than for any other crop grown in the Delta. Weed control is the primary purpose for the rotation, although improved structure and increased nitrogen are important secondary effects. The cropping sequence should provide for 1 to 2 years in rice and 1 to 3 years in lespedeza, soybeans, or pasture. One new and apparently promising rotation in some parts of Arkansas consists of 2 years in rice and 1 to 2 years of water fallow. A water level of 2 to 4 feet is maintained during the fallow period, and a crop of fish is produced. Nitrogen is the major nutrient that must be applied. Phosphorus may be needed on some soils. Lodging limits the rate of nitrogen application. The natural soil conditions and the present knowledge of management practices suggest a great potential rice production here if the market should demand it.

Pastures occupy 10 to 15 percent of the open land. The acreage has expanded rapidly since 1948. Most of the expansion has been on the silty clay and clay soils, except in places where a 3- to 5-year rotation with other crops is practiced. Establishment is a major problem, largely because of crusting and cracking of the soils. Land preparation in the fall and early spring seeding tend to minimize stand failures. Mixtures of grasses and legumes afford the most economical pastures, and ones which generally require little or no fertilization. Red clover and Johnsongrass for the lighter soils and tall fescue and Ladino clover for clay soils are two examples of adapted mixtures. Under intensive management systems where high forage production in late spring and summer is required, Coastal Bermuda-grass and Johnsongrass offer the best possibility. Each grass will require irrigation and the application of the equivalent of 1 pound of nitrogen a day during the growth period.

Soil management is seldom the limiting factor in pasture production. Rather, lack of knowledge of pasture crops and livestock management have usually limited the development of the pasture-livestock program.

The Coastal Prairies

R. K. Walker and R. J. Miears

The Coastal Prairie region in southwestern Louisiana and in southeastern Texas includes about 8 million acres. It almost parallels the coast of the Gulf of Mexico. A long, narrow band of coastal marshland lies between the prairie and the gulf.

The climate is subtropical. The average annual rainfall ranges from 58 inches in Louisiana to 34 inches in Texas. The average January temperature is 55° F. The average July temperature is 83° F. The average number of days between the last frost in spring and first frost in fall is 286. Extremely hot weather and severe cold weather seldom occur.

THE TOPOGRAPHY appears to be flat over wide areas, but the land slopes gradually to the gulf. The maximum elevation above sea level is slightly more than 100 feet, but most of the area is less than 50 feet above sea level. The prairie is bisected by many small streams and several large, well-defined streams with pronounced and fairly steep bordering slopes. Pimple mounds are conspicuous in several places.

The soils were formed from material carried by fresh water to the sea and deposited. These sediments were later uplifted and subjected to soil-forming processes under a grass cover.

The principal soils in Louisiana (and also in extensive sections in Texas) are deep, medium in texture, and slowly permeable. Crowley, Beaumont, and

Midland soils are the major series. The top 10 inches is a friable, light-brown silt loam, which becomes light gray when it dries thoroughly. The next 10 to 18 inches is a smooth, floury silt loam, which grades sharply into mottled yellow, red, and gray, heavy, plastic silty clay or clay. The thickness of the surface soil layer and the depth of subsoil vary considerably.

The large areas of deep, fine-textured, slowly permeable soils lie mainly in Texas. Lake Charles, Edna, and Beaumont are the major soil series. This group of soils is characterized by heavy, dense clay, with little difference between the topsoil and subsoil. The soils are sticky when wet but become slightly granular when dry. The surface soils are dark gray to black.

Extensive areas of deep, fine-textured, slowly permeable soils with dark-gray loam to clay surface soils also exist in the Coastal Prairie. They are sticky when wet but granular and crumbly when dry.

Approximately 2.5 percent of the region is composed of bottom land.

About 90 percent of the Louisiana Coastal Prairie region is in cultivation. Only 25 percent of the Texas region is cultivated.

Rice production dominates the Louisiana and eastern Texas part of the Coastal Prairie.

In the extreme western part in Texas, the main crops are cotton, grain sorghums, and corn. Some rice is grown there also.

Cattle are raised in conjunction with the major crops. Approximately 75 percent of the Texas Coastal Prairie is in pasture. Vegetable crops and dairying are important in small areas near cities.

The general cropping system in the part where rice is the dominant crop is 1 year in rice and 2 years or more in native grass pasture. No definite cropping system is used over large areas in the western end of the region, but cotton generally is rotated with corn and grain sorghum, and winter legumes are grown in some localities in rotation with row crops.

The principal soil problems are poor drainage, both surface and internal; poor physical condition of soils; a low content of organic matter; and a relatively low fertility level. Lack of available nitrogen and phosphorus is the major deficiency.

Surface drainage of large portions of various watersheds was the dominant soil-management problem when the land was originally put into cultivation. Much emphasis has been placed on improvement of drainage of these areas by Federal, State, and local agencies. Some drainage projects have been completed. Others were in varying stages of completion in 1957, and much remained to be done to provide proper drainage of the entire area.

Individual farm drainage has been vastly improved by providing drainage ditches. Field drainage has been greatly improved by land-leveling practices. Conservation of irrigation water in flooding riceland is another result of land leveling, which has been done on an extensive scale and is a standard practice.

Poor internal drainage of the Coastal Prairie soils is an inherent characteristic that cannot be altered very much. This factor is favorable for keeping ricelands under a continuous flood during the growing season, but it prohibits the successful production of a large number of crops and makes the soil difficult to work for good seedbed preparation and cultivation.

A trend toward a rotation of improved pastures and rice has been evident in the Coastal Prairie rice area.

Results of longtime experimental work in Louisiana show that rotation

of improved pastures with rice will increase beef production from 46 to 271 pounds an acre annually and increase rice yields by 5 barrels an acre. The rotation also combats undesirable grasses, broad-leaved weeds, and "red rice," increases the fertility level of the soil, and improves its physical condition.

Improved pastures that may contain ryegrass, whiteclover, Dallisgrass, Bermuda-grass, and lespedeza, supplemented with oats or wheat for temporary winter grazing and with lespedeza or alyceclover for temporary summer grazing and hay production, provide high-quality grazing, hay, and grain in the area.

A NEED exists for supplementary irrigation of nearly all crops in the region, even though the annual rainfall is relatively high.

A large percentage of the total area has facilities for irrigating rice. The facilities can be used in supplementary irrigation on all adapted crops. Contour levees should be erected for all crops, except row crops, to permit intermittent flushing during dry periods. The vast supply of water, the existing pumping facilities, canals, and laterals, and the farmers' knowledge of flushing techniques make irrigation at low cost possible.

Soils that have been planted to rice for many years have a poor physical condition. Factors contributing to poor physical condition of the soils are: Low content of organic matter, poor internal drainage, working the land when it is wet, grazing under wet conditions, submergence over extended periods, and a high content of silt and clay.

A hard rain on a prepared seedbed, followed by rapid drying, results in a hard crust, which seals the soil surface. This condition prevents the emergence of young seedlings and retards the growth of young plants. A solution to this problem has been found for many crops following rice.

Winter and summer grasses, whiteclovers, lespedeza, oats, wheat, and flax have been grown successfully by seeding broadcast in rice stubble without any seedbed preparation. Forage and seed yields compare favorably with yields under prepared seedbed conditions. Adequate fertilization is necessary with either method of seeding.

A trend toward this method of seeding is expected because seedbed preparation involves no expense; seeding and fertilization by airplane can be made at any time that is convenient to the farmer, regardless of conditions of soil moisture; erosion can be controlled by a cover of stubble, straw, and undisturbed topsoil; and less bogging by livestock occurs when wet land has to be grazed.

Seedlings exhibit more vigor when they are established in a stubble and straw-covered surface than in a hard-crust surface, which sometimes follows preparation of the seedbed.

The production of large quantities of rice in excess of domestic consumption and export needs began in 1954. Severe acreage reductions were made under Government price-support and acreage-control program. Diversion of land once in rice to uses that will produce an economic return is necessary in the region.

RESEARCH STUDIES by the Texas and Louisiana Agricultural Experiment Stations show that few other crops are adapted to the poorly drained, highly impervious soils of the Coastal Prairie region. The major potential use for a large acreage of land normally planted to rice is improved pastures that will be used in rotation with rice.

Diversion of land use from rice to the production of livestock feed crops is also a possibility. Work at the Louisiana Rice Experiment Station, Crowley, La., has shown that oats, wheat, and grain sorghums can be grown in the area and that rice and its byproducts are an excellent source of feed.

Cottonseed products, molasses, and miscellaneous feeds are available and make possible the formulation of good feed for livestock at a low cost. A potential for a large increase in the use of feed exists because the beef cattle system in the area has largely been the maintenance of cows and marketing of calves at weaning age. Farmers could realize greater profits from their land and cattle by producing feed crops and marketing higher quality animals at heavier weights than under the present system.

The use of commercial fertilizers for the major crops in the region has increased greatly since 1945. Farmers tend to use the rates recommended on the basis of experiments in Texas and Louisiana. The major deficiencies are in available phosphorus and nitrogen.

All soils in the region need 40 to 80 pounds of nitrogen and 20 to 40 pounds of phosphoric oxide an acre for rice. An additional 20 pounds of potash is needed for light-textured soils. Maximum efficiency is obtained when the phosphorus and potash are applied during the period from seeding to 30 days after emergence of the rice plants. A part of the total nitrogen requirement can be applied with good results as late as eight weeks after emergence.

During the first year of establishment, improved pastures need a minimum application of 40 pounds of nitrogen, 100 pounds of phosphoric oxide, and 60 pounds of potash an acre.

After the pastures are established, annual applications of 60 pounds of nitrogen, 40 pounds of phosphoric oxide, and 20 pounds of potash should be made.

The reaction of the more acid soils should be adjusted to pH 6.2 by the application of agricultural limestone.

Wheat and oats for winter supplementary pasture and grain production have indicated a need for 80 pounds of nitrogen and 60 pounds of phosphoric oxide. Twenty pounds of potash an acre should be applied in potash-deficient areas. Applications of 40 pounds of nitrogen and 40 pounds of phosphoric oxide have produced maximum yields for grain production when grazing is not practiced.

Lespedeza and alyceclover for hay production have produced high yields with the addition of 20 pounds of nitrogen, 60 pounds of phosphoric oxide, and 20 pounds of potash.

Competitive broad-leaved weeds and grasses that thrive in water are one of the limiting factors in rice yields. The lands of the Coastal Prairie that have been planted to rice for a long time are highly infested with seed of plants that will grow in water. In rice growing, the land is submerged to an average depth of 4 to 5 inches when the rice is about 8 inches tall, and submergence is continuous throughout the growing season. Grass and weeds are controlled by submergence with water under ideal weather and soil conditions. Adverse conditions for quick germination of rice seed, rapid emergence, and the growth of plants are frequent, and permit the early growth of grass and broad-leaved plants.

If competitive plants attain a growth equal to the rice plants, they will persist in the water and cause a serious reduction in the yield and quality of the rice.

Broad-leaved plants can be controlled after they emerge by applying herbicides, such as 2,4-D and 2,4,5-T, but grasses are not sensitive to those chemicals. Research with applications of various chemicals before emergence, at emergence, and shortly after emergence has shown good possibilities that grasses can be controlled in rice by herbicides. Complete control of competitive vegetation will permit the rice plants to utilize fertilizers more efficiently and will also increase the yields and quality.