TROPICAL LEGUMES - A BRIEF REVIEW

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SUMMARY

A brief review of the place of tropical legumes in Florida pastures is presented. The nitrogen contribution to the pasture-animal-soil system can be significant in increasing the available protein, reducing the area per animal and reducing or eliminating nitrogen fertilization.

REVIEW

The value of temperate legumes such as red and white clovers is well-known. Aside from the production of nitrogen that can be utilized by the accompanying grass and their high quality, there are unknown factors in legumes that help increase beef production and assure higher reproductive rates in cows. The knowledge of tropical legumes in pasture programs of the tropics is less advanced. White clover normally grows in combination with shorter temperate grass species (ryegrass, etc.), or in the subtropics during cooler periods of the year when the accompanying tropical grass is dormant. Maximum tropical legume growth, however, occurs during hot periods when tropical grass growth is at a maximum. Competition by the grass for light, moisture, and soil nutrients sometimes makes it difficult to establish and maintain tropical legumes in the pasture, and special management may be required for maintaining legume persistence. However, many tropical legumes have developed under adverse conditions of grass competition and over overgrazing. Through a program of tropical legume introduction and evaluation, ecotypes can be developed that will have the attributes that are needed for persistence.

The main characteristic advantage of tropical legume use is their ability to fix nitrogen. A second advantage is that tropical legume quality (digestibility and intake by cattle) does not decrease as rapidly with increasing age as that for tropical grasses. A third advantage is that intake of tropical legumes by cattle is greater than that of tropical grasses at the same level of digestibility. Since legume digestibilities generally are equal to, or higher than those of grasses of the same age, better animal performance would be expected with legume-grass pastures than for grass alone. Furthermore, there is a wide range of tropical legumes from which to select. They range from ecotypes growing under almost continuous flooding to those that can grow and persist with annual rainfall of about 10 inches per year.

Although harvesting seeds of many of the successful tropical legumes is difficult, the major disadvantage of the use of tropical legumes is that the establishment and maintenance of them appears to require too much time and effort for many ranchers. A further disadvantage of the use of trop-
ical legumes-grass pastures is that stocking rates generally will be lower than those on highly fertilized grass pastures. With the present commercial tropical legume-grass pastures, a realistic annual stocking rate probably would be a cow-calf unit per 3-5 acres annually, or one unit per acre in the growing season. It is generally agreed that as grass competition and in most instances stocking rate increase, tropical legume persistence decreases; also evidence indicates that it is easier to maintain a tropical legume in grass pastures in areas where cool weather, infertile soil, or a marked dry season exists.

The two primary attributes essential in the development of tropical legumes are persistence and ease of harvesting adequate seeds.

Florida cattlemen have acknowledged the benefits of tropical legumes for many years as evidenced by their use of hairy indigo and aloyce clover, and more recently American jointvetch. These annuals have performed well under some conditions, while under others have not persisted because of known or unknown reasons. The perennials, 'Siratro', and more recently 'Florida' carpon desmodium, also have been used with success. Siratro seed is difficult to harvest commercially and plants do not persist well under periodic flooding or under continuous heavy grazing. Carpon desmodium seed has been harvested commercially in Florida during the past eight years without undo difficulty. The plants survive higher water tables than Siratro but not as well as jointvetch. It is still too early to determine carpon desmodium's real potential although it mixes well with bahia and other grasses and withstands heavy grazing pressure. In spite of the problems associated with tropical legume persistence, south Florida should be proud of the large areas of successful tropical legume-grass pastures found there in comparison to other countries or areas of similar size.

Yields, crude protein percentages and crude protein yields of 'Greenleaf' desmodium, carpon desmodium (perennials) and hairy indigo (an annual) in mixtures with Pangola digitgrass and Pensacola bahiagrass are presented in Table 1 and compared to values for the grasses with and without nitrogen fertilization. Hairy indigo mixtures produced about twice the yield of the unfertilized grasses but less than either grass fertilized with three equal nitrogen summer applications totaling 100 lb/A/year. It was estimated by clipping experiments that about 135 and 250 lb/A/year of nitrogen fertilizer would be needed for Pangola and bahiagrass, respectively, to equal the yields of carpon desmodium mixtures with the same grasses. With Greenleaf the respective values were 185 and 370. These calculations of nitrogen rates were based upon 100% utilization of the nitrogen applied. Actually, utilization of fertilizer nitrogen by the grasses probably would be about 60 to 70%. Greenleaf desmodium has been the highest yielding tropical legume at the ARC-Ft. Pierce, however, it fails to produce adequate seed except during winters when no frosts occur prior to about February. Seeds of carpon desmodium, on the other hand, are ready for harvesting between November 1 and November 15.

Crude protein contents of the legume-grass mixtures were greater than those of the nitrogen fertilized grasses. The quantity of nitrogen fertilizer needed for Pangola crude protein yields to equal those of hairy indigo, carpon, and Greenleaf were calculated (based on 100% grass utiliza-
tion of the nitrogen applied) to be 105, 240, and 440 lb/A/year, respectively; and respective values for bahiagrass were 140, 280, and 480. Another way to look at the value of these tropical legumes is to estimate the number of acres of Pangola and bahiagrass fertilized with 100 lb/A/year of nitrogen that would be needed to equal crude protein yields produced by hairy indigo, carpon, and Greenleaf in mixtures with grasses without nitrogen fertilizer. They are respectively for Pangola, about 1.0, 2.4, and 4.4 acres, and for bahiagrass, 1.4, 2.8, and 4.8.

Because of the preliminary satisfactory persistence, good palatability, and seeding ability of carpon desmodium, ranchers should include seeds of this species in mixture with jointvetch or other summer growing legumes that are being planted.

How does the legume-fixed nitrogen move in the Legume-Grass-Animal-Soil cycle? Only about 2 to 11% of the legume root N is directly transferred to the grass roots. Leaf leaching (up to 0.5 lb/A per rain storm), and 4 to 10 lb/A from leaf fall also provide small quantities of nitrogen directly to the grass. The majority of nitrogen transferred from legume to grass passes through the grazing animal. It was found that about 20% of the nitrogen consumed as crude protein by a cow-calf unit remains in the animal. Some of the nitrogen falling on the soil from leaves or excreta may be lost by leaching or conversion to ammonia gas although the amounts are not known. Work done in south Africa with an annual rainfall of 30 inches (summer) and with grasses alone fertilized with 60 lb/A/year of nitrogen provides additional answers. Since the nitrogen rate in the area actually covered by excreta has been calculated to be about 400 lb/A, the leaching or gaseous losses of nitrogen could be significant. A conservative estimate of the total amount of nitrogen returned to the soil and re-utilizable by a tropical legume-grass mixture is about 70% of that calculated to be in the foliage by clipping.

The ongoing research at the AREC, Ft. Pierce is to develop better perennial tropical legumes with special attributes that will permit high grazing pressures and increased persistence under waterlogged conditions. In this effort, small plot initial evaluations are followed by grazing experiments in commercial pastures. Presently about 20 tropical legumes are being tested under grazing, several of which would be released for commercial use.

We would be happy to provide small quantities of seeds to ranchers should they be interested in testing the legumes under their grazing conditions.
<table>
<thead>
<tr>
<th>Legume</th>
<th>Dry Matter Yield 1b/A</th>
<th>Crude Protein Content %</th>
<th>Crude Protein Yield 1b/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P. bahia</td>
<td>Pangola</td>
<td>P. bahia</td>
</tr>
<tr>
<td>None</td>
<td>2,100</td>
<td>2,600</td>
<td>7.0</td>
</tr>
<tr>
<td>None-100 lb of N/A/Yr(^+)</td>
<td>5,700</td>
<td>9,400</td>
<td>7.1</td>
</tr>
<tr>
<td>Greenleaf desmodium</td>
<td>12,700</td>
<td>12,400</td>
<td>11.5</td>
</tr>
<tr>
<td>Carpon desmodium</td>
<td>9,100</td>
<td>9,900</td>
<td>9.8</td>
</tr>
<tr>
<td>Hairy indigo</td>
<td>4,900</td>
<td>5,900</td>
<td>11.0</td>
</tr>
</tbody>
</table>

\(^+\) Nitrogen split into three (3) equal summer applications.