MISSISSIPPI STATE UNIVERSITY EXTENSION

Cool-season Annual Clover Production in Mississippi

Volume 12, Issue 9

Rocky Lemus
Mississippi State University

September 2019

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Most of the forage production in Mississippi targeting livestock is dominated by warm-season perennial grasses (bermudagrass and bahiagrass) and cool-season annual grasses (annual ryegrass and small grains). However, there is a number of clover species that can complement forage production to improve yields, reduce nitrogen inputs, improve forage quality, and extend the grazing season.

The most common clover species adapted to Mississippi consist of annuals cool-season species. These clovers have the ability to develop nodules in their roots through a bacteria called Rhizobia and provide their own nitrogen. When properly inoculated, clovers have the capability to fix nitrogen from the air and transfer that usable nitrogen to be used by the clovers or any surrounding grasses. Conservative estimates of annual nitrogen production with cool-season annual clovers can range from 60 to 120 pounds per acre depending on the clover species. Because of this nitrogen fixing potential, the use of nitrogen fertilizer is not recommended on pastures containing greater than 30% clover. If nitrogen is applied, there is a tendency that it can stimulate grass or weed growth and reduce the persistence of the clover. Most clovers will require a minimum pH of 6.0 to maintain productivity and persistence and should be fall planted following seeding rates recommendations.

Annual Cool-season Clovers

Arrowleaf Clover (*Trifolium vesiculosum*) – Despite of the early growth in the winter, arrowleaf is a late maturing clover with good growth until early to mid-May. Some on the unique plant characteristics include large leaflets that are rounded at the base and pointed at the tip. The leaves tend to have V-shaped water marks with pronounced veins and the flowers are white to pink when immature and brown when mature. Plants have an upright growth and can a height up to 50 inches. It could be susceptible to virus and root diseases. Arrowleaf is adapted to to souls that well- to moderately-drained and pH of 5.8 or higher. It does not do well in light textured, droughty soils with low fertility or soils that are wet and poorly drained. It can provide a good reseeding potential and can have up to 90% of hard seed. Several fungal pathogens in the soils (*Pythium ultimum, Pythium irregular, Rhizocotonia solani and Fusarium poliferatum*) can cause damage at different growth stages.

Balansa Clover (*Trifolium michelianum)* – Balansa has been used extensively as cover crop clover. Like ball clover, balansa can be confused with white clover, but some of the unique characteristics are the hairless and serrated leaves, the hollow stems, and the combination of pink and white flowers. It is usually has a good residing potential when allow to bloom during the first year and every other year to maintain the seed bank. Balansa has good cold tolerance, it is adapted to hay clay and wet soils, soil pH ranging from 5.5 to 7.0, and excellent waterlogging. It is a late maturing clover with aggressive vertical growth and 4-5 weeks of flowering, making it very competitive with cool-season annual grasses. Balansa maintains good forage quality due to the later maturing and the hollow stems with fiber accumulation when compared to clovers with a woodier stem. Because of the growth comes from the crown, it can toler-

Table 1. Forage production of different cool-season annual clover across different locations in Mississippi.

Annual Clover	Holly Springs	Starkville	Newton	Poplarville	Average
Arrowleaf	3610	1381	4604	1829	2856
Balansa	2052	2458	3520	1678	2427
Ball	1081	716	--	1996	1264
Berseem	3159	2971	4318	3382	3458
Crimson	2581	1974	3811	3247	2903
Persian	3098	3419	3918	3470	3476

Source: White et al. (2012-2019). Cool-season Annual Forage Variety Trials. Mississippi State University.

ate heavy grazing and this can increase tillering. If grazing, make sure that grazing is done before flowering or otherwise it will not recover well. Bloat risk can occur and increase when cattle is grazing lush pastures dominated by balansa.

Ball Clover *(Trifolium nigrescens)* – Producers tend to sometime mistake ball clover with white clover. Its highly-branched stems can produce yellowish to white flowers seed heads, but the blooms are smaller and more rounded that white clover. Ball clover can form a thick mat and grow up to 3 feet tall with most of the growth close to the ground to partially erect. This type of growth makes it ball clover ideal for grazing. Seed is very small and can contain up to 60% hard seed which provide excellent reseeding ability even under close grazing. Although ball clover can tolerate wet heavy soils, it is best adapted to fine sandy loam and clay loam soils. It has a medium to late maturity with flowering approximately two to three weeks later than crimson clover. Most of the production season occurs from mid-March to late May. Ball clover has a high bloat potential and it should be mixed with annual ryegrass or small grains to reduce the risk.

Berseem clover *(Trifolium alexandrinum)* – Berseem is commonly grown as a winter annual in areas that experience long, warm winters with minimal frosts. It is well adapted to most soil types except sandy soils and it can tolerate poor drainage. Soils with low in phosphorus can also limit forage production. Contrary to ball clover, the reseeding potential is poor because hard percentage is very low at less than 10%. Because of its upright growth, it can be ready to graze within 60 days when it reaches a 12 to 15 inches height and before it begins to flower. If berseem clover is not grazed or clipped before the early flowering stage, the regrowth potential is severely impacted. Berseem is a very later maturing clover which can extend grazing into late May or early June. Vegetative growth has high protein percent (18 to 26%). One of the advantages with berseem clover is the low bloat risk and potential from grazing and no cases have been reported in the literature.

Crimson clover (*Trifolium incarnatum)* – Crimson can grow in various soil types that are well drained and do not perform in poorly drained or acidic soils. It is considered as one of the annual clovers with poorest forage quality. Despite of quality issues it could be very productive when mixed with cool-season annual grasses. Crimson clover has been around for long time and in the south, it is used as benchmark to compare the performance of other clover species and varieties. One of the disadvantages with crimson is that matures early in the spring (early April) compared to other annual clovers. On the other hand, the early maturity reduces warm-season perennial grasses that are greening up in the spring. Like berseem, crimson clover has a low reseeding potential due to low hard seed production and seed damage caused clover head weevils.

Persian clover (*Trifolium resupinatum*) – Persian is best adapted to heavy clay loam soils and poorly drained soils. Persian clover is not adapted to acid sandy soils. It more drought tolerance that berseem clover and it has fair cold tolerance. Persian can produce about 30 percent hard seed when allow to mature. Despite being a cool-season, annual legume with a short growing season, Persian clover performs well under close grazing. Bloat is a serious concern for cattle consuming large quantities of biomass, but this has not been observed in sheep. It is considered one of the most dangerous clover to cause bloat and should never grazed when the stand is over 40 to 50 percent Persian clover unless a bloating block is being supplemented. Annual ryegrass is common companion planted with Persian clover, but it competes strongly for light and soil moisture with Persian clover. It recovers well from grazing, and therefore grass should be grazed often using short grazing cycles or limit grazing to avoid overgrazing which will remove the stems. To maximize seed production during the year of establishment and ensure reseeding and long-term persistence, stand should not be grazed during the flowering period. On the other hand, on well-established stands of Persian clover, light grazing can occur during the flowering period, but should be avoided if possible to optimize seed production and viability for next growing season.

Rose clover (*Trifolium hirtum*) – Rose is tolerant of poor fertility, drought conditions and alkaline soils. Most of the drought tolerance is due to deep rooting depth and it is greater than crimson or arrowleaf clovers. Rose clover do not tolerate acid conditions or very wet soils. Rose clover is very tolerant to frost with a vigorous spring growth. It also has an early season maturity. Rose clover is an excellent re-seeder because of a high hard seed percentage ranging from 75 to 90 percent. Rose clover can develop many tillers during the growing season and can flower under high grazing stocking rates, but animals should be removed in mid-April to allow the stand to produce seed. It has low bloating potential and suited for moderate grazing. Rose clover will provide grazing from March to mid-May.

Upcoming Events

October 24, 2019 — North Mississippi Beef Expo, Verona, MS
October 25, 2019 — North Mississippi Beef Expo, Senatobia, MS
For upcoming forage related events visit: ***http://forages.pss.msstate.edu/events.html***

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