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LOUISIANA AGRICULTURAL EXPERIMENT STATION
LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER


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Evaluation of Pensacola Bahiagrass and Alicia Bermudagrass With and Without Interplanted Ryegrass and Red Clover

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Warm-season perennial grasses play an important role in providing grazing and harvesting hay for Louisiana's livestock industry. Many farmers rely on perennial grasses to provide grazing in the summer and annual forages for grazing during winter months. In the past this system of grassland farming has required two or more separate fields. With increasing demands on land and the high cost of seedbed preparation, farmers may benefit from sodseeding perennial pastures with annuals to extend the productive period. This system offers the advantage of providing two grazing seasons on the same area and may significantly reduce the acreage required per animal unit.

Winter annual grasses and legumes have been studied extensively in pure swards, but only limited data are available on their productivity and quality potentials when grown in a warm-season perennial grass sod. Information is also needed on the extent to which the grazing season may be expanded by incorporation of an annual grass of legume and on subsequent effects of interplanted annuals on performance of the perennial grasses.

An experiment was conducted over 4 years with two warm-season perennial grasses, Pensacola bahiagrass and Alicia bermudagrass, grown in pure swards and sodseeded with ryegrass or red clover with the following objectives:

1. To measure length of extension of forage productivity resulting from incorporating an annual grass or legume in perennial sods.
2. To determine forage quality of pure perennial grass stands and of mixed stands (with annuals) throughout the entire growing season.
3. To study agronomic performance characteristics, such as yield, yield distribution, and compatibility, and persistence.

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Data available on performance of the grasses and legume use in the study indicate that all are well adapted as pasture crops in Louisiana.

Pensacola bahiagrass was first introduced into the United States in 1913. Ward and Watson (12) summarized some of the more important aspects of bahiagrass as a forage crop. Bahiagrass is popular in the south because it is (a) tolerant of a wide range of soil conditions; (b) resistant to encroachment of weeds; (c) easily established by seeding; (d) relatively free from attack by insects and disease organisms; (e) moderately productive in soils of low fertility, and (f) tolerant of close grazing. Forage quality of bahiagrass was highest in early spring, but by mid-summer the percentage of cell wall constituents (CWC) was sufficiently high to suggest that animal intake would be limited. Dry forage yields of 15,000 pounds per acre have been reported when harvested at 4-week intervals (5).

Alicia is a hybrid bermudagrass established by sprigging plant material. Allen (1) reported highest total dry matter yield with Alicia bermudagrass, followed by Coastal, Coster-cross-1, and Common bermudagrass and Pensacola bahiagrass when harvested at 4-week intervals. A more uniform yield distribution was observed with Pensacola bahiagrass, and it was concluded that Pensacola could be better utilized for grazing than for haying. Alicia had the highest structural carbohydrate percentages, while Pensacola and Coster-cross-1 had the highest in vitro digestible dry matter (IVDDM) values. Nelson (9) harvested Alicia and three other bermudagrass cultivars at 35-day intervals and reported these season-average acid detergent fiber (ADF) percentages: Common—32.3, Coastal—34.2, Alicia—34.9, and Coster-cross 1—37.3.

Marchant (4) compared oats and ryegrass seeded in Pensacola bahiagrass and Coastal bermudagrass for effects on average daily gain, average number of days of grazing, and summer growth of the perennials. He reported no significant effect, as measured by annual beef production per acre, on performance of summer perennials resulting from sodseeding of oats or ryegrass the previous winter. There was no difference in animal gains per acre between sodseeded oats and ryegrass. The winter annuals produced an average of 36 percent fewer animal grazing days when planted in bahiagrass sod than when planted in bermudagrass sod.

Robinson (8) pointed out that the success of fall sodseeded crops is closely linked to rainfall and temperature patterns. Most research results suggest that only limited grazing is provided in late fall or winter because of competition from the summer perennials, with most of the growth occurring after February 15 (14).

Welch et al (13) noted that first-harvest bermudagrass yields decreased as rate of nitrogen applied to sod-seeded rye increased. They concluded that Coastal bermudagrass yield reductions were positively related to

Italic numbers in parentheses refer to Literature cited, page 19.
increased density of the over-sown crop. To increase first-harvest Coastal yields, as well as total production from a unit of land area, the winter annuals should be maintained in the vegetative stage rather than allowing it to progress to maturity.

Mississippi researchers (3) sodseeded oats and ryegrass in bermudagrass sods in 8- and 16-inch drill spacings to study the effects of spacing on performance of winter annuals and subsequent perennial yields. The highest yielding treatment was oats drilled into sod at 8-inch intervals. The practice of drilling seed into sod results in more fall and winter production than did the conventional discing method. In general, summer perennial production was reduced in proportion to the degree to which the sod had been disturbed the previous fall.

Established perennial sods were seeded with subterranean clover, crimson clover, alfalfa, vetch, winter peas, oats, wheat, rye, and barley, as reported by Swain et al. (10). Rye and hairy vetch, when sodseeded into Midland bermudagrass, produced the earliest spring growth and outyielded barley, ryegrass, and wheat in that order.

**EXPERIMENTAL PROCEDURE**

**Agronomic Procedure**

In mid-October each year during 1977, 1978, 1979, and 1980, ½ acre plots of Pensacola bahiagrass and Alicia bermudagrass were subdivided, and one-third of each was sodseeded with Redland red clover. Another one-third was sodseeded with Gulf ryegrass, while the remaining one-third of each plot remained with the pure perennial sod. Prior to planting, the entire site was sprayed with Paraquat and burned to eliminate perennial forage residue. Fertilizer was surface-broadcast applied to the area to be sodseeded at the rate of 100 pounds per acre each of P₂O₅ and K₂O. Annuals were planted in 8-inch drills with a John Deere "Power Till" seeder at rates of 10 pounds per acre for red clover and 20 pounds per acre for ryegrass. The ryegrass received 150 pounds per acre of nitrogen in early December and again in mid-January each year.

The perennial alone and perennial-ryegrass sites received 72-216-216 pounds per acre of N, P₂O₅, and K₂O, respectively, in March each year. The perennial-clover plots received the same amounts of P₂O₅ and K₂O per acre, but no nitrogen was applied until May when perennial growth appeared in the mixtures. All treatments received 75 pounds of nitrogen per acre following each harvest during the summer months.

Annuals were harvested with a flail harvester at 2-week intervals until the perennials dominated the mixture, and thereafter, at 4-week intervals. Yield data were obtained by cutting four random strips, 5 X 12 feet, in each of the plots. The entire plot was harvested during the time when annuals constituted an appreciable portion of the forage mixtures; the total production was dried in a forced-air, thermostatically-controlled drier at 130°F.
The dried forage was then chopped with a hammer mill to approximately inch lengths and stored for in vivo digestion trials.

In Vivo Digestibility Trials

Each of the chopped forages was fed to four sheep, which served as replicates, in conventional digestion trials consisting of a 9-day preliminary period followed by a 5-day total-fecal-collection period. The sheep were maintained in conventional digestion crates that permitted individual feeding (twice daily), weigh-backs (once daily), and total fecal collection. The chopped forages were sampled during each digestion trial, dried, and ground in a Wiley Mill to a 1-millimeter fineness for laboratory analyses.

Statistical Analyses

Statistical analyses of the data were conducted according to procedures described by Snedecor and Cochrane (9). Yield and forage quality data are reported as clipping-date means. A regression analysis of each variable on clipping date was conducted using linear, quadratic, cubic, and quartic terms. The criterion for selection of a regression equation was significant at the .05 probability level for the highest order term. Regression analyses were based on data collected over a 4-year period (1978-1981) for sod-seeded plots and over a 3-year period (1979-1981) for pure Alicia bermudagrass or Pensacola bahiagrass stand.

RESULTS AND DISCUSSION

Dry Forage Yield Per Acre

Season-total dry forage yields averaged over the 4 years, in pounds per acre, for the stands were: Pensacola + ryegrass—10,870; Alicia + ryegrass—12,109; Pensacola + clover—10,151; Alicia + clover—10,242; Pensacola alone—8,578; and Alicia alone—10,365. The first harvest of ryegrass varied from January 15 in 1980 to April 2 in 1979, while clover was first harvested from April 6 to April 21 during the 4 years. The pure stands of perennial s were first harvested from May 1 in 1979 to June 17 in 1980. The perennial + ryegrass and perennial + clover mixtures were harvested an average of 8.50 and 6.25 times per year, respectively, while the perennials in pure stands averaged 4.67 harvests per year. Delays in early spring growth of the perennials in pure stands limited the number of harvests and accounted for below expected season-total yields. The additional harvests of the perennials + ryegrass and perennials + clover mixtures accounted for the higher season-total yields.

Alicia yields, averaged over all treatments (alone or in combination with annuals), were 10.5 percent higher than similarly averaged Pensacola yields, but this difference was not significant at the .05 probability level. Alicia alone out-yielded Pensacola alone by 20.7 percent and other
ryegrass out-yielded Pensacola + ryegrass by 11.4 percent. Alicia + clover had practically the same yield as Pensacola + clover.

Ryegrass increased (P < .05) season-total yields in both, Alicia and Pensacola stands. Season-total yields of Alicia were increased 16.8 percent by the incorporation of ryegrass, and Pensacola yields were increased 26.6 percent.

The average dry matter yield of Alicia + clover was almost identical to that of Alicia alone, but the incorporation of red clover in Pensacola sod increased season-total yield 18.2 percent over Pensacola alone.

Forage productivity was extended approximately 75 days with the addition of ryegrass and approximately 30 days by addition of red clover to perennial sods.

![Figure 1](image-url)

Figure 1.—Seasonal distribution of predicted dry forage yield of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures of sodseeded red clover or ryegrass, 1978-81.

Seasonal distribution of dry-forage production is shown in Figure 1. There were no seasonal trends in yield distribution of Alicia alone, Pensacola alone, Pensacola + ryegrass, or Alicia + clover. There was a linear increase in dry forage yield of Alicia + ryegrass as the season advanced. The Pensacola + clover mixture produced its highest yield in June and then decreased through September. Both Alicia alone and Alicia + ryegrass produced significantly (P < .05) more dry forage than Pensacola + ryegrass late in the season (after mid-July). Pensacola + ryegrass was also lower in yield than Pensacola + clover in July but not significantly different in August and September.
Botanical Composition

Since annual grasses and legumes are generally higher in quality than perennial grasses, their contribution to the mixture is advantageous in improving forage quality.

Figure 2.—Predicted percent annual forage in mixtures of Pensacola bahiagrass and Alicia bermudagrass sodseeded with red clover or ryegrass, 1978-81.

Ryegrass constituted 100 percent of the yield harvested through April 1 (Figure 2). There was a decrease in percentage ryegrass in mixtures through July 25; ryegrass was absent in all harvests after July 25.

Clover represented 100 percent of mixtures harvested through April 15. Thereafter, the percentage of clover decreased through August 15, with no clover present in the September harvest.

There was approximately 10 percent more clover in the Alicia + clover mixture from May 15 through June 15 than in the Pensacola + clover mixture. However, these differences were not statistically significant. Clover contributed from 10 to 15 percent more to the botanical composition of mixtures than ryegrass from April 15 to about August 15.

Nutrient Production Per Acre

Digestible dry matter (DDM) production (Figure 3) followed a trend very similar to that of dry forage yield. Season-total DDM value, in pounds per acre, for the stands were: Pensacola + ryegrass—6,856; Alicia + ryegrass—7,455; Pensacola + clover—6,237; Alicia + clover—5,695; Pensacola alone—4,860; and Alicia alone—5,476. There was no seasonal trend in DDM production of Alicia alone, Pensacola alone, Alicia + clover, or Pensacola + ryegrass. A linear increase occurred in DDM production with Alicia + ryegrass as the season advanced. The Pensacol
Figure 3.—Seasonal distribution of predicted digestible dry matter per acre produced by Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures sodseeded with red clover or ryegrass, 1978-81.

Figure 4.—Seasonal distribution of predicted crude protein per acre produced by Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixture sodseeded with red clover or ryegrass, 1978-81.
+ clover mixture produced its highest DDM per acre in June and then decreased through September.

Crude protein (CP) production levels, in pounds per acre, for the different stands were: Alicia + ryegrass—2,033; Pensacola + ryegrass—1,776; Alicia + clover—1,642; Pensacola + clover—1,659; Alicia alone—1,776; Alicia + clover—1,642; Pensacola + clover—1,659; Alicia alone—1,354; and Pensacola alone—1,091. Only one mixture, Pensacola + clover, was affected by season, with a linear decrease in CP per acre from April through September (Figure 4). Pensacola + clover produced significantly (P<.05) more CP per acre than Pensacola + ryegrass through the June harvest. The incident of higher forage quality and additional harvests from ryegrass and clover in stands accounted for the higher season-total nutrient yields of mixtures.

STRUCTURAL CARBOHYDRATES

Cell Wall Constituents

Cell wall constituents (CWC) include the total fibrous fraction of forage, that portion of plant material acted on by rumen microfloria, and consist of acid detergent fiber (ADF) and hemicellulose. The ADF is further subdivided into cellulose and lignin. Cell wall constituents make up the major

![Graph](https://via.placeholder.com/150)

Figure 5.—Predicted cell wall constituents content of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures sodseeded with red clover or ryegrass, 1978-81.
part of a perennial plant cell, and generally the higher the CWC content the lower the quality of that forage.

Cell wall constituent values of the forages, plotted throughout the season, appear in Figure 5: percentages ranged from 35.0 in March, when ryegrass was predominant in the mixture, to 72.0 in August, when perennials dominated the stands. The presence of ryegrass or clover in stands during June and July resulted in significantly lower (P<.05) CWC percentages than in forage from perennials alone.

No significant differences were observed in CWC percentages between Alicia + ryegrass and Pensacola + ryegrass mixtures at any harvest date during the season. The perennial + clover mixtures exhibited significantly lower (P<.05) CWC content than perennial + ryegrass mixtures through mid-July, with no differences in August and September when only the perennials were present. Cell wall constituent percentage of Pensacola alone was not affected by date of harvest, while that of forage from a pure stand of Alicia increased from May through September. There was no significant difference in CWC content among treatments from mid-July through mid-September, when perennials predominated.

Acid Detergent Fiber

Acid detergent fiber (ADF) is the most realistic measure of forage fiber that may be digested by ruminants. Acid detergent fiber includes lignin, a component only partially extracted in the crude fiber analysis. Since ADF is a part of CWC, the seasonal trend of ADF is very similar to that of CWC.

Acid detergent fiber percentages of perennial + ryegrass mixtures ranged from 22.0 in March to 35.0 in September (Figure 6). Perennial + clover mixtures exhibited lower ADF values than perennial + ryegrass mixtures. Acid detergent fiber percentages of Pensacola + clover mixtures were numerically higher than those of Alicia + clover mixtures, although not statistically significant. Acid detergent fiber content of Alicia alone was not affected by harvest date, with a season average of 34.0 percent. ADF of Pensacola alone increased as the season advanced from May through September. There were no significant differences in ADF percentages among treatments from August through September, when only perennials were present.

Hemicellulose

Hemicellulose content in forage is regarded as the difference between CWC and ADF and is generally more digestible than cellulose. It is composed of a mixture of polymers, which may have different digestion coefficients within the same forage. Hemicellulose content of Alicia and Pensacola forages in pure stands were not affected by harvest date, with season averages of 36.2 and 34.4 percent, respectively (Figure 7). Hemicellulose percentages of the perennial + ryegrass and perennial +
Figure 6.—Predicted acid detergent fiber content of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures sodseeded with red clover or ryegrass, 1978-81.

Figure 7.—Predicted hemicellulose content of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures sodseeded with red clover or ryegrass, 1978-81.
clover mixtures increased significantly (P<.05) as the season advanced. There was no significant difference between hemicellulose content of Alicia + ryegrass and Pensacola + ryegrass mixtures at any harvest date. Mixtures including ryegrass were significantly lower (P<.05) in hemicellulose than perennials alone until late June, and mixtures including clover were lower than the perennials alone until late July. Perennial + clover mixtures were significantly lower (P<.05) in hemicellulose than mixtures containing ryegrass until July 1. No significant differences were found in hemicellulose percentages among treatments in August and September.

Cellulose

There were significant (P<.05) increases in cellulose content of perennials + ryegrass and perennials + clover as the season advanced through August (Figure 8). Cellulose percentages of Alicia and Pensacola in pure stands were not affected by harvest date, with season averages of 27.5 and 28.5, respectively. Cellulose content ranged from 17.0 percent in March for perennials + ryegrass to 30.0 percent in August for Pensacola + ryegrass. Since clover is lower in cellulose than ryegrass and persisted in mixtures longer than ryegrass, perennial + clover mixtures exhibited significantly lower (P<.05) cellulose percentages than perennial + ryegrass mixture from mid-April to June. Pensacola + clover mixture

Figure 8.—Predicted cellulose content of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures when sodseeded with red clover and ryegrass, 1978-81.
exhibited consistently non-significantly higher cellulose content in Alicia + clover mixtures. Cellulose percentages did not differ (P > 0.05) among treatments after July when perennials dominated the mixtures.

Acid-Insoluble Lignin

Lignin is considered completely indigestible and a true "anti-quality factor. Acid-insoluble lignin (AIL) content of Alicia + ryegrass increased from 1.75 percent in March to 5.00 percent in July (Figure 9). There was no

Figure 9.—Predicted acid insoluble lignin content of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures sodseeded with red clover or ryegrass, 1978-81.

significant difference in AIL content of Alicia + ryegrass and Pensacola + ryegrass mixtures at any harvest date. However, AIL of Alicia + ryegrass was numerically higher than that of the Pensacola + ryegrass mixtures in June, July, and August. There was a linear increase in AIL content of Pensacola + clover as the season advanced. The AIL content of Alicia + clover was not affected by harvest date, with an average of 4.45 percent. Acid insoluble lignin content of Pensacola in pure stand increased linearly from 3.60 percent in early-May to 5.20 percent in mid-September.
AIL content of Alicia alone was highest in late July and early August. Alicia alone exhibited significantly higher (P<.05) AIL percentages than Alicia + clover from mid-July to mid-August. There was no other significant difference in AIL content among treatments from mid-June through mid-September.

**Crude Protein**

Crude protein (CP) content of forages has long been recognized as an indicator of quality in rations for ruminants. Crude protein level of forage ranging from 15.6 to 18.7 percent, dry matter basis, is considered adequate to meet the protein needs of a beef cow with calf. As noted in Figure 10, the minimal protein requirements were met only while annuals contributed to production. Sharp decreases occurred in CP content of forage as annuals decreased in the mixtures. Clover maintained high CP content of mixtures later into the season than did ryegrass. Crude protein percentages of perennials + clover were significantly (P<.05) higher than those of perennials + ryegrass from early May through late June. There were no significant differences in CP content of either perennial + ryegrass mixtures or perennial + clover mixtures at any harvest date. Pure stands of Alicia and Pensacola did not differ significantly in CP content, with season averages of 14.2 and 13.4 percent, respectively. There were no significant differences in CP percentages among treatments from July through September.
In Vitro Digestible Dry Matter

In vitro digestible dry matter (IVDDM) is generally regarded as a relative or approximate measure of the nutritional value of a forage. Results reported in other studies (1, 6, 7) have shown a high positive correlation between IVDDM (Test Tube) values and DDM (animal) values for forages.

The IVDDM values reported in Figure 11 represent apparent DDM and were calculated from the formula: Apparent DDM = 15.1 + 54.16X, where X is the test tube digestion value (7).

Figure 11.—Predicted in vitro digestible dry matter content of Pensacola bahiagrass and Alicia bermudagrass in pure stands and in mixtures sodseeded with red clover or ryegrass, 1978-81.
No significant differences occurred in IVDDM between Pensacola + ryegrass and Alicia + ryegrass at any harvest date. However, IVDDM percentage decreased sharply from March through August, with only a slight increase at the September harvest. IVDDM ranged from 77 percent in March, when ryegrass represented 100 percent of the mixture, to 55 percent in August when only the perennials were present. There were linear decreases in IVDDM of perennial + clover mixtures, from 67 percent in mid-April to 56 percent in September. There was no significant difference in IVDDM of Alicia + clover and Pensacola + clover mixtures. However, IVDDM of Pensacola + clover was consistently higher numerically.

Pensacola and Alicia in pure stands exhibited sharp decreases in IVDDM content from mid-May through late June, with no significant changes during the remainder of the season. IVDDM values for the pure stand of Pensacola were consistently higher than those of Alicia alone, although not statistically significant.

Mixtures of perennial + clover exhibited significantly (P<.05) higher IVDDM values than either perennial alone until mid-July. No significant differences were observed among treatments during August and September.

Component Digestibility

During the 4-year period individual harvests of four perennial + ryegrass mixtures and thirteen perennial + clover mixtures were selected based on presence of annuals in the harvest, to be evaluated in in vivo digestion trials. Harvest dates for the perennial + ryegrass mixtures ranged from May 1 to June 25, while perennial + clover mixtures were harvested from April 6 to August 24.

Table 1. Component digestibility1 of Pensacola bahiagrass and Alicia bermudagrass sodseeded with red clover or ryegrass, 1978-81

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Harvests</th>
<th>DDM</th>
<th>CWC</th>
<th>HC</th>
<th>ADF</th>
<th>Cellulose</th>
<th>CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alicia + Ryegrass</td>
<td>4</td>
<td>56.7</td>
<td>56.0</td>
<td>61.2</td>
<td>54.5</td>
<td>67.3</td>
<td>60.0</td>
</tr>
<tr>
<td>Pensacola + Ryegrass</td>
<td>4</td>
<td>62.5</td>
<td>60.7</td>
<td>70.2</td>
<td>54.8</td>
<td>68.6</td>
<td>59.2</td>
</tr>
<tr>
<td>Alicia + Clover</td>
<td>13</td>
<td>61.7</td>
<td>58.6</td>
<td>70.0</td>
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<td>73.4</td>
<td>53.0</td>
<td>70.5</td>
<td>54.8</td>
</tr>
</tbody>
</table>

1Digestibility values based on laboratory analyses of forage consumed and fecal excretion of four sheep per treatment.
2Number of individual harvests used in digestion trials during the four-year period.
3In vivo digestible cellulose.
4Cell wall constituents.
5Hemicellulose.
6Acid-detergent fiber.
7Crude protein.
Mean digestion coefficients, over all harvests, for dry matter, structural carbohydrates (CWC, ADF, hemicellulose, cellulose), and CP are presented in Table 1. Mixtures containing Pensacola exhibited consistently higher digestibility for all structural carbohydrates and dry matter than those containing Alicia. However, digestibility of CP was higher in mixtures containing Alicia; these differences were observed in both ryegrass and clover mixtures. With the exception of ADF, structural carbohydrates digestion coefficients tended to be higher for mixtures containing clover; these differences would be of no practical significance in animal performance.

**SUMMARY AND CONCLUSIONS**

Both Pensacola bahiagrass and Alicia bermudagrass were sodseeded with red clover or ryegrass under field conditions over a 4-year period and evaluated for forage yield, distribution of yield, chemical composition, and digestibility. Highest season-total yields were obtained by sodseeding Alicia with ryegrass. Alicia, averaged over all treatments, produced 10.5 percent more DM than Pensacola treatments. Alicia yields were increased 16.8 percent by the incorporation of ryegrass, while Pensacola yields were increased 26.6 percent. Pensacola plot yields were increased 18.2 percent with the incorporation of clover, while Alicia plot yields were unchanged.

Forage productivity was extended approximately 75 days by sodseeding ryegrass and approximately 30 days by sodseeding clover.

Ryegrass and clover accounted for 100 percent of forage mixtures at the initial harvest, and then decreased as the season advanced. Clover persisted in mixtures later into the season than ryegrass. Forage quality declined as annuals decreased in mixtures.

The incorporation of ryegrass and clover resulted in lower structural carbohydrates (CWC, ADF, hemicellulose, and cellulose) percentages early in the season, but these components increased as annuals decreased in mixtures.

Crude protein percentage was reduced as annuals decreased in mixtures. Clover mixtures contributed to CP content in mixtures later into the season than ryegrass mixtures. There was no difference in CP content of Pensacola and Alicia forages in pure stands.

Digestibility of mixtures declined as annuals decreased in the stand. The presence of clover improved digestibility further into the season than did ryegrass.

Digestibility of structural carbohydrates in mixtures containing Pensacola was consistently higher than those of Alicia. Crude protein digestibility was highest in mixtures containing Alicia.

These data reveal that Pensacola bahiagrass and Alicia bermudagrass can be successfully sodseeded with ryegrass or red clover resulting in extended forage productivity and improved forage quality.
Literature Cited


Appendix

Appendix Table A. — Examples of the coefficients for equations used to generate the predicted values displayed in Figures 1 to 11.

1. **Pounds Dry Matter per Acre (Y) for Alicia + Ryegrass** would be predicted from the equation:
   \[ Y = 443 + 6.54 D \]
   Where Y is the predicted pounds of dry matter per acre on Julian date D.
   The predicted DM yield for a harvest on Julian date 200 (July 17) would be:
   \[ Y = 443 + 6.54 \times (200), \]
   or \[ Y = 1751 \] pounds dry matter per acre.

2. **Pounds Dry Matter per Acre (Y) for Alicia + Clover** would be predicted as \[ Y = 222 \] for any harvest date. This value is the average yield for all harvest dates.

3. **Percent Annual (Y) for Alicia + Ryegrass** would be predicted from the equation:
   \[ Y = 66.8 + 1.69 D + 0.0186 D^2 + 0.0000427 D^3 \]
   Consequently, the predicted percent annual in the Alicia Ryegrass mixture on Julian date 150 (May 29) would be:
   \[ Y = 66.8 + 1.69 \times (150) + 0.0186 \times (150)^2 + 0.0000427 \times (150)^3, \]
   or \[ Y = 45.9 \] percent annual in the mixture.

When there is not a statistically significant (P<.05) seasonal trend, the mean of the variable is listed under the "intercept" column. Prediction equations are constructed from the coefficients.
## Appendix Table B—Coefficients in Prediction Equations used for Figures 1-7

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*The treatments are numbered as follows:
- Treatment 1: Alicia + ryegrass
- Treatment 2: Alicia + clover
- Treatment 3: Alicia alone
- Treatment 4: Pensacola + ryegrass
- Treatment 5: Pensacola + clover
- Treatment 6: Pensacola alone

<sup>a</sup>Coefficient of variation in percent.
<sup>b</sup>Coefficient of determination.
<sup>c</sup>For no significant ($P<.05$) seasonal trend, the intercept is the average for all harvests.