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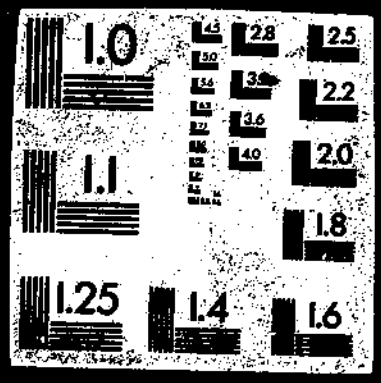

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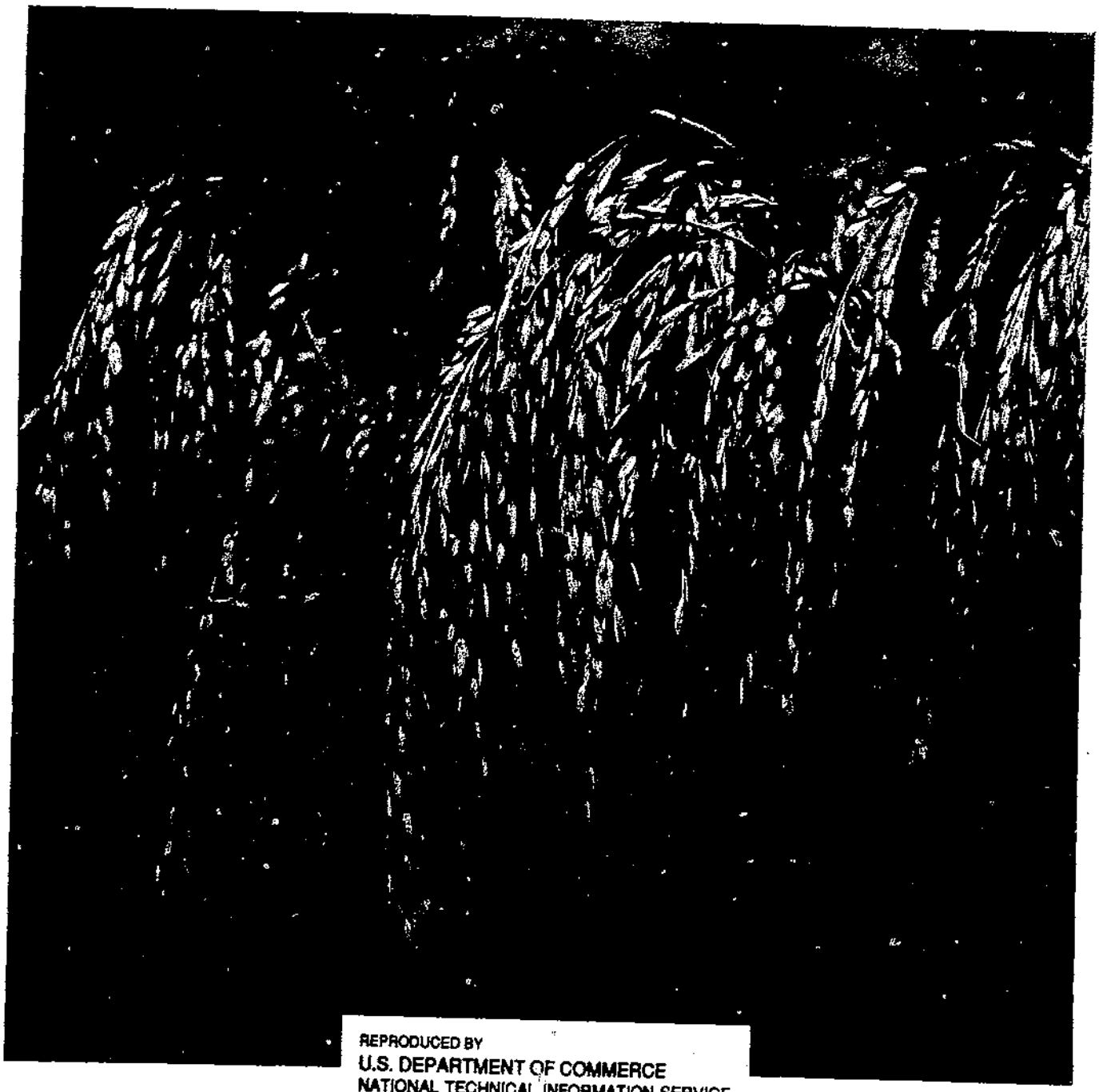

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Abstract

This report presents rice production practice and cost data for farms in six major U.S. rice-producing areas. Rice producers were surveyed concerning specific production practices involved in the production of rice as part of the 1988 Farm Costs and Returns Survey. Production practice data include information on seeding, fertilization, pesticides, irrigation, trucks and tractors, field operations on planted rice acreage as well as set-aside acreage, and drying. Cash and economic costs are estimated for 1988, including and excluding the effects of Government payments.

Keywords: Rice, farm size, production practices, costs of production, Government payments

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Contents

Summary iii

Introduction 1

Data Sources 1

Location of Rice Production 2

Characteristics of Farms Producing Rice 3
- Farm Size 3
- Land Use 3
- Land in Rice Production 4

Rice Production Practices 5
- Seeding 5
- Fertilization 6
- Pesticides 7
- Irrigation 7
- Trucks 9
- Tractors 9
- Field Operations 9
- Drying 10

Rice Production Costs and Returns 11
- Costs and Returns Excluding Government Payments 11
- Costs and Returns Including Government Payments 13

References 16

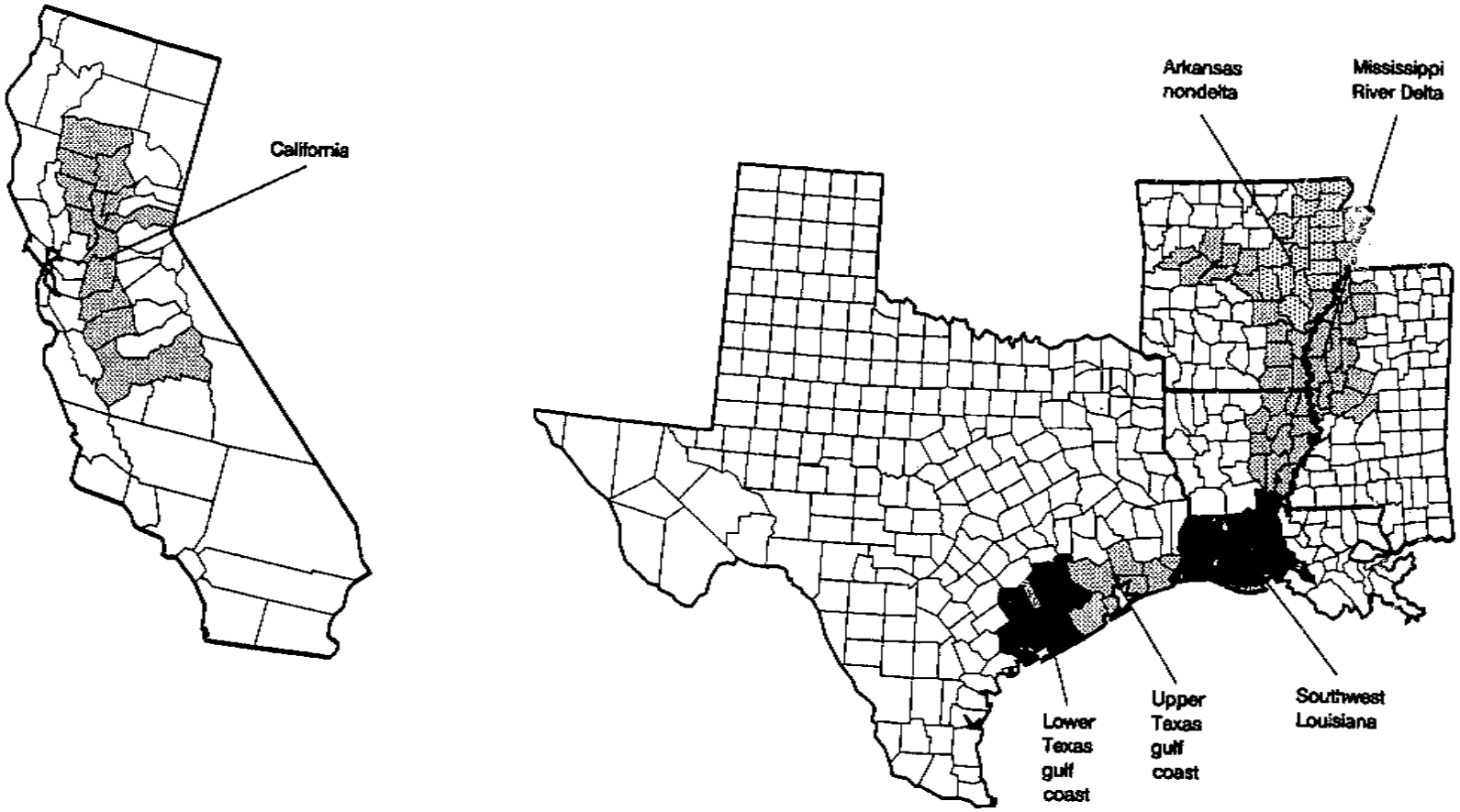
Summary

Rice production in the United States occurs primarily in six areas. In 1988, the largest rice farms were in Texas and the Mississippi River Delta. Enterprise mix varied across production areas, ranging from rice as the only crop produced on farms to rice produced in addition to, or in rotation with, one or more other crops. A majority of rice land in each of the six areas was rented from others rather than being owned by the farm operator, with share-rent being the dominant type of rental arrangement.

Rice seeding is performed primarily with a tractor and grain drill or from an airplane. The use of fertilizers and pesticides, to support and protect the development of the rice plant as it matures, is an important practice in rice production. Grown under flooded field conditions, rice requires much irrigation water obtained from underground or surface sources. Rice field operations performed by tractor-pulled implements consist mainly of tillage operations involved in land preparation prior to seeding.

Major variable cash costs of rice production include fuel, drying, chemicals, labor, fertilizer, and in some areas, purchased water and custom operations. Participation in Government programs by rice producers influences the level of both cash and economic production costs as well as the level of returns.

Figure 1
Major rice production areas



U.S. Rice Production Practices and Costs, 1988

Michael E. Salassi

Introduction

Rice is one of the commodities for which Congress mandates the U.S. Department of Agriculture (USDA) to produce annual estimates of costs of production. To estimate the costs of producing rice, the Economic Research Service (ERS) develops enterprise costs and returns statements that contain the total operator and landlord costs associated with producing rice under average production practices within each major production area. These per-acre cost budgets are aggregated by the planted acreage represented by each budget to produce regional and national estimates of rice costs of production.

Information about rice production practices, which forms the underlying database for the budgets, is obtained from periodic surveys of rice producers. This report presents average production practices and costs of producing rice in the six major rice-producing areas of the United States for 1988. Data presented here were developed from the most recent survey of rice producers, which was conducted for the 1988 crop year. Rice producers were previously surveyed in 1979 and 1984 to obtain data necessary to estimate costs of production. Summaries of the production practices and costs generated from these surveys can be found in (3) and (1).1/

Data Sources

Primary rice production practice data summarized in this report were obtained from the rice version of the 1988 Farm Costs and Returns Survey (FCRS). The FCRS is a multiframe, stratified survey of farm operators conducted annually by ERS and the National Agricultural Statistics Service (NASS) to obtain information concerning farm income and expenses, as well as commodity-specific data for estimating costs of production.

The rice version of the 1988 FCRS contained questions on the organization and financial structure of the entire farming operation, as well as questions about production practices and operating expenses specific to the rice enterprise. A total of

1/ Underscored numbers in parentheses refer to items cited in the References section.

538 rice producers who produced rice in 1988 completed the survey.

Each completed survey in the sample represented a specified number of rice farms in the population with similar characteristics. This number, termed the survey expansion factor, was estimated by NASS for each rice farm responding to the survey. Survey expansion factors are used to expand sample data obtained in the survey to population estimates. They are also used, as in this report, as weighting factors when estimating average characteristics per farm or average costs per acre from the sample of farms collected.

Average costs and returns of producing rice in each major production area were estimated with the use of a farm-level budget generator. The structure of the cost budgets and the methodology used to estimate each budget are similar to those historically used by ERS to estimate commodity costs of production (2). The farm-level budget generator, however, allows for the estimation of a complete rice costs and returns budget for each farm surveyed.

Average production practice and cost data presented in this report include an estimate of the coefficient of variation for each item. The coefficient of variation is a measure of the sample error or variability of the estimated sample mean and takes into account variation in the variable of interest, as well as variation in the expanded number of rice farms estimated from the sample. It is defined as the standard deviation of the estimate divided by its mean and may be interpreted as a measure of the dispersion of sample values about their mean. Survey results can also be influenced by nonsampling error which can be introduced by enumerators, respondents, or survey design. Efforts were made to minimize the effect of nonsampling error by training the enumerators, reviewing and editing the survey data, and analyzing the data for comparability and consistency.

Location of Rice Production

U.S. rice production occurs primarily in just six States. Over 95 percent of the acreage and production of rice is located in Arkansas, California, Louisiana, Mississippi, and Texas, with Missouri accounting for a very small percentage. Arkansas is the leading rice-producing State, with annual planted acreage exceeding 1 million acres and annual production of approximately 60 million hundredweight of rough rice.

To estimate costs of production, ERS defines production areas of a commodity based upon similar production practices and soil characteristics. These production area boundaries coincide with State boundaries for most major field crops. Rice-production areas defined by ERS do not, in most cases, coincide with State boundaries.

In the 1988 FCRS, ERS identified six major rice-producing areas of the United States. These six areas include: (1) the nondelta areas of Arkansas; (2) California; (3) the Mississippi River Delta areas of Arkansas, Louisiana, and Mississippi; (4) southwest Louisiana; (5) the upper Texas gulf coast; and (6) the lower Texas gulf coast (fig. 1).

Characteristics of Farms Producing Rice

The characteristics of farms producing rice in the United States, as well as the relationship of the rice enterprise to the overall farm organization, vary considerably among the major rice production areas. This section compares farm size and land use, as well as rice acreage, tenure, and production on farms in the six major production areas.

Farm Size

The largest rice farms surveyed in 1988 were in Texas and the Mississippi River Delta. Total area operated by rice farms averaged 1,752 acres per farm in the upper Texas gulf coast and 1,118 acres per farm in the lower Texas gulf coast (table 1). Rice farms in the Mississippi River Delta averaged 1,257 acres. California had the smallest rice farms. Most of the rice land in each of the six major production areas was rented from other individuals, rather than owned by the farm operator.

Land Use

Crop rotation is an important aspect of rice production. It is necessary in controlling weeds, particularly for red rice, and is also helpful in controlling some plant diseases. Recommended rotation programs suggest that rice be planted 1 year in 3, although rotations with rice planted 1 year in 2 are also common. The necessity of crop rotation has implications for land use on rice farms.

Rice farms in the Arkansas nondelta and Mississippi River Delta areas were the most diversified farms, producing several crops, primarily cotton, soybeans, and wheat, in addition to rice (table 1). Soybeans are the most common crop rotated with rice. Average acreages of rice and soybeans per farm in these two areas suggest that land used for rice production is planted in rice 1 year in 3, and planted in soybeans the other 2 years. Winter wheat is commonly double-cropped on some of the rice land in these areas. Cotton produced on rice farms, primarily in the Mississippi River Delta, is usually grown on the same land year after year and is not rotated with rice.

Soybeans are also grown in rotation with rice in southwest Louisiana and, to some extent, in Texas. Average soybean acreage about equaled rice acreage on farms in southwest Louisiana, but was substantially less than rice acreage on farms in the upper and lower Texas gulf coasts (table 1). Farms in these areas also leave sizable portions of their land idle, either as pasture or

fallow, rather than planting them in some other crop. Farms in California reported some acreages of other crops, but rice was the dominant crop enterprise on these farms.

Land in Rice Production

The high participation rate of rice producers in Government farm programs has tended to constrain rice acreage per farm, through the effect of set-aside and payment limitation provisions. Rice farms surveyed in 1988 in the Arkansas nondelta, California, Mississippi River Delta, and southwest Louisiana production areas averaged between 250 and 300 acres of planted rice (table 2). Virtually all the rice planted in each production area in 1988 was harvested.

California has historically achieved the highest rice yields per acre due, in part, to favorable, disease-free growing conditions. In 1988, farms in this area reported yields averaging 71.22 hundredweight per harvested acre (table 2). The lower Texas gulf coast area reported the second highest average yields at 64.45 hundredweight per acre. Rice farms in southwest Louisiana had the lowest average yields due primarily to weather and disease problems.

Very little of the land used to produce rice in 1988 was owned by the farm operator. With the exception of California, no production area had more than 19 percent of its average rice acreage planted on land owned by the farm operator (table 3). In California, 32 percent of the total rice acreage was planted on owned land and 22 percent of the farms planted their entire rice acreage on land owned by the farm operation.

Most rice grown in the United States in 1988 was produced on rented land, with share rent being the most common form of rental arrangement. The portion of total rice acreage share-rented ranged from approximately 41 percent in California to 78 percent in southwest Louisiana (table 3). In four of the six production areas (Arkansas nondelta, Mississippi River Delta, southwest Louisiana, and lower Texas gulf coast), more than 40 percent of the rice farms planted their entire rice acreage on share-rented land.

Under typical share rental arrangements, the landlord receives a share of the value of production, as well as a share of any Government payments received, in exchange for paying a portion of the production expenses. Average landlord shares of production and expenses reported in 1988 by rice farms are shown in table 4. The landlord's share of production ranged from approximately one-fourth to one-third of the rice production per acre. The percentage of expenses paid by landlords varied from area to area. However, the most common production expenses paid by landlords included seed, fertilizer, chemicals, drying, irrigation fuel, and fixed irrigation (depreciation).

Ratooning is a common practice in some rice production areas. After the rice is harvested, another application of fertilizer is

applied and the field is reflooded. The rice is allowed to regrow and form new grain heads. When mature, a second (ratoon) crop of rice can be harvested from the same acreage. Farms harvesting a ratoon crop of rice usually plant early-maturing varieties with the harvest of the first crop occurring in early August, giving the second crop adequate time to mature (4, 5).

Rice farms located in the gulf coast region were the only farms that harvested a ratoon crop of rice. Southwest Louisiana and the upper Texas gulf coast areas had ratoon crops of rice averaging almost 10 percent of their planted acreage, while farms in the lower Texas gulf coast harvested two crops of rice from about 58 percent of their total planted acreage (table 2).

Acreage and production data for farms harvesting a ratoon crop of rice in 1988 are shown in table 5. Approximately 54 percent of the farms in the lower Texas gulf coast area harvested a second crop, compared with 18 percent in southwest Louisiana and 16 percent in the upper Texas gulf coast. Ratoon crop acreage averaged 40 percent of initial harvested acreage in southwest Louisiana (139 second-crop acres from 347 harvested acres per farm), 59 percent in the upper Texas gulf coast, and 88 percent in the lower Texas gulf coast. Additional yield obtained from harvesting a second crop was highest in the two Texas areas, averaging 11.45 and 14.60 hundredweight per acre.

Rice Production Practices

This section describes some of the specific production practices involved in producing rice in the United States. Information is presented for each major production area regarding rice seeding, fertilization, pesticide use, irrigation, use of trucks and tractors, field operations, and drying.

Seeding

There are three basic methods to plant rice: seed can be drilled into dry ground with the use of a grain drill pulled by a tractor; it can be broadcast with the use of a broadcast seeder mounted on a tractor; and it can be dropped from a low-flying airplane. Many producers using the aerial planting method plant the rice seed on land that has already been flooded with irrigation water. This technique (waterseeding) suppresses red rice growth, but generally requires a rough or ridged seedbed surface (to minimize seedling drift) and the use of presprouted seeds (which get the seedling off to a more rapid start).

Most of the rice planted in the Arkansas nondelta and Mississippi River Delta areas are planted with a grain drill (table 6). Approximately a third of the rice acreage in the nondelta area of Arkansas was broadcast. More than 90 percent of the acreage in California and southwest Louisiana was waterseeded from an airplane. In the upper Texas gulf coast, about 75 percent of rice acreage was aerially planted, both on flooded and dry land.

Seeding rates per acre varied by both planting method and production area (table 6). Average pounds of seed planted were generally less for aerial-dryland and drilled planting methods, ranging from 99 to 130 pounds per acre. Seeding rates were somewhat higher for the other planting methods, ranging as high as 140 pounds per acre for broadcast rice in the nondelta of Arkansas and 164 pounds per acre for waterseeded rice in California.

Fertilization

A proper balance of plant nutrients is essential to the development of the rice plant, particularly during the early stages of plant growth. Nitrogen, phosphorus, and potassium are the three major plant nutrients important in rice production. Depending upon soil conditions, certain micronutrients may also be deficient in the soil and must be added, zinc being the most common. Nitrogen is usually the most limiting plant nutrient in regard to rice plant growth and development. Adequate amounts of nitrogen in the soil are necessary to attain maximum yields of all rice varieties grown in the United States.

The behavior of nitrogen under flooded soil conditions differs greatly from its behavior under dryland conditions. Flooding the soil lowers the stability of the nitrate form of nitrogen and increases the stability of the ammonium form. Because of this interaction, it is impossible to maintain levels of nitrate in flooded soil conditions, due to leaching and denitrification, and virtually all of the nitrogen present is in the ammonium form. For this reason, inorganic fertilizers used in rice production are of the ammonium form, rather than the nitrate form commonly used on other field crops (4).

Rice farms surveyed in 1988 reported applying nitrogen to their rice acreage more than once, on average, during the growing season (table 7). California was the only production area where nitrogen was applied fewer than two times, with an average of 1.74 applications per acre. All other areas applied nitrogen more than two times per acre planted. The high Texas rate partly reflected the added application of nitrogen associated with the production of a ratoon crop of rice. Application rates for nitrogen ranged from 102 pounds per acre in California to 200 pounds per acre in the lower Texas gulf coast.

The application of phosphorus and potash was more dependent upon the particular soil conditions in the various production areas (table 7). Phosphorus was most commonly applied by rice farms in California, southwest Louisiana, and Texas, with average application rates ranging from 39 to 49 pounds per acre. Potash was commonly applied by farms in southwest Louisiana and Texas, and to a lesser extent in the nondelta of Arkansas. Less than 10 percent of the rice acreage in the Mississippi River Delta area was reported to be treated with either phosphorus or potash.

Pesticides

Protection of the rice plant, as it matures, from the various pests that can retard plant growth and reduce yield is of major importance in rice production. Failure to provide adequate plant protection can result in significant loss of yield and, in some cases, loss of the entire rice crop.

There are four major groups of plant pests important in rice production. Weeds, including grasses, broadleaf weeds, and sedges, compete with rice for water, space, and sunlight. Insects, such as the rice water weevil or the rice stink bug, can damage rice by feeding directly on the rice plant. The flooded condition under which rice is grown is also conducive to a host of diseases that can attack the rice seedling or the mature plant. Weeds, insects, and diseases are generally controlled through the application of chemical pesticides (herbicides, insecticides, and fungicides) to the fields.

A fourth major pest is blackbirds. Blackbirds, particularly the red-winged blackbird, are pests during the planting season by feeding on just-planted rice seed. They can also damage a crop by feeding on the ripening grain heads prior to harvest. No chemical repellents are registered for use in controlling blackbirds in rice. Producers can adjust the planting date or increase the seeding rate in an effort to reduce loss from blackbirds during planting season. As the grain heads are ripening, the only effective control available to the producer is to set up scare devices, such as firearms or propane exploders, at various points throughout the field.

In 1988, more than 60 percent of the farms in the lower Texas gulf coast and more than 70 percent of the farms in the upper Texas gulf coast and California reported using insecticides on their rice crops (table 8). Approximately 30 to 50 percent of the farms in each production area reported using fungicides, except in California where no farm reported the use of fungicides to control diseases.

Weeds are the primary plant pest in rice production. At least 90 percent of the farms in each of the six major production areas reported the use of herbicides to control weeds. The percentage of acres treated indicates that rice fields were usually treated with herbicides more than one time, ranging from an average of 1.64 treatments per acre in southwest Louisiana to 2.68 treatments per acre in the Mississippi River Delta. Farms in each production area also reported expenses for blackbird control, with the greatest incidences occurring in California and the gulf coast areas of Louisiana and Texas.

Irrigation

Unlike most other field crops, rice is grown under flooded field conditions. The land is flooded at or just after planting and the flood is maintained throughout the growing season until the field is drained just prior to harvest. This section describes

the sources of water and types of equipment used in the irrigation of rice.

There are four basic sources of water used to irrigate rice. Primary sources of irrigation water include an onfarm well or an onfarm reservoir or other surface source. Or, the water may be purchased from a canal company or irrigation district and delivered to the farm via an irrigation canal or ditch. A fourth source of irrigation water includes secondary sources such as runoff water collected in a reuse reservoir.

Water from onfarm wells was the major source of irrigation water for rice farms in the Arkansas nondelta and Mississippi River Delta and, to a lesser extent, in southwest Louisiana and the lower Texas gulf coast (table 9). Surface irrigation water (nonpurchased) from onfarm sources was most prevalent in southwest Louisiana. Purchased irrigation water was a major irrigation source in California and Texas.

Farms in production areas that relied on farm wells as a water source for rice reported an average of about two wells per farm being used to irrigate their rice crop (table 10). Well depth varied greatly among the six production areas, with the shallowest wells located in the Arkansas nondelta and Mississippi River Delta areas and the deepest wells located in Texas. Average well diameter exceeded 10 inches in each of the six major areas, with the largest wells being in California and Texas.

The number of irrigation pumps used to irrigate rice is related to the source of water. Well sources of water required a pump to pump the water out of the well and onto the field. Farms using a high percentage of well water, such as in the Arkansas nondelta and Mississippi River Delta areas, used about the same number of pumps per farm to irrigate rice as they had wells (table 11). Farms using surface water (purchased or nonpurchased) usually delivered the water to the field by way of canals or ditches and, in some cases, did not require the use of pumps. Delivery of irrigation water to rice fields by way of canals, which did not require the use of pumps is reflected in the average number of pumps per farm used to irrigate rice being less than one in California and the upper Texas gulf coast regions. The average size of pump, in gallons per minute (GPM), varied considerably among the six major production areas.

Diesel motors were the most common type of power unit used to operate rice irrigation pumps in the Arkansas nondelta, Mississippi River Delta, southwest Louisiana, and the upper Texas gulf coast areas (table 12). Electric motors were used almost exclusively in California and to a significant degree in the Arkansas nondelta, Mississippi River Delta, and the upper and lower Texas gulf coasts. The average size of irrigation motors, in horsepower, depended on the source of water, as well as the pumping lift, as much larger motors were required to pump irrigation water from underground wells than to pump water onto fields from surface water sources.

Trucks

Pickup trucks are used to pick up supplies, carry supplies or workers to the rice fields, and travel from field to field to monitor plant growth or water levels. Rice farms surveyed in 1988 used about two pickups per farm (table 13). Annual mileage per truck for all uses ranged from 13,599 to 20,465 miles and most of those miles were associated with the production of rice. Other types of trucks, such as single-axle, tandem-axle, and semi-trucks, were also used by rice farms, primarily to haul rice after it was harvested.

Tractors

Types of tractors used to pull field implements in rice fields may be two-wheel drive, two-wheel drive with front-wheel assist, four-wheel drive, or crawler-type tractors on which the wheels have been replaced with tracks. Two-wheel drive tractors were the most common type of tractor used in rice field operations on farms in all areas except California where crawler tractors were more common (table 14). Two-wheel drive assist and four-wheel drive tractors were also used in each production area, but to a much lesser extent.

Two-wheel drive tractors, in the areas where they were most commonly used, ranged in average size from 113 to 141 horsepower (table 15). Virtually all tractors used in the production of rice were diesel (table 16) and the majority of these tractors were owned by the farm operation (table 17). With a few exceptions, annual use per tractor averaged 400-600 hours for most types of tractors used (table 18).

Field Operations

Most field operations performed on rice acreage (those operations performed with the use of a truck, tractor, or combine) occur prior to and at planting. Most of these operations are involved with seedbed preparation. Tractors are again used at planting if the rice is being planted with a grain drill or broadcast seeder. In some instances, fertilizers or pesticides may be applied to the field with a tractor before or during planting. Once the rice is planted, no tractor operations in the field are usually needed until the field is drained and ready for harvest. Most of the chemical applications during the growing season are made from an airplane.

Total times-over (trips over the field with implements) ranged from an average of 4.10 in southwest Louisiana to 9.64 in the lower Texas gulf coast (table 19). Most of these times-over were engaged in some type of tillage operation, most commonly plowing, disking, cultivating, or harrowing. The relatively large times-over for the planting operation in the Arkansas nondelta, Mississippi River Delta, and the lower Texas gulf coast reflect the widespread use of drill and broadcast planting methods common in these areas. Estimates of harvesting times-over that are less than one are an indication of the degree of custom harvested

rice, not included in the times-over estimate. The average harvest times-over of 1.46 in the lower Texas gulf coast reflects the high percentage of ratoon crop rice harvested in that area.

The average widths of field implements used in rice production are listed in table 20. Implements listed for each major production area are those that had an average times-over of 0.30 or greater. As evidenced by the table, certain implements are commonly used in all production areas, including offset heavy-duty disks, plowing and regular tandem disks, field cultivators, and landplanes. Other implements, such as chisel plows, roller-packers, and floats, although used to some extent by some farms in each area, are commonly used by a large percentage of farms in only a few areas. The average tractor sizes used to pull these implements are listed in table 21.

Government farm programs for rice, in which most of the rice producers in the Nation participate, require that a certain percentage of a farm's rice base acreage be put to a conserving use. Although no rice is planted on this set-aside acreage, some field operations are usually performed on this land, primarily to control weeds. In some instances, a cover crop may be planted on this land to conserve soil moisture and prevent erosion.

Rice producers surveyed in 1988 were questioned about the specific field operations they performed on their rice set-aside acreage (table 22). Average field times-over ranged from 0.72 trips per acre on set-aside land in California to 2.44 trips per acre in the Mississippi River Delta. Virtually all of these times-over were for tillage, primarily disking. A few farms in the Arkansas nondelta and Mississippi River Delta reported planting some type of cover crop on a small portion of these acres.

Drying

For the best milling yield, rice should be harvested when its moisture content is between 18 and 23 percent. After the rice is harvested, some method of artificially reducing the moisture content (drying) to 12-13 percent is necessary to allow for safe, extended storage of the grain. Much of the harvested rice is dried by commercial dryers, although onfarm drying facilities are common in some areas.

Commercial rice drying was prevalent in all six production areas (table 23). Commercial drying firms dried as much as 86 percent of the production in California and 93 percent of the production in the lower Texas gulf coast. Onfarm drying facilities, present in all six areas, handled more than 50 percent of the production in the Mississippi River Delta and upper Texas gulf coast. In the Arkansas nondelta, 30 percent of the production was reported sold as green (undried) rice. In this case, the farmer sold the rice and relinquished ownership before the rice was dried.

Average moisture content of rice at harvest ranged from 19.2 percent in three areas to 22.7 percent in California (table 23). Charges by commercial firms to dry rice ranged from an average of 62 cents per hundredweight in the Arkansas nondelta to 95 cents per hundredweight in southwest Louisiana. Most common fuel types of onfarm rice dryers included liquefied petroleum (LP) gas, natural gas, and natural air (table 24).

Rice Production Costs and Returns

This section presents estimated costs and returns associated with the production of rice for 1988 in each of the six major rice-producing areas. Gross returns, cash costs, economic costs, and net returns that both include and exclude the effects of Government payments are presented. Estimates presented here were developed using a farm-level budget generator. A complete description of the structure of the ERS cost-of-production accounts can be found in Economic Indicators of the Farm Sector: Costs of Production--Major Field Crops, 1989 (6). Coefficients of variation were also estimated and are presented here for each cost and return item.

Costs and Returns Excluding Government Payments

Average cash costs and returns of rice production per planted acre in the six major production areas, excluding Government payments, are shown in table 25. Gross value of production, or total cash receipts, was estimated as yield per planted acre times the harvest-month price of rice. USDA's National Agricultural Statistics Service cannot disclose or publish State-level harvest-month prices of rice, due to data confidentiality restrictions. Therefore, 1988 harvest-month prices shown here are estimates based on the national-level harvest-month price, the proportion of long-grain and medium-/short-grain rice produced in each area, and the Commodity Credit Corporation (CCC) loan rate differential for long-grain and medium-/short-grain rice.

The highest gross returns in 1988 were in the lower Texas gulf coast and California (table 25). The high returns there resulted from relatively high yields, due, in part, to the large percentage of acreage that was second-cropped, and to the fact that virtually all of this production was long-grain rice, which generally receives a higher market price than medium-grain or short-grain rice. Most of California's annual planted rice acreage is in medium-grain varieties. California also produces virtually all of the Nation's short-grain rice, although this accounts for a very small portion of the total rice produced. Market prices for medium-grain and short-grain rice are generally less than for long-grain. Yields in California, however, were sufficiently large to result in high total cash receipts per acre.

Average gross returns were comparable for farms in the upper Texas gulf coast, Arkansas nondelta, and Mississippi River Delta areas. Average yields were very similar in these areas with most of the acreage planted in long-grain varieties. Southwest Louisiana had the lowest gross returns, due primarily to low yields resulting from adverse weather and disease problems.

Major variable cash cost items associated with rice production include fuel, which includes tractor and combine fuel as well as irrigation fuel, drying, chemicals, hired labor, and fertilizer. These costs comprised 64 to 72 percent of total variable costs of rice production (table 25). In some areas, custom operations and purchased water were also major expenses of rice production. Average variable cash costs per acre (from table 25), along with quartile distributions of rice farms by variable cash cost for each of the six rice production areas, are listed in tables 26-31.

The Arkansas nondelta area had average variable cash costs per acre estimated at $262.88 (table 26). Fifty percent of the farms in this area had estimated costs between $235.82 and $307.16 per acre. Fuel was the largest variable cost component, accounting for 22 percent of total variable cash costs. Fertilizer, chemical, hired labor, and drying costs each averaged about $32 per planted acre.

Average variable cash costs in California were estimated to be $347.62 per planted acre (table 27). Twenty-five percent of rice farms in this production area had costs equal to or greater than $404.64 per acre. Fuel was the largest cost component averaging $54.85 per acre, with 50 percent of farms having fuel costs within a rather narrow $18 range. Estimated costs of fertilizer, custom operations, and paid labor varied considerably more across farms in California than did estimated costs of chemicals and drying.

Fuel and chemicals were the highest cost items on rice farms in the Mississippi River Delta area (table 28). Fuel costs averaged $53.53 per planted acre with 25 percent of farms having fuel costs greater than $70 per acre. Chemical costs averaged $46.10 per acre, although a quarter of the farms reported chemical costs of $26.88 per acre or less. Total variable cash costs were estimated to average $298.24, with 50 percent of farms having costs in the $250 to $330 range.

Variable cash costs in southwest Louisiana averaged $257.32 per planted acre with a median cost of $256.74 (table 29). Fuel costs, the largest component of variable cash costs, varied greatly across farms in the area. Fifty percent of rice farms had estimated fuel costs between $25.04 and $70.27 per acre. This range illustrates the effect of irrigation water source on pumping costs, as roughly 45 percent of rice acres in this area were irrigated by water pumped from surface sources and 55 percent were irrigated by water pumped from wells.

Hired labor was the largest variable cost component on rice farms in the upper Texas gulf coast (table 30). Paid labor costs on these farms averaged $57.30 per acre, with 25 percent of the farms reporting costs greater than $76 per acre. Fertilizer, chemical, purchased irrigation water, and drying costs all averaged more than $40 per planted acre.

Lower Texas gulf coast farms had the highest estimated variable production costs per acre (table 31). Twenty-five percent of farms had costs exceeding $436 per acre. Fuel costs averaged $77.94 per acre and varied significantly across farms.

Fixed costs of production include general farm overhead, taxes and insurance, interest on operating loans (loans for production inputs and machinery), and interest on real estate loans. Whole-farm fixed expenses were allocated to the rice enterprise on the basis of rice's share of the total value of farm production of all crop and livestock enterprises. Production of all crops on the farm was valued at market prices, and livestock production was valued at reported livestock sales in dollars. California rice farms had the highest estimated fixed costs in 1988 at $99 per planted acre of rice (table 25).

Total cash costs of rice production in 1988, the sum of variable and fixed cash costs, ranged from $300 per planted acre in southwest Louisiana to $456 per acre in the lower Texas gulf coast (table 25). Gross value of production less total cash costs, excluding Government payments, was estimated to be positive in four of the six production areas. The Arkansas nondelta area had the highest net return at $45 per acre. Estimated net returns above cash costs were negative for California and the upper Texas gulf coast.

Total economic costs of rice production estimated for 1988 are shown in table 32. Economic costs include the costs of all inputs used in the production process, regardless of ownership, and include charges for variable cash cost items, general farm overhead, taxes and insurance, capital replacement, and a charge for the use of operating capital, other nonland capital, land, and unpaid labor. Land costs shown in table 32 exclude any Government payments paid to landlords under share rental agreements. Total estimated economic costs ranged from $419 per planted acre in southwest Louisiana to $632 per acre in California. Estimated returns to management and risk, excluding Government payments, were negative for all six production areas.

Costs and Returns Including Government Payments

The average costs and returns of producing rice estimated for 1988, including Government payments for farms participating in Federal farm programs, are shown in tables 33 and 34. Inclusion of Government payments influences the level of both cash and economic rice production costs, as well as the level of returns.

The effect of Government payments from participation in the farm program on the gross value of production of rice can be seen in

table 33. In the table, the market value of rice is valued at the estimated harvest-month market price, as in tables 25 and 32. However, to this value is added an estimate of the average payments per planted acre received by producers in each production area from their participation in Federal farm price support programs, weighted by the participation rate. These Government payments, in the case of rice, are primarily deficiency payments and marketing loan payments. Deficiency payments per planted acre in each area were estimated as a function of Agricultural Stabilization and Conservation Service (ASCS) program yield, farm program participation rate, acres of set-aside and conserving use land per acre of planted rice, the percentage of rice acreage harvested, and the average deficiency payment rate for rice ($4.31 per hundredweight in 1988). Marketing loan payments were estimated as a function of actual yield and the average ASCS marketing loan payment per hundredweight.

Average estimated Government payments per planted acre of rice in 1988 ranged from $182 in southwest Louisiana to $328 in California, while gross value of production (market value plus Government payments) ranged from $490 to $752 (table 33). Government payments for rice as a percentage of gross value of production ranged from 35 percent in the Mississippi River Delta to 44 percent in California.

Participation in Government programs had a minimal effect on variable cash production costs in 1988. Average increases in variable cash costs per planted acre of rice ranged from $0.99 in southwest Louisiana to $3.53 in the Mississippi River Delta (table 33). These additional costs represent the added cost of operations performed on set-aside and conserving use land, required as a provision in the farm program. These additional costs do not reflect the cost per acre of maintaining set-aside land but, rather, represent the cost of maintaining the required set-aside acreage per acre of planted rice, weighted by participation rate.

The inclusion of Government payments increased the estimated fixed cash costs of rice production, primarily as a result of the cost estimation methodology used. To allocate whole-farm fixed costs, nonprogram crops produced on rice farms were valued at market prices and livestock products were valued at reported levels of sales, as before. However, program crops produced on rice farms, which included rice as well as some other crops, were valued at 1988 price support levels. The relatively high ratio of Government rice payments to the market value of rice, relative to other crops, caused rice's share of total farm production value (including Government payments) to increase. As a result, whole-farm fixed cash costs allocated to the rice enterprise increased.

Average fixed cash costs of rice production, including Government payments, increased to a range of $48 to $106 per planted acre of rice (table 33). Total cash production costs, variable plus fixed, ranged from $306 per planted acre in southwest Louisiana

to $460 per planted acre in the lower Texas gulf coast. Net returns above total cash costs exceeded $190 per acre for all major production areas except southwest Louisiana and the upper Texas gulf coast and ranged as high as $296 per acre in California.

The major effect of Government payments on the production costs of rice is found in land costs. Since Government payments comprise a sizable portion of the gross returns from rice production and much of the rice acreage in each production area is share rented, the inclusion or exclusion of the share of Government payments received by landlords has a dramatic effect on the resulting estimated land charge. As evidenced in table 34, estimated land charges associated with rice production increased 64 to 109 percent when Government payments were included in the analysis. Other economic costs such as capital replacement, as well as charges for operating capital, nonland capital, and unpaid labor, also increased, although to a much lesser extent. Total economic costs of producing rice ranged from $473 per planted acre in southwest Louisiana to $711 per planted acre in California. Residual returns to management and risk were greater than $20 per acre for all areas except southwest Louisiana.

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(4) Rice Production Handbook. Publication No. 2321, Agricultural Experiment Station, Louisiana State Univ., Baton Rouge, 1987.

(5) 1989 Rice Production Guidelines. Publication No. D-1253, Agricultural Extension Service, Texas A&M Univ., College Station, 1989.

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Table 1--Land tenure and use on farms producing rice, 1988

Item	Arkansas nondelta	California	Mississippi River Delta
		Acres per farm 1/	
Farm acreage:			
Owned	210	295	146
Rented in	861	358	1,125
Rented out	d	d	15
Total 2/	1,034	560	1,257
Crop acreage:			
Corn	d	d	d
Cotton	31	d	165
Rice	285	293	269
Sorghum	41	d	41
Soybeans	416	0	472
Wheat	122	29	102
Other crops	6	56	17
Pasture 2/	d	d	6
Acreage Reduction Program	163	114	178
Conservation Reserve Program	d	d	2
Fallow	0	d	d
Other land	59	34	86
		Coefficient of variation	
Farm acreage:			
Owned	23.48	18.20	21.31
Rented in	8.99	10.38	8.58
Rented out	na	na	44.73
Total	7.57	14.37	7.19
Crop acreage:			
Corn	na	na	na
Cotton	34.29	na	17.66
Rice	9.38	6.34	8.48
Sorghum	23.83	na	31.22
Soybeans	8.52	na	8.05
Wheat	12.99	32.11	16.12
Other crops	42.15	27.88	34.40
Pasture	na	na	40.98
Acreage Reduction Program	8.61	7.82	8.58
Conservation Reserve Program	na	na	41.27
Fallow	na	na	na
Other land	33.82	21.60	24.91

See footnotes at end of table.

Continued--

Table 1--Land tenure and use on farms producing rice, 1988--Continued

Item	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
		Acres per farm 1/	
Farm acreage:			
Owned	97	420	180
Rented in	836	1,373	977
Rented out	d	d	39
Total 2/	921	1,752	1,118
Crop acreage:			
Corn	d	d	47
Cotton	d	d	d
Rice	262	396	338
Sorghum	6	d	50
Soybeans	237	147	20
Wheat	25	0	d
Other crops	d	13	6
Pasture 2/	119	515	377
Acreage Reduction Program	136	291	189
Conservation Reserve Program	d	0	0
Fallow	33	153	54
Other land	88	234	19
		Coefficient of variation	
Farm acreage:			
Owned	17.24	27.75	25.78
Rented in	8.27	13.19	12.06
Rented out	na	na	30.96
Total	7.11	11.37	10.80
Crop acreage:			
Corn	na	na	33.71
Cotton	na	na	na
Rice	5.28	7.78	8.03
Sorghum	36.67	na	36.30
Soybeans	10.11	26.53	37.99
Wheat	21.11	na	na
Other crops	na	38.69	39.06
Pasture	38.10	27.58	26.83
Acreage Reduction Program	11.21	9.86	11.03
Conservation Reserve Program	na	na	na
Fallow	30.10	36.20	42.74
Other land	24.08	26.43	29.59

d = insufficient data for disclosure.
na = not applicable.
1/ Mean per farm producing rice.
2/ Excludes land rented on animal-unit-month (AUM) basis.

Table 2--Rice planted and harvested acreage and yield, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Acres per farm 1/			
Rice acreage:						
Planted	285	293	269	262	396	338
Harvested	284	293	266	260	393	338
Ratoon	0	0	0	25	37	197
			Hundredweight per acre 1/			
Rice yield:						
Per planted acre	52.66	71.19	51.44	44.22	52.90	64.45
Per harvested acre	52.73	71.22	52.02	44.55	53.31	64.45
			Coefficient of variation			
Rice acreage:						
Planted	9.38	6.34	8.48	5.28	7.78	8.03
Harvested	9.44	6.34	8.57	5.33	7.87	8.03
Ratoon	na	na	na	23.23	31.20	14.51
Rice yield:						
Per planted acre	1.91	1.14	3.33	2.10	2.78	2.42
Per harvested acre	1.90	1.14	3.24	2.04	2.67	2.42

na = not applicable.
1/ Mean per farm producing rice.

Table 3--Tenure of land in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent			
Rice acreage:						
Owned	18.6	32.1	9.7	8.4	17.7	5.6
Cash rented	12.2	27.3	32.7	13.8	37.9	17.8
Share rented	69.2	40.6	55.8	77.8	44.4	75.7
Rent free	0	0	d	0	0	d
Farms with entire rice acreage:						
Owned	8.3	22.3	10.0	9.0	11.2	d
Cash rented	6.7	15.2	23.5	4.8	31.4	18.1
Share rented	42.8	23.2	48.1	59.7	31.6	55.7
Rent free	0	0	d	0	0	0
Combination owned and rented	42.2	39.3	15.8	26.5	25.8	24.4
			Coefficient of variation			
Rice acreage:						
Owned	23.51	12.24	27.26	23.25	35.59	37.58
Cash rented	36.01	14.89	14.65	23.04	15.53	23.10
Share rented	8.33	10.68	10.53	4.69	14.14	5.93
Rent free	na	na	na	na	na	na
Farms with entire rice acreage:						
Owned	39.86	20.20	35.79	32.82	35.83	na
Cash rented	44.31	25.91	17.97	43.89	18.29	26.27
Share rented	13.50	19.90	13.01	8.12	18.51	10.77
Rent free	na	na	na	na	na	na
Combination owned and rented	13.69	13.34	26.07	16.17	20.81	21.05

d = insufficient data for disclosure.
na = not applicable.

Table 4--Landlord's share of production and expenses in rice share rental agreements, 1988

Item	Arkansas nondelta	California	Mississippi River Delta
		Percent 1/	
Landlord's share of:			
Production	33.2	30.0	35.4
Expenses--			
Seed	19.4	3.8	21.6
Fertilizer	23.9	14.4	23.1
Chemicals	19.2	10.7	22.6
Drying	16.7	21.8	16.8
Fertilizer application	11.9	d	19.4
Chemical application	11.8	d	19.3
Custom harvest	d	d	d
Irrigation fuel	23.3	11.4	32.0
Purchased water	d	40.8	0
Fixed irrigation	97.3	21.4	87.1
		Coefficient of variation	
Landlord's share of:			
Production	6.12	3.49	8.44
Expenses--			
Seed	23.40	45.31	26.40
Fertilizer	16.26	17.90	23.80
Chemicals	20.43	21.60	24.55
Drying	23.81	17.31	33.21
Fertilizer application	27.26	na	30.92
Chemical application	27.58	na	31.00
Custom harvest	na	na	na
Irrigation fuel	23.39	38.06	29.30
Purchased water	na	17.47	na
Fixed irrigation	1.51	28.99	4.33

See footnotes at end of table.

Continued--

Table 4--Landlord's share of production and expenses in rice share rental agreements, 1988--Continued

Item	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
		Percent 1/	
Landlord's share of:			
Production	32.7	25.0	31.0
Expenses--			
Seed	10.3	26.7	47.5
Fertilizer	16.9	14.7	25.4
Chemicals	15.9	14.7	24.2
Drying	14.3	19.0	25.0
Fertilizer application	11.2	13.4	22.2
Chemical application	9.9	13.4	21.8
Custom harvest	2.2	0	d
Irrigation fuel	48.3	d	23.7
Purchased water	11.9	21.9	35.3
Fixed irrigation	35.8	15.9	37.6
		Coefficient of variation	
Landlord's share of:			
Production	3.47	12.19	9.48
Expenses--			
Seed	29.89	31.24	16.12
Fertilizer	12.71	28.93	15.22
Chemicals	12.88	28.93	15.68
Drying	15.80	25.77	15.22
Fertilizer application	17.49	32.31	17.34
Chemical application	17.49	32.31	17.67
Custom harvest	37.74	na	na
Irrigation fuel	10.74	na	30.35
Purchased water	35.27	32.67	21.65
Fixed irrigation	15.25	44.12	20.00

d = insufficient data for disclosure.
na = not applicable.
1/ Mean over rice acreage under share rental arrangements.

Table 5--Ratoon rice acreage and yield, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent			
Farms	0	0	0	18.1	15.7	54.2
			Acres per farm 1/			
Rice acreage:						
Planted	0	0	0	347	395	412
Harvested	0	0	0	347	395	412
Ratoon	0	0	0	139	235	363
			Hundredweight per acre 1/			
Rice yield:						
First crop	0	0	0	44.75	59.10	57.84
Ratoon crop	0	0	0	7.93	11.45	14.60
			Coefficient of variation			
Farms	na	na	na	20.09	28.61	10.96
Rice acreage:						
Planted	na	na	na	11.09	14.11	9.36
Harvested	na	na	na	11.09	14.11	9.36
Ratoon	na	na	na	17.00	13.75	10.64
Rice yield:						
First crop	na	na	na	3.50	5.96	2.71
Ratoon crop	na	na	na	7.36	14.21	7.09

na = not applicable.
1/ Mean per farm with a ratoon rice crop.

Table 6--Planting methods and seeding rates for rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent of acres			
Planting method:						
Aerial--						
Flooded land	d	98.8	3.0	90.9	47.3	0
Dry land	d	d	6.0	d	27.5	18.5
Drilled	62.0	0	79.1	6.8	19.1	81.5
Broadcast	36.0	0	11.9	0	6.1	0
			Pounds per acre 1/			
Seeding rate:						
Aerial--						
Flooded land	d	164.1	124.1	133.3	114.5	0
Dry land	108.9	d	120.0	127.0	109.0	109.4
Drilled	115.4	0	110.5	129.8	106.2	98.6
Broadcast	140.2	0	121.8	0	101.9	0
			Coefficient of variation			
Planting method:						
Aerial--						
Flooded land	na	1.16	37.40	3.16	13.34	na
Dry land	na	na	33.55	na	19.65	29.60
Drilled	10.80	na	5.31	37.49	29.16	6.74
Broadcast	18.85	na	28.60	na	44.84	na
Seeding rate:						
Aerial--						
Flooded land	na	1.41	6.60	1.16	2.27	na
Dry land	21.44	na	4.13	7.73	2.67	4.14
Drilled	3.36	na	3.15	3.39	2.57	1.95
Broadcast	7.42	na	2.77	na	1.19	na

d = insufficient data for disclosure.
na = not applicable.
1/ Mean per farm reporting seeding method.

Table 7--Fertilization in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent 1/			
Acres treated:						
Nitrogen	215.6	174.4	277.8	202.3	322.8	347.7
Phosphorus	27.1	80.9	6.9	103.0	111.8	105.4
Potash	42.9	13.9	d	105.0	91.5	89.3
			Pounds per acre 2/			
Fertilization rate:						
Nitrogen	132.1	101.8	151.0	107.5	176.0	200.1
Phosphorus	8.7	39.1	2.6	47.0	48.6	46.5
Potash	23.8	5.1	.7	44.6	24.7	26.9
			Coefficient of variation			
Acres treated:						
Nitrogen	6.92	4.08	4.05	2.92	6.09	5.62
Phosphorus	28.84	6.56	42.78	3.63	5.34	3.44
Potash	24.37	27.45	na	3.93	9.74	7.11
Fertilization rate:						
Nitrogen	4.49	6.50	3.01	3.53	3.86	3.54
Phosphorus	34.72	11.11	41.28	4.71	8.28	4.04
Potash	26.26	30.62	47.09	6.65	13.16	8.99

d = insufficient data for disclosure.
na = not applicable.
1/ Sum of acres treated times number of applications as a percentage of total planted rice acreage in the area. A percentage greater than 100 implies that acreage was treated, on average, more than one time.
2/ Mean per farm producing rice.

Table 8--Chemical and pesticide application in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent			
Farms:						
Insecticides	d	70.4	22.3	48.3	73.1	62.3
Fungicides	40.4	0	50.4	32.6	41.5	40.1
Herbicides	95.4	96.6	98.9	91.6	96.5	97.3
Blackbirds	6.5	19.8	11.0	29.6	45.2	19.8
Acres treated: 1/						
Insecticides	d	64.8	35.7	54.9	103.7	119.7
Fungicides	37.5	0	64.0	40.2	58.9	50.8
Herbicides	196.2	258.7	268.4	164.1	249.6	203.2
			Coefficient of variation			
Farms:						
Insecticides	na	7.05	19.21	9.97	7.59	9.36
Fungicides	14.12	na	12.55	13.60	14.67	14.77
Herbicides	2.68	1.80	.79	3.17	2.39	1.75
Blackbirds	42.44	20.91	39.18	14.68	13.75	24.21
Acres treated:						
Insecticides	na	10.32	20.94	10.90	13.71	15.65
Fungicides	18.98	na	14.07	15.92	19.92	18.11
Herbicides	4.50	3.89	5.28	5.88	7.78	5.46

d = insufficient data for disclosure.
na = not applicable.
1/ Sum of acres treated times number of applications as a percentage of total planted rice acreage in the area. A percentage greater than 100 implies that acreage was treated, on average, more than one time.

Table 9--Sources of rice irrigation water, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent of acres			
Water source:						
Well	91.6	14.7	84.7	53.7	d	52.3
Purchased	0	75.5	0	3.5	66.1	37.9
Surface	8.4	7.5	14.4	40.9	28.5	9.8
Other	0	2.3	.9	d	d	0
			Coefficient of variation			
Water source:						
Well	3.43	20.91	4.79	8.90	na	13.24
Purchased	na	5.53	na	41.90	10.33	17.83
Surface	37.38	41.16	27.98	11.43	23.39	45.75
Other	na	46.09	47.75	na	na	na

d = insufficient data for disclosure.
na = not applicable.

Table 10--Irrigation wells used in rice production, 1988

Irrigation wells	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Wells per farm 1/			
Number	5.2	2.4	3.4	2.1	1.6	2.3
			Feet 1/			
Depth	125.3	261.4	110.6	249.5	615.0	622.4
Lift	68.5	65.3	49.1	174.0	156.3	198.2
			Inches 1/			
Diameter	10.0	14.1	12.6	10.1	13.6	14.9
			Coefficient of variation			
Number	8.98	10.28	11.17	6.83	19.15	9.03
Depth	7.70	17.66	3.91	4.78	18.88	7.56
Lift	7.03	12.74	5.07	24.14	22.66	8.61
Diameter	2.82	4.62	4.08	3.51	9.69	4.12

1/ Mean per farm reporting use of irrigation wells.

Table 11--Irrigation pumps used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Average per farm			
Irrigation pumps:						
Number 1/	5.1	0.7	3.2	1.4	0.6	1.3
Pumping rate (GPM) 2/	1,391.4	2,055.3	1,606.2	3,879.5	3,627.7	1,918.6
			Percent			
Pump type:						
Turbine	64.0	73.7	78.6	25.6	41.3	65.0
Submersible	26.3	d	11.1	42.0	19.0	22.9
Centrifugal	9.7	d	9.5	31.3	21.7	12.1
Booster	0	12.7	d	d	d	0
			Coefficient of variation			
Irrigation pumps:						
Number	8.82	19.74	12.80	11.01	21.68	13.42
Pumping rate (GPM)	8.52	11.79	7.34	13.05	16.15	8.74
Pump type:						
Turbine	7.26	11.87	6.82	21.31	30.58	12.23
Submersible	13.39	na	28.32	15.74	36.60	28.66
Centrifugal	42.24	na	39.34	19.54	39.85	47.08
Booster	na	45.23	na	na	na	na

d = insufficient data for disclosure.
na = not applicable.
GPM = gallons per minute.
1/ Mean per farm producing rice.
2/ Mean per farm reporting use of irrigation pumps.

Table 12--Irrigation motors used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent			
Motor type:						
Electric	37.2	94.5	30.6	6.5	24.3	33.1
Gasoline	d	0	d	d	0	d
Diesel	53.5	d	49.3	55.1	40.7	20.8
LP gas	4.4	0	8.7	9.4	d	d
Natural gas	4.1	0	0	22.5	19.4	37.6
Tractor PTO	0	0	d	5.1	d	0
			Horsepower 1/			
Motor size:						
Electric	15.5	22.1	21.0	85.7	38.5	96.8
Gasoline	d	0	d	d	0	d
Diesel	21.1	58.8	34.3	86.5	84.9	124.5
LP gas	34.0	0	37.5	58.5	99.3	63.3
Natural gas	38.9	0	0	82.6	74.9	99.0
Tractor PTO	0	0	d	49.5	d	0
			Coefficient of variation			
Motor type:						
Electric	10.63	3.37	21.30	31.17	45.00	21.01
Gasoline	na	na	na	na	na	na
Diesel	7.87	na	13.74	10.20	26.27	28.08
LP gas	37.90	na	33.16	41.85	na	na
Natural gas	46.54	na	na	20.86	40.85	20.60
Tractor PTO	na	na	na	45.57	na	na
Motor size:						
Electric	15.06	13.66	12.49	9.24	48.24	14.18
Gasoline	na	na	na	na	na	na
Diesel	13.42	17.34	18.54	10.96	26.31	17.53
LP gas	16.59	na	29.12	31.16	30.92	30.31
Natural gas	41.53	na	na	18.43	12.78	17.28
Tractor PTO	na	na	na	18.54	na	na

d = insufficient data for disclosure.
na = not applicable.
LP = liquefied petroleum.
PTO = power take-off.
1/ Mean per farm reporting use of irrigation motors.

Table 13--Use of trucks in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Number per farm 1/			
Trucks:						
Pickups	2.2	2.1	2.0	1.6	2.2	2.2
Single-axle	1.0	.9	.9	1.2	1.4	.6
Tandem-axle	.5	.1	.6	.4	.5	.3
Semi	.4	.2	.2	.1	.1	.2
			Miles per truck 2/			
Annual use:						
Pickups	13,882	15,318	17,028	13,599	16,560	20,465
Single-axle	2,227	2,473	2,967	3,019	2,965	2,449
Tandem-axle	2,269	5,622	3,135	1,953	3,892	2,705
Semi	2,622	3,219	2,192	10,190	d	4,013
			Percent 2/			
Percent of use for rice:						
Pickups	47.1	85.0	47.2	68.9	84.2	78.3
			Coefficient of variation			
Trucks:						
Pickups	5.93	9.20	7.15	4.71	7.51	6.74
Single-axle	11.98	13.99	15.31	7.63	11.33	16.37
Tandem-axle	20.24	45.57	21.19	17.91	20.73	25.19
Semi	19.71	27.33	28.21	43.89	49.58	36.26
Annual use:						
Pickups	6.89	8.12	6.81	6.57	5.97	6.40
Single-axle	22.75	21.87	17.32	13.02	17.52	12.47
Tandem-axle	14.31	34.47	12.80	18.93	29.54	23.04
Semi	14.43	20.05	25.15	22.63	na	13.08
Percent of use for rice:						
Pickups	5.86	3.24	7.20	3.52	3.23	4.26

d = insufficient data for disclosure.
na = not applicable.
1/ Mean per farm producing rice.
2/ Mean per farm reporting item.

Table 14--Number of tractors used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Number per farm 1/			
Tractor type:						
Two-wheel	3.1	.8	2.7	2.8	3.1	3.1
TWA 2/	.1	.1	.2	.1	.1	d
Four-wheel	.4	.7	.3	.6	1.5	.9
Crawler	0	1.4	0	0	0	0
Total	3.6	3.0	3.2	3.5	4.7	4.0
			Coefficient of variation			
Tractor type:						
Two-wheel	6.49	12.38	5.70	5.03	7.96	6.18
TWA 2/	41.39	45.23	28.13	35.51	53.48	na
Four-wheel	18.34	12.83	21.74	11.75	8.66	11.67
Crawler	na	10.13	na	na	na	na
Total	5.67	7.01	5.23	4.51	6.10	5.71

d = insufficient data for disclosure.
na = not applicable.
1/ Mean per farm producing rice.
2/ Two-wheel drive assist.

Table 15--Size of tractors used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Horsepower 1/			
Tractor type:						
Two-wheel	134	88	141	113	123	120
TWA 2/	132	128	163	132	120	173
Four-wheel	217	187	244	196	193	186
Crawler	na	120	na	na	na	na
			Coefficient of variation			
Tractor type:						
Two-wheel	1.92	8.31	1.77	2.12	3.06	2.39
TWA 2/	13.10	27.30	4.74	13.04	28.50	6.50
Four-wheel	7.81	5.81	8.37	6.21	3.18	3.36
Crawler	na	6.07	na	na	na	na

na = not applicable.
1/ Mean per farm reporting item.
2/ Two-wheel drive assist.

Table 16--Type of tractors used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent diesel			
Tractor type:						
Two-wheel	97.0	83.4	98.3	93.7	97.6	94.8
TWA 1/	83.6	100.0	100.0	94.7	100.0	100.0
Four-wheel	100.0	98.0	100.0	100.0	99.0	100.0
Crawler	na	100.0	na	na	na	na
			Coefficient of variation			
Tractor type:						
Two-wheel	1.28	8.48	1.01	1.55	1.07	1.94
TWA 1/	14.14	0	0	5.07	0	0
Four-wheel	0	1.91	0	0	.93	0
Crawler	na	0	na	na	na	na

na = not applicable.
1/ Two-wheel drive assist.

Table 17--Ownership of tractors used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent owned			
Tractor type:						
Two-wheel	94.7	93.8	91.7	96.6	99.3	95.4
TWA 1/	100.0	69.6	75.1	73.8	100.0	100.0
Four-wheel	94.8	84.8	94.9	91.5	95.8	89.7
Crawler	na	86.9	na	na	na	na
			Coefficient of variation			
Tractor type:						
Two-wheel	2.46	3.19	1.87	1.47	.62	2.46
TWA 1/	0	33.13	17.95	22.94	0	0
Four-wheel	4.05	7.62	2.24	3.94	2.88	6.42
Crawler	na	4.54	na	na	na	na

na = not applicable.
1/ Two-wheel drive assist.

Table 18--Hours of annual use of tractors used in rice production, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Hours of annual use 1/			
Tractor type:						
Two-wheel	491	318	640	435	444	542
TWA 2/	381	536	519	459	402	d
Four-wheel	571	426	653	402	582	695
Crawler	na	433	na	na	na	na
			Coefficient of variation			
Tractor type:						
Two-wheel	8.30	12.20	8.76	7.33	11.23	9.61
TWA 2/	19.69	36.69	16.73	16.94	37.98	na
Four-wheel	11.67	14.38	10.84	8.80	9.22	11.40
Crawler	na	18.35	na	na	na	na

d = insufficient data for disclosure.
na = not applicable.
1/ Hours of annual use for all uses.
2/ Two-wheel drive assist.

Table 19--Field operations on planted rice acreage, 1988 1/

Item	Arkansas nondelta	California	Mississippi River Delta
		Times-over 2/	
All field operations	7.57	5.40	6.82
Tillage			
Plowing	5.31	3.82	4.79
Disking	.07	1.68	d
Cultivating	2.10	1.34	2.17
Harrowing	.60	d	1.00
Bedding	.72	.30	.87
Soil packing	d	d	d
Other tillage	.54	.31	.26
Fertilizer and pesticide application	1.20	.09	.34
Planting	.17	.70	.11
Harvesting	1.10	d	1.06
	.98	.85	.85
		Coefficient of variation	
All field operations	4.06	5.66	4.91
Tillage			
Plowing	5.29	6.29	6.21
Disking	47.67	9.25	na
Cultivating	6.02	10.90	6.23
Harrowing	19.29	na	13.57
Bedding	23.01	22.50	14.89
Soil packing	na	na	na
Other tillage	17.90	16.27	24.64
Fertilizer and pesticide application	11.57	44.82	29.49
Planting	28.13	12.59	43.85
Harvesting	4.04	na	4.47
	2.14	5.84	4.95

See footnotes at end of table.

Continued--

Table 19--Field operations on planted rice acreage, 1988--Continued 1/

Item	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
		Times-over 2/	
All field operations	4.10	8.19	9.64
Tillage	2.91	6.73	7.27
Plowing	.40	d	.15
Disking	1.71	3.38	2.60
Cultivating	.16	1.05	2.00
Harrowing	.37	1.45	1.94
Bedding	d	d	0
Soil packing	.07	.26	.45
Other tillage	.20	.33	d
Fertilizer and pesticide application	.15	.18	.09
Planting	.05	.28	.83
Harvesting	.98	1.00	1.46
		Coefficient of variation	
All field operations	4.21	7.73	5.19
Tillage	5.32	8.77	6.43
Plowing	18.51	na	44.90
Disking	7.49	8.55	5.40
Cultivating	33.54	23.46	10.27
Harrowing	19.62	13.77	14.23
Bedding	na	na	na
Soil packing	42.93	35.35	21.74
Other tillage	21.00	39.03	na
Fertilizer and pesticide application	24.56	40.02	45.71
Planting	42.92	24.06	6.72
Harvesting	4.22	5.39	5.39

d = insufficient data for disclosure.
na = not applicable.
1/ Excludes custom operations.
2/ Acres covered in operation divided by total acres.

Table 20--Width of field implements used in rice production, 1988 1/

Item	Arkansas nondelta	California	Mississippi River Delta
		Feet 2/	
Average width:			
Chisel plow	b	17.1	b
Disk plow	b	17.7	b
Offset, heavy-duty disk	21.7	18.0	20.1
Plowing tandem disk	b	b	22.6
Regular tandem disk	23.7	b	23.2
Field cultivator	24.2	b	25.9
Field conditioner	b	b	29.5
Spike-tooth harrow	b	b	b
Spring-tooth harrow	b	b	b
Roller-packer	b	b	b
Drill	18.1	b	20.1
Float	17.2	b	b
Rail	b	b	b
Landplane	17.0	16.1	14.2
Broadcast seeder	24.6	b	b
Landall	21.6	b	b
		Coefficient of variation	
Average width:			
Chisel plow	na	2.22	na
Disk plow	na	3.24	na
Offset, heavy-duty disk	4.81	1.85	6.96
Plowing tandem disk	na	na	3.94
Regular tandem disk	2.88	na	2.41
Field cultivator	5.08	na	3.45
Field conditioner	na	na	7.71
Spike-tooth harrow	na	na	na
Spring-tooth harrow	na	na	na
Roller-packer	na	na	na
Drill	6.20	na	3.44
Float	5.61	na	na
Rail	na	na	na
Landplane	5.78	2.63	4.26
Broadcast seeder	8.75	na	na
Landall	3.66	na	na

See footnotes at end of table.

Continued--

Table 20--Width of field implements used in rice production, 1988--Continued 1/

Item	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
		Feet 2/	
Average width:			
Chisel plow	b	b	b
Disk plow	21.6	b	b
Offset, heavy-duty disk	19.2	16.6	20.0
Plowing tandem disk	19.9	17.4	19.9
Regular tandem disk	20.6	18.5	19.0
Field cultivator	b	23.1	27.9
Field conditioner	b	21.5	b
Spike-tooth harrow	b	22.5	24.0
Spring-tooth harrow	b	b	23.0
Roller-packer	b	b	33.0
Drill	b	b	16.3
Float	b	b	b
Rail	b	22.4	b
Landplane	15.7	24.7	28.1
Broadcast seeder	b	b	b
Landall	b	22.8	b
		Coefficient of variation	
Average width:			
Chisel plow	na	na	na
Disk plow	4.55	na	na
Offset, heavy-duty disk	6.56	4.31	16.75
Plowing tandem disk	5.48	7.33	5.17
Regular tandem disk	4.22	4.00	6.27
Field cultivator	na	9.76	4.06
Field conditioner	na	7.85	na
Spike-tooth harrow	na	6.60	7.82
Spring-tooth harrow	na	na	8.48
Roller-packer	na	na	23.98
Drill	na	na	4.90
Float	na	na	na
Rail	na	7.36	na
Landplane	4.60	13.44	9.45
Broadcast seeder	na	na	na
Landall	na	5.22	na

b = average times-over less than 0.30.
na = not applicable.
1/ For field implements with an average times-over of 0.30 or greater.
2/ Mean per farm reporting item.

Table 21--Size of tractor used to pull field implements in rice production, 1988 1/

Item	Arkansas nondelta	California	Mississippi River Delta
		Horsepower 2/	
Average tractor PTO:			
Chisel plow	b	161.0	b
Disk plow	b	152.7	b
Offset, heavy-duty disk	169.5	167.7	165.1
Plowing tandem disk	b	b	194.0
Regular tandem disk	171.0	b	179.7
Field cultivator	166.6	b	162.8
Field conditioner	b	b	182.3
Spike-tooth harrow	b	b	b
Spring-tooth harrow	b	b	b
Roller-packer	b	b	b
Drill	135.8	b	154.5
Float	153.3	b	b
Rail	b	b	b
Landplane	167.6	150.2	173.3
Broadcast seeder	131.7	b	b
Landall	161.1	b	b
		Coefficient of variation	
Average tractor PTO:			
Chisel plow	na	5.94	na
Disk plow	na	8.60	na
Offset, heavy-duty disk	4.73	5.64	4.25
Plowing tandem disk	na	na	9.20
Regular tandem disk	5.03	na	4.81
Field cultivator	3.64	na	3.01
Field conditioner	na	na	12.71
Spike-tooth harrow	na	na	na
Spring-tooth harrow	na	na	na
Roller-packer	na	na	na
Drill	3.49	na	3.52
Float	6.04	na	na
Rail	na	na	na
Landplane	5.18	6.48	4.00
Broadcast seeder	8.49	na	na
Landall	2.56	na	na

See footnotes at end of table.

Continued--

Table 21--Size of tractor used to pull field implements in rice production, 1988--Continued 1/

Item	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
		Horsepower 2/	
Average tractor PTO:			
Chisel plow	b	b	b
Disk plow	178.7	b	b
Offset, heavy-duty disk	176.2	179.4	156.3
Plowing tandem disk	176.7	190.0	179.0
Regular tandem disk	162.6	171.0	146.2
Field cultivator	b	161.0	168.2
Field conditioner	b	154.5	b
Spike-tooth harrow	b	149.8	136.5
Spring-tooth harrow	b	b	135.7
Roller-packer	b	b	128.4
Drill	b	b	124.4
Float	b	b	b
Rail	b	140.5	b
Landplane	174.4	186.2	162.9
Broadcast seeder	b	b	b
Landall	b	181.1	b
		Coefficient of variation	
Average tractor PTO:			
Chisel plow	na	na	na
Disk plow	6.49	na	na
Offset, heavy-duty disk	6.46	4.00	5.11
Plowing tandem disk	5.51	6.91	5.95
Regular tandem disk	5.98	3.72	7.58
Field cultivator	na	5.86	3.22
Field conditioner	na	10.29	na
Spike-tooth harrow	na	5.68	6.38
Spring-tooth harrow	na	na	9.52
Roller-packer	na	na	4.60
Drill	na	na	3.32
Float	na	na	na
Rail	na	6.56	na
Landplane	4.75	8.51	3.18
Broadcast seeder	na	na	na
Landall	na	8.67	na

b = average times-over less than 0.30.
na = not applicable.
PTO = power take-off.
1/ For field implements with an average times-over of 0.30 or greater.
2/ Mean per farm reporting item.

Table 22--Field operations on Government rice program set-aside acreage, 1988

Item	Arkansas nondelta	California	Mississippi River Delta
		Percent 1/	
Farms	64.3	42.3	75.9
		Times-over 2/	
All field operations	1.61	.72	2.44
Tillage	1.57	.72	2.43
Plowing	d	.23	d
Disking	1.38	.47	2.25
Cultivating	d	d	.03
Harrowing	0	0	0
Bedding	0	0	0
Soil packing	0	d	d
Other tillage	d	0	d
Fertilizer and pesticide application	0	0	0
Planting	d	0	d
Harvesting	0	0	0
		Coefficient of variation	
Farms	8.73	12.60	7.31
All field operations	12.98	17.33	10.09
Tillage	13.24	17.33	10.13
Plowing	na	36.95	na
Disking	15.11	23.66	7.81
Cultivating	na	na	49.70
Harrowing	na	na	na
Bedding	na	na	na
Soil packing	na	na	na
Other tillage	na	na	na
Fertilizer and pesticide application	na	na	na
Planting	na	na	na
Harvesting	na	na	na

See footnotes at end of table.

Continued--

Table 22--Field operations on Government rice program set-aside acreage, 1988--Continued

Item	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
		Percent 1/	
Farms	49.5	59.4	52.3
		Times-over 2/	
All field operations	.93	1.11	.96
Tillage	.93	1.11	.96
Plowing	.24	d	0
Disking	.69	1.01	.91
Cultivating	0	d	0
Harrowing	0	d	d
Bedding	0	0	0
Soil packing	0	0	0
Other tillage	d	0	d
Fertilizer and pesticide application	0	0	0
Planting	0	0	0
Harvesting	0	0	0
		Coefficient of variation	
Farms	9.77	10.29	11.36
All field operations	14.01	11.44	18.03
Tillage	14.01	11.44	18.03
Plowing	28.02	na	na
Disking	19.12	11.27	18.63
Cultivating	na	na	na
Harrowing	na	na	na
Bedding	na	na	na
Soil packing	na	na	na
Other tillage	na	na	na
Fertilizer and pesticide application	na	na	na
Planting	na	na	na
Harvesting	na	na	na

d = insufficient data for disclosure.
na = not applicable.
1/ Percent of farms reporting tillage on set-aside acreage.
2/ Average times-over over all rice set-aside acreage, including farms which reported no set-aside tillage.

Table 23--Rice drying, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent of production 1/			
Rice dried:						
Onfarm	25.0	13.2	53.5	32.5	55.8	6.0
Commercially	44.6	85.9	37.9	58.5	44.2	93.1
Sold green	30.4	d	8.6	9.0	0	d
			Percent 1/			
Moisture level at harvest	19.2	22.7	19.2	20.4	19.2	19.5
			Dollars per hundredweight 2/			
Commercial drying cost	.62	.69	.76	.95	.80	.80
			Coefficient of variation			
Rice dried:						
Onfarm	20.51	24.95	12.76	14.13	11.64	40.60
Commercially	15.63	3.90	17.90	8.52	14.72	2.66
Sold green	19.00	na	36.03	29.56	na	na
Moisture level at harvest	1.17	1.14	1.41	.63	1.14	1.09
Commercial drying cost	9.38	3.36	6.38	4.72	4.95	1.46

d = insufficient data for disclosure.
na = not applicable.
1/ Mean per farm producing rice.
2/ Mean per farm reporting item.

Table 24--Type of fuel used in onfarm drying of rice, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Percent of farms 1/			
Dryer fuel type:						
Electricity	d	d	d	0	19.3	d
Gasoline	d	0	0	d	0	0
Diesel	d	0	d	0	0	0
LP gas	48.8	20.3	70.1	61.1	30.7	43.2
Natural gas	18.3	d	d	32.5	27.8	43.2
Solar	0	0	0	0	0	0
Natural air	22.6	50.6	d	d	19.0	0
Other	0	d	0	0	d	0
			Coefficient of variation			
Dryer fuel type:						
Electricity	na	na	na	na	33.06	na
Gasoline	na	na	na	na	na	na
Diesel	na	na	na	na	na	na
LP gas	19.37	46.87	13.04	12.66	22.40	35.34
Natural gas	39.68	na	na	21.56	25.11	35.34
Solar	na	na	na	na	na	na
Natural air	35.27	24.75	na	na	31.81	na
Other	na	na	na	na	na	na

d = insufficient data for disclosure.
na = not applicable.
LP = liquefied petroleum.
1/ Mean per farm reporting onfarm drying facilities.

Table 25--Rice cash production costs and returns per planted acre excluding Government payments, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Dollars			
Gross value of rice production	364.93	423.58	356.99	307.77	375.59	457.60
Cash costs:						
Seed	19.06	22.01	20.76	28.22	21.21	20.29
Fertilizer	32.06	38.63	31.47	40.54	44.07	48.37
Chemicals	32.41	48.74	46.10	32.50	47.55	48.88
Custom operations	25.16	48.23	37.07	29.11	37.71	33.68
Fuel, lube, and electricity	58.97	54.85	53.53	47.46	32.79	77.94
Repairs	28.73	21.44	29.00	19.28	23.09	35.64
Hired labor	32.40	40.36	38.39	17.27	57.30	42.99
Purchased irrigation water	0	21.64	.44	.34	42.51	30.22
Drying	32.61	49.16	39.32	42.22	42.58	51.29
Miscellaneous	1.33	1.41	1.31	.24	1.69	2.74
Technical services	.15	1.15	.85	.14	.49	.16
Total, variable cash costs	262.88	347.62	298.24	257.32	350.99	392.20
General farm overhead	18.20	38.11	19.11	16.69	30.79	24.95
Taxes and insurance	12.69	16.80	10.36	7.58	13.93	13.53
Interest on operating loans	11.19	18.69	11.53	13.82	13.92	20.92
Interest on real estate	14.56	25.83	5.35	4.81	6.39	4.12
Total, fixed cash costs	56.64	99.43	46.35	42.90	65.03	63.52
Total, cash costs	319.52	447.05	344.59	300.22	416.02	455.72
Gross value of production less cash costs	45.41	-23.47	12.40	7.55	-40.43	1.88
Harvest-period price (dollars/cwt)	6.93	5.95	6.94	6.96	7.10	7.10
Yield (cwt/planted acre)	52.66	71.19	51.44	44.22	52.90	64.45

Continued--

Table 25--Rice cash production costs and returns per planted acre excluding Government payments, 1988--Continued

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Coefficient of variation			
Gross value of rice production	1.91	1.14	3.33	2.10	2.78	2.42
Cash costs:						
Seed	5.05	2.68	3.95	2.15	4.01	2.20
Fertilizer	3.97	5.79	3.00	2.96	4.77	2.81
Chemicals	8.19	4.59	4.68	7.09	5.57	5.49
Custom operations	10.14	11.01	8.37	5.47	10.21	8.61
Fuel, lube, and electricity	6.45	4.37	4.10	6.03	6.68	8.61
Repairs	3.67	5.10	3.25	4.09	4.99	4.59
Hired labor	9.72	12.07	6.24	8.28	10.84	7.98
Purchased irrigation water	na	7.97	58.60	92.90	9.96	20.39
Drying	5.23	3.13	3.13	3.57	4.30	3.03
Miscellaneous	24.12	23.95	42.30	54.42	23.84	18.55
Technical services	70.73	89.84	25.89	71.01	42.10	89.41
Total, variable cash costs	3.11	2.20	1.94	2.53	3.39	3.26
General farm overhead	9.38	10.10	9.78	5.84	11.94	9.69
Taxes and insurance	7.42	9.19	6.58	4.73	14.50	6.67
Interest on operating loans	9.20	13.21	10.47	8.17	14.96	15.75
Interest on real estate	31.27	18.25	22.22	23.07	23.54	45.10
Total, fixed cash costs	10.93	8.11	7.35	4.73	8.73	7.78
Total, cash costs	3.53	2.49	2.07	2.42	3.63	3.37
Gross value of production less cash costs	25.46	50.61	92.00	103.29	31.85	880.43
Harvest-period price (dollars/cwt)	na	na	na	na	na	na
Yield (cwt/planted acre)	1.91	1.14	3.33	2.10	2.78	2.42

na = not applicable.
cwt = hundredweight.

Table 26--Quartile distribution of rice farms by variable cash costs per planted acre, Arkansas nondelta, 1988

Item	Mean 1/	Distribution of rice farms 2/ 25%	Median	75%
		Dollars		
Variable cash costs:				
Seed	19.06	15.39	18.07	21.38
Fertilizer	32.06	23.62	29.37	36.91
Chemicals	32.41	20.13	29.99	43.86
Custom operations	25.16	10.44	26.01	39.40
Fuel, lube, and electricity	58.97	39.45	54.35	78.93
Repairs	28.73	23.90	27.74	32.99
Hired labor	32.40	1.77	24.20	39.54
Purchased irrigation water	0	0	0	0
Drying	32.61	27.72	33.12	38.60
Miscellaneous	1.33	0	0	1.92
Technical services	.15	0	0	0
Total	262.88	235.82	264.54	307.16

1/ Average variable cash cost over expanded rice acres.
2/ Values of cash costs such that the lower 25% of expanded farms have costs less than or equal to the stated value, 50% of expanded farms have costs less than and 50% of expanded farms have costs greater than the stated value, and 75% of expanded farms have costs less than or equal to the stated value. Cash costs do not sum to total.

Table 27--Quartile distribution of rice farms by variable cash costs per planted acre, California, 1988

Item	Mean 1/	Distribution of rice farms 2/ 25%	Median	75%
		Dollars		
Variable cash costs:				
Seed	22.01	19.25	20.84	23.09
Fertilizer	38.63	22.57	34.56	48.55
Chemicals	48.74	32.99	50.51	65.11
Custom operations	48.23	18.12	33.46	57.25
Fuel, lube, and electricity	54.85	43.12	46.88	61.27
Repairs	21.44	14.87	20.25	30.31
Hired labor	40.36	0	25.59	47.38
Purchased irrigation water	21.64	13.03	19.92	31.70
Drying	49.16	41.29	45.91	54.21
Miscellaneous	1.41	0	0	.78
Technical services	1.15	0	0	0
Total	347.62	287.20	336.23	404.64

1/ Average variable cash cost over expanded rice acres.
2/ See footnote 2, table 26.

Table 28--Quartile distribution of rice farms by variable cash costs per planted acre, Mississippi River Delta, 1988

Item	Mean 1/	Distribution of rice farms 2/ 25%	Median	75%
		Dollars		
Variable cash costs:				
Seed	20.76	16.15	19.50	24.27
Fertilizer	31.47	24.05	28.48	36.20
Chemicals	46.10	26.88	41.32	56.18
Custom operations	37.07	17.00	31.71	59.26
Fuel, lube, and electricity	53.53	39.44	51.39	70.73
Repairs	29.00	21.94	28.91	32.58
Hired labor	38.39	13.76	24.95	45.98
Purchased irrigation water	.44	0	0	0
Drying	39.32	31.78	39.54	43.72
Miscellaneous	1.31	0	0	1.13
Technical services	.85	0	0	0
Total	298.24	253.61	294.67	327.84

1/ Average variable cash cost over expanded rice acres.
2/ See footnote 2, table 26.

Table 29--Quartile distribution of rice farms by variable cash costs per planted acre, southwest Louisiana, 1988

Item	Mean 1/	Distribution of rice farms 2/ 25%	Median	75%
		Dollars		
Variable cash costs:				
Seed	28.22	24.67	27.22	30.56
Fertilizer	40.54	32.74	40.19	46.92
Chemicals	32.50	14.21	26.00	40.99
Custom operations	29.11	16.55	25.86	36.10
Fuel, lube, and electricity	47.46	25.04	49.89	70.27
Repairs	19.28	14.20	18.46	23.59
Hired labor	17.27	1.84	10.35	23.73
Purchased irrigation water	.34	0	0	0
Drying	42.22	35.69	40.22	46.41
Miscellaneous	.24	0	0	0
Technical services	.14	0	0	0
Total	257.32	216.81	256.74	299.12

1/ Average variable cash cost over expanded rice acres.
2/ See footnote 2, table 26.

Table 30--Quartile distribution of rice farms by variable cash costs per planted acre, upper Texas gulf coast, 1988

Item	Mean 1/	Distribution of rice farms 2/ 25%	Median	75%
		Dollars		
Variable cash costs:				
Seed	21.21	19.20	21.32	23.96
Fertilizer	44.07	37.46	43.31	50.27
Chemicals	47.55	29.55	42.65	58.02
Custom operations	37.71	19.55	34.32	56.00
Fuel, lube, and electricity	32.79	25.42	30.33	36.86
Repairs	23.09	17.70	22.37	27.94
Hired labor	57.30	32.12	46.58	76.13
Purchased irrigation water	42.51	24.29	45.00	66.50
Drying	42.58	32.07	41.17	48.16
Miscellaneous	1.69	0	0	1.75
Technical services	.49	0	0	0
Total	350.99	306.34	349.12	398.63

1/ Average variable cash cost over expanded rice acres.
2/ See footnote 2, table 26.

Table 31--Quartile distribution of rice farms by variable cash costs, lower Texas gulf coast, 1988

Item	Mean 1/	Distribution of rice farms 2/ 25%	Median	75%
		Dollars		
Variable cash costs:				
Seed	20.29	17.95	19.89	21.78
Fertilizer	48.37	38.24	47.17	54.65
Chemicals	48.88	35.08	47.06	60.94
Custom operations	33.68	16.60	27.52	48.37
Fuel, lube, and electricity	77.94	38.29	64.58	116.62
Repairs	35.64	27.39	32.47	44.51
Hired labor	42.99	14.06	38.71	54.13
Purchased irrigation water	30.22	0	0	51.75
Drying	51.29	43.83	51.43	57.31
Miscellaneous	2.74	0	1.19	5.60
Technical services	.16	0	0	0
Total	392.20	327.67	366.05	436.39

1/ Average variable cash cost over expanded rice acres.
2/ See footnote 2, table 26.

Table 32--Rice economic production costs and returns per planted acre excluding Government payments, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Dollars			
Gross value of rice production	364.93	423.58	356.99	307.77	375.59	457.60
Economic costs:						
Variable cash costs	262.88	347.62	298.24	257.32	350.99	392.20
General farm overhead	18.20	38.11	19.11	16.69	30.79	24.95
Taxes and insurance	12.69	16.80	10.36	7.58	13.93	13.53
Capital replacement	45.50	38.83	39.64	33.50	28.56	59.14
Operating capital	9.10	12.03	10.32	8.90	12.14	13.57
Other nonland capital	17.85	15.89	15.87	14.95	14.31	20.09
Land	57.55	116.19	61.08	51.30	34.43	54.79
Unpaid labor	16.87	46.99	15.26	28.74	28.30	31.88
Total, economic costs	440.64	632.46	469.88	418.98	513.45	610.15
Residual returns to management and risk	-75.71	-208.88	-112.89	-111.21	-137.86	-152.55
Harvest-period price (dollars/cwt)	6.93	5.95	6.94	6.96	7.10	7.10
Yield (cwt/planted acre)	52.66	71.19	51.44	44.22	52.90	64.45

Continued--

Table 32--Rice economic production costs and returns per planted acre excluding Government payments, 1988--Continued

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Coefficient of variation			
Gross value of rice production	1.91	1.14	3.33	2.10	2.78	2.42
Economic costs:						
Variable cash costs	3.11	2.20	1.94	2.53	3.39	3.26
General farm overhead	9.38	10.10	9.78	5.84	11.94	9.69
Taxes and insurance	7.42	9.19	6.58	4.73	14.50	6.67
Capital replacement	4.36	5.04	3.25	4.34	5.91	6.14
Operating capital	3.11	2.20	1.94	2.53	3.39	3.26
Other nonland capital	6.31	6.01	6.93	5.47	6.26	5.42
Land	5.66	4.28	9.57	6.75	10.41	8.69
Unpaid labor	10.31	7.15	8.17	5.37	8.27	7.86
Total, economic costs	2.88	2.00	2.42	2.16	3.01	3.00
Residual returns to management and risk	14.07	6.03	9.31	7.89	9.23	10.65
Harvest-period price (dollars/cwt)	na	na	na	na	na	na
Yield (cwt/planted acre)	1.91	1.14	3.33	2.10	2.78	2.42

na = not applicable.
cwt = hundredweight.

Table 33--Rice cash production costs and returns per planted acre including Government payments, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Dollars			
Gross value of production:						
Rice	364.93	423.58	356.99	307.77	375.59	457.60
Government payments	213.16	327.96	193.72	181.76	228.53	253.79
Total	578.09	751.54	550.71	489.53	604.12	711.39
Cash costs:						
Seed	19.06	22.01	20.76	28.22	21.21	20.29
Fertilizer	32.06	38.63	31.47	40.54	44.07	48.37
Chemicals	32.41	48.85	46.12	32.51	47.56	48.88
Custom operations	25.16	48.26	37.07	29.11	37.71	33.68
Fuel, lube, and electricity	59.35	55.18	54.25	47.81	33.59	78.34
Repairs	29.97	21.81	31.51	19.79	24.17	36.53
Hired labor	32.56	40.49	38.67	17.35	57.65	43.13
Purchased irrigation water	0	21.64	.44	.34	42.51	30.22
Drying	32.61	49.16	39.32	42.22	42.58	51.29
Miscellaneous	1.42	1.51	1.31	.28	1.69	2.74
Technical services	.15	1.15	.85	.14	.49	.16
Total, variable cash costs	264.75	348.69	301.77	258.31	353.23	393.63
General farm overhead	21.91	40.92	22.82	19.07	32.33	26.07
Taxes and insurance	12.86	16.93	10.67	7.72	14.20	13.69
Interest on operating loans	13.53	20.78	13.62	15.50	14.88	22.01
Interest on real estate	17.38	27.84	6.48	5.46	6.55	4.22
Total, fixed cash costs	65.68	106.47	53.59	47.75	67.96	65.99
Total, cash costs	330.43	455.16	355.36	306.06	421.19	459.62
Gross value of production less cash costs	247.66	296.38	195.35	183.47	182.93	251.77
Harvest-period price (dollars/cwt)	6.93	5.95	6.94	6.96	7.10	7.10
Yield (cwt/planted acre)	52.66	71.19	51.44	44.22	52.90	64.45

Continued--

Table 33--Rice cash production costs and returns per planted acre including Government payments, 1988--Continued

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Coefficient of variation			
Gross value of production:						
Rice	1.91	1.14	3.33	2.10	2.78	2.42
Government payments	.21	.11	.83	.45	.77	.24
Total	1.27	.68	2.35	1.43	1.91	1.64
Cash costs:						
Seed	5.05	2.68	3.95	2.15	4.01	2.20
Fertilizer	3.97	5.79	3.00	2.96	4.77	2.81
Chemicals	8.19	4.58	4.68	7.09	5.57	5.49
Custom operations	10.14	11.01	8.37	5.47	10.21	8.61
Fuel, lube, and electricity	6.45	4.37	4.03	5.98	6.57	8.56
Repairs	3.81	5.13	3.14	4.06	5.01	4.45
Hired labor	9.72	12.07	6.18	8.28	10.82	7.95
Purchased irrigation water	na	7.97	58.60	92.90	9.96	20.39
Drying	5.23	3.13	3.13	3.57	4.30	3.03
Miscellaneous	22.94	22.50	42.28	47.81	23.84	18.55
Technical services	70.73	89.84	25.89	71.01	42.10	89.41
Total, variable cash costs	3.12	2.22	1.93	2.54	3.41	3.24
General farm overhead	9.38	9.77	9.51	6.05	11.77	9.31
Taxes and insurance	7.39	9.15	6.43	4.66	14.28	6.58
Interest on operating loans	9.15	13.26	9.91	8.14	15.14	15.67
Interest on real estate	31.39	17.89	22.19	23.04	23.19	44.32
Total, fixed cash costs	11.13	7.96	7.32	4.85	8.56	7.69
Total, cash costs	3.66	2.54	2.13	2.46	3.65	3.33
Gross value of production less cash costs	5.06	4.15	6.40	4.47	7.59	6.55
Harvest-period price (dollars/cwt)	na	na	na	na	na	na
Yield (cwt/planted acre)	1.91	1.14	3.33	2.10	2.78	2.42

na = not applicable.
cwt = hundredweight.

Table 34--Rice economic production costs and returns per planted acre including Government payments, 1988

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Dollars			
Gross value of production:						
Rice	364.93	423.58	356.99	307.77	375.59	457.60
Government payments	213.16	327.96	193.72	181.76	228.53	253.79
Total	578.09	751.54	550.71	489.53	604.12	711.39
Economic costs:						
Variable cash costs	264.75	348.69	301.77	258.31	353.23	393.63
General farm overhead	21.91	40.92	22.82	19.07	32.33	26.07
Taxes and insurance	12.86	16.93	10.67	7.72	14.20	13.69
Capital replacement	46.01	39.22	40.58	33.92	29.36	59.61
Operating capital	9.16	12.06	10.44	8.94	12.22	13.62
Other nonland capital	18.23	16.20	16.54	15.27	14.88	20.43
Land	117.81	190.12	109.78	100.83	66.77	114.78
Unpaid labor	16.99	47.13	15.42	28.85	28.51	32.07
Total, economic costs	507.72	711.27	528.02	472.91	551.50	673.90
Residual returns to management and risk	70.37	40.27	22.69	16.62	52.62	37.49
Harvest-period price (dollars/cwt)	6.93	5.95	6.94	6.96	7.10	7.10
Yield (cwt/planted acre)	52.66	71.19	51.44	44.22	52.90	64.45

Continued--

Table 34--Rice economic production costs and returns per planted acre including Government payments, 1988--Continued

Item	Arkansas nondelta	California	Mississippi River Delta	Southwest Louisiana	Upper Texas gulf coast	Lower Texas gulf coast
			Coefficient of variation			
Gross value of production:						
Rice	1.91	1.14	3.33	2.10	2.78	2.42
Government payments	.21	.11	.83	.45	.77	.24
Total	1.27	.68	2.35	1.43	1.91	1.64
Economic costs:						
Variable cash costs	3.12	2.22	1.93	2.54	3.41	3.24
General farm overhead	9.38	9.77	9.51	6.05	11.77	9.31
Taxes and insurance	7.39	9.15	6.43	4.66	14.28	6.58
Capital replacement	4.39	5.04	3.19	4.29	5.85	6.08
Operating capital	3.12	2.22	1.93	2.54	3.41	3.24
Other nonland capital	6.30	5.95	6.87	5.42	6.22	5.40
Land	4.08	2.84	7.27	4.57	10.91	9.57
Unpaid labor	10.29	7.15	8.18	5.36	8.27	7.85
Total, economic costs	2.75	1.84	2.16	2.22	2.97	2.57
Residual returns to management and risk	17.03	32.23	49.58	58.34	26.91	35.71
Harvest-period price (dollars/cwt)	na	na	na	na	na	na
Yield (cwt/planted acre)	1.91	1.14	3.33	2.10	2.78	2.42

na = not applicable.
cwt = hundredweight.

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