ment water has an EC of 1.0 mmhos. Th district using the replacement water dis charges its drainage water into the Sa Joaquin, where the SWRCB requires limit of EC = 1.5 mmhos on discharge Field beans are estimated to consume acre ft of water per year, and irrigatio efficiency (not including a leaching frac tion) is 80%, so 3.75 acre ft of wate are applied annually. Irrigation labo costs are $2 per acre ft applied with th replacement water, requiring an addi tional cost of $2 per acre for leveling Present and replacement water have th same cost, but dilution water, with an EC of .1 mmhos, costs $10 per acre foot Present water contains 10 lbs of nitroge per acre ft while replacement water con tains 50 lbs per acre ft. Nitrogen i valued at 15¢ per lb. Beans have an ex pected value of $200 per acre, with a expected 10% reduction in yield at a EC of 1.0 mmhos.

Value of variables: $Y = \$200$; $\triangle = 10\%$; $C_{w_1} = C_{w_2}$

$C_L = \$2$; $C_c = \$2$; $C_n = \$0.15$; $C_G = \$10$; $U = 3$
$I = 80\%$; $N_1 = 10$; $N_2 = 50$.

$$R_1 = \frac{.3}{12} = \frac{.1}{4} = .025 \qquad R_2 = \frac{1.0}{12} = .083$$

$$w_1 = \frac{\frac{3.0}{.80}}{1-.025} = \frac{3.75}{.975} = 3.85$$

$$w_2 = \frac{\frac{3.0}{.80}}{1-.083} = \frac{3.75}{.917} = 4.09$$

(Leaching requirement formula and value for maximum concentration of salts for field beans (12) from table by Committee of Consultants "Crop Tolerance and Leaching Requirement Tables," 1-7-74.)

The total leachate volume is, therefore, .85 and 1.09 acre ft for w_1 and w_2 respectively.

Assuming no precipitation, or weathering, and further assuming that the salt balance is being maintained in the root zone, all of the salt contained in the original irrigation water must be contained in the leachate.

Therefore (for original water) $E_d = 3.85 \times .3 \div .85 = 1.36$ mmhos; and (for replacement water) $E_d = 4.09 \times 1.0 \div 1.09 = 3.75$ mmhos.

$$D_1 = .85\frac{(1.5-1.36)}{.1-1.5} = -.085$$

$$D_2 = 1.09\frac{(1.5-3.75)}{.1-1.5} = 1.75$$

$$X = \frac{200}{4.09}(.10) + (0+2)(.083-.025) + \frac{2}{4.09}$$
$$-.15(50-10) + 10\frac{[1.75-(-.085)]}{4.09}$$

$X = 4.89 + 0.12 + 0.49 - 6.00 + 4.44$
$X = \$3.94$ = Cost due to increased salinity for each acre foot of replacement irrigation water applied.

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Maximum vs. Minimum TILLAGE EFFECTS *on barley and wheat in Imperial Valley*

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THE OPTIMUM PLANTING time for wheat and barley in Imperial Valley is between December 15th and January 15th, which makes them excellent crops to follow cotton and late-plantings of grain sorghum. The growing period (and production) of the cereal crops might be increased if the time between the harvest of cotton or grain sorghum and the planting of wheat and barley could be shortened, by eliminating some irrigation and tillage operations. These possibilities were investigated during an experiment designed to compare wheat (Siete Serros and Anza) and barley (CM 67) in the winters of 1971–72 and 1972–73 under maximum and minimum soil preparation following cotton and grain sorghum.

Tillage

The maximum and minimum tillage experiments following cotton were on heavier and more saline soils than those following grain sorghum in 1971–72, but the soils were similar in 1972–73. Maximum soil preparation after cotton and grain sorghum involved shredding of stalks, discing twice, bordering up for pre-irrigation, pre-irrigation, discing once, leveling, a broadcast application of 540 lbs per acre of ammonium nitrate (33⅓% N), planting (80 lbs of seed per acre), and irrigating up.

Minimum soil preparation operations after cotton and grain sorghum involved shredding of stalks, discing twice, leveling, bordering up for irrigation, and application of 540 lbs per acre of ammonium nitrate, planting (80 lbs per acre), and irrigating up.

A second minimum soil preparation after grain sorghum involved removing the sorghum stalks by cutting and baling, an operation practiced in the Imperial Valley, followed by the minimum soil preparation.

Wheat and barley were planted after cotton on December 10, 1971, and January 5, 1972. Sorghum was planted on December 18, 1971, and January 5, 1972. Seven replications were used for the tests following cotton and six following grain sorghum. Yields were determined by harvesting an 8 by 50 ft plot with a combine. No statistical comparisons could be made between the tests following cotton and grain sorghum because two separate locations were used. Growing barley with wheat which matured 14 to 22 days later may have had some effect on the yield of each crop. For this reason, it may be unfair to make rigid yield comparisons between the two crops.

Germination and early seedling growth of wheat and barley were excellent, and no differences due to tillage operations were observed. The slightly lower yields in wheat and barley following cotton may have resulted from the higher soil salinities in this area. Lower grain yields may have resulted from the barley receiving one irrigation too much and the wheat needing an additional irrigation.

After cotton

Compared with wheat, barley was 14 days earlier, slightly shorter in plant height, lower in bushel weight, and severely lodged. No significant differences

Soil before planting grain on minimum tillage (left) and soil before planting on maximum tillage (right).

Barley lodged, mature and light in color, growing next to wheat which is upright, immature, and dark in color under maximum (right) and minimum (left) tillage.

due to soil preparation were obtained for date headed, plant height, bushel weight, lodging, and yield in either wheat or barley (table 1). The two-year average yield for barley was 4,336 lbs per acre for maximum soil preparation and 4,267 lbs per acre, for minimum soil preparation. The comparable wheat yields were 5,079 and 4,518 lbs per acre, respectively. The slight yield differences between maximum and minimum tillage were not statistically significant. Wheat yielded significantly higher than barley in 1972–73, but not in 1971–72.

After grain sorghum

Tillage operation had no effect on any of the characteristics studied (table 2). A slight but non-significant difference in grain yield due to soil preparation was obtained. The two-year average grain yields for barley were 4,367 and 4,232 lbs per acre for maximum and minimum soil preparation, respectively. The figures for wheat were 4,819 and 4,981 lbs per acre, respectively.

The production of barley and wheat in 1971–72 was not affected by incorporating the grain sorghum stalks. Barley produced 4,840 lbs per acre (stalks incorporated) and 4,755 lbs per acre (stalks removed). Wheat yielded 4,961 and 4,864 lbs per acre, respectively, for stalks incorporated and stalks removed. These small differences were statistically non-significant.

In summary, yields of wheat and barley when planted after cotton and grain sorghum under minimum tillage remained as high as when the crop was produced under maximum tillage practices. Grain production (2-year average), was similar after either cotton or grain sorghum. Time between crops, number of land preparation operations, costs, and energy requirements, were all reduced under minimum tillage operation.

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TABLE 1. AGRONOMIC DATA FOR WHEAT AND BARLEY GROWING AFTER COTTON UNDER MINIMUM AND MAXIMUM TILLAGE AT UNIVERSITY OF CALIFORNIA IMPERIAL VALLEY FIELD STATION, EL CENTRO, 1971–72 AND 1972–73

	1971–72*		1972–73†		Average	
Character	Min.	Max.	Min.	Max.	Min.	Max.
			BARLEY/CM67			
Yield, lbs/acre	4321	4147	4212	4525	4267	4336
Bushel weight, lbs	46.4	46.0	50.0	50.2	48.2	48.1
Date headed	3/10	3/10	3/23	3/23	—	—
Days to heading	90	90	77	77	—	—
Height, inches	35	33	33	33	34	33
Lodging, %	80	80	90	90	80	80
			WHEAT			
	Siete Cerros 66		Anza			
Yield, lbs/acre	3603	4256	5452	5902	4518	5079
Bushel weight, lbs	64.3	64.0	64.6	64.0	64.5	64.0
Date headed	3/24	3/24	4/13	4/13	—	—
Days to heading	104	104	98	98	—	—
Height, inches	40	38	31	31	—	—
Lodging, %	0	0	0	0	0	0
LSD—Yield 5%	NS		551			
1%			750			

* Planted December 10, 1971
† Planted January 5, 1972

TABLE 2. AVERAGE AGRONOMIC DATA FOR WHEAT AND BARLEY GROWING AFTER GRAIN SORGHUM UNDER MINIMUM AND MAXIMUM TILLAGE AT THE UNIVERSITY OF CALIFORNIA IMPERIAL VALLEY FIELD STATION, EL CENTRO, 1971–72 AND 1972–73

	1971–72*		1972–73†		Average	
Data	Min.	Max.	Min.	Max.	Min.	Max.
			BARLEY—CM 67			
Yield, lbs/acre	4840	4707	3623	4027	4232	4367
Bushel weight, lbs	46.1	47.1	50.6	50.6	48.4	48.9
Date headed	3/12	3/12	3/22	3/23	—	—
Days to heading	92	92	77	77	—	—
Height, inches	39	36	33	35	36	36
Lodging, %	80	80	90	90	85	85
			WHEAT			
	Siete Cerros 66		Anza			
Yield, lbs/acre	4961	4598	5001	5040	4981	4819
Bushel weight, lbs	63.3	63.4	63.3	63.8	63.3	63.6
Date headed	3/31	3/31	4/13	4/13	—	—
Days to heading	111	111	98	98	—	—
Height, inches	39	39	34	35	—	—
Lodging, %	0	0	0	0	0	0
LSD yield 5%	NS		919			
1%			1252			

* Planted December 10, 1971
† Planted January 5, 1972