SUMMARY OF WORK ON GRASSES

For generations southeastern cattlemen have been looking for better grasses. Not satisfied with the low productivity and carrying capacity of the native range, they obtained seed of promising grasses from other continents and attempted to grow them in this area. By the turn of the century, most of the grass species now being used in improved pastures were being grown in a limited degree in the Southeast. Among those best adapted were carpet grass from the West Indies, Bermuda grass from India, Dallis grass from South America, and Johnson grass from southwest Asia.

During the past twenty years hundreds of grasses, introduced from other lands by the United States Department of Agriculture, have been studied at the Georgia Coastal Plain Experiment Station to determine their ability to grow and their probable usefulness in this area. Only within the past ten years has any attempt been made to improve the best of these grasses through plant breeding. The description and evaluation of the grasses that follows are based upon this research.¹

Perennial Pasture Grasses

CARPET GRASS (*Axonopus affinis*): Carpet grass is a low growing, stoloniferous, sod-forming grass that produces abundant seed. It is well adapted to the low, poorly drained soils of the Coastal Plain, and due to its low fertility requirements, may be grown on most of these soils without fertilization. Carpet grass is low in productivity and in nutritive value. Although cattle graze it readily they make poor gains on pure stands of this grass. The quality and productivity of carpet grass pastures may be improved by fertilization and the introduction of legumes, particularly white Dutch clover. Frequently dense sods of carpet grass must be reduced by close grazing or burning, before legumes can be successfully established.

BERMUDA GRASS (*Cynodon dactylon*): This low-growing, sod-forming grass, that is spread by rhizomes, stolons, and seed, is so well adapted to the well drained cultivated soils of the Southeast that it has become a pest in many fields in which cultivated crops are grown. Bermuda grass has higher soil fertility requirements than carpet grass and makes very little growth on poor soils that have not been fertilized. It is one of the most palatable and nutritious perennial grasses that may be grown in this area. Common Bermuda produces little more dry matter than carpet grass, but, due to its better quality, produces much more beef than carpet grass. Common Bermuda grass becomes sod-bound unless heavily fertilized. It should be disked or turned with a turning plow every third year to rejuvenate it and to control many of the perennial weeds that tend to come into old pasture sods.

Coastal Bermuda: Coastal Bermuda, a product of the grass-breeding project, is an unusually vigorous hybrid that has larger leaves, stems, rhizomes, and stolons, and grows much taller and spreads faster than common Bermuda. In contrast to common Bermuda which seeds profusely, Coastal Bermuda produces very few seed heads and those that are produced rarely contain viable seed. This seedless characteristic of Coastal Bermuda grass

¹In cooperation with the U. S. Department of Agriculture, the Georgia Coastal Plain Experiment Station, and the Georgia Experiment Station.
explains, in part, why it is more palatable and more nutritious than common Bermuda during much of the grazing season. It is resistant to the leafspot disease that causes the leaves of common Bermuda to turn dark and die.

Coastal Bermuda is more drought resistant and will grow in somewhat wetter areas than common Bermuda. It will grow on any well drained soil in which common Bermuda will thrive but makes its most efficient production when well fertilized. The manner in which an old sod of this grass responds to fertilization is shown in Table 51. All tests conducted to date indicate that Coastal Bermuda is an excellent pasture grass. It is more palatable and much more productive than common Bermuda, producing nearly twice as much beef per acre. When well fertilized it has produced 4 to 5 cuttings of hay per season, giving a total yield for the year of from 4 to 6 tons of hay per acre. This hay has compared favorably with timothy hay in palatability and nutritive value. Coastal Bermuda cures very rapidly when cut, which makes it well suited for hay production in the humid Southeast.

Since Coastal Bermuda is practically seedless, it must be propagated by planting stolons or sprigs. Each farmer interested in Coastal Bermuda is advised to establish a nursery on his own farm. Such a nursery gives him an opportunity to determine how this Bermuda will grow on his farm, and supplies fresh vigorous planting material that will be available whenever he finds time to plant it. Farmers wishing to obtain planting material of Coastal Bermuda should contact their County Agents or the Georgia Coastal Plain Experiment Station.

Suwanee Bermuda. This vigorous Bermuda hybrid, likewise a product of the grass-breeding project, has been tested and distributed in a limited way as Tifton Bermuda number 99. Suwanee Bermuda resembles Coastal Bermuda in many respects. It may be distinguished from Coastal Bermuda by its darker green color, its more erect leaves, and its tendency to produce more viable seed. It is unusually well adapted to light sandy soils and tends to be more productive than Coastal Bermuda on such soils, particularly if it is not well fertilized. It must be established by planting stolons and does not sod over as rapidly as Coastal Bermuda. Once established it appears to be equal or superior to Coastal Bermuda for hay production. It makes a more open sod and will not tolerate close clipping as well as Coastal Bermuda, suggesting that it might be inferior to Coastal Bermuda in closely grazed pastures. Limited quantities of Suwanee Bermuda sprigs may be obtained from the Georgia Coastal Plain Experiment Station.

DALLIS GRASS (Paspalum dilatatum): Dallis grass is a leafy bunch grass that produces an abundance of upright seed stalks. The seed stalks, which usually reach a height of 18 to 36 inches and have very few leaves, bear the seeds on 3 to 6 branches. Most of the leaves are borne near the base of the plant.

Dallis grass has a higher soil fertility requirement than carpet, Bahia, and Bermuda grass. Consequently it must be planted in naturally fertile soils such as river bottoms, or it must be well fertilized with commercial fertilizer. It is well adapted to low areas and helps make an excellent pasture when grown in association with white Dutch clover. It is one of the most palatable and nutritious perennial grasses that can be grown in this area.
Two serious fungus diseases attack Dallis grass. Ergot caused by *Claviceps paspali* attacks the seed and destroys many of them, greatly reducing the quality of the seed. When eaten, the mature ergots cause extreme nervousness, causing animals to go down in their front legs. In extreme cases, the animals become prostrate but can usually be cured by a regular dose of epsom salts and a change of feed.

Anthracnose, a foliage disease caused by *Colletotrichum graminicolum*, attacks the leaves and kills the plants under some conditions. Plants allowed to mature seed are more severely injured by this disease than those closely grazed. Close grazing to prevent the formation of mature seed stalks will help to control the damage resulting from both these diseases.

Comparatively little progress has been made in breeding ergot resistant strains of Dallis grass. A strain of this grass carrying considerable resistance to anthracnose has, however, been developed. This strain is leafier than common Dallis grass and will produce more grazing in late summer and fall. At Tifton this strain, designated as D-1, has maintained good stands over a longer period of time than common Dallis grass. Seed of D-1 is being increased for more extensive tests.

**BAHIA GRASS (Paspalum notatum):** Bahia grass is a deep-rooted perennial that spreads slowly by short stout stolons. The seed stalks, ranging from 8 to 36 inches in height—depending upon the type—occur in dense tufts. Most of the leaves are located near the base of the stems and consequently the leafy portion of the plant seldom attains a height of more than 12 inches. Six distinctly different types of Bahia grass have been found growing in the United States. These are described in Table 52. A study of this table indicates that there is something wrong with each of these Bahias. Common Bahia, for instance, lacks frost resistance. Pensacola Bahia, which is highly frost resistant and has many other desirable characteristics, becomes tough and unpalatable in the late summer and fall. Although this Bahia seeds well, the seed shatter so badly that it is difficult to save them.

Observations on winter hardiness, recorded in Table 53, indicate that the Bahia types differ greatly in the amount of cold that they will tolerate. Tifton, Georgia seems to be close to the northern limit for common Bahia grass, while Wilmington Bahia may be successfully grown as far north as Chapel Hill, North Carolina.

Preliminary studies indicate that the soil requirements for the six Bahia types considered here, are similar. Like carpet grass, they will grow on soils of lower fertility than either Dallis or Bermuda grass. Due to their extensive root systems, these Bahias are able to survive on the deep sandy soils that are extremely dry at certain seasons of the year. They will also grow in areas that are too wet for Bermuda grass but require better drainage than carpet and Dallis grass.

Numerous greenhouse studies have demonstrated that live seed of common Bahia, germinating less than 5 per cent in 3 months, can be made to germinate over 50 per cent in 10 days when properly scarified with sulphuric acid. Mechanical scarification is not effective on Bahia grass seed. In field tests, acid-scarified seed of common Bahia produced up to 10 times as many plants per 100 seeds planted as the same seed not scarified. Miero graph Paper
No. 6 of the Georgia Coastal Plain Experiment Station at Tifton, Georgia, supplies instructions on acid scarification of Bahia grass seed. This paper will be sent to anyone upon request.

The more promising of these Bahias are now being subjected to the grazing test. More data will be required before a definite statement can be made concerning their value as pasture plants. It now appears that they rank between carpet and Bermuda grass in production of pounds of beef per acre.

Common Bahia has been tested more on experiment stations and farms than the other strains considered here. In these tests it has made a good enough record that it can be recommended for areas in which it is adapted.

Evidence indicates that Pensacola Bahia may be better than Paraguay Bahia for pasture purposes. Both Pensacola and Paraguay Bahia are heavy seeding, highly aggressive grasses. In several different plantings at Tifton, these strains in a very few years have crowded out practically all other grasses growing in association with them. If either Pensacola or Paraguay Bahia grass can supply the nutritional requirements of animals grazing them, then their aggressive characteristics will be desirable because it will help to keep bitter weeds, etc., out of the pastures. If not, they will become perennial weeds that will be extremely difficult to eradicate in areas desired for clean-cultivation.

A great deal of time is being spent at the Georgia Coastal Plain Experiment Station, breeding Bahia grass in an effort to develop better types. Some of the products of this research promise to be superior to any of the Bahias described in Table 52.

**Napier Grass** (*Pennisetum purpureum*): This coarse perennial grass closely resembling sugar cane, reaches a height of 8 to 12 feet when mature. It is propagated by planting stems, stem cuttings, or crowns.

Napier grass is adapted to a wide range of well drained soils that must be heavily fertilized to produce the growth of which it is capable.

In spite of its coarseness, Napier grass is very palatable. It is nutritious and is particularly good for stimulating milk flow in dairy cows. Due to its habit of growth, Napier grass must be grazed rotationally. From three to five pastures are required to furnish the maximum amount of continuous grazing. The best production is obtained if the grass is allowed to reach a height of 3 to 4 feet before it is grazed. As soon as a majority of the leaves have been removed, the animals should be transferred to a new area.

Napier grass is costly to establish and maintain, and it requires more attention than most grasses. However, the farmer interested in obtaining the maximum production of succulent forage regardless of cost or effort, should seriously consider Napier grass. Only eyespot disease-resistant strains should be planted. Several of these have been developed at the Experiment Station and are available in very limited quantities.

**Perennial Grasses Not Generally Recommended for South Georgia:**
Rhodes grass (*Chloris gayana*), an excellent pasture grass in South Texas, winter-kills badly at Tifton and cannot be recommended for this area.

Pangola grass (*Digitaria decumbens*) is a perennial crabgrass from Africa that offers considerable promise in Florida. It has winter-killed almost com-
pletely during severe winters at Tifton, and, hence, can not be safely planted in the Georgia Coastal Plain.

Para grass (*Panicum purpurascens*) and molasses grass (*Melinis minutiflora*) are two other excellent grasses than can not be grown in South Georgia because of their susceptibility to cold.

Guinea grass (*Panicum maximum*) can not be recommended for this area because of its poor seeding habits and its susceptibility to winter injury.

Centipede grass (*Eremochloa ophiuroides*) is not recommended for pastures. It has given very poor grazing results; is spread by cattle through their droppings, and is extremely difficult to eradicate.

Cogon grass (*Imperata cylindrica*) is so aggressive that it is classed as a serious pest on crop land.

**Annual Pasture Grasses**

**Cattail (Pearl) Millet** (*Pennisetum purpureum*): This coarse-stemmed, leafy annual reaches a height of 6 to 12 feet when mature. Its seeds are borne in “cattail-like” heads which give it its name.

Cattail millet is well adapted to a wide range of well drained soil types. Although it will grow on soils low in fertility, it requires heavy fertilization for maximum production.

Cattail millet is the most productive annual pasture plant tested at Tifton. Greatest production can be obtained when two or more pastures are grazed rotationally. It should be grazed when less than two feet tall to obtain the most palatable and best quality pasturage.

Although cattail millet may be seeded broadcast, better results are usually obtained by planting it in cultivated rows spaced 30 to 36 inches apart. Ten pounds of good seed per acre usually give good stands when planted in rows.

Most farmers who use cattail millet for temporary grazing, point out that it is excellent while it lasts, but say that it does not last long enough. Late maturing strains, being developed by this Station, supply good grazing until frost and provide a much better seasonal distribution of forage than common cattail millet.

**Sudan Grass** (*Sorghum sudanense*): Sudan grass is a leafy annual member of the sorghum family that closely resembles Johnson grass in appearance. Since it does not have root stalks and dies each year, it may be grown without fear that it may become a pest in cultivated fields.

Sudan grass has a higher soil fertility requirement than cattail millet and consequently will require heavy fertilization if planted on poor soils. It will not grow on poorly drained soils.

Adapted to a wide range of climatic conditions, this highly palatable and nutritious grass is the most important temporary pasture crop in the United States. Its susceptibility to foliage diseases, which cause the plants to “fire” badly, is one reason it has not been widely used in the Southeast.

**Tift Sudan**: This Sudan variety, developed at Tifton, is highly resistant to most of the foliage diseases that attack Sudan grass. Repeated tests have indicated that it produces more and better quality forage than common Sudan
whenever there is an attack of foliage diseases. The increase in yield obtained from Tift Sudan, is in direct proportion to the severity of the disease, Tift frequently yielding more than twice as much as common Sudan when disease epidemics are severe. It also gives a longer grazing period.

Grazing studies with Tift Sudan have indicated that it is more palatable than cattail millet and will stimulate a little more milk flow than millet. It is less productive on most sandy soils than cattail millet, and for that reason, millet is generally preferred for temporary grazing. Tift Sudan makes good hay when grown alone or mixed with soybeans or cowpeas. Due to its rather coarse stems it is much more difficult to cure than Bermuda grass.

Broadcast plantings are generally less successful than plantings made in cultivated rows spaced 30 to 36 inches apart. When planted in rows, good stands may be obtained from a planting rate of 10 pounds of seed per acre.

**Lawn Grasses**

**Bermuda Grass** (*Cynodon dactylon*): Bermuda grass has been used on more lawns in the Southeast than any other grass and seems to be the best grass for those who seed ryegrass each fall to have a green winter lawn. It is one of the grasses least tolerant to shade. Unless Bermuda is fertilized heavily with nitrogen, it will not choke out weed growth as effectively as centipede, zoysia, and Bahia grass.

Home owners have usually had more success from vegetative plantings or spriggings of Bermuda, than from seedings. Many seedings have failed because people have planted the cheaper, unhulled seed, and have failed to water their lawns long enough to permit the seeds to germinate.

Hulled seeds germinate much faster than unhulled seeds and hence are more satisfactory for planting lawns, or any area where early establishment is desired. Any treatment that hastens the emergence of turf grass seedlings helps them to compete more successfully with annual weeds, such as crabgrass, and frequently means the difference between success and failure.

**Carpet Grass** (*Axonopus affinis*): Carpet grass is a good sod-forming species that is usually established with seed. It is more shade tolerant, requires less fertilizer than Bermuda grass, and is better adapted to low wet soils than any of the southern turf grasses. Its yellowish-green color is objectionable. Furthermore, its long seed heads are not readily cut with an ordinary lawn mower, thus giving the lawn a ragged appearance unless mowed frequently.

**Centipede Grass** (*Eremochloa ophiuroides*): Centipede grass, introduced from China a number of years ago, is one of the best lawn grasses for the deep South. Since there is no commercial source of seed, due to the low seed yield of the strains generally grown, it is usually propagated by planting the rapidly spreading stolons.

A centipede lawn in Tifton was quickly developed in 1937, by planting seed at a rate of one pound per 2,000 square feet, demonstrating that this grass could be established from seed much easier than from stolons, if a commercial seed source was available.

At low to moderate fertility levels, centipede grass makes such a dense turf that it crowds out all other grasses. This feature, together with its short, erect
seed heads, easily cut with a lawn mower even when mature, appeals to those who give their lawns little attention.

Since centipede grass is not nutritious and is a serious weed in pastures, it is not advisable to use it on farm lawns. It is more susceptible to frost than most of the grasses listed here. Its dense sod makes the establishment of fall-sown winter grass difficult. Occasionally it develops a peculiar yellowing and dying of the leaves that can usually be remedied with a light application of magnesium sulfate. Centipede grass does not resist wear as well as Bermuda grass and hence is not so well suited for heavy duty turf.

St. Augustine Grass (Stenotaphrum secundatum): St. Augustine grass, although somewhat coarser and more tolerant of shade than centipede grass, resembles it in many respects. It requires more moisture and fertilizer for optimum growth than centipede and does not usually make so dense a turf. It is very susceptible to chinch bug injury, manifested by large circular areas of the turf turning yellow and dying. It, like centipede grass, is propagated vegetatively.

Zoysia Manila Grass (Zoysia matrella): Most turf specialists agree that, if a good seed-producing strain or a rapidly spreading strain of zoysia could be found, no turf grass now known could equal it. Once established it makes a dense slow-growing turf that requires little mowing and tolerates shade, sun, and frost better than any turf grass tested at Tifton.

The fine-leaved Manila zoysia, Zoysia matrella, produces a much finer textured turf than the Zoysia japonica. Neither seems to grow as well in sandy loams of the Coastal Plain as in the heavier soils of the Piedmont. The high cost of propagating this grass is limiting its widespread use in the Southeast.

### TABLE 51.

<table>
<thead>
<tr>
<th>Fertilizer Treatment</th>
<th>Yield of Air Dry Hay in Pounds Per Acre When Cut On:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5-12-44</td>
</tr>
<tr>
<td>No Treatment</td>
<td>489</td>
</tr>
<tr>
<td>0-8-4</td>
<td>589</td>
</tr>
<tr>
<td>0-8-0 + Light Top-dressing</td>
<td>1226</td>
</tr>
<tr>
<td>0-8-4 + Light Top-dressing</td>
<td>1195</td>
</tr>
<tr>
<td>0-8-4 + Heavy Top-dressing</td>
<td>1848</td>
</tr>
</tbody>
</table>

Five hundred pounds of 0-8-4 or 0-8-0 were applied per acre in November 1943. Nitrate of soda was applied at the rates of 100 pounds per acre to the light top-dressing plots, and 200 pounds per acre to the heavy top-dressing plots on March 31, May 16, June 20, and July 29 in 1944.
TABLE 52.
A TABULAR COMPARISON OF SIX BAHIA GRASS TYPES
GROWN AT TIFTON, GEORGIA

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Common Bahia</th>
<th>Pensacola Bahia</th>
<th>Paraguay Bahia</th>
<th>Wilmington Bahia</th>
<th>Wallace Bahia</th>
<th>Tampa Bahia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf Width</td>
<td>wide</td>
<td>narrow</td>
<td>narrow</td>
<td>narrow and folded</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>Leaf Length</td>
<td>long</td>
<td>long</td>
<td>medium long</td>
<td>medium long</td>
<td>short</td>
<td>short</td>
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<tr>
<td>Leaf Color</td>
<td>light green</td>
<td>light green</td>
<td>green</td>
<td>dark green</td>
<td>light green</td>
<td>light green</td>
</tr>
<tr>
<td>Rate of Spread</td>
<td>medium</td>
<td>rapid</td>
<td>medium</td>
<td>medium</td>
<td>rapid</td>
<td>slow</td>
</tr>
<tr>
<td>Forage Yield</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>poor</td>
<td>medium</td>
<td>low</td>
</tr>
<tr>
<td>Palatability in Late Summer</td>
<td>good</td>
<td>medium</td>
<td>poor</td>
<td>good</td>
<td>medium</td>
<td>good</td>
</tr>
<tr>
<td>Frost Resistance</td>
<td>slight</td>
<td>very good</td>
<td>good</td>
<td>good</td>
<td>medium</td>
<td>slight</td>
</tr>
<tr>
<td>Seed Yield</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>low</td>
<td>medium</td>
<td>low</td>
</tr>
<tr>
<td>Amount of Seed Shattering</td>
<td>medium</td>
<td>much</td>
<td>slight</td>
<td>medium</td>
<td>medium</td>
<td>medium</td>
</tr>
<tr>
<td>Number of Seeds Per Pound</td>
<td>120,000</td>
<td>240,000</td>
<td>180,000</td>
<td>160,000</td>
<td>115,000</td>
<td>300,000</td>
</tr>
<tr>
<td>Bahia Type</td>
<td>The Relative Amount of Winter-killing Observed At:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tifton, Georgia</td>
<td>Thorsby, Alabama</td>
<td>Chapel Hill, North Carolina</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common</td>
<td>medium</td>
<td>heavy</td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wallace</td>
<td>slight</td>
<td>slight</td>
<td>medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraguay</td>
<td>none</td>
<td>none</td>
<td>medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilmington</td>
<td>none</td>
<td>none</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pensacola</td>
<td>none</td>
<td>none</td>
<td>medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tampa</td>
<td>very heavy</td>
<td>complete</td>
<td>complete</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* These observations were provided by Mr. Paul Tabor, Assistant Chief, Regional Nursery Division, Soil Conservation Service, Spartanburg, South Carolina.