

Beyond Red Clover: Legume Choices for Wisconsin Pastures

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Recently, there's been some discussion in grazing circles on the value of legumes vs. nitrogen fertilization in grass pastures. Grass loves nitrogen and applying nitrogen fertilizer is gratifying—pound for pound it seems to pay for itself in grass yield. At the extreme, some farmers in the United Kingdom and New Zealand apply more than 400 lb. of N/acre/year.

So why bother with legumes? We can think of three reasons: 1) legumes improve nutritional quality of pasture forage, resulting in improved animal performance; 2) legume productivity complements that of grasses, boosting forage yields in mid- to late summer when grass growth declines; 3) legumes are able to convert 'free' atmospheric nitrogen into crop available nitrogen and make it available to other plants in a way that minimizes nitrate losses and enhances soil quality. A good rule of thumb is that 50 pounds of atmospheric nitrogen is fixed for each ton of legume production. So, depending on the amount of a legume present in a sward and its yield potential in a particular setting you could expect a free contribution of 50 to 250 lb N/acre/year to the pasture system.

For most of us, the best approach is to keep both legumes and nitrogen fertilizer in our tool box. Timing of fertilization becomes the key to balancing grass and legume growth. Applying N in spring and early summer, when there is already excess grass, probably doesn't pay. Likewise, mid-summer N application does nothing to enhance legume productivity during their peak growing period in June and July. Late summer to fall may be the best time to focus N fertilization, encouraging fall growth of grasses and improving stockpile yields. Like many grazing management ideas, research has not yet provided insights on how to maintain a balance between legumes and fertilizer N. So for now, it's up to you to experiment on your own farm and observe what works best in your situation.

One way to maximize the value of legumes in the pasture is to select the species that are best adapted to your soils and climate. What are the choices when it comes to legumes for Midwestern pastures?

Red Clover (*Trifolium pratense* L.) is the single most widely planted forage legume in the world. Introduced into North America in the late 1600s, it is also the most common legume sown in Wisconsin pastures, because it establishes rapidly and withstands more shading than other legumes. In terms of adaptation, red clover occupies a middle-of-the-road position, surviving in a broad range of moderate soil type, pH, moisture, and climate conditions. It is relatively intolerant of heat and drought, and prone to winter injury, and disease, which combine to make red clover a short lived plant, surviving 2 to 4 years, depending on management and climate. So, most people regularly frost seed red clover every couple of years to retain it in the stand. Because seed costs are relatively low and because of the nitrogen contribution and improved forage quality of the pasture, this is usually a good investment. There are two types of red clover: medium, adapted to a multiple harvest situation, and mammoth, which was developed as a late maturing, single harvest type. Mammoth red clover has had relatively little breeding work done on it and is likely to be more disease prone and lower yielding than medium red clover.

Alfalfa (*Medicago sativa* L.) has been called the 'queen of forages' and it certainly has no equal when it comes to making hay. Although it has many qualities that make it a good pasture component, it is not widely used by

grazers. Alfalfa is a vigorous, high yielding species that fixes significant amounts of nitrogen. When summer slump is a problem, this most drought tolerant of legumes can play a crucial role in pasture production. Some of the new pasture type alfalfa varieties which have finer stems and are more prostrate may fit better into pasture systems than varieties bred for hay production. Grazing alfalfa has been developed to withstand frequent grazing and may provide greater flexibility in grazing management. Alfalfa can be frost seeded like red clover. For best performance, alfalfa needs relatively high fertility conditions, with potassium especially important, and a pH above 6.5.

White clover (*Trifolium repens* L.) can be grouped into three categories: the ubiquitous wild types (very prostrate, tolerant of overgrazing), intermediate types such as White Dutch, (moderately productive), and Ladino types (largest, often most productive). Unlike red clover, white clover maintains itself in a pasture by vegetative propagation by stolons (horizontal, above ground rooted stems) as well as by reseeding, thus making it somewhat more persistent than red clover. The original tap-root degenerates after the first year and then the plant depends on smaller roots on the stolons for moisture and nutrients. Stolon death during winter or during hot dry periods in the summer have historically been limitations to dependable productivity of white clover. Efforts in Wisconsin and New Zealand over the last 5 years have resulted in development of varieties that are better adapted to these stresses and are currently undergoing farm-scale evaluation.

Alsike clover (*Trifolium hybridum* L.) originated in Scandinavia and is adapted to moist, poorly drained soils in cool climates. Once thought to be a hybrid of white and red clover, it has been recognized as a unique species. It is the most acid tolerant of the legumes, growing well down to a pH of 5.0. Its persistence is similar to that of red clover. Although it is not a high yielding legume, it is the only legume adapted to wet, low pH soils and so can play a role in many Wisconsin pasture systems.

Kura clover (*Trifolium ambiguum* Bieb.) was introduced into the USA in 1911, but did not receive much attention as a forage crop until the mid 1980s. We have just begun to appreciate its potential in Wisconsin. Unique among the clovers, it has an extensive rhizome system that allows it to vegetatively propagate itself, much like quackgrass, making it tolerant of frequent close grazing. Its rhizomes or underground stems make it more persistent than white clover (which has above ground stems) and kura clover has survived for 11 years and counting under Wisconsin field conditions. It tolerates wet soils, and soil pH and fertility levels similar to red clover. Kura clover appears to be the legume we've been waiting for in Wisconsin pastures, with one caveat: it is a challenge to establish. Its seedlings put most of their energy into roots and rhizomes during the seeding year, so it does not compete well with weeds or existing pasture grasses until it is well established. We have determined that success of establishment depends on reducing competition from existing plants by grazing or mowing during the months after sowing. Once established, it will be a permanent component of the pasture so the extra TLC required during that first season will likely pay off for years to come. A number of on-farm demonstrations of kura clover have been established, and we'll be looking at methods to improve establishment over the next few years.

Birdsfoot trefoil (*Lotus corniculatus* L.) is a legume that has not been very successful under Upper Midwestern grazing management regimes. It is a short-lived perennial that persists in pastures primarily via reseeding itself. It does best under longer rotations than we normally use. If we can get it established and maintain it, BFT has several valuable qualities. Due to naturally occurring tannins in its tissues, it does not cause bloat. It is very tolerant of wet soils and soil acidity (pH 5.0). It stockpiles well because it holds onto its leaves at maturity better than clovers and alfalfa. How do we improve BFT survival in pastures? Two approaches suggest themselves: 1) make sure you plant varieties with a prostrate growth habit which persist better than the upright, hay-types, and 2) think about doing some summer stockpiling. Set aside a few paddocks for a longer rotation of 30 to 40 days in midsummer. This will allow the BFT to reseed itself and provide you with stockpiled forage as we go into the summer slump. As your stock graze on the stockpiled forage, they'll spread the BFT seed to other paddocks.

Cicer milkvetch (*Astragalus ciciver* L.) has not caught on as a pasture forage crop because of anti-quality components it contains. These compounds reduce palatability and can cause photosensitization and hair loss in some animals. On the plus side, protein and fiber levels are comparable if not better than alfalfa and it has a deep rhizome and root system which makes it tolerant to drought stress. Its yield potential is less than alfalfa—similar to kura or red clover—and is very persistent if it is not grazed hard in the late summer and autumn.

Sanfoin (*Orobrychis vicifolia* Scop.) is rarely used today in spite of its 400+ year history as a forage crop. It is a non-bloating legume which is drought and cold tolerant. It is adapted to dry, calcareous soils and does well under irrigation in the western states. It is a very short lived plant in Wisconsin, and is probably best treated as an annual because it is susceptible to root and crown rots in this more humid environment. Production is concentrated in the spring, earlier than most other legumes, and while it is intolerant of continuous grazing, it could do well under rotational systems.

Sweet clovers are sometimes talked about as pasture legumes, but they are not well adapted to this purpose. Used most commonly as a green manure, for soil reclamation, and for honey production, these biennial species resemble alfalfa in appearance and in adaptation. They are vigorous, drought tolerant plants that prefer high pH soils. Sweet clovers produce an anti-quality compound, coumarin which gives its tissues a bitter taste. If sweet clover hay becomes moldy, the coumarin converts to dicoumarol and anti-coagulant which can cause bleeding disorders in livestock. There are two species of sweet clover: white (*Melilotus alba* L.), higher yielding and more robust, and yellow (*M. officinalis* L.), smaller, but leafier and more drought tolerant.

Which, among these choices will work on your farm? The information in this article can help point in the right direction (see table 1). We recommend that you carefully consider soil conditions (especially pH and drainage) and anticipated management of the pasture before selecting legumes and grasses to grow in a pasture mixture. Generally it is easier to manage simple mixtures of one or two legumes with one or two grasses that are known to be compatible with each other, but you may need several different seeding mixtures for different paddocks. If your farm has differences in soils, aspect, slope, and drainage, you should plan seeding mixtures and fencing to fit these specific conditions. This will provide diversity, ease of management, and allow you to maximize productivity over the grazing season.