



# RICE — AND RESEARCH

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**T**HE \$75,000,000 CALIFORNIA RICE crop produced in 1962 came from some 323,000 acres of land primarily suited to rice culture and involved 3,200 owners and operators of 1,400 farms. Yields averaged 4,800 pounds of dry paddy rice per acre, two to three times the amount produced per acre in many other areas of the world—despite a mid-harvest October storm that lodged much of the crop, greatly increasing harvesting problems and costs. Because rice is our most highly mechanized crop, only 7½ man hours per acre per year are needed to produce these high rice yields in California, as compared with 400 to 900 man hours in other areas of the world.

Rice is not only important to the economy of our State, but it is the basic food for over 60% of the world's population, including most of the emerging nations. California's highly efficient, all-mechanized rice industry is a tribute to the excellent cooperation of private industry, growers, and research workers in solving many complex problems.

Research has been the very foundation of California's rice industry since the first early attempts to establish the crop near the turn of the twentieth century. The progress reports of rice research included in this issue of *California Agriculture* touch on current accomplishments. They also point to some of the problems remaining to be solved. Many of these research findings were developed at the Rice Experiment Station, Biggs. As the California Cooperative Rice Research Foundation, Inc., rice growers and processing industry members own and maintain this modern research facility from their own private funds for use by University of California and USDA scientists.

Except for a small experimental planting on Union Island in 1894, the first commercial scale rice production in California was a 40-acre planting by Balfour Guthrie and Company near Biggs that yielded from 1,525 to 3,960 pounds per acre at various places in the field. In 1908, William Grant of Biggs seeded 267 varieties in a test planting that averaged 2,993 pounds per acre, with some varieties ranging from 2,407 to 5,477 pounds per acre. A rice test planting of 70 acres was made in 1911 on the Moulton Ranch in Colusa County by C. N. Hawkins, president of the Moulton Ranch Company. To encourage USDA and University of California participation in experimentation with rice, the Sacramento Valley Grain Association was formed to raise funds and land was purchased in 1912 for the Rice Experiment Station at Biggs. The station has been a farmer-owned and supported facility ever since. Research is under the direction of the Chairman of the Department of Agronomy, University of California, Davis, with the coordination of a research advisory committee. This committee includes representatives of USDA, U.C. departments and the board of directors of the Foundation.

## Team effort

From the start, rice research has been a team effort with excellent cooperation between innovator farmers, USDA's Bureau of Plant Industry, University of California scientists, and rice industry workers. Early experiments were dedicated to screening some 8,000 world varieties to locate the few short-grain types found best adapted to California. Waterbune, the short-grain variety used in early plantings was replaced with Colusa as the

first release of the Rice Experiment Station about 1914. It was soon supplemented in 1921 with the release of another short-grain variety, Caloro, and later by the medium-grain variety, Calrose. Proving the value of this early varietal research, Caloro is still grown on about 47% of the State's rice acreage. Currently, 15% is in Colusa, and the balance of 38% is in Calrose.

Pioneering names in the development of rice varieties adapted to California include Dr. Jenkins W. Jones and Dr. C. Roy Adair of USDA; E. L. Adams, currently President of the Rice Growers Association of California and first USDA superintendent of the Rice Experiment Station; and Loren L. Davis, now retired from U.C., Davis. Along with research activities, an extensive foundation seed program has been developed by University personnel to supply seed of the new improved varieties to producers. The development and use of improved varieties have played an important role in establishing rice as a profitable, high-yielding California crop.

## Rice demand

Demands for rice during and immediately after World War I increased production in California to 155,000 acres, yielding an average of 2,700 pounds per acre with a crop valued at \$23,529,000 in 1919. In the next decade, unfavorable marketing conditions caused production to drop to a low of 95,000 acres harvested in 1929. By 1940, rice production again rose to 118,000 acres harvested, averaging 3,600 pounds per acre with a crop value of \$6,514,000. About 110,000 acres were harvested each year until the onset of World War II, which caused another rapid buildup. By 1946, 261,000 acres were harvested. Production continued to increase in response to worldwide food needs until the peak year of 1954 when 477,000 acres were harvested, yielding an average of 2,550 pounds per acre. Since 1955, governmental control limitations have held the industry to about 300,000 harvested acres each year.

During the 1930's, research produced answers to many crop harvesting and drainage problems. Reduced milling quality from sun-checked rice and cracked kernels led to the practice of swathing and pickup threshing. Then later studies in cooperation with manufacturers and rice growers led to the development of techniques allowing direct combining, bulk handling with "bank-out" wagons in the fields, and techniques for commercial drying to safe storage

levels (and most recently by Professor Milton Henderson to on-farm drying methods utilizing farm storage tanks and unheated air). In addition to studies by Dr. D. S. Mikkelsen leading to improvements in timing and placement of nitrogen fertilizers for rice, Dr. W. A. Williams and colleagues discovered the value of legume green manure crops, now commonly utilized.

Early workers were also involved in such critical tests as determining the best dates and methods of planting. First attempts at planting were by drilling in the seed, then flooding; but the ensuing weed problem soon eliminated this practice. Growers learned to control weeds, and especially watergrass, by keeping fields flooded after seedbed operations with from 4 to 6 inches of water. Rice seed was broadcast into the water. Seeding into the flooded paddies was a cumbersome and uncomfortable procedure either with horse-drawn wagons or tractor equipment. Farmers were glad to cooperate with returning Air Force pilots in early experiments resulting in the now common practice of airplane seeding.

The availability of dependable and adaptable surplus aircraft from World War II, and the pilots to fly them, stimulated this practice even more. This concept of airplane seeding, as developed in the Sacramento Valley, now involves nearly all acreage in the State and Nation.

### Pest control

Rice research has been stimulated by new chemicals for weed and pest control as well as for plant nutrition. Rice weed research findings by the University and USDA botanists and agronomists have led to the almost universal use of selective herbicides to kill troublesome broadleaf weeds. In the last two years, research by Dr. Kenneth L. Viste in cooperation with

industry and county farm advisors has provided California farmers with the chemical means of controlling watergrass. These recent advances in knowledge of weed control and fertilization are largely responsible for the sharp increase in yields from the 2,550 pounds per acre average in 1954, to the 4,800 pounds per acre average yield received in the past three years.

Research in plant and animal pest control and the safe use of chemicals must continue because rice fields provide food and shelter for many species of birds, fish and animals. Run-off water from rice fields can also influence organisms living in drainage ditches and streams. Pest control practices and chemicals should be developed that will not adversely affect beneficial animal or plant life in these areas. A cooperative research effort is maintained by the University with the State departments of Fish and Game, Public Health, and Agriculture to coordinate research findings for development of recommended pest control practices.

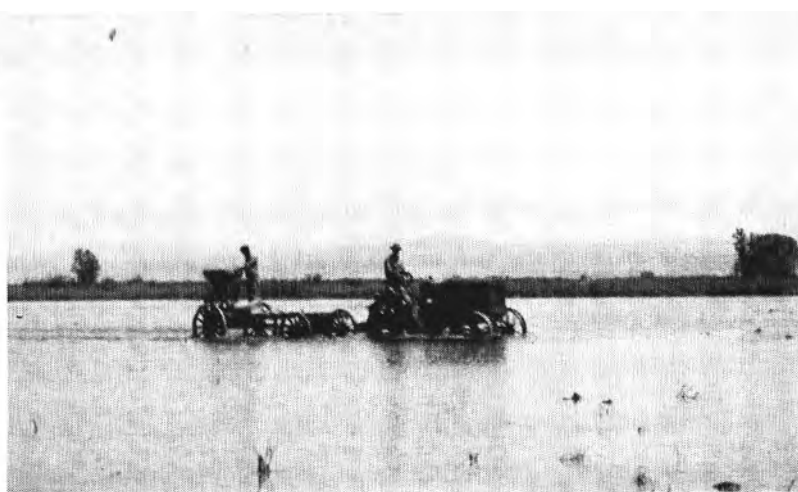
Chemical reactions are the basis of most biological and inorganic processes, and this knowledge can be used to improve production methods. Recent biochemical studies by Dr. D. S. Mikkelsen of the Department of Agronomy have led to the almost universal California practice of using sodium hypochlorite solution in which to pre-soak rice seed. This solution deactivates naturally occurring germination inhibitors, improving chances for successful stand establishment.

One of the most striking examples of the value of partnership research came in 1953 with the successful elimination of the threat of a crop-destroying infestation

of rice leaf miners. By late May, after planting time in 1953, this pest had caused a total loss of 10 to 20% of the crop, costing growers an estimated \$16,000,000. As of May 26, 1953, farmers reported a serious buildup of the pest. By May 28, test plots had been set up and analyzed by Dr. Harry Lange of the U. C. Department of Entomology and local farm advisors. On May 29, commercial applications by airplane were started, and within the next few days, 220,000 acres of rice had been treated with pesticides that successfully eliminated the threat to that acreage from the rice leaf miner. This excellent control effort was possible only because our scientists had a backlog of research information that could be promptly used—and safe chemical pesticides and aircraft were available.

### Plastic levees

Another more recent example of this research partnership in action involves the development of plastic levees which may conceivably change rice irrigation practices in the future. This concept was born only a few years ago out of studies by University research workers Dr. Vern Scott, David Lewis and Dwight C. Finck in cooperation with the plastic industry and local innovator farmers. Following successful completion of feasibility and economic studies, scientists assisted manufacturers in designing equipment to mechanize the operation. Machines now available will set up the plastic dikes in one operation complete with stakes and soil backfilling. Plastic levees eliminate the land waste, weeds, and animal pests as well as the construction problems of the dirt levees.



Broadcast seeding by airplane has replaced cumbersome and uncomfortable procedure of seeding into flooded paddies with horse-drawn wagons or early-day tractor equipment seen above.

Plastic levees are being used to control irrigation water on an estimated 2,500 acres of California rice land this year.

As with several other agricultural industries, rice growers and processors are to be congratulated for their early and continuous support of research. The Rice Experiment Station is owned and maintained out of grower and industry contributions by voluntary assessments on every bag of rice milled in the State. University scientists operate the station and research projects, with the cooperation of USDA specialists, either as resident staff members or as field workers from other campuses. During 1962, an additional \$100,000 in cash and machinery contributions were received to update the facilities at Biggs. Growers and industry people from 19 rice growing counties in the State contributed to the fund—under the leadership of a three man statewide committee consisting of Leland O. Drew and Vincent Vanderford of Yuba City, and Lorris Lauppe of Pleasant Grove. The beneficial impact of this accomplishment will be felt for many years in the future.

The rice industry has kept step with changing events through research and is

thus better prepared to face the problems of the future. The "cold water" problem in rice, to be discussed in the next issue by Dr. Frank Raney of the Department of Irrigation, is based on the pioneering research of Dr. Robert Hagan of the same department. As more high dams are built above the rice-growing areas, these research findings will pay even greater dividends. Plant breeders are also working on cold water tolerance as well as general improvements in palatability, nutritional value and marketing quality of California rice. Older varieties are being improved by breeding-in stiffer straw and removing the pubescence, or hairiness, from plant parts. New early-maturing, long-grain rice varieties for California will be available soon, if needed by the industry.

Continuing support of research, consistent with changing economic conditions, is needed to maintain California's position as one of the most efficient rice producing areas in the world. To get rice research findings to growers more efficiently, farm advisor help to rice growers was reorganized in 1961-62 to include area farm advisors who can give greater technical assistance in work with rice and other field crops.

New tractor-drawn machine seen below is one of the recently developed machines capable of completely installing plastic levees in rice fields in one operation. This "Polydike" machine was developed by Robert Ziegenmeyer, Sutter City, and Tobias Grether, Camarillo, California—following University research proving the feasibility and economy of the plastic levee concept.



K. L. VISTE

## WATERGRASS

## CALIFORNIA

Chemicals now available will apparently control watergrass and some broadleaved weeds, if properly used. Another group of chemicals including MCPA and 2,4-D are extremely effective against the broadleaved weeds. Good crop rotation systems, use of weed-free seed, water management and many other well known riceland management practices are also still available to rice farmers fighting weeds. With proper use of these new chemical tools for weed control, growers could be at the threshold of a new era of rice culture.

**T**HE MAJOR WEED PROBLEMS in California rice requiring further investigations include watergrass control, general weed control (especially in districts where the use of herbicides is seasonally restricted) and control of certain aquatic weeds.

Watergrass remains the most important

## RICE VARIETAL IMPROVEMENT IN CALIFORNIA

IN THE CALIFORNIA varietal improvement program, the main objectives are the development of non-lodging, short-, medium- and long-grain varieties, which emerge well through the cold water of the sowing season, which have a high yield and meet the required milling and cooking characteristics. Joseph R. Thysell, Research Agronomist, CRD, ARS, heads the USDA rice-breeding project at the Rice Experiment Station, Biggs, as re-