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“Stocker Cents” article

The Role of Clover in Stocker Cattle Production

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If you were to ask producers to make a list of the greatest concerns they have for the future of beef cattle production, I would imagine that the rising costs of key inputs like Nitrogen (N) fertilizer might rank among the top items. This rising trend in input costs, set against the typically cyclic nature of commodity products such as beef, will inevitably increase economic pressures to change the way we do things in the future. On the bright side, there is a large amount of untapped potential in our forage resource that can help us achieve greater efficiency in our animal production systems. It is interesting to see that recent high N prices have refocused attention on clovers (and other legumes). Clovers may offer one of the greatest opportunities for lowering production costs and improving production efficiency.

I have written before about the potential benefits of utilizing legumes in grazing systems, both in terms of improved nutritional quality and as a source of N. However, I have not yet focused on stocker cattle production systems, which usually differ significantly from cow-calf operations in forage production practices. Stocker cattle production in Mississippi generally operates on an annual grass system (ryegrass, small grain, etc.), which has different implications for the use of legumes when compared to the predominantly perennial forage bases (bermudagrass, tall fescue, etc.) used in cow-calf operations.

This article will highlight some of the important considerations when incorporating legumes into a stocker grazing system.

Nitrogen fixation

This is probably the most attractive aspect of using clovers, with ammonium nitrate prices in excess of \$350/ton. When we consider all the many sources of information, the general conclusion is that most of the common annual and perennial clovers used in the southeast USA will fix anywhere from 50 to 200 lb of N per acre per year. Sounds great! But what are the realities in a stocker cattle production system that is based on annual crops such as ryegrass? At face value, if we were to get 100 lb N/acre from a clover source each year it would probably be enough to supply all the needs of the companion grass, thereby eliminating our need for purchased N fertilizer. In reality, the complete elimination of N fertilizer may not be possible, particularly in an annual grass system. Consider that N-fixation by the clover is directly related to clover growth and yield i.e. the more clover you have and better it is growing, the more N is being fixed. Therefore, it takes some time from planting till there is enough clover present to be contributing significant quantities of N to the system. In general, if you plant clover and annual ryegrass at the same time, the clover will not produce enough N during the fall and

winter to make any available to the ryegrass. Therefore, some N fertilizer is required during this time to help establishment and early growth of the ryegrass.

But how much N and when?

A 2-year study conducted by Dr. Gerald Evers at Overton TX, showed that N applications of between 40 and 70 lb/A, on annual ryegrass/crimson clover mixes at or shortly after planting, were effective in getting good fall/winter growth without any adverse affect on the clover growth. In fact, these early N applications actually doubled the early clover growth, in addition to giving a 10-fold increase in ryegrass production, when compared with a no nitrogen treatment. Based on data from this same study, a subsequent 70-100 lb/A N application in January or February will significantly reduce clover production (by up to as much as half), but will result in approximately a 20% increase in total dry matter production due to an increase in ryegrass productivity. Later applications in March (70 lb N/A) had little to no yield benefit on the grass/clover mixes, suggesting that perhaps there was adequate N being supplied by the clover, and from earlier applications by this time. It is interesting to note that, even in a nitrogen fertilization system, the ryegrass/clover mix yielded about 1500 lb/A more dry matter than the grass alone, suggesting significant yield advantages from using clover in the mix. The take home message from this is that adding clover to an annual grass system will generally improve yield and will contribute nitrogen during the spring. However, split applications of 40-60 lb N/A at planting and a couple of months later are required if you want good fall and winter grazing.

Importance of the animal and grazing management in N-fixation

Nitrogen is fixed from the atmosphere by *rhizobia* bacteria in nodules on the roots of legumes. So how does it get from there to where it can be used by the grass growing with the clover? The fact is that direct transfer of N from the clover plant to the grass plant is pretty low when you consider the amount of N being fixed. Of the total N fixed only about 5% will be directly available to companion grass species (i.e. clovers that fix about 50-200 lb N/A/yr will result in 2-10 lb N/A made directly available to the grass). This relatively small proportion of N is released from nodules on the roots and some by the decay of old clover leaves and stems that fall to the ground. By far the greatest mechanism for making N produced in the clover available to the companion grass is for the clover to be consumed by the grazing animal, after which much of the N (ingested as plant proteins) is cycled back onto the pasture in urine and fecal material, to be made available to the grass (and clover). It is fair to say that in the absence of a grazing animal the clover plants would eventually release much of their N into the soil through the natural growth and decay process, however, this is a much slower process and requires greater length of time before the N is available to the grass in significant quantities. The nature of these processes is the reason why utilizing clovers in a hay production system can be largely ineffective as the N is removed (in the hay) before it has a chance to become available to the grass.

Given that the grazing animal is our greatest means of converting legume N (protein) into a form suitable for the grass to use, we are left with the problem of distribution. When the N is fixed by the clover it will be relatively evenly distributed throughout the

pasture. However, once the animal consumes the clover the chances of an even redistribution of the N are slim, given the animal's habit of grazing in certain areas and urinating/defecating in others. This is where grazing management can help. It is perhaps a surprising fact that during times of peak forage growth there may be no real advantage in rotational grazing over continuous stocking in terms of per head performance, as forage supply is generally not limiting and the animals are essentially in a free-choice situation (although it should be noted that even during these times that carrying capacity can be increased for a given per head performance by using rotational grazing). However, rotational grazing still has some advantages. In addition to preventing overgrazing and under grazing, and improving forage utilization, a rotational stocking system can result in a much more even distribution of N throughout the pasture. i.e. if you are moving animals regularly and restricting pasture area, cattle will be less likely to develop specific grazing habits that lead to areas that are heavily grazed and 'camping' areas (where they rest and deposit dung and urine).

Perennial clovers and N-fixation in an annual grass system?

It is possible that perennial clovers, such as white clover, may be a more effective source of N for annual ryegrass-based systems. The development of more persistent white clover lines has allowed this species to be used in a wider geographic region in the south, and in summer grass pastures that would have otherwise been very difficult to maintain a perennial clover in. Given that much of the ryegrass grown in the southeast is on overseeded summergrass pastures, it is possible that a perennial legume grown in these pastures may be of significant benefit to the overseeded crop. The main advantage of a perennial clover over an annual clover seeded with the ryegrass is that the N fixation process could continue on the absence of the ryegrass and the clover would be present earlier in the fall allowing N to be available during the establishment and early growth phase. WE do not currently know what this advantage might be, but it is worth considering using one of the new white clovers in your bermudagrass fields, particularly where you intend overseeding winter annuals.

Improving nutritional quality with legumes

Annual ryegrass and small grains vary in digestibility from >70% during the winter and early spring to about 50% by May, and crude protein will fall from 30% to 10-15% over the same period. Basically, these grasses are very good quality feed and you may ask what nutritional benefit do we really get from including clover in the mix. From a digestibility and crude protein standpoint, legumes on average are still greater in both these categories when compared to grasses, but it is fair to say that you might not always see a significant improvement in animal performance. However, clovers do typically have greater trace element levels than grasses, which can help with potential grass tetany problems (clovers have about 2-3 times the amount of magnesium and calcium than grasses). Clovers may also be of nutritional benefit in an annual grass system where the clover's growth season extends beyond that of the grass. As the grass ages, and its quality declines, the average quality of the pasture may be supported by the continued growth of the higher quality clover as it becomes a greater component in the pasture. Clovers that fall into this category are annual clovers, such as Arrowleaf and Persian clover, and perennial clovers such as White and Red clover.

Clovers may also be used in tall fescue pastures to improve the quality of this grass in stocker cattle production. In truth, tall fescue is a pretty good quality forage anyway (ryegrass is a little better at similar maturity) but with the addition of clover, it will rival any ryegrass pasture in terms of quality.

Clovers and anti-quality factors in stocker cattle production

Probably the biggest concern with utilizing clovers in a stocker system is the risk of bloat. Legume bloat is caused by the rapid release of soluble protein from the plant while in the rumen. This protein causes a foam that blocks the release of gas from the rumen causing it to blow up like a balloon, and ultimately may cause death by asphyxiation (rumen contents entering the wind pipe). While some clovers are more prone to cause bloat than others (e.g. Persian clover), the main factor in preventing bloat is to ensure that enough effective fiber is present to slow the rumen breakdown of the plant material, and to ensure that animals are introduced slowly to a pasture with high clover content. Generally, if you have no more than a 30% clover content with grass, the chances of bloat will be fairly low. If you have a greater than 30% clover stand you may want to add hay and a bloat preventative, such as bloat blocks, to the pasture. There are also legumes, such as Arrowleaf clover, that not only do not cause bloat but also prevent bloat due to the small amounts of condensed tannin contained in the plant (this binds up the soluble protein and stops the foam forming). It is the focus of many bio-tech programs to develop other legume species (e.g. alfalfa that can produce condensed tannins to prevent bloat and improve protein utilization).

There is no doubt that whatever the animal production system, clovers can be of some benefit. However, I will leave you with two thoughts to bear in mind. 1) clovers (*rhizobia*) fix nitrogen only and still need lime (pH 6-7), potassium and phosphate (in fact clovers require at least medium levels of P and K), and 2) Clovers are not as tolerant of over grazing as grasses so rotational grazing is the best way to keep clover in your pastures. For more information on stocker cattle production, contact your local Extension office.