Mississippi State University

Scholars Junction

MAFES Research Bulletins

MAFES (Mississippi Agricultural and Forestry Experiment Station)

4-1-1976

# Evaluation of investments in rice-soybean rotations in the Delta of Mississippi

B. R. Eddleman

David W. Parvin Jr.

James G. Hamill

Fred T. Cooke Jr.

Follow this and additional works at: https://scholarsjunction.msstate.edu/mafes-bulletins

## Recommended Citation

Eddleman, B. R.; Parvin, David W. Jr.; Hamill, James G.; and Cooke, Fred T. Jr., "Evaluation of investments in rice-soybean rotations in the Delta of Mississippi" (1976). *MAFES Research Bulletins*. 392.
https://scholarsjunction.msstate.edu/mafes-bulletins/392

This Article is brought to you for free and open access by the MAFES (Mississippi Agricultural and Forestry Experiment Station) at Scholars Junction. It has been accepted for inclusion in MAFES Research Bulletins by an authorized administrator of Scholars Junction. For more information, please contact scholcomm@msstate.libanswers.com.

79
.E8

April 1976

Bulletin 822

# Evaluation of Investments in Rice-Soybean Rotations in the Delta of Mississippi

by B. R. Eddleman, Agricultural Economist,
MAFES Department of Agricultural Economics
D. W. Parvin, Jr., Associate Agricultural Economist
MAFES Department of Agricultural Economics
James G. Hamill, Associate Agricultural Economist
MAFES Department of Agricultural Economics
Fred T. Cooke, Jr., Agricultural Economist,
CED, ERS, USDA, stationed at Stoneville

MAFES MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION
DIRECTOR JAMES H. ANDERSON MISSISSIPPI STATE MS 39762
in Cooperation with
CED, ERS, USDA

## Acknowledgments

Recognition is extended to Alfred L. Thomas, County Agent, Bolivar County, who first made us aware of the need for the information in this report.

The authors also acknowledge the assistance of their colleagues James M. Anderson, Norman C. Merwine, James H. Simpson and John E. Waldrop by their critical reading and review of this manuscript.

Chester M. Wells, Jr., Head of the Editorial Department of MAFES, is due a special note of thanks for his suggestions, criticisms and editorial guidance in turning earlier drafts of this manuscript into a readable product.

# Evaluation of Investments in Rice-Soybean Rotations in the Delta of Mississippi

Removal of government restrictions on rice production triggered a increase in production in Mississippi---harvested acreage increased from 62,000 in 1973 to 108,000 in 1974 and 171,000 in 1975 [1, 2]. A still larger acreage may be planted this year. Increases in acreage likely will be on land planted to rice for the first time and much of it must be put to grade ("formed"). Rice production also requires investment in irrigation wells and equipment for putting water on the growing crop. In addition, producers may find it to their advantage to provide on-farm drying and storage of any new production before selling it to a mill.

Farmers who are considering the production of rice for the first time or who are thinking of expanding their existing rice acreage need a basis for estimating the profitability of the investment required. This involves the formulation of their expectations of future conditions[1] and the incorporation of these into decision-making---a process that becomes more difficult when decisions involve a flow of returns over long periods of time, as is true for investments in rice production.

## Objectives

Our study was designed to generate information to assist farmers in appraising the feasibility of investing in the land forming, the irrigation wells and equipment and the drying-storing facilities needed for an efficient rice operation. Specifically, our attempt was to determine the number of years required to "pay back" a given per acre investment in rice production or, alternatively, to determine the investment per acre that could be recaptured over a specified number of years.

## Procedure and Sources of Data

Gross income per acre was estimated for the years 1976-1990 for rice and soybeans grown in two rotations (Table 1), for continuous soybeans grown on clay soil and for solid cotton grown on clay soil. We assumed three yield levels[2] for each crop and converted production to value, using three different prices for each crop (Table 2).

Estimates of the cost of producing an acre of each crop in 1976 were made, based on production practices that we obtained from published reports of previous research [3, 4]. We used 1975 prices of production inputs except for those cost items with a machinery component, for which we used estimates of 1976 machinery and equipment prices provided by distributors in the area.

Variable costs ("direct expense") accounted for the bulk of the es-

*Numbers in brackets refer to literature cited at the end of this bulletin.*

[1] *Their estimates of crop yields and of actual or relative prices for products produced and resources used in production and their expectations with regard to changes in laws, regulations and other man-made constraints that impinge either directly or indirectly upon the success of their venture.*

[2] *The yield of soybeans grown in rice-soybean rotation was assumed to be three bushels higher than that of soybeans grown continuously. This yield difference is reflected in the differences in net returns reported in Tables 4 and 5.*

timated total cost of producing each crop in 1976 (Table 3). However, our estimates do not reflect all fixed costs ("indirect expense") that would be entailed in bringing new land into a rice-soybean rotation.[3] Labor and machinery ownership and operation are the production items we expect to experience the greatest cost increases in the next few years; consequently, costs of these items for 1977 and subsequent years will be increased over our 1976 estimates by 2.5 percent per year compounded annually. Because no crop can be grown in the year when land is being put to grade, a cost equal to the net income that could have been realized from producing continuous soybeans or solid cotton was charged to the rice-soybean rotations in 1976.

Net income per acre from each crop was calculated by subtracting total specified expenses in each of the 15 years from our estimates of gross annual income.[4] Thus, our estimates of net income for solid cotton and for continuous soybeans are the returns to operator management, land and general farm overhead. For rice

Table 1. Two Rice-Soybean Rotations, Clay Soils, Delta of Mississippi, 1976-1990.

| Year | One Year Rice One Year Soybeans | One Year Rice Two Year Soybean |
|---|---|---|
| 1 | None (land forming) | None (land forming) |
| 2 | Rice | Rice |
| 3 | Rice | Rice |
| 4 | Soybeans | Soybeans |
| 5 | Soybeans | Soybeans |
| 6 | Rice | Rice |
| 7 | Soybeans | Soybeans |
| 8 | Rice | Soybeans |
| 9 | Soybeans | Rice |
| 10 | Rice | Soybeans |
| 11 | Soybeans | Soybeans |
| 12 | Rice | Rice |
| 13 | Soybeans | Soybeans |
| 14 | Rice | Soybeans |
| 15 | Soybeans | Rice |

**Table 2. Annual gross income per acre for rice, soybeans and cotton, specified product price yield situations, Delta of Mississippi, 1976-1990.**

| Product price | Rice yields (bushels) | | | Soybeans yields (bushels) | | | Cotton yields (pounds of lint)[1] | | |
|---|---|---|---|---|---|---|---|---|---|
| | 90 | 100 | 110 | 23 | 28 | 33 | 500 | 550 | |
| | ----------(Dollars)---------- | | | | | | | | |
| Rice: | | | | | | | | | |
| 3.00 | 270.00 | 300.00 | 330.00 | | | | | | |
| 3.75 | 337.50 | 375.00 | 412.50 | | | | | | |
| 4.50 | 405.00 | 450.00 | 495.00 | | | | | | |
| Soybeans: | | | | | | | | | |
| 4.50 | | | | 103.50 | 126.00 | 148.50 | | | |
| 5.00 | | | | 115.00 | 140.00 | 165.00 | | | |
| 5.50 | | | | 126.50 | 154.00 | 181.50 | | | |
| Cotton[2]: | | | | | | | | | |
| .40 | | | | | | | 238.75 | 262.63 | 2 |
| .45 | | | | | | | 273.44 | 300.78 | 3 |
| .50 | | | | | | | 308.13 | 338.94 | 3 |

[1]Includes the value of seed produced based on 1.55 pounds of seed per pound of lint.

[2]Price of cottonseed per pound was set at $.05, $.0625, and $.075 when lint prices were $.40, and $.50 per pound, respectively.

[3]*The prorated annual cost of the investment in land forming, irrigation wells and equipment, and dry storing facilities is reflected in our comparisons of net returns from new rice-soybean rotation with retu from continuous soybeans and solid cotton (Tables 4 and 5).*

[4]*The results presented in Tables 4 and 5 were computed from the average net income for the years 1976-1*

**ble 3. Estimated cost of producing one acre of rice, soybeans and cotton, usual input practices, y soil, Delta of Mississippi, 1976.**

| m | Rice [1] with per acre yields (bushels) of | | | Soybeans [2] with per acre yields (bushels) of | | | Solid cotton[3] with per acre yields (pounds of lint) of | | |
|---|---|---|---|---|---|---|---|---|---|
| | 90 | 100 | 110 | 23 | 28 | 33 | 500 | 550 | 600 |
| | (Dollars) | | | | | | | | |
| rect expense[4] | 186.72 | 190.72 | 194.72 | 45.10 | 45.50 | 45.90 | 213.82 | 218.32 | 222.82 |
| xed expense[5] | 31.63 | 31.63 | 31.63 | 14.31 | 14.31 | 14.31 | 47.37 | 47.37 | 47.37 |
| tal expense[6] | 218.35 | 222.35 | 226.35 | 59.41 | 59.81 | 60.21 | 261.19 | 265.69 | 270.19 |

**urce: [3] with 1976 estimates of machinery and equipment costs.**
**Rice behind soybeans with 110-120 DBHP tractor.**
**Continuous soybeans, 8 row-equipment.**
**Solid cotton, 38-40 inch rows, 8 row-equipment.**
**Includes direct expenses for tractor and equipment, special equipment, labor, production aterials, variable harvesting costs, other miscellaneous production costs and interest on erating capital.**
**Includes ownership costs of tractor, equipment and special harvesting equipment. Does not in-ude fixed costs on irrigation well, charges for land forming or fixed costs for drying and storage of e on the farm.**
**Sum of direct expense and fixed expense.**

ybeans grown in a new rice-ybean rotation, however, our es-nates of net income are the ferences between gross income d specified costs. *(The prorated nual cost of the investment in nd forming, irrigation wells and uipment, and drying-storing facilities was not charged to the rice-soybean rotation, but is reflected in our comparisons of net returns from a new rice soybean rotation with returns from continuous soybeans and solid cotton.)*

We then subtracted from the estimated per acre net returns to soybeans and rice grown in a new rotation the estimated net returns from continuous soybeans and solid cotton. Finally, the differences in net income were discounted to their 1976 value, using discount rates of seven, nine and eleven percent as follows:

$$(1)\quad V_o = \sum_{n=1}^{t} \frac{NI_{rn} - NI_{an}}{(1+i)^n}$$

Where $V_o$ = the present value of the stream of per acre net income differences

$NI_{rn}$ = the estimated net income per acre from a rice-soybean system of rotation in year n

$NI_{an}$ = the estimated net income per acre from either the continuous soybean or solid cotton alternative in year n

n = a particular year in the planning period (n = 1, 2, . . . , t)

t = the planning period in years

i = the rate used to discount the stream of net income differences

$\sum_{n=1}^{t}$ = the summation of the discounted stream of per acre net income differences for any number of years up to t = 15 (i.e., the planning period is varied by years, 1, 2, 3, . . . , 15).

Table 4. Excess of Net Returns Per Acre From Two Rice-Soybean Rotations Over Continuous Soybeans, for Specified Yields and Prices of Rice and Soybeans and Specified Rates of Discount on Investment, by Number of Years Required to "Payback" Investment in Rice-Soybean Rotations, Clay Soils, Delta of Mississippi, 1976-1990*

| | One Year Rice - One Year Soybean Rotation | | | | | | | | | One Year Rice - Two Year Soybean Rotation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26 bu. Soybeans - 90 bu. Rice 1/ | | | 31 bu. Soybeans - 100 bu. Rice 2/ | | | 36 bu. Soybeans - 110 bu. Rice 3/ | | | 26 bu. Soybeans - 90 bu. Rice 1/ | | | 31 bu. Soybeans - 100 bu. Rice 2/ | | | 36 bu. Soybeans - 110 bu. Rice 3/ | | |
| | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB |
| Year | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
| | (7% discount rate) | | | | | | | | | | | | | | | | | |
| 1 | $-41 | -52 | -63 | -62 | -75 | -88 | -82 | -98 | -113 | -41 | -52 | -63 | -62 | -75 | -88 | -82 | -98 | -113 |
| 2 | -36 | 3 | 41 | -53 | -13 | 27 | -70 | -28 | 14 | -36 | 2 | 41 | -53 | -13 | 27 | -70 | -28 | 14 |
| 3 | -34 | 50 | 134 | -48 | 42 | 132 | -62 | 34 | 130 | -34 | 50 | 134 | -48 | 42 | 132 | -62 | 34 | 130 |
| 4 | -24 | 61 | 146 | -38 | 53 | 144 | -52 | 45 | 142 | -24 | 61 | 146 | -38 | 53 | 144 | -52 | 45 | 142 |
| 5 | -15 | 72 | 158 | -29 | 64 | 156 | -43 | 56 | 154 | -15 | 72 | 158 | -29 | 64 | 156 | -43 | 56 | 154 |
| 6 | -16 | 107 | 231 | -28 | 105 | 238 | -39 | 103 | 245 | -16 | 107 | 231 | -28 | 105 | 238 | -39 | 103 | 245 |
| 7 | -8 | 116 | 241 | -20 | 114 | 248 | -31 | 112 | 256 | -8 | 116 | 241 | -20 | 114 | 248 | -31 | 112 | 256 |
| 8 | -11 | 146 | 303 | -20 | 149 | 318 | -30 | 152 | 334 | 0 | 125 | 250 | -12 | 123 | 257 | -23 | 121 | 265 |
| 9 | -4 | 154 | 311 | -13 | 157 | 329 | -23 | 160 | 342 | -4 | 151 | 306 | -14 | 154 | 321 | -23 | 156 | 336 |
| 10 | -9 | 178 | 364 | -16 | 185 | 386 | -23 | 193 | 409 | 3 | 158 | 314 | -7 | 161 | 329 | -16 | 164 | 344 |
| 11 | -3 | 184 | 371 | -10 | 192 | 394 | -17 | 200 | 416 | 9 | 165 | 322 | -1 | 168 | 337 | -10 | 171 | 351 |
| 12 | -8 | 204 | 416 | -13 | 216 | 444 | -19 | 227 | 473 | 3 | 185 | 366 | -4 | 192 | 387 | -12 | 198 | 408 |
| 13 | -3 | 210 | 422 | -8 | 222 | 451 | -13 | 233 | 480 | 9 | 191 | 373 | 1 | 198 | 394 | -7 | 204 | 415 |
| 14 | -8 | 225 | 459 | -12 | 240 | 493 | -17 | 255 | 527 | 14 | 196 | 379 | 6 | 203 | 400 | -2 | 210 | 421 |
| 15 | -4 | 230 | 465 | -8 | 245 | 499 | -12 | 260 | 533 | 7 | 210 | 413 | 1 | 220 | 439 | -5 | 230 | 465 |
| | (9% discount rate) | | | | | | | | | | | | | | | | | |
| 1 | $-40 | -51 | -62 | -61 | -74 | -86 | -81 | -96 | -111 | -40 | -51 | -62 | -61 | -74 | -86 | -81 | -96 | -111 |
| 2 | -35 | 1 | 38 | -52 | -14 | 25 | -69 | -29 | 12 | -35 | 1 | 38 | -52 | -14 | 25 | -69 | -29 | 12 |
| 3 | -34 | 46 | 126 | -48 | 38 | 124 | -62 | 30 | 121 | -34 | 46 | 126 | -48 | 38 | 124 | -62 | 30 | 121 |
| 4 | -24 | 57 | 138 | -38 | 48 | 135 | -52 | 40 | 133 | -24 | 57 | 138 | -38 | 48 | 136 | -52 | 41 | 133 |
| 5 | -16 | 66 | 148 | -30 | 58 | 146 | -44 | 50 | 143 | -16 | 66 | 148 | -30 | 58 | 146 | -44 | 50 | 143 |
| 6 | -17 | 98 | 213 | -29 | 95 | 219 | -40 | 92 | 225 | -17 | 98 | 213 | -29 | 95 | 219 | -40 | 92 | 225 |
| 7 | -10 | 106 | 222 | -22 | 103 | 228 | -33 | 100 | 234 | -10 | 106 | 222 | -22 | 103 | 228 | -33 | 100 | 234 |
| 8 | -13 | 132 | 276 | -22 | 133 | 288 | -32 | 135 | 301 | -3 | 114 | 230 | -15 | 111 | 236 | -27 | 108 | 242 |
| 9 | -7 | 138 | 283 | -16 | 140 | 296 | -26 | 141 | 309 | -7 | 136 | 279 | -16 | 137 | 291 | -26 | 138 | 303 |
| 10 | -10 | 158 | 327 | -18 | 164 | 345 | -26 | 169 | 364 | -1 | 142 | 286 | -11 | 143 | 298 | -21 | 145 | 310 |
| 11 | -5 | 164 | 333 | -13 | 169 | 352 | -21 | 174 | 370 | 4 | 148 | 292 | -6 | 149 | 304 | -16 | 150 | 316 |
| 12 | -10 | 179 | 368 | -16 | 188 | 392 | -23 | 196 | 416 | 0 | 164 | 327 | -9 | 168 | 344 | -17 | 172 | 361 |
| 13 | -5 | 184 | 374 | -12 | 193 | 397 | -19 | 201 | 421 | 4 | 168 | 332 | -4 | 172 | 350 | -13 | 177 | 367 |
| 14 | -10 | 196 | 402 | -16 | 207 | 430 | -21 | 218 | 458 | 8 | 173 | 337 | -1 | 177 | 354 | -9 | 181 | 371 |
| 15 | -6 | 200 | 407 | -12 | 211 | 435 | -18 | 222 | 462 | 3 | 183 | 363 | -4 | 190 | 384 | -12 | 197 | 405 |
| | (11% discount rate) | | | | | | | | | | | | | | | | | |
| 1 | $-40 | -50 | -60 | -60 | -72 | -85 | -80 | -94 | -109 | -40 | -50 | -60 | -60 | -72 | -85 | -80 | -94 | -109 |
| 2 | -35 | 0 | 36 | -51 | -14 | 22 | -68 | -30 | 9 | -35 | 0 | 36 | -51 | -14 | 22 | -68 | -30 | 9 |
| 3 | -33 | 43 | 119 | -47 | 34 | 116 | -61 | 26 | 113 | -33 | 43 | 119 | -47 | 34 | 116 | -61 | 26 | 113 |
| 4 | -24 | 52 | 130 | -38 | 44 | 127 | -52 | 36 | 124 | -24 | 52 | 130 | -38 | 44 | 127 | -52 | 36 | 124 |
| 5 | -17 | 61 | 139 | -31 | 53 | 136 | -44 | 44 | 133 | -17 | 61 | 139 | -31 | 53 | 136 | -44 | 44 | 133 |
| 6 | -18 | 90 | 198 | -30 | 86 | 202 | -42 | 83 | 207 | -18 | 90 | 198 | -30 | 86 | 202 | -42 | 83 | 207 |
| 7 | -12 | 97 | 206 | -23 | 93 | 210 | -35 | 90 | 214 | -12 | 97 | 206 | -23 | 93 | 210 | -35 | 90 | 214 |
| 8 | -14 | 119 | 252 | -24 | 119 | 262 | -34 | 119 | 273 | -6 | 103 | 213 | -18 | 100 | 217 | -30 | 96 | 221 |
| 9 | -9 | 125 | 258 | -19 | 125 | 269 | -29 | 125 | 279 | -9 | 122 | 254 | -19 | 122 | 264 | -29 | 122 | 273 |
| 10 | -12 | 141 | 294 | -21 | 145 | 310 | -29 | 148 | 325 | -4 | 128 | 259 | -14 | 127 | 269 | -25 | 127 | 279 |
| 11 | -8 | 146 | 300 | -16 | 149 | 315 | -25 | 153 | 330 | 0 | 132 | 264 | -10 | 132 | 274 | -20 | 132 | 284 |
| 12 | -11 | 158 | 328 | -19 | 164 | 347 | -26 | 170 | 367 | -3 | 145 | 293 | -12 | 147 | 307 | -22 | 149 | 320 |
| 13 | -8 | 162 | 332 | -16 | 168 | 352 | -23 | 174 | 371 | 0 | 148 | 297 | -9 | 151 | 311 | -18 | 153 | 325 |
| 14 | -12 | 172 | 354 | -18 | 179 | 377 | -25 | 187 | 400 | 3 | 152 | 301 | -6 | 154 | 317 | -15 | 157 | 328 |
| 15 | -9 | 174 | 358 | -16 | 182 | 380 | -22 | 190 | 403 | 0 | 160 | 320 | -9 | 164 | 337 | -17 | 168 | 354 |

* The results were computed from the average net income for the years 1976-1990.

| | One Year Rice - One Year Soybean Rotation | | | | | | | | | One Year Rice - Two Year Soybean Rotation | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 26 bu. Soybeans - 90 bu. Rice 1/ | | | 31 bu. Soybeans - 100 bu. Rice 2/ | | | 36 bu. Soybeans - 110 bu. Rice 3/ | | | 26 bu. Soybeans - 90 bu. Rice 1/ | | | 31 bu. Soybeans - 100 bu. Rice 2/ | | | 36 bu. Soybeans - 110 bu. Rice 3/ | | |
| | 4.50SB4/ | 5.00SB4/ | 5.50SB4/ | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB | 4.50SB | 5.00SB | 5.50SB |
| Year | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R | 3.00R | 3.75R | 4.50R |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) |
| | (7% discount rate) | | | | | | | | | | | | | | | | | |
| 1 | $ 21 | -11 | -44 | 3 | -33 | -68 | -15 | -54 | -93 | 21 | 11 | -44 | 3 | -33 | -68 | -15 | -54 | -93 |
| 2 | 86 | 82 | 78 | 73 | 70 | 66 | 61 | 58 | 55 | 86 | 82 | 78 | 73 | 70 | 66 | 61 | 58 | 55 |
| 3 | 144 | 167 | 190 | 137 | 163 | 190 | 130 | 160 | 190 | 144 | 167 | 190 | 137 | 163 | 190 | 130 | 160 | 190 |
| 4 | 208 | 214 | 220 | 203 | 212 | 221 | 198 | 210 | 222 | 208 | 124 | 220 | 203 | 212 | 221 | 198 | 210 | 222 |
| 5 | 268 | 259 | 250 | 265 | 259 | 252 | 262 | 258 | 253 | 268 | 259 | 250 | 265 | 259 | 252 | 262 | 258 | 253 |
| 6 | 316 | 328 | 341 | 317 | 335 | 352 | 319 | 341 | 364 | 316 | 328 | 341 | 317 | 335 | 352 | 319 | 341 | 364 |
| 7 | 370 | 370 | 369 | 374 | 377 | 381 | 377 | 385 | 392 | 370 | 370 | 369 | 374 | 377 | 381 | 377 | 385 | 392 |
| 8 | 412 | 430 | 448 | 419 | 444 | 469 | 426 | 457 | 489 | 422 | 409 | 396 | 427 | 418 | 408 | 432 | 426 | 420 |
| 9 | 460 | 467 | 474 | 469 | 482 | 495 | 477 | 496 | 515 | 460 | 464 | 469 | 469 | 479 | 489 | 477 | 493 | 508 |
| 10 | 496 | 520 | 543 | 508 | 540 | 571 | 520 | 560 | 599 | 507 | 501 | 494 | 517 | 516 | 514 | 427 | 531 | 534 |
| 11 | 541 | 554 | 567 | 554 | 575 | 596 | 567 | 596 | 624 | 552 | 535 | 518 | 563 | 551 | 539 | 574 | 567 | 559 |
| 12 | 572 | 600 | 628 | 588 | 626 | 663 | 604 | 651 | 698 | 583 | 581 | 578 | 597 | 602 | 606 | 611 | 622 | 633 |
| 13 | 613 | 631 | 650 | 630 | 658 | 686 | 647 | 684 | 721 | 624 | 612 | 601 | 639 | 634 | 628 | 654 | 655 | 656 |
| 14 | 639 | 670 | 702 | 659 | 701 | 743 | 679 | 731 | 783 | 661 | 642 | 622 | 678 | 664 | 650 | 694 | 686 | 677 |
| 15 | 676 | 699 | 722 | 697 | 730 | 764 | 717 | 761 | 805 | 687 | 679 | 671 | 705 | 705 | 704 | 724 | 731 | 737 |
| | (9% discount rate) | | | | | | | | | | | | | | | | | |
| 1 | $ 21 | -11 | -43 | 3 | -32 | -67 | -15 | -53 | -91 | 21 | -11 | -43 | 3 | -32 | -67 | -15 | -53 | -91 |
| 2 | 83 | 78 | 74 | 71 | 67 | 63 | 58 | 55 | 51 | 83 | 79 | 74 | 71 | 67 | 63 | 59 | 55 | 51 |
| 3 | 138 | 159 | 180 | 131 | 155 | 180 | 124 | 152 | 179 | 138 | 159 | 180 | 131 | 155 | 180 | 124 | 152 | 179 |
| 4 | 197 | 203 | 209 | 192 | 200 | 209 | 187 | 198 | 209 | 197 | 203 | 209 | 192 | 200 | 209 | 187 | 198 | 209 |
| 5 | 252 | 244 | 236 | 249 | 243 | 236 | 246 | 241 | 237 | 252 | 244 | 236 | 249 | 243 | 236 | 246 | 241 | 237 |
| 6 | 295 | 306 | 317 | 295 | 311 | 327 | 296 | 316 | 336 | 295 | 306 | 317 | 295 | 311 | 327 | 296 | 316 | 336 |
| 7 | 343 | 342 | 342 | 345 | 348 | 352 | 347 | 354 | 361 | 343 | 342 | 342 | 345 | 348 | 352 | 347 | 354 | 361 |
| 8 | 378 | 394 | 410 | 384 | 406 | 427 | 389 | 417 | 444 | 388 | 376 | 365 | 391 | 383 | 375 | 395 | 390 | 385 |
| 9 | 420 | 426 | 432 | 427 | 438 | 450 | 434 | 450 | 467 | 420 | 424 | 428 | 427 | 436 | 444 | 433 | 448 | 461 |
| 10 | 450 | 470 | 490 | 460 | 486 | 513 | 469 | 503 | 537 | 460 | 454 | 448 | 467 | 466 | 466 | 475 | 479 | 483 |
| 11 | 487 | 498 | 509 | 497 | 515 | 533 | 508 | 533 | 557 | 496 | 482 | 468 | 505 | 495 | 486 | 513 | 508 | 503 |
| 12 | 512 | 535 | 558 | 525 | 556 | 587 | 537 | 577 | 616 | 521 | 519 | 516 | 532 | 536 | 539 | 543 | 552 | 562 |
| 13 | 544 | 559 | 575 | 557 | 581 | 605 | 571 | 603 | 634 | 553 | 543 | 534 | 565 | 561 | 557 | 577 | 578 | 580 |
| 14 | 564 | 590 | 616 | 580 | 615 | 650 | 596 | 640 | 684 | 582 | 567 | 551 | 595 | 585 | 574 | 608 | 603 | 597 |
| 15 | 592 | 612 | 632 | 609 | 637 | 666 | 625 | 663 | 700 | 602 | 595 | 588 | 616 | 616 | 615 | 631 | 637 | 642 |
| | (11% discount rate) | | | | | | | | | | | | | | | | | |
| 1 | $ 20 | -11 | -42 | 3 | -32 | -66 | -15 | -52 | -89 | 20 | -11 | -42 | 3 | -32 | -66 | -15 | -52 | -89 |
| 2 | 80 | 76 | 71 | 68 | 64 | 59 | 56 | 52 | 48 | 80 | 76 | 71 | 68 | 64 | 59 | 56 | 52 | 48 |
| 3 | 132 | 152 | 171 | 125 | 148 | 170 | 118 | 143 | 169 | 132 | 152 | 171 | 125 | 148 | 170 | 118 | 143 | 169 |
| 4 | 188 | 193 | 198 | 182 | 190 | 197 | 177 | 187 | 197 | 188 | 193 | 197 | 182 | 190 | 197 | 177 | 187 | 197 |
| 5 | 238 | 230 | 222 | 234 | 228 | 222 | 230 | 226 | 222 | 238 | 230 | 222 | 234 | 228 | 222 | 230 | 226 | 222 |
| 6 | 276 | 286 | 295 | 276 | 290 | 303 | 275 | 293 | 311 | 276 | 286 | 295 | 276 | 290 | 303 | 275 | 293 | 311 |
| 7 | 318 | 318 | 317 | 319 | 322 | 325 | 320 | 327 | 333 | 318 | 318 | 317 | 319 | 322 | 325 | 320 | 327 | 333 |
| 8 | 349 | 363 | 376 | 353 | 372 | 391 | 357 | 381 | 405 | 357 | 347 | 337 | 359 | 352 | 345 | 362 | 358 | 354 |
| 9 | 385 | 390 | 395 | 390 | 400 | 410 | 394 | 410 | 424 | 385 | 388 | 390 | 390 | 397 | 404 | 394 | 407 | 418 |
| 10 | 410 | 426 | 443 | 417 | 440 | 463 | 424 | 454 | 483 | 417 | 412 | 408 | 423 | 423 | 422 | 429 | 433 | 436 |
| 11 | 439 | 449 | 459 | 448 | 463 | 479 | 456 | 478 | 499 | 447 | 435 | 424 | 454 | 446 | 438 | 460 | 457 | 453 |
| 12 | 460 | 479 | 498 | 470 | 496 | 522 | 480 | 513 | 547 | 467 | 465 | 462 | 476 | 479 | 482 | 484 | 492 | 500 |
| 13 | 485 | 498 | 512 | 495 | 516 | 536 | 506 | 534 | 561 | 492 | 484 | 476 | 502 | 499 | 496 | 511 | 513 | 515 |
| 14 | 501 | 522 | 543 | 513 | 542 | 571 | 526 | 562 | 599 | 516 | 502 | 489 | 525 | 517 | 509 | 535 | 532 | 428 |
| 15 | 522 | 539 | 555 | 535 | 559 | 583 | 548 | 580 | 612 | 530 | 524 | 518 | 542 | 541 | 540 | 553 | 558 | 562 |

* *The results were computed from the average net income for the years 1976-1990.*

1/ Compared with solid cotton yielding 500 pounds of lint per acre.

2/ Compared with solid cotton yielding 550 pounds of lint per acre.

3/ Compared with solid cotton yielding 600 pounds of lint per acre.

4/ Prices of lint were $.40, $.45 and $.50 per pound when soybeans and rice were priced at $4.50 - $3.00, $5.00 - $3.75, and $5.50 - $4.50 per bushel, respectively.

# Application to Investment in a Rice-Soybean Rotation[5]

The discounted net incomes (Tables 4 and 5) represent the additional net income that would be available to repay the investment in land forming, irrigation wells and equipment, and drying-storing facilities.[6] Once these investments have been recaptured these additions to net income would become increased returns to operator management, land and general farm overhead.

*Returns to investment and length of "payback" period*---The results reported in Tables 4 and 5 may be used in two ways. Suppose that a soybean producer has been attaining yields of 28 bushels per acre. He is considering forming his land for rice production and using a rotation of rice in one year and soybeans in one year. He expects to average 100 bushels per acre from rice and 31 bushels from soybeans following rice in the rotation. He also expects to receive an average price of $5.00 per bushel for soybeans, $3.75 for rice. He wishes to know how much investment per acre for land forming, for an irrigation system and for drying-storing facilities could be paid back in six years, using a discount rate of seven percent. Looking at column (5) of Table 4, under the seven percent discount rate, he finds that an investment of $105 per acre could be repaid in six years.

Or suppose that the same producer estimates that he must invest $145 per acre to get into rice production and wishes to know how many years it will take to repay this investment under the yield, product prices and discount rate specified in the above example. In Column (5) of Table 4, under the seven percent discount rate, he finds that a payback period of eight years would be required to return the $145 investment. The repayment period and the investment required for other yield levels, for other prices of rice and soybeans and for a rotation of one year of rice and two years of soybeans can be determined for discount rates of seven, nine and eleven percent by interpreting Table 4 in the same manner. Table 5 contains the same information for producers who are considering a change from solid cotton to a rice-soybean rotation.

*Price that rice must bring for rice-soybean rotations to compete with continuous soybeans*---Rice would have to be priced at above $3.00 for a rice-soybean rotation to return a positive return on investment. [illegible] example, rice would have to br[illegible] $3.76 per bushel to recapture a $[illegible] investment per acre within [illegible] years, if soybeans bring $4.50 a[illegible] nine percent discount rate is u[illegible] (Figure 1).[7] With this price [illegible] soybeans and the same disco[illegible] rate, rice would have to bring $[illegible] to return an investment of $100 [illegible] acre in 12 years.

*Price that cotton must brin[illegible] compete with rice-soyb[illegible] rotations*---A price of only 20 c[illegible] per pound of lint[8] would be requ[illegible] for solid cotton yielding 500 pou[illegible] of lint per acre to compete effect[illegible] ly with the rice-soybean rotati[illegible] under conditions of $3.00 rice, $[illegible] soybeans, a $325 per acre inv[illegible] ment in a rice-soybean rotation [illegible] a two-year payback period wi[illegible] nine percent discount rate (Fi[illegible] 2).[9] A lower investment in [illegible] soybean rotations and a lo[illegible] payback period would req[illegible] higher cotton prices for cotton t[illegible] main competitive, holding [illegible] other assumptions constant, [illegible] cotton still needs to bring onl[illegible] cents to compete with an in[illegible] ment of $100 per acre in a [illegible] soybean rotation using a 15-[illegible] payback period.

[5] *The results of this study are applicable only to situations where land forming is required for rice prod[illegible] tion.*

[6] *We believe that our estimates of profitability and of the lengths of "payback" periods are conservati[illegible] because we held yields and prices constant through 1990 while allowing labor and machinery ownership c[illegible] operation costs to increase by 2.5 percent per year compounded annually.*

[7] *The price of rice did not vary more than five cents per bushel above or below the curves shown in Figur[illegible] for the three yield situations and the two rice-soybean rotations.*

[8] *Includes the value of seed which was computed by adding 1.25 cents for each 5-cent increase in lint pr[illegible] (seed were considered to have no value with lint at 20 cents or lower).*

[9] *The price of cotton lint did not vary more than one cent per pound above or below the curves shown[illegible] Figure 2 for the three yield situations and the two rice-soybean rotations.*

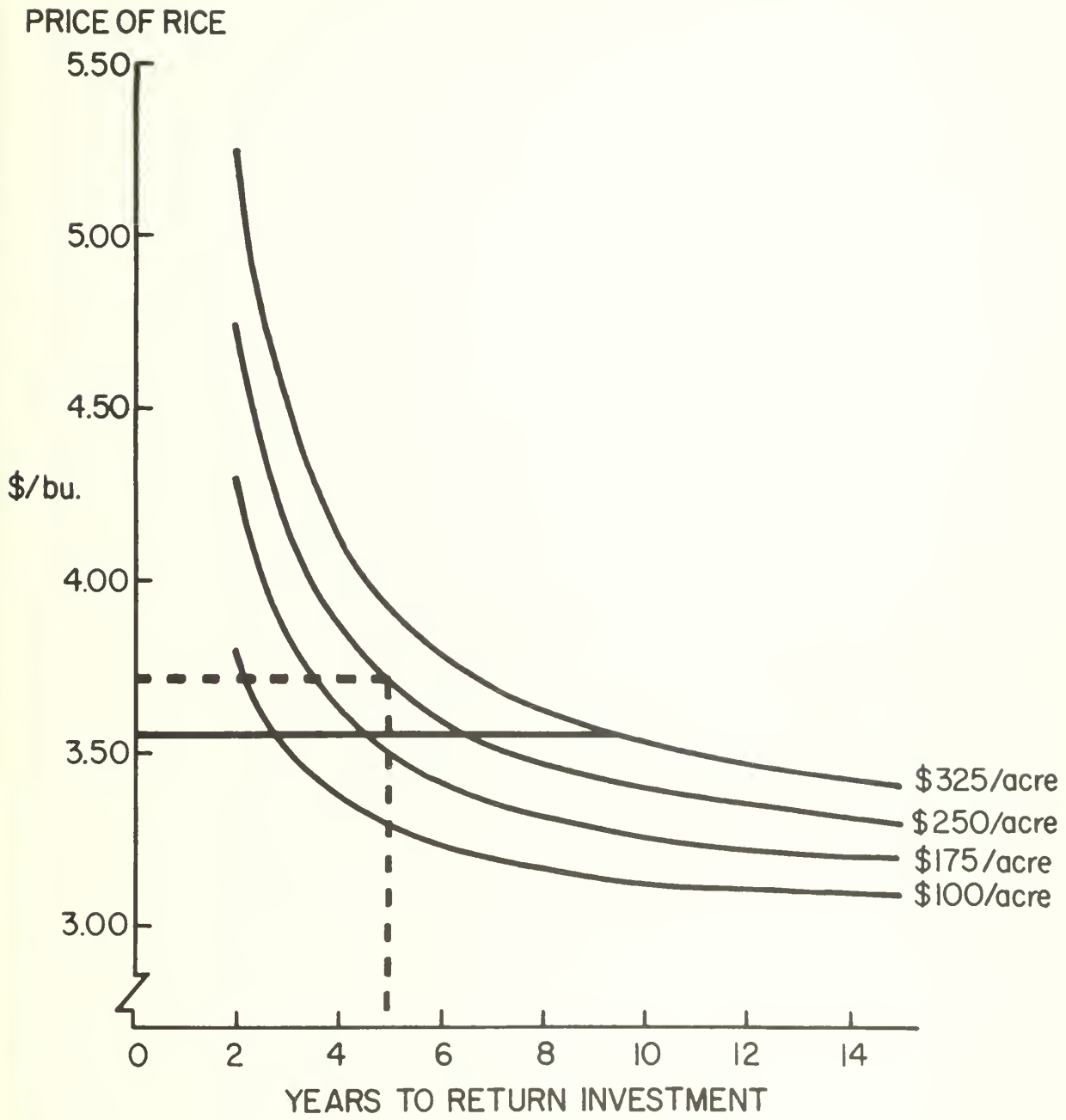


**Figure 1. Price that rice must bring to return specified investments[1] in rice-soybean rotations, with $4.50 soybeans and a 9 percent discount rate, by years required to repay investment, clay soils, Delta of Mississippi.**

[1] *An amount in addition to the net return from continuous soybeans yielding 23 bushels per acre and selling for $4.50 per bushel.*

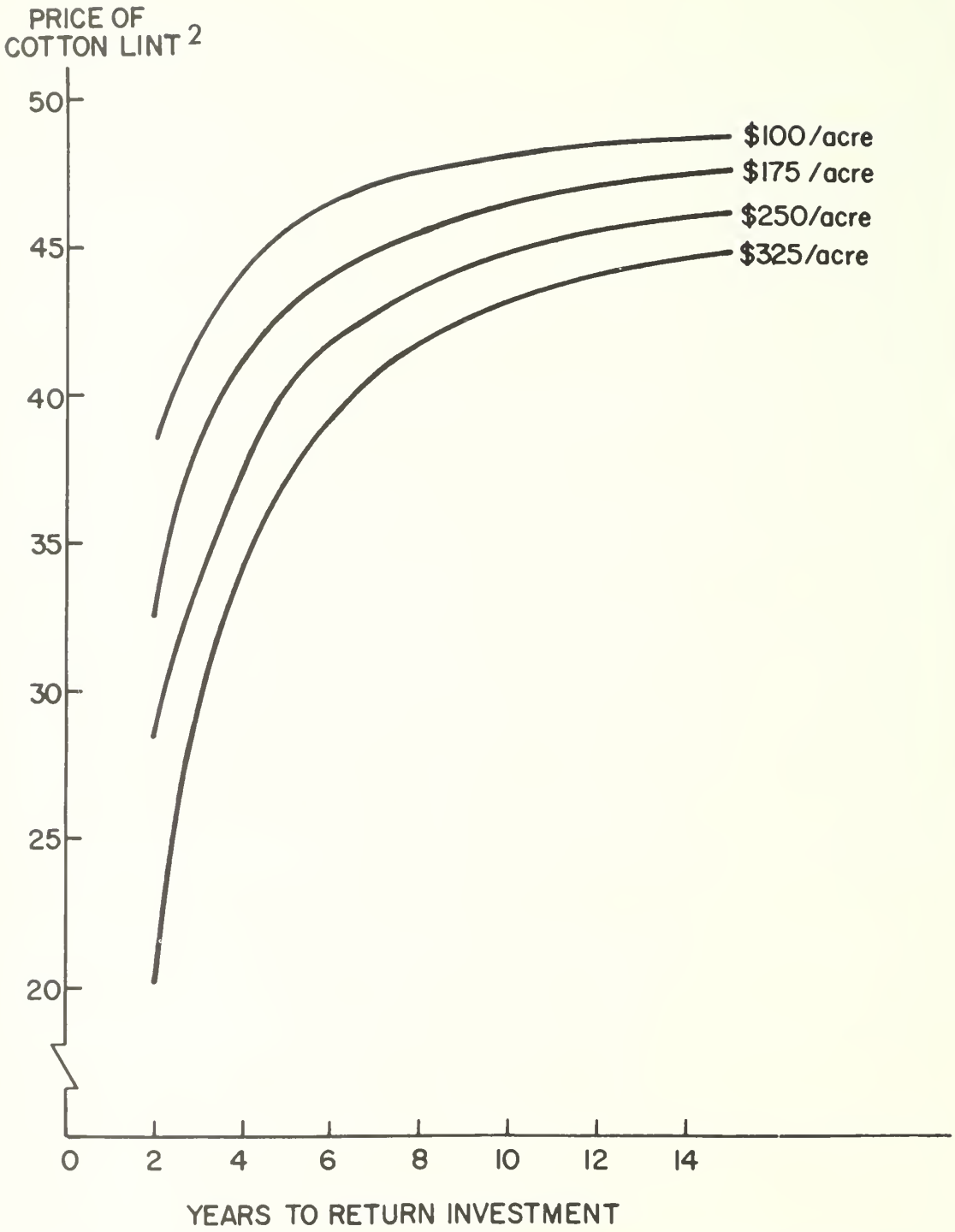


**Figure 2. Price that cotton must bring to give a net return equal to the investment[1] in rice-soybean rotations, using a 9 percent discount rate, by years required to repay investment, clay soils, Delta of Mississippi.**

[1] *An amount equivalent to the net return from rice-soybean rotations with 90 bushel rice at $3.00 and 26 bushel beans at $4.50.*

[2] *Includes the value of seed which was computed by adding 1.25 cents for each 5-cent increase in lint price (seed were considered to have no value with lint at 20 cents or lower).*