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THE DOMESTIC RESOURCE COST OF RICE PRODUCTION IN THE UNITED STATES

The United States has been a major rice-exporting country for over 25 years. Because rice exports account for less than 1 percent of total U.S. export earnings, political concern with increased rice production arises from other interests. In order of priority, increased production and exports have been evaluated with respect to their effect on farm income, social cost to the country, and their support of U.S. foreign policy objectives.[1]

This major emphasis on maintenance of the income of rice farmers has resulted in a government floor price support plus export subsidies in all but two of the past 17 years in order to meet world competition.[2] The floor price support has been legally guaranteed to rice crops from at least a minimum base area of approximately 670,000 hectares. Under these conditions, with yields increasing at a faster rate than domestic demand, exports have become increasingly essential to avoid undesirably large carryover stocks. Direct food grants, sales for foreign currency, and subsidized export financing have been used to limit potential stock holdings arising from the continuing farm price support to established production areas. In 1975, the production surplus, after accounting for domestic consumption, amounted to approximately 65 percent of total rice output. If the planted area in 1975 had been limited to the legal minimum for price support, the production surplus in excess of domestic consumption would still have been 45 percent. On this basis, it would have been necessary to export approximately 1.05 million tons of milled rice to keep domestic stock levels constant. In fact, about 2.5 million tons were exported in the crop year ending June 30, 1975, but only because world prices remained above U.S. support prices and large concessionary exports were authorized for developing countries.[3]

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[1] For a more detailed discussion of the importance of these objectives, see (8).

[2] Export subsidies have continued in one form or another throughout the period.

[3] Concessionary exports were sold at market prices but with substantial credit subsidies.

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U.S. policy makers, reluctant to reduce the extent or level of area and price support, are interested in the social and financial costs or benefits inherent in their present rice policy. Given the production techniques used in early 1975, what is the minimum world price below which some form of subsidization to private producers would be necessary? Does this minimum price vary appreciably among the major rice-producing areas in the United States? And, how does social profitability differ from private profitability?

The purpose of this paper is to estimate the social and financial rice export costs (ECs) along with the domestic resource costs (DRCs) for the major rice-producing areas of the United States. Sensitivity of these results will be determined for alternative yields and for alternative prices of land, labor, fertilizer, and capital. This analysis should help provide rice policy makers with guidelines of real and financial costs and returns of rice policy alternatives. It will provide an indication of the comparative advantage of producing rice in the various areas and of the export subsidies required at various production and world price levels.

MAJOR RICE PRODUCTION AREAS IN THE UNITED STATES

Five major rice production areas, Northeast Arkansas, Southeast Louisiana, California, the Mississippi Delta, and East Texas, which together accounted for over 90 percent of the total area harvested in 1975, have been selected for study.[4] The estimated suitability and use of cropland to rice of these areas are given in Table 1. In many ways, the production practices are similar for these five areas. All land on which rice is grown is irrigated and intensively fertilized. Except in California, intensity of land use is limited by the need for rotation to control yield-reducing weeds. The highly capital-intensive methods employed throughout include the use of large self-propelled combines for simultaneous harvesting and threshing along with mechanical drying of the grain. Seeding by airplane is employed in California, the Texas Gulf Coast (East Texas), and the Mississippi Delta. Elsewhere, the seeds are broadcast or drilled. Farm size is relatively large, varying from an average of 150 hectares in Arkansas to 377 in East Texas (see Appendix Table 1). Yields throughout are high compared with most of Asia, ranging from 4.1 tons of rough rice per hectare in Louisiana to 6.0 tons in California in 1974.

Given the rice production and price support possibilities under laws in effect in 1974 and 1975, total U.S. production could have been expected to continue to rise as long as the world price remained higher than American export costs. Under these conditions, the increases would have tended to be concentrated in the Mississippi Delta area where the largest potential rice area was planted in other crops (especially in soybean production which was less profitable than rice at 1975 relative prices). If world prices would have declined to levels below U.S. export costs, American production would have tended to revert to the 1973 land pattern to only those areas guaranteed floor price protection, with a slowly increasing

[4] Northeast Arkansas has been assumed representative of the Grand Prairie area which accounts for less than one-quarter of the area planted in rice in Arkansas. Because production costs in the two areas differed by less than 5 percent, the Grand Prairie area was not treated separately.

TABLE 1.—SUITABILITY AND USE OF CROPLAND TO RICE IN MAJOR RICE PRODUCTION AREAS IN THE UNITED STATES*
(*thousand hectares*)

Areas	Total	Cropland suited to rice	Potential rice area[b]	Harvested area[a]			
				1973	1974	1975	1976[c]
Northeast and Grand Prairie, Arkansas	947	715	351	175	238	281[c]	319[e]
Southwest Louisiana	726	726	363	242	254	243[c]	238[e]
California	268[d]	268[d]	204[d]	162	189	213	160
Mississippi Delta							
Arkansas	810	398	199	41	63	81[c]	[e]
Louisiana	96	55	28	9	18	20[c]	[e]
Mississippi	951	547	273	25	44	69	53
Missouri	566	226	113	2	6	7	6
Total Delta	2,423	1,226	613	77	131	177[c]	[e]
East Texas	1,032	984	241	222	228	222	210
Total	5,396	3,919	1,772	878	1,040	1,134	986

*Data from Warren C. Grant and Shelby H. Holder, Jr., "Recent Changes and the Potential for U.S. Rice Acreage," Rice Situation, RS-26, U.S. Department of Agriculture, October 1975, p. 12, except harvested area 1976 and 1975 (finalized figures only) which are from U.S. Department of Agriculture, Agricultural Marketing Service, *Rice Market News*, 57, 33, August 17, 1976, p. 3.

[a]Harvested area for calendar years are official Southern Cooperative Series data. Area breakdowns are estimated by Grant and Holder (*op. cit.*), based on county data when available. Excludes approximately 7,000 hectares in Arizona, Florida, Illinois, North Carolina, Oklahoma, South Carolina, and Tennessee.

[b]Approximate acreage that could be grown annually after taking into account limitations imposed by available water for irrigation and/or agronomic factors associated with rotations. These estimates were made in the mid-1960s and have been adjusted for known changes that have occurred since then.

[c]Preliminary.

[d]Estimates not available for San Joaquin Valley region, but judging from known area harvested, the San Joaquin Valley estimates are not apt to add more than 15 percent to the totals shown.

[e]Includes area classified in earlier years as part of Mississippi Delta.

average yield. The threat of profit-erasing penalties would have tended to discourage expansion.[5]

The basis for these conclusions was revised when new legislation was enacted in early 1976 (*10*). Under the new law, which replaces the prior law only for the 1976 and 1977 crop seasons, anyone can plant rice without fear of penalty. However, loan privileges and price protection are available only to those farmers with allotments. As long as price protection at least approaches estimated farm costs for the allotment holders, it can be expected that their approximately 728,750 hectares of land will be used for growing rice.[6] At average 1975 yields, planting at this level would result in a minimum crop of approximately 3.7 million tons of rough rice, with domestic consumption totaling about half this amount. However, in 1976 farmers without allotments and price protection planted an additional area exceeding 250,000 hectares. They were hopeful that prices would remain high enough to make their efforts profitable. With an increase in stock carry-over in mid-1976 and with world prices remaining relatively low, 1977 plantings—outside the core allotment area—will tend to decline unless export profitability improves.

PRIVATE COSTS

The basic data on the average costs of production in early 1975 have been obtained from a study made by Grant and Mullins (*6*) which was based on interviews with farmers, research and extension specialists, agricultural supply firms, and custom operators, and published information on prices paid, wage rates, interest rates, taxes, and U.S. Department of Agriculture county yield data. The basic data have been adjusted by the author to permit annualization and further detailing of investment costs. Land costs reported in terms of land rents were adapted to reflect market prices, but values representing the social opportunity costs were used to indicate the social costs of the land. Charges were estimated and added for overhead and management to complete the farm budgets. Estimated prices paid by farmers in each area for selected inputs are shown in Appendix Table 2. Fertilizer nutrient use is shown in Appendix Table 4. A summary of farm production costs is shown in Table 2.

These costs reflect the average levels of inputs and yields obtained by farmers in each rice area. Among farmers in each area, marginal costs and yields may differ slightly, but the variations in conventional inputs, such as seeding rates, fertilizer and herbicide use, and standard water management practices, are relatively small. Differences likely to be of consequence would reflect adoption or non-

[5] Under legislation existing through 1975, farmers on land not officially given a production allotment would not produce rice when surpluses could bring marketing quota limitations along with prohibitive penalties. This limitation applies to all but a very small percentage of new (nontraditional) rice farmers and to traditional producers who might plant areas in excess of their allotment and marketing quota. For further description of laws in effect in 1974 and 1975, see (*8*, pp. 340-44).

[6] For the 1976 crop the support price (target price) was set at $8.25 per 100 pounds of rough rice (paddy) with farm costs varying between approximately $7.00 and $9.00 depending upon the particular area involved. Further, unless allotment holders plant at least 90 percent of their allotted area in rice or an authorized substitute, a portion of the allotment will be withdrawn.

TABLE 2.—ESTIMATED OWNER-OPERATOR FINANCIAL COSTS AND RETURNS FOR ROUGH RICE PER ACRE IN MAJOR U.S. RICE AREAS, EARLY 1975[a]
(dollars/acre)

Item	Northeast Arkansas	California	Southwest Louisiana	Mississippi Delta	East Texas
Factor costs, nontraded goods					
Labor	71.86	73.47	52.53	64.48	82.64
Land	75.00	118.23	79.20	50.00	56.75
Capital	14.16	12.74	12.93	14.68	13.68
Tradable goods	222.93	213.65	214.31	239.40	241.45
Farm gate cost					
per acre	383.95	418.09	358.97	368.56	394.52
per cwt.	7.52	7.43	9.02	8.19	8.89
Gross returns					
Production *(cwt./acre)*	51.00	56.30	39.80	45.00	44.38
Value @ $7/cwt.	357.00	394.10	278.60	315.00	310.66
Value @ $9/cwt.	459.00	506.70	358.20	405.00	399.42

[a]See Appendix Table 5 for details.

adoption of recent innovations, such as special treatment for problem soils and interest in larger power units and associated equipment.

Several areas with slightly different budget characteristics have been considered to be similar to simplify the analysis. Northeast Arkansas has been assumed representative of the adjacent and much smaller Grand Prairie area. Specific cost estimates were not available for the San Joaquin Valley area which accounted for less than 10 percent of California production in 1975. The Sacramento Valley estimates were thus assumed to be representative of the entire area. The original cost study divided Texas ricelands approximately in half. In this analysis, the more easterly half has been assumed to be representative because costs and yields in the two areas differ by less than 3 percent.

To permit cost comparisons with world (border) prices, milling, transport, storage, and port charges have been added to production costs. The total of these costs is defined as export costs. Allowance has been made for by-product revenue. Detailed milling costs for rice mills in the South were assumed to be relevant also for California mills because no recent California studies are available. Transport and port costs were determined by the author from shippers in areas where recent studies were not available. These farm to export costs are shown in Appendix Table 5.

DRC ratios and ECs have been estimated for high quality rice using U.S.

Grade No. 2 (4 percent broken) and for concessionary U.S. Grade No. 5 (20 percent broken). Calculations for the shipments using high quality, long grain varieties have been made for all areas except California, where long grain is not grown. For concessionary shipments, cost estimates are for the predominant medium grain varieties.

Finally, estimates were made by the author of the percentage of each cost item arising directly or indirectly from traded goods. Similarly, estimates were made by the author of labor and capital involved. These are shown in Appendix Table 3. To the extent the estimates of percentages traded and nontraded are in error, the measured DRC ratio will suffer a bias (3). By using similar percentage allocations for all areas, this bias is approximately the same for a given grade in each area, making it possible to use the different DRC estimates as measures of relative comparative advantage within the country. As such uniformity of bias is difficult to realize when comparing areas in different countries, the DRC ranking could be less reliable in such instances.

SHADOW PRICES

The DRC, as used in this study, is a measure of the social opportunity cost of earning a unit of foreign exchange by producing rice for export. Estimation of DRC requires conversion of market prices into social opportunity costs. For the U.S. calculations, transfer payments (direct and indirect taxes) need to be eliminated, and the only shadow price adjustments considered necessary are those for land and capital.

Adjustment of the foreign exchange rate is ruled out because the U.S. dollar is used as the numeraire in all DRC calculations in this set of country studies. Because labor markets are relatively free in the United States, market prices can be considered reasonable measures of laborers' marginal products.

The market (financial) and opportuntity (shadow) costs of land are compared in Table 3. The shadow price has been estimated by calculating the social

TABLE 3.—ESTIMATED LAND COSTS*
(dollars/acre)

Area	Social opportunity cost	Financial cost (market price)
Northeast Arkansas	76.07	75.00
California	181.73	118.23
Southwest Louisiana	76.07	79.20
Mississippi Delta	50.34	50.00
East Texas	5.08	56.75

*Data for social opportunity cost from Appendix Tables 7 and 8. Financial cost data from Warren C. Grant and Troy Mullins, "Estimated Costs and Returns Per Acre of Rice in Major Producing Areas, 1975 Season," Departmental Information Report No. 75-5, Texas Agricultural Experiment Station and Texas A&M University, 1975, calculated on a "net rent" basis at an annual interest rate of 9 percent.

profitability of the next best alternative, excluding only land costs. At the margin, and considering average 1974 market prices, the next best alternative use was found to be safflower in California and soybeans elsewhere. Cattle grazing might appear as a possibility in Texas where it is the most important rotation use of rice lands. However, it would not be profitable to use the land continuously for cattle grazing, which becomes economical at present prices only because the cattle eat the red rice and weeds whose levels must be reduced before the land can profitably be used again to grow white rice.[7]

In all areas, except Texas, the estimated shadow price of land closely approaches the market value. In California the opportunity cost was high because the market value of the land did not reflect the unusually high market price of safflower in 1974. In Texas the land was practically valueless in alternative uses at prices existing in 1974.

The shadow price of capital has not been estimated.[8] As an approximation, the "prime loan" interest rate, which averaged close to 9 percent in 1974, was used. Sensitivity analysis is then employed in order to evaluate the effect of other rates. The author estimates that the long-run rate of capital could vary between 5 and 10 percent.

A weighted average nominal protection coefficient (NPC) of 0.67, indicating the impact of petroleum quotas and U.S. price controls, was used to estimate shadow prices on indirect petroleum product inputs.[9] No similar shadow price adjustment was used for urea fertilizer since its manufacture generally involved natural gas or other nitrogen sources. Finally, no shadow adjustment was made on farm equipment and machinery prices as Baldwin (*1*) indicated that they had zero nominal tariffs.

COMPARATIVE ADVANTAGE OF MAJOR U.S. RICE-GROWING AREAS

Estimated DRC coefficients and related parameters are shown in Table 4 for U.S. Grade No. 2 long grain rice (a typical quality used in commercial sales) and in Table 5 for U.S. Grade No. 5 medium grain rice (a typical quality used in concessional sales under Public Law 480). Table 6 shows estimated export costs.[10]

Using average 1974 border prices of milled rice and early 1975 estimated costs of rice and alternative crops, all major rice-producing areas in the United States had low DRC coefficients, indicating a high comparative advantage.[11] In all areas

[7] The weeds reduce yields while the red rice varieties lower the product value in the market. For further details, see (*4*) and (*12*).

[8] For discussion of this point, see (*7*) and (*2*).

[9] While Baldwin estimated an NPC of approximately 1.30 in 1970 (*1*), in a personal communication Richard B. Norgaard has suggested that an NPC of 0.67 might be a more reasonable estimate in 1974 considering that the price controls on so-called "old oil" caused the domestic prices of crude oil and products to be less than comparable international prices.

[10] Export costs represent the minimum border price that will cover full production and marketing costs. At EC, DRC = 1.0.

[11] The early 1975 costs were probably several percent higher than average 1974 costs, but were the only detailed costs available. Consequently, DRCs and ECs may be slightly biased on the high side for 1974.

TABLE 4.—ESTIMATED COSTS AND RETURNS AND DOMESTIC RESOURCE COST PARAMETERS U.S. LONG GRAIN NO. 2 MILLED RICE*
(*dollars/cwt.*)

Costs and returns and indicators	Northeast Arkansas	California (medium grain)	Southwest Louisiana	Mississippi Delta	East Texas
Gross output[a]	26.79	25.89	26.79	26.79	26.79
Tradable inputs[a]	7.79	6.26	9.32	9.50	9.57
Value added[a]	19.00	19.63	17.47	17.29	17.22
Factor costs, except capital[a]	6.34	7.31	6.97	5.74	6.61
Indirect taxes[a]	0.13	0.14	0.18	0.16	0.17
Private profitability[a]	12.53	12.18	10.32	11.39	10.44
Gross output[b, c]	26.79	25.89	26.79	26.79	26.79
Tradable inputs[c]	7.85	6.30	9.36	9.59	9.67
Value added[c]	18.94	19.59	17.43	17.20	17.12
DRC except capital[d]	6.38	9.35	6.83	5.80	4.49
(a) Labor[d]	3.66	3.48	3.35	3.76	4.28
(b) Land[d]	2.72	5.87	3.48	2.04	0.21
Social profitability	12.56	10.24	10.60	11.40	12.63
Domestic capital costs[d]	0.35	0.38	0.59	0.51	0.37
NSP at OER	12.21	9.86	10.01	10.89	12.26
SPFX/OER	1.00	1.00	1.00	1.00	1.00
NSP at SPFX	12.21	9.86	10.01	10.89	12.26
NPCO	1.00	1.00	1.00	1.00	1.00
NPCI	0.99	0.99	1.00	0.99	0.99
EPC on value added	1.00	1.00	1.00	1.01	1.01
DRC coefficient	0.355	0.497	0.426	0.367	0.284
Excess cost of DRC coefficient	0.645	0.503	0.574	0.633	0.711
Ratio DRC coefficient to SPFX/OER	0.355	0.497	0.426	0.367	0.284

* For sources and details, see Appendix Table 5.

[a] At actual market prices.

[b] Border price (average 1974 price): Grade No. 2 long grain, $590.61/ton f.o.b. U.S. Gulf ports; Grade No. 2 medium grain, $570.77/ton f.o.b. U.S. California ports.

[c] At world market prices.

[d] At opportunity costs.

Note: DRC = Domestic resource costs
EPC = Effective protection coefficient
NPCI = Nominal protection coefficient on tradable inputs
NPCO = Nominal protective coefficient on outputs
NSP = Net social profitability
OER = Official exchange rate
SPFX = Shadow price of foreign exchange

TABLE 5.—ESTIMATED COSTS AND RETURNS AND DOMESTIC RESOURCE COST PARAMETERS U.S. MEDIUM GRAIN GRADE NO. 5 PL 480 QUALITY MILLED RICE*
(dollars/cwt.)

Costs and returns and indicators	Northeast Arkansas	California (medium grain)	Southwest Louisiana	Mississippi Delta	East Texas
Gross output [a]	22.84	22.84	22.84	22.84	22.84
Tradable inputs[a]	7.77	6.79	9.11	9.24	9.19
Value added[a]	15.07	16.05	13.73	13.60	13.65
Factor costs, except capital[a]	5.26	6.17	5.75	4.80	5.45
Indirect taxes[a]	0.13	0.14	0.18	0.16	0.17
Private profitability[a]	9.68	9.74	7.80	8.64	8.03
Gross output[b, c]	22.84	22.84	22.84	22.84	22.84
Tradable inputs[c]	7.82	6.83	9.15	9.33	9.27
Value added[c]	15.02	16.01	13.69	13.51	13.57
DRC except capital[d]	5.29	7.87	5.64	4.81	3.68
(a) Labor[d]	3.03	2.98	2.74	3.12	3.51
(b) Land[d]	2.26	4.89	2.90	1.69	0.17
Social profitability	9.73	8.14	8.05	8.70	9.89
Domestic capital costs[d]	0.52	0.49	0.62	0.60	0.56
NSP at OER	9.21	7.65	7.43	8.10	9.33
SPFX/OER	1.00	1.00	1.00	1.00	1.00
NSP at SPFX	9.21	7.65	7.43	8.10	9.33
NPCO	1.00	1.00	1.00	1.00	1.00
NPCI	0.99	0.99	0.99	0.99	0.99
EPC on value added	1.00	1.00	1.00	1.01	1.01
DRC coefficient	0.387	0.522	0.457	0.400	0.312
Excess cost of DRC coefficient	0.613	0.378	0.543	0.600	0.688
Ratio DRC coefficient to SPFX/OER	0.387	0.522	0.457	0.400	0.312

* For sources and details, see Appendix Table 5.

[a] At actual market prices.

[b] Border price (average 1974 price): Grade No. 5, PL 480 medium grain $503.73/ton f.o.b. U.S. ports.

[c] At world market prices.

[d] At opportunity costs.

Note: DRC = Domestic resource costs
EPC = Effective protection coefficient
NPCI = Nominal protection coefficient on tradable inputs
NPCO = Nominal protective coefficient on outputs
NSP = Net social profitability
OER = Official exchange rate
SPFX = Shadow price of foreign exchange

TABLE 6.—EXPORT COSTS OF RICE IN THE UNITED STATES, EARLY 1975
(dollars/ton)[a]

Area	Social viewpoint	Financial viewpoint	
	Full costs (EC)	Full costs (EC)	Out-of-pocket costs (EC)
Long grain, Grade No. 2 (4 percent broken)			
Northeast Arkansas	321	319	248
California (medium grain)	353	308	231
Southwest Louisiana	370	372	287
Mississippi Delta	351	347	282
East Texas	320	365	303
Medium Grain, Grade No. 5 (20 percent broken)			
Northeast Arkansas	300	299	228
California	335	297	220
Southwest Louisiana	339	341	256
Mississippi Delta	325	323	257
East Texas	298	335	273

[a] Assumptions: For prices of capital, fertilizer, and labor, see Appendix Tables 2 and 5. For price of land, see Table 3. For calculation examples, see Appendix Table 5.

the DRC coefficients are lowest (i.e., have the highest comparative advantage) for the higher quality rice. This result occurred because the lower costs of the lower quality rice were more than offset by the large premium on high quality rice in world markets. The border price of Grade No. 2 medium grain rice, for example, was $570.77 per ton, compared with only $503.73 per ton for medium grain Grade No. 5.

As indicated in Tables 4 and 5, social profitability was slightly higher than private profitability for production from Arkansas, Louisiana, and the Mississippi Delta. Social profitability was much higher in Texas considering the low opportunity cost of land, irrigation capital costs, and transport charges. With a high opportunity cost of land in California, private profitability was considerably above social profitability.

Comparative advantage in rice production, as indicated by the DRC coefficient, is greatest in Texas and least in California. When judged by social ECs, the relative ranking is similar. However, from the financial viewpoint, considering the differentials between market and social opportunity costs of land, the EC ranking is reversed. California has a relatively lower market cost for land and enjoys the lowest financial EC, while Texas has a relatively higher market cost for land and competes closely with Louisiana for the highest financial EC.

These differences between social and financial ECs indicate that the supply response of the U.S. rice farmer does not necessarily conform to criteria for social efficiency. For example, if the border price of Grade No. 5 had declined to $300,

an average California rice farmer would continue to have found it profitable to produce for export with his EC of $297, while from the social viewpoint such action would have been inefficient because the social EC is $335.

The out-of-pocket estimates of EC eliminate land and farmers' capital and management costs. They indicate how far world prices could decline before farmers (if unprotected) would cease production in the relatively short run. California has the advantage when the cost of land is eliminated. Arkansas, with its relatively high yield, is close behind. Compared with social costs, the ranking of Texas is reversed because elimination of its small opportunity cost of land has little effect on financial, out-of-pocket costs. Given the heavy capital investment and the potential loss of allotments with their price support feature, the out-of-pocket ECs could guide supply response by allotment-holding farmers over several years of world prices below full financial costs. For farmers without allotments, the incentive to continue to produce at a loss would be weaker, and prices of alternative crops would be a more relevant guide to production decisions. The potential for world shortages to reappear would offer both types of farmers an additional incentive to continue producing rice. Whether or not congressional relief could be expected in the event of low world prices would depend upon the degree of influence of rice-production-oriented legislators and the orientation of the political party in power (8).

SENSITIVITY ANALYSIS

Sensitivity of the DRC coefficients to changes in yields or prices of important inputs (capital, fertilizer, labor, and land) is indicated by the elasticity estimates on Table 7 for each of the five producing areas and for two important rice qualities. The DRC elasticities indicate the percentage change of the DRC coefficient for a one percent change in the yields or in the price of the relevant parameter. Examination of these elasticities reveals the importance of each parameter relative to the maintenance of continued comparative advantage.

Table 7 and Charts 1 and 2 illustrate the much greater sensivity to proportionate changes in yield than to other changes. This result is as expected, the effect of changing the whole being greater than that of changing one of its parts. As shown in Charts 1 and 2, when the Arkansas yield is varied from 25 percent below the base (1974/75) level to 25 percent above, the minimum border price that would cover full production and marketing costs of long grain Grade No. 2 rice moves from $279 to $363 a ton and the DRC from .262 to .550. Because of firm water control and generally effective pesticide use, yield declines of this consequence below trend are most unusual in Arkansas and elsewhere in the United States. Declines below trend of about 5 percent are not uncommon but would increase the DRC coefficient only about 4 percent. This year-to-year variance can be important in the short run, but rates of yield increase can mean more relative to comparative advantage internationally in the longer run. Yield growth rates in California appear to be declining over the past decade but in Louisiana, where yields are comparatively low, yield growth rates could expand rapidly given an adaptive technological breakthrough.

Sensitivity to changes in land values and labor costs is next in importance. The sensitivity to land values is much more pronounced for California, where land

TABLE 7.—ELASTICITY OF DRC COEFFICIENTS WITH RESPECT TO SELECTED PARAMETERS*[a]

	Grade No. 2 Long Grain					Grade No. 5 Medium Grain				
	Northeast Arkansas	California (medium grain)	Southwest Louisiana	Mississippi Delta	East Texas	Northeast Arkansas	California (medium grain)	Southwest Louisiana	Mississippi Delta	East Texas
Capital	.23	.16	.29	.30	.26	.27	.18	.33	.34	.32
Fertilizer	.08	.08	.12	.09	.16	.08	.08	.14	.08	.19
Labor	.55	.36	.45	.59	.89	.52	.36	.44	.58	.83
Land	.41	.60	.47	.32	.05	.39	.59	.51	.31	.04
Yield	-.83	-.80	-.87	-.88	-.88	-.86	-.84	-.91	-.92	-.91

*See Tables 5 and 6 and Appendix Table 5 for basic data and sources.

[a]These elasticities are defined as $\frac{\blacktriangle \text{ Price X}}{\text{Price X}} \Big/ \frac{\blacktriangle \text{ DRC coefficient}}{\text{DRC coefficient}}$ and indicate the percentage change of the DRC coefficients for a one percent change in the price or quantity (yield) of the relevant parameter.

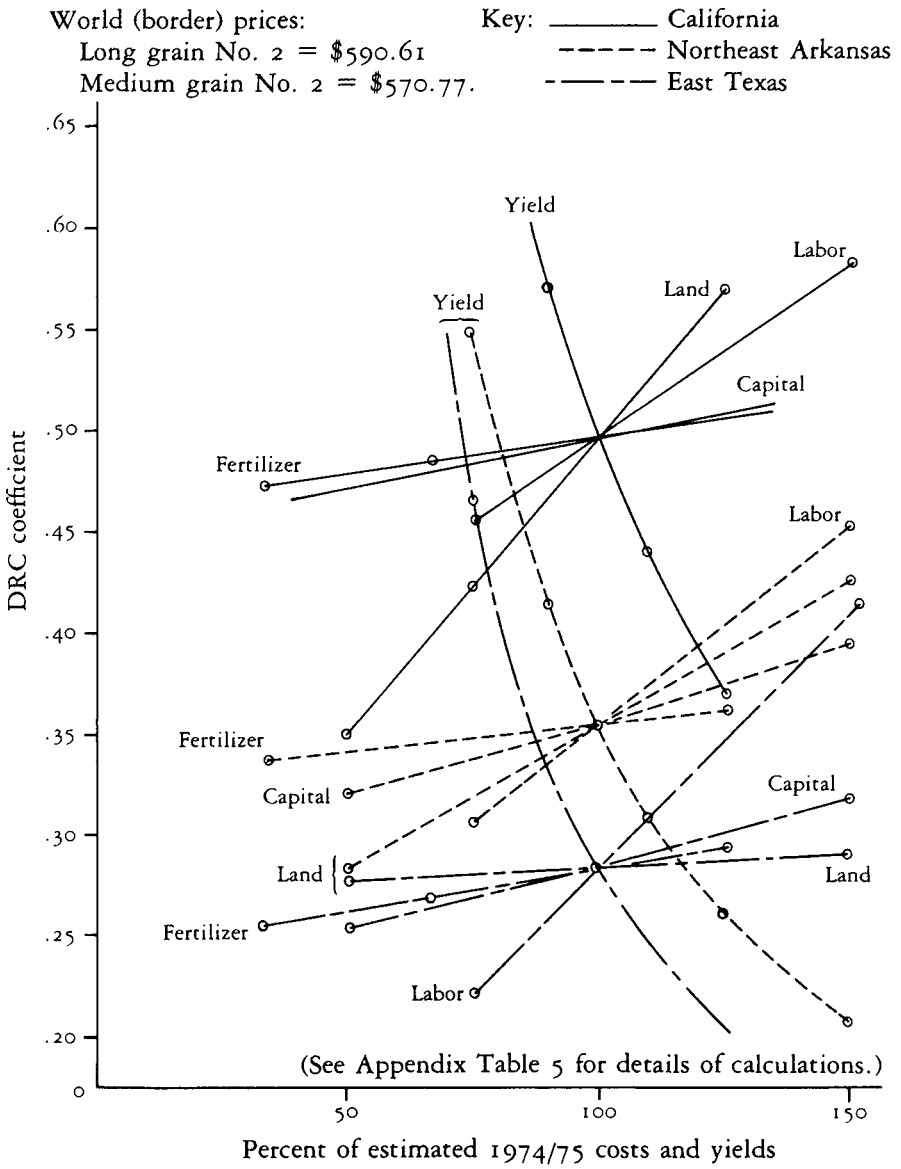

CHART 1.—SENSITIVITY OF DOMESTIC RESOURCE COST COEFFICIENT FOR LONG GRAIN NO. 2 MILLED RICE TO CHANGES IN YIELDS AND IN COSTS OF FERTILIZER, LAND, CAPITAL, AND LABOR FROM 1974/75 BEST ESTIMATES FOR NORTHEAST ARKANSAS, EAST TEXAS, AND CALIFORNIA (MEDIUM GRAIN RICE)

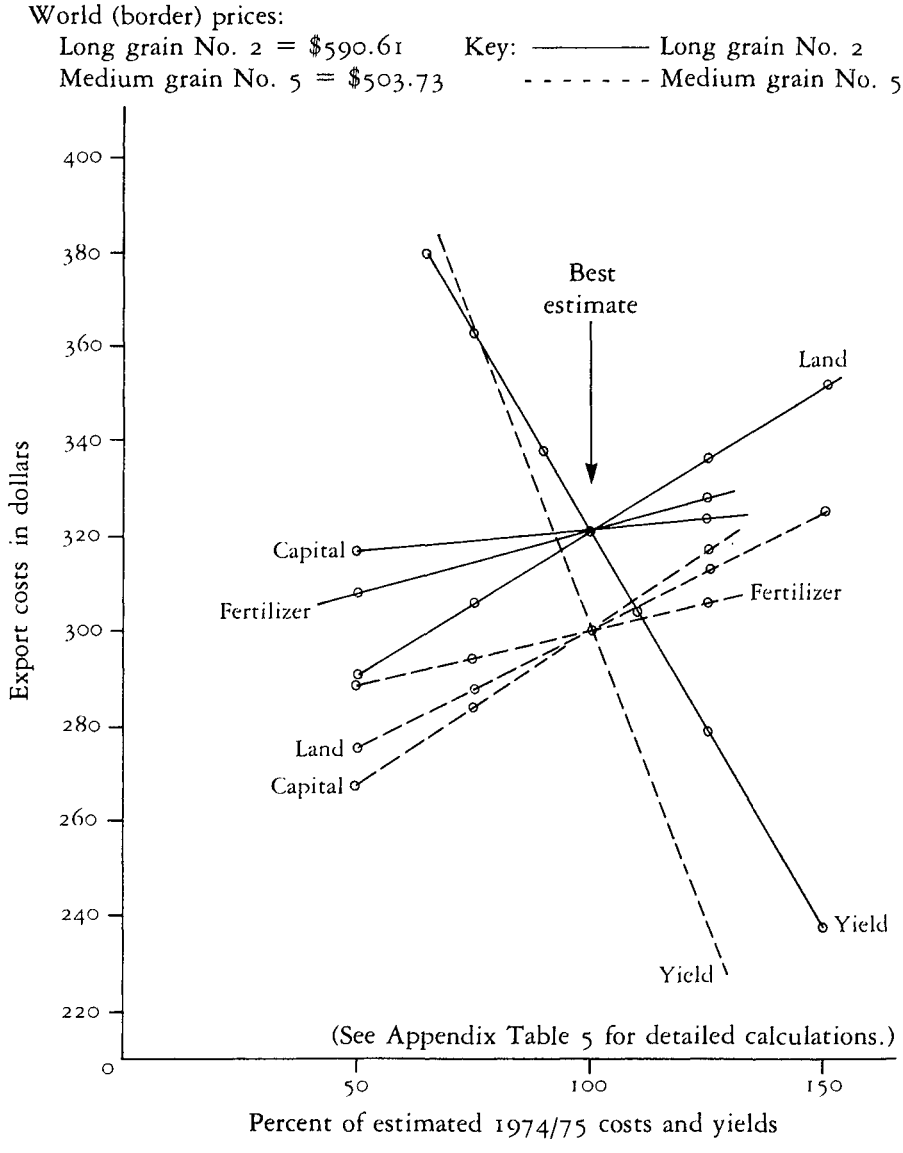

CHART 2.—SENSITIVITY OF EXPORT COSTS OF LONG GRAIN NO. 2 AND MEDIUM GRAIN NO. 5 TO CHANGES IN YIELDS AND IN COSTS OF FERTILIZER, LAND, AND CAPITAL FROM 1974/75 BEST ESTIMATES FOR ARKANSAS

value represents 37 percent of total farm costs, than for the Mississippi Delta, where it accounts for only 14 percent. The sensitivity to land values is lowest in Texas, where the low opportunity cost of land is less than 2 percent of farm costs. In most rice areas in the United States, this land parameter can fluctuate widely, reflecting the volatility of safflower and soybean prices upon which these land values depend. Safflower prices declined almost 50 percent between mid-1974 and 1975, while soybean prices declined approximately 35 percent between

December 1974 and 1975, rising rapidly again in mid-1976. Consequently, 50 percent changes in land values could well be experienced with an important impact on the EC, the DRC coefficient, and in turn on comparative advantage of U.S. rice production. Labor costs have been rising more than 5 percent per year. With the high elasticities relative to labor, these increases must be carefully considered in longer-run planning.

Sensitivity to changes in the fertilizer price appears to be much less than in some rice-producing countries of Asia. In U.S. rice areas in 1975, fertilizer represented less than 9 percent of export costs (except in Texas where it was 16 percent). A two-thirds reduction in the price of nitrogen would have dropped the export costs only slightly over $20 per ton in both Arkansas and California, causing relatively small declines in the DRC coefficient. This low level of sensitivity of the DRC coefficient is readily evident from Chart 3 which shows the variation in the DRC coefficient as the fertilizer price is changed, holding the world rice price constant. It is only at rice prices below $350 a ton that the 1975 peak fertilizer price ($300 per ton for urea) would have made U.S. rice exports unprofitable. At that time, the corresponding world rice price was over $500.

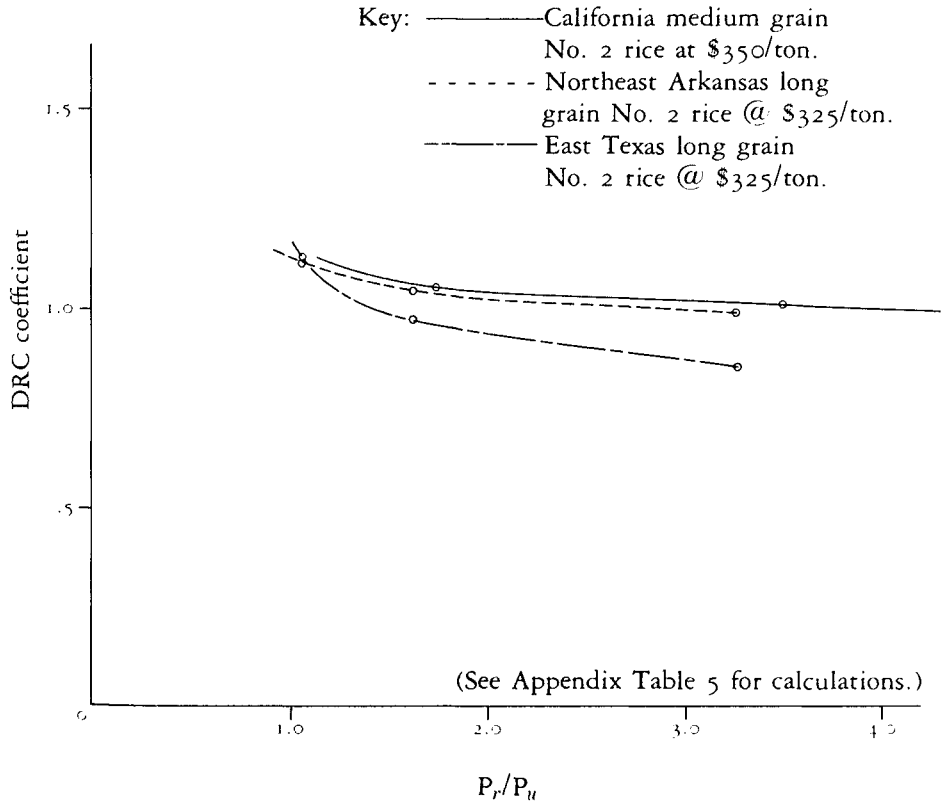

CHART 3.—SENSITIVITY OF THE DOMESTIC RESOURCE COST COEFFICIENT AS THE MILLED RICE/UREA BORDER PRICE RICE RATIO (P_r/P_u) VARIES BECAUSE OF CHANGES IN THE UREA PRICE

Even at a rice price of only $325 per ton, the DRC coefficient for Arkansas rice would have varied only between 0.99 and 1.12 as the urea price moved from $100 to $300 per ton.

For California, an error in the estimate of the capital cost would be of relatively minor importance. A 50 percent reduction in capital costs would have reduced export cost by less than $30 per ton and the DRC by less than .04. It is interesting to note that the elasticity relative to the price of capital is much less than to the price of labor in a country using a highly capital intensive mode of production. This result arises to some extent because only the nontradable portion of capital costs is considered in this calculation. In addition, however, the high labor costs lead to the capital intensity and are reflected in the high elasticities relative to labor.

Chart 2 illustrates how changes in the key parameters have relatively similar effects on the EC for both qualities of rice, Grade No. 2 long grain and Grade No. 5 medium grain. Because farm costs for the unmilled rice are the same for both milled qualities, the higher EC for the long grain Grade No. 2 is a reflection of its higher milling cost.

The critical sensitivity of the DRC coefficient to changes in the world (border) rice price is apparent from examination of Chart 4. When in early 1975 the world

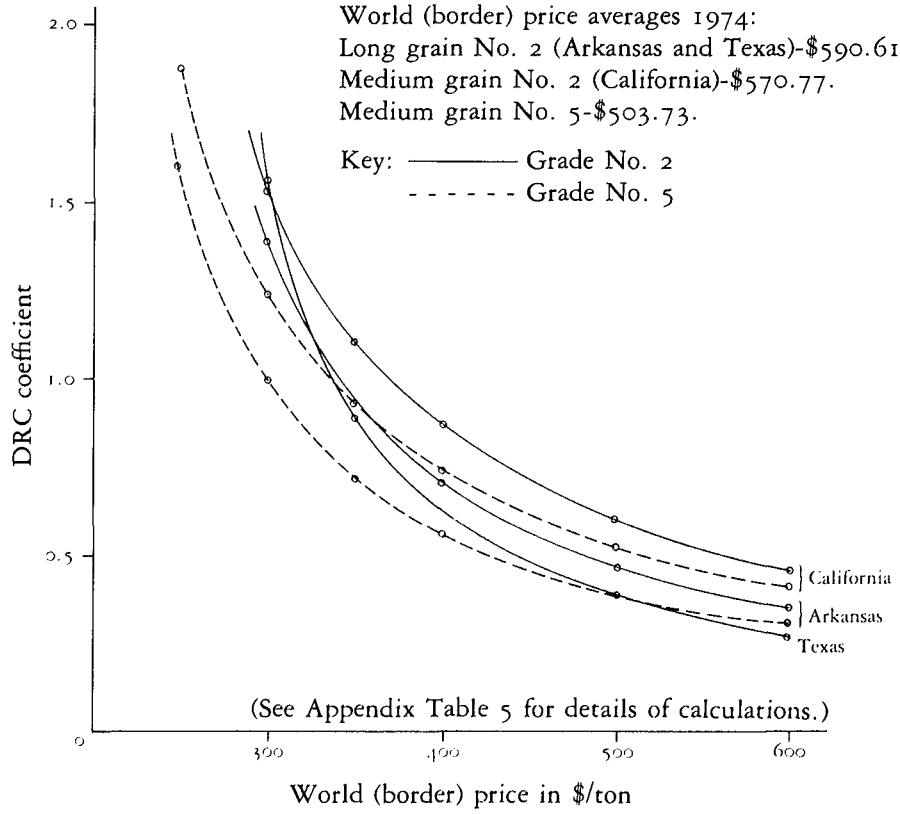

CHART 4.—SENSITIVITY OF THE DOMESTIC RESOURCE COST COEFFICIENT, AS THE WORLD (BORDER) MILLED RICE PRICE CHANGES FROM 1974/75 BEST ESTIMATES, FOR NORTHEAST ARKANSAS, CALIFORNIA, AND EAST TEXAS.

rice price for Grade No. 2 long grain rice was $590 per ton, the DRC coefficient for U.S. rice from all producing areas—both Grade No. 2 and Grade No. 5—would have been .50 or below. At the mid-1975 world price for Grade No. 2 rice of about $350 per ton, California would have already lost its international comparative advantage with an EC greater than $350 and a DRC coefficient of 1.11. In mid-1976, with Grade No. 2 rice at $250 per ton and Grade No. 5 approaching $225, all producing areas have lost their comparative advantage. And, with no shortage of stocks in the world, the PL 480 quality has a market advantage only because its sales are subsidized by soft-loan terms.

The rice-fertilizer border price ratios shown on Charts 3 and 5 relate commercial fertilizer and milled rice prices, both at border prices.[12] These charts

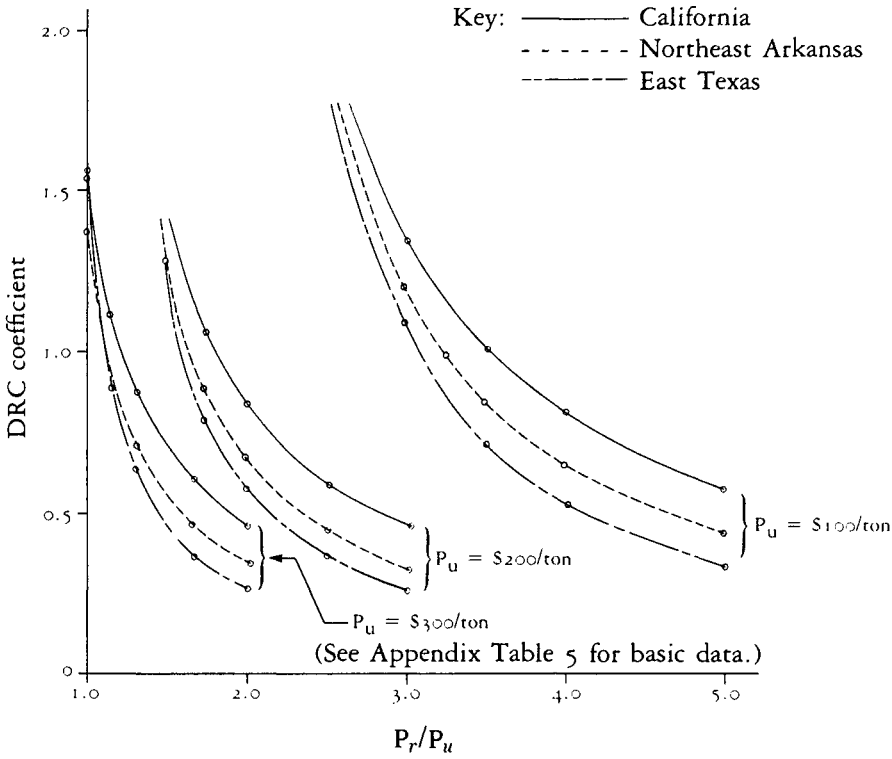

CHART 5.—SENSITIVITY OF DRC COEFFICIENT AS THE GRADE NO. 2 MILLED RICE/UREA BORDER PRICE RATIO (P_r/P_u) IS VARIED BECAUSE OF CHANGES IN THE WORLD PRICE FOR NORTHEAST ARKANSAS, CALIFORNIA AND EAST TEXAS.

[12] In an earlier study of rice in Asia by Timmer and Falcon, the rice-fertilizer price ratio was suggested as a key parameter in influencing a country's rice production level (9). Other important parameters were the retail rice price and per capita income, both of which were important determinants of consumption levels. The ratio referred to gave the relative price of rough rice to fertilizer nutrient (presumably N), both at the farm level. This relationship of domestically controlled prices gave no indication as to whether or not the country would have a comparative advantage allowing any surplus they developed to be exported profitably. At the time referred to in this study, early 1975, the Timmer and Falcon price relative to farmers in the United States was approximately 0.75. At the same time, the rice-fertilizer price relative referred to in Charts 3 and 5 was approximately 0.6 for Grade No. 2 long grain rice and 0.75 for Grade No. 5 medium grain rice. Translation of these latter ratios into Timmer and Falcon ratios would not be meaningful.

illustrate the sensitivity of the DRC to changes in this ratio, depending upon whether the change is effected by variations of the fertilizer (urea) or milled rice price.[13] The DRC is most sensitive to variations in the milled rice price while it is relatively insensitive to variations in the urea price. In accord with earlier sensitivity findings, this result means that small percentage increases (decreases) in the border price of rice will rapidly increase (decrease) the international comparative advantage of U.S. rice, while very large percentage movements in the border price of urea will be required to make even relatively small changes in international comparative advantage. For example, as shown in Chart 5, in Northeast Arkansas at per ton border prices of $300 for urea and $300 for milled rice (a ratio of 1), rice production would show a DRC of 1.4, being uncompetitive internationally. An increase in the milled rice price to $340, holding other prices constant, would reduce the DRC to 1.0.

SUMMARY AND CONCLUSIONS

The DRC coefficient and the minimum border price (EC) that will cover full rice production and marketing costs have been estimated for the five major rice production areas in the United States. The DRC measure brings out the relative domestic comparative advantage in rice production of East Texas and of Northeast Arkansas at price relationships existing in 1974-75. From a financial viewpoint, using market prices the ECs are lowest for California and highest for Texas and Louisiana. These relationships hold for both high and PL 480 quality rice. In the international market, U.S. producing areas showed a strong comparative advantage at the high world rice prices that prevailed in 1974.

The DRC coefficient was practically insensitive to fertilizer price changes. Its sensitivity to land price changes was relatively high, and opportunity costs could affect social land costs given the volatility of prices of alternative crops. The coefficient also displayed a considerable sensitivity to labor costs, which could influence costs in the longer run either directly as labor costs rise or indirectly as farmers are induced to adopt more highly capital-intensive operations.

The analysis brought out the high level of sensitivity of the DRC coefficient to world rice prices and to yields. Yields are not expected to be troublesome for U.S. export competitiveness in the short run, given their relatively small variance. In contrast, world rice prices that are highly volatile dropped below the U.S. EC levels in 1976. Even if farmers without allotments decide to withdraw from rice production in 1977, the country faces the possibility of a large surplus for exports from the remaining allotment holders. And those surpluses will add to the large carryover of stocks from the 1975 crop. Unless world shortages again force prices upward, U.S. policy makers will have to reconsider an expansion of export subsidies or an expensive storage program if farmers are not to be faced with heavy losses.

[13] Urea, being the predominant fertilizer used, is taken as a proxy for commercial fertilizers in these ratios.

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11 U.S. Department of Agriculture, Agricultural Marketing Service, *Rice Market News*, 57, 33, August 17, 1976.

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APPENDIX TABLE 1.—CHARACTERISTICS OF RICE PRODUCTION ON OWNER-OPERATED FARMS IN MAJOR RICE-PRODUCING AREAS IN THE UNITED STATES*[a]

Area	Average farm size (*ha.*)[b]	Crop competing at the margin	Average yield		Seed use for rice (*cwt. of rough rice/acre*)
			Rice (*cwt./ acre*)	Competing crop (*per acre*)	
Northeast Arkansas	150	Soybean	51.00	30 bu.	1.40
California	338	Safflower	56.30	1 ton	1.61
Southwest Louisiana	205	Soybean	39.80	30 bu.	1.35
Mississippi River Delta	295	Soybean	45.00	23 bu.	1.62
Texas	387	Soybean	44.38	25 bu.	1.20

*See Appendix Table 5 for other sources.

[a] 1 acre = 0.405 hectare; 1 long ton = 1.016 metric tons; 1 pound = 0.4536 kilogram; 1 bushel soybeans = 60 pounds; cwt. = hundred pound weight.

[b] U.S. Department of Commerce, *Census, California Rice Farms*, 1969.

APPENDIX TABLE 2.—ESTIMATED PRICES PAID BY RICE FARMERS FOR SELECTED INPUTS AT THE START OF THE RICE-PLANTING SEASON IN 1975*
(*in dollars*)

Item	Unit	Northeast Arkansas	California[a]	Southwest Louisiana	Mississippi River Delta	Texas (Gulf Coast)
Seed	cwt.	18.67	15.25	22.50	20.00	23.50
Fertilizer						
Nitrogen	lb.	.30	.31	.35	.27	.33
Phosphate	lb.	.28	.30	.28	.28	.26
Potash	lb.	.10	—	.10	.10	.07
Zinc	lb.	.70	.33	—	—	—
Herbicides and insecticides						
Methyl para	pint	—	—	—	—	1.18
Molinate	lb.	4.00	—	3.30	3.80	—
Premix	acre	—	—	—	—	7.16
Propanil	lb.	3.00	—	12.50	3.00	12.20[b]
Phenoxy	qt.	3.17	—	—	4.35[a]	—
MPCA	oz.	—	.21	—	—	—
Furadan	lb.	—	3.00[b]	.28	—	.29
Copper sulphate	acre	—	9.00	—	—	—
Parathion	lb.	—	3.00	—	—	2.62
Ordram	acre	—	.43[a]	—	—	16.50
Labor						
Regular	hr.	3.25	3.50	2.45	2.30	4.00
Seasonal	hr.	3.00	3.00	1.50	2.30	4.00
Fuel						
Gasoline	gal.	.459	.459	.459	.459	.459
Diesel	gal.	.339	.339	.339	.339	.316
Sales tax (*percent*)		3	5	3	[d]	4
Capital (*percent*)		9	9	9	9	9

* Data computed from Appendix Table 5.
[a]Sacramento and San Joaquin Valleys.
[b]Per pound = 0.4536 kilogram
[c]Per acre = 0.405 hectare
[d]Arkansas and Louisiana, 3 percent; Mississippi, 5 percent.

APPENDIX TABLE 3.—ALLOCATION OF COSTS BETWEEN TRADED AND NONTRADED AND LABOR AND CAPITAL

Item	Estimated percentage[a]		Nontraded factor[b] costs (percent)		
	Traded	Nontraded	Labor	Capital	Return on capital
By-products	(Same percentage as crop)			100	
Custom application and combining	75	25	100		
Depreciation, buildings	70	30		100	
Depreciation, capital equipment	90	10		100	
Fertilizer	90	10	100		
Hauling and equipment movement	75	25	100		
Herbicides	100	—			
Insecticides	100	—			
Insurance	—	100	50		50
Labor	—	100	100		
Land	—	100			
Land out of harvest	50	50	100		
Machinery and tractors, operation and maintenance, excluding labor	100	—			
Management	—	100	100		
Milling costs, except depreciation	66.7	33.3	100		
Operating capital	—	100			100
Other (miscellaneous)	50	50	100		
Overhead			100		
	(Same percentage as total costs, excluding land and management)				
Seed	100	—			
Selling commissions	—	100		100	
Storage	50	50		100	
Survey of levees	—	100		100	
Transport to port, including port charges	50	50		100	

[a] Where imports were exported (or imported) on the margin, they have been considered as traded goods. Percentages are judgments of the author and have been rounded to simplify calculation.

[b] Estimates are based on the author's experience and rounded for simplification of calculation.

APPENDIX TABLE 4.—FERTILIZER NUTRIENT USE ON OWNER-OPERATED FARMS IN MAJOR RICE-PRODUCING AREAS*

Area	Crop	*N*	*P*	*Potash*[a]
		(pounds per acre)		
Northeast Arkansas	Rice	100	4	30
	Soybean	—	20	40
California	Rice	110	30	—
	Safflower	80	—	—
Southwest Louisiana	Rice	55	56	60
	Soybean	—	20	40
Mississippi River Delta	Rice	120	—	—
	Soybean	—	—	—
Texas	Rice	117	65	30
	Soybean	12	48	48

*Data computed from Appendix Tables 5, 7, and 8.
[a]Potash, not nutrient.

APPENDIX TABLE 5-1.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FROM OWNER-OPERATED FARMS IN CALIFORNIA*

Item	Rough rice ($/acre)		Milled rice, medium grain ($/cwt.)[i]			
			Grade No. 2		Grade No. 5	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Factor costs, nontraded						
A. Labor[c]						
Fertilizer[a]	4.31	4.31				
Custom applications	3.02	3.02				
Labor	33.98	33.98				
Drying	4.81	4.81				
Hauling	1.96	1.96				
Equipment movement	0.12	0.12				
Insurance	0.09	0.09				
Overhead[f]	2.66	2.54				
Management[h]	22.52	22.52				
Subtotal	73.47	73.35	2.38	2.37	1.98	1.97
Other milling costs			0.62	0.62	0.52	0.52
Storage			0.05	0.05	0.05	0.05
Transport and port			0.44	0.44	0.44	0.44
Total labor			3.49	3.48	2.99	2.98
B. Land[g]	118.23	181.73	3.82	5.87	3.18	4.89
C. Capital						
Interest-real operating capital[d]	4.62	4.60				
Insurance	0.08	0.08				
Depreciation, equipment[e]	6.22	6.22				
buildings[e]	1.82	1.82				
Subtotal	12.74	12.72	0.41	0.41	0.35	0.35
By-products[k]			(0.29)	(0.29)	(0.08)	(0.08)
Depreciation, milling[j]			0.26	0.26	0.22	0.22
Total nontraded			7.69	9.73	6.66	8.36
Rough rice total factor costs	204.44	267.80				
Rough rice total tradables	213.65	215.13				

APPENDIX TABLE 5-1.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FROM OWNER-OPERATED FARMS IN CALIFORNIA* (CONTINUED)

Item	Rough rice ($/acre)		Milled rice, medium grain ($/cwt.)[i]			
			Grade No. 2		Grade No. 5	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Rough rice total farm costs/acre	418.09	482.93				
Rough rice total farm costs/cwt.	7.43	8.57				
Tradable goods						
Seed[a]	24.55	24.55				
Taxes [b]	4.46	—				
Insecticides[a]	13.05	13.05				
Custom application	9.06	10.19				
Machinery, etc.	41.93	46.12				
Other costs	4.82	4.82				
Hauling	5.86	6.59				
Equipment movement	0.38	0.38				
Overhead	10.55	10.44				
Subtotal	114.66	116.14	3.71	3.75	3.09	3.13
Fertilizer [a]	38.79	38.79	1.25	1.25	1.04	1.04
Depreciation,						
machinery[e]	55.96	55.96				
buildings[e]	4.24	4.24				
Subtotal	60.20	60.20	1.95	1.95	1.62	1.62
Depreciation, milling[j]			0.26	0.26	0.22	0.22
Other costs, milling[j]			1.25	1.25	1.04	1.04
By-products, milling[k]			(2.64)	(2.64)	(0.70)	(0.70)
Storage			0.05	0.05	0.05	0.05
Transport and						
port			0.43	0.43	0.43	0.43
Total tradables	213.65	215.13	6.26	6.30	6.79	6.83
Total nontraded			7.69	9.73	6.66	8.36
Total cost tradables and nontraded/cwt.			13.95	16.03	13.45	15.19
Total cost tradables and nontraded/ton			308	353	297	335

*Seed use and farm costs, except land, overhead, management, custom drying, and sales taxes from Warren R. Grant and Troy Mullins, "Estimated Costs and Returns Per Acre of Rice in Major Producing Areas, 1975 Season," Departmental Information Report No. 75-5, The Texas Agricul-

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[a]For quantities used and unit prices, see Appendix Tables 1, 2, 4, and 6.

[b]See Appendix Table 2 for sales tax rates.

[c]See Appendix Table 2 for hourly labor rates. Costs indicated are for operation and maintenance of machinery, tractors, and irrigation and when not included above for input application.

[d]Operating capital assumed to be required for an average of four months per crop. For financial calculations, it is required for all preharvest variable cost items. For social costs, transfers (sales taxes) are not included.

[e]Equipment and building depreciation refers to annualized original investment (at early 1975 prices), discounting at 9 percent and assuming a ten-year life for equipment and 40-year for buildings.

[f]Five percent of all costs except land and management.

[g]Opportunity cost of most profitable alternative crop at the margin; see Appendix Table 2.

[h]Five percent of value of output, assuming $8.00 per cwt.

[i]Pounds of rough rice required for 1 pound milled rice; 1.82 pounds for Grade No. 2 and 1.515 pounds for PL 480 Grade No. 5.

[j]Milling costs of medium grain No. 2 are 16 percent higher than for medium grain No. 5. For long grain No. 2, they are 44 percent higher than for medium grain No. 5.

[k]By-product prices estimated for planting season 1975; seconds heads, $14.00/cwt.; bran, $3.40/cwt.; brewers rice, $8.00/cwt.; and polishings, $4.75/cwt.

APPENDIX TABLE 5-2.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FROM OWNER-OPERATED FARMS IN ARKANSAS*

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[i]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Factor costs, nontraded						
A. Labor[c]						
Fertilizer[a]	3.42	3.42				
Custom applications	3.28	3.28				
Labor	35.95	35.95				
Drying	4.94	4.94				
Hauling	1.02	1.02				
Insurance	0.11	0.11				
Overhead[f]	2.74	2.74				
Management[h]	20.40	20.40				
Subtotal	71.86	71.86	2.56	2.56	2.13	2.13
Other milling costs			0.72	0.72	0.52	0.52
Storage			0.05	0.05	0.05	0.05
Transport and port			0.33	0.33	0.33	0.33
Total labor			3.66	3.66	3.03	3.03
B. Land[g]	75.00	76.07	2.68	2.72	2.23	2.26
C. Capital						
Interest-real operating capital[d]	4.62	4.61				
Insurance	0.11	0.11				
Depreciation, equipment[e]	7.68	7.68				
buildings *e*	1.75	1.75				
Subtotal	14.16	14.15	0.51	0.51	0.42	0.42
By-products[k]			(0.47)	(0.47)	(0.12)	(0.12)
Depreciation milling[j]			0.31	0.31	0.22	0.22
Total nontraded			6.69	6.73	5.78	5.81
Rough rice total factor costs	161.02	162.08				
Rough rice total tradables	222.93	224.53				
Rough rice total farm costs/acre	383.95	386.61				
Rough rice total farm costs/cwt.	7.52	7.58				

APPENDIX TABLE 5-2.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FROM OWNER-OPERATED FARMS IN ARKANSAS* (CONTINUED)

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[l]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Tradable goods						
Seed[a]	26.14	26.14				
Taxes[b]	3.80	—				
Insecticides[a]	20.29	20.29				
Custom application	9.85	11.08				
Machinery, etc.	39.85	43.83				
Other costs	4.94	4.94				
Hauling	3.06	3.44				
Overhead	11.00	11.00				
Subtotal	118.93	120.53	4.24	4.30	3.53	3.58
Fertilizer[d]	30.78	30.78	1.10	1.10	0.91	0.91
Depreciation, machinery[e]	69.13	69.13				
buildings[e]	4.09	4.09				
Subtotal	73.22	73.22	2.61	2.61	2.18	2.18
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Other costs, milling[j]			1.45	1.45	1.04	1.04
By-products, milling[k]			(2.46)	(2.46)	(0.66)	(0.66)
Storage			0.05	0.05	0.05	0.05
Transport and port			0.34	0.34	0.35	0.35
F.A.S. to F.O.B.			0.15	0.15	0.15	0.15
Total tradables	222.93	224.53	7.79	7.85	7.77	7.82
Total nontraded			6.69	6.73	5.78	5.81
Total cost tradables and nontradables/cwt.			14.48	14.58	13.55	13.63
Total cost tradables and nontradables/ton			319	321	299	300

*For sources and notes see Appendix Table 5-1.

APPENDIX TABLE 5-3.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FOR OWNER-OPERATED FARMS IN SOUTHWEST LOUISIANA*

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[i]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Factor costs, nontraded						
A. Labor[c]						
Fertilizer[a]	4.03	4.03				
Custom applications	3.52	3.52				
Labor	22.10	22.10				
Drying	4.82	4.82				
Insurance	0.09	0.09				
Overhead[f]	2.05	1.95				
Management[h]	15.92	15.92				
Subtotal	52.53	52.43	2.40	2.40	2.00	2.00
Other milling costs			0.72	0.72	0.52	0.52
Storage			0.05	0.05	0.05	0.05
Transport and port			0.18	0.18	0.17	0.17
Total labor			3.35	3.35	2.74	2.74
B. Land[g]	79.20	76.07	3.62	3.48	3.01	2.90
C. Capital						
Interest-real operating capital[d]	4.41	4.41				
Insurance	0.10	0.10				
Depreciation, equipment[e]	6.71	6.71				
buildings[e]	1.71	1.71				
Subtotal	12.93	12.93	0.60	0.60	0.49	0.49
By-products[k]			(0.32)	(0.32)	(0.09)	(0.09)
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Total nontraded			7.56	7.42	6.37	6.26
Rough rice total factor costs	144.66	141.43				
Rough rice total tradables	214.31	215.36				
Rough rice total farm cost/acre	358.97	356.79				
Rough rice total farm cost/cwt.	9.02	8.96				

APPENDIX TABLE 5-3.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FOR OWNER-OPERATED FARMS IN SOUTHWEST LOUISIANA* (CONTINUED)

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[i]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Tradable goods						
Seed[a]	30.37	30.37				
Taxes[b]	3.96	—				
Insecticides[a]	15.59	15.59				
Custom applications	10.56	11.88				
Machinery, etc.	37.82	41.60				
Other costs	4.82	4.82				
Overhead	10.51	10.42				
Subtotal	113.63	114.68	5.20	5.24	4.33	4.37
Fertilizer[d]	36.30	36.30	1.66	1.66	1.38	1.38
Depreciation,						
machinery[e]	60.40	60.40				
buildings[e]	3.98	3.98				
Subtotal	64.38	64.38	2.94	2.94	2.45	2.45
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Other costs, milling[j]			1.45	1.45	1.04	1.04
By-products, milling[k]			(2.61)	(2.61)	(0.69)	(0.69)
Storage			0.05	0.05	0.05	0.05
Transport and port			0.17	0.17	0.18	0.18
F.A.S to F.O.B.			0.15	0.15	0.15	0.15
Total tradables	214.31	215.36	9.32	9.36	9.11	9.15
Total nontraded			7.56	7.42	6.37	6.26
Total cost, tradables and nontradables/cwt.			16.88	16.78	15.48	15.41
Total cost, tradables and nontradables/ton			372	370	341	339

*For sources and notes see Appendix Table 5-1.

APPENDIX TABLE 5-4.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FOR OWNER-OPERATED FARMS IN MISSISSIPPI DELTA*

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[i]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Factor costs, nontraded						
A. Labor[c]						
Fertilizer[d]	3.20		3.20			
Custom applications	4.02		4.02			
Labor	27.17		27.17			
Levee survey	0.17		0.17			
Drying	6.31		6.31			
Hauling	2.02		2.02			
Loading out	0.97		0.97			
Insurance	0.10		0.10			
Overhead[f]	2.52		2.52			
Management[h]	18.00		18.00			
Subtotal	64.48	64.48	2.61	2.61	2.17	2.17
Other milling costs			0.72	0.72	0.52	0.52
Storage			0.05	0.05	0.05	0.05
Transport and port			0.38	0.38	0.38	0.38
Total labor			3.76	3.76	3.12	3.12
B. Land[g]	50.00	50.34	1.98	2.04	1.68	1.69
C. Capital						
Interest-real operating capital[d]	4.75	4.73				
Insurance	0.11	0.11				
Depreciation, equipment[e]	7.59	7.59				
buildings[e]	2.23	2.23				
Subtotal	14.68	14.66	0.60	0.60	0.49	0.49
By-products[k]			(0.40)	(0.40)	(0.11)	(0.11)
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Total nontraded			6.25	6.31	5.40	5.41
Rough rice total factor costs	129.16	129.48				
Rough rice total tradables	239.40	242.04				
Rough rice total farm cost/acre	368.56	371.52				
Rough rice total farm cost/cwt.	8.19	8.26				

APPENDIX TABLE 5-4.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FOR OWNER-OPERATED FARMS IN MISSISSIPPI DELTA* (CONTINUED)

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[i]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Tradable goods						
Seed[a]	32.40	32.40				
Taxes[b]	3.94	—				
Insecticides[a]	18.50	18.50				
Custom applications	12.08	13.59				
Machinery, etc.	45.06	49.57				
Other costs	6.30	6.30				
Hauling	6.08	6.84				
Loading out	0.97	0.97				
Overhead[f]	11.80	11.60				
Subtotal	137.13	139.77	5.55	5.65	4.62	4.71
Fertilizer[a]	28.80	28.80	1.16	1.16	0.97	0.97
Depreciation,						
machinery[e]	68.26	68.26				
buildings[e]	5.21	5.21				
Subtotal	73.47	73.47	2.97	2.97	2.47	2.47
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Other costs, milling[j]			1.45	1.45	1.04	1.04
By-products, milling[k]			(2.53)	(2.53)	(0.67)	(0.67)
Storage			0.05	0.05	0.05	0.05
Transport and port			0.39	0.38	0.39	0.39
F.A.S. to F.O.B.			0.15	0.15	0.15	0.15
Total tradables	239.40	242.04	9.50	9.59	9.24	9.33
Total nontraded			6.25	6.31	5.40	5.41
Total cost, tradables and nontraded/cwt.			15.75	15.90	14.64	14.74
Total cost, tradables and nontraded/ton			347	351	323	325

*For sources and notes see Appendix Table 5-1.

APPENDIX TABLE 5-5.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FOR OWNER-OPERATED FARMS IN EAST TEXAS*

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[i]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Factor costs, nontraded						
A. Labor[c]						
Fertilizer[a]	5.76	5.76				
Custom applications	4.56	4.56				
Labor	42.18	42.18				
Drying	4.88	4.88				
Hauling	2.01	2.01				
Sales commission	2.22	2.22				
Insurance	0.08	0.08				
Overhead[f]	3.20	3.20				
Management[h]	17.75	17.75				
Subtotal	82.64	82.64	3.39	3.39	2.82	2.82
Other milling costs			0.72	0.72	0.52	0.52
Storage			0.05	0.05	0.05	0.05
Transport and port			0.12	0.12	0.12	0.12
Total labor			4.28	4.28	3.51	3.51
B. Land[g]	56.75	5.08	2.33	0.21	1.94	0.17
C. Capital						
Interest-real operating capital[d]	6.04	6.01				
Insurance	0.08	0.08				
Depreciation, equipment[e]	5.83	5.83				
buildings[e]	1.73	1.73				
Subtotal	13.68	13.65	0.56	0.56	0.47	0.47
By-products[k]			(0.50)	(0.50)	(0.13)	(0.13)
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Total nontraded			6.98	4.86	6.01	4.24
Rough rice total factor costs	153.07	101.37				
Rough rice total tradables	241.45	257.02				
Rough rice total farm cost/acre	394.52	358.39				

APPENDIX TABLE 5-5.—ECONOMIC AND FINANCIAL COSTS OF ROUGH AND MILLED RICE FOR OWNER-OPERATED FARMS IN EAST TEXAS*
(CONTINUED)

Item	Rough rice ($/acre)		Milled rice ($/cwt.)[l]			
			No. 2 long grain		No. 5 med. grain	
	Market costs	Social costs	Market costs	Social costs	Market costs	Social costs
Rough rice total farm cost/cwt.	8.89	8.08				
Tradable goods						
Seed[a]	28.20	28.20				
Taxes[b]	4.04	—				
Insecticides[a]	22.91	22.91				
Custom applications	13.69	15.40				
Machinery, etc.	41.39	45.53				
Other costs	4.87	4.87				
Hauling	6.02	6.77				
Overhead[f]	12.04	12.04				
Subtotal	133.16	135.52	5.46	5.56	4.55	4.63
Fertilizer[a]	51.85	51.85	2.13	2.13	1.77	1.77
Depreciation, machinery[e]	52.41	52.41				
buildings[e]	4.03	4.03				
Subtotal	56.44	56.44	2.31	2.31	1.93	1.93
Depreciation, milling[j]			0.31	0.31	0.22	0.22
Other costs, milling[j]			1.46	1.46	1.04	1.04
By-products, milling[k]			(2.43)	(2.43)	(0.65)	(0.65)
Storage			0.05	0.05	0.05	0.05
Transport and port			0.13	0.13	0.13	0.13
F.A.S. to F.O.B.			0.15	0.15	0.15	0.15
Total tradables	241.45	257.02	9.57	9.67	9.19	9.27
Total nontraded			6.98	4.86	6.01	4.24
Total cost, tradables and nontraded/cwt.			16.55	14.53	15.20	13.51
Total cost, tradables and nontraded/ton			365	320	335	298

*For sources and notes see Appendix Table 5-1.

APPENDIX TABLE 6.—INSECTICIDES, HERBICIDES, AND ZINC USED BY RICE FARMERS IN MAJOR PRODUCING AREAS

Item	Unit of measure	Northeast Arkansas	California	Southwest Louisiana	Mississippi River Delta	Texas Coast Coast
Copper Sulphate	acre	—	0.08	—	—	—
Furadan	lbs.	—	0.10[b]	8.00	—	10.00
MPCA	oz.	—	10.44	—	—	—
Molinate	lbs.	0.75	—	0.40	1.50	—
Ordram	lbs.	—	15.90	—	—	0.45[b]
Parathion	lbs.	—	0.06	—	—	0.50
Prenoxy	qt.	0.33	—	—	1.00[a]	—
Propanil	lbs.	4.80	—	1.00[c]	3.00	1.00[c]
Zinc	lbs.	3.50	10.50	—	—	—

[a] pounds
[b] acres
[c] gallons

APPENDIX TABLE 7.—ECONOMIC COSTS OF SOYBEAN PRODUCTION ON OWNER-OPERATED FARMS IN ARKANSAS, LOUISIANA, MISSISSIPPI DELTA, AND EAST TEXAS, EARLY 1975*
(*dollars/acre*)

Item	Arkansas and Louisiana	Mississippi Delta	East Texas
Variable costs			
1. Seed[a]	13.20	11.02	8.25
2. Fertilizer: P, K [b]	9.60	3.24	19.80
3. Insecticide, herbicide, and lime	13.10	7.77	5.93
4. Custom application of items 1,2 and/or 3	—	1.50	4.38
5. Machinery, tractor and irrigation operation and maintenance	9.07	13.90	15.54
6. Labor[c]	5.06	4.94	20.96
7. Hauling	4.50	1.33	2.25
8. Interest on operating capital[d]	1.63	1.84	1.60
9. Custom drying	—	—	5.00
Total variable costs	56.16	45.54	83.71
Fixed costs, machinery and tractors			
10. Depreciation[e]	20.60	20.85	35.74
11. Insurance	0.07	0.07	0.11
Total fixed and variable costs	76.83	66.46	119.56
Overhead[f]	3.85	3.38	5.98
Management[g]	8.25	6.32	6.88
Total cost/acre	88.93	76.16	132.42
Total benefits/acre	165.00	126.50	137.50
Net benefits/acre (opportunity cost)	76.07	50.34	5.08

*U.S. Department of Agriculture, "Soybeans, Mixed Soils, Eastern Arkansas, 6 Row Equipment," Oklahoma State University: L. Eugene Johnson, "Estimating Cost and Returns for Specific Crops in 1975", Cooperative Extension Service, University of Arkansas Division of Agriculture and U.S. Department of Agriculture cooperating, February 1975; Arthur Gerlow, "Estimated Cost Per Acre of Soybeans, Owner Operated, Central Gulf Coast (1975)," unpublished; and D. W. Parvin, Jr., J. M. Anderson, F. T. Cooke, Jr., S. H. Holder, Jr., and J. G. Hamill, *Specific Inputs and Prices Associated with Soybean Production Costs for the Mississippi Delta, 1975*, Bulletin 832, Mississippi Agricultural and Forestry Experiment Station in cooperation with U.S. Department of Agriculture, Economic Research Service, Commodity Economic Division, April 1975.

[a] Quantities of seed use/acre: Arkansas and Louisiana 1.2 bu.; Mississippi Delta, 66 lbs.; East Texas, 45 lbs.

[b] For quantities used and unit prices, see Appendix Tables 2 and 4.

[c] See Appendix Table 2 for hourly labor rates. Costs indicated are for operation and maintenance of machinery, tractors and irrigation and, when not included above, for input application.

[d] Operating capital assumed to be required for an average of four months per crop. For social costs, it is required for all preharvest variable cost items except transfers (sales taxes).

[e] Equipment depreciation refers to annualized original investment (at early 1975 prices), discounting at 9 percent and assuming a ten-year life for equipment.

[f] Five percent of all costs except land and management.

[g] Five percent of value of output, assuming $5.50 per bushel. See Appendix Table 1 for average yields.

APPENDIX TABLE 8.—ECONOMIC COSTS OF SAFFLOWER PRODUCTION ON OWNER-OPERATED FARMS IN CALIFORNIA, EARLY 1975*[a]
(dollars/acre)

Item	Cost
Preharvest variable costs	
1. Seed, 20 pounds	4.30
2. Fertilizer: N[b]	24.80
3. Custom application of fertilizer	0.60
4. Machinery, tractor and irrigation operation and maintenance	8.41
5. Labor	5.51
6. Interest on operating capital[c]	1.31
Harvest, variable costs	
7. Hauling	6.48
8. Machinery and tractor operation and maintenance	5.62
9. Labor	3.26
Total variable costs	60.29
Fixed costs, machinery and tractors	
10. Depreciation[d]	
a) Machinery and equipment	19.27
b) Buildings	0.33
11. Insurance	0.37
Total fixed costs	19.97
Total fixed and variable costs	80.26
Overhead[e]	4.01
Management[f]	14.00
Total cost/acre	98.27
Total benefits/acre	280.00
Net benefits/acre (opportunity cost)	181.73

*Data from University of California, "Safflower Production Costs in the Riceland Area of Glenn County," Agriculture Extension Service, Orland, California, January 1974, updated by author based on estimates of Robert L. Sailsbery, Farm Advisor and of Philip S. Parsons, Extension Economist, both of Glenn County.

[a]Cost study based on rice operation where safflower is included as a rotation crop. If safflower were to replace rice as the primary crop, some costs (i.e., fertilizer) might differ.

[b]For quantities used and unit prices, see Appendix Tables 2 and 4.

[c]Operating capital assumed to be required for an average of four months per crop.

[d]Equipment and building depreciation refers to annualized original investment (at early 1975 prices), discounting at 9 percent and assuming a ten-year life for equipment and 40 years for buildings.

[e]Five percent of all costs except land and management.

[f]Five percent of value of output, $280/ton of 2,000 lbs.