Skip-Row Planting and Irrigation of Graded Furrows

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ABSTRACT

GROUNDWATER depletion, declining well yields, and increasing pumping costs are emphasizing the need to efficiently manage and use irrigation water for crop production in the Southern High Plains. Skip-row planting and irrigation of fewer furrows than crop rows, referred to as skip-row irrigation, has been used extensively to reduce water application for irrigated cotton. We hypothesized that skip-row irrigation can increase irrigation water-use efficiency for production of corn and grain sorghum by reducing water application quantities in graded furrows.

Skip-row irrigation field tests were conducted in 1976-77 on corn, and in 1979 on grain sorghum on a site having differential profile permeability associated with prior deep tillage. Tests consisted of planting two 0.75 m rows and leaving out one or two rows between planted strips in 1976, and one row between planted strips in 1977 and 1979. One furrow was irrigated between each pair of crop rows. Skip-row irrigation reduced average water intake from 130 to 60 mm, or to 46 percent of every-row irrigation. Where the residual deep tillage effect almost doubled water intake, skip-row irrigation averaged 34 percent of every-row irrigation. These data suggest that reduction of water intake is greater on more permeable soils. Water intake data indicate that skip-row irrigation is effective in reducing size of graded-furrow irrigation and limiting the potential losses to profile drainage.

Although skip-row irrigation reduced yields on a total-area basis, yields and irrigation water-use efficiencies on a planted-row basis were increased. An exception was when the number of seasonal irrigations of corn in 1977 was also reduced by one-half, which resulted in major plant water stress and low yields. We concluded that skip-row irrigation resulted in efficient use of irrigation water where planted-row yields were not reduced below conventional yields from every-row irrigation.

INTRODUCTION

Declining groundwater supplies and increasing energy costs emphasize the importance of efficient management and use of irrigation water in the Southern High Plains. The efficiency of water application, storage in the plant root zone, and use by crops are influenced by the irrigation amount applied. Frequently, graded-furrow applications are too large for efficient soil-profile storage and use by crops. Large applications can increase losses to profile drainage and surface runoff, and increase residual profile storage that is not taken up by plants. Wide spacing of irrigated furrows and alternate-furrow irrigation has developed as one practical way to reduce water application quantities.

Conventional furrow-irrigated field crops in this area, with the exception of wheat, are planted one row per bed and have the same number of furrows as crop rows. The use of a wide or alternate-furrow approach usually involves irrigating one furrow for every two crop rows. Irrigation of two normally spaced crop rows with one furrow is a practical system for wide-furrow irrigation. Where water is inadequate for the irrigated land available, wide-furrow irrigation can be combined with skip-row planting that leaves one or more unplated rows between planted strips. This practice can be used to spread a limited water supply over a larger area or to better maintain an existing irrigated area with declining groundwater and well yields, thus reducing the area in dryland cropping or fallow.

This paper reports the results of skip-row irrigation tests for grain production by corn and grain sorghum. Tests were conducted on a plot area that had differential profile permeability associated with residual effects of a one-time deep tillage with a large moldboard plow in 1966. The use of plots with differential permeability permitted obtaining results applicable to irrigated fine-textured soils with a range in water intake characteristics.

LITERATURE REVIEW

Wide spacing of irrigated furrows has been studied under a range of conditions in Texas and Oklahoma. In tests by Longenecker et al. (1969) and Stone et al. (1979), doubling the furrow spacing allowed water application to be reduced by one-half, while yields were usually not reduced. Where reductions occurred, they were relatively small, within the 10 to 20 percent range. Irrigation of wide-furrow spacing (1.5 to 2 m) had less effect in reducing irrigation-water intake in tests by Musick and Dusek (1974) on a slowly permeable soil where major lateral wetting occurred on the upper part of the field during the 12 to 24 h application sets. Sorghum yields from the upper part were similar to those obtained with conventional spacing; however, the reduced wetting of the lower part of the field from the wide-furrow spacing significantly reduced yield.

Skip-row planting of cotton has been widely used and extensively evaluated during the past 30 yr (Longenecker et al., 1963; Newman, 1967; Hawkins and Peacock, 1968; Kittock, 1975; Bruce, 1965). In almost all test conditions, cotton rows adjacent to skip-rows had increased yield per row, but the yield increase only partially com-

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pensated for leaving out rows; thus, yields on a total-area basis were reduced. The best-yielding skip-row system on a total-area basis has been seed two rows and skip one. Although leaving out more than one row increased the soil water storage available to plants and thus increased yield per row, total-area yields were reduced.

The use of alternating two rows planted with one skip-row and irrigating one furrow between the two planted rows facilitates the use of a wider furrow spacing than alternate-furrow irrigation, while maintaining each crop row adjacent to an irrigated furrow on one side. Newman (1967) tested this system along with the system of two planted rows alternated with two skip-rows for limited irrigation of cotton in the Souther High Plains. The plant-two, skip-one system of 1 m spaced rows increased average irrigation water-use efficiency for lint production by 52 percent, while the plant-two, skip-two system increased efficiency by 21 percent, compared with solid planting and every-furrow irrigation. Newman attributed increased per-row yield in part to plant ability to use soil water stored in the skip-one and skip-two row zones.

Musick and Dusek (1972) tested a double-bed, 2 m strip of grain sorghum that was irrigated by one furrow separating two beds and alternated with a 2 m strip of winter wheat during the nongrowing-season for sorghum. Since storage efficiency of nongrowing-season rainfall is normally quite low (Musick, 1970), this sytem used total annual rainfall for increased grain yields, better than conventional planting and irrigation of each crop. Both wheat and sorghum developed roots completely across the 2 m skip during the nongrowing period of the adjacent crop.

The narrow 2 m strips involving alternating crops were not practical for large-scale field production, so we initiated a study involving alternating 4.5 m strips of wheat and sorghum (Musick and Dusek, 1976). The sorghum strips consisted of six 0.75 m rows with the four inside rows irrigated by two furrows on a 1.5 m spacing. The four inside rows were adjacent to the irrigated furrow on one side, and the outside rows benefited from border-row effects. The border rows used soil water storage from the adjacent strip during the nongrowing period of winter wheat. In the 6 yr study, water intake was reduced to 47 percent of the intake when all five inside furrows of the six-row strip were irrigated. Grain yields were reduced by only 19 percent, indicating efficient use of water for grain production. Initial wetting of the soil profile was by emergence irrigation of all five inside furrows.

Where water application is substantially reduced, such as in wide-furrow irrigation, plant vegetative canopy should also be reduced to moderate evapotranspiration (ET) demand and severity of plant water stress. The use of skip-row planting reduced vegetative canopy more than is possible by reducing within-row plant spacing. Also, skip-row irrigation has a greater effect than alternate- or wide-furrow irrigation in reducing average size of water application quantities which can potentially increase irrigation water-use efficiency (IWUE). Musick and Dusek (1971) reduced the normal 100 mm irrigation in level border plots to 50 mm and increased average IWUE for grain production from 1.41 to 2.34 kg/m^3.

MATERIALS AND METHODS

Skip-row, graded-furrow irrigation tests were conducted at the USDA Conservation and Production Research Laboratory, Bushland, TX, with irrigated corn in 1976 and 1977 and grain sorghum in 1979. We selected the skip-row system of two rows planted and one skipped as a system designed to reduce water intake on Pullman clay loam to about one-half of that with conventional graded-furrow irrigation. Since the system of skip-row planting on graded-furrow irrigated land is primarily intended to reduce the size of irrigation and increase IWUE where water is limited, we designated the practice as "skip-row" irrigation. Farmers in the Southern High Plains commonly refer to irrigation of every furrow as "row irrigation." We used "every-row" irrigation to designate the practice of conventional graded-furrow irrigation.

The soil, Pullman clay loam, is a member of the fine, mixed thermic family of Torrertic Paleustolls. It has a clay loam A horizon mixed by tillage to the 0.2 m depth and clay B2t and B3 horizons that extend to about the 1.2 m depth overlying a calcic zone (35 to 70 percent calcium carbonate by weight). The soil has a relatively dense, blocky structure below the surface tillage layer, with bulk densities of 1.5 to 1.7. The profile is slowly permeable when wet, with basic intake rates of 1 to 3 mm/hr. The slowly permeable B2t horizon extends from normal tillage depth to about 0.6 m. The clay type is predominantly montmorillonite. Shrinkage cracks develop during major drying, causing the soil to have a relatively high initial water intake capacity during the first 20 to 30 min of about 40 mm. Normal intake during seasonal irrigation averages about 100 mm. Plant-available soil water for the 1.2 m major root zone, between $-1/3$ and -15 bar matric potential, is 160 mm (Musick et al. 1976).

The site was deep-tilled with a large moldboard plow, described by James and Wilkins (1972), as a one-time operation in 1966. The plow disrupted and partially vertically mixed the slowly permeable clay B2t horizon to 0.4 and 0.6 m. The 0.6 m plow depth fully penetrated this horizon, and the 0.8 m treatment penetrated a layer of more permeable clay below. The effect of deep tillage on water intake and crop yields during the 14 yr test period through 1979 was discussed by Musick and Dusek (1975a) and Musick et al., 1981 (in press).

A split-plot blocked design with two replications was used. Residual tillage treatments were main plots; skip-row and every-row treatments were subplots in 1976. The test area and plot number were doubled in 1977-79 with the skip-row and every-row test in adjacent main blocks. Residual deep-tillage plots were split for two water levels of two (I-1) and four (I-2) seasonal irrigations. Tillage plots were eighteen 0.75 m rows 205 m long in 1976-77 and 305 m long in 1979. Yields were sampled at three length-of-run sites per plot in 1976-77, and four in 1979. The plot area was fallowed in 1978.

Crops were planted one row per bed on 0.75 m bed-furrow spacing with a six-row planter. The planter seeded two, two-row strips in the skip-row system. A skip-two row strip treatment was included in 1976 to evaluate lateral soil-water depletion by corn. Lateral depletion by sorghum border rows was measured in a previous study (Musick and Dusek, 1975b). Also, data were taken from an adjacent graded-furrow plot area of corn and sorghum to evaluate the yield ability of border-rows to compensate for a one-row skip.

Hybrids planted were 'DeKalb XL-75' corn in 1976, 'Pioneer 3321' corn in 1977, and 'DeKalb F-67' sorghum in 1979. Plant populations for corn were 50,000 to 60,000

TABLE 1. PLANTING DATES, IRRIGATION DATES, AND SEASONAL RAINFALL.

Year	Crop	Planting date	Irrigation Treatment	Irrigation Dates	Seasonal rainfall, mm
1976	Corn	Apr. 14	I-1	Apr. 27, July 15, Aug. 2	262
1977	Corn	Apr. 28	I-1	May 3, June 27, July 20	345
			I-2	May 3, June 20, July 8, July 21, Aug. 3	345
1979	Sorghum	May 9	I-1	May 15, July 17, Aug. 16	267
			I-2	May 15, July 10, July 31, Aug. 16, Sept. 5	267

per ha, and the sorghum seeding rate was 7 kg/ha. Corn was planted in late April and sorghum in mid-May, and both irrigated for emergence. Atrazine was applied for seasonal weed control. Two 5 m^2 subsamples were taken for grain yield at four sites per plot with length-of-run. They were hand-harvested in October, oven-dried at 70 °C to constant weight, and hand-shelled (corn) or threshed (sorghum); yield data were adjusted to 14 percent moisture, wet-basis.

An offset disk was used for primary tillage before planting in 1976 and 1979, and the site was moldboard plowed to 0.2 m in 1977. Nitrogen fertilizer was applied as anhydrous ammonia before bedding at an adequate rate for high yields.

Two seasonal irrigations were applied to the three crops as a moderate water treatment (I-1), and four seasonal irrigations were applied to 1977 corn and 1979 sorghum as an adequate water level for high yields (I-2). The two seasonal irrigations applied to every-row plots were designed to approximate the water intake from the four seasonal irrigations applied to the skip-row treatment. Dates of all irrigations and seasonal rainfall from planting to harvest are presented in Table 1. In 1976, water was applied to all furrows of skip-row plots during the emergence irrigation and the skip-row treatment was applied to all seasonal irrigations. In 1977 and 1979, the skip-row treatment was applied during emergence irrigation also.

Irrigation water was applied through gated pipe, and flow rates were adjusted to individual furrows by use of a bucket and stopwatch. Most applications were adjusted within the rage of 0.5 to 1.0 L/s. Furrow flow rates were selected by experience so that the water advance time across plots did not vary appreciably. Tailwater runoff was allowed for about 3 to 8 h, and was measured by individually calibrated H-flumes equipped with FW-1 stage recorders. Runoff was measured from two furrows per plot in skip-row treatments, and four furrows per plot in the every-row plots. Water intake was determined as application minus runoff.

Soil water was sampled by the gravimetric method by 0.3 m increments to 1.8 m depth at the beginning and end of season. These data plus net irrigation water intake and seasonal rainfall were used in a water balance to estimate seasonal evapotranspiration. In 1976, samples were taken in the skip-two plots to evaluate soil-profile water depletion at corn tasseling and after harvest. Sampling sites were in the row and at 0.38, 0.75, and 1.13 m laterally from the row into the skip-row area. Seasonal rainfall was average to below average during the three crop seasons (Table 1).

RESULTS AND DISCUSSIONS

Water Intake

Water intake data are presented in Table 2 for all irrigations. For the three crops, two water levels, and four residual tillage treatments (72 irrigations), water intake averaged 130 mm per irrigation in every-row irrigation compared with 60 mm in skip-row irrigation. Thus, water intake on skip-row irrigated plots averaged 46 per-

TABLE 2. IRRIGATION WATER INTAKE DURING SKIP-ROW AND EVERY-ROW IRRIGATION OF CORN IN 1976-77 AND SORGHUM IN 1979.

Residual tillage depth, m	I-1 (Two seasonal irrigations)				I-2 (Four seasonal irrigations)			
	Skip-row		Every-row		Skip-row		Every-row	
	Preseason, mm	Seasonal, mm	Preseason, mm	Seasonal, mm	Preseason, mm	Seasonal, mm	Preseason, mm	Seasonal, mm
1976 Corn								
0.2	72	92	72	185				
0.4	118	86	118	228				
0.6	138	98	138	214				
0.8	142	110	142	233				
Total	470	386	470	860				
1977 Corn								
0.2	76	104	135	228	76	190	135	427
0.4	73	109	151	266	73	195	151	492
0.6	80	128	259	318	80	205	259	496
0.8	90	117	242	286	90	203	242	489
Total	319	458	787	1098	319	793	787	1904
1979 Sorghum								
0.2	63	88	124	175	63	211	124	431
0.4	72	102	171	219	72	257	171	444
0.6	83	121	199	215	83	252	199	443
0.8	80	126	163	221	80	268	163	438
Total	298	437	657	830	298	988	657	1756

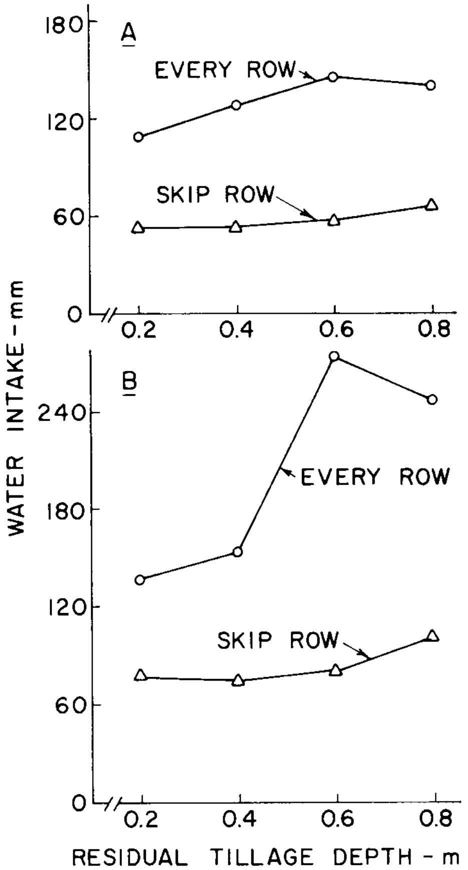

FIG. 1 Water intake on an area basis (a) average for skip-row and every-row irrigation in relation to residual tillage depth for all seasonal irrigations, 1976-77 and 1979 and (b) during emergence irrigation of corn, 3 May 1977.

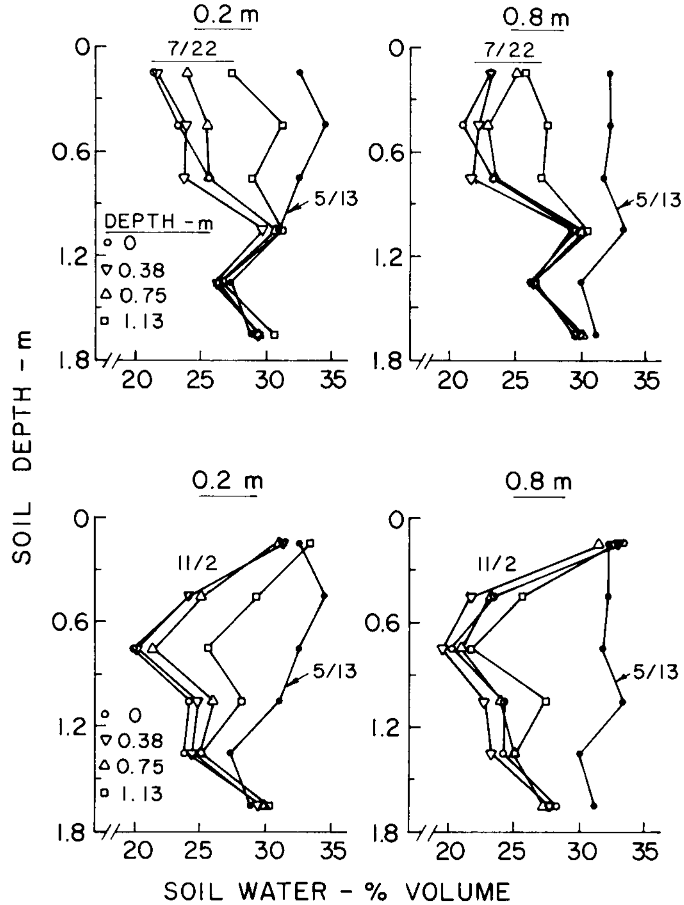

FIG. 2 Soil water with depth at sites within the row and 0.38, 0.75, and 1.13 m laterally across a 2.25 m skip between paired corn rows on 13 May (at planting), 22 July (after tasseling-upper graph), and 2 November (after harvest-lower graph) for the 0.2 m and 0.8 m tillage depths, 1976.

cent of that on every-row irrigated plots. For the 3 yr test, the range was 41.3 percent of every-row intake for 1977 corn to 51.8 percent for 1979 sorghum. The reduction in average intake by skip-row irrigation was slightly greater for the drier I-1 treatment (44.8 percent) than for the I-2 treatment (47.8 percent). It averaged slightly lower for residual deep tillage treatments (44.0 percent) than for conventional tillage (48.6 percent) (Fig. 1).

If skip-row irrigation had not influenced water intake per furrow, the average area intake would have been reduced to one-third of every-row irrigation. The increased per-furrow intake in the skip-row system resulted in lateral wetting beyond the 0.75 m width of every-row irrigation, and the average area intake was increased to 46 percent. The lateral wetting distance was related to the duration of water flow, with the wide wetting zone occurring on the upper part of the plot length.

Residual deep tillage had a major effect on irrigation-water intake during the emergence irrigation, when the surface soil was in a loosened condition. As the surface soil reconsolidated, the effect on increasing water intake during the growing season was greatly reduced (Table 2). We used the increased profile permeability associated with residual deep tillage to evaluate the effect of skip-row irrigation in reducing intake under conditions of increased permeability. This effect is illustrated in Fig. 2 for the emergence irrigation of corn on May 3, 1977. Residual deep tillage increased water intake on every-row plots from 135 mm for the conventional 0.2 m tillage depth to the 242 to 259 mm range for residual tillage depth of 0.6 to 0.8 m. The 0.6 and 0.8 m tillage depths fully penetrated the slowly permeable clay B2t horizon. While deep tillage had a major effect on water intake on the every-row treatment, it had virtually no effect on the skip-row treatment (Fig. 1). Average intake by the skip-row treatment on 0.6 and 0.8 m tillage plots averaged 34 percent of intake by every-row irrigated plots with the same tillage depth. These results suggest that on more permeable soils, wide spacing of irrigated furrows may be used to reduce irrigation water application in direct proportion to the increase in irrigated furrow spacing. Results agree with those of Longenecker et al. (1969) and Stone et al. (1979) in which doubling the irrigated furrow spacing permitted reducing water application by one-half. Profile drainage losses are greater on the more permeable soils, and skip-row or wide-furrow irrigation should be useful in reducing these losses by reducing the size of individual irrigations.

Soil Water Depletion

For efficient water use in skip-row systems, plant roots should have the ability to fully use the soil water stored in the skip-row zone. Lateral soil-water depletion data for corn in a two-row skip (2.25 m spacing between crop rows) at tasseling and after harvest is presented in Fig. 3 for normal and residual deep-tillage (0.8 m) plots. The data indicate excellent ability to deplete soil water to a 0.75 m lateral distance from the row, the central point between rows in a one-row skip, but less ability to deplete soil water laterally to the 1.13 m central point between a

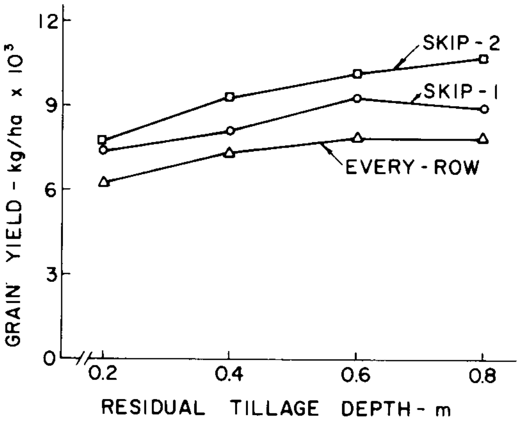

FIG. 3 Corn grain yield on a planted-row basis in relation to residual tillage depth, 1976.

two-row skip. However, results indicated deep tillage improved crop ability to deplete soil water to the 1.13 m lateral distance, which suggests a deep-tillage effect in increasing root development. The lateral depletion of soil water into the skip-row zone by corn agrees with previous soil-water depletion data obtained for grain sorghum (Musick and Dusek, 1975b) and suggests that soil water will not be fully used where the skip-row zone exceeds one row.

Grain Yields and IWUE

A major consideration in skip-row cropping is the ability of the crop to increase yield per-row to compensate for yield loss from rows not planted. We conducted a test in 1976 (unpublished) to evaluate the ability of border rows of 6-row plots of corn and sorghum to compensate for one 0.75 m skip-row separating plots. All furrows were irrigated including skip-row furrows on the outside of border rows, to prevent soil water availability from limiting border-row yield response. Corn yields from 12 samples taken from border rows and central inside rows averaged 9,800 and 7,130 kg/ha, respectively, and sorghum yields averaged 10,380 and 7,300 kg/ha, respectively. Corn border-row yields compensated for 74.8 percent of the yield loss from not planting the skip-row, while sorghum border-rows compensated for 84.4 percent. The greater yield compensation for the sorghum skip-row was related to reduced plant competition causing more tillers to produce mature heads. Although corn and sorghum can increase per-row yields to mostly compensate for a one-row skip, there is no water-use efficiency advantage unless irrigation water application is reduced. In a 1977 corn study, we found that skip-row planting in level border plots, where the entire soil surface was flooded, reduced area yields and water-use efficiency (unpublished).

For better understanding yield effects in skip-row systems, yields have frequently been reported on both a per-row and total-area basis. Since the skip-one row irrigation reduced the size of water application to less than one-half of that for every-row irrigation, we concluded that irrigation is efficiently used for crop yield when per-row yield in skip-one row treatment is not reduced below that in every-row treatment. Therefore, skip-row and every-row yields are presented in Figs. 3, 4, and 5 on a per-row basis for the four tillage treatments. The 1976 corn yields are also presented in Table 3 on a per-row basis, indicating the efficient use of irrigation water

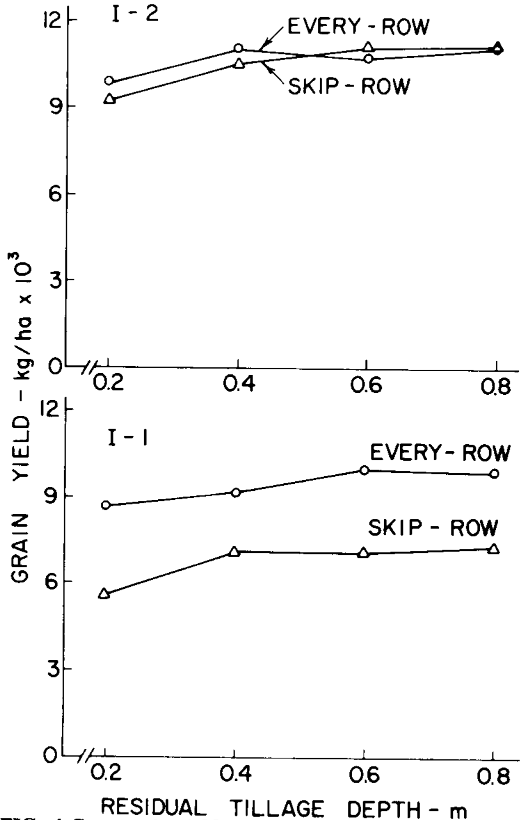

FIG. 4 Corn grain yield on a planted-row basis in relation to residual tillage depth, 1977. Treatment I-2 (top) had four and treatment I-1 (bottom), two seasonal irrigations.

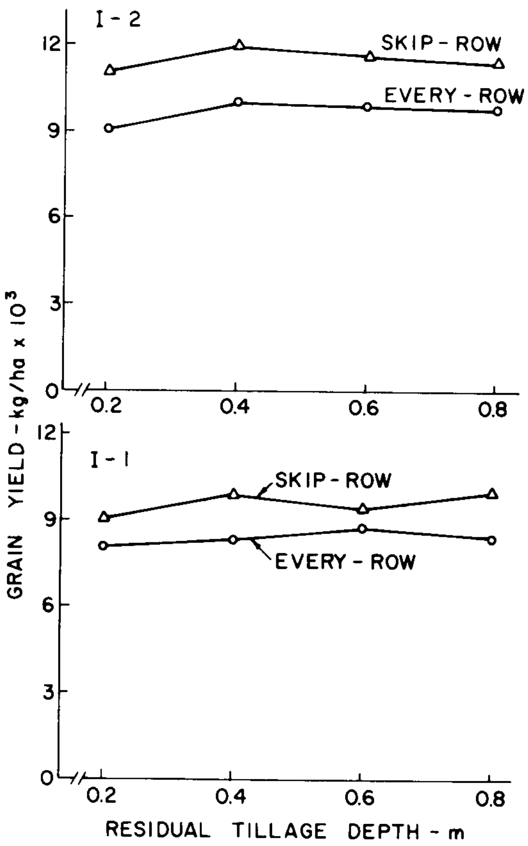

FIG. 5 Sorghum grain yield on a planted-row basis in relation to residual deep tillage, 1979. Treatment I-2 (top) had four and Treatment I-1 (bottom), two seasonal irrigations.

TABLE 3. CORN GRAIN YIELD ON A TOTAL-AREA BASIS, SEASONAL EVAPOTRANSPIRATION (ET), IRRIGATION-WATER INTAKE, AND WATER-USE EFFICIENCY, 1976.

Residual tillage depth, m	Grain yield, kg/ha			ET, mm		Seasonal Irrigation intake, mm		Water-use efficiency, kg/m^3			
								Seasonal ET		Seasonal intake*	
	Skip one row	Skip two rows	Every row	Skip one row	Every row	Skip one row	Every row	Skip one row	Every row	Skip one row	Every row
0.2	4900cd†	3850e	6210b	416	509	92	185	1.18	1.22	2.42	1.91
0.4	5370c	4630d	7330a	440	565	86	228	1.22	1.30	2.83	1.93
0.6	6150b	5040c	7820a	452	560	98	214	1.36	1.40	3.18	2.24
0.8	5910b	5350c	7760a	464	587	110	233	1.27	1.32	2.45	1.95

*Water-use efficiency of net seasonal intake was based on emergence irrigation only yields of 2670, 2940, 3030, and 3220 kg/ha for 0.2, 0.4, 0.6, and 0.8 m residual tillage depths, respectively, at a reduced plant population of 22,000 plants/ha.
†Treatment yields in rows and columns not followed by the same letters are significantly different at the 5% level by Duncan's Multiple Range Test.

(Fig. 3). Irrigation WUE of seasonal intake averaged 2.72 kg/m^3 for skip-one row treatment compared with 2.01 kg/m^3 for the every-row treatment (Table 3). Skip-row irrigation had very little effect on WUE of seasonal ET.

The skip-two row system tested in 1976 increased per-row yields over the skip-one system; however, the additional yield increase was quite small with conventional (0.2 m) tillage. It increased slightly more with the 0.4 to 0.8 m tillage depths, where corn was able to more fully deplete available water in the skip-two system. We concluded that the skip-one row system offered the most potential for efficient water use, and subsequent tests were restricted to this system.

Yield data for 1977 corn are presented on a per-row basis in Fig. 4. As the wetter I-2 level, corn skip-row yields were similar to every-row yields. However, under conditions of major plant water stress at the I-1 level, per-row yields were substantially lower in the skip-row treatment than in the every-row treatment. Reducing both the number of irrigations and water intake per irrigation by about one-half resulted in too great a water reduction for irrigated corn, and severe plant water stress greatly reduced skip-row yields.

The 1976-77 corn results suggest that skip-row irrigation can be used to reduce the size of irrigation for corn, but the number of irrigations normally applied should not be reduced. Musick and Dusek (1980) found that reducing irrigation-water application to corn reduces water-use efficiency because of yield sensitivity to plant water stress. Results from skip-row irrigation tests in 1976-77, however, indicate that this system can be used to reduce water application and increase IWUE. On soils where graded-furrow irrigation normally results in substantial water loss to profile drainage, the favorable effect on IWUE should be greater than we obtained on Pullman clay loam.

Grain sorghum yield response to skip-row irrigation is presented in Fig. 6. Skip-row yields were higher than every-row yields on a per-row basis for both water levels. Sorghum is considerably more tolerant than corn to plant water stress, and these results suggest that skip-row irrigation can be used over a wide range of applications to reduce both size and number of applications for grain sorghum production.

The WUE calculated for sorghum was based on a non-irrigated yield of 3,200 kg/ha from a nearby area that had a wet soil profile at planting. Skip-row irrigation increased IWUE on the wetter I-2 treatment from 1.43 for every-row irrigation to 1.76 kg/m^3, and on the drier I-1 treatment, from 2.55 to 2.90 kg/m^3. Although skip-row irrigation increased the IWUE where the same number of irrgations were applied, the IWUE of I-2 skip-row irrigation was lower than that of I-1 every-row irrigation, in which about the same amount of water was applied. Stewart et al., (1981) in 1979 conducted a nearby study with grain sorghum that compared skip-row irrigation (skip one 0.75 m row) with alternate-furrow and every-row irrigation. The IWUE for grain yield was significantly higher, 2.02 kg/m^3 compared with 1.50 kg/m^3, for skip-row irrigation than for every-row irrigation. However, the IWUE of skip-row irrigation was not significantly different from that of alternate-furrow irrigation (2.14 kg/m^3).

Water-use efficiency is normally much lower for dryland crop production than for irrigated production because dryland yields are relatively low. Seasonal precipitation is normally too low for dryland corn to produce grain. Dryland sorghum yields average about one-fourth the yields normally obtained under irrigation and the WUE of seasonal ET averages about one-half of that of irrigated sorghum (Unger, 1972; Musick and Dusek, 1971). The major advantage of limited irrigation in the Southern Plains is associated with the use of a limited water supply to irrigate a larger area and thus reduce the crop area that is in less efficient dryland production. The results illustrate that skip-row irrigation uses limited irrigation water efficiently for increased yields. However, this system may not be superior to other systems that reduce total water application, such as (a) applying fewer irrigations at the more critical stages of plant development and (b) using alternate-furrow or wide-furrow irrigation where every row is planted. Weed control was not a problem in this study. However, under some conditions, weeds may be more difficult to control in skip-row systems.

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