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Water Supplies and Cost in Relation to Farm Resource Use Decisions and Profits on Sacramento Valley Farms

by

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WATER SUPPLIES AND COSTS IN RELATION TO FARM RESOURCE USE DECISIONS AND PROFITS ON SACRAMENTO VALLEY FARMS

1. Enterprise Choices, Resource Allocations, and Earnings on 1,280-Acre Rice Farms in the Central Sacramento Valley

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FOREWORD

This report focuses on the rice farming phase of an investigation into how water quantities and costs affect enterprise choices, resource allocations, and profits in the Sacramento Valley. The investigation was authorized under California Agricultural Experiment Station Project Number 1321-07-10. Support for the research leading to this report came from the OFFICE OF WATER RESOURCES RESEARCH, USDI, under the program of Public Law 88-379, as amended, and by the University of California, Water Resources Center. It is a part of the Office of Water Resources Research Project No. B-068 CAL as well as the California Water Resources Center Project UCAL-WRC-W-111.

This over-all investigation, under the title, "On-Farm Irrigation Water Supplies and Costs in Relation to Cropping Systems and Production Adjustments in the Sacramento Valley," also includes a second phase that centers on the southern Sacramento Valley. A report on this additional research, now nearing completion, will bear the title, Water Supplies and Costs in Relation to Farm Resource Use Decisions and Profits on Sacramento Valley Farms; 2. General Crop Farms in the Southern Sacramento Valley.

The author acknowledges his debt to the many individuals and organizations who contributed importantly to the success of the research that led to this report. Ralph Hanan and Raúl Fiorentino, at the time of their contributions Research Assistants in the Department of Agricultural Economics at Davis, bore primary responsibility for the statistical work. Hanan aided in Collecting and processing the field and secondary data, and did the planning and operation of the programming and other analytical procedures. Fiorentino assisted in completing the statistical work on this report, and, particularly, in final refinements of both the data and the exhibits that appear herein. Craig Boyer also shared in the statistical analysis.

Many people provided data, viewpoints and/or advice and judgments that were essential for pursuing and completing the analyses reported here. I also drew heavily on work published by researchers and other personnel in the California Agricultural Experiment Station and Agricultural Extension Service, the Department of Water Resources, the United States Department

of Agriculture, the Agricultural Stabilization and Conservation offices in the rice-producing counties, the County Agricultural Commissioners' offices and other state experiment stations, as well as on some unpublished data that became available to me.

I am particularly grateful to W. O. Pruitt for making available experimental results on evapotranspiration rates and water use for crops, to Milton Miller for his valuable counsel and suggestions. Thanks, too, to many other individuals in County Agricultural Extension, Irrigation District, County Assessor's, and individual business firm office for a great deal of information and many suggestions. The farmers who furnished information in formal interviews, and on other occasions, merit special thanks; it is only through their cooperation that it was possible to obtain critical technical farm organization and operating information.

SUMMARY

This study of 1,280-acre rice farms in the Butte-Colusa subarea of the Sacramento Valley focuses on the economic impacts of variations in available water quantities and costs on farm earnings and profits (see pages 10-22). It examines three farm models each representing an important rice-growing soil and reflecting the dominant organization and operating characteristics of 1,280-acre rice farms in the study. Total irrigation water available approximated 5.75 acre-feet per acre for 60,000 acres of basin land, and 6.75 acre-feet per acre for 104,000 acres of alluvial soils. Cost rates per acre varied from about $10.00 to approximately double that level for rice and usually ranged from $4.00 to $5.00 per acre for other crops, except pasture rates for which crops were $1.00 to $1.50 higher. Price levels, acreage allotments, and other politico-economic aspects of the context for the investigation reflect the middle 1960's (1964-1966). The analysis draws on latest research information concerning irrigation practices for rice to evaluate differences in water quantities and costs, yields, and net returns for each of these varying irrigation practices. It undertakes to relate these irrigation practice phenomena to total farm earnings and profits for each of three major categories of soils commonly used to produce rice. Growers in Butte and Colusa counties normally produce 45 to 50 percent of all the rice produced in the Sacramento Valley, and 40 to 45 percent of California's total production. The rice acreage concentrates on the basin and old alluvium soils, but extends onto the more recent alluvium soils to some extent. Differences among these three soils in soil structure, water permeability, and adaptability to crops other than rice made it necessary to include three models in the analyses, one for each of the basin, old alluvium, and new alluvium soils, in order to reflect properly the physical and economic results of these variations.

The study analyzed three rice irrigation practices: (1) deep flooding, not lowered; (2) deep flooding, lowered; (3) shallow flooding. The first practice was standard for rice in California while land remained unlevelled, dikes contoured, and checks irregular in shape. Both deep flooding lowered and shallow floodings, however, expanded during the 1960's as farmers leveled their fields, established uniform slopes and rectangular checks.

Knowledge accumulated through their own experience and experimental research has encouraged rice growers to introduce and expand those practices. Deep flooding remains the most general practice in growing rice, however, at the time of this study. The three practices for irrigated crops other than rice differ according to the percentage of available soil moisture depletion permitted before reirrigating: (1) dry, 100 percent; (2) medium, 80 percent; (3) wet, 60 percent.

Total average investments for 1,280-acre rice farms range from nearly $700,000 for the basin model to over $800,000 units on recent alluvium. Capital represented by land dominates these total investments. These relatively high capital investments also mean large annual fixed costs, whether expressed on the total farm or the per acre basis. Such costs of owning and maintaining the capital range from about $81,000 total farm and $68.00 per acre for the basin, to over $91,000 total farm and $77.00 per acre for the recent alluvium models. The high original and average investments required for power units, and for dikers, harvesters, and other machinery large enough to permit operators to use power and labor efficiently, largely explain why this study focuses on 1,280-acre rice farms; the 400 to 550 acres of rice possible on a unit of this size (depending on acreage allotment regulations), constitute enough acreage to use most of the unit capacity of such efficient machinery.

An analysis of net returns-over-variable expenses for rice, and other adapted crop alternatives showed that, with fixed costs ignored, rice yielded net returns per acre at double or greater the level of crops ranking next highest in earnings on all three of the soils studied. These returns range from $219.00 per acre for the basin soils under a deep-shallow treatment to $184.00 for the deep flooding irrigation practice. The same relationships, with somewhat higher per-acre returns, held for rice on the other two soils. These results, particularly for rice, reflect results of applying latest research knowledge and technology under careful water management and control on levelled land with rectangular checks. The physical inputs, production expenses, and prices for rice are those in effect during the late 1960's. Acreage allotments, however, represent 40 percent of tillable land on these 1,280-acre analysis models. Rice yields reflect superior management,

as well as the advantages of latest research technology; they range from 60 hundredweight per acre for the deep flooded irrigation to 68 hundredweights per acre for the other two methods on basin soils to a spread from 65 to 72.5 hundredweights per acre on the two alluvial models. These yields compare with the state average for each of the 1969 and the 1970 seasons at 55 hundredweights, per acre. The differential between this statwide average at 55 hundredweights, and the yields used in the analysis of these three soils, represent the premium on up-to-date technology based on the latest research, optimal water control and management, and sound decisions and management by the operator.

A series of linear programming analyses within the framework of 28 constraints evaluated the potential effect on total farm net returns-over-variable expenses of varying water quantities, water prices, and prices for rice. The constraints relate to seasonal totals and intraseasonal water quantities available, total tillable land, and the maximum acreages of individual crops within this total, and harvester hours per season. This analysis yielded the total farm net returns-over-variable expenses, ignoring fixed costs. A comparison of this total farm net receipt figure, under varying conditions of water quantity and price as well as rice prices, with total farm fixed costs identifies the "breakeven" level at which these farm receipts exactly cover fixed costs. This level includes interest on investment at a market rate but leaving no income or profit to management.

Total farm net returns-over-variable expenses decline sharply as water prices rise from zero to the highest price tested in the analysis. The highest water prices at which total farm net income would cover fixed costs and leave a postive return to management are $15.00 per acre-foot for basin, $14.00 for old alluvium and $21.00 for recent alluvium income in the linear program analyses under these specified optimal management, technology and allotment conditions. These analyses apply the high performance yields and 40 percent acreage allotments used in this study. Rice growers would find production quite profitable, however, at prices in the vicinity of $7.00 per acre-foot, provided their rice yields and acreage allotments remain at these high performance levels. Total farm net returns drop sharply on basin soils for each dollar of rise in the earlier increments of water