

## ESTABLISHMENT OF LEGUMES IN BAHIAGRASS SOD

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Bahiagrass (Paspalum notatum) is widely grown from Texas through the Carolinas, and in Florida is a major pasture grass. It is a tough competitor which forms an extremely dense sod crowded with stubby stolons. Bahiagrass is popular because it resists encroachment from weeds, has few disease and insect problems, withstands close grazing, establishes from seed, and does not require high soil fertility. However, grazing studies indicate that bahiagrass is lower in nutritional value when compared with bermudagrass or digitgrass. By midsummer protein and digestibility are low, suggesting that animal intake and performance are adversely affected. In addition bahiagrass is a warm season species that produces 85% of its annual dry matter from May to October. In spite of the valuable attributes of bahiagrass its forage quality is low, and it produces little winter forage.

An ideal method of overcoming these deficiencies is to manage bahiagrass with legumes that provide needed quality and biological nitrogen. At present there are no commercially available perennial legumes adapted to south Florida, but ranchers can use a combination of winter and summer annual species. Florida's summer annual legumes are jointvetch or aeschynomene (Aeschynomene americana), hairy indigo (Indigofera hirsuta), and alyce clover (Alysicarpus vaginalis), and the winter species (which act as annuals in south Florida) are alfalfa (Medicago sativa), red clover (Trifolium pratense) and white clover (T. repens).

Since natural reseeding is not always reliable with summer annuals or impossible with most winter annuals (except Dutch clover), reseeding is a frequent practice. Establishment by conventional tillage, which involves chopping or disking, is expensive and energy intensive. An alternative is sod-seeding, which Kentucky workers have shown to use only 20% of the energy input of conventional (prepared seedbed) tillage. However, widespread use of sod-seeding in Florida has been limited by a low probability of success in establishment. At the University of Florida's Ona Agricultural Research Center in south Florida considerable research effort has been devoted to sod-seeding in the past 4 years. We have identified several reasons why legume stands often fail even when water and fertility are adequate.

Forage legumes are slow to establish, and it is extremely important to control bahiagrass competition. A grass competes with a developing legume seedling for light, water, and nutrients: in this order of importance. Although little is known about the competitive effects for water and nutrients, we have found that having sufficient light available to legume

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seedlings when they emerge is quite important. Twenty five percent shade did not inhibit aescynomene seedling growth, and seedling weight was equal to that of plants grown in full sunlight, but when 90% of the light was shaded from aescynomene seedlings, there was: a 94% reduction in seedling weight; a 45% reduction in weight from seedlings grown under 73% light reduction; and a 19% reduction in seedling weight was found when plants were grown under 55% light reduction.

There are two forms of competition from bahiagrass: 1) competition from previous grass growth present at the time of seedling emergence; and 2) competition resulting from new grass growth during seedling development. Sod management for these forms of competition is different for winter and summer annual legumes.

#### Controlling competition before seeding.

Removal of sod cover can be accomplished in several ways, and the choice may be dictated by economics. Some alternatives are disking, mowing, grazing, and fire.

When bahiagrass sod was heavily disked and seeded in early December to red or white clover as compared to drilling seed directly into a thick, untreated sod, the average dry matter yield of the legumes after 2 years was 27% lower in the drilled plots as compared to disk and broadcast seeded plots (Table 1). The number of legume seedlings was 52% higher in the disk and broadcast plots. In another study aescynomene yields were also much greater where bahiagrass was heavily disked as compared to drilling in untreated grass (1300 vs 600 kg/ha). The reason for the difference was the removal of the bahiagrass canopy by disking. Since most sod-seeding drills simply cut a slot in the sod and deposit the seed with a minimum of disturbance, they do not remove the grass canopy. If a drill is used or if there is too much cover to allow for a good disking, then some other sod canopy elimination practices must be used.

Table 1. Comparison of method of seeding on dry matter yield of red and white clover in bahiagrass sod. Ona ARC. 1977-78.

<u>Year</u>	<u>Zip<sup>(R)</sup> Sod Seeded</u>	<u>Disk and Broadcast</u>
	-----kg/ha-----	-----
1977	3500	6230
1978	<del>5500</del>	<del>6030</del>
Average	4500	6130

Harvesting excess forage as hay is best, as this justifies cost of mowing and eliminates the cover. Mowing seems to defeat the purpose of sod-seeding as it requires more time and energy, and the thatch can result in as much competition as uncut grass.

Grazing is an excellent alternative, and research has shown that yields of red and white clover seeded in bahiagrass that had been grazed to a 5 cm (2 inch) stubble were equal to the yield of legumes seeded in a bahiagrass sod which had been burned. Burning has most often resulted in the best legume stands in our research. Grazing is probably a more useful tool for removing sod cover before seeding winter legumes because after weaning calves in the fall, cows can be concentrated on bahiagrass until the canopy is removed. In June when summer annuals are seeded, the nutritional requirement of cows with calves is probably too high to allow the kind of prolonged bahiagrass grazing which promotes good summer annual legume growth. When compared with burning prior to seeding, grazing as a method of canopy elimination resulted in aeschynomene stands and yields that were comparable. Grazing or disking, followed by broadcasting seed resulted in 1500 and 1300 kg/ha, respectively, vs 600 kg/ha for untreated bahiagrass.

Fire is an excellent way to prepare bahiagrass for inter seeding of legumes. Often a dense bahiagrass canopy can be burned after a frost in December, but sometimes chemical desiccation is necessary. The herbicide Paraquat<sup>(R)</sup> has been applied at 0.56 kg/ha (0.5 lb/A) to kill and dry out the canopy in order to allow burning. The result was excellent stands of both winter and summer annual legumes (Table 2).

Table 2. Dry matter yield of winter or summer legumes seeded with a Zip<sup>(R)</sup> sod seeder in bahiagrass treated with various herbicides. Ona ARC. 1977-78.

<u>Canopy control</u>		<u>Herbicide treatment</u>	<u>Legume yield</u>	
<u>Before seeding</u>	<u>After seeding</u>		<u>Winter annual<sup>†</sup></u>	<u>Summer annual<sup>†</sup></u>
			<u>-----kg/ha-----</u>	
yes	no	Paraquat (R) † bum	6640 <sup>§</sup>	2970
no	yes	Dowpon (R) M	3840	2810
no	no	no herbicide	1310	260

† Red and white clover.

‡ Aeschynomene, hairy indigo, alyce clover.

§ Divide kg/ha by 1.121 to get lb/A.

Burning 12 to 14 cm tall (4.7 to 5.5 inch) bahiagrass resulted in temperatures that reached 83 C (182 F) at the soil surface. The value of this heat is demonstrated in the control of insects and other pests that eat legume seedlings. At the Ona ARC a small land snail (*Polygyra cereolus*) has been found to be responsible for decimating stands of sod-seeded clovers. Burning resulted in 98% mortality of this pest, resulting in successful legume establishment.

### Controlling competition after seeding.

Control of sod growth after legume emergence can be accomplished with grazing or herbicides. Herbicides are valuable for controlling competition after seeding because they can stop grass growth. When herbicides were applied to 7 to 10 cm tall (2.8 to 4 inch) bahiagrass in late June, better yields of summer legumes were obtained as compared to untreated grass (Table 3). Successful stands of legumes resulted when canopy cover was slight at seeding and sod control was employed during legume development.

Table 3. Dry matter yield of summer legumes sod-seeded in bahiagrass treated with various herbicides Ona ARC.1977-78.

Herbicide	Sod control	Legume yield <sup>*</sup>		
		Aeschynomene	Alyce clover	Hairy indigo
kg/ha				
Round-up(R)	Excellent	4950	5030	1900
Dowpon(R)	Good	2920	4130	1380
Paraquat(R)	Poor	100	970	140
No herbicide	Poor	210	450	120

\* Divide kg/ha by 1.121 to get lb/A.

Using herbicides to control competition after seeding winter legumes has questionable value. Delaying seeding date in south Florida until after November 15 usually assures that bahiagrass growth will be slowed by cool temperatures. When night temperatures fall below 15 C (59 F) bahiagrass growth almost stops. If competition at seeding time has been removed, little growth will develop after seeding. Hence, with winter annuals it is much more important to remove competition at seeding than to control competition after seeding.

To demonstrate this point, the canopy was removed at seeding by paraquat and burning, and the grass canopy regrew slowly, but was unchecked through the late fall and winter. (Table 2). Excellent yields were obtained from red and white clover (6640 kg/ha) in this burn treatment but poorer yields (3840 kg/ha) resulted in a Dowpon M treatment where the grass canopy remained at seeding, but all new growth was stopped. Similar summer annual yields resulted with a burn vs Dowpon M treatment (2970 vs 2810 kg/ha) but yields produced from untreated grass were poor (260 kg/ha). Both types of competition control are necessary when sod seeding summer legumes in bahiagrass, but removing sod cover prior to seeding is most important for winter legumes.

### Sod-seeding machines.

If a good job is done controlling grass competition and adequate fertility and water are supplied (for winter legumes), the type of sod-seeding drill that you use makes little difference in the legume establishment. We have used very simple, relatively inexpensive machines, such as the Zip(R)

seeder; intermediately priced machines, such as the John Deere Powr-till<sup>(R)</sup> and Tye<sup>(R)</sup> seeder; or very expensive, sophisticated machines like the Bettison 3-D seeder and have had success with all of these. If the practices for successful establishment are followed, then machine preference is a personal and economic matter. As pointed out earlier, disking sod and broadcasting seed can result in good establishment.

The following are steps recommended for establishing winter or summer annuals in bahiagrass in south Florida.

Winter annuals (alfalfa, red and white clover).

1. Limit the use of nitrogen on bahiagrass after September 15. Raise the soil pH to 6.0 for clover and 6.5 for alfalfa,
2. Before seeding graze, remove as hay, or burn off all excess bahiagrass leaving a maximum of 7.6 cm (3 inches).
3. Inoculate seed with proper strain of fresh Rhizobium and seed legumes after November is to take advantage of cool temperatures which limit bahiagrass growth. Waiting until November 15 also increases the chances of rain from cold fronts.
4. Fertilize legumes at seeding with 340 to 450 kg/ha (300 to 400 lbs/A) of 0-10-20 and after the first cutting (about March 15) apply another 340 to 450 kg/ha of 0-10-20. Apply micronutrients if none were applied in the past 4 years.
5. Irrigate if necessary. Irrigation may be more important with disk and broadcast methods of seeding than sod drill methods because of poorer seed-to-soil contact with the former.
6. Bahiagrass growth may be grazed or mowed during legume establishment, provided seedlings are not clipped.

Summer annuals (aeschynomene, -alyce clover, hairy indigo).

1. Limit the use of nitrogen fertilizer on bahiagrass after April 15. Raise soil pH to 5.5 to 6.0.
2. Before seeding, graze, remove as hay, or burn (after desiccation with paraquat) all excess bahiagrass, leaving a maximum of 7.6 cm (3 inch).
3. If herbicides are used to control sod growth after seeding, best results will result if the chemicals are applied 2 to 3 weeks before seeding so that sod-control is in effect. Dowpon M, especially if part of a smutgrass control program, is recommended at 2.5 kg/ha active (3.0 lb/A).
4. Inoculate seed with proper strain of fresh Rhizobium and seed legumes after June 15 to increase the probability of favorable moisture conditions. Seed naked aeschynomene (de-hulled), and for all legumes it is desirable to use seed rates that are 20 to 25% higher than used

in prepared seed beds.

5. Fertilize legumes at seeding with 560 kg/ha (500 lb/A) of 0-10-20. Use micronutrients if none have been applied in the past 4 years.
6. If no herbicides were used to control grass growth, then graze or mow to remove competition. Do not allow legume seedlings to be grazed. When legumes are 7 to 10 cm tall (3 to 4 inches) remove cattle and allow the legumes to reach 60 cm (24 inches) before grazing.

Quality legumes can be established in bahiagrass, provided these steps are followed. Seek advice from county extension or extension forage specialist about varieties, seeding rates, soil testing, etc. With costly nitrogen fertilizer and expensive feed costs, legumes are too good to do without.

#### Bibliography

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