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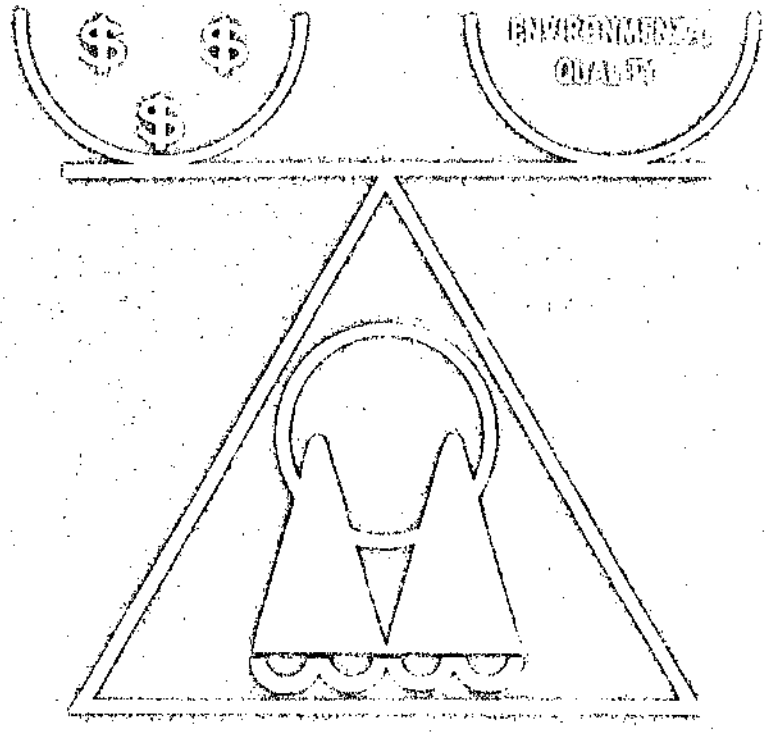
THE ECONOMIC IMPACT OF CANCELLING THE USE OF 2,4,5-T IN RICE PRODUCTION



ABSTRACT

Cancelling registration for use of 2,4,5-T would lower rice producers' farm income $4.5 million in the rice areas of the Arkansas, Louisiana, and Mississippi deltas. Loss in income would result from weed infestations that would reduce field yields and contaminate harvested grain. The type of indigenous weed infestations and the close proximity of cotton and soybeans limit the herbicides which can be used safely and effectively. Through the years, farmers and aerial applicators had learned to use 2,4,5-T; thus, damage to susceptible crops has been minimal and weed control effective. Inability to use 2,4,5-T could also disrupt existing domestic marketing practices and adversely affect U.S. dollar markets abroad.

Keywords: Rice; 2,4,5-T; Phenoxy herbicides; Chemical herbicides; Noxious weeds (rice); Pesticides; Economic impact; Cost-benefit analysis.

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Washington, D.C. 20250 March 1973

SUMMARY

Cancellation of the phenoxy herbicide 2,4,5-T to control weeds in rice would reduce farm income $4.5 million in the Arkansas, Louisiana, and Mississippi deltas. Certain uses have been restricted because high dosages of the herbicide given to rodents indicated that 2,4,5-T may be harmful to humans. Rice production in these three Southern States requires intensive control of weeds and grasses. Further, effective herbicides that do not injure rice or nearby cotton and soybean crops have been hard to find. Rice producers spend about $0.4 million on 2,4,5-T to control broadleaf weeds; savings are $4.9 million. The return is close to $11 on every dollar spent for 2,4,5-T.

Restricting the use of 2,4,5-T would result in income losses of about $49 per acre if weed-infested acreage is not treated. Quality losses would total $15 and yield losses, $34 per acre.

The Mississippi and Arkansas deltas would be particularly affected by a cancellation of the 2,4,5-T registration. With no local milling facilities, Mississippi depends on the high quality of its rice to attract outside buyers. Therefore, lower quality would adversely affect rice prices. The State's rice growers spend about $0.2 million on 2,4,5-T annually, which prevents losses of over $1.8 million.

Although Arkansas has excellent milling and marketing facilities, rice producers would incur income losses from reduced yield and some decrease in prices because of lower quality. In 1971, rice producers spent about $0.2 million on 2,4,5-T and more than $2.6 million in yield and quality losses were thus prevented.

The other major rice-producing areas in Texas, California, and Southwestern Louisiana do not use 2,4,5-T for weed control because other less costly herbicides are effective on indigenous weeds. Thus, restricting use of 2,4,5-T would have little immediate impact. However, in the Louisiana delta area, which has limited rice acreage, 2,4,5-T is necessary to control some types of weeds.

Domestic and foreign markets for rice could be much affected. Arkansas and Mississippi supply much of the rice used domestically today. Should they be unable to meet domestic demand for high-quality rice, other rice-producing States would shift some of their high-quality export rice into these markets. Such shifts would alter existing marketing channels and seriously deter marketing agencies now active in Arkansas and Mississippi. Dollar rice markets abroad could also be affected since the major U.S. asset is high-quality rice. Exports of inferior-quality rice could mean losses in dollar sales and in foreign exchange for the United States. The rice carryover could increase and the U.S. Government would have more rice to move through Federal programs that have lower quality requirements.

THE ECONOMIC IMPACT OF CANCELLING THE USE OF 2,4,5-T IN RICE PRODUCTION

By
Arthur R. Gerlow[1]

INTRODUCTION

Problem

For many years phenoxy herbicides have been used to control broadleaf weeds in the rice-producing areas of the United States. The phenoxy herbicides used in the rice areas are 2,4,5-T; 2,4-D; MCPA; and silvex.[2] Recent laboratory studies indicate that high dosages of 2,4,5-T, or an impurity identified as a dioxin, or both, may increase the incidence of birth defects in experimental animals.[3] This finding has been interpreted as a possible human health hazard. Therefore, certain uses of 2,4,5-T have been restricted. If these restrictions are extended to rice production, the economic impact would be considerable in rice areas which rely on 2,4,5-T for controlling broadleaf weeds.

Objective

The primary objective of this report is to estimate the economic impact of restricting the use of 2,4,5-T in the major rice areas of the United States. Subjects considered are the reasons for using 2,4,5-T, the availability of herbicide substitutes, the cost of 2,4,5-T applications, and the economic benefits derived from use.

Major Producing Areas

The major rice-producing areas of the United States are located in four Southern States and California (see figure). Louisiana, Texas, Arkansas, and Mississippi produced about 80 percent, and California, about 18 percent, of total 1971 production.

In Arkansas, the rice areas are located in three separate geographic regions. The Grand Prairie Area is in the east-central part, including most of Arkansas, Lonoke, and Prairie Counties and a small part of Monroe County. The northeastern area lies between Crowley's Ridge on the east and the White and Black Rivers on the southwest and west, including parts of 15 counties. The southeastern area is composed primarily of five counties located in the Mississippi Delta.

In Louisiana, the rice area lies in two separate regions. The southwestern area, the older and larger, is located in eight parishes in southwestern Louisiana. The northern area is primarily in the Mississippi Delta in 10 northeastern parishes.

The Mississippi rice area is located in east-central Mississippi in 12 delta counties.

The Texas rice area lies primarily along the Gulf Coast in 17 southeastern counties.

The major rice-growing area in California is found in eight counties in the northern part of the Sacramento Valley. A small acreage of rice is also grown in eight counties in the San Joaquin Valley.

Value of Production

Total value of the 1970 rice crop was approximately $444 million dollars (table 1). In most States where rice is produced, the crop represents a major

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[2]See appendix table 2 for more complete identifications of herbicides and weeds.

[3]Macleod, Colin M., et. al., *Report on 2,4,5-T*, "A Report of the Panel on Herbicides of the President's Science Advisory Committee." U.S. Govt. Print. Off., Wash., D.C., unnumbered, Mar. 1971.

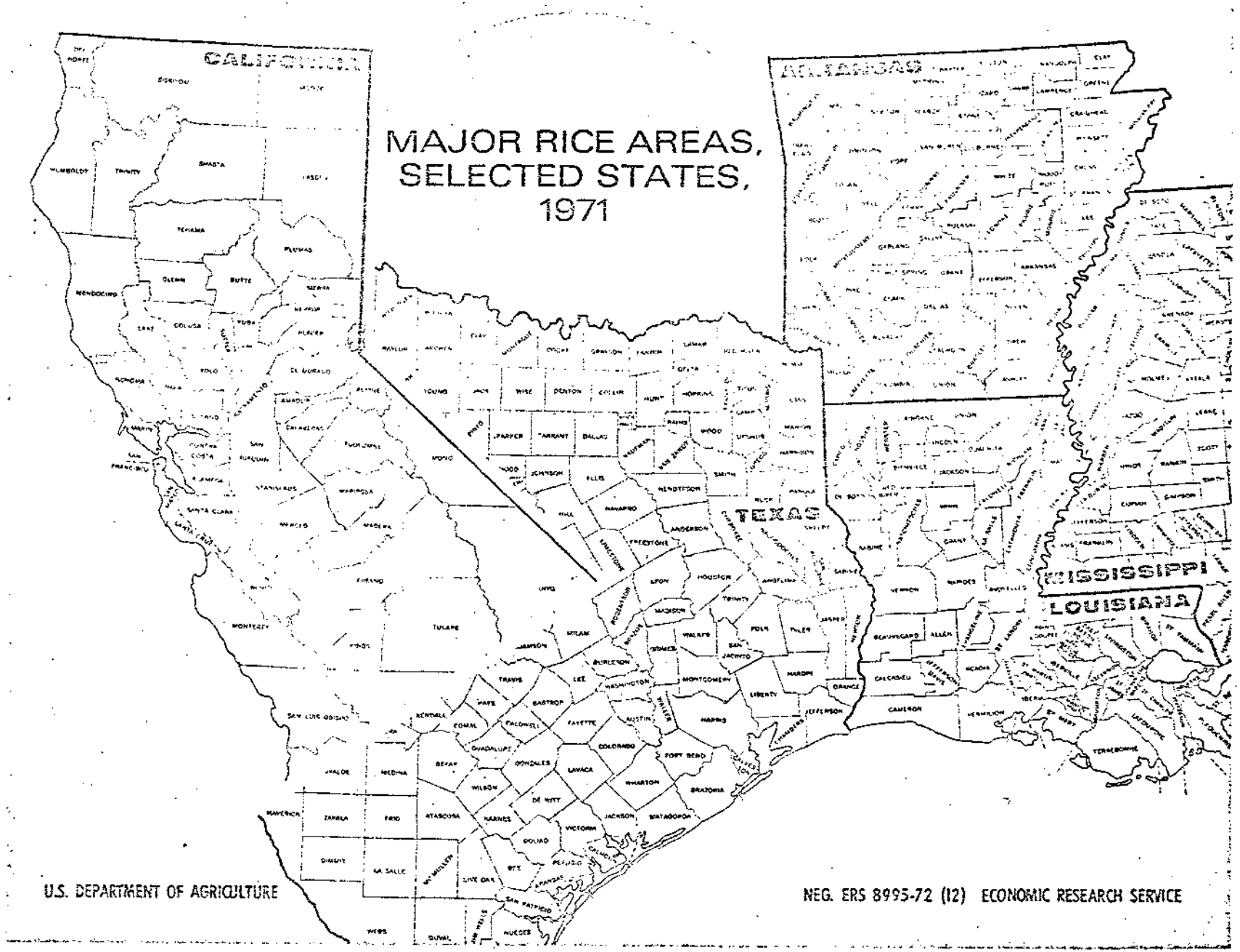
MAJOR RICE AREAS,
SELECTED STATES,
1971
CALIFORNIA
ARKANSAS
TEXAS
MISSISSIPPI
LOUISIANA
U.S. DEPARTMENT OF AGRICULTURE
NEG. ERS 8995-72 (12) ECONOMIC RESEARCH SERVICE

Table 1—Rice harvested, yield per acre, production, and value, selected States, 1971

State	Acres harvested	Yield per acre	Production	Value[1]
	1,000 acres	*Pounds*	*1,000 cwt.*	*1,000 dollars*
Louisiana	522.0	3,800	19,836	101,164
Texas	468.0	4,900	22,932	121,540
Arkansas	441.0	4,950	21,830	117,882
Mississippi	51.0	4,450	2,270	12,258
Missouri	4.9	4,800	235	1,227
California	331.0	5,200	17,212	89,847
Total	1,817.9	4,638	84,315	443,918

[1]Total value was determined by multiplying total State production by the season average price for the individual States of Louisiana, Texas, Arkansas, and Mississippi, and the season average U.S. price for California and Missouri. State price data were not available for these two States.

Source: *Rice Situation*, Econ. Res. Serv., U.S. Dept. Agr., RS-19, Mar. 1972

source of agricultural income and is highly important to large sectors of the rural economy.[4]

Consumption and Marketing

Annual per capita consumption of rice averages about 8.3 pounds in the United States. Although the amount continues to increase, production has always exceeded domestic consumption and large quantities are exported. In 1970, approximately 58 percent of total U.S. rice production was exported.[5] About half this quantity was for dollar sales and the remainder was exported under various Government programs (mainly P.L. 480).[6]

The quantity of rice which moves into domestic channels or is exported for dollars or under P. L. 480 varies widely among States. For example, about 45 percent of Arkansas and Mississippi rice is marketed domestically, about 27 percent goes as dollar exports, and 28 percent is exported under P. L. 480. For Louisiana, 23 percent of the rice is marketed through domestic channels, 13 percent through dollar exports, and 64 percent through exports under P. L. 480. In Texas, the figures are 28 percent, 35 percent, and 37 percent, respectively.[7]

California also moves large quantities of its rice into dollar export sales; however, data on its market distribution are not available. These marketing patterns indicate that Mississippi and Arkansas are putting almost 75 percent of their rice production into domestic and dollar export markets which demand higher quality rice. Therefore, production changes which affect the quality of rice produced in these States can seriously affect their markets and prices.

[4]For data and comparisons of importance of individual States, see appendix table 1.

[5]*Rice Situation*, Econ. Res. Serv., U.S. Dept. Agr., RS-18, Sept. 1971.

[6]It is generally assumed that small changes in U.S. exports would not materially affect world rice prices because world demand is highly elastic.

[7]Data prepared by The Rice Millers Association, 1048 Pennsylvania Building, 425 13th Street, N. W., Wash., D.C. 20004.

PRODUCTION PRACTICES

Seedbed Preparation and Irrigation

Rice cultural practices are generally quite similar, however, there is some variation because of environmental and other factors peculiar to individual States. Cultural practices for rice, in many respects, resemble those for other small-grain crops. Rice is usually fertilized and planted on a prepared seedbed. From this point on, rice differs from other small-grain crops because after the rice plant emerges, it is flooded with water. The irrigation flood is maintained throughout the entire growing season, except for periods when water may be drained so that herbicides and fertilizer can be applied. Water is also usually drained 2 weeks before harvest.

This irrigation flood is reasonably effective in controlling many weeds. However, some weeds survive and flourish under flooded conditions. Experimental results in the past showed yield reductions of almost 50 percent in fields heavily infested with weeds and grasses.[8] Equally important, weed seeds contaminate the harvested rice, which causes losses in quality and lower prices.

Chemical Weed and Grass Control

Kinds of Chemicals Used

Herbicide use in rice production began about the mid-1940's, when 2,4-D was used to control broadleaf weeds with outstanding effectiveness. However,

[8]Ryker, T. C., and Clair A. Brown. *The Use of 2,4-D in Rice Fields for the Control of Weeds*, La. Agr. Expt. Sta., Bul. No. 411, Baton Rouge, Feb. 1947.

2,4-D is very toxic to cotton, soybeans, and several other broadleaf crops. Legislation was enacted in some States to limit its use. During the late 1950's and early 1960's, other herbicides were developed, such as MPCA, silvex, and propanil. Propanil effectively controls barnyardgrass and many other major weeds and grasses. However, this improved control has provided a favorable environment for the growth of other aquatic and broadleaf weeds and grasses which were not, in some cases, important problems during past years. Therefore, the achievement and maintenance of more effective total weed control usually requires additional applications of other types of herbicides—the phenoxy group.[9] Thus, general use of this group has increased in the rice areas of the southern United States in recent years. California's rice area has been treated primarily with other chemicals.

Alternative Herbicides to 2,4,5-T

Silvex and 2,4-D are possible herbicide substitutes for 2,4,5-T. Substituting silvex for 2,4,5-T will control redstem and ducksalad but should drift occur from aerial spraying, injury to neighboring soybean fields is possible. Further, if silvex is sprayed on days when the temperature is 90° Fahrenheit or above, the herbicide may volatilize and damage cotton and soybeans. On the other hand, the toxicity of 2,4-D to cotton is so high as to prevent its use in an area where cotton is grown. These two herbicides are known to injure broadleaf crops. Therefore, using silvex and 2,4-D as an alternative to 2,4,5-T in soybean and cotton areas would be highly questionable.

There is also the possibility of using ground spray equipment to apply these herbicides on ricefields. But use of such equipment will damage rice growth and rice levees, which makes adequate water control very difficult. Therefore, use of ground spray equipment at this time is also highly questionable.

Importance of Herbicide Use

Use of herbicides in the rice-producing areas of the United States is an important and necessary practice for the continued production of high-quality rice demanded by domestic and foreign (dollar sales) markets. Today 85 to 95 percent of the rice acreage in producing areas of the southern United States receives one to two treatments of propanil, and some of the acreage receives additional treatments of phenoxy herbicides (table 2).[10] In California, about 90 percent of the rice acreage in 1971 was treated with MCPA, about 3 percent was treated with propanil, and less than one-half percent received applications

[9] The phenoxy herbicides used in the rice-producing areas are primarily 2,4-D, 2,4,5-T, silvex, and MCPA.

[10] Propanil is not a phenoxy herbicide.

Table 2—Estimated rice acreage and percentage of total treated with specific herbicides, selected States, 1971

State	Total rice acreage[1]	Herbicide[2]			
		Propanil	MCPA	2,4,5-T	2,4-D
	Acres	*Acres treated*	*Acres treated*	*Acres treated*	*Acres treated*
Louisiana	522,000	444,000	---	11,000	2,200
Texas	468,000	444,000	30,000	---	---
Arkansas	441,000	419,000	---	45,500	35,000
Mississippi	51,000	48,000	---	44,000	---
California	331,000	11,000	295,000	500	200
Total	1,811,000	1,363,000	325,000	101,000	37,400
	Percent[3]	*Percent*[3]	*Percent*[3]	*Percent*[3]	*Percent*[3]
Louisiana	100	85	---	2	(4)
Texas	100	95	6	---	---
Arkansas	100	95	---	10	8
Mississippi	100	95	---	85	---
California	100	3	89	(4)	(4)
Total	100	75	20	6	2

[1] Acreage harvested from *Rice Situation*, Econ. Res. Serv., U.S. Dept. Agr., RS-19, Mar. 1972. [2] These data were derived from official State records when available, from surveys, and from estimates made by professional workers in given areas. [3] Percentages do not sum to 100 percent because some acres did not receive any of these herbicides and others were treated with more than one of them. [4] Less than one-half percent.

of 2,4,5-T or 2,4-D. The States in which 2,4,5-T is used extensively are Mississippi and Arkansas—85 and 10 percent, respectively, of the acreage.

Kinds of Weeds and Grasses Controlled

Weeds and grasses which are detrimental to rice production and the general types of herbicides used for their control are listed in table 3. Propanil is used to control some species of broadleaf weeds and grasses. The phenoxy herbicides do not effectively control weed grasses in rice. Propanil is applied soon after the rice and weed plants emerge and has little, if any, residual effect. Weeds that emerge after propanil is applied are not controlled by the treatment. Often these weeds are controlled by one or more applications of phenoxy herbicides. Several phenoxy herbicides can be used to control the same weeds. However, the time of application and the effectiveness of the herbicides vary. These variations are discussed in the following sections, with emphasis on the importance of 2,4,5-T to the rice areas.

Since weed and grass populations are, for the most part, results of soil productivity, climatic conditions, and cultural practices indigenous to specific areas, the following evaluation of the use and importance of 2,4,5-T in rice production will be by individual State or producing area.

Table 3—Weeds and grasses infesting ricefields and chemicals recommended for control, in Southern rice-producing areas, 1970[1]

Herbicides	
Phenoxy[2]	Nonphenoxy[3]
Alligatorweed[4]	Barnyardgrass
Arrowhead[4]	Beakrush (spearhead)
Dayflower[4]	Ducksalad
Ducksalad	Eclipta
Eclipta	Fimbristylis
Gooseweed	Hemp sesbania (coffeebean)
Hemp sesbania (coffeebean)[5]	Northern jointvetch (curly indigo)
Morningglory[4]	Redstem
Northern jointvetch (curly indigo)[5]	Signalgrass
Redstem	Spikerush
Spikerush	*Sprangletop*
Smartweed[4]	Umbrellaplant
Waterhyssop	Waterhyssop
	Yellow foxtail

[1] Scientific names for plants and herbicides are shown in app. table 2. [2] Phenoxy herbicides for the rice area are 2,4,5-T; 2,4-D; silvex; and MCPA. [3] Nonphenoxy herbicide for the rice areas is propanil. [4] Only phenoxy herbicides are recommended to control these weeds. [5] These weeds were not controlled by phenoxy herbicides in Mississippi.

Source: *Recommended Chemicals for Weed and Bush Control, Arkansas, 1971.* Agr. Ext. Serv., Univ. Ark., Div. Agr. cooperating, MP 44 (Rev.), Jan. 1971; and *1969 Weed Control Recommendations for Mississippi,* State Coll., Miss. Agr. Expt. Sta., 1969.

ECONOMIC IMPORTANCE OF 2,4,5-T BY PRODUCING AREA

Mississippi

In Mississippi, rice is grown in the cotton-producing counties in the northern portion of the Mississippi River Delta. On the whole, the soils are very fertile and range from light to heavy texture. Much of the rice is produced on the heavier clay soils. The soils are characterized by high infestations of broadleaf weeds and weed grasses.

Currently, 95 percent of the rice acreage is treated with one application of propanil, and about 33 percent of the total receives two applications. These treatments are adequate to control most weeds, except hemp sesbania (coffeebean) and curly indigo (northern jointvetch). Control of these two weeds currently requires applications of a phenoxy herbicide. Northern jointvetch is effectively controlled by 2,4,5-T, but other phenoxy herbicides often are inadequate. Producers in the Mississippi rice area primarily grow cotton; about 51,000 acres of rice are interspersed within 13 cotton counties. Since rice is usually produced close to cotton, there is considerable danger of cotton damage when phenoxy herbicides are used. Of these herbicides, 2,4,5-T is least likely to be harmful.[11] Thus, rice producers need to use 2,4,5-T for effective and safe control of broadleaf weeds.

Cotton damage resulting from phenoxy herbicides has decreased considerably in the last 10 years (from 60 claims in 1960 to 10 claims in 1971), principally because producers and custom aerial operators are now using 2,4,5-T.[12] Fewer small marginal custom aerial operators remain in business. Those remaining are exercising greater care in applying phenoxy herbicides. In effect, the area is

[11] Porter, W. K., Jr., Thomas, C. H., and Baker, J. B. *A Three-year Study on the Effect of Some Phenoxy Herbicides on Cotton.* Weeds, Vol. 7, No. 3, July 1959.

[12] Claim estimates were made by a Mississippi Plant Board Inspector in Stoneville, Miss. An area insurance adjuster for Lloyd's of London also reported a decrease in claims; there were none in 1970 from 2,4,5-T damage and only one in 1971.

adjusted to the use of 2,4,5-T, custom aerial operators are proficient in its safe use, and as a result, cotton damage is minimal.

Hemp sesbania (coffeebean) is the major problem weed that 2,4,5-T now controls.[13] Without effective control treatments, infestations of hemp sesbania and related weeds could be expected to increase rapidly. In weed-crop competition studies conducted in Arkansas, hemp sesbania reduced yields 10 to 40 percent where infestations ranged from about 10,000 to 40,000 plants per acre.[14] Therefore, within 2 or 3 years, weed infestations in Mississippi should reach levels that would reduce yields 10 percent or more. Hemp sesbania also causes losses by lowering the quality of rice. The weed produces a black seed which is difficult to remove from milled rice. The presence of these seeds causes lower rice grades and consequently, lower market prices. The manager of the Mississippi Rice Marketing Association reported that rice received from fields not treated with 2,4,5-T usually graded a U.S. No. 4 or below because of weed seeds. Normally, most of the rice received by the Association grades a U.S. No. 1; about 10 percent grade below No. 1 because of chalky or damaged rice, or both.

Alternative methods for broadleaf weed control in Mississippi are presently limited. Changes in rotations are not successful in controlling weeds. Propanil has little, if any, residual effect, and does not effectively control all important species of broadleaf weeds. In addition, a Mississippi State law prohibits use of 2,4-D in spray form between April 1 and October 1. The invert-emulsion form can be applied to rice between those dates, however. This form is a mixture of water and 2,4-D and is applied as a thick mayonnaise-type liquid which theoretically reduces drift.

Damage to cotton, however, has been reported from use of the invert-emulsion form. According to a representative of the State plant board, an insurance adjuster, and professional research workers, use of the invert-emulsion form of 2,4-D usually results in extensive cotton damage, because some mechanical limitations remain in the method for making the liquid. Also, this form evidently does not control some aquatic weeds (ducksalad and redstem) as effectively as does a conventional treatment of 2,4,5-T. Apparently custom aerial operators lack the equipment and technical knowledge to apply the invert-emulsion form of 2,4-D safely and effectively.

Mississippi rice farmers using normal weed control measures currently receive a premium payment of $1.17 per acre for a higher quality rice. Without effective weed control, rice quality would be lowered to a U.S. No. 4, and yields would fall about 10 percent. Income reductions resulting from quality losses would average about $17.33 per acre and from yield losses, about $23.58 per acre. As approximately 85 percent of the rice acreage in Mississippi is treated with 2,4,5-T, or about 44,000 acres, restricting the use of this herbicide could lower the area income of rice farmers about $1.0 million (44,000 times $23.58). Additionally, quality would be reduced and rice prices would be lower. Resulting income losses to area rice farmers would be about $760,000 (44,000 times $17.33) (table 4).[15]

Table 4—Estimated cost of using 2,4,5-T and economic effects of restricting its use in rice areas of the Southern United States, 1971

Item	Area treated	Loss in value per acre	Total cost
	Acres	*Dollars*	*Dollars*
Cost of 2,4,5-T[1]	100,500	---	429,535
Estimated losses with 2,4,5-T restricted for—			
Mississippi:			
Loss in yield[2]	44,000	23.58	1,037,520
Loss in quality[3] .	44,000	17.33	762,520
Arkansas:			
Loss in yield[4] ...	45,500	46.01	2,093,525
Loss in quality[5] .	45,500	12.47	567,490
Louisiana:			
Loss in yield[6] ...	11,000	23.89	262,790
Loss in quality[7] .	11,000	15.21	167,310
Total loss			4,891,155
Net loss			4,461,620

[1] Summation of "total cost" line from appendix table 3, with cost of 2,4-D ($9,520) deleted from the mixed herbicide applications in Arkansas. [2] Without effective herbicide (2,4,5-T) controls, infestations of hemp sesbania (coffeebean) and curly indigo (northern jointvetch) would increase and in 2 or 3 years, yield reductions of 10 percent would be prevalent. The total value of losses from yield reductions would be: 44,000 acres [(.10) (4,450) ($5.30)] = $1,037,520. A rice price of

[13] Morningglory is also a serious weed problem which can cause quality losses, but the weed is effectively controlled with 2,4,5-T. Research workers in the area do not consider morningglory as difficult to control as coffeebean.

[14] For additional data on yield reductions, see Smith, Roy J., Jr. *Weed Competition in Rice.* Weed Science, Vol. 16, No. 2, Apr. 1968.

[15] The estimated 85 percent of the rice acreage treated with 2,4,5-T was obtained from a 1971 rice survey of the Mississippi Delta area by Fred Cooke, Agricultural Economist, FPED, ERS, USDA, Stoneville, Miss.

$5.30 per hundredweight was used, which represents the seasonal average price for Louisiana, Mississippi, and Arkansas in 1971. [3]Assuming that in Mississippi there are currently no practical alternative substitutes for 2,4,5-T, then farmers would receive a lower price for rice because of quality loss due to hemp sesbania (coffeebean) and curly indigo (northern jointvetch). With normal weed control, farmers presently receive $1.17 per acre in price premiums for rice. Without weed control, rice quality would be lowered to a U.S. No. 4 grade. Quality losses incurred would result from the loss of the $1.17 premium plus a discount of $18.08 per acre (app. table 5), or a total per acre loss of $19.25. Quality losses were 10 percent less than $19.25 because of lower yields from higher levels of weed infestations as explained in footnote 2. The net per acre loss would be $17.33 = $1.17 + $18.08 - [.10 (1.17 + 18.08)] and the total State loss would be $762,520 or ($17.33 X 44,000 acres). [4]The type of weed infestations occurring in Arkansas would result in yield losses if 2,4,5-T is not used. On the 14,000 acres using 2,4-D and 2,4,5-T combinations, the delay in application date for 2,4-D alone would cause a 12-percent yield loss (discussion on page 7). On the 31,500 acres treated with 2,4,5-T alone, failure to apply the herbicide would result in a 20-percent yield reduction (discussion on page 7). The total loss from yield reduction would be: 14,000 acres [(.12) (4,950) ($5.30)] + 31,500 acres [(.20) (4,950) ($5.30)] = $2,093,525. [5]Assuming that the 14,000 acres treated with both 2,4-D and 2,4,5-T are only treated with 2,4-D, some quality loss would continue and the rice grade would be lowered one grade to a U.S. No. 2, as this formulation is not too effective in controlling curly indigo (northern jointvetch). The quality loss per acre would be $4.67 computed as follows from appendix table 5 (same procedure as in footnote 3): $3.09 + $2.22 - [(.12) ($3.09 + 2.22)], or a total loss of $65,380 ($4.67 X 14,000 acres). The 31,500 acres receiving only 2,4,5-T are for the most part in the delta areas, where alternative herbicide substitutes are limited. Therefore, the quality loss on these acres would be greater (lowered three grades to a U.S. No. 4), or about $15.94 per acre, and computed as follows from app. table 5 (same procedure as in footnote 3): $3.09 + $16.83 - [(.20) ($3.09 +$16.83)]. The total loss in quality would be ($15.94 X 31,500 acres), or $502,110, plus the $65,380 from above. [6]Without effective herbicide (2,4,5-T) controls, infestations of hemp sesbania (coffeebean) and curly indigo (northern jointvetch) would increase and in 2 or 3 years, yield reductions of 10 percent would be prevalent. The total value of losses from yield reductions would be $262,790: 11,000 acres [(.10) (4,507) ($5.30)]. [7]In general, the delta rice area of northeastern Louisiana is similar to that of Mississippi. The availability of substitutes for 2,4,5-T is limited. Restricting the herbicide would result in quality losses averaging about $15.40 per acre and computed as follows from app. table 5 (same procedure as in footnote 3): $17.13 - $.23 - [(.10) ($17.13 - $.23)]. The total loss would be $167,310: ($15.21 X 11,000 acres).

Arkansas

The rice area in Arkansas includes both the Mississippi River Delta area and the prairie areas of the State and is larger than the Mississippi rice area. Rice production practices in the delta counties of Arkansas are similar to those in Mississippi. Weed and grass problems are somewhat different, however, as there are problems in Arkansas with ducksalad and redstem besides hemp sesbania and curly indigo. Occurrence of either ducksalad or redstem will often reduce yields and control requires early applications of herbicides. Because 2,4,5-T can be applied as early as 3 weeks after rice emergence without crop damage, it is being used today in both the delta and prairie areas. Applications of 2,4-D must be delayed until after the tillering stage, however. Competition from aquatic weeds during this delay reduces yields 12 percent or more, although the weeds are eventually killed with 2,4-D. Because of the difference in application dates, some farmers apply both 2,4,5-T and 2,4-D to the same field. Failure to apply any phenoxy herbicides to fields infested with ducksalad and redstem results in yield reduction of as much as 20 percent.[16]

Effective substitutes for 2,4,5-T are limited in Arkansas too. Some aquatic and broadleaf weeds and grasses can be controlled by timely applications of propanil. Other weeds, such as morningglory, are not controlled by propanil. Redstem and ducksalad are only controlled if propanil is applied when these plants are very small (less than 1 inch). Many rice producers, however, have difficulty recognizing these weeds soon enough to control them with additional applications of propanil. Also, the fields must be drained for propanil applications and drainage allows the fields to be reinfested with grasses. In addition, the registration of uses for propanil precludes the use of sufficient applications to control redstem and ducksalad effectively.

The use of silvex or 2,4-D is also a possibility, but each has disadvantages. Using 2,4-D does not prevent all yield losses from infestations of ducksalad and redstem, because it can be safely used only after significant weed competition has already occurred. In addition, 2,4-D is highly toxic to cotton and does not control curly indigo as effectively as 2,4,5-T.

Although it can be applied at the same time as 2,4,5-T, silvex is not as effective in controlling curly indigo and is also less economical than 2,4,5-T. Silvex controls ducksalad and redstem as effectively as 2,4,5-T and has a lower level of toxicity to cotton than 2,4-D but is more toxic to soybeans than is 2,4,5-T. Crop toxicity occurs because the ester form of silvex is volatile at temperatures of 90° Fahrenheit or above and the vapors will injure susceptible crops. In general, no good substitute exists for 2,4,5-T which will effectively control the same weeds and provide a comparable margin of safety to rice plants and susceptible crops produced near ricefields.

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[16]Estimate made from experimental weed-control tests by Dr. Roy J. Smith, Jr., Research Agronomist, ARS, USDA, stationed at the Rice Experiment Station, Stuttgart, Ark.

The Arkansas Plant Board reported that approximately 70,000 acres of rice were treated with phenoxy herbicides in 1971. Of this total, 31,500 acres were treated with 2,4,5-T alone, 14,000 acres with both 2,4,5-T and 2,4-D, and the remainder with other forms of phenoxy herbicides (primarily 2,4-D alone).

The economic losses from restricting use of 2,4,5-T in Arkansas result from changes both in rice grades and yields. Some quality losses would occur on the 14,000 acres being treated with both 2,4,5-T and 2,4-D if use of the former is eliminated because 2,4-D does not control curly indigo as effectively as 2,4,5-T. Grades would be lowered to a U.S. No. 2, representing an acre loss of $4.67. Quality losses would also occur on 31,500 acres treated with 2,4,5-T alone. Since the treated acreage is for the most part in the delta where alternative herbicide substitutes are limited, greater quality losses would occur (grades lowered to a U.S. No. 4), averaging about $15.94 per acre. Total losses from quality reductions would average about $567,000 (table 4). Yield losses would also be incurred if use of 2,4,5-T is restricted. On 14,000 acres, the delay in application date for 2,4-D alone, instead of 2,4,5-T and 2,4-D, would result in a 12-percent yield reduction, or an income loss of $0.4 million. On 31,500 acres treated with 2,4,5-T alone, failure to apply a phenoxy herbicide would result in a 20-percent yield reduction, or an income loss of about $1.6 million. The total loss from yield reductions would be about $2.0 million (table 4).

Louisiana

Rice production in Louisiana is in two distinct sections, each with its own cultural practices and weed and grass problems. The Northeastern Louisiana rice area contains 10 parishes with 18,000 acres of rice in and adjacent to the Mississippi River Delta area. The remaining 504,000 acres are located in the older area generally referred to as the Southwestern Louisiana rice area.

The northeastern area has soil and weed problems similar to those in the Mississippi and Arkansas delta rice areas. The major weeds and grasses controlled with 2,4,5-T are coffeebean and curly indigo. Use of 2,4-D is limited to fields half a mile or more from susceptible crops (cotton, for example) and can only be applied when a State inspector considers conditions (wind, temperature, and so on) safe for its use.[17]

An estimated 11,000 acres of rice were treated with 2,4,5-T in 1971.[18] Restricting its use would result in lower yields and quality and could cost producers about $400,000 annually, primarily in the northeastern area (table 4). Because of the similarities between the Louisiana, Arkansas, and Mississippi deltas, crop experimental data from Arkansas were used to estimate yield losses for both Louisiana and Mississippi.

The major production area is in the southwestern part, located primarily on prairie soils that have a relatively low fertility level. The weeds and grasses prevalent in the area are being controlled with one application of propanil. Approximately 0.4 percent of the acreage is treated with 2,4-D to control alligatorweed, coffeebean, indigo, and spearhead (*beakrush*) weeds. Plot tests at the rice experiment station indicate little difference in yield between applications of 2,4-D and 2,4,5-T. Therefore, farmers in this area use 2,4-D because it is cheaper and as effective as 2,4,5-T for the indigenous weeds.

Texas

The Texas rice area lies primarily on coastal prairie soils in the southeastern part of the State. Until 1970, most noxious weeds were controlled effectively with either one or two applications of propanil. Recently, dayflower has become a troublesome problem. Rice producers first noticed the weed in second-crop rice and treated about 15,000 acres with MCPA in 1970. In 1971, a Texas weed specialist reported that 55 percent of the rice acreage in the area was seriously infested with dayflower. However, data from the office of the Texas Commissioner of Agriculture indicated that only 30,000 acres were treated with MCPA. Producers are becoming aware of the seriousness of the problem and will probably treat larger acreages next year with phenoxy herbicides.

The use of 2,4-D is presently banned in eight of the rice counties, which contain about 56 percent of the State's rice acreage. Uses of 2,4,5-T or MCPA are not banned in the area. MCPA is being used because it is more economical than 2,4,5-T and effectively controls dayflower. Some 2,4,5-T is used but mainly on pastures, canal banks, and fence rows. Therefore, restrictions on use of this herbicide would have little impact on rice production in Texas if weed problems and other factors remain static.

[17] Agricultural Pesticide Applicator's Act No. 525, 1964, RS 3 1622-3,1634.

[18] See footnote 15.

California

Rice producers in California treated approximately 90 precent of the State's total rice acreage with MCPA. The acreage treated with 2,4,5-T amounted to less than one-half percent of total rice acreage. Restrictions on 2,4,5-T use would apparently have little immediate impact on rice production in California, unless weed problems or other conditions change.

Conclusions

1. Restricting the use of 2,4,5-T would primarily affect the delta areas in the Southern rice-producing States except Texas. The close proximity of cotton to ricefields in the areas limits or prevents the use of effective herbicide substitutes. Thus, restrictions would cause income losses to rice farmers of $4.9 million because of the lower yields and rice quality resulting from higher levels of weed infestations.

2. There are presently about 100,500 acres of rice treated with 2,4,5-T in these States. The applications cost rice farmers about $0.4 million a year. Returns on 2,4,5-T expenditures are averaging about $11 for every dollar spent.

3. A restriction on the use of 2,4,5-T in these areas would cause income losses of about $49 per acre. Around two-thirds ($34 per acre) of the income loss would be from yield reductions resulting from weed competition. The remaining one-third ($15 per acre) would be due to losses in quality from weed seed contamination of the harvested grain.

4. Approximately half the estimated income losses ($4.9 million) would occur in Arkansas and about 40 percent in Mississippi, the two States mainly affected by restricting the use of 2,4,5-T. Only about 10 percent of the losses would occur in Louisiana, primarily because the State has limited rice production in its delta area.

Appendix table 1—Estimated agricultural value of all crops and rice and proportion of value of rice to value of all crops, selected States, 1969

States	Value of		Proportion of rice to all crops
	All crops	Rice	
	1,000 dollars	*1,000 dollars*	*Percent*
Mississippi	368,286	13,356	4
Arkansas	536,055	126,072	24
Louisiana	343,015	98,677	29
Texas	1,233,234	102,818	8
Subtotal	2,480,590	340,923	14
California	2,295,617	106,975	5
Total	4,776,207	447,898	9

Source: U.S. Department of Agriculture, *Agricultural Statistics, 1970*, U.S. Govt. Print. Off., Wash., D.C., 1970.

Appendix table 2—Scientific names for weeds, grasses, and herbicides mentioned in this report

Common name	Scientific name
Weeds and grasses:	
Alligatorweed	*Alternanthera philoxeroides* (Mart.) Griseb.
Arrowhead	*Sagittaria* spp.
Barnyardgrass	*Echinochloa* spp.
Beakrush (spearhead)	*Rhynchospora* corniculata
(hornedrush)	(Lam.) Gray
Dayflower	*Commelina* spp.
Ducksalad	*Heteranthera* limosa (SW.) Willd.
Eclipta	*Eclipta alba* (L.) Hassk.
Fimbristylis	*Fimbristylis* spp.
Gooseweed	*Sphenoclea zeylanica* Gaertn.
Hemp sesbania	*Sesbania exaltata* (Raf.)
(coffeebean)	Cory
Morningglory	*Ipomoea* spp.
Northern jointvetch	*Aeschynomene virginica*
(curly indigo)	(L.) B.S.P.
Redstem	*Ammannia auriculata* Willd.
Signalgrass	*Brachiaria* spp.
Smartweed	*Polygonum* spp.
Spikerush	*Eleocharis* spp.
Sprangletop	*Leptochloa* spp.
Umbrellaplant	*Cyperus* spp.
Waterhyssop	*Bacopa rotundifolia* (Michx.) Wettst.
Yellow foxtail	*Setaria* spp.
Herbicides:	
Propanil	3',4'-dichloropropionanilide
2,4,5-T	(2,4,5-trichlorophenoxy)acetic acid
2,4-D	(2,4-dichlorophenoxy)acetic acid
Silvex	2-(2,4,5-trichlorophenoxy) propionic acid
MCPA	[(4-chloro-o-tolyl)oxy] acetic acid

Appendix table 3—Estimated cost of using 2,4,5-T and 2,4-D in rice areas, selected States, 1971

Item	Unit	2,4,5-T			2,4-D and 2,4,5-T	Total
		Mississippi	Arkansas	Louisiana	Arkansas	
Herbicide						
Quantity per acre[1]	Lb.	1.00	1.00	1.00	1.50	---
Cost per pound	Dol.	2.34	2.34	2.34	[2]1.62	---
Herbicide cost per acre	do.	2.34	2.34	2.34	2.43	---
Application cost per acre[3]	do.	3.00	1.25	1.25	1.25	---
Total herbicide cost	do.	5.34	3.00	3.59	3.68	---
Acres treated	Acres	44,000	31,500	11,000	14,000	100,500
Total area cost	Dol.	234,960	113,085	39,490	51,520	439,055

[1] Herbicide rates based on active ingredients. [2] Composite costs of 2,4,5-T and 2,4-D when estimated prices were $2.34 and $0.90 per pound. [3] The higher application cost in Mississippi reflects the risk of damage to nearby cotton.

Appendix table 4—Distribution of average rice yields among U.S. grades, and calculated distribution of yields when lowered a specific number of grades, selected States, 1971[1]

State	U.S. grade	Average distribution of rice yield		Calculated distribution of rice yields when average distribution is lowered—			
		Percentage[2]	Pounds[3]	1 grade	2 grades	3 grades	4 grades
	No.	*Percent*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Mississippi	1	46.9	2,087				
	2	44.2	1,967	2,087			
	3	6.3	280	1,967	2,087		
	4	1.0	45	280	1,967	2,087	
	5,6	1.6	71	116	396	2,363	4,450
	Total	100.0	4,450	4,450	4,450	4,450	4,450
Arkansas	1	80.0	3,960				
	2	14.0	693	3,960			
	3	3.0	148	693	3,960		
	4	1.0	50	148	693	3,960	
	5,6	2.0	99	149	297	990	4,950
	Total	100.0	4,950	4,950	4,950	4,950	4,950
Louisiana[4]	1	60.0	2,704				
	2	22.0	992	2,704			
	3	6.0	270	992	2,704		
	4	2.0	90	270	992	2,704	
	5,6	10.0	451	541	811	1,803	4,507
	Total	100.0	4,507	4,507	4,507	4,507	4,507

[1] Figures in blocks are values used in table 4 to determine quality losses. [2] Percentage estimates computed from *Rice Annual Marketing Summary*, Consum. and Mktg. Serv., Grain Div., U.S. Dept. Agr., 1966. [3] Estimated State yields are from county acreages reported by Louisiana Cooperative Crop Reporting Service, La. Dept. Agr., and U.S. Dept. Agr., and from *Rice Situation*, U.S. Dept. Agr., RS-19, Mar. 1972. [4] Grade distribution and yields are for delta area and are not representative of the older rice areas.

Appendix table 5—Premiums and discounts paid for rice, average distribution of premiums and discounts among U.S. grades, and calculated distribution of premiums and discounts when yields are lowered a specified number of grades, selected States, 1971[1]

State	U.S. grade	Premium and discounts[2]	Average distribution of premiums and discounts[3]	Calculated distribution of premiums and discounts when average distribution is lowered—			
				1 grade	2 grades	3 grades	4 grades
	No.	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
Mississippi	1	0.10	2.09				
	2	0	---	---			
	3	-.15	-.42	-2.95	-3.13		
	4	-.30	-.14	-.84	-5.90	-6.26	
	5,6	-.50	-.36	-.58	-1.98	-11.82	-22.25
	Total	---	1.17	-4.37	-11.01	-18.08	-22.25
Arkansas	1		3.96				
	2		---	---			
	3		-.22	-1.04	-5.94		
	4		-.15	-.44	-2.08	-11.88	
	5,6		-.50	-.74	-1.48	-4.95	-24.75
	Total		3.09	-2.22	-9.50	-16.83	-24.75
Louisiana	1		2.70				
	2		---	---			
	3		-.40	-1.49	-4.06		
	4		-.27	-.81	-2.98	-8.11	
	5,6		-2.26	-2.70	-4.06	-9.02	-22.54
	Total		-.23	-5.00	-11.10	-17.13	-22.54

[1] Figures in blocks are values in table 4 to determine quality losses. [2] Premium and discounts per hundredweight paid by Commodity Credit Corporation for rice going into government loan. [3] Premium and discounts were determined for the average and calculated yield distribution by multiplying yields in appendix table 4 by premium and discounts shown here. For example, the first value, $2.09, is computed as follows: $0.10 (20.87 cwt).