Masoud Hashemi

Fall, more specifically the first half of September, is the best time for the reseeding of pastures and hay fields. Selecting the right species is the fundamental first step in forage management. When selecting forage species factors such as the type of animal that will be grazing, whether the field is used as pasture or for hay production, soil condition, and geographic characteristics need to be considered. The characteristics of some perennial legumes and grasses that are suitable to grow in Massachusetts are described below.

Perennial Legumes

Most legumes grown for forages have taproots and broad, compound leaves (composed of a number of leaflets) that are arranged alternately on the stem. New shoots originate from the crown of the plant, and the growing point of each shoot is located at the top of the shoot. As a family, legumes produce higher quantities of protein than grasses.

If properly inoculated, legumes have the capacity to use atmospheric nitrogen, eliminating the need to apply nitrogen from commercial sources. Legumes also supply a considerable amount of nitrogen to the grass portion of the mixture.

Alfalfa

Alfalfa is the most frequently grown forage legume and the highest-yielding perennial forage crop grown in many countries. It produces more protein per unit area than other forage legumes and can be grown alone or in combination with various grass species. For high yields and persistence, alfalfa requires well-drained soil, a pH above 6.1, adequate fertility and proper harvest management. Well-managed alfalfa normally persists for 3 or more years. The protein and energy levels of alfalfa-based forage are determined by stage of growth at the time of cutting. Alfalfa has a 6-week critical fall harvest period that should be observed to avoid winterkill.

Birdsfoot Trefoil

Birdsfoot trefoil is a non-bloating legume best suited for permanent pasture situations. It will reseed itself, making it an excellent choice for steep or stony land not suitable for cultivating. Although individual plants live for only a few years, stands of birdsfoot trefoil have remained productive for 10 or more years when allowed to go to seed. It is also well adapted to soils with marginal drainage. Birdsfoot trefoil has a lower yield potential and is more difficult to dry than alfalfa, so it is recommended for hay production only in areas where alfalfa will not grow well. Since birdsfoot trefoil seedlings are slow to establish, at least a year is required to get a satisfactory stand. Birdsfoot trefoil, similar to alfalfa, has a critical fall harvest period, beginning about 10 days earlier than alfalfa.

Red Clover

Red clover is a short-lived perennial. Yields are good the year after establishment but are often quite low the following year. It can be grown in fields that are too wet or too acidic for alfalfa. When seeded in mixtures, red clover can suppress the establishment of other legumes. As a feed crop, red clover is most often stored as silage since it is difficult to dry, and often results in "dusty" or "moldy" hay.

There are two general types of red clover: double-cut or "medium" red clover and single-cut or "mammoth" red clover. Double-cut will flower in the seeding year, with vigorous regrowth after cutting. Single-cut is slower growing and matures about 2 weeks later than double-cut. Single-cut does not flower in the seeding year or after the first cut in succeeding years.

Use of red clover as a plow down (cover crop) has become an important practice on many farms.

White Clover

White clover is used mainly in pastures. It is a short-lived perennial that can reseed itself. There are three general types of white clover: ladino, white Dutch and small wild white. All three are similar in appearance but differ in size, with wild white being the smallest and ladino the largest. All have stolons, which are stems that creep on the ground, with branches that are erect or upward slanting. Roots are shallow and fibrous and develop from nodes of the creeping stolons. White clover has low tolerance to drought but is relatively tolerant to frequent grazing and has good palatability. White clover can be frost seeded or no-tilled into existing grass pastures to improve forage quality and yield.

Sweet Clover

Sweet clover is a slow-growing biennial often used to alleviate compaction. Sweet clover does not flower in the year of establishment. In the spring of the second year, it grows quickly to become a tall, coarse-stemmed plant. The presence of coumarin in sweet clover makes it less palatable to livestock.

There are two types of sweet clover: white-flowered and yellow-flowered. White sweet clover is deeper rooted, taller and coarser, which makes it more suitable as cover crop than for forage. The yellow-flowered is more palatable to livestock and more attractive to bees. Moldy sweet clover hay may contain dicoumarol, which can prevent normal blood clotting and result in the death of livestock from bleeding.

Alsike Clover

Alsike clover is a perennial although it is often treated as a biennial. It can grow on soils that are acidic and poorly drained. Alsike produces only one cut of hay per year and is not normally a preferred forage legume. Alsike clover can cause photosensitivity and liver damage in horses, so it should not be included in horse hay or pasture mixtures.

Kura Clover

Kura clover is a relatively new pasture legume. Kura clover has poor seedling vigour and is difficult to establish. However, once established, kura clover is very persistent, winter-hardy and can tolerate less-than-ideal drainage, fertility, pH and grazing management. It spreads by underground stems called rhizomes, has an extensive root system and thickens with time. Proper seedbed preparation and seeding methods are important. Kura clover must be inoculated with the correct strain of Rhizobium bacteria.

Perennial Grasses

Grasses have many long, slender leaves that are borne on a stem. They have very fibrous roots that help bind the soil together, thereby reducing erosion. Some grasses have rhizomes or underground stems that produce new shoots at each node. Grasses with rhizomes are capable of thickening up a stand. Grasses without rhizomes are known as bunch grasses.

Grass species differ in their competitiveness with legumes. This will influence the grass-to-legume ratio of an established stand. Grasses such as orchardgrass and the ryegrasses tend to be more competitive with alfalfa than timothy or bromegrass. Grasses are lower in protein than legumes when cut at a similar stage of development.

Timothy

Timothy is the most widely sown forage grass in New England and is commonly grown in mixtures with alfalfa or birdsfoot trefoil. It is a bunchgrass with limited tillering ability, which makes it non-aggressive when sown with other species. It is easy to establish in early spring or late summer and is adapted to heavier soils and variable drainage. Timothy is palatable and high yielding in first cut. Although some varieties have been developed for improved regrowth, regrowth after first-cut and mid-season production is not as high as that from either bromegrass or orchardgrass.

Smooth Bromegrass

Smooth bromegrass is an earlier, more aggressive grass than timothy. Better drought tolerance results in more regrowth in second cut. It spreads by rhizomes, and the stand can thicken over time. Smooth bromegrass is palatable and tends to retain its nutritional value with increasing maturity better than most grasses. Its major drawback tends to be its large fluffy seed, which makes it difficult to seed through the small seed box of drills. It does not establish well if it is either surface seeded or seeded deeper than 5 cm (2 in.).

Meadow Bromegrass

Meadow bromegrass is useful as a pasture species because of its early spring growth and faster recovery rate after grazing. It is best used in rotational grazing.

Orchardgrass

Orchardgrass develops earlier and is much more aggressive than timothy or bromegrass. It is palatable when young but loses palatability and digestibility more quickly than other grasses. Plant breeders have developed newer varieties that are later maturing, do not decline in palatability and digestibility as early and match more closely the maturity of other species in a mixture. Orchardgrass will grow much more vigorously in the warm, dry conditions of midsummer than timothy or bromegrass, resulting in a greater proportion of grass in the second and third cutting of alfalfa-grass mixtures. Orchardgrass is not as winter-hardy as either timothy or bromegrass and will not persist in wet soils. Its aggressive seedlings make orchardgrass easy to establish. It is recommended for intensively managed pastures or as very early-cut haylage.

Reed Canarygrass

Reed canarygrass is best known for its ability to tolerate poorly drained soils. It can, however, provide high yields on well-drained soils and will produce higher yields than other grass species during dry conditions. Reed canarygrass spreads by rhizomes. It develops coarse stems and leaves, and quickly loses palatability and digestibility after heading. Regrowth is vegetative and does not form a seed head, so second- and third-cuts can be high quality. Reed canarygrass is slow to establish and is not competitive in the year of seeding.

In the past, livestock have performed poorly on reed canarygrass because of certain alkaloids it contained. Current recommended reed canarygrass varieties are free of tryptomine and carboline alkaloids, which cause poor performance. Some varieties are lower in the gramine alkaloids that reduce palatability, intake and animal performance. In Massachusetts reed canarygrass has been considered as invasive species and buying and selling seeds is prohibited.

Tall Fescue

Tall fescue is a coarse, leafy grass that is useful in long-term pastures and erosion control. It is adapted to most soil types, tolerates imperfect drainage and withstands animal traffic well. Its ability to maintain good feed quality into late fall makes it useful in "stockpile grazing" or fall-saved pasture for deferred grazing. A seed-borne systemic fungus (an endophyte) has been linked to poor animal performance on tall fescue pasture. Once introduced by infected seed, the fungus cannot be controlled in an established stand of tall fescue. All recommended varieties are endophyte-free.

Meadow Fescue

Meadow fescue is a hardy grass used in hay and pasture mixtures. It grows best on deep, fertile soils, but will tolerate variable drainage and low fertility. Meadow fescue yields well during the summer and fall and maintain its feed quality later into the season than most grass species. Meadow fescue is shorter, has finer leaves and a shallower root system than tall fescue and is not as persistent.

Perennial Ryegrass

Perennial ryegrass is a short-lived perennial that comes in turf, pasture and hay-adapted varieties. The pasture-adapted varieties tend to have finer leaves, smaller and more numerous tillers, and are later maturing than the hay varieties. Turf-type perennial ryegrasses contain endophytes, so they should not be used for forage. Perennial ryegrass is early and vigorous in the spring, and grows well into the fall, but is unproductive during the hot, dry summer months. Excessive top growth of perennial ryegrass can result in winterkill, in alfalfa mixtures that are left to over-winter. Perennial ryegrass is not well suited to areas with prolonged ice cover and extreme cold without adequate snow cover.

Kentucky Bluegrass

Kentucky Bluegrass is a highly palatable grass that tolerates heavy traffic and close, frequent grazing better than other cool-season grasses, making it well adapted for permanent pastures. It grows best during cool, moist weather on well-drained, fertile soils. It is slow to establish but spreads to form a dense sod. It is relatively low yielding and has poor drought and heat tolerance. When properly fertilized and managed, Kentucky bluegrass production can be markedly improved, especially during spring. In pastures, they serve as a bottom grass that controls weed invasion, withstands close grazing and tramping, and fills in when other species thin out.