PLASTIC RICE LEVEES

shown economically feasible

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Despite higher annual installation costs, benefits from use of plastic levees for rice production can result in earnings of about one and a half times the extra cost, as compared with soil levees. Increased yields per acre result from production on land otherwise taken up by soil levees. Savings in time, labor and machinery are possible in tillage and harvesting operations. Plastic levees also permit a more rapid harvest so that problems with early fall rains are minimized. Photo to left shows completed plastic rice levee with upper check flooded.

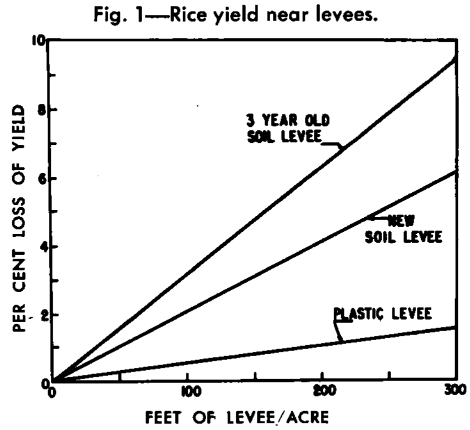
Plastic levees offer a new approach to overcoming the limitations of soil levees, as discussed in the November issue of *California Agriculture.* A special study was conducted in 1961 in Yuba County to obtain information on weed growth and rice production adjacent to rice levees. For this study five plots were placed at random along each of two levees in three rice fields. The three fields contained plastic levees, three-year-old soil levees, and new soil levees with carefully graded borrow pits. The plots extended 25 feet on either side of the levee centerline and were placed one month after planting.

There were no appreciable differences found in watergrass populations of the field with plastic levees as compared with the field in soil levees. This is particularly interesting since the same field was used for the plastic levees for two successive years. Evidently no significant decrease in watergrass seed production occurred in the first year as there was sufficient seed present to make use of all growth opportunities during the second year. It appears that the use of plastic levees will not materially affect the watergrass population in the fields from year to year unless sources of seed other than soil levees are also eliminated.

About two weeks before the main harvest, the ten plots in each of the three fields were harvested by hand. The transects were harvested in 2 × 2 foot squares beginning 25 feet on either side of the levee centerline and working toward the center. The sample harvested nearest the center was only 1 × 2 feet. The sample bundles were air dried for three days, threshed, and cleaned. The cleaned rice was stored indoors in bags for several days prior to weighing to allow the moisture content of the samples to equilibrate.

The data were analyzed statistically to determine the point in the plot at which the yields decrease significantly from the yields near the ends. The yields of all blocks between the cutoff points and the ends of the plots were averaged together to give an average midfield yield. The yields between the cutoff points and the levee centerline were divided by the average midfield yield to determine the percentage of midfield yield for each sample block. A difference in rice growth on the high and low water sides of the levee can be seen in the graph (Fig. 1).

Fig. 1—Rice yield near levees.



The data of Figure 1 were used to determine the relationship of the total per cent loss of rice near the levees as a function of length. This relationship is shown in the other graph (Fig. 2) for the three types of levees studied. This graph can be used for any length of levee per acre to determine the total per cent loss in yield for each type of levee. The difference between loss values for any two types of levees represents the increase in yield if plastic levees are used in place of soil levees. There is a notable difference between the loss of rice for three-year-old soil levees and the new soil levees with carefully graded borrow pits.

In addition to the differences in yield for the three types of levees, there are substantial differences in the amount of equipment time required for tillage and harvest operations. When plastic levees or new soil levees are used, the major tillage operations—plowing, disking, and floating—can be performed on the entire field before the levees are constructed. Considerably less time is required for turning and maneuvering than when these operations must be performed between existing soil levees. Actual measurements on the Zall farm showed that the plastic levee field required 12.5 per cent less tillage time than the three-year-old soil levee field. This amounted to a saving of 0.28 tractor hour per acre.

The removal of plastic levees before harvest permits the entire field to be harvested rapidly as one unit rather than working around the soil levees. Both fields at the Zall farm were harvested with one 14-foot self-propelled harvester served by one tractor-drawn bankout wagon. The plastic levee field required 22 per cent less harvest time than the soil levee field. This amounted to a saving of 0.21 hour per acre, or an increase in bulk rate of 10 sacks per hour for the plastic levees.

A breakdown of costs based on actual field data for plastic levees is given in the table below. The cost of materials includes stakes, fasteners, and plastic film and is tabulated for three film thicknesses. The installation cost includes plowing the furrow, setting the stakes, installing the plastic film, and backfilling the furrow. Removal cost includes pulling the stakes and removing them from the field.

ANNUAL COSTS OF MATERIALS, INSTALLATION, AND REMOVAL OF PLASTIC LEVEES

Stake spacing	Costs per 100′ of plastic levee				
	Materials			Installation	Removal
feet	4 mil	6 mil	8 mil		
2.5	$3.40	$4.40	$5.40	$1.47	$.78
3.0	3.15	4.15	5.15	1.31	.72
3.5	3.01	4.01	5.01	1.21	.66
4.0	2.87	3.87	4.87	1.11	.60

Aerial view of harvesting in rice field showing complex turning pattern necessary with field sectioned off by soil levees.

The cost per acre for any component of plastic levees can be computed from the table by multiplying the cost per 100 feet by the number of feet of levee per acre divided by 100. Thus the cost of using plastic levees depends directly on the length of levee per acre—as do some of the other benefits.

Costs of soil levees on a per-acre basis are based on survey data published in 1958 and the following costs apply to the major operations involved:

Soil Levee Construction..$2.14 per acre
Soil Levee Maintenance.. 0.38 per acre
Drain and Open Checks.. 0.35 per acre
Soil Levee Removal........ 1.31 per acre

These costs can be combined for a given soil-levee life to determine actual annual costs.

The annual costs of the three types of levees being compared are given using the Zall farm which has 169 feet of levee per acre as the example in table below. The plastic levees are assumed to be made of 8 mil film on a 4-foot stake spacing.

ANNUAL COSTS OF THREE TYPES OF LEVEES BASED ON 169 FT. OF LEVEE/ACRE

Type of levee	Plastic	New soil	Three-year-old soil
Materials	$8.23	....	....
Installation	1.87	$2.14	$0.71
Maintenance	....	....	0.38
Drain and open checks	....	0.35	0.35
Removal	1.01	1.31	0.44
TOTALS	$11.11	$3.80	$1.88

The value of increased rice production associated with the use of plastic levees in place of soil levees can be calculated by using the graphs and tables. Using an average yield of 50 sacks per acre valued at $4.50 per sack, the benefits for the two possible comparisons are shown in the table below:

VALUE OF INCREASED PRODUCTION FOR TWO LEVEE COMPARISONS

	Per cent increase in yield for 169 ft. of levee/acre	Increase in yield sacks/acre	Value per acre
Plastic vs. 3-yr.-old soil..	4.4%	2.20	$9.90
Plastic vs. new soil.....	2.6%	1.30	5.85

At an average cost of $8.00 per hour for tillage, the saving with plastic levees

Straight-through harvesting pattern possible by use of plastic rice levees.

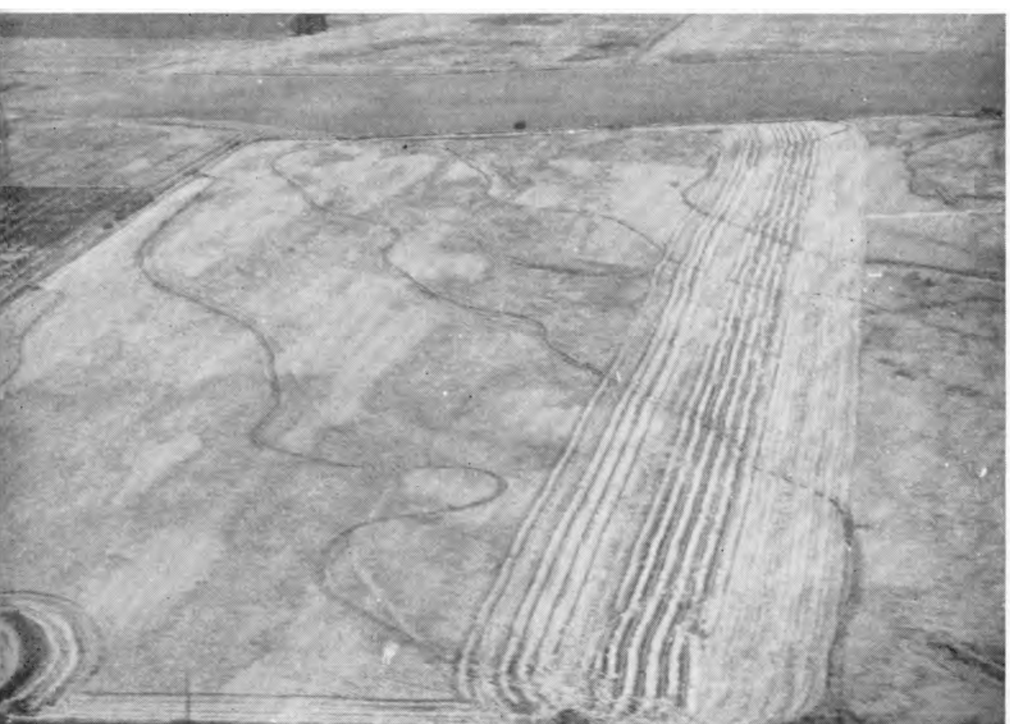
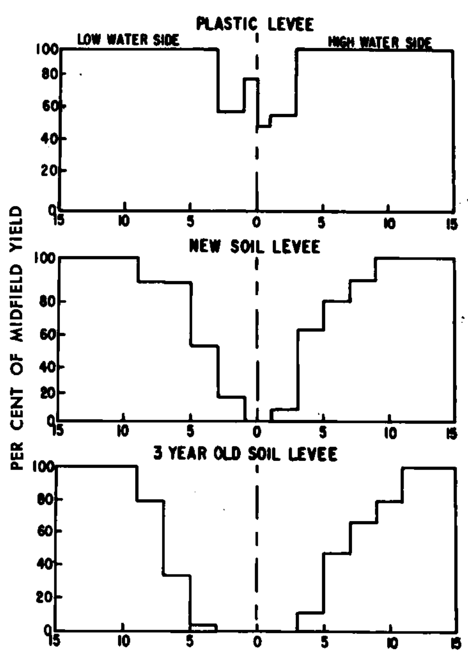


Fig. 2—Loss of yield versus length for three types of levees.



is $2.00 per acre. At a rate of $22.82 for one combine and operator plus a bankout wagon, tractor and man, the benefit for reduced harvest time is $4.79 per acre. A benefit-less-cost figure is given below for the two comparisons:

1. Plastic Levees vs. Three-year-old Soil Levees

Total cost of plastic levees	$11.11 per acre
Total annual cost of 3-year-old soil levees	1.88
Added increment of cost due to plastic levees	$9.23 per acre
Benefits resulting from use of plastic levees:	
.28 hr. per acre saving in tillage operations	$2.00
.21 hr. per acre saving in harvest operations	4.79
2.20 sack per acre increase in rice yield	9.90
Total savings per acre	$16.69
Net additional earnings per acre = $16.69 – 9.23 = $7.46	

2. Plastic Levees vs. New Soil Levees

Total cost of plastic levees	$11.11 per acre
Total cost of new soil levees	3.80
Added increment of cost due to plastic levees	$7.31 per acre
Benefits resulting from use of plastic levees:	
.21 hr. per acre saving in harvest operations	$4.79
1.30 sack per acre increase in rice yield	5.85
Total savings per acre	$10.64
Net additional earnings per acre = $10.64 – 7.31 = $3.33	

If growers receive extra income from rice lands used for game hunting, the weed growth is a benefit in favor of old soil levees and should be deducted from the benefits of plastic levees in figuring additional earnings.

Since there are substantial net additional earnings per acre for the example given, it is economically feasible to replace soil levees with plastic levees. It must be kept in mind that the costs compared depend on the length of levee per acre, and the benefits of increased yield are dependent on both length of levee per acre and the average yield. A new calculation of costs and benefits must be made from the tables and graphs for every field where a change in levee construction practice is being considered. The only foreseeable change in plastic levee economics is that the costs may decrease as further mechanization is accomplished—improving the economic feasibility of plastic levees.

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IMPROVING YIELDS IN SELF-POLLINATED CROPS

SOME MIXTURES of pure-line varieties of self-pollinated crops show promise of improving yields and stabilizing productivity, as compared to the pure lines.

In the past half-century much of the improvement in yielding ability of crops such as barley, wheat and beans has resulted from selecting pure-line varieties—consisting of a single genetic type.

These pure-line varieties are highly uniform for such features as size, maturity, disease resistance, and quality factors that improve their marketability. Valuable as these pure-line varieties have been, there are theoretical reasons for believing that certain types of mixed populations may be still more useful in agriculture.

Investigations have been conducted to test the theory that mixtures which provide a controlled measure of genetic diversity may not only yield more than a single pure line but also perform more steadily year after year. Under test is the idea that individual plants may encounter different environments not only within fields but also in different locations and years, and that different plant types may be able to exploit particular sites to their own particular advantage and to the advantage of the entire population.

One experiment with lima beans conducted at four locations over four years indicated that mixtures of pure lines were less likely to produce as high yields—or as low yields—in any one year as the best pure line included in the mixtures. The important point is that certain of the mixtures yielded more, when averaged over several years, than the best constituent pure line included in the mixture.—*R. W. Allard, Professor of Agronomy and Agronomist, Department of Agronomy, University of California, Davis.*

UREA FORM

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Urea formaldehyde was the first major synthetic nitrogen source developed for controlled availability. It has been commercially available for about a decade and primary uses have been with turfgrass and ornamentals. To obtain satisfactory responses, several aspects of its properties must be understood.

In the manufacture of urea formaldehyde these two components react to form polymers of various complexity. The ratio of urea to formaldehyde, and other factors affecting the reactions, influence the susceptibility of the product to mineralization—namely, conversion of the nitrogen to ammonium or nitrate forms. Commercial materials vary, particularly in the fraction of the total material that is readily available.

In commercial materials a substantial portion of the total nitrogen (25 per cent or more) is cold-water soluble. This fraction is of low molecular weight and is nitrified readily. The bulk of this fraction nitrifies, when conditions are favorable, within a four-week period. The remaining fraction which is relatively resistant to nitrification is mineralized at a much slower rate.

Under typical greenhouse soil conditions, about 6 to 7 per cent of the fraction relatively resistant to mineralization is converted to nitrate or ammonium each month. There is also some evidence that this rate tends to increase as the resistant fraction ages. From a given initial supply of this type of nitrogen the yield of mineral nitrogen tends to remain more nearly uniform than would be expected.

The 6 to 7 per cent rate of mineralization per month is some 50 times as fast as natural soil humus is mineralized. Thus, nitrogen from "residual" urea-formaldehyde is much more available than nitrogen from soil humus.