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Cattle and Forage Field Day

A Tribute to Mac Peacock
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Ona, Florida

PRACTICAL CROSSBREEDING PROGRAMS FOR BEEF CATTLE IN FLORIDA

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Introduction

While there are many types of crossbreeding systems possible, the ones most likely to be useful and practical for use in Florida are some form of a rotational crossbreeding system or, in small herds and a few specialized systems, a terminal crossbreeding program. A third option, the rota-terminal, combines both systems and could also be considered for more intensively managed operations. I am able to recommend certain crossbreeding programs over others in part because of the years of research that were conducted on crossbreeding systems here at the Range Cattle REC by F. M. "Mac" Peacock..

One of the purposes of crossbreeding is to utilize the phenomenon of heterosis, or hybrid vigor. Heterosis is measured by the improvement that we get for many traits, particularly those of greatest economic importance to the cattleman, when we cross various breeds. Heterosis generally results in an improvement in cow fertility, calf newborn vigor and survival rate, milk production and calf growth rate. Crossbreeding does not, however, generally have much of an impact on carcass traits, like ribeye area, fat thickness, marbling, etc. The impact of heterosis on the traits that it does increase, however, is so great that the use of purebreds as commercial animals, even in other parts of the country, usually is not economically feasible.

Crossbreeding offers another advantage besides heterosis; producers can select breeds whose superior traits will *complement* each other in a particular crossbreeding system, producing crossbred animals with a more desirable combination of traits than can be found in existing breeds. The effect of combining desirable traits from two or more different breeds to produce superior crossbred animals is referred to as "complementarity."

Breed complementarity can be illustrated in terms of adaptation to the Florida climate. Angus cattle are at a disadvantage in Florida during summer months due to their inability to control body temperature during periods of heat stress. Brahman cattle, on the other hand, are comfortable during the summer because they are well-adapted to high temperatures; but they often suffer in the winter during wet, cold, and windy periods. The F_1 animal that results from crossing Angus and Brahman breeds is comfortable during both summer and winter months in Florida; its level of adaptation to cold, and to heat, is intermediate to the corresponding levels of adaptation exhibited by each parental breed. Through proper selection of breeds for use in a crossbreeding system, cattle producers can "genetically engineer" the desired level of performance for traits in the crossbred progeny.

One of the givens regarding crossbreeding programs in Florida has been the use of Brahman crossbred cows as a part of the system. A particular advantage of the F_1 Brahman ×Angus or Brahman ×Hereford crossbred cow (and other cows with Brahman breeding) is her ability to restrict her calf's birth weight and thus be able to calve easily even when bred to bulls of large breeds such as Simmental, Gelbvieh, or Charolais. The

calves from this type of mating, while relatively small at birth, have the genetic potential for very rapid growth due to the combination of the effect of 50% of the genes being from the large sire breed and the positive effects of both individual and maternal heterosis on growth. Individual heterosis is the improvement due to the calf being crossbred and impacts calf vigor and growth while maternal heterosis relates to the dam of the calf being crossbred and the increase in performance is due in large part to the increased milk production of the calf's dam. This combination of the crossbred calf's potential for growth, along with the high and sustained milk yield of the Brahman F_1 crossbred cow, can result in exceptional calves at weaning. Unfortunately, however, such explosive growth to weaning may be related to lowered growth postweaning. Also, the current market demands regarding Brahman-influenced cattle may cause us to reconsider the crossbreeding programs that are most appropriate.

Selection of Breeds for Use in Crossbreeding Systems

The choice of breeds to include in a crossbreeding system is of critical importance because, for many traits, there are large differences in average performance among the breeds. The specific breeds and breed crosses that are most appropriate for one particular ranch with its own set of management and nutritional conditions may not--and likely *will* not--be the most appropriate combination for another ranch, operating under different conditions. Breeds differ in growth rate, milk production, carcass traits, age at puberty, fertility, and adaptation to Florida conditions. The differences between breeds and variability in the level of heterosis expected from various crosses need to be taken into consideration when planning a crossbreeding program.

When choosing breeds for a crossbreeding system, the environment--both nutritional and climatic--must also be considered. For example, the growth potential of the Simmental breed is much higher than that of the Angus and Hereford breeds, but cows sired by Simmental bulls may not maintain sufficient body condition to rebreed while lactating unless the level of nutrition provided is adequate to support their higher requirements. This problem is especially acute for lactating first-calf heifers. So, under low-input production systems (native range, for example), use of the larger, heavier-milking breeds--likely to produce cows weighing over 1100 lb--will not be feasible. The higher nutritional requirements of the Simmental and other heavy-milking breeds and their crosses must be considered in order to avoid lowered fertility. Traditional crosses involving the Angus, Hereford, and Brahman breeds and(or) Brangus and Braford are likely to be more profitable because they will be able to maintain higher reproductive rates under lower pasture quality. Under improved, fertilized pastures and adequate supplementation during the winter months, the use of larger, heavier-milking breeds can produce highly productive cows (as long as excessively large-framed bulls that will produce extremely large daughters are not used).

Another factor that must be considered in breed selection is market demand. Breeds selected must be utilized in a system that will produce calves that are in demand by stockers and feeders. It is for this reason that the Brahman can no longer play as large a role in crossbreeding programs as it has in the past; or, it must be utilized differently to

avoid production of calves with distinctive Brahman characteristics. Usually this will limit the level of Brahman in feeder calves to less than 50% Brahman breeding. Feeder calves must also have moderate frame sizes, an indicator of the weight of the carcass that they will produce, in the range from 5 to perhaps as high as 7 and possess adequate muscling. Therefore, the breeds selected must also have bulls available with appropriate frame scores and muscling to produce medium-framed, muscle score #1 feeder calves.

To produce a consistent set of calves year after year, it is essential that an appropriate crossbreeding system with a particular set of breeds be established and continuously maintained. Thus, availability of superior bulls for each breed included in the system is, necessarily, an important criterion for breed selection. Availability of bulls of some breeds that may be useful for crossbreeding programs in Florida is a major concern. While adequate numbers of Brahman and Brahman-derivative breed bulls are produced here, only a relatively small number of bulls of the *Bos taurus* breeds are produced in Florida. It is also important that the bulls that are purchased be able to maintain their body condition and breed cows under your ranch's conditions, and to continue to do so for at least four years. Generally, this requires that the bulls be born and raised in the Southeast.

Crossbreeding Systems

This section discusses the crossbreeding systems that may be used by Florida cattle producers, beginning with the simplest (or traditional) systems and continuing on to newer systems that may be more appropriate for the future. There are three basic types of crossbreeding systems: terminal, rotational, and composite. All have been used in various parts of the world; each has its inherent set of advantages and disadvantages. Only those most relevant to Florida's commercial ranches will be considered in detail.

Three-Breed Terminal Crossbreeding

The three-breed terminal cross is diagramed in **Figure 1**. In the first step, Brahman bulls are mated to Angus cows to produce Brahman × Angus F_1 calves. The males can be castrated and sold as feeders or grown out as bulls and the selected animals sold for breeding. The heifer calves are retained, grown out and bred to Angus or Hereford bulls for their first calves (to minimize calving difficulty) and to Charolais (or another large sire breed) bulls for all subsequent calves. All Charolais-sired calves, steers and heifers, are sold as feeders.

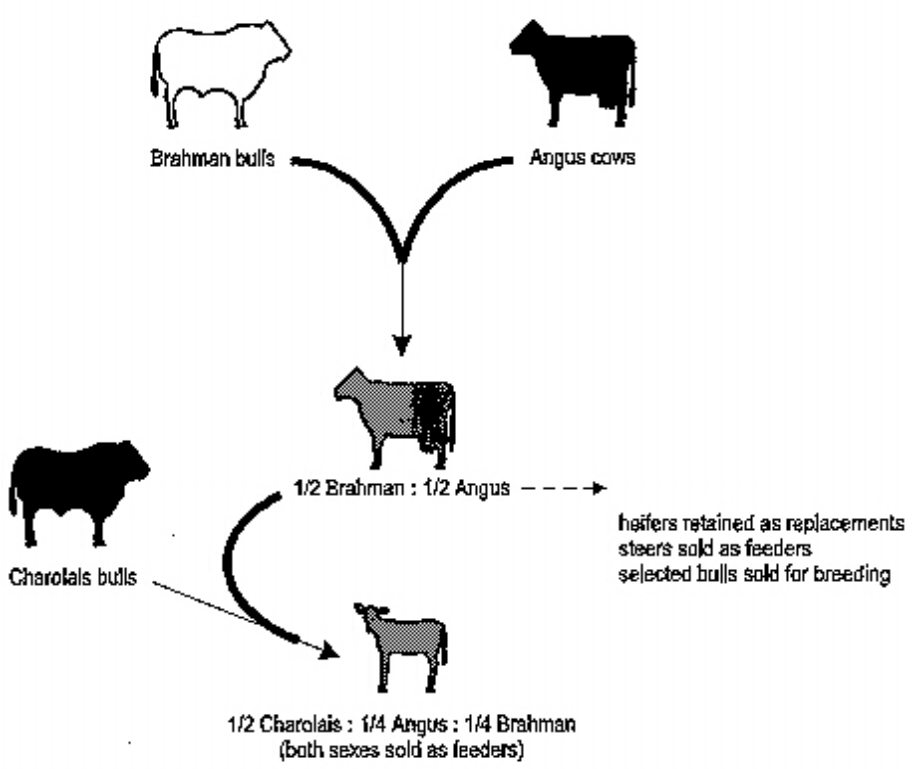

Figure 1. Three-breed terminal crossbreeding

The three-breed terminal cross has certain very desirable attributes. Both individual and maternal heterosis are fully utilized in the terminal cross progeny because the dams are F_1 crosses and the terminal sire breeds used do not have any breed composition in common with the F_1 dams (i.e. there is no Charolais in the ½ Brahman: ½ Angus dams). The terminal cross allows a producer to design the optimal type of F_1 cow which suits the ranch's environment, and the choice of a terminal sire breed is made to complement the F_1 dam to produce fast-growing calves that will produce appropriately-sized carcasses with adequate muscling and meat quality. Perhaps the most effective method of using this system in Florida would be to: (1) breed moderate-framed Brahman bulls to small Angus cows to produce 1000 to 1100 lb Brahman × Angus F_1 cows, and (2) breed these F_1 cows to Frame Score 6 or 7 bulls of a muscular sire breed with high growth potential (Charolais, Limousin, Simmental, Belgian Blue etc.) to produce rapidly growing muscular terminal cross calves which will have .4 in of fat before reaching 1300 lb.

As both the heifer and steer progeny of the three-breed terminal cross are slaughtered, the major problem with the three-breed terminal cross is the lack of an efficient method to produce replacement heifers. Unless the replacement heifers can be purchased (which is not generally possible), about 50% of the cowherd must be straightbred Angus (in this example) to allow the production of replacement heifers. About half of the purebred cows (25% of the total herd) must be bred to Angus bulls to provide Angus replacement heifers for the system. The other half of the Angus cows would be bred to Brahman bulls to

produce the F_1 cows. Since half the cows in the system are purebreds, this half does not utilize any of the positive effects of maternal heterosis. If sexed semen were to become available, the production of the F_1 brood cows would be made easier as only half as many Angus cows would be needed to produce the F_1 replacement heifers (since no bull calves would be produced). With the increased interest in F_1 bulls for crossbreeding, however, the sale of the Brahman × Angus F_1 bulls that would be produced along with the F_1 cows could improve the profitability of the system.

It is possible for owners of small herds (< 50 cows) and a few larger producers to use this system, or an approximation of it, by utilizing purchased crossbred heifers or young cows which are then bred to terminal sires (Charolais, Simmental, Gelbvieh, etc). Quality F_1 heifers or cows are seldom available at commercial prices, and while crossbred heifers and young cows that have a Brahman influence may be available through auction markets, the exact breed composition and, therefore, expected heterosis, is not known. In any case, the likelihood of them being F_1s is remote. The purchase of auction market females as replacements also brings with it a considerable risk of introduction of diseases. If quality crossbred heifers from well-managed rotational crossbreeding programs can be obtained, then a terminal crossbreeding system may be a good alternative to rotational systems for producers with smaller herds.

Rotational Crossbreeding Systems

Two-Breed and Three-Breed Rotational Crossbreeding

The traditional crossbreeding programs in Florida have been two- and three-breed rotational crosses of the Brahman and *Bos taurus* breeds such as the Angus and Hereford. Such crossbreeding systems have worked well and produced productive cows which were well adapted to Florida. The nutrient requirements of cows produced by these systems are moderate and generally not difficult to meet under typical Florida pasture and winter supplementation programs. In a two-breed rotational crossbreeding system (diagramed in **Figure 2**), two breeds of bulls are used. The daughters of Angus bulls are bred to Brahman bulls and the daughters of Brahman bulls are bred to Angus bulls. Such a two-breed rotation involving the Brahman has fallen out of favor in recent years as half the calves from such a cross would be about two-thirds Brahman (after the proportions have stabilized after the system has been in place for several generations) and would be subject to large price docks as feeder calves. Another problem with this system is that the Angus-sired heifers will reach puberty much earlier than the Brahman-sired heifers. Angus and Brahman-sired calves would also be very different in appearance and for this reason could not be sold as a uniform group. This illustrates the need for the bulls of the breeds involved in two- as well as three-breed rotations to be similar in frame size and level of milk production so that replacement heifers and cows can be managed as groups, except during the breeding season, and uniform sets of calves can be sold.

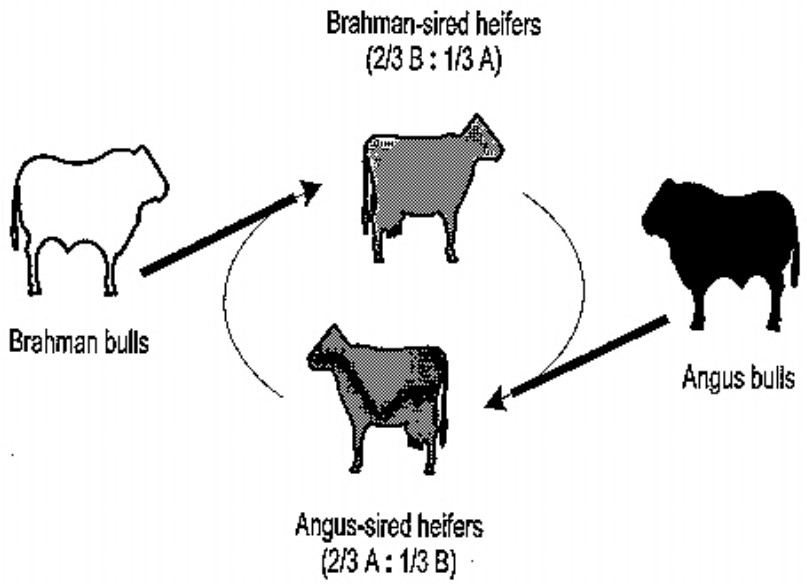

Figure 2. Two-breed rotational cross using Brahman and Angus breeds

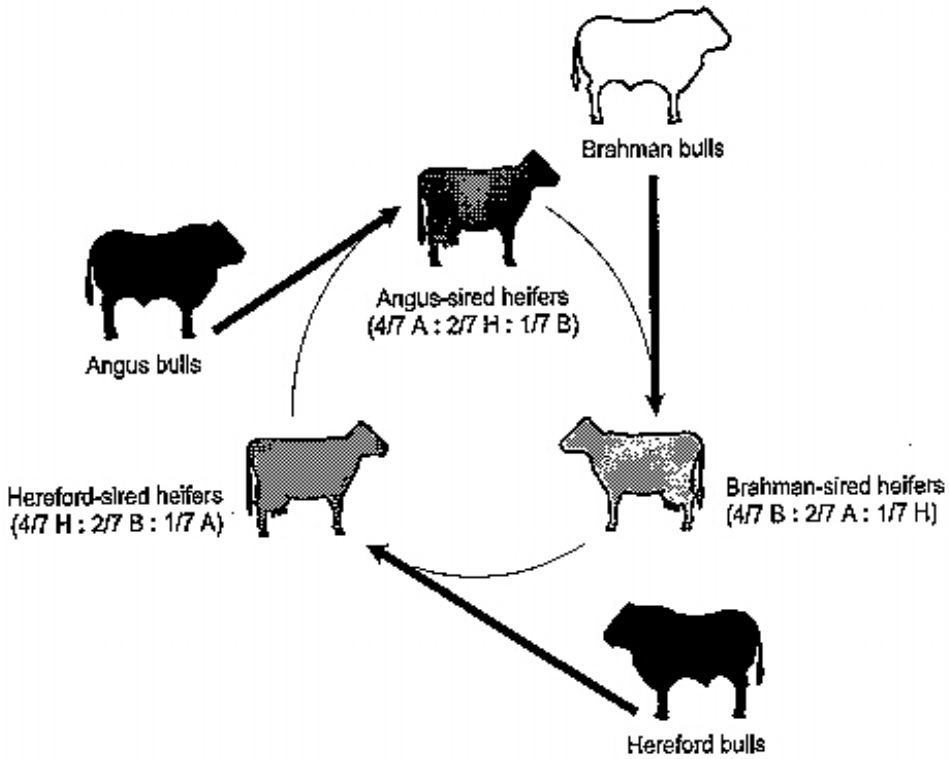

Figure 3. Three-breed rotational cross using Brahman, Hereford, and Angus breeds

The three-breed rotation involving the Brahman and two *Bos taurus* breeds, such as the Brahman × Hereford × Angus (**Figure 3)**, however, continues to be used to some extent in Florida. The calves sired by Brahman bulls (after the proportions have stabilized after

the system has been in place for several generations) are about 4/7^{ths} Brahman, slightly over half, and might be discriminated against by some feeder buyers. The Brahman-sired heifer calves, on the other hand, should perform nearly as well as the highly productive F_1 Brahman × Hereford or Brahman × Angus cow. As with the two-breed rotation, however, the Brahman-sired females will be distinctly different from the Angus and Hereford-sired females, in both appearance and in expected age at puberty.

Rotational Crossbreeding Systems Using Brahman-Derivative Breed or Crossbred Bulls

A criticism of the two- and three-breed rotations that were just discussed is the variability that can be produced in terms of degree of Brahman characteristics. It is possible to maintain a constant level of Brahman influence, say three-eighths, in all calves produced through use of a rotation of Brahman-derivative breeds (each with three-eighths Brahman), such as the rotation of Brangus × Braford × Simbrah (**Figure 4**). This is the system that has been used at the Deseret Ranch for nearly 15 years. A simplification of the system would be to use just two Brahman-derivative breeds in the system, Beefmaster × Brangus, for example. One advantage of this type of rotation is that the appearance of most of the calves from each of the sire breeds is similar in terms of Brahman characteristics and other traits. This is especially true when bulls of each sire breed are approximately the same frame size. While some variation in the amount of ear and skin occurs in the calves from this type of crossbreeding program, the majority of the calves should appear to have roughly the same degree of Brahman influence as the parental 3/8 Brahman breeds. One of the disadvantages of this system is that the growth and reproductive rates of the calves produced are likely to be somewhat less than that from the three-breed rotation involving the "purebred" sire breeds (Brahman, Angus, Hereford) due to a lower level of heterosis maintained using this system. The weaning weights of the calves from such a system may not be much less than that of the traditional three-breed rotation of Angus, Hereford and Brahman, however, if a larger breed such as the Simbrah is included in the rotation. Because of the general availability of bulls of these breeds and the fact that this type of crossbreeding system produces both replacement heifers that will work in Florida and feeder calves that are acceptable to the western stockering and finishing programs makes it one of the most practical for use in Florida today.

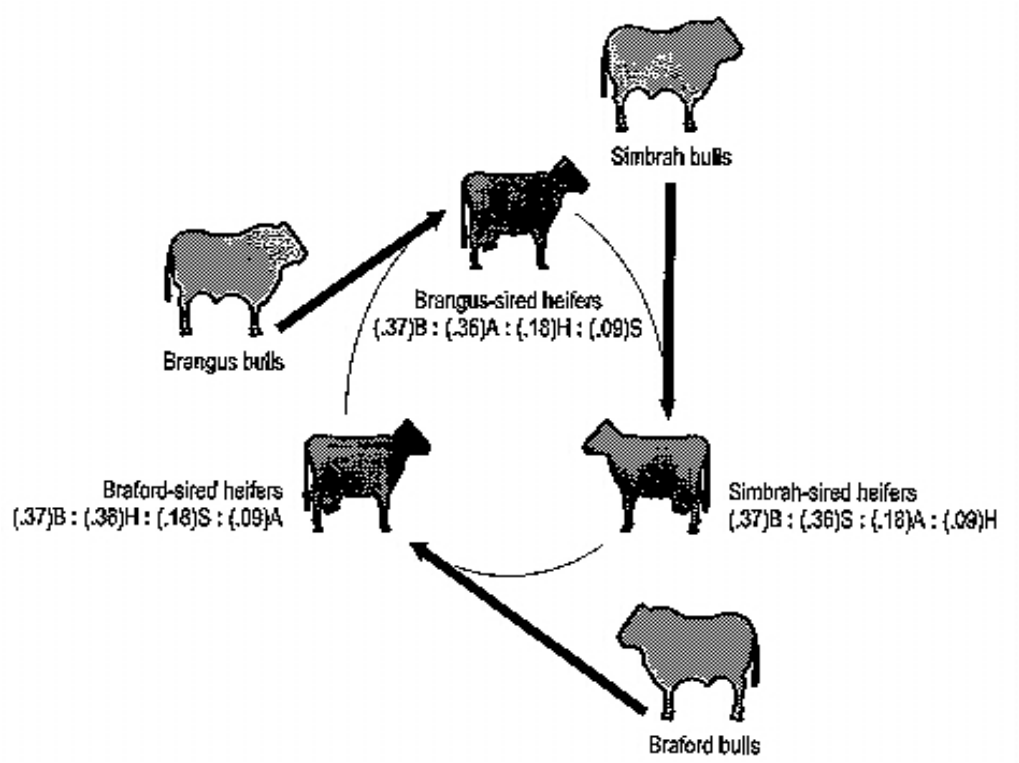

Figure 4. Three-breed rotational cross using Brahman-derivative breeds

Rota-Terminal Crossbreeding

A variation on the terminal-cross crossbreeding system which at least partially overcomes the problem of the procurement of replacement heifers for a terminal crossbreeding system has been called a "rota-terminal" crossbreeding program. With a rota-terminal system (diagramed in Figure 5), replacement heifers are produced in a two-breed rotational crossing scheme, (such as Brangus × Simbrah), and then all cows which are not needed to produce replacements are bred to an unrelated, rapidly growing breed with good carcass characteristics, such as the Charolais. All the Charolais-sired calves and the Brangus × Simbrah crossbred steers are sold as feeders. A simple and practical way of handling this type of system would be to maintain Brangus and Simbrah breeding herds during the first part of the breeding season, say four to six weeks, and then pull all Brangus and Simbrah bulls and turn out Charolais bulls for the remainder of the breeding season. Alternatively, an artificial insemination program using Brangus and Simbrah semen might be used early in the breeding season and then the Charolais bulls would be used as clean-up bulls. The replacement heifers are kept from the earlier calving, more fertile cows using this system of crossbreeding. There is an added advantage that the early-born heifer calves, which tend to conceive earlier as yearlings, are the ones from which the replacements are kept. Also, the later-born heifers, which otherwise would be lighter at weaning simply due to being younger, may be comparable in weight to the earlier-born heifers as they are sired by the growthier, terminal-cross breed bulls.

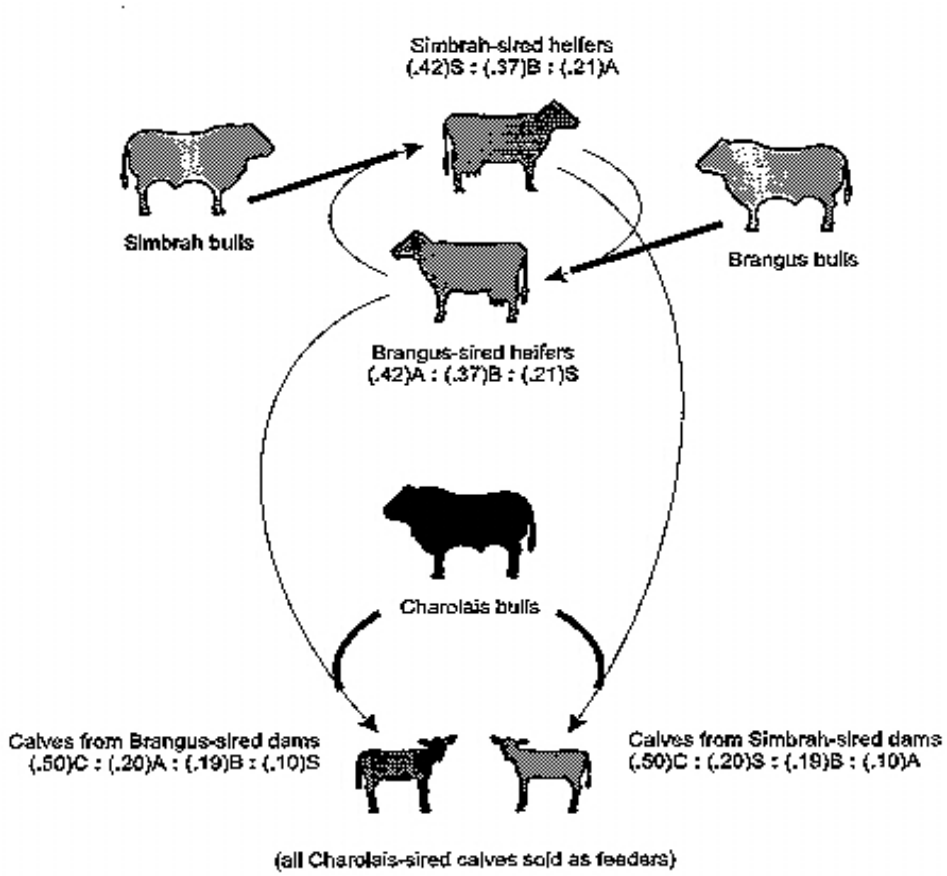

Figure 5. Rota-terminal crossbreeding using Simbrah, Brangus, and Charolais breeds

Bull Selection for Use in Crossbreeding Systems

Regardless of the system of mating and breeds used, care must be taken to select superior purebred animals to initiate and(or) continue a crossbreeding program. Selection of bulls is especially important as in just three generations, they will account for 87.5% of the genetic makeup of the herd. When considering the traits required in the bulls used, it is important to consider what will be required of their progeny as the final product: the slaughter steers and heifers and their carcasses, and also of the heifers that will be kept as replacements. The finished carcass should weigh between 600 and 850 lb and have .4 to .5 in of fat over the ribeye. This translates into a live weight at slaughter of approximately 1000 to 1300 lb. Cattle that reach this weight range at .4 to .5 in of fat are frame score 5 to 6. Since the purpose of this presentation is to discuss crossbreeding programs, I won't discuss this topic any further at this point. Table 1 contains information on the various traits that should be considered in the selection of bulls to use in crossbreeding systems.

For further information regarding bull selection and crossbreeding programs in general, I would recommend that you ask for a new bulletin (Bulletin 326) entitled "Crossbreeding Programs for Beef Cattle in Florida" that will be released soon.

I would like to end this by reiterating my comments regarding Mac Peacock and his career here at Ona. His Master's Thesis which was entitled "Factors Affecting the Weaning Weight of Range Calves" and was dated January, 1953 used data collected on calf weaning weights from 1945 to 1951 at this Range Cattle Station. Mac worked here in crossbreeding research for nearly 35 years. Mac was responsible for two major, long-term crossbreeding studies. The first involved crosses of the Brahman and Shorthorn breeds maintained under different pasture conditions. A major result of this study was one of the first documentations of genotype by environmental interactions as the crossbred cows had a greater response to the improved pastures. The second major crossbreeding study utilized the Angus, Charolais and Brahman breeds and this study was planned and conducted by Mac along with Dr. Koger from start to finish. The Charolais, Angus, Brahman study continued for many years and multiple generations and yielded much useful information regarding the levels of heterosis to be expected from terminal-cross and rotational crossbreeding systems as well as the use of both purebred and crossbred sires.

Table 1. Selection criteria for bulls chosen as sires in crossbreeding programs.

Birth weight	< 95 lb < 80 lb, if used on heifers EPD appropriate for breed
Weaning weight	> 600 lb + EPD[a]
Yearling weight	Ratio > 100 + EPD[a]
Frame Score	5 or 6
Scrotal circumference	> 32 cm, by 12 months of age + EPD[b]
Ribeye area	> 1.2 in^2 per 100 lb body weight + EPD[b]
Maternal milk	EPD appropriate for breed

[a] Exceptions to the positive EPD rule could be made for large breeds (such as Simmental, Chaolais, Gelbvieh) where EPDs close to zero may be appropriate for Florida conditions.

[b] In breeds where EPDs for scrotal circumference or ribeye area are available, bulls with positive EPD values for these traits should be selected.

UTILIZATION OF BIOSOLIDS ON BAHIAGRASS PASTURES

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Introduction

With the increased costs of fertilizers and low cattle prices there is a need to evaluate alternative economic sources of fertilizers for pastures. Biosolids are an alternative source of fertilizer which is becoming increasingly popular for fertilization of pasture grasses. Not only is it a good source of nitrogen but it also contains other valuable nutrients (such as sulfur, phosphorus, iron, etc). In addition biosolids are an organic source of nitrogen, making it a slow release fertilizer.

Biosolids can also be applied to agricultural land to improve physical properties (e.g., water retention, infiltration, aggregate stability) and chemical characteristics of soils. In the past there had been concern over heavy metal contamination from sludges and biosolids. Over the past 30 years biosolids and sludges have become substantially cleaner and thus heavy metal contamination of the environment from sludge application is of little concern. The concentrations of nutrients and heavy metals in sludge should be provided by the suppliers.

Using biosolids as an organic slow release fertilizer for crops and grasses grown in Florida would be a beneficial source of nutrients compared to inorganic fertilizers which can leach more readily than slow release fertilizers in sandy soils. Before biosolids can be used by growers in Florida there is a need to demonstrate that it is a safe and viable source of nutrients for crops in Florida. There is also a need to determine how fast nitrogen is made available to the grass.

The objectives of this study were to evaluate granular biosolids as a potential source of nutrients for bahiagrass as well as to determine the rate of nitrogen availability.

Experimental Procedure

An experiment was set up on an established bahiagrass pasture located at the Range Cattle Research and Education Center to determine the rate of release of nitrogen from granular biosolids. In addition the study evaluated the effect of granular biosolids on bahiagrass production and quality. Treatments consisted of 7 rates (0, 0.25, 0.5, 1.0, 2.0, 4.0, and 8.0 tons pelletized biosolids/acre). These rates of biosolids provided 0, 22.5, 45, 90, 180, 360 and 720 lbs N/acre, respectively.

Table 1 shows the chemical analyses of the granular biosolids used for the study. The biosolids were surface applied in April the first year and March the second year of the study. There were also an additional 5 treatments which only received biosolids the first year in order to evaluate how long biosolids would last. Treatments were applied to 10 X 20 ft plots and randomized in a complete block design with 4 replications.

Soil samples were collected periodically at 6 inch increments to a depth of 3 feet, during the growing season and analyzed for pH, macro- and micronutrients and selected heavy metals (Pb, Cd, and Ni). Bahiagrass was harvested every 35 days for yield and tissue analyses of various nutrients as well as protein, digestibility and heavy metals.

Results and Discussion

Yield

In both 1994 (Figure 1) and 1995 (Figure 2) total bahiagrass yields increased with increasing rates of biosolid application. Yields in 1994 ranged from 4.5 to 10 tons/acre for the 0 and 8 ton biosolid/acre treatments, respectively. In 1995 similar yield increases were observed. Yield increases from biosolid application were observed in all harvests.

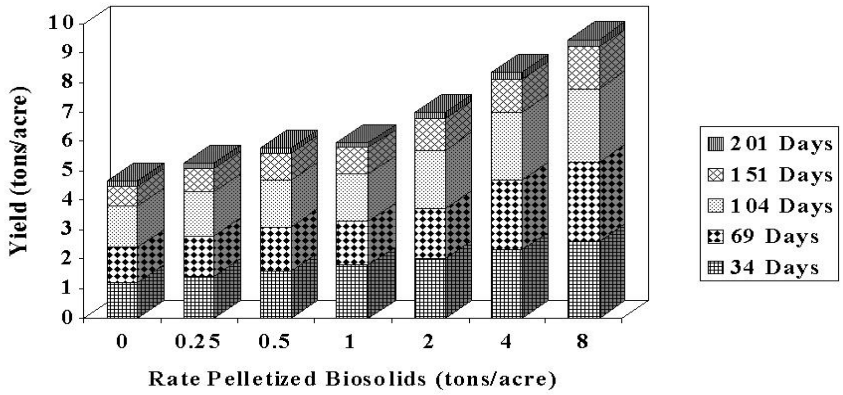

Fig. 1. Total dry matter yield of bahiagrass forage in 1994.

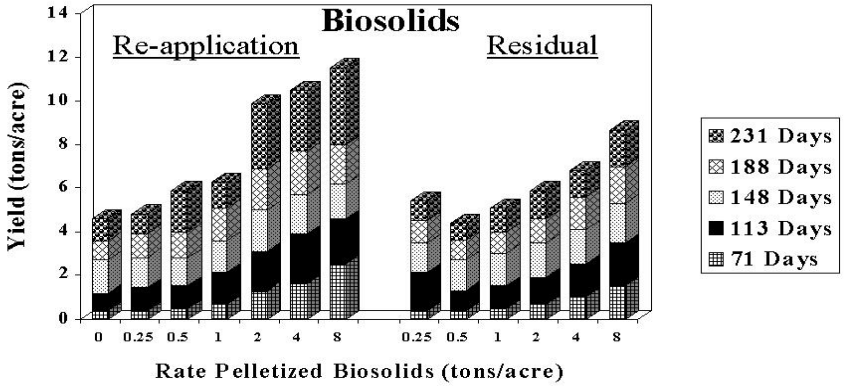

Fig. 2. Total dry matter yield of bahiagrass forage in 1995.

Residual treatments which only received biosolids in the first year of the study still showed yield responses in the second and third year (Figure 2). This indicates that biosolids are a slow release source of nutrients providing nutrients for up to 2 years after application. Thus when considering the economics of biosolid application one needs to consider the long term benefits as well as the immediate ones.

Tissue Composition

Crude Protein

Crude protein content of bahiagrass was increased with increasing rates of biosolids in both 1994 (Figure 3) and 1995. This is a result of biosolids providing needed nitrogen for protein production of the grass. The residual treatments in 1995 which again had only received biosolids at the beginning of the study also showed increases in crude protein content 1 year after application. This again indicates the long term benefits from biosolid application.

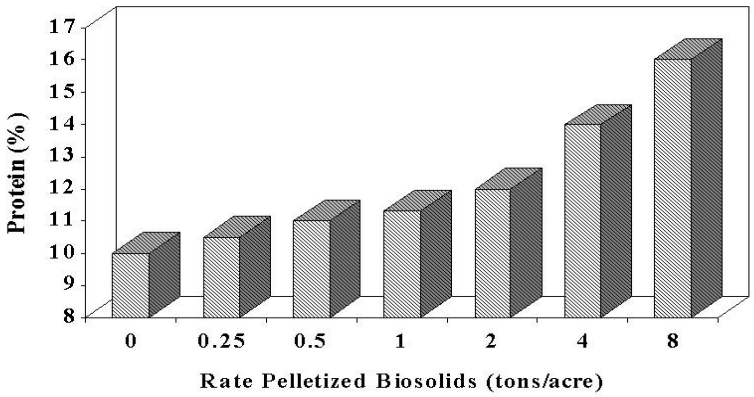

Fig. 3. Protein content of bahiagrass at the June harvest, 34 days after biosolid application.

In Vitro Digestibility

In the first year an increase for in vitro dry matter digestibility was observed in the first harvest with increasing rates of biosolids (Figure 4). However, over time these increases were reduced with no effect in the second year of the study.

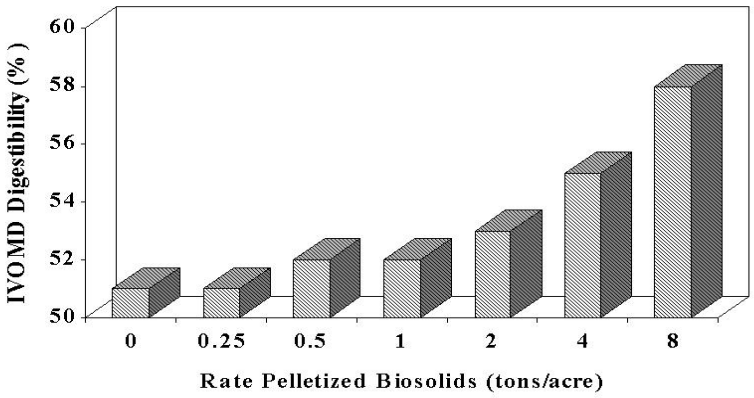

Fig. 4. IVOMD digestibility of bahiagrass at the June harvest 34 days after biosolid application.

Rate of Nitrogen Availability

Availability of nitrogen from biosolids increased as rate of biosolids decreased. Approximately 75% of the nitrogen in the biosolids was available to bahiagrass the first year at the low rate of biosolid application rate (0.25 tons/acre) (Figure 5). At the highest rate of biosolid application (8 tons/acre), nitrogen availability the first year was reduced to 30%. This is probably a result of bahiagrass nitrogen uptake being maximized.

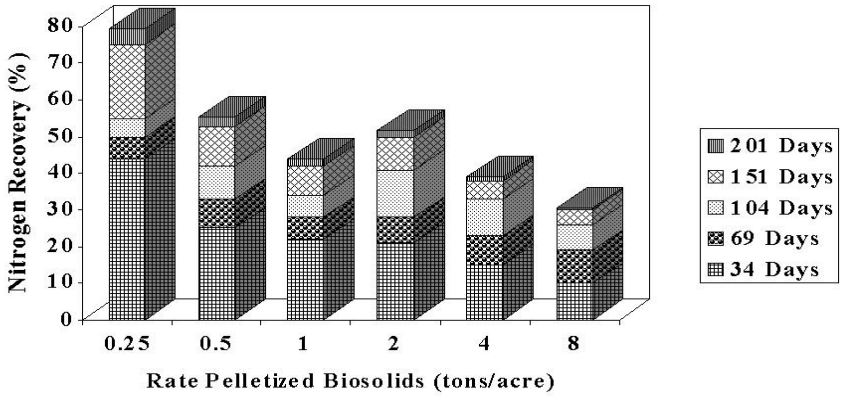

Fig. 5. Nitrogen recovery by bahiagrass.

Laboratory studies were also conducted to evaluate the rate of nitrogen release as affected by the size of the pellets. The study showed that smaller granulation of the biosolids (ground vs pellets) contributed to a faster release of nitrogen (Figure 6).

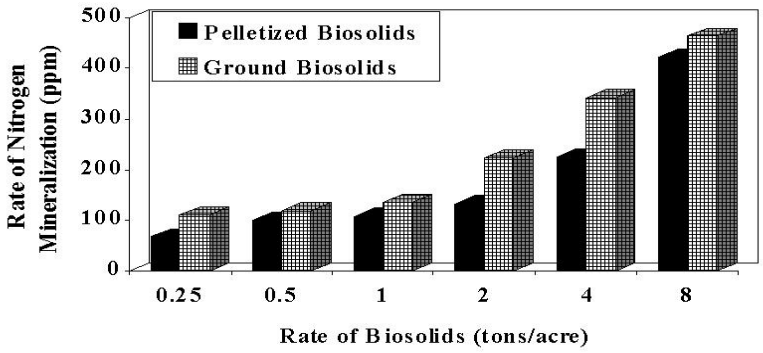

Fig. 6. Nitrogen mineralization (comparison of pelletized to ground biosolids).

Other Nutrients and Metals

Iron uptake in bahiagrass increased at increasing rates of biosolid application (Figure 7). This shows that biosolids are a source of iron for grasses. A typical sign of iron deficiency in bahiagrass is yellow chlorotic patches which normally appear early in the growing season soon after nitrogen application. Zinc, Cu, and Mn levels were also increased in the bahiagrass as a result of biosolid application. Thus, biosolids appear to be a good source of micronutrients. There were also trends showing P levels in tissue to increase with application of biosolids. Levels of heavy metals (Cd, Pb, Ni, and Ba) were low in all the bahiagrass harvests at any of the biosolid rates.

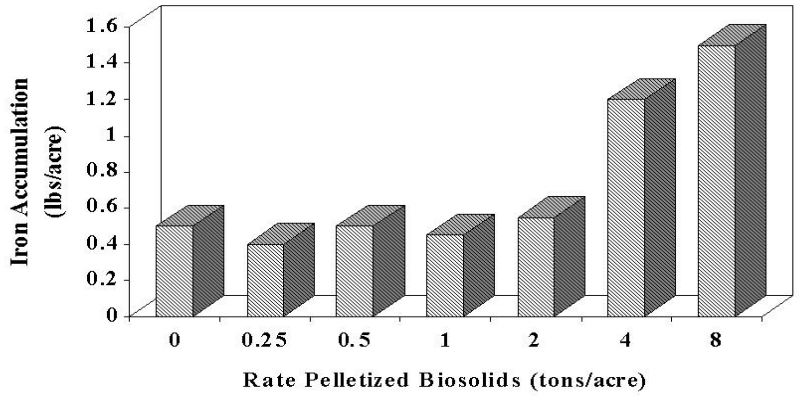

Fig. 7. Iron accumulation by bahiagrass at the June harvest, 34 days after biosolid application.

Soil Analysis

Soil samples taken below the 6 inch depth indicated low levels of all nutrients including P and N. Heavy metals (Pb, Cd, Ni) levels were very low in all soil samples. This indicates biosolid application to soils at agronomic rate to pose no environmental problems.

Conclusions

Results of this study indicate that biosolids increase yields and quality of bahiagrass. Approximately 30 to 75% of the nitrogen from the biosolids is available to the grass the first year with the other 25 to 70% available in the following years. Thus, biosolids are a good alternate source of fertilizer which can be used on forage grasses grown in Florida.

Table 1. Composition of the Municipal Biosolids (Dry Weight Basis) for the First Year (1994) and Second Year (1995) of Application (Average Values from 3 Analyses Performed).

Element	**Concentration**	
	Year 1	**Year 2**
N (TKN) (%)	4.14	4.91
NH_4-N (%)	0.35	0.41
NO_3-N (%)	<0.01	<0.01
P (%)	4.14	2.05
K (%)	0.11	0.10
S (%)	3.43	3.27
Ca (%)	2.0	1.9
Mg (%)	0.60	0.58

Na (%)	0.15	0.20
Fe (ppm)	19,400	19,500
Mo (ppm)	4.75	6.8
Mn (ppm)	430	418
Cu (ppm)	777	821
Zn (ppm)	1,105	923
Cd (ppm)	7.47	6.61
Ni (ppm)	45.9	48.0
Pb (ppm)	262	208
pH	7.02	7.29

NUTRITIONAL BENEFITS OF LEGUMES FOR FLORIDA PASTURES

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Grass-legume mixtures have been recommended because greater livestock production could result when legumes were present compared to grass alone. Drs. Hodges and Pitman reported summer-long average daily gains (ADG) at 1.0 and 1.3 lb/head/day, respectively, for yearling steers grazing aeschynomene-bahiagrass mixtures (*vs.* 0.6 and 0.9, respectively, for bahiagrass alone) at the Range Cattle REC. I think that we have been realistic in saying that legumes are not suited to management used on all ranches, and to those who wish to grow legumes, we have been quick to point out that the annuals are very undependable because of weather. However, we have failed to point out that legumes may not always result in greater livestock performance even with stands which we consider to be good.

There may be two situations when livestock respond positively to legumes growing in bahiagrass. First, when bahiagrass is deficient in protein and can not meet needs of the cattle. Here, there must be a sufficient amount of leafy legume to provide the protein. A second situation is when a very nutritious legume is present in large amounts and is a major part of the diet. Here, protein and TDN from the legume can increase animal performance over bahiagrass even though bahiagrass alone is a good pasture. We are going to look for these situations in two studies.

The first study involved *Aeschynomene evenia* (evenia) and bahiagrass continuously grazed (no pasture rotation) by 1.5-yr old steers (530 lb shrunk) in 1996 and 2-yr old heifers (709 lb shrunk) in 1997. Cattle were stocked at 1.2 head/A (3 head on 2.5 acre pastures). Evenia+bahiagrass was compared to unfertilized bahiagrass in both years (two replicates of each treatment in each year). Evenia was sown in February 1996 after burning bahiagrass, and in 1997 it came back from live-over plants and from seed. These were fair to good stands of evenia with average plant densities of 2.5 and 1.3 plants / ft^2 in 1996 and 1997, respectively.

In August 1996, steers grazing evenia+bahiagrass had greater ADG than steers grazing bahiagrass alone (Table 1), otherwise there were no differences in ADG between treatments. I do not attribute this lack of response to evenia being an unpalatable legume compared with American jointvetch (*A. americana*), with which you are more familiar. When grazing began, evenia was about 12" tall and was readily eaten.

Table 1.Average daily gain and live weight gain (LWG) of yearling steers grazing bahiagrass + evenia or bahiagrass alone over 112 d in 1996.

	July	**Aug**	**Sept**	**Oct**	**LWG**
	---------- lb/head/day ----------				- lb/A -
bahiagrass + evenia	1.1	2.1	1.2	1.1	187
bahiagrass alone	1.1	1.1	1.2	1.3	158

Estimates of evenia (leaves and stem tips) as a percentage of diet dry matter were 5%, 25%, 10% and 5% for July to October, respectively. Available whole-plant evenia increased from 440 lb/A in July when evenia was leafy and high in nutritive value to 2510 lb/A in October when it was mostly stem and very low in crude protein (Table 2). The palatable, nutritious leaves that made up 25-30% of the whole-plant evenia yield in July and August were mostly gone by September. Leaves ranged from 23% crude protein and 72% TDN in July to 18% crude protein and 63% TDN in October. Because of the stem, whole-plant evenia was lower than bahiagrass in TDN at every date. Hand-plucked

bahiagrass leaves dropped below 8.0% crude protein in August, but otherwise bahiagrass alone provided good protein and TDN for these steers.

Table 2. Available forage (dry matter), crude protein and total digestible nutrients (TDN) in bahiagrass + evenia or bahiagrass alone in 1996.

	July	**Aug**	**Sept**	**Oct**
	---------- yield, lb/A ----------			
bahiagrass +	2710	2720	2020	2030
evenia (whole plant)	440	1310	1480	2510
Total	3150	4030	3500	4540
bahiagrass alone	2540	2380	2260	1880
	---------- Crude protein, % ----------			
evenia (leaves)	23.3	21.2	24.7	18.4
evenia (whole plant)	11.7	11.9	11.6	7.8
bahiagrass alone[t]	8.0	7.6	8.7	8.5
	---------- TDN, % ----------			
evenia (leaves)	72.1	67.9	68.4	63.3
evenia (whole plant)	44.0	43.7	35.7	31.3
bahiagrass alone[t]	54.8	53.7	51.7	52.7

[t]Hand plucked leaves.

Over the 112-day grazing seasons in both years, there were no statistically significant differences in ADG between treatments. In 1996, ADG averaged 1.4 lb/head/day for steers grazing evenia+bahiagrass *vs.* 1.2 for steers grazing bahiagrass alone. In 1997, ADG averaged 0.7 lb/head/day for heifers grazing evenia+bahiagrass *vs.* 0.9 for heifers grazing bahiagrass alone. I believe there was just not enough leafy evenia available throughout the grazing season to result in an animal response. Perhaps I managed evenia so that cattle used it before it was really needed, and when the leaves could have provided a nutritional input, they were gone.

In the second study, June-weaned (9-month old) steers (525 and 561 lb shrunk in 1996 and 1997, respectively) continuously grazed leucaena (1 acre) + bahiagrass (1 acre) *vs*. bahiagrass alone (2 acres). Steers were stocked at 1.5 head/A (3 head on 2 acres), and there was no supplement fed. There were three replicates of each treatment in each year. Bahiagrass was fertilized with 50 lb N/A in March and was grazed periodically before steers were placed on bahiagrass in June. All steers grazed 9 acres of bahiagrass and had access to a small leucaena area not used for the study so they could become accustomed to the legume. At the first of July, steers were assigned to their respective pastures.

Average daily gain at every 28-day weigh date was greater for steers grazing leucaena and bahiagrass compared to ADG of steers grazing bahiagrass alone (Table 3). It is estimated that leucaena leaves made up at least 40% of the diet dry matter from July to mid-September. By mid-October, leucaena leaves made up <5% of the diet.

Table 3. Average daily gain and liveweight gain (LWG) of June-weaned steers grazing leucaena + bahiagrass and bahiagrass alone over 112 d. Average 1996 and 1997.

	July	**Aug**	**Sept**	**Oct**	**LWG[t]**
	---------- lb/head/day ----------				- lb/A -
leucanena + bahiagrass	1.4	1.5	0.5	0.8	116
bahiagrass alone	0.9	0.3	-0.6	0.0	19

Leucaena leaves were present in large amounts in July and August, after which their yield declined through September to October (Table 4). Crude protein concentrations in leucaena leaves were very high, and earlier research has indicated that this protein is of high quality. Hand-plucked samples of bahiagrass, which simulated what steers were eating, were relatively high for that grass, and were well above levels needed by grazing steers. The point being that the response to leucaena was not a protein response. Leucaena leaves, which were a large part of the diet, were high in protein and TDN which resulted in good steer gains.

Table 4. Available forage (dry matter), crude protein and total digestible nutrients (TDN) on 2 acre units grazed by June-weaned steers. Treatments were 1 acre bahiagrass + 1 acre leucaena vs 2 acres bahiagrass alone. Average 1996 and 1997.

	July	**Aug**	**Sept**	**Oct**

	---------- yield, lb/A ----------			
bahiagrass (1 acre)	2580	2010	2470	2060
leucaena leaf (1 acre)	1970	1880	850	210
Total (2 acre)	4550	3890	3320	2270
bahiagrass alone (2 acre)	6050	4740	6020	4820
	---------- Crude protein, % ----------			
leucaena leaf	28.0	25.7	27.8	34.1
bahiagrass alone[t]	10.1	9.1	8.9	8.9
	---------- TDN, % ----------			
leucaena leaf	61.8	57.9	59.0	68.1
bahiagrass alone[t]	53.1	48.2	46.9	43.8
[t]Hand plucked leaves.				

The grazing season on legumes in Florida is short (about 125 days). In spring, rainfall limits growth of legumes until June, and in fall flowering and short days in September limits growth after that time. When you are lucky enough to get a good stand, legumes are a limited resource. I think ranchers need to judge when cattle are likely to get the most from legumes and time grazing in relation to nutritive value of the bahiagrass and the nutritional demands of cattle.

HEIFER DEVELOPMENT ON 'FLORALTA' LIMPOGRASS PASTURES

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'Floralta' limpograss (*Hemarthria altissima*) was released in 1984 as a more persistent limpograss compared to others available at the time, however it was noted through digestion and laboratory studies that Floralta was of lower quality than some other limpograsses such as Bigalta.

A factor contributing to the large increase in acreage of limpograss in Florida is its ability to produce during the cool season. It has been determined that 30 to 40% of the total annual production from limpograss occurs during the cool season. Limpograss tends to be greater in energy but lower in crude protein (CP) than most other tropical grasses. It holds its energy value with advancing maturity, and this along with its ability to grow during the cool season has contributed to ranchers stockpiling this grass during the late summer and fall for use during the winter and dry early spring. Limpograss is better adapted to wetter, higher organic matter soils, and some producers suggest that this is the only type soil that limpograss should be planted on. However there is large acreage of limpograss on typical flatwoods soil. It has been suggested that limpograss has a lower N requirement than some other stem-type tropical grasses. Generally limpograss is not affected by armyworms or loopers.

In terms of the challenges facing the use of limpograss, it is affected by spittle bug. The way we graze limpograss at the Range Cattle REC by allowing it to stockpile during the early summer probably contributes to the spittle bug problem. However we have never lost a stand due to spittle bug. I believe this is because our grazing management does not impose a great deal of stress on the stand which allows it to recover from various stressors. Yellowing of limpograss pasture particularly after heavy grazing or fertilization is an issue that has increased over the past 3 to 4 years. Although yellowing of limpograss forage is related to an iron deficiency, in my opinion management of the grass relative to the stress that is placed on the stand is also a major contributing factor.

We have not seen a problem with mole crickets in limpograss pastures at the Range Cattle REC, although there may have been some reports among producers during 1997. These reports may have been related to marginally inappropriate soils that the limpograss was established on. Although Floralta is more persistent than other hemarthrias, in my opinion it potentially has a persistence problem relative to some of the stars and bermudas. This makes management of this grass very important.

We have grazed limpograss under both continuous and rotational systems, and as a general statement concerning stem-type tropical grasses, and especially limpograss, in my opinion they should be rotationally grazed. The ranchers that I think are doing the best job with limpograss are using a rotational system. Rotational grazing means different things to different people in terms of grazing duration and rest period, but no one I know is grazing limpograss continuously during an entire growing season.

Grazing evaluation comparing limpograss to bahiagrass conducted by Lynn Sollenberger (Agronomy Journal, 1989, 81:760) showed similar daily gain between the two grasses, but due to greater forage production, gain per acre was greater for limpograss. Crude protein was greater for bahiagrass forage while IVOMD was greater for limpograss forage. Due to greater IVOMD, it was thought that cattle grazing limpograss would have a greater daily gain, however it was noted that low CP of the limpograss forage may have limited animal performance.

Because CP of limpograss is relatively low and IVOMD is relatively high, it was thought that improved cattle performance could be obtained by providing a protein supplement to cattle grazing limpograss. Lynn Sollenberger's research group (Table 1) utilized a grazing only control, and fed a corn-urea supplement to provide two levels of supplemental protein from urea to cattle rotationally grazing limpograss.

Table 1. Protein supplementation of steers grazing limpograss pasture.

	Daily gain, lbs	**BUN**
Control - grazing only	0.6	6.0
Low protein	1.2	8.2
High protein	1.3	11.4

Forage availability data from pasture, lbs DM/acre

Start of a rotational cycle	6280
End of a rotational cycle	3410

Crude protein of pasture	6.9
IVOMD of pasture	59.0
TDN/CP	8.6

BUN = blood urea nitrogen, mg/dL, DM = dry matter,

IVOMD = in vitro organic matter digestion, TDN = total digestible nutrients.

Holderbaum (1991; Journal of Production Agriculture, 4:437)

Providing urea which is a ruminally degradable protein, resulted in increased daily gain compared to the control. Blood urea nitrogen (BUN) has been used as an indicator of protein status in cattle. Cattle with BUN values below 8 to 10 mg/dL are thought to be in negative protein status and might respond to supplemental protein. BUN values were increased by protein supplementation. Forage data in this study showed that pregraze values were 6300 lbs DM per acre, with postgraze values at 3400 lbs DM per acre. These values are low compared to studies at the Range Cattle REC, indicating differences in grazing management between the two sites. Crude protein of the limpograss forage was relatively low while IVOMD was relatively high. The ratio of TDN to CP has been used as a forage index to suggest when providing a protein supplement might be called for. An increasing ratio suggests that inadequate protein is available to support the energy level in the forage. The critical level for this ratio is 7 to 10. In this study the TDN to CP ratio of the limpograss pasture was consistent with a response to protein.

Studies at the Range Cattle REC evaluated protein supplementation of steers grazing limpograss pastures from May through December. Steers were fed 5 lbs per head daily of a molasses based supplement containing a control (no additional protein), urea which is a ruminally degraded protein, feathermeal which is a high ruminal escape protein or a combination of urea and feathermeal. No response to protein supplementation was found over 3 years of the study. Near the start of the study, there was over 10,000 lbs forage DM per acre and near the end there was over 7500 lbs.

Why the response to protein supplement in studies at Gainesville and not at the Range Cattle REC? Pitman et al. (1994; Crop Science, 34:210) conducted CP and IVOMD analyses on separated leaf and stem fractions of limpograss pasture (Table 2). They found that IVOMD and CP of limpograss leaf were relatively high and fairly well balanced, while for the stem, IVOMD was high, but CP was very low, and the TDN to CP ratio was highly out of balance.

Table 2. Crude protein and in vitro organic matter digestion of leaf and stem fractions of limpograss pasture.

		Leaf			**Stem**		
	Forage lbs DM/a	IVOMD	CP	TDN/CP	IVOMD	CP	TDN/CP
Summer	14,500	52	7	7.4	50	2	25.0
Fall	10,800	56	9	5.6	54	4	15.4

DM = dry matter, IVOMD = in vitro organic matter digestion, %;CP = crude protein, % TDN = total digestible nutrients, %.

These results relate to the Gainesville and Range Cattle REC studies through differences in grazing management, timing and length of the studies. Studies in Gainesville concluded in the fall, and grazing management resulted in greater utilization of the available forage during a pasture grazing cycle. This probably resulted in a greater proportion of stem in the diet which is low in CP relative to energy and therefore better suited for a protein response. Grazing management in studies at the Range Cattle REC resulted in ample forage at the corresponding time as Gainesville studies. This probably resulted in a greater proportion of leaf in the diet which is better balanced between energy and protein and less likely to see a protein response.

These studies led us to initiate a heifer development program utilizing limpograss. We are using a 5 pasture rotation with 1 week of grazing and 4 weeks of rest. Heifers are weaned in September and bred in March and April. Pastures are fertilized with 300 lbs per acre of a 20-5-10 in the spring and 200 lbs per acre of ammonium nitrate in the fall.

A major objective of our study is for limpograss to be the sole source of forage such that no hay is fed during the winter and early spring. To do this we have to stock the pastures to get through the time of year where forage availability is at its lowest, which for us is the early spring. Under these conditions at our location this stocking rate is 1 heifer per acre.

During the first two years of the study we compared two treatments from weaning (early October) until the end of the breeding season (April 30): 6 lbs per head daily of a molasses (93%)-urea (7%) or a molasses (83%)-urea (2%)-feathermeal (15%) supplement. During this time we were evaluating the response to natural protein.

Table 3. Performance of weaned heifers grazing limpograss and fed molasses based supplements containing urea or urea and feathermeal.

		Initial weight, lbs	**Weight at bulls in**	**% that met target weight**	**Weight at bulls out**	**% pregnant**
Year 1	**Urea**	528	668	65	711	65
	Urea-FM	528	675	75	750	65
Year 2	**Urea**	557	640	80	737	57
	Urea-	557	654	86	770	79

	FM					

Initial weight taken in early October; Bulls in is the start of the breeding season (March 1); % that met target weight at the start of the breeding season (650 lbs in year 1 and 600 lbs in year 2); Bulls out is the end of the breeding season (April 30).

Heifers used in the first year were from the Range Cattle REC herd, while those used in the second year were from Ralph Palez, and were of a lower mature size and weight than the Range Cattle REC cattle, although they were heavier but the same age at the beginning of the trial. In both years, heifers fed the supplement containing FM were only slightly heavier at the start of breeding. 65 to 75% of the heifers reached target weight in year 1, while greater than 80% reached target weight in year 2. Pregnancy percentage was not influenced by treatment in the first year but was increased in the second year. It is important to note that heifers were of excellent weight and body condition following the breeding season.

The response to protein supplementation was related to occurrence of first frost, and number of cycles through the rotational grazing system. From the start of the trial until first frost, heifers gained slightly more than 1.0 lbs daily, there was no difference between treatments. This also totaled approximately three grazing cycles, and condition of the upper layers of the sward was deteriorating with regard to leaf percentage and forage quality. From first frost until end of the breeding season, heifers fed the supplement containing urea-feathermeal had a greater daily gain.

During the first two years of the study, there were approximately 200 days of supplementation from weaning until the end of breeding. Early in the trial, there was no response to protein supplementation, and based upon the fall data after breeding we questioned whether any supplementation was needed in the fall prior to frost. Therefore, in the third year we are evaluating two treatments from weaning until first frost : no supplement - grazing only, and 6 lbs daily of the molasses - urea - feathermeal supplement. After frost, all heifers are fed the supplement until the end of breeding. Beginning October and using an average frost date of mid-January, this potentially could save about 100 days of supplementation.

Table 4. Effect of timing of supplementation on the performance of weaned heifers grazing limpograss.

	Initial weight, lbs	**Weight at suppl.**	**Weight at bulls in**	**% that met target weight**	**Weight at bulls out**

Control	523	612	632	56	770
Supplement	520	611	667	69	814

Initial weight taken in early October; Wt at suppl. = weight when supplement was started for control cattle, also time of first frost (1-14-98); Bulls in is the start of the breeding season (March 1); % that met target weight at the start of the breeding season (650 lbs); Bulls out is the end of the breeding season (April 30).

From the start of the trial until first frost, supplement appeared to be substituting for the forage, and no response was observed. After supplementation began, cattle that were fed supplement from the beginning had better performance so that at the start of breeding, cattle fed supplement from the beginning had a slightly greater percentage that met the target weight. This advantage continued through the breeding season. The important item to note is that all heifers are performing well and at the end of the breeding season, heifers are of excellent body condition and weight.

After the breeding season, heifers were rerandomized and placed on either a control - no supplement, grazing only, or 2 lbs daily of a 32% CP molasses-urea supplement for the spring - summer - fall season. For three years, we have not seen a response to supplementation with 2 lbs of a 32% CP molasses - urea supplement from the end of the breeding season (April 30) until the heifers begin to calve in early December. Heifers are gaining from 1.0 to 1.4 lbs daily during this period. Again forage availability has been very ample during this time.

CURRENT INFORMATION ON MOLE CRICKETS IN SOUTH CENTRAL FLORIDA

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Mole cricket damage to bahiagrass pastures in south-central Florida was severe during 1996-97 but negligible during 1997-98. The average annual cost of mole crickets to Florida pasture and turf in terms of pasture damage, replanting and chemical control is estimated at $50 million. In order to understand the year-to-year variation in mole cricket outbreak on pasture and develop timely control measures, studies were initiated by the South Florida Beef and Forage Extension group in 1997 with the following goals in

mind:

1. To monitor tawny and southern mole cricket population distribution on pasture and relate changes in population to environmental factors.

2. To use mole cricket population histories on pasture to evaluate the effectiveness of commercially available biological and chemical pesticides for control.

3. To select grasses that are tolerant to mole cricket damage and evaluate the impact of fertilizer application on grass tolerance.

1) Monitoring of Mole cricket Populations in Relation to Environmental Factors:

"Pit fall" traps were installed directly on three ranches in Polk county; one ranch each in DeSoto, Pasco, Highlands and Manatee counties and two at the Range Cattle Research and Education Center (RCREC) in Hardee county. With the exception of the RCREC, Ona sites, all the remaining sites contained at least 20 acres of bahiagrass pasture. Three traps were installed on each 10-acre block of pasture. Mole crickets trapped were removed and counted every week beginning from July 1997 through August 1998. The weekly average mole crickets counted in a trap for the various sites and corresponding weekly rainfall are shown in Figure 1.

In DeSoto county, the pasture that was used suffered minor damage during the 1996-97 mole cricket outbreak. The weekly average number of trapped mole crickets in July 1997 was 10 nymphs per trap. The catch declined to 2 adults per trap by October 1997, and dropped to zero between December 1997 and mid May 1998. In late May 1998, a sharp increase occurred in young nymphs trapped at the DeSoto site which now stands at a count of 5 per trap per week.

In Hardee county, a damaged and renovated bahiagrsss pasture showed a July 1997 weekly average count of 2 nymphs per trap. This increased to 10 juveniles per trap between August and September 1997. From October 1997 to March 1998, hardly any mole crickets were observed at this renovated site in Hardee county. Since late May 1998 we have noticed a few nymphs here (1-2 per trap weekly).

In the Pasco county ranch, pasture damage in 1996-97 season was moderate. Between July and August 1997, weekly trapped numbers ranged from 5-10 nymphs per trap. The weekly count declined to 2 adults per trap between November 1997 and April 1998. A resurgence in young nymphs (12 per trap weekly) has been noticed since late May 1998.

For Polk county, two badly damaged pastures were monitored in the Green Swamp (GS) area and one slightly damaged pasture on a deep Sandy Ridge (SR). At the Green Swamp locations, nymph counts during July-August 1997 were 20-80 per trap. Following one heavy rainfall, 350 nymphs were recorded in one single trap. Weekly trapped cricket numbers declined to 5 adults by November 1007 and to zero by March 1998. Since April

1998, weekly cricket counts have ranged between 10 and 95 nymphs per trap in the Green Swamp. Weekly juvenile mole crickets trapped on the Sandy Ridge remained low between 3 and 9 per trap from July to October 1997. Then it suddenly increased to 43-75 winged adults per trap after one major rainfall in November 1997. Since then, the weekly trapped counts of mole crickets on the ridge have stayed high (22 per trap) through June 1998 with an increasing proportion of young nymphs.

In Manatee county, weekly trapped nymphs in a pasture heavily destroyed were as high as 84 per trap in July and August 1997. We counted nearly 500 nymphs in one trap in July 1997 after a 3-inch rainfall. The weekly counts declined sharply to 0-4 per trap between September 1997 and March 1998. From April to July 1998 we have observed about 10 mole crickets per trap weekly, half of which are newly hatched nymphs.

Mole crickets have a life span of one year so we deal with a new generation each year. The transition from old to new normally occurs between May and July. Soil moisture seems to control the movement and activity of mole crickets on bahiagrass pasture. The longer the juvenile and young adult mole crickets remain undisturbed in the soil during fall and winter the greater the damage to pasture is going to be. The record 1997-98 fall and winter rainfall and associated flooding flushed out a large number of juvenile-adult mole crickets from low-lying pastures, resulting in the decline of numbers trapped in all counties. This probably accounts for the negligible damage to pasture during 1997-98 period. Migration of crickets from flooded pasture to sandy ridges as was observed in Polk county indicates that mole crickets are fighters in inclement weather. Golf courses and home-owner lawns, which are normally well drained could provide additional shelter in wet weather. We are already experiencing a resurgence of nymphs on most south-central bahiagrass pastures since the rains subsided.

2) Testing Effectiveness of Commercially Available Pesticides for mole cricket Control

Mole crickets can be controlled biologically. Specific nematodes, red-eyed Brazilian fly and Larra wasp have been used to reduce mole cricket infestation. An advantage of biological control is that the agents continue to attack mole crickets throughout the year. Secondly, biological control does not usually have a negative environmental impact. Unfortunately, production of UF-IFAS's patented nematode (*Steinernema scapterisci)* for mole cricket control, which is marketed as "Proactant" has been on hold for nearly a year. A spring application of Proactant biopesticide will kill 50-80% of adult twany mole crickets before they lay their eggs. Fall applications have proven effective when performed as part of a two-pronged approach (10 Proactant for adult mole crickets and (2) a chemical insecticide for nymphs and juvenile crickets.

Chemical methods of control have been ben difficult for two reasons. Since mole crickets live mostly underground, it is difficult to spray with a contact insecticide. Additionally, mole crickets sample their food before ingesting it. Feed that is not attractive enough is rejected. 'Prozap Agriband' (10% Sevin bait granules) was developed using liquid

molasses as an attractant blended with carbaryl. Due to the lack of nematode biopesticide on the market, the efficacy of Prozap bait for mole cricket control was tested alone in three separate trials in Polk county. Each of the three sites used to monitor mole cricket populations in Polk county was subdivided into two 10-acre fields and installed with three standard pitfall traps. Population histories of fields were developed from July to September 1997. Bait was applied at 10 lb/A to a 10-acre field at each site on 4 September and the other field used as a non-treated control. Due to unsatisfactory control, bait application was repeated on 3 October 1997.

On site 1, on a Sandy Ridge, average weekly mole cricket counts remained about 6 during both bait applications until the influx of adult crickets from low-lying pastures in November 1997 (Figure 2). Overall, there was no difference between treated and non-treated fields in weekly counts of mole crickets.

On site 2, in the Green Swamp area, weekly mole cricket counts per trap before Prozap bait application ranged from 24 to 149 on field targeted for treatment and 0-20 for the non-treated field (as shown in Figure 3). These crickets were mostly nymphs and juveniles. On 4 September when bait was first applied, weekly mole cricket counts were 20 and 8 for the treated and non-treated fields, respectively. There was a temporary 65% decrease in mole cricket counts on treated field 2 weeks after bait application, but this increased back to 20 the following week, prompting us to administer a second bait application on 3 October 1997. We observed that mole crickets (mostly adults) were attracted to the treated site immediately after the second bait application. From then on, weekly trappings declined sharply on both fields for the rest of the year because of heavy rains and flooded soil conditions.

On site 3, also in the Green Swamp, weekly mole cricket counts declined 60% 2 weeks after the 4 September bait application (Figure 4). However, a large number of mole crickets were attracted to the treated field after the 3 October bait application. Flooded soil conditions prevented long term evaluation of bait effectiveness at this site as well.

Our preliminary conclusions on Prozap bait were (1) the bait has a capacity to attract mole cricket immediately after application and is lethal when consumed (2) At 10 lb/A, a blanket application of Prozap will cost around $18/A. It will rather be cost effective if it is applied to known "hot spots" (areas with heavy concentrations of mole crickets) and (3) long term effectiveness could not be determined due to confounding heavy rainfall. We plan to test it again in fall of 1998.

3) Selection of tolerant Grasses under Various Fertilizer Regime

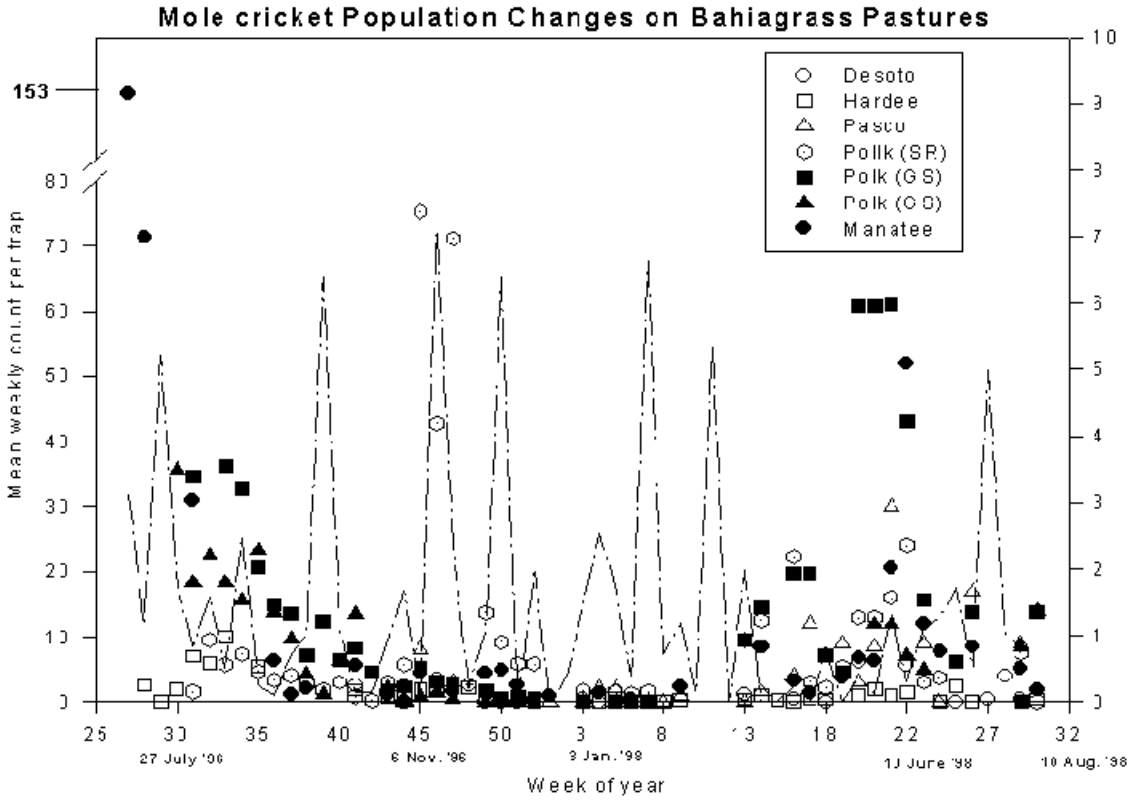
Strips (50 x 200 ft) of Pensacola bahiagrass, Floralta limpograss and Florona stargrass were established alongside one another in Hardee, Pasco, DeSoto and Manatee counties in July 1997. There are three replications at each location. Established grass strips were cut back in March 1998 and four fertilizer treatments (60 lb N/A, 60-25-60 lb/A of N-P_2O_5-K_2O, N-P_2O_5-K_2O plus micro-nutrients, and a control) were applied to 50 x 50 ft sections of each grass. Besides the fertilizer treatments, bahiagrass also received lime vs.

no-lime treatments. Metal exclosure cages are installed on each plot to allow for cattle grazing and grass yield determination at each location. Grass is harvested at 35 d intervals for yield and quality. Additionally, pitfall traps are installed on the 60 lb N/A fertilizer treatment for each grass to monitor relative mole cricket infestation.

Preliminary cricket information in 1998 (Table 1) indicates a greater number of mole crickets trapped on limpograss in Pasco and Manatee counties and least number trapped on stargrass. However, these new stands of grass do not appear to be damaged by mole crickets enough to influence forage yields.

Table 1. Weekly trapped mole cricket counts in grass cultivars grown in several south central counties during 1998.

County	**Grass**	**Mole cricket infestation - Weekly count per trap -**
DeSoto	Pensacola bahiagrass Floralta limpograss	**1.6a** **1.3a**
Hardee	Pensacola bahiagrass Floralta limpograss Florona stargrass	**0.6a** **0.6a** **0.1a**
Pasco	Pensacola bahiagrass Floralta limpograss Florona stargrass	**5.8b** **27.2a** **1.0c**
Manatee	Pensacola bahiagrass Floralta limpograss Florona stargrass	**19.4b** **39.4a** **17.2b**


Mole cricket Population Changes on Bahiagrass Pastures
153
Desoto
Hardee
Pasco
Polk (SR)
Polk (GS)
Polk (OS)
Manatee
Mean weekly count per trap
Weekly rainfall, in
Week of year
27 July '96
6 Nov. '96
9 Jan. '98
10 June '98
10 Aug. '98

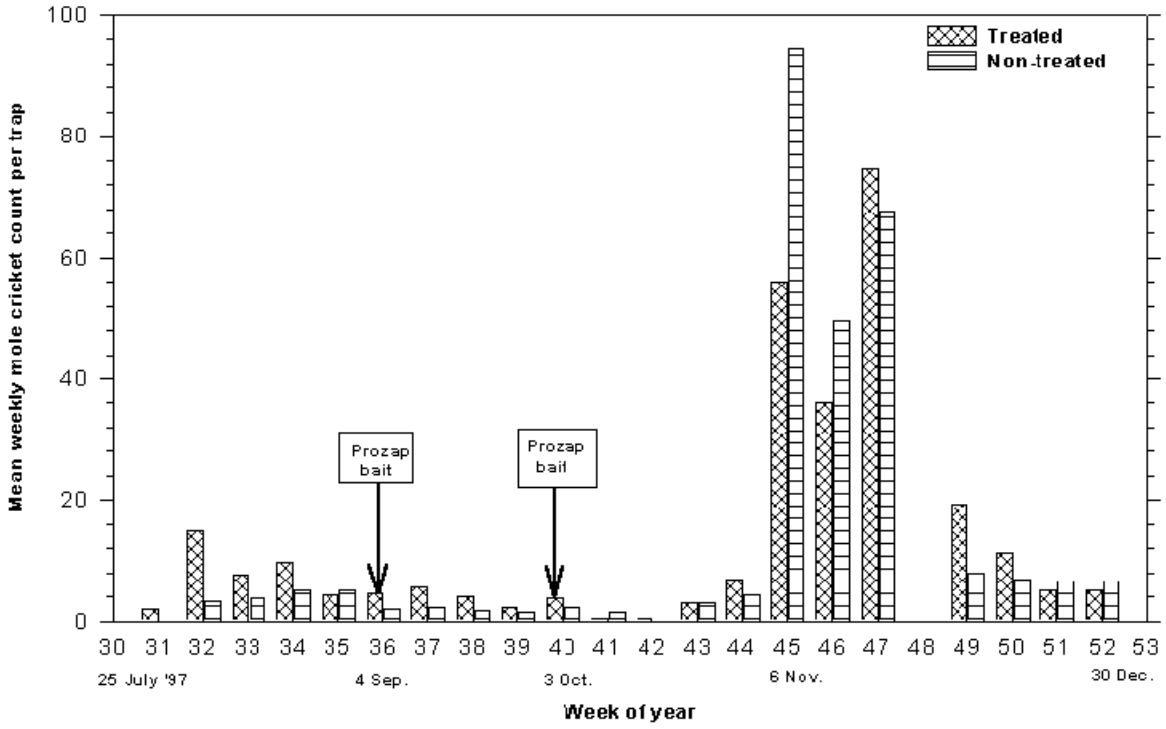


Figure 2. Weekly trapped mole crickets on bahiagrass pasture at Jack Water's Ranch in Polk County from July '97 through December '97.

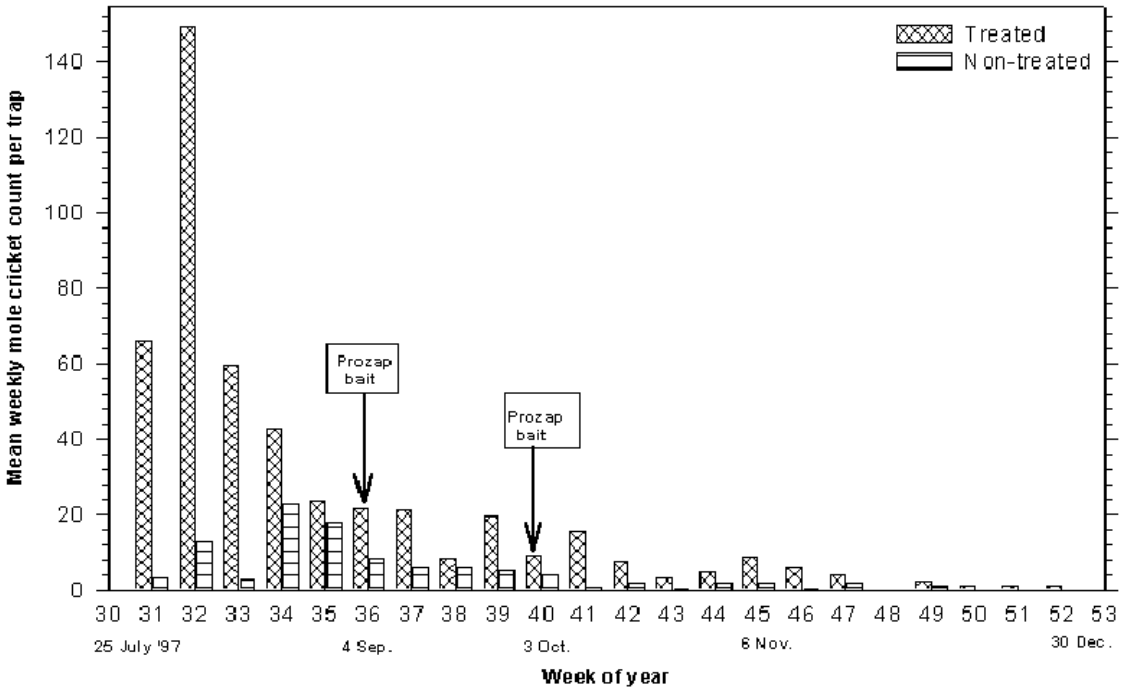


Figure 3. Weekly trapped mole crickets on bahiagrass pasture at George Clark's Ranch in Polk County from July '97 through December '97.

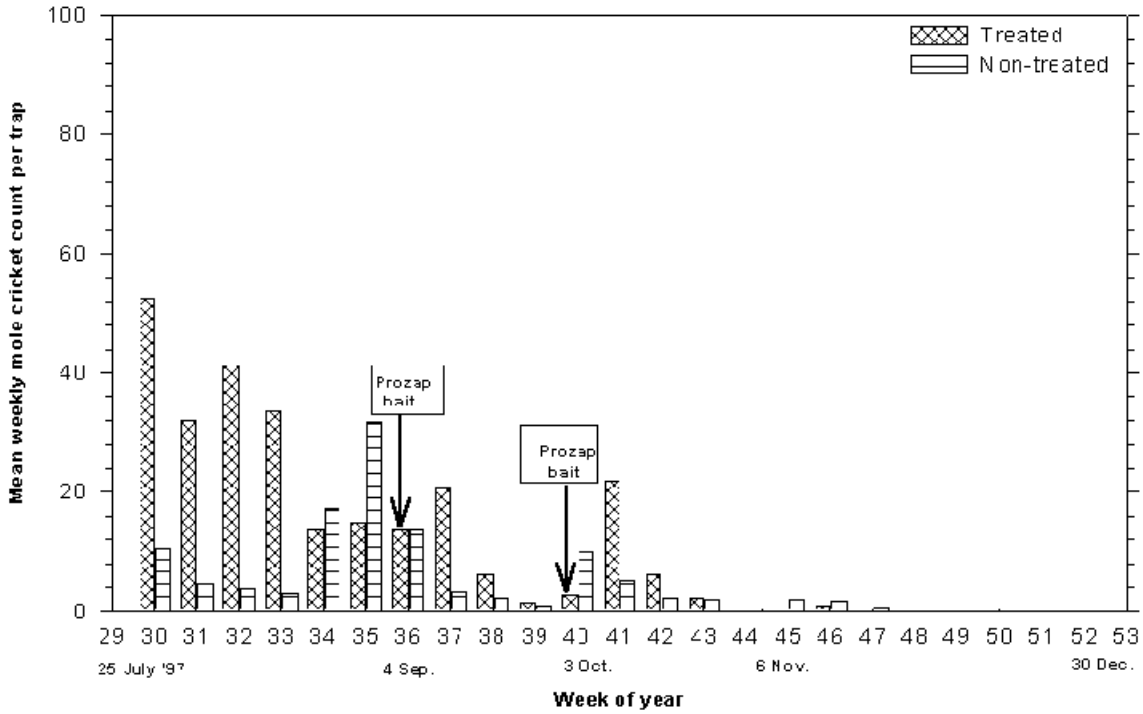


Figure 4. Weekly trapped mole crickets on bahiagrass pasture at A. D. Combee's Ranch in Polk County from July '97 through December '97.

SMUTGRASS CONTROL IN BAHIAGRASS PASTURES

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Smutgrass is a serious weed problem in many Florida pastures. The two main species of smutgrass found in Florida are 1) *Sporobolus indicus* (small smutgrass type) and 2) *Sporobolus jacquemontii* (large smutgrass type). Both smutgrass species are perennial bunch-type plants. *Sporobolus indicus* is often affected with a black fungus which is found on the seed heads giving them a spike like appearance. *Sporobolus jacquemontii* generally has an open type seed head with no fungus and broad leaf blades at the base of the plant. The reddish smutgrass seeds which may remain attached to the seed head for

sometime after maturing, are spread mainly by adhering to livestock, by water, or wind and may remain viable for two or more years.

Smutgrass produces in excess of 45,000 seeds per plant with over 1400 seeds per head (Currey et al., 1973). Seed production takes place continuously throughout the growing season with natural germination averaging less than 9% because of a hard seed coat. Mature smutgrass plants are generally unpalatable to cattle. However, cattle will readily consume the regrowth of smutgrass for several weeks following a burn or mowing. During this period of young vegetative growth the quality is about equal to bahiagrass.

Research at Ona by McCaleb et al (1966) indicated mowing did not control smutgrass; but helped to spread the smutgrass seed. Under continuous close mowing plant diameter decreased but number of plants increased. When mowing stopped, plants recovered to their former density. Cultivation and complete renovation was expensive and gave variable and unsatisfactory results.

Early herbicide research with dalapon provided satisfactory smutgrass control in both bahiagrass and pangolagrass (Mislevy and Currey, 1980; Mislevy et al., 1980). However, in the early 1980's dalapon was removed from the market and is no longer available for smutgrass control. In 1989 DuPont received a pasture label for distribution and use of Velpar in Florida for smutgrass control in bermudagrass and bahiagrass pastures.

Recent studies at Ona indicate broadcast spraying in July, August and early September (when adequate moisture is available and plants are actively growing) with 0.75 to 1.0 lb/A active Velpar®, plus 0.1% V/V silicone surfactant resulted in 90+% control of the large smutgrass type growing in association with bahiagrass. Since the large and small smutgrass types are generally found growing together, the same recommended rate for both the large and small smutgrass types should be used.

Mowing smutgrass to a 3" stubble and allowing plants to regrow back to a 12" height prior to spraying with 0.75 to 1.0 lb/A active Velpar resulted in no improvement in smutgrass control when compared with the non-mowed treatment. Mowing had no effect on bahiagrass recovery with mowed and non-mowed treatments averaging 84 and 85% bahiagrass ground cover 1 year after treatment. This was more than a 50% increase in bahiagrass ground cover 12 months after the herbicide application.

Bahiagrass will turn slightly yellow about 15 to 20 days after being treated with Velpar. As the rate of Velpar increases, the yellow color will also intensify. However, about 40 days after Velpar application bahiagrass will turn dark green. This green color will be darker than the non-treated pastures.

Commercial applicators and growers must remember Velpar will kill oak trees, therefore caution must be exercised when spraying smutgrass in bahiagrass pastures with oak trees. Velpar will also hurt pangolagrass and selected cultivars of *Cynodon* grasses. Consult the Velpar label for other restrictions.

Conclusions

Excellent control (90+%) of the large and small smutgrass types can be obtained from Velpar rates ranging between 0.75 to 1.0 lb active/A plus 0.1% V/V silicone surfactant. When Velpar is applied using the large commercial applicators 1.0 lb/A provided better control than 0.75 lb/A. Preliminary research results indicate mowing smutgrass, followed by 12 inches of regrowth prior to herbicide application did not significantly improve smutgrass control when compared with the non-mowed treatments. Best results are obtained when smutgrass is sprayed during July and August and pastures are wet. Remember, Velpar requires rain within a few days after application. Bahiagrass turns yellow 15 to 20 days after Velpar application, however about 40 days after treatment the pastures turn dark green.

Velpar will kill oak trees, therefore caution must be exercised. Velpar will also hurt pangolagrass and certain *Cynodon* cultivars.

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McCaleb, J. E., E. M. Hodges, and W. G. Kirk. 1966. Smutgrass control. Florida Agric. Exp. Stn. Circ. S-149. 10 pg.

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