Hilgardia

A JOURNAL OF AGRICULTURAL SCIENCE PUBLISHED BY
THE CALIFORNIA AGRICULTURAL EXPERIMENT STATION

Volume 56 • Number 5 • October 1988

Reuse of Drainage Water for Irrigation: Results of Imperial Valley Study

I. Hypothesis, Experimental Procedures, and Cropping Results

James D. Rhoades, Frank T. Bingham, John Letey,
Allan R. Dedrick, Maura Bean, Glenn J. Hoffman,
William J. Alves, Robert V. Swain, Porfirio G. Pacheco,
and Robert D. Lemert

II. Soil Salinity and Water Balance

James D. Rhoades, Frank T. Bingham, John Letey,
Paul J. Pinter, Jr., Robert D. Lemert, William J. Alves,
Glenn J. Hoffman, John A. Replogle,
Robert V. Swain, and Porfirio G. Pacheco

UNIVERSITY OF CALIFORNIA DIVISION OF AGRICULTURE AND NATURAL RESOURCES

ABSTRACTS

I. Hypothesis, Experimental Procedures, and Cropping Results

An irrigation/cropping management strategy has been developed to facilitate the use of brackish waters for irrigation, with the goal of expanding the available water supply and minimizing the off-site pollution potential of drainage disposal. A field experiment conducted in the Imperial Valley of California to test the strategy has produced four years of cropping results. After seedling establishment, when the crops were in a sufficiently mature, salt-tolerant growth stage, brackish drainage water (Alamo River) was substituted for the normal water (Colorado River) to irrigate wheat and sugarbeets (in a succes-

Continued inside back cover

THE AUTHORS:

James D. Rhoades is Research Leader, U.S. Salinity Laboratory, U.S. Department of Agriculture, Agricultural Research Service (USDA-ARS), 4500 Glenwood Drive, Riverside, CA 92501.

Frank T. Bingham (deceased) was Professor, Department of Soil and Environmental Sciences, University of California, Riverside.

John Letey is Professor, Department of Soil and Environmental Sciences, University of California, Riverside.

Allan R. Dedrick is Agricultural Engineer, USDA-ARS, U.S. Water Conservation Laboratory, Phoenix, Arizona.

Maura Bean is Research Food Technologist, Western Regional Research Center, Albany, California.

Glenn J. Hoffman is Research Leader, USDA-ARS, Water Management Research Laboratory, Fresno, California.

William J. Alves is Computer Specialist, USDA-ARS, U.S. Salinity Laboratory, Riverside, California.

Robert V. Swain is Agricultural Research Technician, USDA-ARS Irrigation Desert Research Station, Brawley, California.

Porfirio G. Pacheco is Laboratory Assistant, Department of Soil and Environmental Sciences, University of California, Riverside.

Robert D. Lemert is Physical Science Technician, USDA-ARS, U.S. Salinity Laboratory, Riverside, California.

Paul J. Pinter, Jr. is Research Biologist, USDA-ARS, U.S. Water Conservation Laboratory, Phoenix, Arizona.

John A. Replogle is Research Leader, USDA-ARS, U.S. Water Conservation Laboratory, Phoenix, Arizona.

James D. Rhoades, Frank T. Bingham, John Letey, Paul J. Pinter, Jr., Robert D. Lemert, William J. Alves, Glenn J. Hoffman, John A. Replogle, Robert V. Swain, and Porfirio G. Pacheco

II. Soil Salinity and Water Balance

INTRODUCTION

Crop yield and quality results obtained in field tests (part I) indicate that saline water can be successfully substituted for "good water" to irrigate certain crops in rotation when they are in a salt-tolerant growth stage, with the "good water" used for the other irrigations. In the tests, substantial substitution of saline drainage water (25 to 50 percent) was made for Colorado River water in producing the two crop rottions (two cycles of wheat:sugarbeets:cantaloupes, designated the successive rotation; and cotton:cotton:wheat:alfalfa, designated the block rotation) without appreciable effects on yield or quality.

In this paper, we present data on water use and soil salinity status obtained in the field tests.

EXPERIMENTAL PROCEDURES

The experimental irrigation and cropping layout and test methods are described in part I, as are the initial soil salinity conditions. Because those conditions changed over time on all plots, the reference of salinity used here to judge treatment effects is the mean of the control fields of each crop year.

Soil samples were periodically collected from the seedbed (0 to 6 inches) at the time of seedling establishment and from the major root zone when each crop was harvested. These samples were analyzed for salinity, sodicity, and boron by standard methods (Rhoades 1982). Additional soil samples were taken after each irrigation of the wheat crop and periodically during the alfalfa cropping period in the block rotation fields to determine the rate of desalination by irrigation with Colorado River water.

Water applied at each irrigation was measured with calibrated flumes (see part I); the soil water content just before each irrigation was determined from neutron-probe measurements. No attempt was made to directly measure the volume and composition of deep percolation. Leaching amounts were calculated as the difference between water applied and crop consumptive use as estimated using pan evaporation data from Brawley, California, and crop coefficients established in lysimeter studies at Brawley.

RESULTS

Amounts of Irrigation Water Applied

Successive Crop Rotation

The average amounts of all water applied to each crop for the four-year period are given in table 1 by treatment. These data include water used for preplant irrigations and land preparation. Essentially the same amounts of irrigation water were applied irrespective of treatment. Alamo River water accounted for 35 percent of the applied irrigation water on the Ca treatment and 53 percent on the cA treatment, based on the entire rotation. However, based only on the crops receiving Alamo River water, the percentages were 45 and 65 for Ca and cA treatments, respectively. Substantial amounts of Alamo River water thus were substituted for Colorado River water in the irrigation of the wheat and sugarbeets grown in this rotation.

Block Rotation

Based on the complete rotation in the block system, the percentages of Alamo River water were about 25 and 45 for the cA and A treatments, respectively (table 2). For the cotton crops, the percentages were about 50 and 100 for cA and A treatments, respectively. Less Alamo River water was used for irrigation in this block rotation by the recommended strategy (treatment cA) than in the successive crop rotation.

Evapotranspiration and Leaching Fraction

Table 3 lists the estimated amounts of water consumed by the plant through evapotranspiration and lost as deep percolation. The consumptive use was assumed to be the same in all treatments, because the yields were similar. Temperature and rainfall summaries for the experimental period are given in appendix tables 1 through 4.

Successive Crop Rotation

According to the estimates (table 3), the first wheat crop was under-irrigated, and no net leaching occurred. Leaching apparently accounted for 18 percent of the water applied to the first crop of sugarbeets and 32 percent of the first crop of cantaloupes. In the second cycle of this rotation, leaching was estimated at 17 percent for the wheat crop, 21 percent for the sugarbeets, and essentially zero for the cantaloupes. These data suggest that the higher levels of salinity and sodicity and the greater treatment differences after the second cantaloupe crop, compared with the first crop (data described later), resulted from under-irrigation in 1985. Overall, the leaching fraction was estimated to be 0.14 for this rotation. The excesses of applied water leading to leaching occurred primarily when irrigations were made during the preplant and seedling establishment periods.

The greatest potential for leaching and salt removal in this rotation occurred during the cantaloupe cropping season, when the evapotranspiration rate was relatively low and only Colorado River water was used for irrigation. Sufficient water must be applied to this crop to achieve leaching, as it was in 1983, if Alamo River water is to be used successfully for irrigation in this rotation.

Block Rotation

According to the estimates in table 3, the overall leaching fraction in the block rotation was 0.10. This value is lower than that achieved in the successive crop rotation, primarily because there was no apparent leaching during the alfalfa cropping. However, the leaching achieved up to the beginning of alfalfa production (0.17) was greater than that obtained in the successive crop production. The use of Colorado River water to grow wheat between the cotton and alfalfa crops apparently resulted in sufficient leaching and salt removal, as will be shown later, so that little leaching was required during the subsequent alfalfa cropping period to maintain good yields. If alfalfa had directly followed the cotton crops, yield in the plots receiving Alamo River water might have been lower.

Soil Salinities, Sodicities, and Boron Levels

Salinity is expressed in terms of the electrical conductivity of the saturated soil paste extract (EC_e) in dS/m. Sodicity is expressed as the sodium adsorption ratio of the extract ($SAR_e = Na/[(Ca + Mg)/2]^{1/2}$, where all solute concentrations are in $mmol_c/L$). Boron level is expressed as concentration in the extract (B_e, mg/L).

Successive Crop Rotation

Wheat crop, 1982. The levels of salts during seedling establishment of the first wheat crop were essentially those present in the soil at the initiation of the experiment (see part I). These levels are relatively low and nonprohibitive to the establishment of wheat seedlings (Maas 1986).

Average salinity values at the end of the wheat crop (table 4), in order, were cA > Ca > C at relatively shallow depths of the root zone, but all values were below the threshold level (6 dS/m) associated with wheat yield reduction (Maas 1986). Sodicity levels in the 0- to 6-inch depth were higher for the cA than the other treatments, but the resultant combinations of SAR_e and EC_{iw} would not be expected to cause loss of soil permeability (Rhoades 1984, 1986).

Sugarbeet crop, 1983. Salinity and sodicity levels in the seed-line area, near the outer edges of the wide flat bed, on November 17, 1982 (representative of the seedling establishment period) were both cA > Ca > C (table 5). Apparently, however, none of the values was excessive for sugarbeets, since a very good stand was obtained on all plots.

Average salinity, sodicity, and boron levels beneath the furrow at the end of the first sugarbeet crop are given in table 6. Salinity and sodicity at shallow depths were cA > Ca > C, but no value exceeded the threshold level for loss of yield (EC_e = 8 dS/

m; B_e = 4-6 mg/L) or for permeability (Rhoades 1984, 1986). Indeed, no losses of yield resulted (see part I).

Cantaloupe crop, 1983. The average levels of salinity and sodicity in the seed-line region of the seedbed (the inner margins of the wide flat bed) on September 1, 1983, are given in table 7. Even though all fields were irrigated solely with Colorado River water for germination, the salinity levels were relatively high in the seed-line region. These levels were probably caused by the inward flow of water from the furrow toward the center of the bed that resulted from furrow irrigation and the wide, flat beds used that year. Despite the high salinity, germination and stand establishment were very good. However, another style of bed preparation would be preferable, such as the sloping beds used for the 1985 crop, to minimize the accumulation of salts near the seedlings.

The average levels of salinity, sodicity, and boron beneath the furrow at the end of the first cantaloupe crop were similar for all treatments (table 8). The SAR values were lower than those following the wheat (table 4) and sugarbeet (table 6) crops, but the EC values did not differ greatly following the three crops.

Wheat crop, 1984. Average salinity and sodicity levels in the seedbed region on January 17, 1984, were similar for all treatments—relatively low and nonlimiting for seedling development (table 9).

Salinity, sodicity, and boron levels at the end of the 1984 wheat season are given in table 10. Salinity and sodicity levels were cA > Ca > C, particularly at the shallow soil depths, but were below threshold values associated with yield or permeability problems on all plots.

Sugarbeet crop, 1985. Salinity and sodicity in the seed-line region of the seedbed on October 9, 1984 (table 11), were lower than in the 1983 crop, not significantly different between treatments, and not limiting to seedling establishment.

The average levels of salinity, sodicity, and boron beneath the furrow at the end of this second sugarbeet crop were in the order cA > Ca > C, especially in the shallow soil depths (table 12). At the shallower depths, levels were significantly higher than in 1983, but were still below accepted threshold values associated with losses in yield and permeability.

Cantaloupe crop, 1985. The seedbed was of a semi-sloping type in 1985, and salinity levels within the seed region were much lower (table 13) than in the 1983 crop (table 7). No significant differences in salinity or boron existed between treatments, but sodicity was significantly higher in the cA treatment fields (table 13). The levels were well within tolerable limits, and very good seedling establishment was obtained.

At the end of the second complete cycle of the successive crop rotation, salinity, sodicity, and boron levels beneath the furrows were higher at the shallow soil depths (table 14) than they were at the end of the first cycle. The reason probably is the relatively low use of Colorado River water for irrigation of the last cantaloupe crop compared with the first crop. The salinity levels of all treatments exceeded the threshold value for cantaloupe (1.5 to 3.0 dS/m) and were not much lower than those present at the end of the 1985 sugarbeet crop. They were higher than after the first cantaloupe crops (table 8). Still, acceptable yields of cantaloupes were obtained, as has been previously discussed. Additional water in the production of this crop would have provided greater salinity reduction.

Block Rotation

Cotton crop, 1982. The average levels of salinity and sodicity in the seed-line region of the sloping beds on May 13, 1982, are listed in table 15. Although salinity was very high in the A treatment plots, the stand of cotton was good. High yields were obtained in all treatments.

Average levels of salinity, sodicity, and boron beneath the furrow near the end of the first cotton crop were in the order A > cA > C (table 16). In every case, however, levels were lower than the accepted threshold limits, so that no differences in yield would be expected.

Cotton crop, 1983. Symmetrical beds were used for cotton production in 1983, which is not recommended where salinity is high. Salinity and sodicity levels were thus much higher in that year (table 17) than in 1982, even in the C treatment fields. These relatively high EC_e and SAR_e levels, as well as crust-forming rains, were responsible for the poor cotton stand and lower yield in 1983 than in 1982. Had the crop been replanted after the crust-producing rains in the experimental fields as they were in surrounding commercial fields, and had sloping beds been used for seedling establishment, better yields would probably have resulted in 1983.

Near the end of the second cotton crop, levels of salinity, sodicity, and boron beneath the furrow (table 18) were higher than in the 1982 crop (table 16). The salinity levels in the cA and A treatments were close to the threshold generally associated with loss in yield (7 to 8 dS/m). Salinity was not much higher than the threshold, however, and little loss in yield would be expected under such conditions. The low yields obtained in 1983 are thought to have been caused by the poor stand.

Wheat crop, 1984. The average levels of salinity, sodicity, and boron of the wheat crop after each of the six irrigations with Colorado River water are given in tables 19 to 24. Since this crop was irrigated to stimulate germination, the salinity conditions at the first sampling (January 17) were essentially those that existed during seedling establishment. Salinity and sodicity at the shallow depth in the cA and A plots decreased from the relatively high levels present after cotton production to levels similar to those in the C plots. The average salinity levels at this soil depth did not exceed the threshold for yield loss (6 dS/m), and high wheat grain yields were obtained (see part I). Salinity was higher than 6 dS/m in the lower depths of all treatments, but the relatively shallow-rooted wheat crop did not seem to be unduly affected by this "deep" salinity.

Alfalfa crop, 1985. Table 25 presents the average levels of salinity, sodicity, and boron in the seed-line region of the alfalfa seedbed on November 15, 1984. Salinity levels were higher than they had been in the surface depths of the preceding wheat crop, probably because the salt was concentrated in the raised seedbed through the furrow irrigation process. These levels did not differ between treatments, however. Good stand establishment was obtained.

The average levels of salinity, sodicity, and boron beneath the seed line during the growing season and at the end of the study period are given in tables 26 to 28. The EC_e levels were higher than the threshold for alfalfa (2 to 3 dS/m) and that existing at the end of the wheat crop, probably because of the lower leaching fraction achieved with the alfalfa, as was discussed earlier. The levels of salinity and sodicity and resultant yields, however, were not significantly different between treatments.

Yields were not affected by the previous use of Alamo River water for irrigation in the Ca and cA treatment plots.

Plant Water Stress

Infrared thermometry (IRT) was used to measure leaf canopy temperatures to test for indications of plant water stress. Any stress that resulted from interference in the extraction of water from the soil or its flow through the plant would cause canopy temperatures to rise relative to those of a nonstressed canopy. Leaf diffusion resistance measurements of selected cotton plants were also made in 1982 as another means of assessing plant water stress.

IRT data collected in wheat and cotton (tables 29 and 30, respectively) and the leaf diffusion resistance information obtained in cotton (table 31) revealed no significant differences in canopy temperature or diffusion resistance that could be attributed to the salinity treatments. These results support the crop yield and salinity results indicating that no significant crop stress resulted from the substitution of Alamo River water for Colorado River water in this trial.

SUMMARY AND CONCLUSIONS

The results obtained in this field experiment support the use of a strategy of substituting saline drainage water for the "normal" water when irrigating certain crops in a rotation. The saline water is used after seedling establishment, so that a good stand can be obtained under lower salinity, at a time when the crop is in a more mature growth stage and more tolerant of salinity. The other crops in the rotation are irrigated with the normal water to keep soil salinity in the active root zone within acceptable limits for sustained crop production and subsequent cropping on the same land of even salt-sensitive crops.

During our four-year experiment, soil salinity and boron were kept within acceptable limits for seedling establishment and subsequent growth of the individual crops grown in the rotations. No significant differences in yield or crop quality occurred in any of the five crops grown when Alamo River water was substituted for Colorado River water for up to 25 to 50 percent of the irrigation requirements of the two representative rotations tested (see part I). No problems of soil degradation were observed, such as reduction in permeability or tilth. Accumulative leaching was minimal (less than 15 percent) but adequate in the clay soil, and was achieved through normal irrigation management.

Salinity levels were higher at the end of the experimental period than at the beginning (table 3, part I). At least one reason was that the field had been extensively leached in the land-leveling process just before the experiment began.

ACKNOWLEDGMENTS

Acknowledgment is made of the assistance provided by the following agencies and persons: The Southern District and Office of Water Conservation-California Department of Water Resources, California State Water Resources Control Board, Imperial Irrigation District, and University of California, Kearney Foundation, who provided financial support. Fifield Land Company, who provided land for the studies and carried out all of the farming operations. Dr. Robin Saunders of the U.S. Department of Agriculture, Agricultural Research Service (USDA, ARS) Western Regional Research Center, Albany. California, and Dr. Gordon Rubenthaler and H. C. Jeffers, USDA, ARS, Western Wheat Quality Laboratory, Pullman, Washington, who analyzed the quality of the wheat grain. Earl Moroni of Growers' Orita Ginning Association, Brawley, California, who helped with ginning the cotton, and Gus Hyer, ARS-Cotton Research Center, Shafter, California, who provided lint quality analysis.

LITERATURE CITATIONS

MAAS, E. V.
1986. Salt tolerance of plants. Applied Agric. Res. 1(1): 12-26.

RHOADES, J. D.
1982. Soluble salts. *In* Page, A. L., R. H. Miller, and D. R. Kenney (eds.). Methods of soil analysis. Part 2, chemical and microbiological properties. Agronomy Monograph 9: 167-178.
1984. Using saline waters for irrigation. Proc. Int. Workshop on Salt-Affected Soils of Latin America, Maracay, Venezuela, Oct. 23-30, 1983. pp. 22-52. Also publ. in Sci. Rev. on Arid Zone Res. 2:233-64.
1986. Use of saline water for irrigation. Special issue Bull. Water Quality. Burlington, Ontario, Canada: National Water Res. Inst.

TABLE 1. AMOUNTS OF COLORADO AND ALAMO RIVER WATERS USED FOR IRRIGATION IN THE SUCCESSIVE CROP ROTATION*†

Treatment‡	1982 wheat Colo. R.	1982 wheat Alamo R.	1982 wheat Total	1982 wheat Alamo	1983 sugarbeets Colo. R.	1983 sugarbeets Alamo R.	1983 sugarbeets Total	1983 sugarbeets Alamo	1983 cantaloupes Colo. R.	1983 cantaloupes Alamo R.	1983 cantaloupes Total	1983 cantaloupes Alamo
	inches			%	inches			%	inches			%
C	21.6 (0.1)	0	21.6 (0.1)	0	49.9 (0.2)	0	49.9 (0.2)	0	24.6 (0.3)	0	24.6 (0.3)	0
Ca	16.4 (0.2)	5.1 (0.0)	21.5 (0.2)	24	28.0 (0.0)	21.1 (0.1)	49.2 (0.1)	43	24.5 (0.1)	0	24.5 (0.1)	0
cA	5.2 (0.0)	16.7 (0.2)	21.9 (.02)	76	17.6 (0.1)	31.5 (0.1)	49.1 (0.2)	64	24.7 (0.1)	0	24.7 (0.1)	0

Treatment‡	1984 wheat Colo. R.	1984 wheat Alamo R.	1984 wheat Total	1984 wheat Alamo	1985 sugarbeets Colo. R.	1985 sugarbeets Alamo R.	1985 sugarbeets Total	1985 sugarbeets Alamo	1985 cantaloupes Colo. R.	1985 cantaloupes Alamo R.	1985 cantaloupes Total	1985 cantaloupes Alamo
	inches			%	inches			%	inches			%
C	32.4 (0.2)	0	32.4 (0.2)	0	55.1 (0.2)	0	55.1 (0.2)	0	14.2 (0.2)	0	14.2 (0.2)	0
Ca	17.0 (0.1)	15.6 (0.1)	32.6 (0.1)	48	28.0 (0.1)	26.1 (0.1)	54.1 (0.2)	48	13.9 (0.2)	0	13.9 (0.2)	0
cA	12.1 (0.1)	20.7 (0.1)	32.6 (0.1)	63	19.3 (0.1)	34.4 (0.2)	53.7 (0.2)	64	13.6 (0.2)	0	13.6 (0.2)	0

Treatment‡	Complete rotation Colo. R.	Complete rotation Alamo R.	Complete rotation Total	Complete rotation Alamo
	inches			%
C	197.8 (0.5)	0	197.8 (0.5)	0
Ca	127.9 (0.3)	67.9 (0.2)	195.7 (0.5)	35
cA	92.6 (0.3)	103.3 (0.1)	195.9 (0.4)	53

*Includes preplant water applications.

†Values within parentheses are standard error of mean.

‡C = only Colorado River water used for irrigation; Alamo River water used for irrigation in relatively smaller (Ca) or larger (cA) amounts after seedling establishment with Colorado River water.

TABLE 2. AMOUNTS OF COLORADO AND ALAMO RIVER WATERS USED FOR IRRIGATION IN THE BLOCK ROTATION*†

	1982 cotton				1983 cotton				1984 wheat			
Treatment‡	Colo. R.	Alamo R.	Total	Alamo	Colo. R.	Alamo R.	Total	Alamo	Colo. R.	Alamo R.	Total	Alamo
	inches			%	inches			%	inches			%
C	51.4 (0.7)	0	51.4 (0.7)	0	46.3 (0.2)	0	46.3 (0.2)	0	32.4 (0.3)	0	32.4 (0.3)	0
cA	20.3 (0.5)	30.5 (1.2)	50.7 (1.6)	60	24.3 (0.2)	21.5 (0.2)	45.7 (0.2)	47	31.4 (0.1)	0	31.4 (0.1)	0
A	0	46.7 (1.0)	46.7 (1.0)	100	0	45.2 (0.3)	45.2 (0.3)	100	31.3 (0.2)	0	31.3 (0.2)	0

	Alfalfa				Complete rotation			
	Colo. R.	Alamo R.	Total	Alamo	Colo. R.	Alamo R.	Total	Alamo
	inches			%	inches			%
C	80.6 (0.2)	0	80.6 (0.2)	0	211.5 (0.3)	0	211.5 (0.3)	0
cA	81.0 (0.3)	0	81.0 (0.3)	0	157.3 (0.7)	52.4 (1.3)	209.7 (2.0)	25
A	80.0 (0.6)	0	80.0 (0.6)	0	111.2 (0.7)	92.0 (1.2)	203.1 (1.6)	45

*Includes pre-plant water applications.

†Values within parentheses are standard error of mean.

‡C = only Colorado River water used for irrigation; Alamo River water used for irrigation in relatively smaller (Ca) and larger (cA) amounts after seedling establishment with Colorado River water.

TABLE 3. ESTIMATED EVAPOTRANSPIRATION AND DEEP PERCOLATION

Crop	V_{et}*	V_{iw}†	V_{dw}‡	LF§	Accum. V_{et}¶	Accum. V_{iw}	Accum. V_{dw}	Accum. LF
	inches				*inches*			
Successive crop rotation								
1982 wheat	25.8	21.9	−3.9	−0.18	25.8	21.9	−3.9	−0.18
1983 s.beet	40.5	49.1	8.6	0.18	66.3	71.0	4.7	.07
1983 melons	16.8	24.7	7.9	0.32	83.1	95.7	12.6	.13
1984 wheat	27.1	32.8	5.7	0.17	110.2	128.5	18.3	.14
1985 s.beet	42.3	53.7	11.4	0.21	152.5	182.2	29.7	.16
1985 melons	16.8	13.6	−3.2	−0.24	169.3	195.8	26.5	.14
Block rotation								
1982 cotton	38.9	50.7	11.8	0.23	38.9	50.7	11.9	.23
1983 cotton	40.7	45.7	5.0	0.11	79.6	96.5	16.9	.18
1984 wheat	27.1	31.4	4.3	0.14	106.7	127.9	21.3	.17
1985 alfalfa	81.2	81.0	−0.2	0.00	187.8	208.9	21.1	.10

*Evapotranspiration estimated from pan evaporation and crop factors at Brawley, California.

†Total amount of water applied for irrigation.

‡Estimate of deep-percolation drainage water; i.e., $V_{iw} - V_{et}$.

§Estimate of leaching fraction; i.e., V_{dw}/V_{iw}.

¶Accumulated over entire experimental period.

TABLE 4. AVERAGE LEVELS OF SALINITY AND SODICITY ON JUNE 14, 1982, THROUGHOUT THE WHEAT ROOT ZONE, 1982 CROP, SUCCESSIVE CROP ROTATION*

Treatment†	Soil depth	EC_e	SAR_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*
C	0–6	2.37 (.13)	6.5 (.3)
	6–12	3.17 (.50)	7.0 (.5)
	12–18	3.48 (.76)	6.9 (.6)
	18–24	4.02 (.83)	7.3 (.9)
	24–36	5.23 (.72)	7.7 (1.0)
Ca	0–6	2.97 (.22)	6.6 (.2)
	6–12	3.13 (.4)	7.1 (.5)
	12–18	3.45 (.6)	6.8 (.4)
	18–24	4.4 (.7)	7.9 (.7)
	24–36	5.5 (.4)	7.6 (.8)
cA	0–6	4.38 (.21)	8.5 (.2)
	6–12	3.68 (.2)	7.5 (.2)
	12–18	4.25 (.4)	7.2 (.2)
	18–24	5.1 (.4)	7.3 (.3)
	24–36	5.6 (.3)	8.1 (.5)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 5. AVERAGE SALINITY AND SODICITY LEVELS ON NOVEMBER 17, 1982, IN THE SEED-LINE REGION OF THE SUGARBEET SEEDBED, 1982 CROP*

Treatment†	Soil depth	EC_e	SAR_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*
C	0–6	3.6 (.6)	5.7 (.6)
Ca	0–6	4.2 (.7)	6.6 (.6)
cA	0–6	5.7 (.7)	9.1 (.7)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 6. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON ON JUNE 24, 1983, THROUGHOUT THE SUGARBEET ROOT ZONE BENEATH THE FURROW, 1983 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	2.2 (.3)	4.7 (.4)	.77 (.07)
	6–12	2.9 (.5)	5.5 (.1)	.63 (.07)
	12–18	3.5 (.6)	6.2 (.4)	.68 (.03)
	18–24	4.0 (.5)	6.6 (.5)	.65 (.05)
	24–36	4.8 (.4)	6.8 (.8)	.61 (.06)
Ca	0–6	3.6 (.3)	6.7 (.3)	1.01 (.08)
	6–12	3.8 (.4)	6.1 (.2)	.74 (.07)
	12–18	4.0 (.5)	6.3 (.3)	.72 (.06)
	18–24	4.8 (.3)	6.2 (.6)	.71 (.08)
	24–36	5.1 (.3)	6.7 (.7)	.76 (.09)
cA	0–6	4.2 (.1)	8.3 (.5)	1.12 (.15)
	6–12	3.9 (.4)	7.5 (.3)	.66 (.06)
	12–18	4.6 (.5)	7.1 (.3)	.63 (.05)
	18–24	5.4 (.3)	6.9 (.5)	.58 (.06)
	24–36	5.5 (.3)	7.1 (.6)	.62 (.07)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations each in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 7. AVERAGE LEVELS OF SALINITY AND SODICITY ON SEPTEMBER 1, 1983, IN THE SEED-LINE REGION OF THE CANTALOUPE SEEDBED, 1983 CROP*

Treatment†	Soil depth	EC_e	SAR_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$
C	0–6	6.3 (1.1)	4.2 (.4)
Ca	0–6	10.7 (1.3)	6.2 (.8)
cA	0–6	10.3 (2.4)	7.3 (1.2)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 8. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON ON NOVEMBER 22, 1983, THROUGHOUT THE CANTALOUPE ROOT ZONE BENEATH THE FURROW, 1983 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	3.6 (.6)	3.1 (.3)	.39 (.05)
	6–12	4.0 (.9)	4.0 (.6)	.32 (.06)
	12–18	4.3 (.9)	4.2 (.8)	.28 (.06)
	18–24	5.3 (.7)	4.1 (.8)	.30 (.07)
	24–36	5.3 (.7)	3.9 (.8)	.33 (.09)
Ca	0–6	3.3 (.3)	3.5 (.1)	.43 (.02)
	6–12	4.4 (.6)	3.9 (.2)	.39 (.02)
	12–18	5.3 (.5)	3.8 (.2)	.34 (.03)
	18–24	5.8 (.4)	3.9 (.4)	.41 (.06)
	24–36	6.7 (.5)	4.4 (.6)	.47 (.08)
cA	0–6	3.3 (.4)	3.6 (.2)	.53 (.03)
	6–12	4.2 (.6)	4.5 (.2)	.42 (.04)
	12–18	5.1 (.5)	4.4 (.3)	.42 (.04)
	18–24	5.8 (.4)	4.1 (.2)	.41 (.07)
	24–36	6.5 (.6)	4.3 (.4)	.44 (.07)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations each in replicates 2 and 5.

†C = Only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 9. AVERAGE LEVELS OF SALINITY AND SODICITY ON JANUARY 17, 1984, IN THE WHEAT SEEDBED, 1984 CROP; SUCCESSIVE CROP ROATION*

Treatment†	**Soil depth**	**EC_e**	**SAR_e**	**B_e**
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	2.35 (.6)	5.55 (.05)	0.89 (.18)
Ca	0–6	2.10 (.1)	6.60 (.00)	0.91 (.16)
cA	0–6	2.35 (.3)	6.00 (1.3)	0.83 (.05)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations each in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 10. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON ON JUNE 4, 1984, IN THE WHEAT ROOT ZONE, 1984 CROP, SUCCESSIVE CROP ROTATION*

Treatment†	**Soil depth**	**EC_e**	**SAR_e**	**B_e**
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	2.43 (.2)	5.8 (.05)	.82 (.02)
	6–12	2.94 (.4)	6.4 (.3)	.68 (.04)
	12–18	2.96 (–)	7.8 (–)	.62 (–)
	18–24	4.60 (.2)	5.5 (.1)	.46 (.06)
	24–36	4.88 (.2)	6.2 (.6)	.42 (.02)
	36–48	5.09 (.3)	7.0 (.7)	1.12 (.66)
Ca	0–6	3.70 (.1)	7.3 (.01)	1.39 (.54)
	6–12	4.38 (.4)	7.6 (.5)	1.43 (.78)
	12–18	4.80 (.4)	6.4 (.04)	1.13 (.66)
	18–24	5.55 (.05)	7.7 (.3)	1.12 (.49)
	24–36	5.56 (.05)	7.7 (.02)	1.05 (.51)
	36–48	4.07 (1.8)	8.3 (.8)	1.03 (.46)
cA	0–6	3.95 (.25)	8.2 (.3)	.89 (.00)
	6–12	4.88 (1.1)	8.1 (.1)	.71 (.05)
	12–18	5.02 (1.4)	8.8 (.4)	.70 (.03)
	18–24	5.39 (1.1)	7.9 (1.2)	.62 (.03)
	24–36	5.94 (.2)	7.0 (1.1)	.48 (.06)
	36–48	6.30 (.5)	8.0 (2.1)	.54 (.13)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations each in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 11. AVERAGE LEVELS OF SALINITY AND SODICITY ON OCTOBER 9, 1984, IN THE SEED-LINE REGION OF THE SUGARBEET SEEDBED, 1985 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	2.4 (.3)	5.3 (.2)	.52 (.02)
Ca	0–6	2.3 (.3)	5.8 (.3)	.56 (.02)
cA	0–6	2.1 (.2)	6.2 (.3)	.58 (.02)

*Values within parentheses are standard error of mean; 18 replicates; samples collected from three locations each in all replicates.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 12. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE FURROW ON JUNE 24, 1985, THROUGHOUT THE SUGARBEET ROOT ZONE, 1985 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	2.9 (.4)	5.6 (.2)	.70 (.09)
	6–12	3.5 (.6)	6.2 (.4)	.42 (.03)
	12–18	4.8 (.3)	6.3 (.5)	.38 (.03)
	18–24	5.3 (.3)	6.4 (.5)	.39 (.04)
	24–36	4.6 (.8)	6.8 (.8)	.38 (.05)
Ca	0–6	5.5 (.2)	8.2 (.1)	.76 (.04)
	6–12	4.8 (.4)	7.8 (.2)	.44 (.02)
	12–18	5.7 (.4)	7.7 (.5)	.40 (.03)
	18–24	6.0 (.4)	7.6 (.7)	.39 (.02)
	24–36	6.0 (.3)	7.3 (.5)	.38 (.02)
cA	0–6	6.6 (.5)	9.1 (.5)	.98 (.21)
	6–12	6.0 (.4)	8.7 (.2)	.45 (.04)
	12–18	6.4 (.3)	8.9 (.3)	.40 (.03)
	18–24	6.6 (.2)	8.3 (.3)	.38 (.03)
	24–36	6.7 (.1)	8.2 (.2)	.35 (.03)

*Values within parentheses are standard error of mean; 18 replicates; samples collected from three locations each in all replicates.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 13. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON ON SEPTEMBER 5, 1985, IN THE SEED-LINE REGION OF THE CANTALOUPE SEEDBED, 1985 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	2.29 (.1)	4.9 (.2)	0.74 (.06)
Ca	0–6	2.85 (.3)	5.5 (.1)	0.79 (.07)
cA	0–6	2.37 (.1)	6.7 (.4)	0.83 (.02)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations each in replicates 2 and 5.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 14. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE FURROW ON DECEMBER 16, 1985 THROUGHOUT THE CANTALOUPE ROOT ZONE, 1985 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	4.0 (.5)	5.8 (.3)	1.00 (.03)
	6–12	2.5 (.5)	5.1 (.5)	0.73 (.04)
	12–18	3.0 (.7)	5.4 (.4)	0.55 (.03)
	18–24	4.6 (.4)	5.4 (.7)	0.50 (.02)
	24–36	4.6 (.5)	5.8 (.7)	0.49 (.03)
	36–48	4.7 (.6)	7.2 (1.1)	0.46 (.03)
	48–60	4.8 (.5)	6.0 (0.7)	0.46 (.04)
Ca	0–6	5.6 (.9)	7.7 (0.5)	1.26 (.14)
	6–12	3.7 (.4)	7.1 (0.3)	0.93 (.09)
	12–18	4.8 (.5)	7.1 (0.4)	0.69 (.07)
	18–24	5.4 (.5)	6.9 (0.5)	0.54 (.04)
	24–36	5.7 (.3)	6.9 (0.6)	0.49 (.03)
	36–48	6.2 (.5)	7.4 (0.8)	0.48 (.04)
	48–60	5.7 (.3)	7.2 (0.9)	0.48 (.04)
cA	0–6	5.8 (1.0)	8.5 (0.6)	1.24 (.09)
	6–12	4.9 (.4)	7.8 (0.4)	0.99 (.11)
	12–18	5.6 (.5)	7.9 (0.2)	0.73 (.06)
	18–24	6.3 (.3)	7.6 (0.2)	0.60 (.04)
	24–36	6.1 (.2)	7.7 (0.3)	0.51 (.03)
	36–48	6.5 (.3)	8.1 (0.3)	0.52 (.04)
	48–60	6.4 (.1)	8.2 (0.3)	0.48 (.04)

*Values within parentheses are standard error of mean; 18 replicates; samples collected from three locations each in all replicates.

†C = only Colorado River water used for irrigation; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts.

TABLE 15. AVERAGE LEVELS OF SOIL SALINITY AND SODICITY ON MAY 13, 1982, IN THE SEED-LINE REGION OF THE COTTON SEEDBED, 1982 CROP*

Treatment†	Soil depth	EC_e	SAR_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$
C	0–6	4.20 (.38)	5.5 (.2)
cA	0–6	3.53 (.43)	5.5 (.3)
A	0–6	7.10 (.37)	8.1 (.3)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations in replicates 2 and 5.

†C = only Colorado River water used for irrigation; cA = Alamo River water substituted for Colorado River water after seedling establishment; A = only Alamo River water used.

TABLE 16. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE FURROW ON NOVEMBER 3, 1982 THROUGHOUT THE COTTON ROOT ZONE, 1982 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	2.47 (.11)	5.5 (.3)	0.88 (.03)
	6–12	3.28 (.50)	6.3 (.3)	0.85 (.03)
	12–18	3.88 (.67)	6.8 (.4)	0.77 (.03)
	18–24	4.17 (.70)	7.6 (.5)	0.72 (.04)
	24–30	5.33 (.47)	8.3 (1.0)	0.80 (.06)
	30–36	5.70 (.55)	8.7 (1.2)	0.78 (.07)
cA	0–6	3.90 (.11)	7.9 (.3)	1.23 (.07)
	6–12	5.00 (.48)	7.9 (.4)	1.03 (.08)
	12–18	5.63 (.48)	8.2 (.6)	0.97 (.06)
	18–24	6.20 (.26)	9.0 (.7)	0.97 (.10)
	24–30	6.78 (.40)	9.9 (.9)	1.00 (.11)
	30–36	6.98 (.64)	10.9 (1.5)	1.05 (.11)
A	0–6	5.23 (.44)	8.9 (.4)	1.12 (.12)
	6–12	6.07 (.22)	8.5 (.2)	0.93 (.12)
	12–18	6.45 (.17)	8.9 (.4)	0.83 (.11)
	18–24	6.98 (.19)	9.3 (.6)	0.82 (.09)
	24–30	6.90 (.24)	10.1 (.8)	0.83 (.09)
	30–36	6.97 (.38)	10.1 (1.0)	0.87 (.12)

*Values within parentheses are standard error of mean; six replicates; samples collected from three locations each in replicates 2 and 5.

†C = only Colorado River water used for irrigation; cA = Alamo River water substituted for Colorado River water after seedling establishment; A = only Alamo River water used.

TABLE 17. AVERAGE LEVELS OF SOIL SALINITY AND SODICITY ON JULY 20, 1983 IN THE SEED-LINE REGION OF THE COTTON SEEDBED, 1983 CROP*

Treatment†	EC_e	SAR_e
	dS/m	$(mmol_c/L)^{1/2}$
C	10.9 (3.4)	12.5 (2.7)
Ca	6.3 (1.0)	11.5 (2.2)
A	18.6 (3.1)	25.0 (3.6)

*Values within parentheses are standard error of mean; 18 replicates; samples collected from three locations each in all six replicates.

†C = only Colorado River water used for irrigation; cA = Alamo River water substituted for Colorado River water after seedling establishment; A = only Alamo River water used.

TABLE 18. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE FURROW ON DECEMBER 12, 1983, THROUGHOUT THE COTTON ROOT ZONE, 1983 CROP*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	3.5 (.4)	5.4 (0.2)	1.18 (.06)
	6–12	5.0 (.6)	7.6 (.7)	1.15 (.04)
	12–18	6.5 (.5)	8.8 (.9)	1.11 (.08)
	18–24	6.8 (.5)	9.7 (1.0)	1.12 (.07)
	24–36	7.2 (.5)	10.2 (.9)	1.11 (.10)
Ca	0–6	6.7 (.4)	9.8 (.5)	1.51 (.05)
	6–12	7.6 (.3)	10.8 (.7)	1.29 (.11)
	12–18	8.2 (.2)	11.4 (.7)	1.28 (.12)
	18–24	8.3 (.4)	12.3 (1.1)	1.43 (.14)
	24–36	8.4 (.7)	13.2 (1.5)	1.27 (.15)
A	0–6	7.7 (.5)	11.0 (.4)	1.92 (.11)
	6–12	7.6 (.3)	10.8 (.4)	1.51 (.06)
	12–18	7.9 (.3)	10.8 (.7)	1.33 (.12)
	18–24	8.1 (.3)	10.7 (.9)	1.37 (.09)
	24–36	8.3 (.4)	11.4 (1.1)	1.27 (.06)

*Values within parentheses are standard error of mean; 18 replicates; samples collected from three locations each in all replicates.

†C = only Colorado River water used for irrigation; cA = Alamo River water substituted for Colorado River water after seedling establishment; A = only Alamo River water used.

TABLE 19. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON THROUGHOUT THE WHEAT ROOT ZONE AFTER THE IRRIGATION OF JANUARY 17, 1987*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	3.0 (.35)	4.9 (.3)	.80 (.04)
	6–12	4.6 (1.2)	6.7 (1.6)	.75 (.06)
	12–18	5.5 (1.1)	8.2 (1.2)	.77 (.04)
	18–24	6.8 (1.2)	10.5 (2.4)	.82 (.02)
	24–36	7.6 (.90)	11.7 (2.5)	.84 (.06)
	36–48	7.5 (1.2)	11.1 (2.2)	.78 (.09)
cA	0–6	4.0 (.75)	7.5 (.41)	.75 (.08)
	6–12	6.2 (.83)	8.8 (.78)	1.05 (.06)
	12–18	7.7 (.79)	9.9 (.82)	.88 (.03)
	18–24	8.0 (.57)	10.2 (.72)	.74 (.03)
	24–36	8.1 (.42)	10.2 (1.1)	.72 (.05)
	36–48	7.8 (.43)	10.5 (1.1)	.82 (.08)
A	0–6	5.6 (.39)	10.9 (.9)	1.22 (.01)
	6–12	8.0 (.54)	12.8 (.1)	1.15 (.06)
	12–18	8.5 (.29)	12.0 (.2)	.86 (.06)
	18–24	8.2 (.34)	12.0 (.2)	.75 (.04)
	24–36	7.8 (.50)	11.3 (.7)	.76 (.04)
	36–48	8.1 (.55)	12.0 (.9)	.94 (.22)

*Values within parentheses are standard error of mean; three samples were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop; Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 20. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON THROUGHOUT THE WHEAT ROOT ZONE AFTER THE IRRIGATION OF FEBRUARY 24, 1984*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	2.3 (.3)	5.5 (.1)	.88 (.06)
	6–12	3.8 (.8)	6.3 (.2)	.76 (.03)
	12–18	5.0 (.9)	8.1 (.8)	.66 (.06)
	18–24	6.3 (.9)	9.4 (1.7)	.66 (.11)
	24–36	7.4 (.5)	10.6 (1.3)	.67 (.06)
	36–48	7.4 (.7)	12.7 (2.9)	.60 (.13)
cA	0–6	3.2 (.5)	7.3 (1.1)	1.02 (.06)
	6–12	5.6 (.7)	8.5 (.6)	.75 (.08)
	12–18	7.0 (.1)	9.8 (.3)	.70 (.06)
	18–24	7.3 (.3)	9.0 (.5)	.58 (.03)
	24–36	7.6 (.5)	10.9 (1.4)	.65 (.14)
	36–48	7.4 (.7)	10.2 (1.4)	.61 (.12)
A	0–6	3.5 (.4)	7.2 (.2)	1.20 (.03)
	6–12	6.0 (.2)	10.2 (.7)	.98 (.03)
	12–18	7.0 (.5)	10.7 (.5)	.77 (.04)
	18–24	7.2 (.2)	10.3 (.3)	.72 (.06)
	24–36	7.8 (.4)	10.0 (1.0)	.65 (.13)
	36–48	8.1 (.7)	10.1 (1.4)	.69 (.14)

*Values within parentheses are standard error of mean; three samples collected were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 21. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON THROUGHOUT THE WHEAT ROOT ZONE AFTER THE IRRIGATION OF MARCH 26, 1984*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	2.3 (.44)	4.9 (.12)	.78 (.02)
	6–12	3.5 (1.0)	6.2 (.48)	.80 (.01)
	12–18	5.5 (1.4)	9.0 (1.6)	.67 (.06)
	18–24	6.2 (.95)	9.4 (1.4)	.68 (.06)
	24–36	6.9 (.64)	10.4 (1.5)	.58 (.05)
	36–48	7.6 (.90)	11.0 (2.3)	.63 (.13)
cA	0–6	2.2 (.2)	6.4 (.40)	.91 (.06)
	6–12	4.6 (.4)	9.8 (.60)	.82 (.05)
	12–18	5.9 (.6)	10.7 (1.3)	.79 (.09)
	18–24	7.4 (.3)	10.0 (1.0)	.73 (.12)
	24–36	6.5 (.7)	11.4 (1.5)	.71 (.08)
	36–48	6.4 (.4)	11.0 (2.2)	.65 (.11)
A	0–6	3.2 (.30)	6.6 (.52)	.99 (.05)
	6–12	6.2 (.23)	10.4 (.23)	.97 (.04)
	12–18	7.4 (.47)	11.4 (.50)	.74 (.06)
	18–24	7.6 (.58)	12.1 (1.5)	.66 (.07)
	24–36	7.5 (.44)	11.5 (2.0)	.65 (.09)
	36–48	8.2 (.84)	11.3 (1.8)	.67 (.12)

*Values within parentheses are standard error of mean; three samples collected were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 22. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON THROUGHOUT THE WHEAT ROOT ZONE AFTER THE IRRIGATION OF APRIL 13, 1984*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	$(mmol_c/L)^{1/2}$	*mg/L*
C	0–6	2.0 (.3)	5.0 (.3)	.67 (.02)
	6–12	4.3 (1.0)	6.5 (.1)	.61 (.06)
	12–18	5.2 (1.2)	7.9 (.8)	.60 (.08)
	18–24	6.3 (.8)	8.5 (1.1)	.56 (.10)
	24–36	6.7 (.8)	9.1 (1.6)	.54 (.08)
	36–48	6.7 (.9)	9.0 (1.4)	.59 (.16)
cA	0–6	3.2 (.7)	6.4 (.3)	.75 (.05)
	6–12	5.5 (1.3)	8.5 (.6)	.69 (.02)
	12–18	6.6 (.8)	9.2 (.8)	.50 (.03)
	18–24	6.9 (.6)	9.4 (.6)	.61 (.03)
	24–36	7.6 (.6)	10.3 (.6)	.55 (.04)
	36–48	8.1 (.7)	10.4 (1.5)	.57 (.07)
A	0–6	3.6 (.3)	6.7 (.7)	.95 (.06)
	6–12	6.0 (.7)	9.0 (.3)	.82 (.03)
	12–18	7.4 (.9)	10.6 (1.0)	.68 (.07)
	18–24	7.8 (.8)	11.4 (1.1)	.67 (.04)
	24–36	8.4 (1.0)	11.4 (1.8)	.58 (.07)
	36–48	9.1 (1.3)	12.2 (2.1)	.68 (.15)

*Values within parentheses are standard error of mean; three samples collected were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 23. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON THROUGHOUT THE WHEAT ROOT ZONE AFTER THE IRRIGATION OF APRIL 30, 1984*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	2.5 (.3)	4.1 (.4)	.61 (.04)
	6–12	4.5 (.8)	6.3 (.7)	.57 (.03)
	12–18	5.3 (.9)	7.7 (1.3)	.54 (.05)
	18–24	5.7 (1.0)	8.6 (1.9)	.52 (.06)
	24–36	6.3 (0.7)	8.7 (2.0)	.52 (.07)
	36–48	6.2 (0.6)	8.6 (1.7)	.46 (.05)
cA	0–6	2.9 (.5)	5.2 (.9)	.74 (.05)
	6–12	5.8 (1.4)	8.5 (1.4)	.72 (.06)
	12–18	7.2 (.5)	9.8 (1.5)	.61 (.03)
	18–24	7.4 (.5)	10.0 (1.1)	.58 (.00)
	24–36	7.6 (.6)	10.5 (1.3)	.49 (.04)
	36–48	7.9 (1.2)	10.9 (1.6)	.55 (.06)
A	0–6	2.9 (.5)	5.6 (.7)	.73 (.05)
	6–12	6.4 (.5)	9.9 (.9)	.74 (.07)
	12–18	7.6 (.9)	10.8 (1.8)	.59 (.04)
	18–24	7.8 (.7)	10.6 (1.6)	.54 (.03)
	24–36	7.6 (.7)	10.3 (1.7)	.56 (.07)
	36–48	7.5 (.8)	11.0 (2.1)	.54 (.10)

*Values within parentheses are standard error of mean; three samples were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 24. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON THROUGHOUT THE WHEAT ROOT ZONE AFTER THE IRRIGATION OF JUNE 5, 1984*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	3.6 (.9)	5.3 (.6)	1.08 (.12)
	6–12	6.6 (1.9)	9.6 (1.9)	.91 (.08)
	12–18	8.2 (2.0)	10.0 (1.8)	.85 (.02)
	18–24	7.7 (1.3)	11.1 (2.0)	.78 (.06)
	24–36	9.8 (1.9)	11.8 (2.7)	.78 (.11)
	36–48	9.3 (1.4)	11.3 (1.6)	.78 (.08)
cA	0–6	2.6 (.4)	5.6 (.8)	1.07 (.08)
	6–12	5.7 (1.0)	8.5 (1.0)	.90 (.06)
	12–18	7.0 (1.1)	9.5 (1.4)	.77 (.07)
	18–24	8.1 (.8)	9.9 (1.2)	.77 (.06)
	24–36	8.0 (.9)	10.3 (1.3)	.78 (.09)
	36–48	9.3 (1.3)	11.7 (2.0)	.79 (.13)
A	0–6	2.7 (.4)	5.3 (.1)	1.07 (.05)
	6–12	6.0 (.9)	9.0 (.8)	.92 (.07)
	12–18	7.7 (.9)	10.8 (1.7)	.79 (.04)
	18–24	8.7 (.8)	10.9 (1.6)	.75 (.05)
	24–36	8.4 (1.0)	10.5 (1.9)	.71 (.05)
	36–48	9.3 (1.4)	11.7 (2.7)	.93 (.15)

*Values within parentheses are standard error of mean; three samples were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 25. AVERAGE LEVELS OF SALINITY AND SODICITY ON NOVEMBER 15, 1984, IN THE SEED-LINE REGION OF THE ALFALFA SEEDBED*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	4.0 (.03)	6.3 (0.2)	0.64 (.01)
cA	0–6	4.3 (0.4)	7.1 (0.3)	0.72 (.03)
A	0–6	4.4 (0.4)	7.1 (0.4)	0.79 (.04)

*Values within parentheses are standard error of mean; 18 replicates; three samples collected separately from each of all six replicates.

†Only Colorado River water was used to irrigate this crop; Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 26. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE SEED-LINE THROUGHOUT THE ALFALFA ROOT ZONE AFTER THE IRRIGATION OF APRIL 3, 1985*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	3.73 (1.18)	7.9 (1.6)	0.86 (.09)
	6–12	4.20 (1.31)	9.4 (1.7)	0.82 (.02)
	12–18	5.03 (1.24	12.1 (1.8)	0.90 (.21)
	18–24	5.43 (0.92)	10.8 (.85)	0.58 (.01)
	24–36	6.87 (0.78)	13.6 (2.4)	0.57 (.07)
	36–48	8.13 (1.06)	16.9 (3.7)	0.66 (.05)
cA	0–6	2.70 (.45)	7.3 (.6)	1.01 (.08)
	6–12	4.30 (.71)	10.1 (1.0)	.88 (.08)
	12–18	5.13 (.47)	10.9 (0.8)	.79 (.10)
	18–24	6.30 (.23)	11.5 (1.0)	.57 (.08)
	24–36	7.43 (.38)	13.6 (0.6)	.57 (.11)
	36–48	8.07 (.64)	13.8 (0.9)	.54 (.08)
A	0–6	3.67 (.45)	9.0 (1.1)	1.01 (.04)
	6–12	5.10 (.89)	11.2 (1.2)	.89 (.04)
	12–18	6.67 (.47)	13.0 (.8)	.67 (.04)
	18–24	7.17 (.58)	13.0 (1.1)	.59 (.02)
	24–36	7.37 (.68)	13.8 (1.4)	.54 (.04)
	36–48	7.13 (.72)	13.7 (2.2)	.57 (.07)

*Values within parentheses are standard error of mean; three samples were composited into one sample from each of replicates 1, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 27. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE SEED-LINE THROUGHOUT THE ALFALFA ROOT ZONE AFTER THE IRRIGATION OF JULY 30, 1985*

Treatment†	**Soil depth**	**EC_e**	**SAR_e**	**B_e**
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	1.76 (.12)	4.3 (.2)	.90 (.13)
	6–12	3.11 (1.04)	5.8 (.7)	.99 (.13)
	12–18	5.55 (1.66)	7.5 (1.5)	.89 (.10)
	18–24	6.36 (1.09)	9.1 (2.1)	.75 (.09)
	24–36	6.40 (.29)	9.4 (.8)	.68 (.03)
	36–48	7.80 (1.00)	10.3 (1.2)	.74 (.04)
cA	0–6	2.71 (1.19)	5.7 (1.3)	1.18 (.28)
	6–12	4.24 (.71)	6.8 (.9)	1.13 (.18)
	12–18	6.83 (.52)	8.7 (.6)	.95 (.16)
	18–24	7.75 (.65)	10.8 (1.1)	.79 (.13)
	24–36	8.47 (.33)	12.6 (1.1)	.69 (.05)
	36–48	9.10 (.21)	13.0 (1.0)	.82 (.11)
A	0–6	1.88 (.09)	5.0 (.3)	.89 (.10)
	6–12	4.48 (.52)	7.0 (.4)	1.10 (.16)
	12–18	6.20 (.34)	7.6 (2.3)	.84 (.16)
	18–24	6.46 (.19)	10.3 (0.5)	.69 (.12)
	24–36	7.78 (.15)	11.2 (.5)	.65 (.09)
	36–48	8.36 (.60)	12.4 (1.0)	.65 (.11)

*Values within parentheses are standard error of mean; three samples were composited into one sample from each of replicates 2, 3, and 6.

†Only Colorado River water was used to irrigate this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 28. AVERAGE LEVELS OF SALINITY, SODICITY, AND BORON BENEATH THE SEED-LINE THROUGHOUT THE ALFALFA ROOT ZONE AFTER THE IRRIGATION OF DECEMBER 19, 1985*

Treatment†	Soil depth	EC_e	SAR_e	B_e
	inches	*dS/m*	*$(mmol_c/L)^{1/2}$*	*mg/L*
C	0–6	2.54 (.46)	4.7 (0.3)	1.18 (.16)
	6–12	4.96 (.79)	6.1 (0.6)	1.11 (.14)
	12–18	6.00 (.66)	7.8 (.7)	.93 (.08)
	18–24	7.36 (.55)	10.0 (1.1)	.85 (.07)
	24–36	7.91 (.90)	11.2 (1.5)	.82 (.05)
	36–48	8.41 (.55)	12.3 (0.9)	.86 (.04)
	48–60	8.25 (.62)	12.1 (1.2)	.86 (.08)
cA	0–6	3.15 (.51)	6.1 (0.5)	1.36 (.10)
	6–12	6.55 (.72)	8.2 (0.6)	1.56 (.05)
	12–18	7.64 (.94)	10.5 (0.8)	1.25 (.07)
	18–24	8.24 (.89)	11.6 (1.1)	1.00 (.05)
	24–36	9.11 (.81)	13.2 (1.8)	.90 (.09)
	36–48	9.40 (1.09)	14.0 (2.5)	.88 (.08)
	48–60	9.91 (1.17)	15.5 (2.9)	.94 (.11)
A	0–6	2.33 (.14)	5.3 (.3)	1.44 (.09)
	6–12	5.51 (.71)	7.6 (.1)	1.59 (.10)
	12–18	7.24 (.46)	9.8 (.7)	1.17 (.07)
	18–24	8.40 (.52)	12.2 (1.3)	.93 (.05)
	24–36	9.57 (.83)	13.6 (2.0)	.87 (.08)
	36–48	10.46 (1.04)	14.3 (2.4)	.86 (.07)
	48–60	9.29 (.85)	13.2 (2.1)	.85 (.09)

*Values within parentheses are standard error of mean; 18 replicates; three samples collected from each of all six replicates.

†Colorado River water was used solely for the irrigation of this crop (C); Alamo River water was used to irrigate the two preceding cotton crops solely (A) or after seedling establishment with Colorado River water (cA).

TABLE 29. WHEAT CANOPY TEMPERATURES ON MARCH 31, 1982*

Time	Treatment†‡							
	C_2	C_5	Ca_2	Ca_5	cA_2	CA_5	DB§	WB¶
	°C							
1027–1116	21.0 (0.69)	21.2 (0.87)	20.5 (0.68)	21.0 (0.55)	21.0 (0.66)	21.0 (0.96)	21.2	14.8
1256–1341	21.7 (0.76)	21.6 (0.55)	21.6 (0.48)	21.8 (0.52)	21.8 (0.67)	21.8 (0.68)	23.2	16.2
1424–1503	21.6 (0.85)	21.3 (0.52)	21.8 (0.62)	21.2 (0.29)	21.5 (0.79)	20.9 (0.58)	23.2	15.5

*Wheat was at or just before anthesis. Temperature values are averages of 24 oblique canopy temperatures measured with an IRT (12 north and 12 south).

†C = only Colorado River water used for irrigation, replicates 2 and 5; Alamo River water used for irrigation after seedling establishment in relatively lesser (Ca) and greater (cA) amounts, replicates 2 and 5.

‡Numbers within parentheses are standard deviations.

§Dry bulb air temperature.

¶Wet bulb air temperature.

TABLE 30. COTTON CANOPY TEMPERATURES ON THREE DATES IN 1982*

Date	Time	Treatment† C	Treatment† cA	Treatment† A	DB‡	WB§
		°C				
Aug. 2	0811–0852	26.5	26.8	26.6	30.0	20.3
	0921–1001	28.0	28.2	28.0	32.8	22.7
	1024–1105	28.7	29.1	28.7	35.0	22.3
	1140–1222	30.0	30.1	29.9	34.8	23.8
	1311–1347	29.5	30.2	29.6	37.0	21.4
	1425–1508	29.6	30.5	30.5	37.5	21.9
	1553–1638	31.8	32.7	31.9	36.8	20.8
Sept. 21	0959–1041	30.4	30.3	30.2	30.6	20.8
	1116–1200	31.7	31.9	31.8	33.2	21.5
	1238–1326	32.7	32.6	32.9	34.5	21.6
	1352–1437	32.6	32.1	32.3	35.2	21.0
Sept. 28	1010–1048	25.8	25.8	25.7	24.3	15.3
	1154–1228	27.8	27.6	27.5	28.4	16.0
	1340–1421	28.4	28.1	28.3	27.6	16.4
	1551–1532	26.5	26.3	26.2	27.2	16.4

*Temperature values are averages of 96 observations (six north- and six south-facing oblique temperatures in each of six replicates per treatment).

†C and A = only Colorado River and Alamo River waters used for irrigation, respectively; cA = Alamo River water used for irrigation following seedling establishment with Colorado River water. Nonparametric statistical analysis using Friedman's analyses of variance by ranks reveal no difference among treatments.

‡Dry bulb air temperature at 1.5 m.

§Wet bulb air temperature at 1.5 m.

TABLE 31. COTTON LEAF DIFFUSION RESISTANCE ON TWO DATES IN 1982*

Date	Time	Treatment†‡ C	Treatment†‡ cA	Treatment†‡ A
Sept. 21	1006–1107	1.34 (0.48)	1.18 (0.32)	1.09 (0.27)
	1207–1304	1.02 (0.20)	0.99 (0.19)	0.86 (0.10)
	1343–1442	0.92 (0.21)	0.89 (0.15)	0.77 (0.09)
Sept. 28	1011–1117	2.38 (0.55)	1.77 (0.47)	2.67 (1.70)
	1154–1258	1.45 (0.41)	1.39 (0.32)	1.41 (0.18)
	1345–1444	1.42 (0.26)	1.53 (0.21)	1.49 (0.31)

*Resistance values are averages of four upper and four lower leaf diffusion resistances measured in two replicates of each treatment, seconds/cm. The upper and lower leaf surfaces were considered to be connected in parallel and computed as the product of the upper and lower resistances divided by their sum.

†C and A = only Colorado River or Alamo River waters used for irrigation, respectively; cA = Alamo River water used for irrigation following seedling establishment with Colorado River water.

‡Values within parentheses are standard deviations.

APPENDIX: Climatological Data for Experimental Period

TABLE 1. CLIMATOLOGICAL DATA, IRRIGATED DESERT RESEARCH STATION, BRAWLEY, CALIFORNIA, 1982

	Temperature*											
	Year			Normal			Days				Rainfall	
Month	Mean max.	Mean min.	Mean daily	Mean max.	Mean min.	Mean daily	90°+	100°+	110°+	32°−	Year	Normal
	°F						number				inches	
Jan	69.5	39.7	54.6	77	30	53.7	0	0	0	3	.20	.39
Feb	76.6	45.8	61.2	87	33	58.1	0	0	0	0	.15	.33
Mar	76.3	47.4	61.8	85	38	61.8	0	0	0	0	.27	.30
Apr	85.8	52.2	69.0	95	42	67.8	10	0	0	0	0	.12
May	93.2	57.6	75.4	102	48	75.3	23	4	0	0	T	.04
Jun	100.8	62.4	81.6	109	53	84.1	30	18	0	0	0	.005
Jul	105.8	72.5	89.2	112	60	90.5	31	28	10	0	.76	.11
Aug	105.5	76.5	91.0	114	70	90.0	29	25	9	0	.04	.38
Sep	99.6	67.7	83.6	116	51	84.4	24	15	5	0	.16	.34
Oct	90.0	54.0	72.0	97	45	74.0	19	0	0	0	T	.21
Nov	75.5	45.1	60.3	86	36	62.1	0	0	0	0	.11	.24
Dec	68.9	40.5	54.7	78	32	54.3	0	0	0	1	1.86	.43
Annual	87.3	55.1	71.2	96.5	47.3	71.3	166	90	24	4	3.55	2.895

*Normal means based on 25-year average 1958–82 inclusive.

TABLE 2. CLIMATOLOGICAL DATA, IRRIGATED DESERT RESEARCH STATION, BRAWLEY, CALIFORNIA, 1983

	Temperature*						Days				Rainfall	
	Year			Normal								
Month	Mean max.	Mean min.	Mean daily	Mean max.	Mean min.	Mean daily	90°+	100°+	110°+	32°−	Year	Normal
	°F						number				inches	
Jan	73.0	41.1	57.0	82	28	53.8	0	0	0	4	.22	.38
Feb	72.8	45.0	58.9	84	36	58.1	0	0	0	0	1.02	.36
Mar	77.5	50.2	63.8	88	40	61.9	0	0	0	0	1.63	.35
Apr	81.3	49.4	65.4	93	40	67.7	2	0	0	0	0	.11
May	95.1	58.8	76.9	113	49	75.3	21	10	2	0	0	.04
Jun	102.2	63.2	82.7	108	53	84.1	28	24	0	0	0	.005
Jul	108.2	73.3	90.8	116	61	90.5	31	31	10	0	0	.11
Aug	102.6	76.3	89.4	114	67	90.0	29	21	7	0	3.05	.48
Sep	103.1	75.6	89.4	113	63	84.6	28	22	5	0	.75	.36
Oct	91.6	61.4	76.5	99	56	74.0	22	0	0	0	T	.21
Nov	79.5	49.2	64.4	92	35	62.2	1	0	0	0	0	.23
Dec	72.0	44.1	58.0	78	32	54.4	0	0	0	1	.84	.44
Annual	88.2	57.3	72.8	98.3	47.7	71.4	162	108	24	5	7.51	3.075

*Normal means based on 26-year average 1958–83 inclusive.

TABLE 3. CLIMATOLOGICAL DATA, IRRIGATED DESERT RESEARCH STATION, BRAWLEY, CALIFORNIA, 1984

Month	Temperature*						Days				Rainfall	
	Year			Normal								
	Mean max.	Mean min.	Mean daily	Mean max.	Mean min.	Mean daily	90°+	100°+	110°+	32°−	Year	Normal
	°F						number				inches	
Jan	74.0	41.5	57.8	84	31	53.9	0	0	0	2	.31	.38
Feb	77.1	42.0	59.6	85	34	58.2	0	0	0	0	0	.34
Mar	83.7	46.7	65.2	91	34	62.0	3	0	0	0	0	.34
Apr	85.7	51.0	68.4	103	43	67.7	9	2	0	0	T	.11
May	100.9	61.7	81.3	114	52	75.6	29	19	4	0	0	.04
Jun	102.7	66.2	84.5	113	55	84.1	30	22	3	0	0	T
Jul	105.2	77.6	91.4	115	69	90.6	31	28	8	0	1.07	.14
Aug	105.6	77.4	91.5	118	73	90.1	31	27	7	0	.02	.47
Sep	104.5	73.3	88.9	113	62	84.8	30	23	9	0	.13	.35
Oct	88.1	56.7	72.4	101	45	74.0	11	3	0	0	0	.20
Nov	77.8	45.9	61.8	90	33	62.1	1	0	0	0	.27	.23
Dec	66.0	42.4	54.2	74	31	54.4	0	0	0	2	1.46	.48
Annual	89.3	56.9	73.1	118	31	71.5	175	124	31	4	3.26	3.08

*Normal means based on 27-year average 1958–84 inclusive.

TABLE 4. CLIMATOLOGICAL DATA, IRRIGATED DESERT RESEARCH STATION, BRAWLEY, CALIFORNIA, 1985

Month	Temperature*						Days				Rainfall	
	Year			Normal								
	Mean max.	Mean min.	Mean daily	Mean max.	Mean min.	Mean daily	90°+	100°+	110°+	32°−	Year	Normal
	°F						number				inches	
Jan	69.0	39.6	54.3	75	32	53.6	0	0	0	1	.08	.37
Feb	72.2	40.0	56.1	86	26	58.1	0	0	0	4	.17	.34
Mar	78.6	46.9	62.8	88	35	62.0	0	0	0	0	0	.33
Apr	89.9	52.0	71.0	101	48	67.9	15	2	0	0	0	.11
May	96.5	59.1	77.8	103	50	75.6	29	6	0	0	0	.04
Jun	106.9	67.7	87.3	115	55	84.2	29	25	17	0	T	T
Jul	109.6	76.7	93.2	118	69	90.7	31	30	13	0	.06	.14
Aug	109.2	73.5	91.4	119	64	90.1	31	31	10	0	0	.45
Sep	96.1	65.1	80.6	109	55	84.6	23	13	0	0	.97	.37
Oct	89.9	58.3	74.1	103	49	74.0	17	1	0	0	.27	.20
Nov	76.0	45.7	60.8	90	33	62.1	4	0	0	0	1.00	.26
Dec	72.4	40.5	56.4	81	30	54.6	0	0	0	2	.52	.48
Annual	88.9	55.4	72.2	119	26	71.5	179	108	40	7	3.07	3.09

*Normal means based on 28-year average 1958–85 inclusive.

Continued from inside front cover

sive crop rotation of wheat:sugarbeets:cantaloupes) and cotton (in a block rotation of cotton:cotton:wheat:alfalfa). A good stand was obtained under relatively low conditions of salinity by using Colorado River water for the preplant and early-season irrigations.

The salt-sensitive crops in the rotations (cantaloupes and alfalfa) were irrigated with Colorado River water only. This procedure kept soil salinity within acceptable limits over time so that production and quality were sustained when the sensitive crops were grown on the same land.

The high crop yields and qualities obtained in this field test support the validity of the recommended strategy.

II. Soil Salinity and Water Balance

This paper presents data on water use and soil salinity status obtained in the field experiment—the remaining information needed to complete the "strategy verification" process. These data, together with those presented in part I, support the use of saline drainage waters for irrigation for the following reasons: (1) Soil salinity and boron were kept within acceptable limits for seedling establishment and subsequent growth of the individual crops grown in the rotations. (2) No significant loss of yield or crop quality occurred in any of the five crops grown with substitution of the saline Alamo River water for Colorado River water for up to 25 to 50 percent of the total irrigation requirements of the two representative rotations. (3) No problems of soil degradation were observed, even though accumulative leaching was minimal (less than 15 percent), with the clay soil.

S.I. EQUIVALENTS OF SELECTED ENGLISH UNITS

English	S.I.
1 acre	0.405 hectare (ha)
1 foot (ft)	0.304 meter (m)
1 inch (in)	2.54 centimeters (cm)
1 cubic foot (ft^3)	28.3 liters (L) or 0.0283 cubic meters (m^3)
1 acre-foot	12.33 ha-cm
1 ton (2000 lb)	0.907 tonne (t)
1 ton/acre	2.24 t/ha
1 pound (lb)	0.454 kilogram (kg)
1 lb/acre	1.12 kg/ha
1 pound/bushel (lb/bu)	12.87 kg/m^3

2.5 m-pr-10/88-BT/PF

The Journal HILGARDIA is published irregularly. Number of pages and number of issues vary per annually numbered volume. Address: Agriculture and Natural Resources Publications, University of California, 300 Lakeside Drive, 6th Floor, Oakland, CA 94612-3550.