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Part I

IRRIGATION WATER REQUIREMENTS

FOR

CROP PRODUCTION ROSWELL ARTESIAN BASIN

AN AGRONOMIC ANALYSIS AND BASIC DATA

by

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in cooperation with

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The project Water Requirements for Crop Production in the Roswell Artesian Basin (Water Resources Research Institute Report 4) was published in four parts.

Parts I, II, and III contain the analysis and basic data for the subsections. Part IV is the overall project analysis and summary. These were published by multilith in limited numbers to be used as work copies and for reference and file copies. The four parts are as follows:

Water Requirements for Crop Production in the Roswell Artesian Basin

Part I - An Agronomic Analysis and Basic Data

Part II - An Economic Analysis and Basic Data

Part III - An Engineering Analysis and Basic Data

Part IV - Project Analysis and Summary

The Project Analysis and Summary of the entire project was printed as Water Resources Research Institute Report No. 5 and is available for general distribution.

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This agronomy section is a part of an interdisciplinary research project (An Analysis of Irrigation Water Requirements for Crop Production in the Roswell Artesian Basin, New Mexico).

The principal investigator for this section was Carl E. Barnes, assistant professor of agronomy of the New Mexico Southeastern Branch Experiment Station, New Mexico State University. The other sections of the research were: agricultural engineering, conducted by Evan Carroon, consulting engineer, Alamogordo, who served on a part-time basis, 1967-1968; Eldon Hanson, agricultural engineer, New Mexico State University, who assisted throughout the project; and Robert Freeburg, agricultural engineer, New Mexico State University, 1966; the agricultural economics section, conducted by Robert R. Lansford and Bobby J. Creel, agricultural economists, New Mexico State University; and the soils section, conducted by Harold Dregne, soil scientist, New Mexico State University. H. R. Stucky, Director, New Mexico Water Resources Research Institute, New Mexico State University, was coordinator of the project.

In addition to these, other groups and individuals aided in the study. Special appreciation is expressed to the following: U. S. Soil Conservation Service, especially work-unit personnel in Roswell, Hagerman, and Artesia, New Mexico; State Engineer Office; Agricultural Stabilization and Conservation Service personnel; and the Agricultural Extension County Agents in Chaves and Eddy Counties; and finally to the farmers who participated in this study.

ABSTRACT

This study presents data concerning crop and water management practices in the Roswell Artesian Basin and their influence on water use and crop production.

The more detailed portions of this study evaluated the effects of six irrigation regimes on cotton production, four irrigation regimes on alfalfa production, and three management systems for the production of alfalfa seed. The highest yield of cotton for the three-year study was obtained with an average of 24.77 acre-inches of irrigation water while the maximum alfalfa forage yield in a two-year study was obtained with 69.98 acre-inches of irrigation water. Row seeding was more beneficial for alfalfa seed production when compared to broadcast seeding.

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IRRIGATION WATER REQUIREMENTS FOR CROP PRODUCTION IN THE ROSWELL ARTESIAN BASIN, NEW MEXICO

by Carl E. Barnes[1]

INTRODUCTION

Farmers in the Roswell Artesian Basin, as in other areas of New Mexico, are continually faced with the problems of adjusting to changing conditions. Many farmers in this area are faced with the need for rapid adjustment of their farming operations to comply with a legal restriction placed on the quantity of ground water diverted for irrigation. On January 10, 1966, the District Court of Chaves County, New Mexico, entered the partial final judgment and decree on all lands for which water rights have been adjudicated within the Roswell Artesian Basin, located within Chaves and Eddy Counties, New Mexico. The decree required that the water-right holder install a meter on each well no later than January 1, 1967, and that it be maintained and operated by the water-right holder. It also set the annual duty of water -- three acre-feet per annum -- to be exceeded only if the total amount of water diverted in any period of five consecutive years does not exceed 15 acre-feet. The order further provided for the appointment of a watermaster to enforce the provisions of the decree.[2]

To supply current information on water requirements, production costs, and profit-maximizing enterprise combinations for various farm situations a three-year study was undertaken by the New Mexico Agricultural Experiment Station in cooperation with the New Mexico Water Resources Research Institute. This study was designed to obtain information on crops grown, yields, soil quality, water quality, types of irrigation systems, methods of irrigation, and amounts of water used by alfalfa and cotton, and to analyze these factors as they relate to the water requirements for crop production. A team composed of agronomists, agricultural engineers, agricultural economists, and soils specialists was selected to conduct the research.

This is a report of the agronomic phase of the project. A

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1. Assistant Professor of Agronomy, Southeastern Branch Experiment Station, New Mexico Agricultural Experiment Station, New Mexico State University.
2. State of New Mexico, et al. vs. L.T. Lewis, Hagerman Canal Company, et al. (Consolidated Number 14945, District Court of Chaves County, State of New Mexico), Partial Final Judgment and Decree (mimeo, 6 99.), 1966.

similar report is available on the agricultural engineering, agricultural economics, and soils phases. These reports were summarized and have been published in an overall report of the project which is available for general distribution. The sectional reports have been published in limited numbers for reference use and data storage.

OBJECTIVES OF THE STUDY

The objectives of the overall project as stated in the agreement between the Pecos Valley Artesian Conservancy District and the New Mexico Water Resources Research Institute were:

1. To assemble and analyze existing cropping patterns, water use, water quality, soil quality, and crop yields for the Roswell Underground Water Basin.

2. To determine the water requirements of crops, of farms, and of the basin under various irrigation methods, efficiencies, and cropping patterns.

3. To determine farm and basin income effects from various irrigation methods, efficiencies, and cropping patterns.

The specific objectives of the agronomic phase of the study were:

1. To determine the effect of the following treatments on lint yield, fiber properties, and plant characteristics of Acala 1517D cotton:

    (a) Six different irrigation regimes and two levels of phosphorus fertilizer;

    (b) Delaying the first postplant irrigation until the prebloom or early bloom stage (July 1);

    (c) Three different dates for the final irrigation.

2. To determine the effect of four different irrigation regimes and two levels of phosphorus on the production of alfalfa forage.

3. To determine the effect of three different management systems on the production of alfalfa seed.

4. To measure the water that was applied in growing grain and forage sorghums, barley, and certain other crops.

5. To determine present water use and resulting soil moisture

conditions for crops grown in the Roswell Artesian Basin.

6. To determine the quality of irrigation water used and the percentage of total soluble salts present in the soil, for crops grown under objectives 1, 2, and 5 above.

DEFINITION OF TERMS

Certain terms are used throughout this report and the following descriptions are presented to clarify their use:

Irrigation regime: A sequence of irrigation water applications on a given field or farm as detailed in the text of this report.

Consumptive use: The unit amount of water utilized on a given area in the process of transpiration, in the building of plant tissue, in evaporation from adjacent soil, water surface, or snow, or in intercepted precipitation, in any specified time. Consumptive use is expressed in volume per unit area, such as acre-inches or acre-feet per acre (1).

Consumptive irrigation requirement: The depth of irrigation water, exclusive of precipitation, stored soil moisture, or ground water, that is required for crop production (1).

Irrigation efficiency: The percentage of irrigation water pumped or diverted, that is stored in the soil and that is available for consumptive use. When the water is measured at the farm headgate (or irrigation well) it is called farm irrigation efficiency; when measured at the field it is designated as field irrigation efficiency (1).

Frost-free period: The period from the date in the spring of the last recorded temperature of 32°F or less, until the date of the first recorded temperature of 32°F or less in the fall.

Water use efficiency: The pounds of matter produced per acre-inch of water available. In this report, for cotton this term is expressed in pounds of lint produced per acre-inch of water, and for alfalfa in pounds of dry forage per acre-inch of water. These computations were based on total water -- that is, irrigation water plus precipitation, for the period November 1 through October 31.

PROCEDURE

Irrigation water application measurements for crops grown for

Table 1. Proposed irrigation dates and water applications for six irrigation regimes in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Proposed Irrigation Date and Water Applied					
	Preplow & Preplant	June 1	July 1	July 20	Aug. 5	Aug. 20
	(ac.-in.)	(ac.-in.)	(ac.-in.)	(ac.-in.)	(ac.-in.)	(ac.-in.)
A	9-12	---	3-4	3-4	---	---
B	9-12	---	3-4	3-4	3-4	---
C	9-12	3-4	3-4	3-4	---	---
D	9-12	3-4	3-4	3-4	3-4	---
E	9-12	---	3-4	3-4	3-4	3-4
F	9-12	3-4	3-4	3-4	3-4	3-4

objectives 1, 2, 3, and 4, as mentioned earlier, were obtained by using portable in-line meters at the point of delivery in the field. All crops for these objectives were grown at the Southeastern Branch Experiment Station, Artesia, New Mexico.

Objective 1(a)

Acala 1517D cotton was planted in a split-plot design, with four replications. Main plots varied in irrigation regime and subplots varied in level of phosphorus fertilizer. There were six irrigation regimes and two levels of phosphorus fertilizer. The proposed dates of irrigation applications and acre-inches to be applied are shown in table 1. The irrigation dates are approximate dates used to compare the various regimes. The actual dates and acre-inches applied to each regime each year are shown in table B-1. The post-bloom irrigations were applied when the uppermost open blooms were 4 to 6 inches below the tops of the plants. The two levels of phosphorus fertilizer were 15 and 45 pounds of elemental phosphorus per acre, applied as a sidedressing during May of each year. The plots were uniformly fertilized with two sidedressed applications of nitrogen (applied in May and June) at the rate of 40 pounds of elemental nitrogen each application.

Yield determinations were made by hand-picking the center two

rows of each plot. Fifteen-boll samples were collected from each plot prior to first harvest for use in determining lint percent, boll size, and fiber characteristics. Fiber characteristics were determined in the Cotton Fiber Laboratory, Agronomy Department, New Mexico State University. Plant height measurements were made for all plots prior to each irrigation beginning with the July 1 irrigation. Data were recorded for days to first bloom, days to first open boll, percent of plants showing symptoms of verticillium wilt, and number of plants per foot at harvest.

Objective 1(b) and (c)

The effect of delaying the first postplant irrigation until July 1 as compared to a June 1 irrigation was to be determined by comparing Regime A with C, B with D, and E with F. Likewise the effect of the date of the last irrigation was to be ascertained by comparing Regime A with B, B with E, C with D, and D with F.

Objective 2

Zia alfalfa was planted in a split-plot design, with four replications, on April 11, 1966, at the rate of 24.4 pounds of seed per acre. Main plots varied in irrigation regime and sub-plots varied in phosphorus fertility level. The irrigation regimes in 1966 and 1967, and acre-inches of water applied in each application, were: Regime A, 3; Regime B, 4; Regime C, 5; Regime D, 6.

In 1968 Regime D was discontinued and replaced by Regime E with an application of 8 acre-inches. Regimes A, B, and C were irrigated twice between each harvest while Regimes D and E were irrigated once each harvest. The dates of irrigation and actual water applications are shown in table C-1. The first differential water applications were made on June 22, 1966; however, because of an extreme weed infestation in the first two harvests of 1966, the data were discarded and only 1967 and 1968 results are included in this report. The phosphorus fertility levels used were 35 and 70 pounds of elemental phosphorus per acre, applied in February of each year as a broadcast application. Yield determinations were made by harvesting a 4-foot swath from the center of each plot and using a standard dry-matter content of 22 percent to convert the green forage yields to a dry forage basis.

Objective 3

Zia alfalfa was planted on April 11, 1966. The experimental design was a split-plot design, with four replications. Main plots varied in management system as follows: (1) A seed crop was harvested from the first growth in the spring and forage was harvested for the remainder of the season. (2) Forage was harvested from the first spring growth, seed was harvested from the second growth, and forage was harvested for the remainder of the season. (3) Two seed crops were harvested.

Sub-plots varied in seeding method as follows: (1) Broadcast seeding at the rate of 6.7 pounds per acre. (2) Seeded in rows 24 inches apart at the rate of 1.1 pounds per acre.

All plots were fertilized each February with 50 pounds of elemental phosphorus per acre. Diuron was applied after each seed harvest at the rate of 2 pounds per acre to control alfalfa seedlings.

Objective 4

Irrigation water applications on all experimental crops grown at the Southeastern Branch Experiment Station were to be recorded by means of portable in-line meters at the point of delivery in the field with water to be applied as judged necessary to maintain optimum plant growth.

Objective 5

Twelve case farms, described by Lansford and Creel (4), were selected as cooperating units. Water application records for each crop grown on the case farms were maintained by the cooperator and were submitted to the Southeastern Branch Experiment Station during 1966 and 1967 and to the Department of Agricultural Economics and Agricultural Business at New Mexico State University during 1968. These irrigation records were incorporated into the report by Lansford and Creel (4). In addition, Case Farms J and L were selected for a more intensive study of measurement of water applications on a selected irrigation unit of alfalfa and cotton.

The selected unit of alfalfa on Case Farm J in 1967 was 6.11 acres of field 1, Lansford and Creel (4) and, in 1968, a part of field 3 measuring 7.19 acres. The selected unit of cotton on Case Farm J in 1967 was 5.78 acres in field 2 and, in 1968, 5.90 acres in field 4.

The selected alfalfa field on Case Farm L in both years was 5.74 acres in field 8. The selected unit of cotton in both years was 52.8 acres in field 1 of Case Farm L.

The water applications were obtained by reading the meter on the irrigation well at the beginning and end of the irrigation on each of the selected units. The amount of water applied was controlled by the cooperator. Yield data for the selected units of alfalfa were obtained by weighing a random sample of 20 bales each harvest and multiplying the average weight per bale by the total number of bales produced. Yield of cotton from the selected units was determined from weights obtained at the gin.

Objective 6

Water samples were taken periodically from the irrigation wells at the Southeastern Branch Experiment Station and on all case farms

except Case Farm H which had surface water rights.

Soil samples were taken in the spring and fall from two replications of the cotton and alfalfa irrigation studies conducted at the Southeastern Branch Station. The sampled profiles were 0 to 10, 10 to 24, 24 to 36, and 36 to 60 inches. Composite soil samples from three sites in a selected unit of cotton and alfalfa were collected from Case Farms J, K, and L. The sampled profiles were 0 to 10, 10 to 24, and 24 to 36 inches. A composite sample from three sites in cotton fields for the 0-to-10-inch profile were collected for Case Farms A, C, F, G, and I.

The analyses of the water and soil samples were conducted by the Soil Testing Laboratory, New Mexico State University.

Objectives 1, 2, 3, and 5

Soil moisture data were obtained for crops grown in objectives 1, 2, and 3, and for the selected units of alfalfa and cotton on Case Farms J and L. The soil moisture data were obtained by means of aluminum access tubing and a neutron depth moisture probe and portable scaler. Readings were in terms of percent moisture by volume and these data are reported as "relative moisture index" to illustrate comparative moisture use during the season.

Consumptive Water Use and Consumptive Irrigation Requirement

To establish a basis for determining irrigation efficiencies, consumptive water use and consumptive irrigation requirement data were computed for the various crops grown on the 12 case study farms for the years 1966-1968. These computations were made by using the basic procedures outlined by Blaney and Hanson (1) and Henderson and Sorenson (3). Temperature and rainfall data used were those recorded at Walker Air Base (Roswell) and at the Southeastern Branch Experiment Station (Artesia).

Consumptive use data for Roswell and Artesia were computed by utilizing the consumptive use factors $\underline{f}$ (1, table B-3), the consumptive use coefficients $\underline{K}$ (1, p. 25) and temperature data discussed previously. The value for effective precipitation used in computing consumptive irrigation requirement was obtained from total monthly precipitation at the two weather stations and by applying the method of estimating monthly effective precipitation as reported by Blaney and Hanson (1, p. 21). Monthly precipitation and computed monthly effective precipitation for 1966-1968 at Artesia and Roswell are shown in table A-1. Frost-free periods for Artesia and Roswell for 1966-1968 are shown in table A-2.

The computed consumptive use, effective rainfall, and consumptive irrigation requirement for the various crops are shown in

tables 2 and 3. The periods of moisture use employed in these computations are shown in table 4 and a brief description of each follows.

Alfalfa

The moisture use period for alfalfa was considered to be from the first date in the spring having a mean air temperature of 50°F until the first recorded temperature of 28°F or less. A consumptive use coefficient K of 0.85 was used for the frost-free period, and a K value of 0.50 was used for the period before and after the frost-free period.

Cotton

March 15 was fixed as the date of preplant irrigation and the beginning date of moisture use by cotton, and April 15 was fixed as the average planting date. A K value of 0.40 was used for the period March 15 to April 15 and for the period from 32°F to 28°F in the fall. A K value of 0.62 was used for the period from April 15 to the end of the frost-free period in the fall.

Sorghum, grain

The moisture use period for grain sorghum was considered to be from May 1, date of preplant irrigation, to the date of the first recorded temperature of 28°F or less, in the fall. A K value of 0.70 was used for this period.

Sorghum, silage

The moisture use period for silage sorghum was considered to be from May 1, date of preplant irrigation, to September 1, harvest date, and a K value of 0.70 was used for this period.

Corn, silage

Silage corn was considered to have the same moisture use period as silage sorghum and a K value of 0.75 was used for the moisture use period.

Small grain, spring

The moisture use period for spring small grain was considered to be from March 1 to June 15. A K value of 0.70 was used for this period.

Small grain, winter

Fall seeded (winter) small grain was considered to have a moisture use period from September 1, date of preplant irrigation, to December 1, and from January 1 to June 1. A K value of 0.35 was used for September, October, November, January, and February, and a

Table 2. Consumptive use, effective rainfall, and consumptive irrigation requirement from weather records at the Southeastern Branch Experiment Station, for crops grown in the Roswell Artesian Basin, New Mexico, 1966-68.[1]

Crop	Year	Consumptive Use (inches)	Effective Rainfall (inches)	Consumptive Irrigation Requirement (inches)
Alfalfa	1966	39.62	8.30	31.32
	1967	40.18	4.22	35.96
	1968	38.27	9.60	28.67
	Mean	39.36	7.37	31.98
Cotton	1966	27.04	7.74	19.30
	1967	28.08	4.05	24.03
	1968	26.73	7.84	18.89
	Mean	27.28	6.54	20.74
Grain sorghum	1966	25.48	5.60	19.88
	1967	26.57	4.00	22.57
	1968	24.94	7.10	17.84
	Mean	25.66	5.57	20.10
Sorghum silage	1966	19.68	5.32	14.36
	1967	19.68	3.41	16.27
	1968	19.68	6.49	13.19
	Mean	19.68	5.07	14.61
Corn silage	1966	21.00	5.32	15.68
	1967	21.00	3.41	17.59
	1968	21.00	6.49	14.51
	Mean	21.00	5.07	15.93
Small grain (spring)	1966	14.11	3.63	10.48
	1967	14.11	1.69	12.42
	1968	14.11	2.28	11.83
	Mean	14.11	2.53	11.58
Small grain (winter)	1967	18.63	1.76	16.87
	1968	18.63	5.31	13.32
	Mean	18.63	3.54	15.10

1. Source: Weather station records, Southeastern Branch Experiment Station, Artesia, New Mexico.

Table 3. Consumptive use, effective rainfall, and consumptive irrigation requirement from weather records at Walker Air Base, for crops grown in the Roswell Artesian Basin, 1966-1968.[1]

Crop	Year	Consumptive Use (inches)	Effective Rainfall (inches)	Consumptive Irrigation Requirement (inches)
Alfalfa	1966	38.58	8.37	30.21
	1967	39.46	8.46	31.00
	1968	38.64	11.91	26.73
	Mean	38.89	9.58	29.31
Cotton	1966	26.95	8.23	18.72
	1967	27.58	8.23	19.35
	1968	27.02	8.70	18.32
	Mean	27.18	8.39	18.80
Grain sorghum	1966	25.43	6.29	19.14
	1967	26.09	8.20	17.89
	1968	25.53	7.74	17.79
	Mean	25.68	7.41	18.27
Sorghum silage	1966	19.40	5.37	14.03
	1967	19.40	7.37	12.03
	1968	19.40	7.41	11.99
	Mean	19.40	6.72	12.68
Corn silage	1966	20.69	5.37	15.32
	1967	20.69	7.37	13.32
	1968	20.69	7.41	13.28
	Mean	20.69	6.72	13.97
Small grain (spring)	1966	13.87	3.64	10.23
	1967	13.87	1.69	12.18
	1968	13.87	2.68	11.19
	Mean	13.87	2.67	11.20
Small grain (winter)	1967	18.30	1.28	17.02
	1968	18.30	5.93	12.37
	Mean	18.30	2.40	14.70

1. Source: Weather station records, Walker Air Base, Roswell, New Mexico.

K value of 0.70 was used for March, April, and May.

RESULTS AND DISCUSSION

Cotton Irrigation Study

Irrigation water applications, irrigation efficiencies, and total water applied to the cotton irrigation study during 1966, 1967, and 1968 are presented in table B-1. The February, 1966, irrigation was applied to facilitate land preparation after land-leveling operations, and the December irrigations in 1966 and 1967 were applied before plowing under the crop residue. The April, 1966, March, 1967, and April, 1968, irrigations were applied prior to planting to provide adequate moisture for stand establishment. In 1966, Regimes B and E, and D and F received the same irrigations. This was because rainfall (4.20 inches) received during August 20-24 replaced a scheduled irrigation on Regimes E and F. Irrigation efficiencies shown in table B-1 are computed efficiencies based on consumptive irrigation requirements shown in table 2. Some of the efficiencies are in excess of 100 percent because irrigation water applied was less than was indicated by the computed consumptive irrigation requirement.

Lint yield data are shown in table B-2. The combined years (mean) analysis indicates that there were significant (5 percent) differences for the interaction of irrigation regimes and fertilizer

Table 4. Consumptive use periods for computing consumptive use and consumptive irrigation requirement of crops grown in the Roswell Artesian Basin, New Mexico.

Crop	Earliest Moisture Use	Latest Moisture Use
Alfalfa	50°F[1]	28°F
Cotton	March 15	28°F
Sorghum, grain	May 1	28°F
Sorghum, silage	May 1	September 1
Corn, silage	May 1	September 1
Small grain, spring	March 1	June 15
Small grain, winter	September 1	June 1

1. Mean air temperature.

rates. The extreme examples of this interaction are exemplified by the decrease of 47 pounds of lint per acre for Regime B in the comparison of 15-versus 45-pounds of phosphorus per acre, while the 45-pound phosphorus application increased lint yield by 99 pounds in Regime E when compared with the 15-pound application. The test of significance, as presented in table B-2, was employed in a manner to provide for the comparison of all treatments (an irrigation regime combined with a fertility level comprises a treatment). In this comparison treatment E-45 with 807 pounds per acre was significantly higher yielding than all other treatments while treatment F-45 with 754 pounds ranked second and was significantly higher yielding than the third ranking treatment, B-15, 713 pounds. Treatments B-15, F-15, 710 pounds, E-15, 708 pounds, D-45, 705 pounds, and D-15, 681 pounds, were not significantly different in yielding ability. Similarly, treatments D-45 and D-15 did not yield significantly higher than treatment B-45, 666 pounds. The continuing stepwise comparison shows that treatments D-15, B-45, C-45, 662 pounds, C-15, 665 pounds, and A-15, 653 pounds, were not significantly different. The final comparison indicates that treatments C-45, C-15, A-15, and A-45, 635 pounds, were not significantly different in yielding ability.

The combined years data for comparing the dates of the last irrigation are altered by the fact that all regimes received an effective irrigation in the form of rainfall during the latter part of August, 1966. Utilizing only data for 1967 and 1968, the average yield for Regimes A and C, receiving the last irrigation on July 21-23, was 611 pounds; Regimes B and D, receiving the last irrigation on August 5-8, yielded 604 pounds; and Regimes E and F, receiving the last irrigation on August 22-27, yielded 658 pounds. These data indicate a slight increase of 7.7 percent in yield for the late August irrigation compared with the late July irrigation. This same comparison for the 1967 data amounted to a 32.4 percent increase, and, in 1968, showed a decrease in yield of 15.7 percent.

This difference in response between 1967 and 1968 may have been partially due to the difference in amount of rainfall received, as 1967 was below average and 1968 was above average in rainfall. There was also an increased incidence of verticillium wilt in 1968, as indicated in table B-3.

Water use efficiency data shown in table B-4 indicate that the interaction of irrigation regimes and fertility levels was significantly (5 percent) different, with the most notable differences in response being between Regimes B and E. The comparison of fertility levels in Regime B shows a decrease of 1.5 pounds of lint per acre-inch of water for 45 pounds of phosphorus when compared with 15 pounds, while the same comparison in Regime E shows an increase of 2.8 pounds of lint.

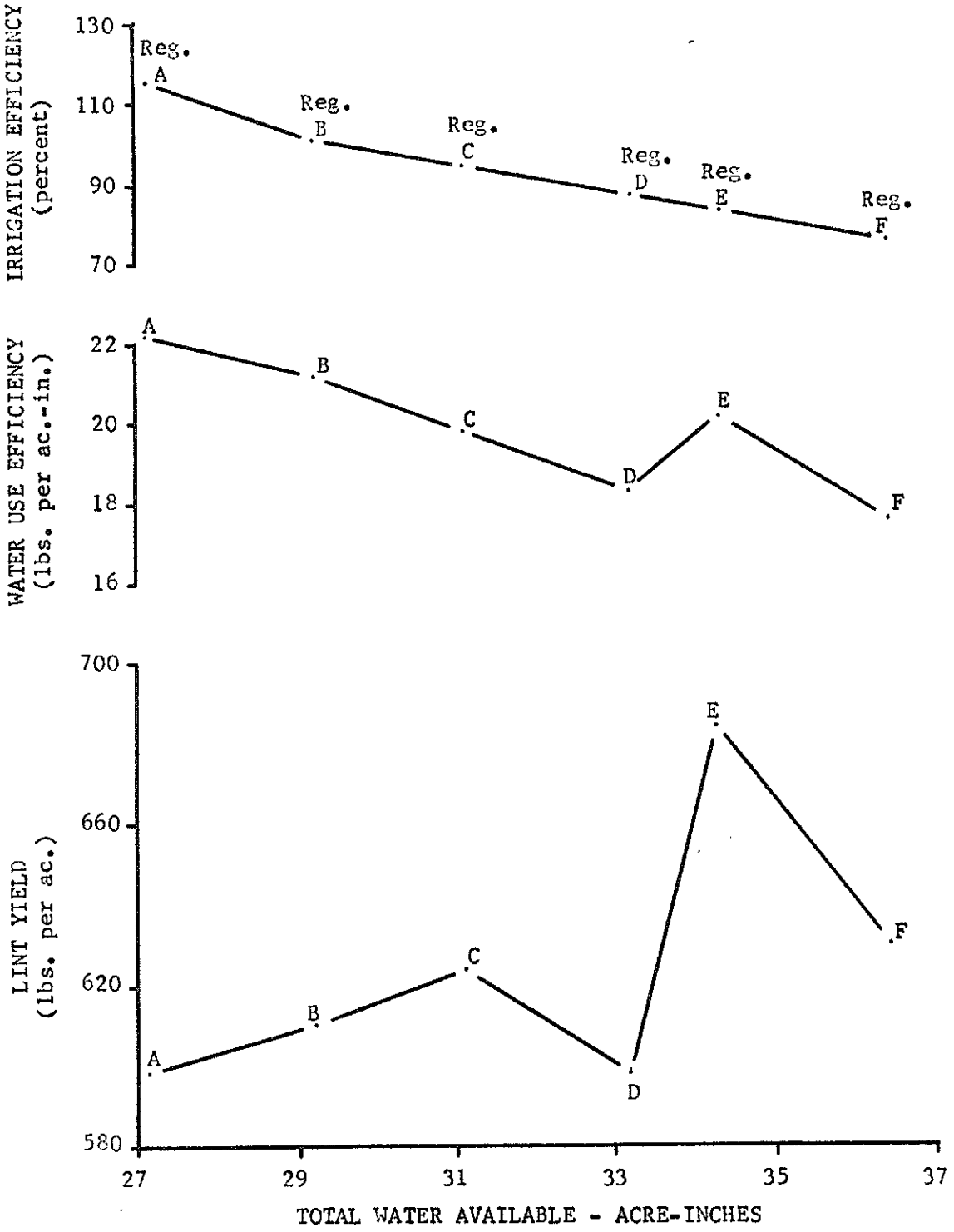

Figure 1. Mean total water available, lint yield, water use efficiency, and irrigation efficiency for six regimes in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68.

A summary of lint yield, water use efficiency, and irrigation efficiency is presented graphically in figure 1. These data would seem to indicate an increase in yield with increased total water applications up to approximately 34.5 acre-inches per acre. Water use efficiency and irrigation efficiency tend to decrease with increased water applications. The most notable exceptions are the sharp increases in yield and water use efficiency in the comparison of Regimes D and E.

Fiber strength data (table B-5) and fiber length data (table B-6) indicate that Regimes A and C, which received their last irrigation between July 21-23, produced a stronger but shorter fiber than did the other four regimes. Phosphorus fertility level had little effect on fiber strength or length. The interaction of irrigation regime and fertility level was significant for micronaire data, table B-7. The most notable differences in response being in the comparison of treatments B-15 with B-45 and E-15 with E-45.

Three different measurements of stages of plant maturity are presented in tables B-8 through B-10. The number of days from planting to first open bloom are shown in table B-8. Differences between regimes or fertility levels were not significant at the 5 percent level. Regimes A and C were earlier maturing than the other regimes, as measured by the number of days to first open boll (table B-9), and by percent of the total yield obtained at first picking (table B-10). The percent of yield at first picking data indicate that Regime B matured earlier than Regimes D and E, while Regime F was the slowest-maturing regime.

Boll size data are shown in tables B-11 and B-12. Significant (5 percent) differences for the interaction of irrigation regimes and fertility levels were recorded for grams of lint per boll (table B-11). In all regimes except Regime B, the higher fertility level produced the larger bolls. Differences for grams of seed cotton per boll (table B-12) were not significant; however, the comparison of fertility means indicates a significant increase for the 45-pound application when compared to the 15-pound application.

Significant (5 percent) differences were found for the interaction of fertility levels and irrigation regimes (table B-13). Treatment C-45 had a significantly higher percent lint than all treatments except C-15 and A-45.

Fertility level had little effect on plant height measured at four different times during the growing season (tables B-14 through B-17). Differences between regimes for the combined years data were not significant for measurements made prior to the second, third, and fourth postemergence irrigations. However, significant (5 percent) differences in mature plant height (table B-17) were recorded. Regime F produced the tallest plants, Regimes B, D, and E produced slightly shorter plants, and Regimes A and C produced the least amount of plant growth.

The percent total soluble salts present in soil samples taken from the plots are presented in table B-18. These data were collected primarily to determine whether salt content increased in those regimes receiving the lesser amounts of water. A comparison of the data taken on May 23, 1966, with data collected toward the end of the study (October 8, 1968) indicates no accumulation of salts. However, the time period involved was relatively short for this condition to have become established, and the total precipitation received during the last year of the study may have had considerable effect on the amount of salt leached below the sampled profile.

A supplementary test (Experiment B) was conducted in 1968 to evaluate the response of the various treatments in the absence of an infestation of verticillium wilt. The data from this experiment are presented in tables B-19 through B-22. The test area was a site that had produced barley the previous two years. All treatments were as nearly as possible like those of the 1968 test reported in tables B-1 through B-17. The verticillium wilt index data in table B-20 indicate the absence of symptoms in Experiment B, whereas the 1968 data presented in table B-3 demonstrate the higher incidence of verticillium wilt in the original test site. The comparison of lint yield data in table B-20 with 1968 data in table B-2 shows that yields were measurably higher for Experiment B. These data would appear to emphasize the value of maintaining a crop rotation program in the farming operation.

Alfalfa Irrigation Study

Irrigation dates, acre-inches of water applied, harvest dates, and irrigation efficiencies for the alfalfa irrigation study are shown in tables C-1 and C-2 for the 1967 and 1968 crop years. Forage yield and water use efficiency data for Regimes A, B, C, and D in 1967, Regimes A, B, C, and E in 1968, and the combined years of 1967 and 1968 for Regimes A, B, and C are presented in table C-3.

The effect of one irrigation per harvest compared with two irrigations per harvest, using the same total amount of water per harvest, may be determined by comparing Regime A and Regime D in 1967 and Regime B and E in 1968. In 1967 Regime A received two 3-inch irrigations per harvest and yielded 4.49 tons per acre and produced 192.9 pounds of forage per inch of water. Regime D received one 6-inch irrigation per harvest and yielded 3.58 tons per acre and produced 136.8 pounds of forage per inch of water. Both the forage yield and water use efficiency were significantly higher for Regime A with two irrigations per harvest.

Similarly, in 1968 Regime B (two 4-inch irrigations) produced a significantly higher forage yield and water use efficiency than did Regime E (one 8-inch irrigation). In 1967 Regime C (two 5-inch irrigations) produced the highest forage yield of 7.93 tons per acre followed in order by Regime B (two 4-inch irrigations) with 6.60 tons,

Regime A with 4.49 tons, and Regime D with 3.58 tons per acre. In each case the differences in yield were statistically significant (5 percent).

Regime B had the highest water use efficiency in 1967 with 216.3 pounds of forage per inch of water but was not significantly higher than Regimes A and C; however, Regime D with 136.8 pounds of forage was significantly lower in efficiency than the other three regimes. In 1968 Regime C produced the highest yield of 9.29 tons per acre, followed, in order, by Regimes B, E, and A. Again each of the differences was significant. Regime B had the highest water use efficiency with 240.4 pounds of forage per inch of water but was not significantly higher than Regime C with 227.4 pounds of forage. The combined years (1967-68) data for Regimes A, B, and C show that Regime C with 8.61 tons of forage per acre was significantly higher-yielding than Regime B with 7.45 tons, and that Regime B was significantly higher-yielding than Regime A with 5.20 tons. Water use efficiency for Regime B, 228.2 pounds, and Regime C, 220.5 pounds, was not significantly different but both were significantly higher than Regime A, 202.2 pounds.

The mean percent total soluble salts present in soil samples taken from the plots on four different dates are listed in table C-4. The average values for salt content for 1967-68, taken in the spring and fall, indicate a reduction in salt content for all regimes at the 0-to-10-inch profile, an increase for Regimes B and C at the 36-to-60-inch profile, and slight increase for Regime A at the 24-to-36-inch profile. These values may be partially explained by the expected differences in depth of water penetration in the various regimes. However, the period of time involved was relatively short for a full appraisal of this factor, and the inherent differences in the soil at the beginning of the experiment were not known.

The data from the alfalfa irrigation study appear to indicate that higher yields can be obtained by irrigating twice per harvest than by irrigating once per harvest when the same total amount of water per harvest is used. The combined years data, presented graphically in figure 2, indicate (1) the yield of forage increases in a near linear response as the total water applied increases, when the same number of irrigations per harvest are employed, (2) water use efficiency increases with increased water applications up to two 4-inch applications per harvest, and (3) irrigation efficiency, computed on the basis of consumptive irrigation requirement (table 2), decreases in a near linear response as yield increases, within the limits of total water applications used in this study.

Alfalfa Seed Production Study

Forage and seed yield data for the three management systems for 1967 and 1968 are presented in table D-1. Forage yields were not significantly different for Systems I and II in either year. The

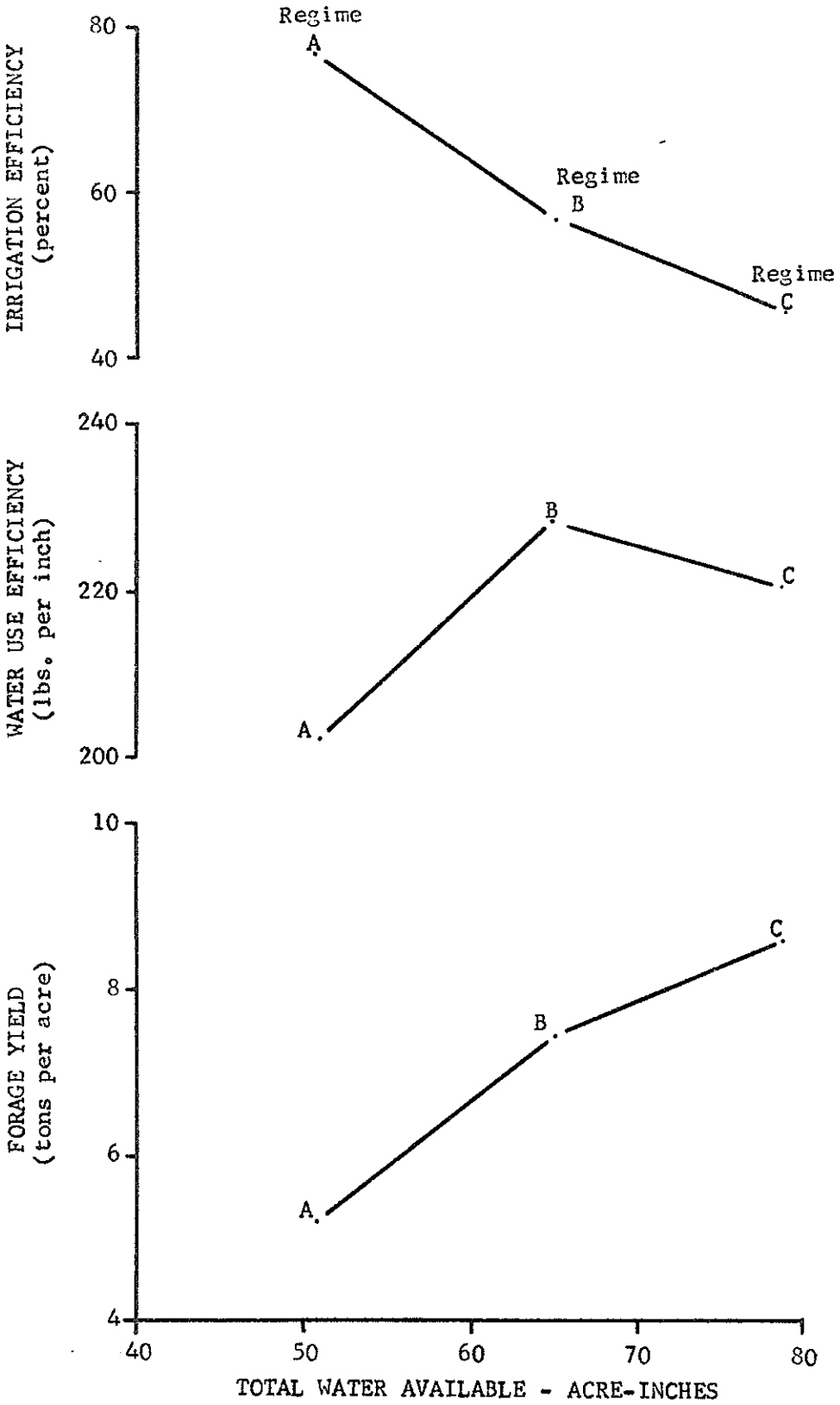

Figure 2. Mean total water available, forage yield, water use efficiency, and irrigation efficiency for three regimes in the alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68.

mean forage yield for three harvests in 1967 was 3.38 and 3.10 tons per acre for Systems I and II, respectively, and for 1968, 3.27 and 3.84 tons per acre, respectively. The forage yield comparisons for row versus broadcast seeding were not significantly different. The yield for row-seeded plots was 3.11 and 3.22 tons per acre in 1967 and 1968, respectively, while broadcast-seeded plots yielded 3.37 and 3.89 tons.

Seed yield in 1967 was 44.0, 19.2 and 223.0 pounds per acre for Systems I, II, and III, respectively, but these differences were not significant (5 percent). There was an extremely variable seed set between the various plots (the coefficient of variation was 152.7 percent), and an apparent rather low level of pollinating-insect activity during the seed set period for the harvests made on July 17 and August 7. Seed yield for System II was 40.1 pounds per acre in 1968, which was significantly higher than the yield of 16.8 and 16.4 pounds for Systems I and III, respectively. Rainfall received during the first week of July caused seed germination in the pod and greatly reduced the yield in the July 16 harvest. The large difference in seed yield of System III in 1967 and 1968 was partially due to the complete loss of the second seed crop in 1968, caused largely by a heavy infestation of lygus. Mean seed yield in 1967 was 120.7 pounds per acre for row-seeded plots compared with 70.0 pounds for broadcast-seeded plots. In 1968 the seed yield was 30.5 and 18.4 pounds for row- and broadcast-seeded plots, respectively. In both years the differences were significant.

Irrigation water applications and harvest dates are shown in table D-2. Irrigations for the seed crop were applied approximately every two weeks until full bloom, and were discontinued until after seed harvest.

Miscellaneous Crops

To obtain information concerning water use and the resulting yield for various crops, without initiating formal irrigation studies, records were made of the water applied to the various experimental crops grown at the Southeastern Branch Station in Artesia. These data are shown in table E-1. Mean dry forage yield for the hybrid forage sorghum test for 1966-1968 was 8.39 tons per acre with an average of 27.78 acre-inches of irrigation water applied. The 38.12 acre-inches applied in 1967 are explained by a preplow irrigation of 9.57 inches on December 6, 1966, which was more than should have been required. This excessive application was caused primarily by poor land preparation, which was also true of the sorghum-sudangrass hybrid test area in 1967. The average dry forage yield for the sorghum-sudangrass hybrid test during 1966-1968 was 6.48 tons per acre with 30.70 acre-inches of irrigation water. The data shown for grain sorghum in 1966 are the average yields for a row-spacing, seeding-rate study using a standard grain sorghum hybrid, RS-610, and the data for 1968 were the average yields for 13 bird-resistant grain sorghum hybrids.

The mean soybean yield during 1966-1968 was 1,390 pounds per acre with 24.24 acre-inches of irrigation water applied. The soybean yield data are the average yields of seven strains or varieties in 1966; of thirteen strains or varieties in 1967; and six strains or varieties in 1968.

In 1966 and 1967 a test of five bermudagrass varieties over-seeded with hairy vetch was conducted. The mean dry forage yield for all varieties for the two years was 4.20 tons per acre with 77.12 acre-inches of irrigation water applied.

The average grain yield for the winter barley nursery in 1966 and 1967 was 2,543 pounds per acre and the dry forage yield was 1.06 tons per acre with 30.05 acre-inches of irrigation water applied. The plots were harvested three times for forage yield. The low grain yields in 1967 were caused primarily by frost damage on May 2.

The sugarbeet yield data for 1966 were the averages of 10 strains for the harvest on October 10. The 1968 data are the averages of three irrigation regimes for the harvest on November 19. The mean root yield for these two tests was 32.60 tons per acre with 47.52 acre-inches of irrigation water applied.

Forage corn hybrids were grown for the first time in 1968. The mean dry forage yield for eight hybrids was 5.33 tons per acre with 11.50 acre-inches of irrigation water applied. The plant stand was established from stored moisture received during the winter months. For most years additional irrigation water would be required for stand establishment.

Selected Irrigation Units
Case Farms J and L

Irrigation water applications, irrigation efficiency, and yield for selected irrigation units of alfalfa and cotton on Case Farms J and L are shown in tables F-1 through F-8. One of the differences in the management of water on these two farms was that a system of applying two irrigations per cutting for alfalfa was employed on Case Farm J while one irrigation per cutting was applied on Case Farm L.

In 1967, 45.47 acre-inches of irrigation water produced 8.53 tons of forage per acre and an irrigation efficiency of 79.1 percent on Case Farm J, while 71.38 acre-inches of water produced 8.48 tons of forage per acre and an irrigation efficiency of 50.4 percent on Case Farm L (tables F-1 and F-2). In 1968, 40.21 acre-inches of water produced 5.18 tons of forage per acre and an irrigation efficiency of 71.3 percent on Case Farm J, and on Case Farm L 68.54 acre-inches of water produced 8.69 tons of forage and an irrigation efficiency of 41.8 percent (tables F-3 and F-4). The lower yield on Case Farm J in 1968 was partially attributed to cutworm and hail

damage to the second cutting.

These data would seem to substantiate the observations made during the irrigation study at the Southeastern Branch Experiment Station that increased yield results when irrigations are applied twice per cutting when compared to one irrigation per cutting, and that irrigation efficiency decreases as yield increases. The 1967 yield on both farms was practically the same with considerably less water use on Case Farm J. In 1968 the forage yield per acre was lower on Case Farm J than on Case Farm L; however, from the standpoint of pounds of forage per inch of irrigation water, Case Farm J produced slightly more than Case Farm L (257.0 and 252.0 pounds per acre-inch, respectively), without compensating for accountable yield loss on Case Farm J.

In 1967 a total of 34.06 acre-inches of water was applied to produce 486.0 pounds of lint cotton per acre and an irrigation efficiency of 70.5 percent on Case Farm J (table F-5), while 45.94 acre-inches of water applied on Case Farm L produced 857.0 pounds of lint and an irrigation efficiency of 52.3 percent (table F-6). During 1968, 29.8 acre-inches of water produced 619.0 pounds of lint and an irrigation efficiency of 63.3 percent on Case Farm J, and on Case Farm L, 27.07 acre-inches of water produced 418.0 pounds of lint and an irrigation efficiency of 69.8 percent (tables F-7 and F-8).

Irrigation Water Quality and Soil Salinity

Results of the analysis of water samples taken from the irrigation well(s) at the Southeastern Branch Experiment Station, Artesia, and on the cooperating farms are presented in tables G-1 through G-16. These data are presented as an indication of water quality in the Roswell Artesian Basin and are useful in the prediction of potential yield and water requirements as reported by Dregne (2).

Following is an example of the application of these data, using data from the irrigation well at the Southeastern Branch Experiment Station. The mean electrical conductivity was 1780 or 1.780 EC x 10^3 as shown by Dregne (2). According to relative yield curves (2, p. 7) for alfalfa, the relative yield with 42 acre-inches of water would be approximately 40 percent, and approximately 90 percent yield would be expected with 66 acre-inches of water. For barley, the relative yield would be 60 percent with 9 acre-inches of water and 100 percent with 18 acre-inches of water. For corn, approximately 28 acre-inches of water would be required to produce 100 percent of the yield potential. It should be noted that the water quality data for Case Farm C appear to be the only instance where there is a theoretical potential of sodium accumulation in the soil; however, the extremely high salt content of this water, coupled with the gypsiferous character of most of the soils in the basin, results in the salinity

hazard precluding the potential development of a sodium hazard.

The percent total soluble salts present in soil samples taken from Case Farms A, C, F, G, and I are presented in table G-17, and from alfalfa and cotton fields on Case Farms J, K and L in table G-18. With two exceptions, these data indicate that leaching has been sufficient to prevent an accumulation of salts in the soil. The exceptions are Case Farm A, where additional leaching will be required to maintain a satisfactory salt level, and the October 2, 1967, sampling on Case Farm C, which indicated a substantial increase in salt content as compared to the May 4, 1967, sampling. The lower salt content for 1968 samplings on Case Farm C may have been caused by leaching resulting from above-average rainfall during 1968.

SUMMARY

A multiphase research project was jointly undertaken by the New Mexico Agricultural Experiment Station, Southeastern Branch Experiment Station, the Department of Agricultural Economics and Agricultural Business, the Department of Agricultural Engineering, and the New Mexico Water Resources Research Institute, to supply information with respect to crop yields and irrigation water use under a variety of conditions on farms within the Roswell Artesian Basin.

The agronomic study consisted of differential water applications in replicated tests of cotton and alfalfa, a replicated alfalfa seed production study, the measurement of water applied to various experimental crops grown at the Southeastern Branch Experiment Station, Artesia, New Mexico, the recording of irrigation water applied to crops grown on cooperating farms in the Roswell Artesian Basin, and the measurement of irrigation water quality and salt content of soils on these farms.

The results of the cotton irrigation study indicated that: (1) application of the first postemergence irrigation on June 1, compared with July 1, was ineffective in increasing lint yield; (2) there was an apparent increase in yield with additional late season irrigations, the last irrigation being applied between August 22 to 27; (3) irrigations applied after July 21 to 23 delayed maturity and produced fiber of greater length but less strength; (4) water use efficiency and field irrigation efficiency tended to decrease as yield increased; and, (5) there was no evidence of salt accumulations in the soil with decreased water applications.

Alfalfa forage yield increased and field irrigation efficiency decreased with increased water applications when the same number of irrigations per harvest were applied. Two irrigations per harvest produced more forage than did one irrigation per harvest when the same total amount of water per harvest was applied. Water use

efficiency increased to a maximum with the application of two 4-inch irrigations per cutting of alfalfa. The irrigation regime that produced the highest yield during the two-year study received an average of 69.98 acre-inches (two 5-inch irrigations per harvest) of irrigation water annually, and produced 8.61 tons of forage per acre, and had a field irrigation efficiency of 46.2 percent.

The results of the alfalfa seed production study indicated that alfalfa seed production has many production hazards, with insect damage and unfavorable weather conditions being two prime examples. The data indicated that row seeding is more beneficial for seed production when compared with broadcast seeding.

Irrigation water quality and salt content in the soil for the majority of cooperating farms in the Roswell Artesian Basin indicated that leaching had been sufficient to maintain a satisfactory salt content for crop production. There were two exceptions where the impending development of a salinity hazard appeared to exist.

Computed consumptive use and consumptive irrigation requirement data for various crops grown in the Roswell Artesian Basin for the years of 1966, 1967, and 1968 are included in this report.

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APPENDIX A - PRECIPITATION AND FROST-FREE PERIOD

Table A-1. Monthly precipitation recorded at the Southeastern Branch Experiment Station, Artesia, New Mexico, and at Walker Air Base, Roswell, New Mexico, and computed effective rainfall 1966-1968.

Location	Month	Year 1966		1967		1968	
		R[1] (in.)	r[2] (in.)	R[1] (in.)	r[2] (in.)	R[1] (in.)	r[2] (in.)
Artesia	January	0.46	0.44	0.00	0.00	1.42	1.33
	February	0.12	0.11	0.12	0.11	1.07	1.01
	March	1.01	0.96	0.12	0.11	1.02	0.97
	April	1.79	1.66	0.00	0.00	0.27	0.26
	May	0.82	0.78	1.34	1.26	1.11	1.05
	June	0.49	0.46	0.68	0.65	0.01	0.01
	July	0.19	0.18	1.10	1.04	3.94	3.28
	August	5.51	3.90	0.49	0.46	2.37	2.15
	September	0.29	0.28	0.62	0.59	0.03	0.03
	October	0.00	0.00	0.00	0.00	1.05	1.00
	November	0.00	0.00	0.10	0.10	1.41	1.32
	December	0.00	0.00	0.33	0.31	0.26	0.25
	Total	10.68	8.77	4.90	4.63	13.96	12.66
Roswell[3]	January	0.53	0.50	0.00	0.00	1.50	1.40
	February	0.03	0.03	0.20	0.19	1.17	1.10
	March	0.25	0.24	0.07	0.07	1.93	1.79
	April	1.97	1.82	0.00	0.00	0.06	0.06
	May	0.54	0.51	0.11	0.10	0.57	0.54
	June	2.35	2.14	3.55	3.03	0.60	0.57
	July	0.15	0.14	0.97	0.92	5.50	3.90
	August	2.89	2.58	4.00	3.32	2.67	2.40
	September	0.97	0.92	0.85	0.81	0.10	0.10
	October	0.00	0.00	0.02	0.02	0.41	0.39
	November	0.00	0.00	0.22	0.21	1.11	1.05
	December	0.00	0.00	1.07	1.02	0.22	0.21
	Total	9.68	8.88	11.06	9.69	15.84	13.51

1. R - monthly precipitation.
2. r - computed effective rainfall.
3. Source: Precipitation records, Climatological Data, U. S. Department of Commerce, Vols. 70-72.

Table A-2. Frost-free period recorded at the Southeastern Branch Experiment Station, Artesia, New Mexico, and at Walker Air Base, Roswell, New Mexico, 1966-1968.

Location	Year	Latest and Earliest Occurrence of 32°F		Frost-free Period (Days)
		Spring	Fall	
Artesia	1966	April 6	Oct. 14	191
	1967	May 2	Oct. 18	169
	1968	April 29	Sept. 28	152
	Mean	April 22	Oct. 10	170
Roswell[1]	1966	April 20	Oct. 14	177
	1967	May 2	Oct. 17	168
	1968	April 30	Oct. 17	170
	Mean	April 27	Oct. 16	172

1. Source: Climatological Data, U. S. Department of Commerce, Vols. 70-72.

APPENDIX B - COTTON IRRIGATION

Table B-1. Irrigation water applications, irrigation efficiency, and total water applied for six irrigation regimes in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Date of Irrigation	Acre-Inches of Water					
	Regime A	Regime B	Regime C	Regime D	Regime E	Regime F
Feb. 21, 1966	2.80	2.80	2.80	2.80	2.80	2.80
April 1	7.97	7.97	7.97	7.97	7.97	7.97
June 1	--	--	3.06	3.06	--	3.06
July 1	4.02	4.02	3.06	3.06	4.02	3.06
July 21	4.02	4.02	4.02	4.02	4.02	4.02
August 4	--	4.02	--	4.02	4.02	4.02
Total Irrigation Water, 1966	18.81	22.83	20.91	24.93	22.83	24.93
Precipitation	11.76	11.76	11.76	11.76	11.76	11.76
Total Water, 1966	30.57	34.59	32.67	36.69	34.59	36.69
Irrigation Efficiency, percent	102.6	84.5	92.3	77.4	84.5	77.4
Dec. 7, 1966	3.06	3.06	3.06	3.06	3.06	3.06
March 30, 1967	8.96	8.96	8.96	8.96	8.96	8.96
June 1	--	--	3.01	3.01	--	3.01
July 1	3.96	3.96	3.01	3.01	3.96	3.01
July 21	3.96	3.96	3.96	3.96	3.96	3.96
August 5	--	3.96	--	3.96	3.96	3.96
August 22	--	--	--	--	3.96	3.96
Total Irrigation Water, 1967	19.94	23.90	22.00	25.96	27.86	29.92
Precipitation	4.47	4.47	4.47	4.47	4.47	4.47
Total Water, 1967	24.41	28.37	26.47	30.43	32.33	34.39
Irrigation Efficiency, percent	120.5	100.5	109.2	92.6	86.2	80.3
Dec. 6, 1967	3.01	3.01	3.01	3.01	3.01	3.01
April 5, 1968	5.97	5.97	5.97	5.97	5.97	5.97
May 31	--	--	3.17	3.17	--	3.17
July 1	4.03	4.03	2.98	2.98	4.03	2.98
July 23	4.03	4.03	4.03	4.03	4.03	4.03
August 8	--	4.03	--	4.03	4.03	4.03
August 27	--	--	--	--	2.54	2.54
Total Irrigation Water, 1968	17.04	21.07	19.16	23.19	23.61	25.73
Precipitation	12.72	12.72	12.72	12.72	12.72	12.72
Total Water, 1968	29.76	33.79	31.88	35.91	36.33	38.45
Irrigation Efficiency, percent	110.8	89.6	98.6	81.4	80.0	73.4

Table B-2. Total lint yield for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Lint Yield[1] 1966	1967	1968	Mean
	(lbs. P per acre)		(lbs. per acre)		
A	15	744a	611a	605a	653ef
	45	731a	573a	601a	635f
	Mean	737BC	592A	603A	644A
B	15	879a	684a	577a	713c
	45	820a	650a	526a	666def
	Mean	849ABC	667A	552A	690A
C	15	716a	590a	659a	655ef
	45	741a	595a	651a	662ef
	Mean	728C	593A	655A	660A
D	15	841a	675a	525a	681cde
	45	921a	702a	491a	705cd
	Mean	881AB	689A	508A	693A
E	15	894a	752a	477a	708c
	45	915a	846a	660a	807a
	Mean	905A	799A	569A	757A
F	15	897a	730a	500a	710c
	45	967a	810a	484a	754b
	Mean	932A	770A	492A	731A
Fertility Mean	15	828A	674A	557A	687B
	45	849A	696A	569A	705A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-3. Verticillium wilt index for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Wilt Index[1, 2]			
		1966	1967	1968	Mean
	(lbs. P per acre)				
A	15	1.75a	1.26a	1.50a	1.50a
	45	2.25a	1.76a	1.25a	1.75a
	Mean	2.00A	1.50BC	1.38A	1.62C
B	15	2.00a	2.00a	2.50a	2.17a
	45	3.00a	2.00a	2.75a	2.58a
	Mean	2.50A	2.00ABC	2.62A	2.38ABC
C	15	2.50a	1.25a	2.00a	1.92a
	45	3.00a	1.25a	2.50a	2.25a
	Mean	2.75A	1.25C	2.25A	2.08BC
D	15	4.47a	2.25a	3.25a	3.42a
	45	4.75a	2.00a	4.00a	3.25a
	Mean	4.25A	2.12AB	3.62A	3.33A
E	15	3.00a	2.50a	5.00a	3.50a
	45	2.75a	2.00a	3.75a	2.83a
	Mean	2.88A	2.25AB	4.38A	3.17AB
F	15	2.25a	2.50a	5.00a	3.25a
	45	1.50a	2.25a	5.25a	3.00a
	Mean	1.88A	2.38A	5.12A	3.12AB
Fertility Mean	15	2.71A	1.96A	3.21A	2.62A
	45	2.71A	1.88A	3.25A	2.61A

1. Visual evaluation: 1=0 to 10 percent of plants showing symptoms; 2=11 to 20 percent; and so on.
2. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-4. Water use efficiency for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Lint per Acre-Inch of Water[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)	(lbs.)	(lbs.)	(lbs.)	(lbs.)
A	15	24.3a	25.0a	20.3a	23.2ab
	45	23.9a	23.4a	20.2a	22.5abc
	Mean	24.1A	24.2A	20.2A	22.9A
B	15	25.4a	24.1a	17.1a	22.2bc
	45	23.7a	22.9a	15.6a	20.7def
	Mean	24.6A	23.5A	16.3AB	21.4A
C	15	21.9a	22.3a	20.7a	21.6cde
	45	22.7a	22.5a	20.4a	21.9cd
	Mean	22.3A	22.4A	20.5A	21.7A
D	15	22.9a	22.2a	14.6a	19.9f
	45	25.1a	23.1a	13.7a	20.6ef
	Mean	24.0A	22.6A	14.1B	20.2A
E	15	25.8a	23.3a	13.1a	20.8ef
	45	26.5a	26.2a	18.2a	23.6a
	Mean	26.2A	24.7A	15.6AB	22.2A
F	15	24.4a	21.2a	13.0a	19.6ef
	45	26.3a	23.6a	12.6a	20.8ef
	Mean	25.4A	22.4A	12.8B	20.2A
Fertility Mean	15	24.7A	23.0A	16.5A	21.4B
	45	25.3A	23.6A	16.8A	21.9A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-5. Fiber strength for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Fiber Strength[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)		(grams per grex)		
A	15	2.45a	2.65a	2.19a	2.43a
	45	2.46a	2.72a	2.25a	2.48a
	Mean	2.46A	2.69A	2.22A	2.45A
B	15	2.41a	2.57a	2.17a	2.38a
	45	2.40a	2.54a	2.15a	2.36a
	Mean	2.41A	2.56AB	2.16A	2.37B
C	15	2.52a	2.61a	2.29a	2.48a
	45	2.44a	2.67a	2.29a	2.46a
	Mean	2.48A	2.64A	2.29A	2.47A
D	15	2.34a	2.58a	2.11a	2.34a
	45	2.30a	2.62a	2.26a	2.39a
	Mean	2.32B	2.60A	2.18A	2.37B
E	15	2.34a	2.40a	2.16a	2.30a
	45	2.32a	2.42a	2.27a	2.34a
	Mean	2.33B	2.41C	2.22A	2.32B
F	15	2.46a	2.47a	2.18a	2.37a
	45	2.36a	2.43a	2.23a	2.34a
	Mean	2.41A	2.45BC	2.21A	2.36B
Fertility Mean	15	2.42A	2.55A	2.18B	2.38A
	45	2.38A	2.57A	2.24A	2.40A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-6. Fiber length data for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Fiber Length[1, 2]			
		1966	1967	1968	Mean
	(lbs. P per acre)	(in.)	(in.)	(in.)	(in.)
A	15	1.19a	1.16e	1.19a	1.18a
	45	1.20a	1.20bcde	1.18a	1.19a
	Mean	1.20A	1.18B	1.19B	1.19B
B	15	1.22a	1.24ab	1.23a	1.23a
	45	1.22a	1.20bcde	1.26a	1.23a
	Mean	1.22A	1.22AB	1.24A	1.23A
C	15	1.17a	1.18de	1.20a	1.18a
	45	1.17a	1.17e	1.19a	1.18a
	Mean	1.17A	1.18B	1.19B	1.18B
D	15	1.24a	1.23abc	1.26a	1.24a
	45	1.21a	1.25a	1.24a	1.23a
	Mean	1.23A	1.24A	1.25A	1.24A
E	15	1.22a	1.22abcd	1.25a	1.23a
	45	1.21a	1.19cde	1.24a	1.21a
	Mean	1.21A	1.20AB	1.24A	1.22A
F	15	1.22a	1.22abcd	1.23a	1.22a
	45	1.22a	1.22abcd	1.23a	1.22a
	Mean	1.22A	1.22AB	1.23AB	1.22A
Fertility Mean	15	1.21A	1.21A	1.22A	1.22A
	45	1.20A	1.20A	1.22A	1.21A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.
2. 1966 data are "upper half mean length" and 1967 and 1968 data are "2.5 percent span length."

Table B-7. Micronaire data for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Micronaire[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)				
A	15	4.4a	4.0a	4.0a	4.2ab
	45	4.4a	3.9a	4.2a	4.2ab
	Mean	4.4A	4.0A	4.1AB	4.2A
B	15	4.4a	3.7a	4.0a	4.0bc
	45	4.4a	3.3a	3.4a	3.7d
	Mean	4.4A	3.5A	3.7C	3.9B
C	15	4.6a	4.0a	4.2a	4.3a
	45	4.6a	3.8a	4.1a	4.2ab
	Mean	4.6A	3.9A	4.2A	4.2A
D	15	4.1a	3.6a	3.6a	3.8cd
	45	4.4a	3.8a	3.4a	3.9cd
	Mean	4.3A	3.7A	3.5C	3.8B
E	15	4.4a	3.7a	3.5a	3.9cd
	45	4.6a	4.1a	4.0a	4.2ab
	Mean	4.5A	3.9A	3.8BC	4.0AB
F	15	4.4a	3.8a	3.7a	4.0bc
	45	4.6a	3.9a	3.4a	4.0bc
	Mean	4.5A	3.9A	3.6C	4.0AB
Fertility Mean	15	4.4A	3.8A	3.8A	4.0A
	45	4.5A	3.8A	3.8A	4.0A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-8. Days to first open bloom for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Number Days to First Open Bloom[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)				
A	15	80a	85a	76a	80a
	45	80a	87a	76a	81a
	Mean	80A	86A	76A	81A
B	15	81a	86a	76a	81a
	45	81a	87a	76a	81a
	Mean	81A	86A	76A	81A
C	15	82a	87a	74a	81a
	45	81a	87a	75a	81a
	Mean	81A	87A	74A	81A
D	15	81a	87a	76a	81a
	45	81a	88a	76a	82a
	Mean	81A	87A	76A	82A
E	15	82a	86a	75a	81a
	45	81a	86a	74a	80a
	Mean	81A	86A	74A	81A
F	15	81a	86a	77a	82a
	45	81a	86a	75a	81a
	Mean	81A	86A	76A	81A
Fertility Mean	15	81A	86A	76A	81A
	45	81A	87A	76A	81A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-9. Days to first open boll for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Number Days to First Open Boll[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)				
A	15	132a	139f	130a	134a
	45	129a	140ef	130a	133a
	Mean	131BC	139C	130A	134B
B	15	139a	143d	132a	138a
	45	139a	142de	132a	138a
	Mean	139A	143B	132A	138A
C	15	129a	140ef	129a	133a
	45	127a	139f	128a	132a
	Mean	128C	139C	129A	132B
D	15	139a	144cd	132a	138a
	45	139a	146bc	133a	139a
	Mean	139A	145AB	132A	139A
E	15	139a	144cd	133a	139a
	45	135a	148ab	132a	138a
	Mean	137A	146A	132A	138A
F	15	135a	146bc	136a	139a
	45	135a	149a	136a	140a
	Mean	135AB	147A	136A	139A
Fertility Mean	15	136A	142B	132A	137A
	45	134A	144A	132A	136A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-10. Percent of total yield obtained at first picking for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Percent of Total Yield at First Picking[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)				
A	15	69.4b	68.6a	42.6a	60.2a
	45	64.2c	56.4a	44.2a	54.9a
	Mean	66.8A	62.5A	43.4A	57.6A
B	15	50.9d	44.5a	26.6a	40.7a
	45	49.6e	43.5a	29.7a	41.0a
	Mean	50.3B	44.0B	28.2B	40.8B
C	15	73.8a	63.3a	47.2a	61.4a
	45	73.8a	64.3a	47.5a	61.8a
	Mean	73.8A	63.8A	47.4A	61.6A
D	15	46.6f	37.1a	18.6a	34.1a
	45	43.7g	38.1a	23.2a	35.0a
	Mean	45.1B	37.6BC	20.9B	34.5C
E	15	44.4g	30.7a	25.7a	33.6a
	45	47.3f	34.0a	24.8a	35.4a
	Mean	45.8B	32.3C	25.3B	34.5C
F	15	42.4h	28.2a	19.1a	29.9a
	45	39.9i	26.8a	17.0a	27.9a
	Mean	41.2B	27.5C	18.0B	28.9D
Fertility Mean	15	54.6A	45.4A	30.0A	43.3A
	45	53.1B	43.8A	31.1A	42.7A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-11. Lint per boll for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level (lbs. P per acre)	Lint Per Boll[1] 1966 (gms.)	1967 (gms.)	1968 (gms.)	Mean (gms.)
A	15	1.97a	2.05a	2.25a	2.09c
	45	2.08a	2.12a	2.30a	2.17abc
	Mean	2.02A	2.08A	2.27ABC	2.13A
B	15	1.93a	2.17a	2.55a	2.22ab
	45	1.98a	2.05a	2.37a	2.13bc
	Mean	1.96A	2.11A	2.46A	2.18A
C	15	2.02a	2.22a	2.42a	2.22ab
	45	2.17a	2.20a	2.40a	2.26a
	Mean	2.09A	2.21A	2.41AB	2.24A
D	15	1.92a	2.18a	2.13a	2.08c
	45	2.00a	2.32a	2.15a	2.16abc
	Mean	1.96A	2.25A	2.14C	2.12A
E	15	1.98a	2.13a	2.13a	2.08c
	45	2.08a	2.22a	2.43a	2.24ab
	Mean	2.03A	2.17A	2.28ABC	2.16A
F	15	2.10a	2.13a	2.20a	2.14abc
	45	2.12a	2.23a	2.32a	2.22ab
	Mean	2.11A	2.18A	2.26BC	2.18A
Fertility Mean	15	1.99B	2.15A	2.28A	2.14B
	45	2.07A	2.19A	2.33A	2.20A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-12. Seed cotton per boll for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Seed Cotton per Boll[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)	(gms.)	(gms.)	(gms.)	(gms.)
A	15	6.02a	6.02a	6.60a	6.21a
	45	6.22a	6.20a	6.75a	6.39a
	Mean	6.12A	6.11A	6.67BC	6.30A
B	15	6.12a	6.55a	7.48a	6.72a
	45	6.30a	6.13a	7.13a	6.52a
	Mean	6.21A	6.34A	7.31A	6.62A
C	15	6.03a	6.43a	6.98a	6.49a
	45	6.43a	6.30a	6.95a	6.56a
	Mean	6.23A	6.37A	6.97AB	6.52A
D	15	6.10a	6.52a	6.47a	6.36a
	45	6.27a	7.00a	6.48a	6.59a
	Mean	6.18A	6.76A	6.48C	6.48A
E	15	6.32a	6.42a	6.45a	6.40a
	45	6.45a	6.47a	7.10a	6.68a
	Mean	6.38A	6.44A	6.77BC	6.54A
F	15	6.48a	6.35a	6.53a	6.46a
	45	6.53a	6.65a	6.82a	6.67a
	Mean	6.51A	6.50A	6.67BC	6.56A
Fertility Mean	15	6.18A	6.38A	6.75A	6.44B
	45	6.37A	6.46A	6.87A	6.57A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-13. Lint percent for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Lint Percent[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)				
A	15	32.7a	34.0a	34.1a	33.6cd
	45	33.5a	34.1a	34.1a	33.9abc
	Mean	33.1AB	34.1A	34.1A	33.8AB
B	15	31.6a	33.1a	34.1a	32.9ef
	45	31.4a	33.4a	33.2a	32.7ef
	Mean	31.5C	33.2A	33.6A	32.8CD
C	15	33.4a	34.4a	34.6a	34.2abc
	45	33.7a	34.9a	34.5a	34.4a
	Mean	33.6A	34.7A	34.6A	34.3A
D	15	31.4a	33.5a	33.0a	32.6f
	45	31.9a	33.1a	33.1a	32.7ef
	Mean	31.7C	33.3A	33.1A	32.7D
E	15	31.4a	33.2a	33.1a	32.6f
	45	32.2a	34.2a	34.2a	33.6cd
	Mean	31.8C	33.7A	33.6A	33.1CD
F	15	32.4a	33.6a	33.6a	33.2de
	45	32.4a	33.6a	34.0a	33.3de
	Mean	32.4BC	33.6A	33.8A	33.2BC
Fertility Mean	15	32.2A	33.6A	33.7A	33.2B
	45	32.5A	33.9A	33.8A	33.4A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-14. Plant height prior to the first July irrigation for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Plant Height[1]			
		6-30-66	6-29-67	7-1-68	Mean
	(lbs. P per acre)	(in.)	(in.)	(in.)	(in.)
A	15	16.0a	9.5a	7.8a	11.1a
	45	14.5a	8.0bc	7.0a	9.8a
	Mean	15.2A	8.8A	7.4A	10.4A
B	15	14.2a	7.8c	7.8a	9.9a
	45	16.5a	8.0bc	8.2a	10.9a
	Mean	15.4A	7.9A	8.0A	10.4A
C	15	16.8a	8.0bc	7.5a	10.8a
	45	16.5a	9.5a	8.5a	11.5a
	Mean	16.6A	8.8A	8.0A	11.1A
D	15	16.2a	8.2bc	7.2a	10.6a
	45	17.5a	8.2bc	7.8a	11.2a
	Mean	16.9A	8.2A	7.5A	10.9A
E	15	14.8a	9.0ab	8.2a	10.7a
	45	14.2a	8.8abc	9.2a	10.8a
	Mean	14.5A	8.9A	8.8A	10.7A
F	15	16.0a	9.0ab	7.2a	10.8a
	45	16.2a	9.0ab	8.0a	11.1a
	Mean	16.1A	9.0A	7.6A	10.9A
Fertility Mean	15	15.7A	8.6A	7.6A	10.6A
	45	15.9A	8.6A	8.1A	10.9A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-15. Plant height prior to the second July irrigation for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level (lbs. P per acre)	Plant Height[1] 7-21-66 (in.)	7-20-67 (in.)	7-23-68 (in.)	Mean (in.)
A	15	30.2a	21.7a	18.5a	23.5a
	45	29.2a	19.0a	18.0a	22.1a
	Mean	29.8C	20.4A	18.2A	22.8A
B	15	30.5a	21.0a	18.5a	23.3a
	45	31.0a	20.8a	18.0a	23.2a
	Mean	30.8BC	20.9A	18.2A	23.3A
C	15	31.8a	20.5a	18.8a	23.7a
	45	31.5a	21.2a	18.8a	23.8a
	Mean	31.6AB	20.9A	18.8A	23.8A
D	15	32.5a	21.2a	16.8a	23.5a
	45	32.8a	21.8a	18.0a	24.2a
	Mean	32.6A	21.5A	17.4A	23.8A
E	15	30.5a	21.0a	17.8a	23.1a
	45	30.0a	21.5a	18.5a	23.3a
	Mean	30.2BC	21.2A	18.1A	23.2A
F	15	31.5a	20.5a	17.8a	23.2a
	45	32.0a	22.0a	16.2a	23.4a
	Mean	31.8AB	21.2A	17.0A	23.3A
Fertility Mean	15	31.2A	21.0A	18.0A	23.4A
	45	31.1A	21.0A	17.9A	23.3A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-16. Plant height prior to the first August irrigation for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Plant Height[1]			
		8-3-66	8-7-67	8-7-68	Mean
	(lbs. P per acre)	(in.)	(in.)	(in.)	(in.)
A	15	35.2a	34.8a	29.5a	33.2a
	45	34.2a	32.5a	28.8a	31.8a
	Mean	34.8A	33.6A	29.1A	32.5A
B	15	33.5a	34.5a	30.8a	32.9a
	45	34.5a	32.8a	28.5a	31.9a
	Mean	34.0A	33.6A	29.6A	32.4A
C	15	35.8a	34.5a	29.0a	33.1a
	45	35.2a	35.0a	29.2a	33.2a
	Mean	35.5A	34.8A	29.1A	33.1A
D	15	37.5a	35.2a	28.0a	33.6a
	45	37.2a	36.0a	29.2a	34.2a
	Mean	37.4A	35.6A	28.6A	33.9A
E	15	35.5a	35.0a	28.0a	32.8a
	45	34.8a	34.5a	29.5a	32.9a
	Mean	35.1A	34.8A	28.8A	32.9A
F	15	36.0a	33.8a	29.0a	32.9a
	45	36.0a	35.5a	28.5a	33.3a
	Mean	36.0A	34.6A	28.8A	33.1A
Fertility Mean	15	35.6A	34.6A	29.0A	33.1A
	45	35.3A	34.4A	29.0A	32.9A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-17. Mature plant height for six irrigation regimes and two fertility levels in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Fertility Level	Plant Height[1]			
		1966	1967	1968	Mean
	(lbs. P per acre)	(in.)	(in.)	(in.)	(in.)
A	15	39.0c	33.0a	41.8a	37.9a
	45	38.8c	33.8a	40.0a	37.5a
	Mean	38.9B	33.4C	40.9B	37.7C
B	15	49.0a	36.8a	51.5a	45.8a
	45	44.0b	37.2a	48.8a	43.3a
	Mean	46.5A	37.0B	50.1A	44.5B
C	15	42.5bc	33.0a	39.8a	38.4a
	45	39.5c	33.2a	40.2a	37.7a
	Mean	41.0B	33.1C	40.0B	38.0C
D	15	44.2b	37.5a	49.5a	43.8a
	45	49.2a	37.0a	49.8a	45.3a
	Mean	46.8A	37.2AB	49.6A	44.5B
E	15	47.0ab	40.2a	50.5a	45.9a
	45	44.0b	37.2a	49.2a	43.5a
	Mean	45.5A	38.8AB	49.9A	44.7B
F	15	49.5a	40.0a	51.8a	47.1a
	45	48.0ab	40.5a	54.5a	47.7a
	Mean	48.8A	40.2A	53.1A	47.4A
Fertility Mean	15	45.2A	36.8A	47.5A	43.1A
	45	43.9A	36.5A	47.1A	42.5A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-18. Percent total soluble salts in soil samples from six irrigation regimes in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Irrigation Regime	Date of Sample	Sampled Profile (inches) 0-10	10-24	24-36	36-60
		(percent total soluble salts)			
A	5-23-66	0.172	0.172	0.182	0.180
	10-30-66	0.145	0.180	0.175	0.185
	5-2-67	0.168	0.168	0.160	0.182
	11-2-67	0.152	0.165	0.195	0.225
	5-23-68	0.148	0.172	0.175	0.190
	10-8-68	0.135	0.155	0.152	0.162
Mean	Spring	0.162	0.171	0.172	0.184
	Fall	0.144	0.167	0.174	0.191
B	5-23-66	0.165	0.172	0.175	0.172
	10-30-66	0.158	0.185	0.180	0.155
	5-2-67	0.178	0.172	0.158	0.168
	11-2-67	0.155	0.188	0.158	0.168
	5-23-68	0.148	0.172	0.170	0.160
	10-8-68	0.135	0.152	0.152	0.148
Mean	Spring	0.163	0.172	0.168	0.167
	Fall	0.149	0.175	0.163	0.157
C	5-23-66	0.170	0.192	0.175	0.182
	10-30-66	0.160	0.175	0.172	0.175
	5-2-67	0.168	0.152	0.155	0.172
	11-2-67	0.165	0.172	0.218	0.182
	5-23-68	0.155	0.170	0.172	0.188
	10-8-68	0.142	0.155	0.162	0.165
Mean	Spring	0.164	0.172	0.168	0.181
	Fall	0.155	0.168	0.184	0.174

(continued)

Table B-18. Percent total soluble salts in soil samples from six irrigation regimes in the cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968 (continued).

Irrigation Regime	Date of Sample	Sampled Profile (inches) 0-10	10-24	24-36	36-60
		(percent total soluble salts)			
D	5-23-66	0.162	0.165	0.162	0.175
	10-30-66	0.158	0.185	0.180	0.160
	5-2-67	0.165	0.170	0.150	0.162
	11-2-67	0.148	0.198	0.188	0.195
	5-23-68	0.145	0.170	0.172	0.165
	10-10-68	0.132	0.155	0.160	0.135
Mean	Spring	0.158	0.168	0.162	0.168
	Fall	0.146	0.179	0.175	0.163
E	5-23-66	0.160	0.180	0.188	0.195
	10-30-66	0.160	0.175	0.170	0.185
	5-2-67	0.165	0.160	0.172	0.172
	11-2-57	0.168	0.195	0.175	0.195
	5-23-68	0.145	0.178	0.192	0.188
	10-10-68	0.132	0.150	0.160	0.168
Mean	Spring	0.157	0.172	0.184	0.185
	Fall	0.153	0.173	0.168	0.182
F	5-23-66	0.160	0.165	0.172	0.180
	10-30-66	0.142	0.170	0.198	0.182
	5-2-67	0.168	0.178	0.150	0.172
	11-2-67	0.165	0.200	0.195	0.200
	5-23-68	0.145	0.162	0.185	0.175
	10-10-68	0.142	0.168	0.162	0.158
Mean	Spring	0.158	0.168	0.169	0.176
	Fall	0.150	0.179	0.185	0.180

Table B-19. Irrigation water applications, irrigation efficiency, and total water applied for six irrigation regimes in cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

Date of Irrigation	Acre-Inches of Water					
	Regime A	Regime B	Regime C	Regime D	Regime E	Regime F
March 29	5.96	5.96	5.96	5.96	5.96	5.96
June 1	--	--	2.94	2.94	--	2.94
July 2	3.98	3.98	2.94	2.94	3.98	2.94
July 24	3.98	3.98	3.98	3.98	3.98	3.98
August 8	--	3.98	--	3.98	3.98	3.98
August 23	--	--	--	--	2.50	2.50
Total Irrigation Water, 1968	13.92	17.90	15.82	19.80	20.40	22.30
Precipitation	12.72	12.72	12.72	12.72	12.72	12.72
Total Water, 1968	26.64	30.62	28.54	32.52	33.12	35.02
Irrigation Efficiency, percent	135.7	105.5	119.4	95.4	92.6	84.7

Table B-20. Yield and agronomic data for six irrigation regimes and two fertility levels in cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

Irrigation Regime	Fertility Level (lbs. P per acre)	Days to First Open Bloom (no.)[1]	Days to First Open Boll (no.)[1]	Verticillium Wilt Index[1,2]	Yield of Total Crop at First Picking (percent)[1]	Total Lint Yield (lbs. per ac.)[1]	Water Use Efficiency (lbs. per ac. in.)[1]	Lint Percent (percent)[1]
A	15	75a	130a	1.00a	37.0a	929bcd	34.9a	35.1a
	45	74a	130a	1.00a	42.6a	894de	33.6a	34.9a
	Mean	75A	130B	1.00A	39.8A	912A	34.2A	35.0A
B	15	74a	134a	1.00a	12.4a	850e	27.7cd	33.8a
	45	74a	135a	1.00a	17.3a	916cde	29.9bc	34.5a
	Mean	74A	135A	1.00A	14.9BC	883A	28.8B	34.1BC
C	15	74a	129a	1.00a	43.8a	952abcd	33.3a	35.4a
	45	74a	130a	1.00a	39.6a	1007a	35.3a	35.2a
	Mean	74A	130B	1.00A	41.7A	979A	34.3A	35.3A
D	15	74a	135a	1.00a	17.9a	996ab	30.6b	34.5a
	45	74a	135a	1.00a	16.1a	936abcd	28.8bc	33.6a
	Mean	74A	135A	1.00A	17.0B	966A	29.7B	34.1BC
E	15	74a	137a	1.00a	13.5a	994ab	30.0bc	34.7a
	45	74a	136a	1.00a	12.4a	982abc	29.7bc	34.7a
	Mean	74A	137A	1.00A	13.0BC	988A	29.8B	34.7AB
F	15	75a	138a	1.00a	11.9a	901de	25.7de	33.8a
	45	75a	138a	1.00a	7.5a	843e	24.1e	33.3a
	Mean	75A	138A	1.00A	9.7C	872A	24.9C	33.6C
Fertility Mean	15	74A	134A	1.00A	22.8A	937A	30.4A	34.6A
	45	74A	134A	1.00A	22.6A	930A	30.2A	34.4A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.
2. Visual evaluation: 1=0 to 10 percent of plants showing symptoms; 2=11 to 20 percent, and so on.

Table B-21. Boll size and fiber characteristics for six irrigation regimes and two fertility levels in cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

Irrigation Regime	Fertility Level (lbs. P per acre)	Seed Cotton per Boll (gms.)[1]	Lint per Boll (gms.)[1]	Fiber Length (in.)[1]	Fiber Strength (gms./grex)[1]	Micronaire[1]
A	15	7.65a	2.68a	1.23a	2.12a	4.2a
	45	7.50a	2.62a	1.22a	2.10a	4.2a
	Mean	7.57A	2.65A	1.22B	2.11A	4.2A
B	15	7.45a	2.52a	1.26a	2.08a	4.2a
	45	7.53a	2.60a	1.26a	2.07a	4.3a
	Mean	7.49A	2.56A	1.26A	2.08A	4.2A
C	15	7.50a	2.65a	1.19a	2.18a	4.1a
	45	7.52a	2.65a	1.21a	2.08a	4.2a
	Mean	7.51A	2.65A	1.20B	2.13A	4.2A
D	15	7.62a	2.63a	1.26a	2.07a	4.3a
	45	7.47a	2.52a	1.25a	2.12a	4.1a
	Mean	7.54A	2.57A	1.25A	2.10A	4.2A
E	15	7.38a	2.57a	1.26a	2.14a	4.4a
	45	7.30a	2.53a	1.26a	2.06a	4.2a
	Mean	7.34A	2.55A	1.26A	2.10A	4.3A
F	15	7.13a	2.42a	1.26a	2.19a	4.2a
	45	6.95a	2.32a	1.26a	2.12a	4.2a
	Mean	7.04A	2.37B	1.26A	2.16A	4.2A
Fertility Mean	15	7.46A	2.58A	1.24A	2.13A	4.2A
	45	7.38A	2.54A	1.24A	2.09A	4.2A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

Table B-22. Plant height at four different times during the growing season for six irrigation regimes and two fertility levels in cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

Irrigation Regime	Fertility Level	Plant Height[1]			Mature Plant Height
		July 1	July 23	Aug. 7	
	(lbs. P per acre)	(in.)	(in.)	(in.)	(in.)
A	15	9.0a	24.2a	35.8a	45.5a
	45	9.0a	23.0a	34.2a	43.8a
	Mean	9.0A	23.6A	35.0A	44.6C
B	15	8.8a	23.2a	33.2a	58.2a
	45	8.8a	23.0a	33.8a	57.5a
	Mean	8.8A	23.1A	33.5A	57.9B
C	15	9.5a	22.5a	33.8a	41.0a
	45	9.0a	23.0a	34.2a	44.2a
	Mean	9.2A	22.8A	34.0A	42.6C
D	15	9.5a	23.5a	34.2a	55.5a
	45	9.0a	23.2a	33.5a	59.2a
	Mean	9.2A	23.4A	33.9A	57.4B
E	15	9.2a	23.5a	33.2a	56.0a
	45	8.0a	20.8a	32.5a	55.8a
	Mean	8.6A	22.1A	32.9A	55.9B
F	15	9.0a	22.0a	34.8a	59.0a
	45	8.0a	22.0a	34.5a	64.5a
	Mean	8.5A	22.0A	34.6A	61.8A
Fertility Mean	15	9.2A	23.2A	34.2A	52.5A
	45	8.6B	22.5A	33.8A	54.2A

1. Data in the same column followed by the same letter are not statistically different at the 5 percent probability level.

APPENDIX C - ALFALFA IRRIGATION

Table C-1. Irrigation dates, water applied, harvest dates, and irrigation efficiency for the alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

Date of Irrigation or Harvest	Acre-Inches of Water			
	Regime A	Regime B	Regime C	Regime D[1]
Crop Year 1967				
1966				
October 28	2.98	4.00	4.97	5.98
1967				
February 15	3.02	4.03	5.00	5.98
March 16	3.02	4.03	5.00	0.00
April 10	3.02	4.03	5.00	5.98
April 25	Harvest	Harvest	Harvest	Harvest
May 1	3.02	4.03	5.00	5.98
May 16	3.02	4.03	5.00	0.00
May 30	Harvest	Harvest	Harvest	Harvest
June 5	3.02	4.03	5.00	5.98
June 19	3.02	4.03	5.00	0.00
June 30	Harvest	Harvest	Harvest	Harvest
July 7	3.02	4.03	5.00	5.98
July 21	3.03	4.03	5.00	0.00
July 31	Harvest	Harvest	Harvest	Harvest
August 4	3.02	4.02	5.00	5.98
August 18	3.02	4.03	5.00	0.00
August 28	Harvest	Harvest	Harvest	Harvest
September 6	3.00	4.25	5.00	6.00
September 22	3.02	4.03	5.00	0.00
October 5	Harvest	Harvest	Harvest	Harvest
Water Applied, acre-inches				
Total irrigation water	42.23	56.60	69.97	47.86
Precipitation	4.47	4.47	4.47	4.47
Total water, 1967	46.70	61.07	74.44	52.33
Irrigation Efficiency, percent	85.2	63.5	51.4	75.1

1. Regime D was replaced by Regime E in 1968 (see table C-2).

Table C-2. Irrigation dates, water applied, harvest dates, and irrigation efficiency for the alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

Date of Irrigation or Harvest	Acre-Inches of Water			
	Regime A	Regime B	Regime C	Regime E[1]
Crop Year 1968				
1967				
November 1	3.02	4.03	5.00	5.98
1968				
March 4	3.02	4.03	5.00	8.01
April 8	3.02	4.03	5.00	0.00
April 23	3.02	4.03	5.00	8.01
May 1	Harvest	Harvest	Harvest	Harvest
May 10	3.02	4.03	5.00	8.01
May 23	3.02	4.03	5.00	0.00
June 4	Harvest	Harvest	Harvest	Harvest
June 10	3.02	4.03	5.00	8.01
June 24	3.02	4.03	5.00	0.00
July 12	Harvest	Harvest	Harvest	Harvest
July 19	3.02	4.03	5.00	8.01
August 2	3.02	4.03	5.00	0.00
August 11	Harvest	Harvest	Harvest	Harvest
August 16	3.02	4.03	5.00	8.01
August 30	3.02	4.03	5.00	0.00
September 11	Harvest	Harvest	Harvest	Harvest
September 19	3.02	4.03	5.00	8.01
October 3	3.02	4.03	5.00	0.00
October 11	Harvest	Harvest	Harvest	Harvest
Water Applied, acre-inches				
Total irrigation water	42.28	56.42	70.00	62.05
Precipitation	12.72	12.72	12.72	12.72
Total water, 1968	55.00	69.14	82.72	74.77
Irrigation Efficiency, percent	67.8	50.8	41.0	46.2

1. Regime E replaced Regime D in 1968. For Regime D, see table C-1.

Table C-3. Total dry forage yield and water use efficiency for the alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68.

Year	Irrigation Regime	Yield of Dry Forage (tons per acre)[1] Harvest Number First	Second	Third	Fourth	Fifth	Sixth	Total Yield	Water Use Efficiency (lbs. per ac.-in.)
1967	A	0.70b	0.59a	0.78c	0.68c	0.90c	0.83c	4.49c	192.9a
	B	0.98ab	0.86a	1.18b	1.12b	1.35b	1.11b	6.60b	216.3a
	C	1.22a	1.11a	1.50a	1.40a	1.47a	1.25a	7.93a	213.6a
	D	0.80b	0.49a	0.55c	0.56c	0.60d	0.58d	3.58d	136.8b
1968	A	1.28d	0.93c	1.25b	0.69d	1.02b	0.75b	5.91d	211.4bc
	B	1.77b	1.68b	1.47a	1.21b	1.18a	0.99a	8.30b	240.4a
	C	2.18a	1.98a	1.50a	1.43a	1.15a	1.05a	9.29a	227.4ab
	E	1.49c	1.50b	1.21b	0.93c	1.16a	1.02a	7.31c	195.5c
1967-68 Mean	A	0.98c	0.76c	1.01c	0.69c	0.96b	0.79c	5.20c	202.2b
	B	1.38b	1.27b	1.32b	1.17b	1.26a	1.05b	7.45b	228.2a
	C	1.70a	1.54a	1.50a	1.41a	1.30a	1.15a	8.61a	220.5a

1. Data in the same column and within the same time period, followed by the same letter, are not significantly different at the 5 percent probability level.

Table C-4. Percent total soluble salts present in soil samples from the alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68.

Year	Date of Sample	Irrigation Regime	Percent Total Soluble Salts Sampled Profile (inches) 0-10	10-24	24-36	36-60
1967	May 4	A	0.192	0.168	0.165	0.182
		B	0.175	0.160	0.190	0.180
		C	0.162	0.175	0.172	0.148
		D	0.162	0.165	0.180	0.190
	October 26	A	0.152	0.198	0.165	0.162
		B	0.165	0.175	0.180	0.210
		C	0.142	0.175	0.205	0.205
		D	0.155	0.168	0.192	0.170
1968	May 2	A	0.162	0.198	0.172	0.170
		B	0.138	0.185	0.178	0.170
		C	0.145	0.180	0.205	0.208
		E	0.155	0.175	0.205	0.218
	October 15	A	0.170	0.170	0.185	0.162
		B	0.145	0.175	0.172	0.178
		C	0.140	0.155	0.165	0.180
		E	0.140	0.162	0.182	0.208
1967-68 Mean	Spring	A	0.178	0.182	0.169	0.176
		B	0.156	0.172	0.184	0.175
		C	0.154	0.178	0.189	0.178
	Fall	A	0.161	0.184	0.175	0.162
		B	0.155	0.175	0.176	0.194
		C	0.141	0.165	0.185	0.192

APPENDIX D - ALFALFA SEED PRODUCTION

Table D-1. Dry forage and seed yield in the alfalfa seed production study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68.

Management System	Seeding Method	Forage Yield[1] 1967	Forage Yield[1] 1968	Seed Yield[1] 1967	Seed Yield[1] 1968
		(tons per acre)		(pounds per acre)	
I	Rows	3.28a	2.89a	64.7a	20.7c
	Broadcast	3.47a	3.66a	23.2a	12.8d
	Mean	3.38A	3.27A	44.0A	16.8B
II	Rows	2.93a	3.56a	24.0a	50.3a
	Broadcast	3.27a	4.12a	14.4a	30.0b
	Mean	3.10A	3.84A	19.2A	40.1A
III	Rows	---	---	273.3a	20.4c
	Broadcast	---	---	172.6a	12.4d
	Mean	---	---	223.0A	16.4B
Mean	Rows	3.11a	3.22a	120.7a	30.5a
	Broadcast	3.37a	3.89a	70.0b	18.4b

1. Data in the same column followed by the same letter are not significantly different at the 5 percent probability level.

Table D-2. Irrigation water applied and harvest dates for the three management systems used in the alfalfa seed production study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68.

Date of Irrigation or Harvest	Irrigation Water Applied		
	System I	System II	System III
	(ac.-in.)	(ac.-in.)	(ac.-in.)
1966			
November 28	4.01	3.98	4.00
1967			
February 15	4.01	3.98	4.00
March 16	4.01	3.98	4.00
April 10	4.01	3.98	4.00
April 25	---	Forage harvest	---
May 1	4.01	3.98	4.00
May 16	4.01	3.98	3.95
June 5	---	3.98	---
June 19	---	3.98	---
July 17	Seed harvest	---	Seed harvest
July 21	6.00	---	6.00
August 4	4.01	---	4.00
August 7	---	Seed harvest	---
August 14	Forage harvest	---	---
August 18	4.01	6.00	4.00
September 6	4.06	4.27	---
September 15	Forage harvest	Forage harvest	---
September 22	4.04	3.98	---
October 4	---	---	Seed harvest
October 11	4.04	3.98	6.00
October 20	Forage harvest	Forage harvest	---
Total, crop year 1967	50.22	50.07	43.95

(continued)

Table D-2. Irrigation water applied and harvest dates for the three management systems used in the alfalfa seed production study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967-68 (continued).

Date of Irrigation or Harvest	Irrigation Water Applied		
	System I	System II	System III
	(ac.-in.)	(ac.-in.)	(ac.-in.)
1967			
November 1	4.01	3.98	4.00
1968			
March 4	4.01	3.98	4.00
April 8	4.01	3.98	4.00
April 23	4.01	3.98	4.00
May 1	---	Forage harvest	---
May 10	4.01	3.98	4.00
May 23	4.01	3.98	4.00
June 10	---	3.98	---
June 24	---	3.98	---
July 16	Seed harvest	---	Seed harvest
July 19	4.01	---	4.00
August 1	---	Seed harvest	---
August 2	4.01	3.98	4.00
August 12	Forage harvest	Forage harvest	---
August 16	4.01	3.98	4.00
August 30	4.01	3.98	4.00
September 12	Forage harvest	---	---
September 19	4.01	3.98	---
October 3	4.01	3.98	---
October 11	Forage harvest	Forage harvest	---
October 15	---	---	Seed harvest
Total, crop year 1968	48.12	51.74	40.00

APPENDIX E - MISCELLANEOUS CROPS

Table E-1. Mean yield and irrigation water applied to various crops grown at the Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

Crop	Crop Year	Yield		Water Applied (ac.-in.)
Forage Sorghum,[1] tons per acre	1966	7.89		23.98
	1967	8.00		38.12
	1968	9.27		21.24
	Mean	8.39		27.78
Sorghum-Sudan Hybrid,[1] tons per acre	1966	7.54		29.86
	1967	5.80		41.23
	1968	6.09		21.00
	Mean	6.48		30.70
Soybeans, pounds per acre	1966	2,107		31.18
	1967	1,019		18.58
	1968	1,045		22.97
	Mean	1,390		24.24
Grain Sorghum, pounds per acre	1966	4,515		23.79
	1968	4,646		17.89
	Mean	4,580		20.84
Bermudagrass-Hairy Vetch Mixture,[1] tons per acre	1966	4.63		89.70
	1967	3.77		64.53
	Mean	4.20		77.12
Barley (Winter), pounds per acre	1966	4,033[2]	0.84[1,4]	19.31
	1967	1,053[2]	1.27[1,4]	40.79
	Mean	2,543	1.06[1,4]	30.05
Sugarbeets, tons per acre	1966	35.81		52.71
	1968	29.40		42.34
	Mean	32.60		47.52
Corn Silage, tons per acre	1968	5.33		11.50[3]

1. Yield data are for oven-dry forage.
2. Frost damage on May 2 reduced yield.
3. Plant stand was established with stored moisture received from precipitation.
4. Forage yield, tons per acre.

APPENDIX F - COOPERATING FARMS

Table F-1. Irrigation efficiency, forage yield, and irrigation water applied to a selected irrigation unit of alfalfa on Case Farm J, Roswell Artesian Basin, New Mexico, 1967.

Date of Irrigation or Harvest	Water Applied (acre-inches)	Forage Yield (tons per acre)
1966		
December 15	4.74	
1967		
March 4	2.36	
March 14	2.55	
April 3	2.54	
April 24	---	1.63
May 2	2.81	
May 11	2.69	
May 27	---	1.23
May 29	2.85	
June 13	3.41	
June 24	---	1.56
June 30	3.19	
July 12	3.15	
July 31	---	1.60
August 3	3.04	
August 25	4.94	
September 10	---	1.56
September 16	3.37	
September 28	3.83	
October 16	---	0.95
Totals	45.47	7.53
Irrigation Efficiency, percent	79.1	

Table F-2. Irrigation efficiency, forage yield, and irrigation water applied to a selected irrigation unit of alfalfa on Case Farm L, Roswell Artesian Basin, New Mexico, 1967.

Date of Irrigation or Harvest	Water Applied (acre-inches)	Forage Yield (tons per acre)
1966		
December 14	10.04	
1967		
March 10	10.70	
April 7	9.74	
May 4	---	1.80
May 10	9.87	
June 12	---	1.80[1]
June 19	10.12	
July 16	---	1.85
July 27	10.77	
August 19	---	1.64
August 28	10.14	
September 30	---	1.39
Totals	71.38	8.48
Irrigation Efficiency, percent	50.4	

1. Estimated yield. Bales were removed before sample bales could be weighed.

Table F-3. Irrigation efficiency, forage yield, and irrigation water applied to a selected irrigation unit of alfalfa on Case Farm J, Roswell Artesian Basin, New Mexico, 1968.

Date of Irrigation or Harvest	Water Applied (acre-inches)	Forage Yield (tons per acre)
March 25	2.99	
April 8	2.69	
April 30	---	0.80
May 2	3.34	
May 27	2.84	
June 8	3.00	
June 12	2.37	
June 22[1]	---	0.96
July 1	3.29	
July 19	3.47	
July 26	---	1.46
August 5	3.47	
August 8	2.37	
August 20	2.97	
September 3	---	1.13
September 5	3.37	
September 22	4.04	
October 14	---	0.83
Totals	40.21	5.18
Irrigation Efficiency, percent	71.3	

1. A hailstorm on May 10 and cutworm infestation delayed the second harvest.

Table F-4. Irrigation efficiency, forage yield, and irrigation water applied to a selected irrigation unit of alfalfa on Case Farm L, Roswell Artesian Basin, New Mexico, 1968.

Date of Irrigation or Harvest	Water Applied (acre-inches)	Forage Yield (tons per acre)
February 27	12.69	
April 11	11.18	
May 5	---	2.00[1]
May 9	11.48	
June 4	---	1.28
June 11	12.75	
July 14	---	2.24
July 27	11.87	
August 20	---	2.00[1]
August 29	8.57	
October 5	---	1.17
Totals	68.54	8.69
Irrigation Efficiency, percent	41.8	

1. Estimated yield. Bales were removed before sample bales could be weighed.

Table F-5. Lint yield, irrigation efficiency, and irrigation water applied to a selected irrigation unit of cotton on Case Farm J, Roswell Artesian Basin, New Mexico, 1967.

Date of Irrigation	Water Applied (acre-inches)
1966	
December 20	11.32
1967	
March 20	10.28
May 6	3.74
June 23	1.99
July 17	3.45
August 9	3.28
Total	34.06
Irrigation Efficiency, percent	70.5
Lint Yield, pounds per acre	486.0

Table F-6. Lint yield, irrigation efficiency, and irrigation water applied to a selected irrigation unit of cotton on Case Farm L, Roswell Artesian Basin, New Mexico, 1967.

Date of Irrigation Start	Finish	Water Applied (acre-inches)
11-30-66	12-04-66	13.98
3-13-67	3-19-67	9.99
4-11-67	4-12-67	0.97[1]
4-26-67	4-26-67	0.50[1]
6-23-67	---	9.10
7-31-67	8-04-67	7.49
9-01-67	9-04-67	3.91
Total		45.94
Irrigation Efficiency, percent		52.3
Lint Yield, pounds per acre		857.0

1. Isolated spot irrigation applied to establish plant stand.

Table F-7. Lint yield, irrigation efficiency, and irrigation water applied to a selected irrigation unit of cotton on Case Farm J, Roswell Artesian Basin, New Mexico, 1968.

Date of Irrigation	Water Applied (acre-inches)
March 30	7.93
May 8	5.00
June 25	5.69
July 30	6.34
August 17	4.84
Total	29.80
Irrigation Efficiency, percent	63.3
Lint Yield, pounds per acre	619.0

Table F-8. Lint yield, irrigation efficiency, and irrigation water applied to a selected irrigation unit of cotton on Case Farm L, Roswell Artesian Basin, New Mexico, 1968.

Date of Irrigation		Water Applied (acre-inches)
Start	Finish	
12-30-67	1-04-68	2.18[1]
3-24-68	4-04-68	13.23
6-22-68	7-01-68	5.89
8-02-68	8-07-68	3.21
8-20-68	8-22-68	2.56
Total		27.07
Irrigation Efficiency, percent		69.8
Lint Yield, pounds per acre		418.0

1. Preplow irrigation.

APPENDIX G - WATER QUALITY AND SOIL SALINITY

Table G-1. Analysis of water samples from the irrigation well at the Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968.

	Date of Sample						
	3-29-66	4-29-66	5-29-66	6-29-66	7-29-66	8-15-66	8-29-66
pH	7.8	7.8	7.4	7.7	7.0	7.1	7.1
Total Soluble Salts[1]	1650	1700	1750	1900	1800	1880	1800
Calcium and Magnesium[2]	18.90	19.70	20.20	20.30	20.70	18.40	20.00
Sodium[2]	1.74	2.07	2.40	2.04	2.07	2.17	3.42
Potassium[2]	0.050	0.075	0.061	0.084	0.030	0.073	0.060
Carbonate[2]	0.86	0.86	0.96	1.48	0.52	2.91	3.32
Bicarbonate[2]	0.96	1.56	2.04	1.58	3.50	1.48	0.49
Chloride [2]	1.50	1.90	1.87	1.50	1.87	2.47	2.85
Sulfate[2]	15.50	15.50	16.50	17.50	16.20	14.50	20.10
Sodium Adsorption Ratio	0.56	0.65	0.75	0.63	0.64	0.71	1.06
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	8.4	9.4	10.5	9.0	9.0	10.5	14.0

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-1. Analysis of water samples from the irrigation well at the Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968 (continued).

	Date of Sample						
	9-29-66	10-28-66	11-29-66	12-29-66	1-29-67	2-28-67	3-29-67
pH	7.0	7.2	8.0	7.0	7.2	7.3	7.1
Total Soluble Salts[1]	1800	1750	1750	1750	1800	1950	1880
Calcium and Magnesium[2]	22.00	21.80	22.73	21.02	20.48	19.69	21.41
Sodium[2]	2.71	2.48	1.78	1.82	0.92	1.46	1.65
Potassium[2]	0.170	0.070	0.103	0.063	0.040	0.022	0.054
Carbonate[2]	2.62	3.12	4.31	1.61	6.18	1.35	1.30
Bicarbonate[2]	1.27	1.87	0.29	2.36	0.13	2.93	2.75
Chloride[2]	2.25	1.12	6.50	5.50	9.00	6.00	5.00
Sulfate[2]	3.22	3.32	3.32	3.14	3.40	3.26	3.32
Sodium Adsorption Ratio	0.79	0.74	0.52	0.56	2.85	0.46	0.50
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	1.1	10.0	7.0	7.9	0.4	6.8	0.7

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-1. Analysis of water samples from the irrigation well at the Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968 (continued).

	Date of Sample						
	4-4-67	4-29-67	5-3-67	5-29-67	6-29-67	8-1-67	8-31-67
pH	7.0	7.1	6.9	7.0	7.0	7.2	7.1
Total Soluble Salts[1]	1800	1920	1800	1900	1800	1750	1800
Calcium and Magnesium[2]	17.44	22.09	17.78	22.05	19.36	18.86	21.06
Sodium[2]	1.26	1.30	1.27	1.26	1.12	1.34	1.57
Potassium[2]	0.046	0.040	0.025	0.022	0.029	0.039	0.046
Carbonate[2]	1.82	2.39	1.30	1.04	2.13	1.24	1.30
Bicarbonate[2]	2.44	1.61	3.06	3.22	3.00	3.35	3.01
Chloride[2]	7.50	7.00	7.50	8.50	13.50	7.50	7.00
Sulfate[2]	2.76	3.32	2.81	3.40	2.98	3.18	3.28
Sodium Adsorption Ratio	0.42	3.90	0.42	0.37	0.36	0.43	0.48
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	6.0	5.50	6.0	0.5	5.0	6.0	6.0

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-1. Analysis of water samples from the irrigation well at the Southeastern Branch Experiment Station, Artesia, New Mexico, 1966-1968 (continued).

	Date of Sample					
	10-6-67	11-1-67	12-1-67	2-28-68	4-3-68	Mean
pH	7.7	7.6	7.4	7.2	7.9	7.3
Total Soluble Salts[1]	1500	1800	1700	1600	1750	1780
Calcium and Magnesium[2]	21.42	27.72	15.54	17.22	18.48	20.63
Sodium[2]	1.04	1.04	1.06	2.50	2.50	1.77
Potassium[2]	0.039	0.035	0.042	0.050	0.030	0.054
Carbonate[2]	3.64	2.08	3.64	1.56	1.04	2.10
Bicarbonate[2]	1.30	1.30	0.52	0.26	2.08	1.86
Chloride[2]	3.75	2.25	3.00	12.00	9.75	5.33
Sulfate[2]	16.24	15.00	16.24	7.24	7.50	8.57
Sodium Adsorption Ratio	0.31	0.29	0.38	0.85	0.82	0.79
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	4.0	3.0	6.0	12.36	11.89	6.8

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-2. Analysis of water samples from the irrigation well on Case Farm A, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample				
	8-14-66	4-11-67	8-23-67	3-9-68	Mean
pH	8.0	6.9	7.2	7.2	7.3
Total Soluble Salts[1]	3320	3700	3700	3600	3580
Calcium and Magnesium[2]	20.60	18.27	21.06	19.32	19.12
Sodium[2]	17.70	16.34	20.15	20.50	18.67
Potassium[2]	1.200	0.058	0.123	0.090	0.368
Carbonate[2]	1.19	1.19	1.09	2.08	1.39
Bicarbonate[2]	2.70	1.84	1.97	1.56	2.02
Chloride[2]	19.80	42.00	40.50	26.24	32.14
Sulfate[2]	17.20	3.34	3.34	6.24	7.53
Sodium Adsorption Ratio	5.51	5.41	6.20	6.49	5.90
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	44.0	65.0	48.0	51.4	52.1

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-3. Analysis of water samples from two irrigation wells on Case Farm B, Roswell Artesian Basin, New Mexico, 1966-67.

	Date of Sample Well No. 1			
	8-14-66	4-11-67	8-30-67	Mean
pH	7.6	6.9	7.3	7.3
Total Soluble Salts[1]	4200	4500	4000	4233
Calcium and Magnesium[2]	22.30	18.52	24.65	21.82
Sodium[2]	30.60	21.31	21.60	24.50
Potassium[2]	0.085	0.006	0.054	0.048
Carbonate[2]	1.61	3.84	1.97	2.47
Bicarbonate[2]	2.13	0.83	2.08	1.68
Chloride[2]	21.50	59.00	49.50	43.33
Sulfate[2]	16.5	3.22	3.34	7.69
Sodium Adsorption Ratio	6.16	7.00	6.15	6.44
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	48.0	53.0	46.0	49.0

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-3. Analysis of water samples from two irrigation wells on Case Farm B, Roswell Artesian Basin, New Mexico, 1966-67 (continued).

	Date of Sample Well No. 2			
	8-14-66	4-11-67	8-23-67	Mean
pH	7.8	7.7	7.1	7.5
Total Soluble Salts[1]	4250	4100	4200	4183
Calcium and Magnesium[2]	25.70	25.08	22.26	24.35
Sodium[2]	20.00	18.52	20.88	19.80
Potassium[2]	0.090	0.073	0.058	0.074
Carbonate[2]	0.98	1.19	2.08	1.42
Bicarbonate[2]	1.74	0.26	2.62	1.54
Chloride[2]	23.40	49.00	51.50	41.30
Sulfate[2]	20.80	3.68	3.52	9.33
Sodium Adsorption Ratio	5.58	5.23	6.25	5.69
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	43.0	42.0	48.0	44.3

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-4. Analysis of water samples collected from irrigation well No. 1, Case Farm C, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample				
	8-14-66	4-11-67	8-30-67	4-5-68	Mean
pH	7.5	8.0	7.2	7.7	7.6
Total Soluble Salts[1]	9500	10,000	5850	7500	8212
Calcium and Magnesium[2]	22.10	24.50	28.56	20.58	23.94
Sodium[2]	62.00	41.47	47.60	59.5	52.64
Potassium[2]	0.180	0.117	0.070	0.200	0.142
Carbonate[2]	1.56	1.45	1.24	1.04	1.32
Bicarbonate[2]	0.75	2.73	2.23	2.08	1.95
Chloride[2]	72.60	135.00	59.00	71.25	84.46
Sulfate[2]	20.30	2.78	3.56	11.06	9.42
Sodium Adsorption Ratio	18.6	11.84	12.59	18.53	15.39
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	73.0	62.0	62.0	74.0	67.8

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-5. Analysis of water samples from irrigation well No. 2, Case Farm C, Roswell Artesian Basin, New Mexico, 1967-68.

	Date of Sample			
	4-11-67	8-30-67	4-5-68	Mean
pH	7.4	7.9	8.0	7.8
Total Soluble Salts[1]	7000	5400	6000	6133
Calcium and Magnesium[2]	19.60	22.86	19.32	20.59
Sodium[2]	39.44	55.54	47.00	47.33
Potassium[2]	0.085	0.196	0.140	0.140
Carbonate[2]	2.08	1.09	2.08	1.75
Bicarbonate[2]	1.56	1.48	0.26	1.10
Chloride[2]	107.00	60.00	56.25	74.42
Sulfate[2]	3.27	3.48	7.50	4.75
Sodium Adsorption Ratio	12.60	16.43	15.11	14.71
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	80.0	70.0	70.0	73.3

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-6. Analysis of water samples taken from three irrigation wells on Case Farm D, Roswell Artesian Basin, New Mexico, 1966-67.

	Date of Sample Well No. 1			
	8-14-66	4-19-67	8-30-67	Mean
pH	8.0	8.0	7.9	8.0
Total Soluble Salts[1]	910	950	1000	953
Calcium and Magnesium[2]	8.08	10.24	9.01	9.11
Sodium[2]	1.96	1.39	1.82	1.72
Potassium[2]	0.040	0.057	0.039	0.045
Carbonate[2]	0.78	1.14	2.54	1.49
Bicarbonate[2]	2.47	2.73	1.71	2.30
Chloride[2]	1.87	9.50	7.50	6.29
Sulfate[2]	5.62	2.58	2.52	3.57
Sodium Adsorption Ratio	0.97	0.61	0.85	0.81
Residual Sodium Carbonate	2.2	0.0	0.0	0.7
Sodium Percentage	19.4	11.0	16.0	15.5

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-6. Analysis of water samples taken from three irrigation wells on Case Farm D, Roswell Artesian Basin, New Mexico, 1966-67 (continued).

	Date of Sample Well No. 2			
	8-14-66	4-21-67	8-30-67	Mean
pH	7.6	7.1	7.2	7.3
Total Soluble Salts[1]	870	920	950	913
Calcium and Magnesium[2]	8.08	8.42	10.12	8.87
Sodium[2]	1.76	1.41	1.43	1.53
Potassium[2]	0.040	0.008	0.026	0.025
Carbonate[2]	1.30	2.28	3.22	2.27
Bicarbonate[2]	2.08	2.31	1.37	1.92
Chloride[2]	1.50	5.50	4.00	3.67
Sulfate[2]	5.84	2.69	2.50	3.68
Sodium Adsorption Ratio	0.87	0.68	0.63	0.73
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	17.8	14.0	12.0	14.6

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-6. Analysis of water samples taken from three irrigation wells on Case Farm D, Roswell Artesian Basin, New Mexico, 1966-67 (continued).

	Date of Sample Well No. 4			
	8-14-66	4-11-67	8-30-67	Mean
pH	7.9	8.2	7.7	7.9
Total Soluble Salts[1]	850	950	800	867
Calcium and Magnesium[2]	8.33	9.50	9.56	9.13
Sodium[2]	1.85	1.00	0.84	1.23
Potassium[2]	0.050	0.068	0.036	0.051
Carbonate[2]	1.30	1.04	2.70	1.68
Bicarbonate[2]	1.95	3.17	1.58	2.23
Chloride[2]	1.50	8.00	4.00	4.50
Sulfate[2]	5.18	2.56	2.46	3.40
Sodium Adsorption Ratio	0.90	0.45	0.03	0.46
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	18.0	9.0	8.0	11.7

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-7. Analysis of water samples from the irrigation well on Case Farm E, Roswell Artesian Basin, New Mexico, 1967-68.

	Date of Sample			
	5-10-67	8-29-67	4-5-68	Mean
pH	7.4	7.3	8.1	7.6
Total Soluble Salts[1]	900	950	780	877
Calcium and Magnesium[2]	8.77	10.90	6.30	8.66
Sodium[2]	1.75	1.06	2.50	1.77
Potassium[2]	0.018	0.025	0.030	0.024
Carbonate[2]	1.40	1.71	2.08	1.73
Bicarbonate[2]	3.22	2.93	0.52	2.22
Chloride[2]	7.50	10.00	9.00	8.83
Sulfate[2]	2.73	2.48	1.40	2.20
Sodium Adsorption Ratio	0.85	0.45	1.40	0.89
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	18.0	8.0	28.0	18.0

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-8. Analysis of water samples from two irrigation wells on Case Farm F, Roswell Artesian Basin, New Mexico, 1967-68.

	Date of Sample					
	Well No. 1			Well No. 2		
	4-11-67	3-9-68	Mean	5-10-67	3-9-68	Mean
pH	7.9	7.7	7.8	7.8	7.7	7.8
Total Soluble Salts[1]	1100	800	950	900	900	900
Calcium and Magnesium[2]	7.44	8.40	7.92	11.07	10.08	10.58
Sodium[2]	1.37	2.50	1.94	1.65	2.50	2.08
Potassium[2]	0.127	0.030	0.078	0.073	0.040	0.056
Carbonate[2]	0.99	0.52	0.76	1.14	2.60	1.87
Bicarbonate[2]	2.31	1.30	1.80	3.04	0.00	1.52
Chloride[2]	7.00	9.00	8.00	5.00	8.25	6.62
Sulfate[2]	3.60	2.48	3.04	2.48	3.80	3.14
Sodium Adsorption Ratio	0.70	1.21	0.96	0.70	1.11	0.90
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	15.0	22.9	18.94	12.0	19.80	15.90

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-9. Analysis of water samples from two irrigation wells on Case Farm G, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample Well No. 1				
	8-16-66	4-5-67	8-23-67	4-1-68	Mean
pH	7.9	7.5	7.1	7.8	7.6
Total Soluble Salts[1]	1580	1600	1850	1700	1682
Calcium and Magnesium[2]	15.9	16.66	21.29	16.80	17.66
Sodium[2]	2.76	1.14	1.80	2.50	2.05
Potassium[2]	0.750	0.042	0.039	0.041	0.218
Carbonate[2]	1.04	0.62	1.56	1.04	1.06
Bicarbonate[2]	0.78	1.63	2.80	2.08	1.82
Chloride[2]	3.37	9.00	9.00	12.75	8.53
Sulfate[2]	13.00	2.98	3.10	3.74	5.70
Sodium Adsorption Ratio	0.98	0.39	0.55	0.86	0.70
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	14.0	6.0	7.0	12.92	10.0

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

(continued)

Table G-9. Analysis of water samples from two irrigation wells on Case Farm G, Roswell Artesian Basin, New Mexico, 1966-1968 (continued).

	Date of Sample Well No. 2				
	8-16-66	4-5-67	8-23-67	4-1-68	Mean
pH	7.1	7.1	7.1	7.5	7.2
Total Soluble Salts[1]	1900	1800	1800	1700	1800
Calcium and Magnesium[2]	17.10	15.19	12.42	15.12	14.96
Sodium[2]	2.52	1.65	4.90	2.50	2.89
Potassium[2]	0.040	0.033	0.052	0.030	0.039
Carbonate[2]	1.56	2.08	1.71	1.56	1.73
Bicarbonate[2]	3.64	2.34	2.60	3.12	2.14
Chloride[2]	3.37	10.00	9.00	12.00	8.59
Sulfate[2]	15.0	2.64	2.90	3.74	6.07
Sodium Adsorption Ratio	0.86	0.59	1.96	0.90	1.08
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	12.8	9.0	28.0	14.16	16.0

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-10. Analysis of water samples from irrigation well No. 3 on Case Farm G, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample			
	4-5-67	9-20-67	4-1-68	Mean
pH	7.6	7.6	7.9	7.7
Total Soluble Salts[1]	1800	1700	1600	1700
Calcium and Magnesium[2]	17.88	17.72	16.38	17.33
Sodium[2]	1.65	1.85	2.50	2.00
Potassium[2]	0.022	0.054	0.030	0.035
Carbonate[2]	1.50	2.80	1.56	1.95
Bicarbonate[2]	1.56	2.52	1.82	1.97
Chloride[2]	9.00	22.70	10.50	14.07
Sulfate[2]	2.13	3.22	3.74	3.03
Sodium Adsorption Ratio	0.55	0.62	0.87	0.68
Residual Sodium Carbonate	0.0	0.0	0.0	0.0
Sodium Percentage	8.0	9.0	13.2	10.1

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-11. Analysis of water samples from the irrigation well on Case Farm I, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample				
	8-16-66	4-5-67	9-8-67	3-5-68	Mean
pH	6.8	7.6	8.0	7.4	7.4
Total Soluble Salts[1]	2400	2300	1700	2200	2150
Calcium and Magnesium[2]	26.00	28.42	33.18	28.14	28.94
Sodium[2]	1.31	1.15	1.07	2.50	1.51
Potassium[2]	0.034	0.037	0.040	0.05	0.040
Carbonate[2]	1.30	1.50	2.60	1.04	1.61
Bicarbonate[2]	2.60	1.11	0.26	1.04	1.25
Chloride[2]	1.12	5.50	3.00	7.50	4.28
Sulfate[2]	28.76	3.02	22.92	5.84	15.14
Sodium Adsorption Ratio	0.36	0.80	0.26	0.66	0.52
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	4.8	3.0	3.0	8.02	4.70

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-12. Analysis of water samples from irrigation well No. 1 on Case Farm J, Roswell Artesian Basin, New Mexico, 1967-68.

	Date of Sample				
	6-21-67	8-23-67	9-14-67	3-13-68	Mean
pH	7.4	7.4	6.9	7.9	7.4
Total Soluble Salts[1]	1200	1180	1300	1000	1170
Calcium and Magnesium[2]	13.03	14.21	10.63	10.92	12.20
Sodium[2]	1.18	0.84	1.22	2.50	1.44
Potassium[2]	0.046	0.041	0.030	0.060	0.044
Carbonate[2]	2.18	1.87	2.13	1.56	1.94
Bicarbonate[2]	3.64	2.62	2.52	0.52	2.32
Chloride[2]	6.50	5.00	5.00	9.75	6.56
Sulfate[2]	2.58	2.84	2.78	5.12	3.33
Sodium Adsorption Ratio	0.46	0.03	0.52	1.06	0.52
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	8.0	5.0	10.0	18.54	10.4

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-13. Analysis of water samples from irrigation well No. 2 on Case Farm J, Roswell Artesian Basin, New Mexico, 1967-68.

	Date of Sample						
	4-4-67	5-9-67	6-11-67	8-25-67	10-5-67	3-25-68	Mean
pH	7.2	7.2	7.3	7.3	7.8	7.9	7.4
Total Soluble Salts[1]	1400	1400	1250	1200	1000	1200	1242
Calcium and Magnesium[2]	9.99	11.41	12.78	12.65	13.86	13.02	12.28
Sodium[2]	1.80	1.10	2.50	1.13	1.05	2.50	1.68
Potassium[2]	0.012	0.010	0.015	0.046	0.036	0.07	0.032
Carbonate[2]	1.61	3.90	1.82	3.27	2.60	1.56	2.46
Bicarbonate[2]	3.12	3.90	1.97	1.35	2.08	1.56	2.33
Chloride[2]	7.00	6.00	7.50	4.00	3.00	12.75	6.71
Sulfate[2]	2.58	2.62	2.69	2.82	8.46	6.50	4.28
Sodium Adsorption Ratio	0.80	0.46	0.98	0.45	0.39	0.98	0.68
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	15.0	8.0	16.0	8.0	7.0	16.0	11.7

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-14. Analysis of water samples from the irrigation well on Case Farm K, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample							
	8-19-66	4-20-67	5-13-67	6-21-67	7-27-67	9-6-67	3-27-68	Mean
pH	7.2	8.0	7.2	7.3	7.4	8.0	7.6	7.5
Total Soluble Salts[1]	1000	950	1100	1100	1050	980	1000	1026
Calcium and Magnesium[2]	12.10	8.96	9.26	10.63	12.00	11.54	9.24	10.53
Sodium[2]	1.94	1.13	1.76	1.01	1.00	0.73	2.50	1.44
Potassium[2]	0.052	0.047	0.038	0.027	0.035	0.027	0.050	0.039
Carbonate[2]	0.78	3.01	3.38	3.53	1.61	1.14	2.08	2.22
Bicarbonate[2]	2.86	0.05	0.75	0.34	2.34	2.02	2.08	1.49
Chloride[2]	1.12	4.50	4.50	4.50	5.50	4.50	11.25	5.12
Sulfate[2]	7.44	2.62	2.62	2.88	2.66	2.68	3.80	3.53
Sodium Adsorption Ratio	0.79	0.51	0.81	0.43	0.04	0.03	1.16	0.54
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	6.6	11.0	15.0	8.0	7.0	5.0	21.2	10.5

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-15. Analysis of water samples from irrigation well No. 1 on Case Farm L, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample							
	8-19-66	4-7-67	5-9-67	6-20-67	8-1-67	8-28-67	3-25-68	Mean
pH	7.2	7.1	7.1	7.2	7.0	7.1	7.2	7.1
Total Soluble Salts[1]	1490	1600	1600	1600	1450	1400	1500	1520
Calcium and Magnesium[2]	15.40	12.93	13.18	12.98	15.77	23.87	15.54	15.67
Sodium[2]	1.31	4.70	1.28	1.63	0.75	0.85	2.50	1.86
Potassium[2]	0.059	0.031	0.000	0.042	0.031	0.040	0.060	0.038
Carbonate[2]	2.02	3.22	8.00	2.65	2.65	2.28	2.08	3.27
Bicarbonate[2]	2.52	1.58	0.13	2.08	2.39	2.10	3.12	1.99
Chloride[2]	1.57	6.00	5.50	6.00	6.50	4.50	9.75	5.69
Sulfate[2]	12.70	2.90	2.58	2.32	2.94	2.98	2.50	3.70
Sodium Adsorption Ratio	5.50	1.06	0.49	0.62	0.26	0.24	0.89	1.29
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	7.8	26.0	8.0	11.0	4.0	3.0	13.8	10.5

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-16. Analysis of water samples from irrigation well No. 2 on Case Farm L, Roswell Artesian Basin, New Mexico, 1966-1968.

	Date of Sample							
	8-19-66	4-7-67	5-9-67	6-20-67	8-1-67	8-29-67	3-25-68	Mean
pH	7.2	7.0	7.1	7.2	7.0	7.2	7.2	7.1
Total Soluble Salts[1]	1520	1600	1600	1600	1400	1400	1500	1517
Calcium and Magnesium[2]	16.30	8.86	12.74	15.63	11.17	15.91	15.12	13.68
Sodium[2]	3.28	1.75	1.32	1.37	0.67	0.62	2.50	1.64
Potassium[2]	0.087	0.004	0.022	0.035	0.032	0.027	0.030	0.034
Carbonate[2]	1.66	2.54	3.95	3.27	1.87	2.23	1.56	2.44
Bicarbonate[2]	2.62	2.52	1.43	1.30	2.99	2.46	3.38	2.38
Chloride[2]	1.50	3.50	4.00	7.00	3.00	5.00	10.50	4.93
Sulfate[2]	13.50	2.98	2.82	2.42	2.98	2.98	2.50	4.31
Sodium Adsorption Ratio	1.15	0.83	0.52	0.48	0.28	0.21	0.90	0.62
Residual Sodium Carbonate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium Percentage	16.7	16.0	9.0	8.0	5.0	3.0	14.2	10.3

1. EC x 10^6 millimhos.
2. Milliequivalents per liter.

Table G-17. Percent total soluble salts present in soil samples from the 0- to 10-inch soil profile in cotton fields on five case farms, Roswell Artesian Basin, New Mexico, 1967-68.

Case Farm	Date of Sample	Field Number	Total Soluble Salts
A	5-04-67	7	0.17
	10-24-67	7	0.29
	3-05-68	7	0.36
	10-28-68	7	0.41
C	5-04-67	1	0.17
	10-24-67	1	0.46
	3-05-68	1	0.14
	10-28-68	1	0.20
F	5-04-67	2	0.16
	10-24-67	2	0.17
	3-05-68	2	0.12
	10-28-68	2	0.13
G	5-04-67	7	0.17
	10-24-67	7	0.15
	3-05-68	7	0.14
	10-28-68	7	0.13
I	10-24-67	3	0.15
	3-05-68	4	0.16
	10-28-68	4	0.15

Table G-18. Percent total soluble salts present in soil samples taken from alfalfa and cotton fields on Case Farms J, K, and L, Roswell Artesian Basin, New Mexico, 1966-1968.

Case Farm	Crop	Field Number	Date of Sample	Sampled Profile (inches) 0-10	10-24	24-36
				(percent total soluble salts)		
J	Alfalfa	1	6-23-66	0.15	0.20	0.26
		1	11-11-66	0.14	0.20	0.26
		1	5-03-67	0.22	0.17	0.17
		1	10-13-67	0.22	0.15	0.24
		3	2-21-68	0.12	0.15	0.20
		3	10-04-68	0.13	0.16	0.16
	Cotton	2	6-15-66	0.15	0.19	0.24
		2	11-11-66	0.13	0.16	0.17
		2	5-03-67	0.18	0.14	0.18
		2	11-30-67	0.26	0.22	0.26
		4	3-18-68	0.12	0.17	0.20
		4	10-02-68	0.13	0.14	0.17
K	Alfalfa	3	6-21-66	0.14	0.19	0.22
		3	11-11-66	0.13	0.16	0.16
		3	5-03-67	0.18	0.16	0.19
		3	10-13-67	0.13	0.16	0.19
		3	3-06-68	0.11	0.15	0.17
		3	10-28-68	0.12	0.15	0.17
	Cotton	5	6-21-66	0.16	0.14	0.15
		5	11-11-66	0.11	0.14	0.15
		4	5-03-67	0.15	0.26	0.24
		4	11-27-67	0.15	0.14	0.13
		4	3-07-68	0.11	0.13	0.14
		4	10-28-68	0.12	0.13	0.14
L	Alfalfa	8	6-10-66	0.13	0.14	0.14
		8	11-11-66	0.11	0.13	0.13
		8	5-04-67	0.16	0.16	0.18
		8	10-13-67	0.13	0.14	0.18
		8	5-03-68	0.10	0.13	0.13
		8	10-02-68	0.11	0.11	0.12
	Cotton	1	6-10-66	0.14	0.14	0.14
		1	11-11-66	0.11	0.13	0.14
		1	5-04-67	0.19	0.22	0.14
		1	11-30-67	0.17	0.15	0.14
		1	3-19-68	0.13	0.14	0.14
		1	10-02-68	0.13	0.14	0.14

APPENDIX H - SOIL MOISTURE DEPLETION

RELATIVE MOISTURE DEPLETION INDEX

Soil moisture data were obtained with the use of a neutron depth moisture probe and portable scaler. Moisture determinations were made prior to application of irrigation water and again after irrigation when the soil was dry enough to permit access to the tube sites. Additional moisture determinations were made periodically when possible. The data obtained were expressed in percent moisture by volume.

A computer program was developed by the Office of Experimental Statistics, New Mexico State University, whereby the data were subjected to analysis by linear regression to predict the moisture content on the date of irrigation. Utilizing the predicted moisture content and multiplying by the depth of the sampled profile one can obtain the inches of moisture, by volume, present in the soil on the date of irrigation. Using the inches present after an irrigation and the inches present before the succeding irrigation, one has a basis for determining moisture depletion.

As stated previously the data obtained were based on moisture content by volume and the data presented in figures H-1 through H-23 are reported as "relative moisture depletion index." These data were obtained by assigning a value of 1.0 for Regime A in the cotton and alfalfa irrigation studies (see pp. 4 and 5). The depletion from all regimes and the selected irrigation units on Case Farm J and L were compared to Regime A for the year the data were collected.

The relative moisture depletion index for the six regimes in the 1967 cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, is presented in figures H-1 through H-8. Figure H-1 shows the total relative moisture depletion for the six irrigation regimes and the comparative depletion by profile depth. The mean relative moisture depletion index for all regimes as measured at different times during the season is presented in figure H-2. These data indicated that approximately two-thirds of the total measured depletion was from the upper 24 inches of the soil profile. The data in figure H-2 also indicate a period of high moisture use from July 1 to September 6 and also show increased depletion from the lower soil profiles as the season progressed, an indication of root growth into the lower profiles during the season.

The cumulative depletion during the 1967 season for the individual irrigation regimes is shown in figures H-3 through H-8.

In 1968 the sampled profile depth for cotton was increased to 72 inches, compared to 48 inches in 1967. Data from Experiment B, (see p. 47) grown in 1968, are presented in figures H-9 through H-16.

Observation of figure H-10 will reveal that the period of data collection was shorter than in 1967. This was caused by the necessity to replant to establish a stand, and moisture determinations were not started until after stand establishment. The data also indicate that the period of highest moisture use was recorded for July 24 to August 23. This period coincides with the bloom period as did the period of highest moisture use in 1967 (July 1 to August 7, figure H-2).

Data for the individual regimes in 1968 are presented in figures H-11 through H-16.

Relative moisture depletion index data from selected irrigation units of cotton on Case Farms J and L are shown in figures H-17 and H-18. These data show a higher total depletion for Case Farm J which may account for the increased yield of 201 pounds per acre when compared to Case Farm L (yield data shown in table F-7, p. 69).

Comparative total moisture depletion data for four irrigation regimes in the alfalfa study for 1967 and 1968 are shown in figures H-19 through H-22. A comparison of Regime A with D, figure H-19, and Regime B with E, figure H-20, shows an increase in total depletion for those regimes (D and E) receiving a single irrigation per harvest when compared to regimes (A and B) receiving the same amount of water per harvest but applied in two applications. Coupled with the higher yields (table C-3, p. 54) obtained with two irrigations per harvest these data emphasize the importance of maintaining adequate moisture in the upper 24-inch soil profile to promote forage production of alfalfa. A relatively small amount of moisture was depleted below the 36-inch depth.

Moisture depletion data during the growing season for the various regimes are shown in figures H-21 and H-22 and indicate a near linear depletion pattern during the growing season.

Total moisture depletion for selected irrigation units of alfalfa on Case Farms J and L are shown in figure H-23. The data show a lower moisture depletion for Case Farm J during both years when compared to Case Farm L. During both 1967 and 1968 less water was applied on Case Farm J (tables F-1 through F-4, pp. 63-66); however, the yields in 1967 were nearly the same while in 1968 Case Farm L had the higher yield. There was accountable yield loss on Case Farm J in 1968 due to hail damage and cutworm damage. These data indicate that depletion from the lower profile depths increased with the heavier, less frequent irrigations employed on Case Farm L compared with the lighter, more frequent irrigations applied on Case Farm J.

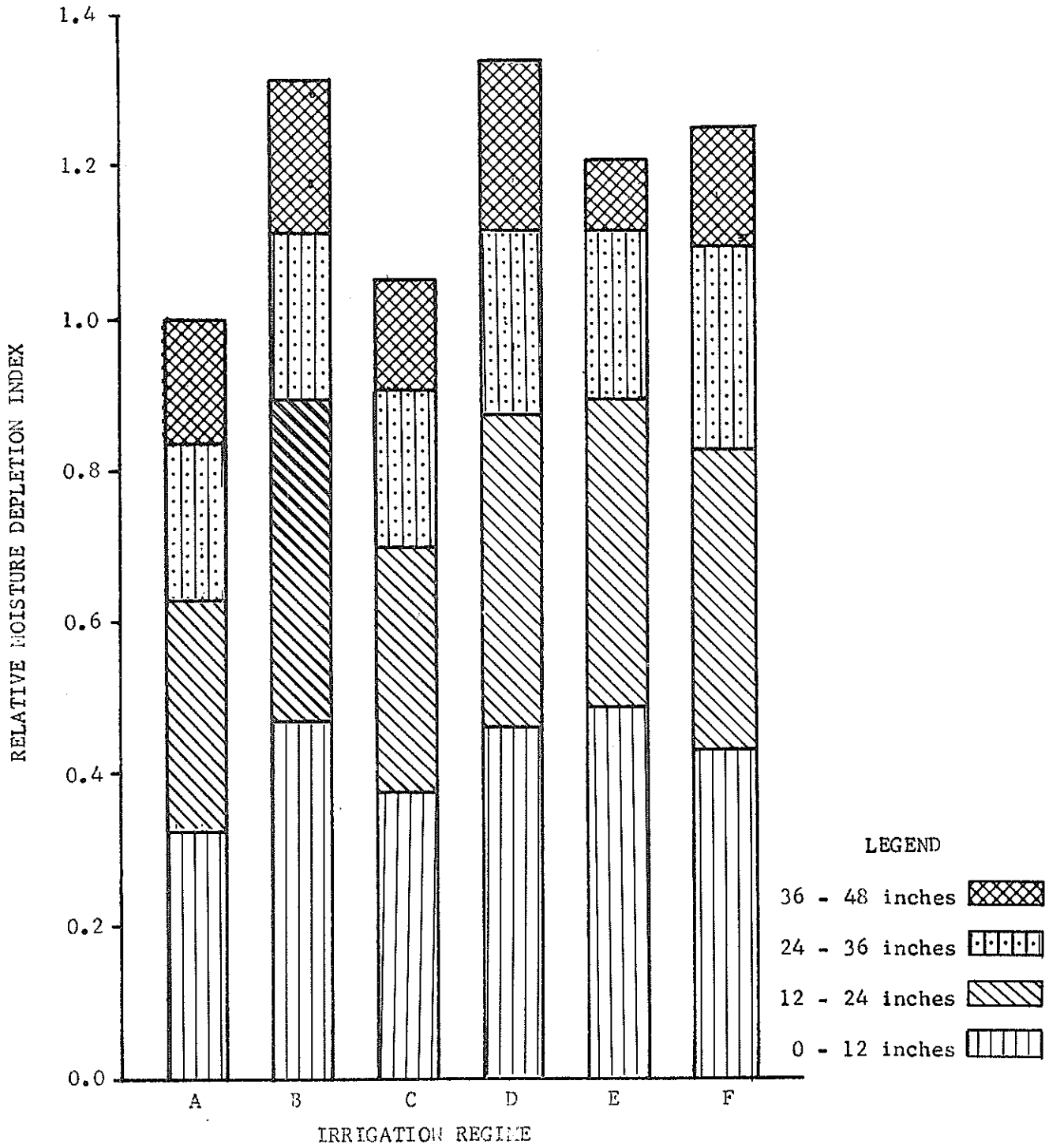

Figure H-1. Relative moisture depletion index for six irrigation regimes, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

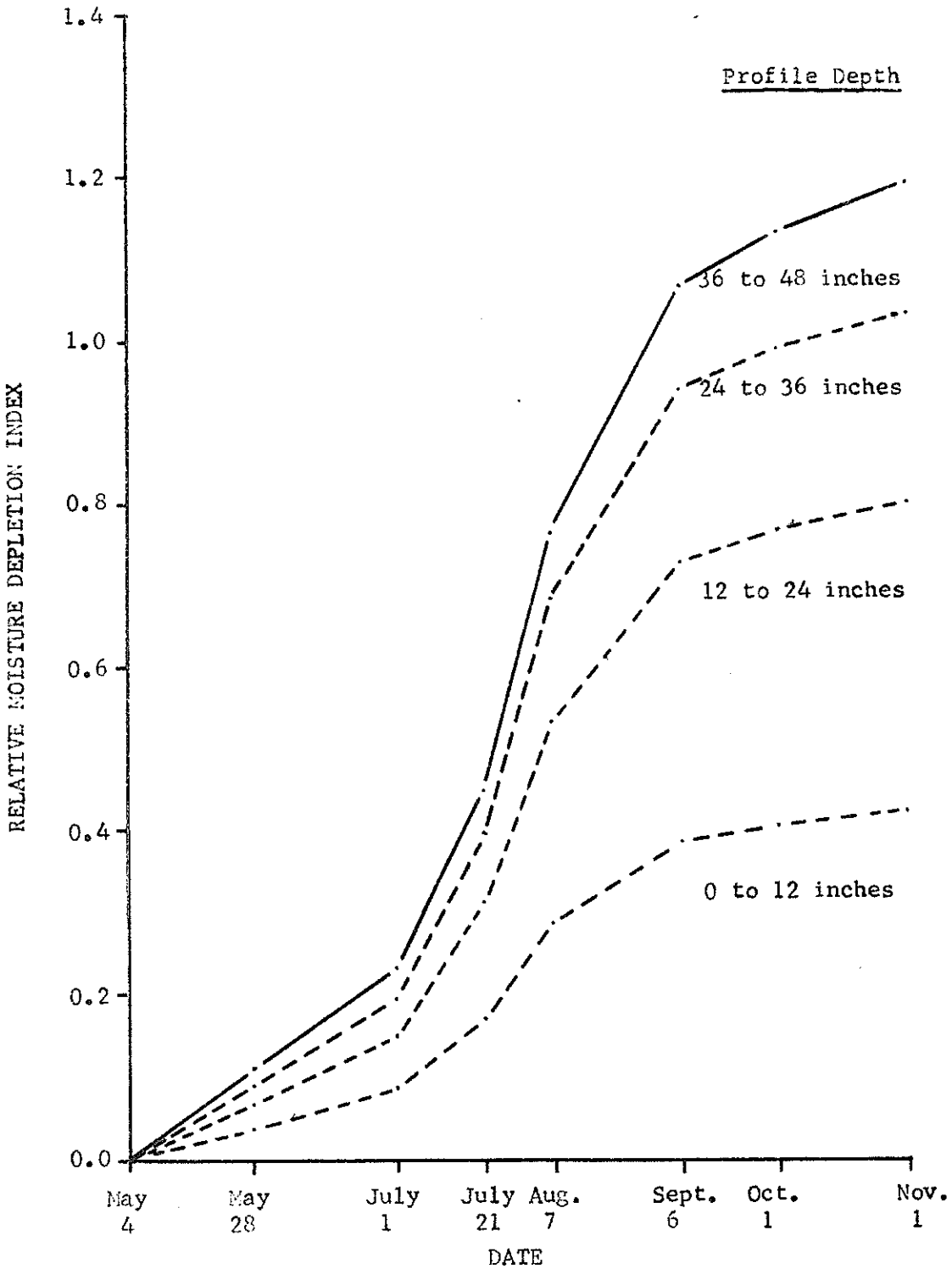

Figure H-2. Mean relative moisture depletion index for six irrigation regimes, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

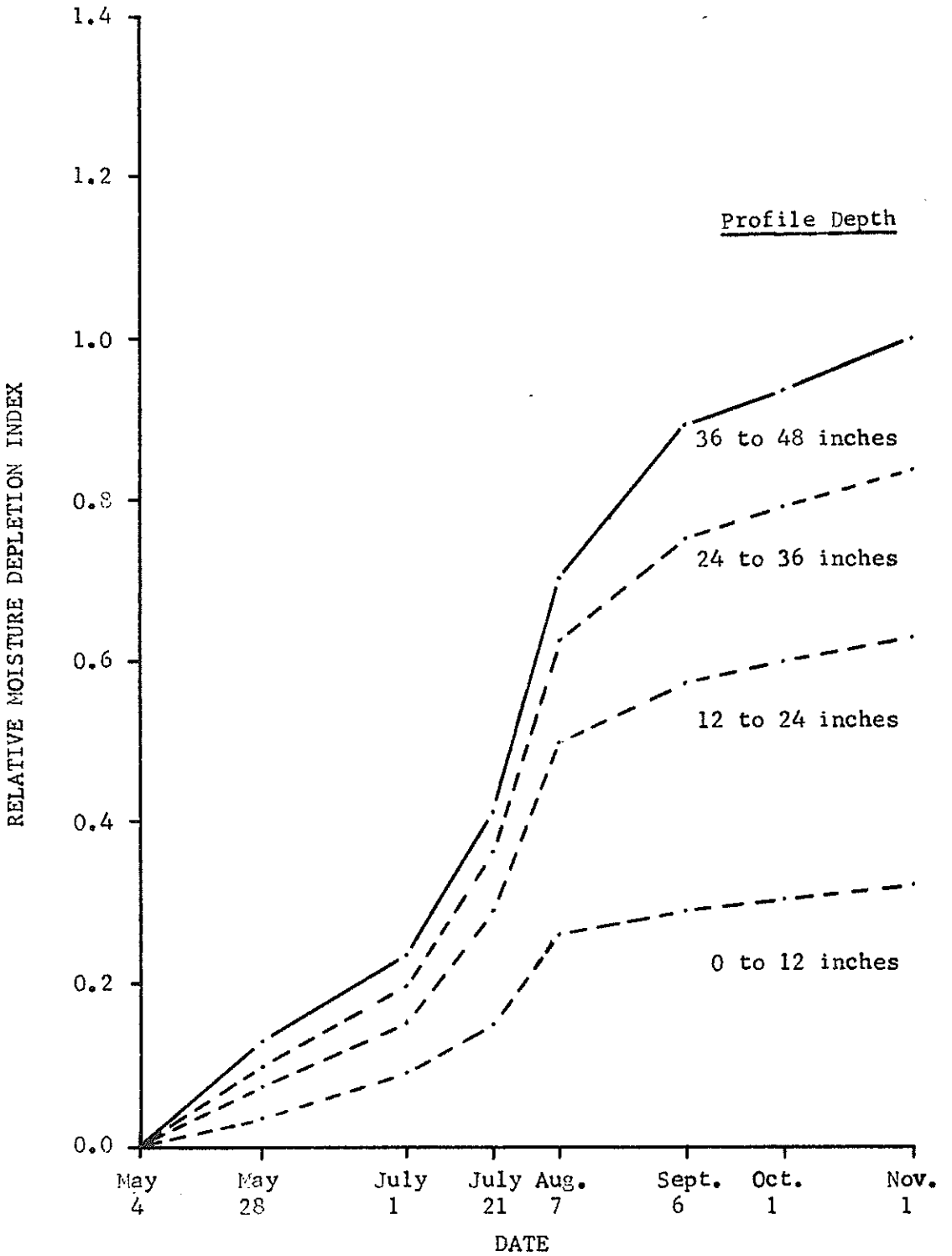

Figure H-3. Relative moisture depletion index, Regime A, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

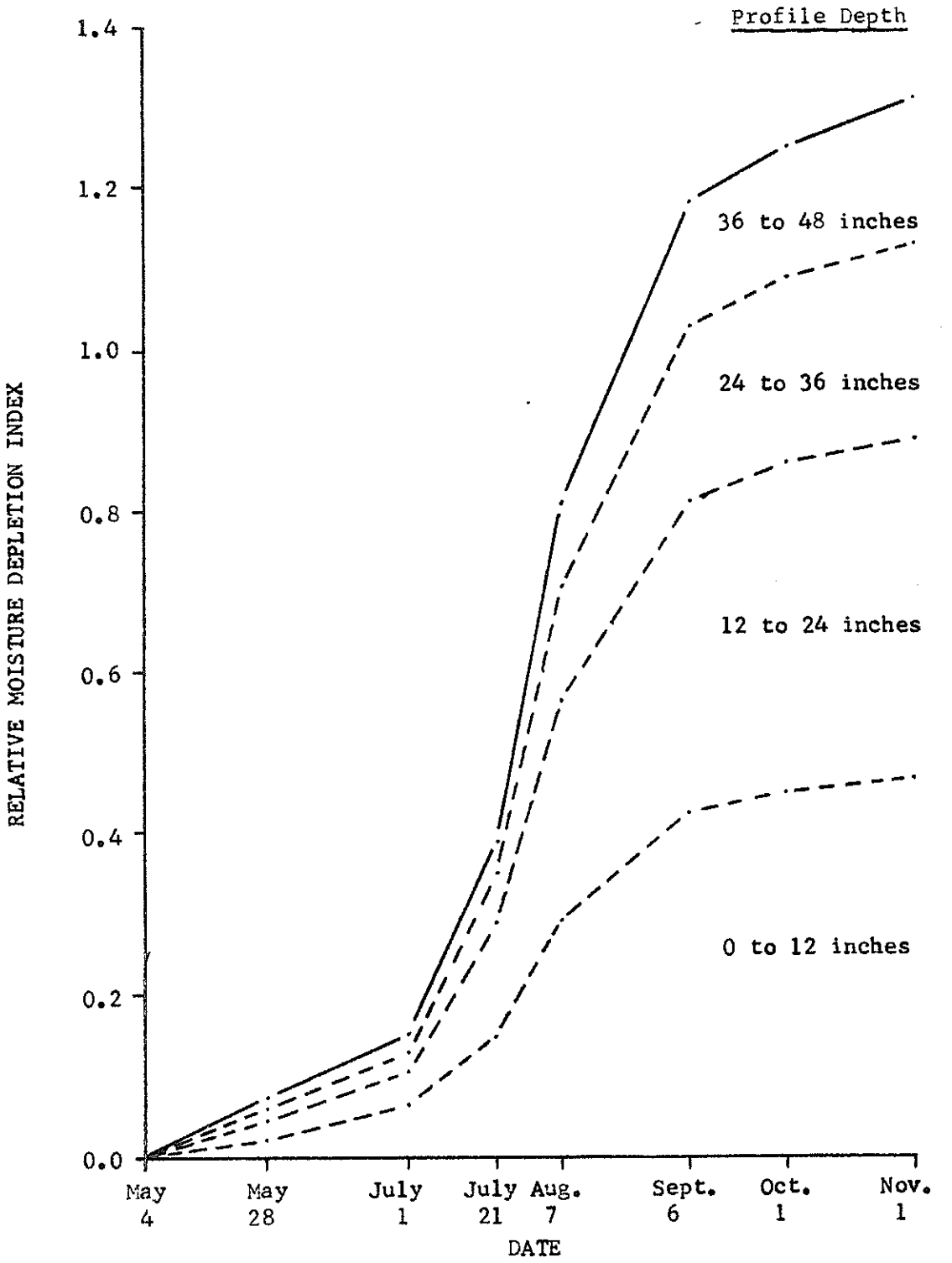

Figure H-4. Relative moisture depletion index, Regime B, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

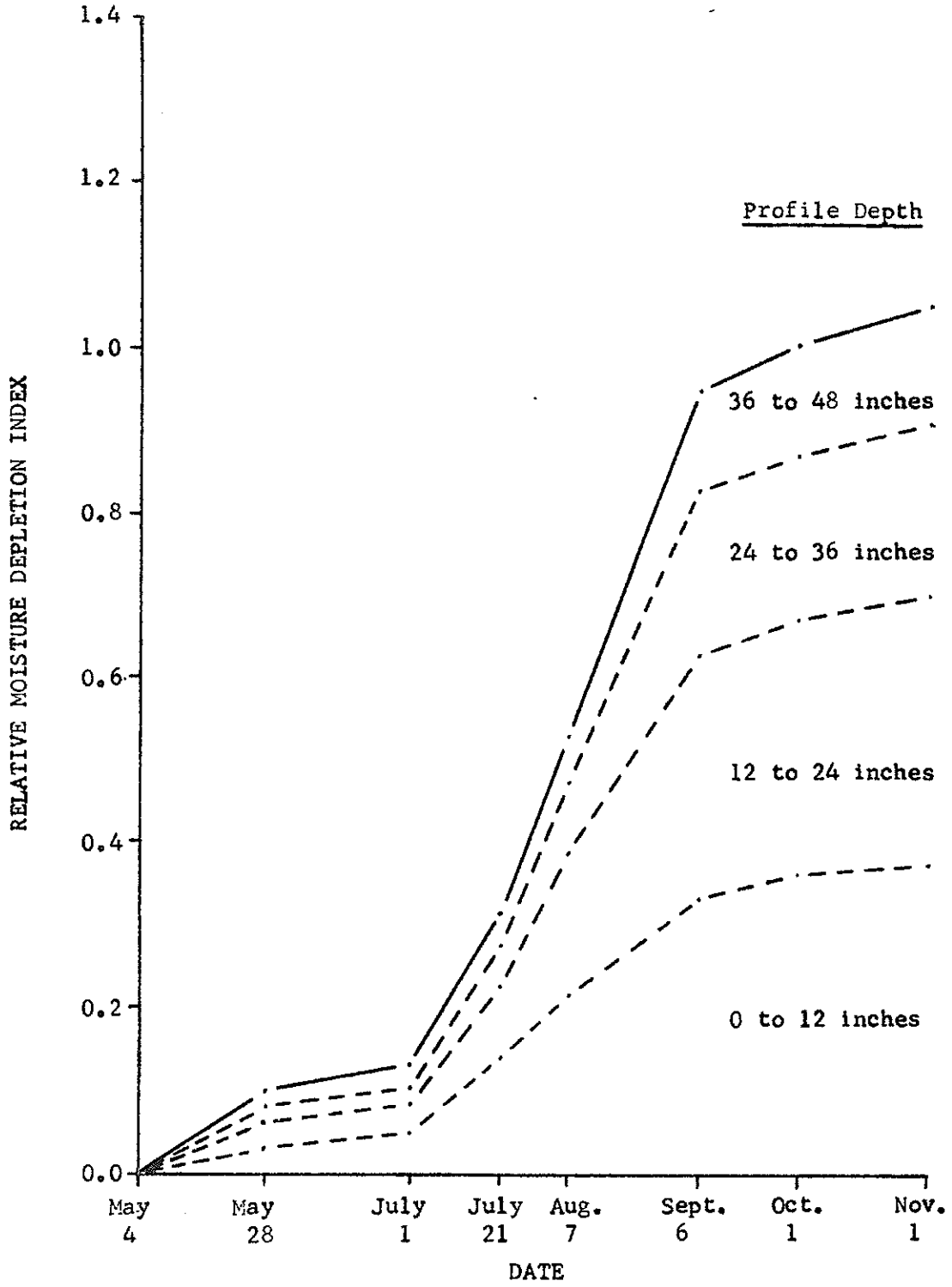

Figure H-5. Relative moisture depletion index, Regime C, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

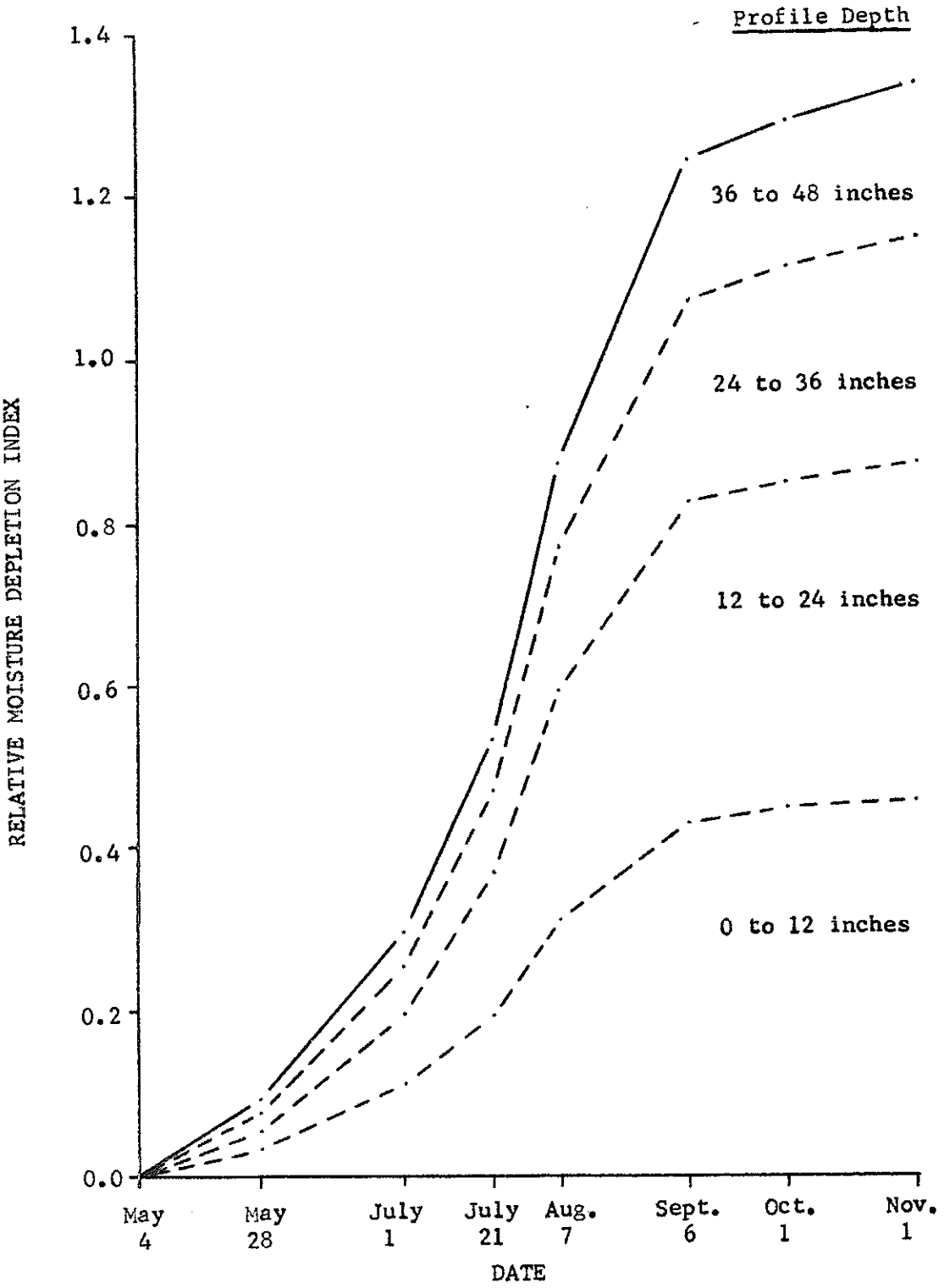

Figure H-6. Relative moisture depletion index, Regime D, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

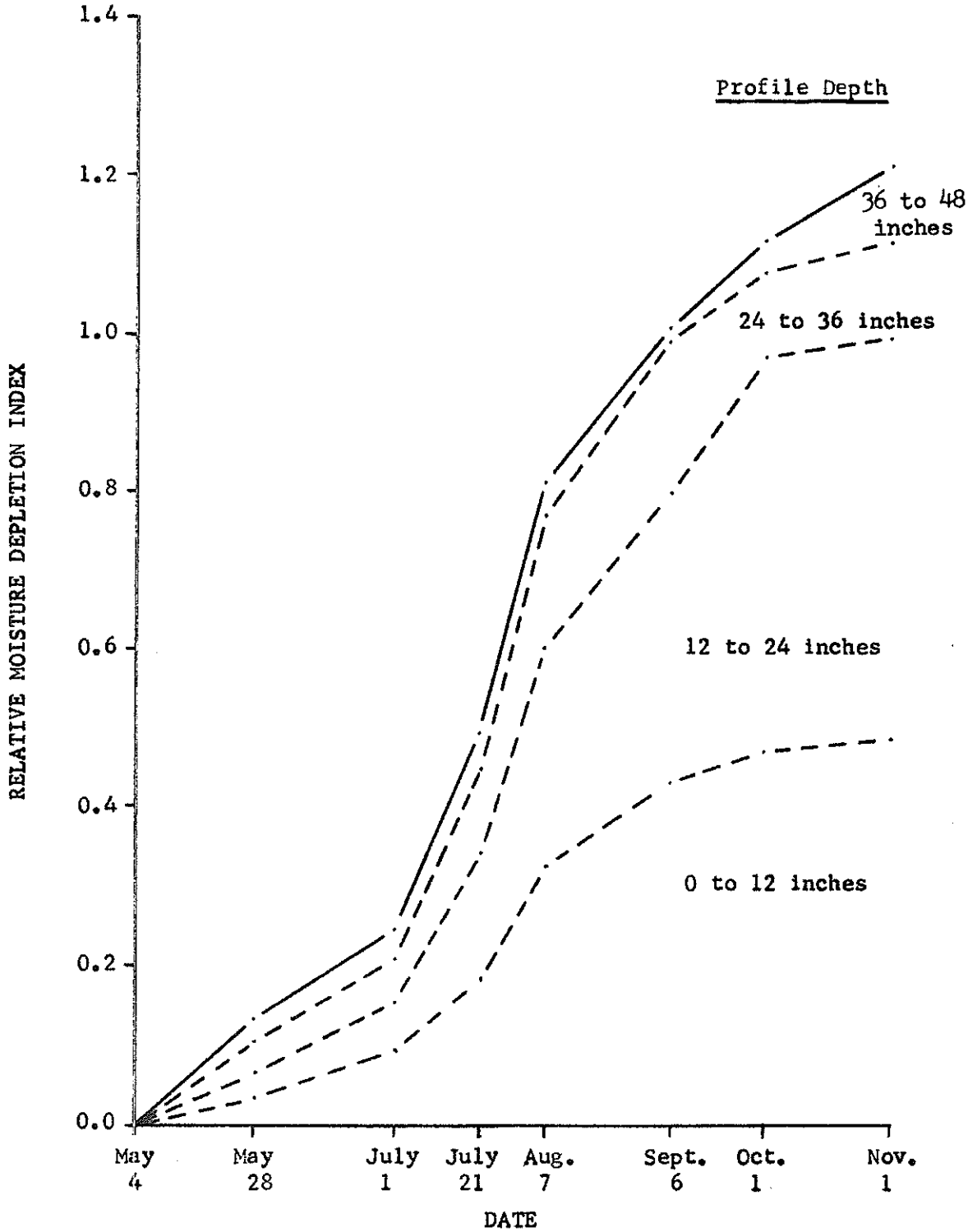

Figure H-7. Relative moisture depletion index, Regime E, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

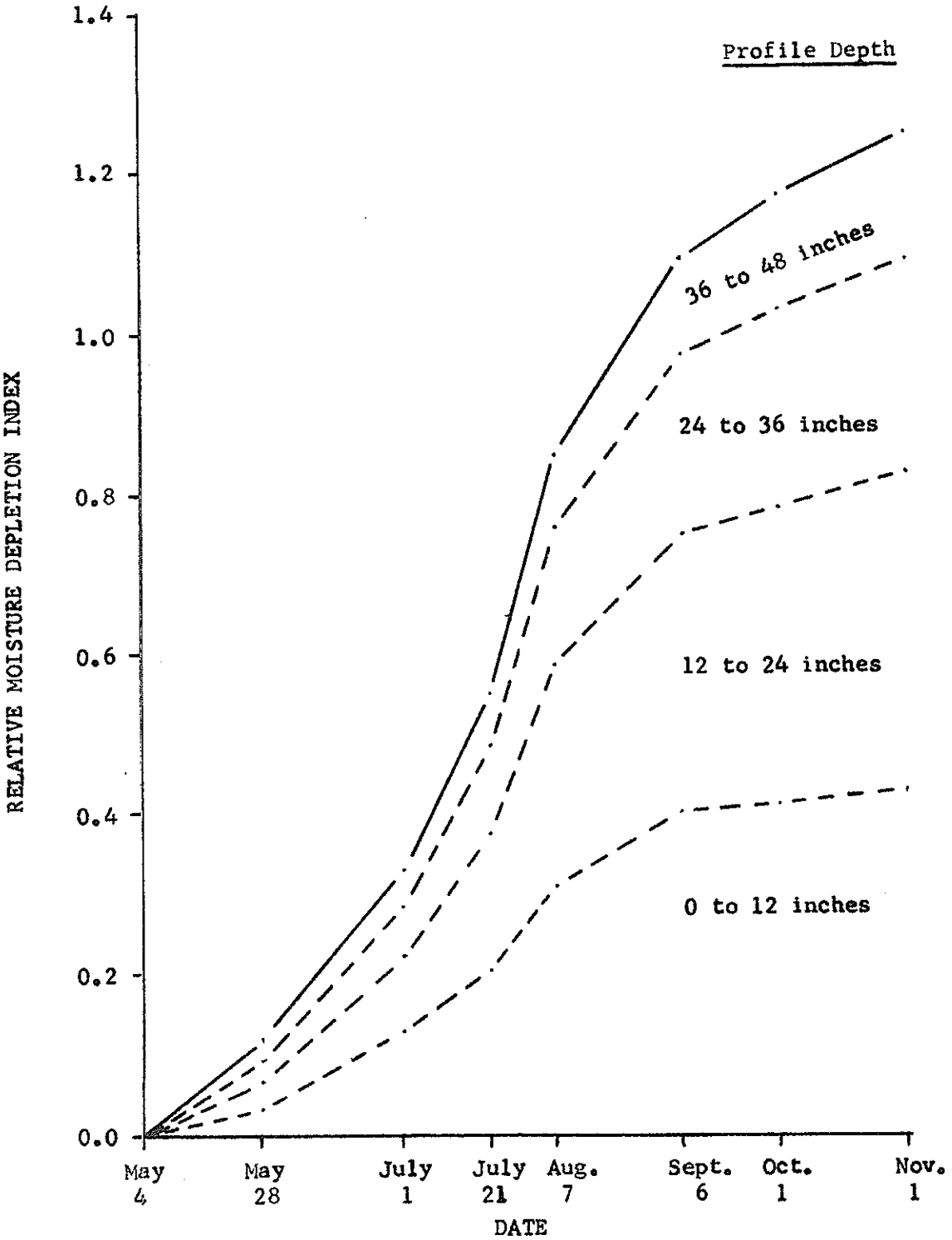

Figure H-8. Relative moisture depletion index, Regime F, cotton irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

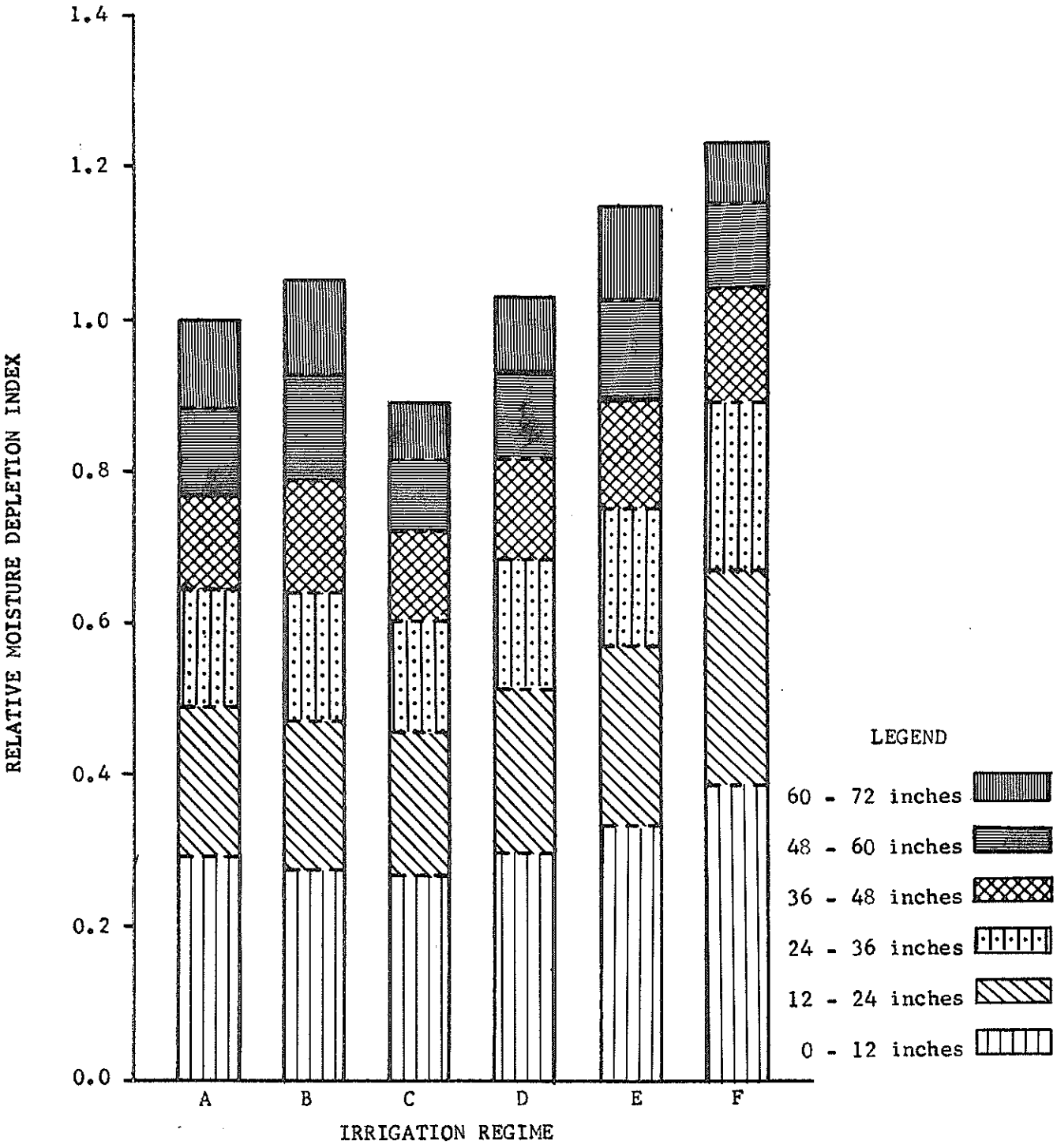

Figure H-9. Relative moisture depletion index for six irrigation regimes, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

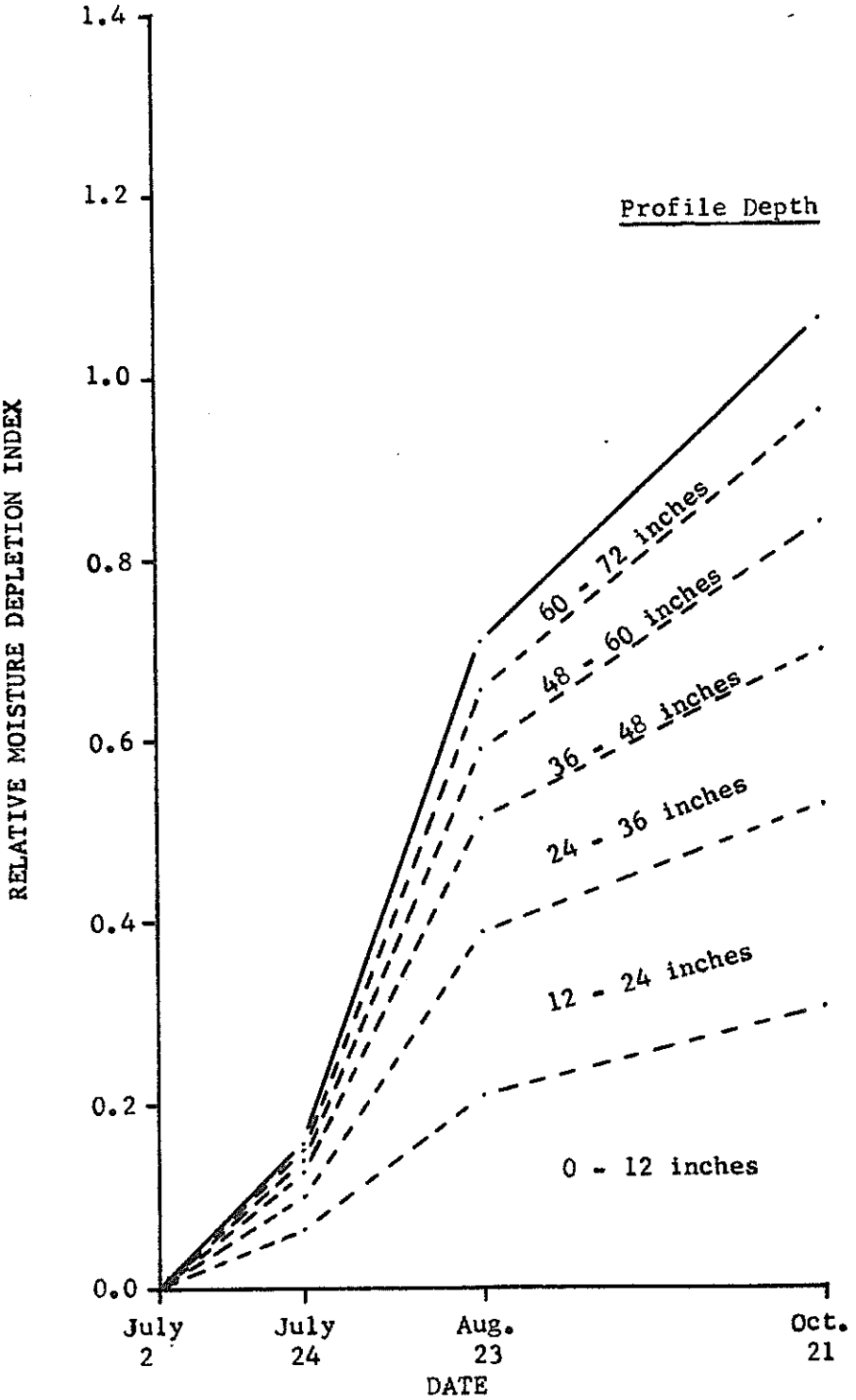

Figure H-10. Mean relative moisture depletion index for six irrigation regimes, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

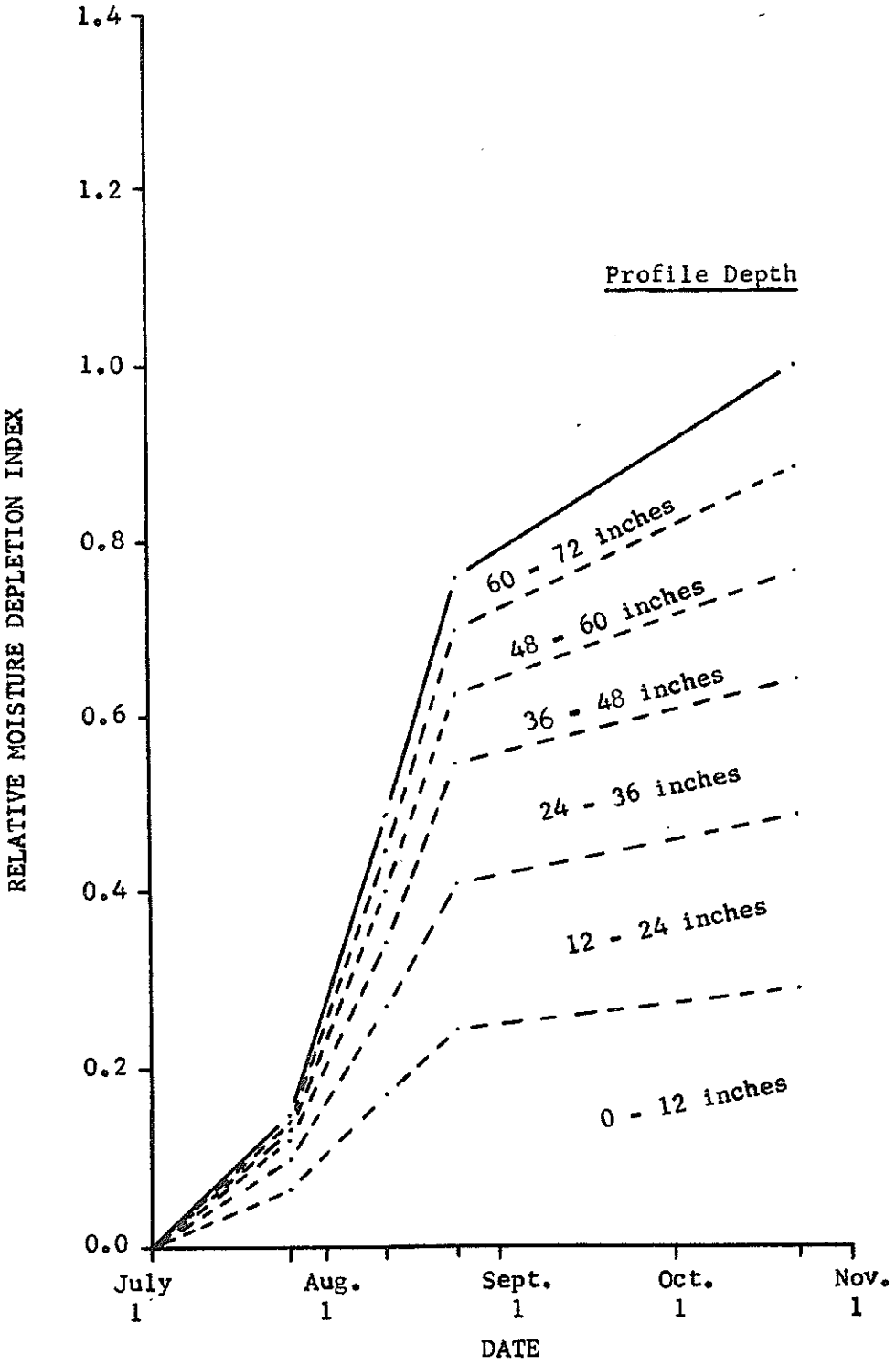

Figure H-11. Relative moisture depletion index for Regime A, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

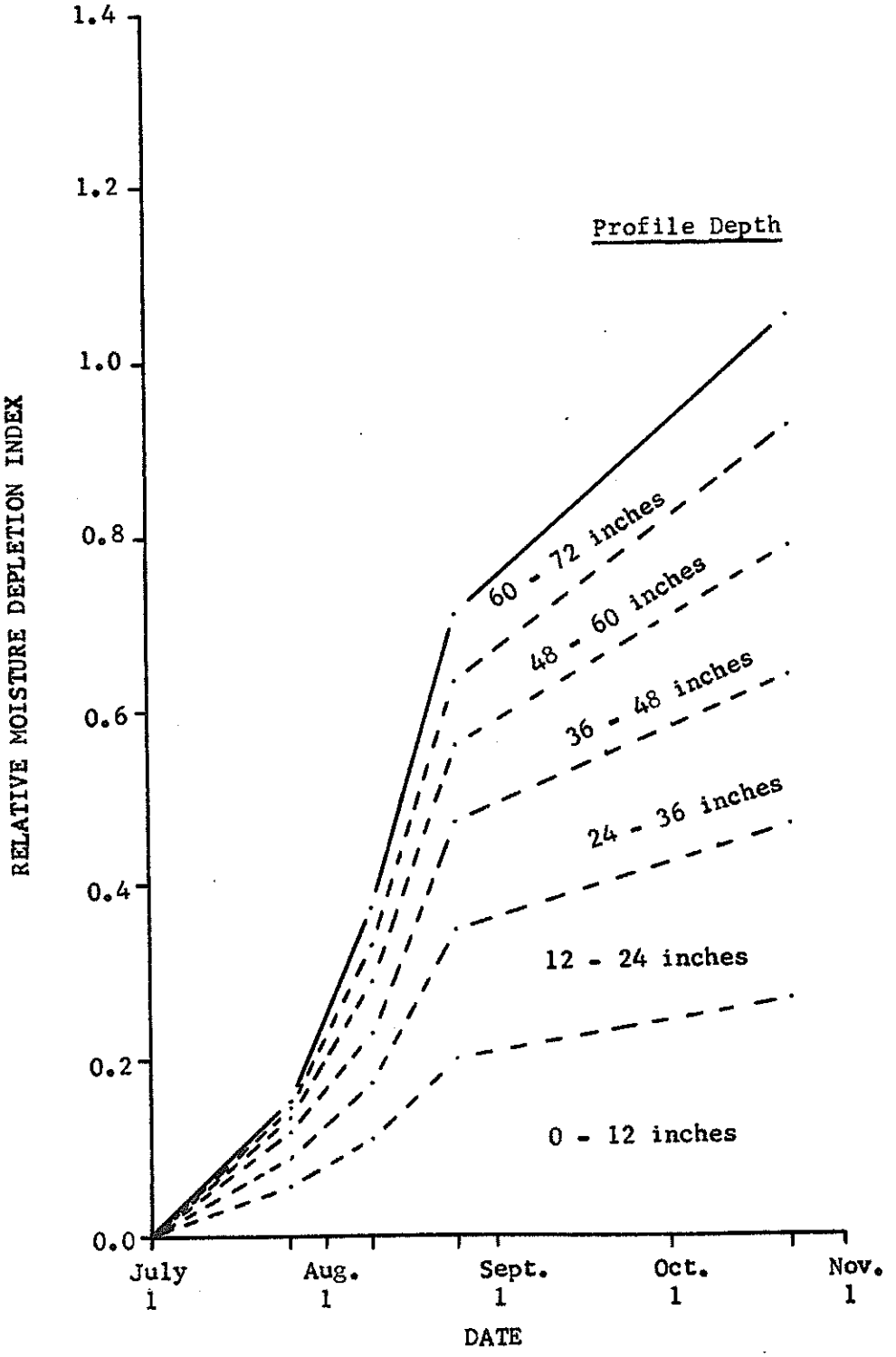

Figure H-12. Relative moisture depletion index for Regime B, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

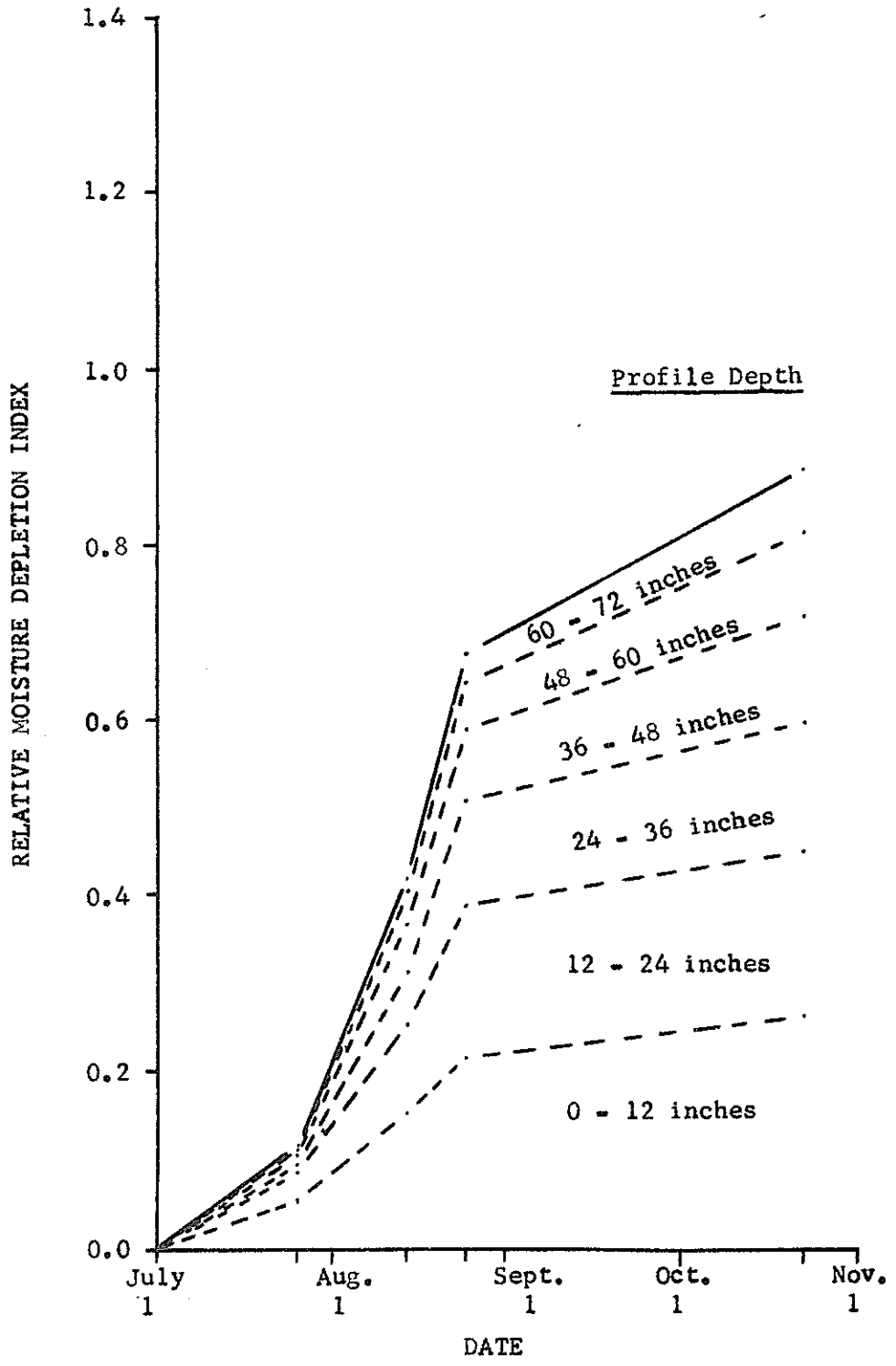

Figure H-13. Relative moisture depletion index for Regime C, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

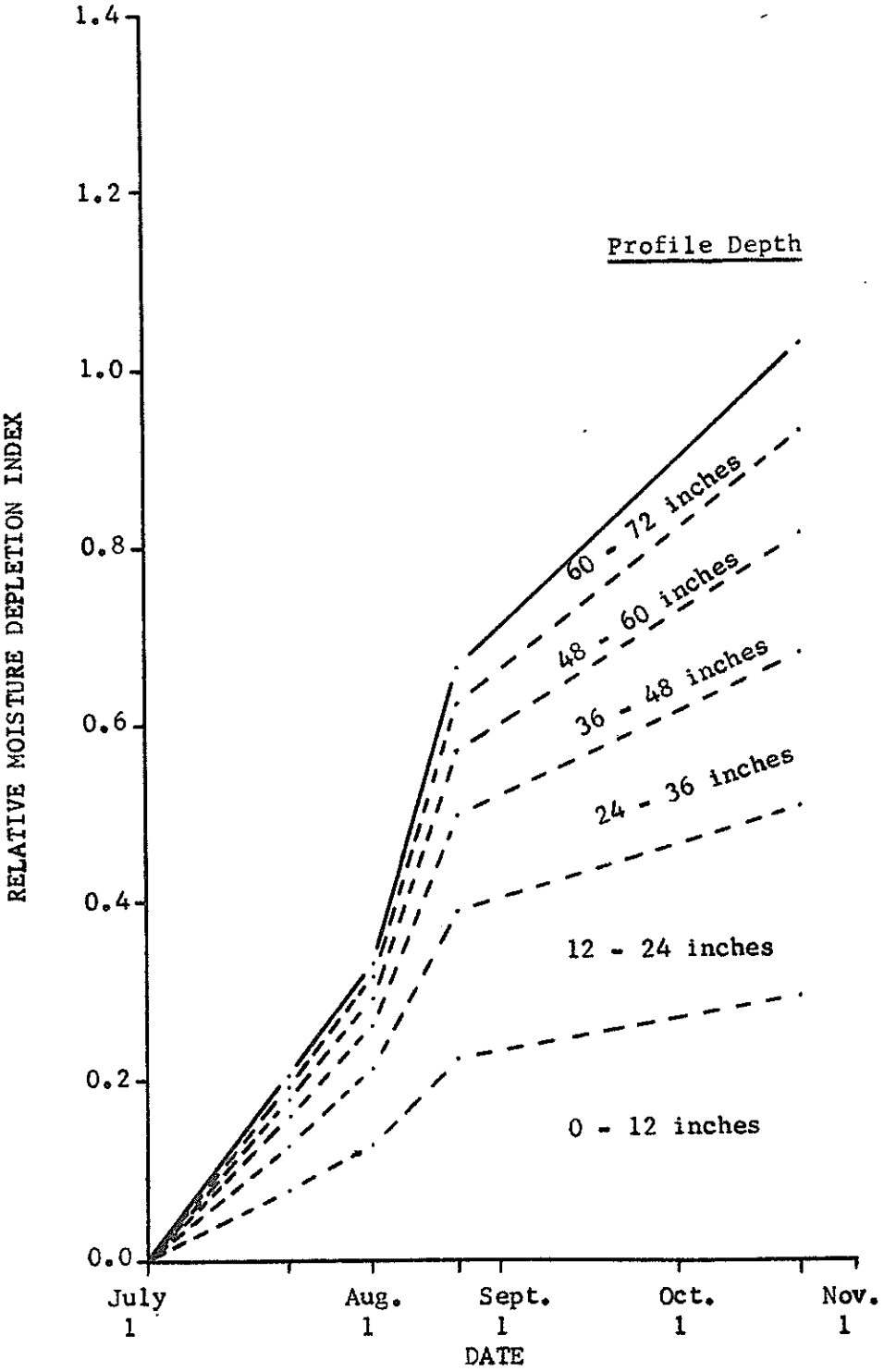

Figure H-14. Relative moisture depletion index for Regime D, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

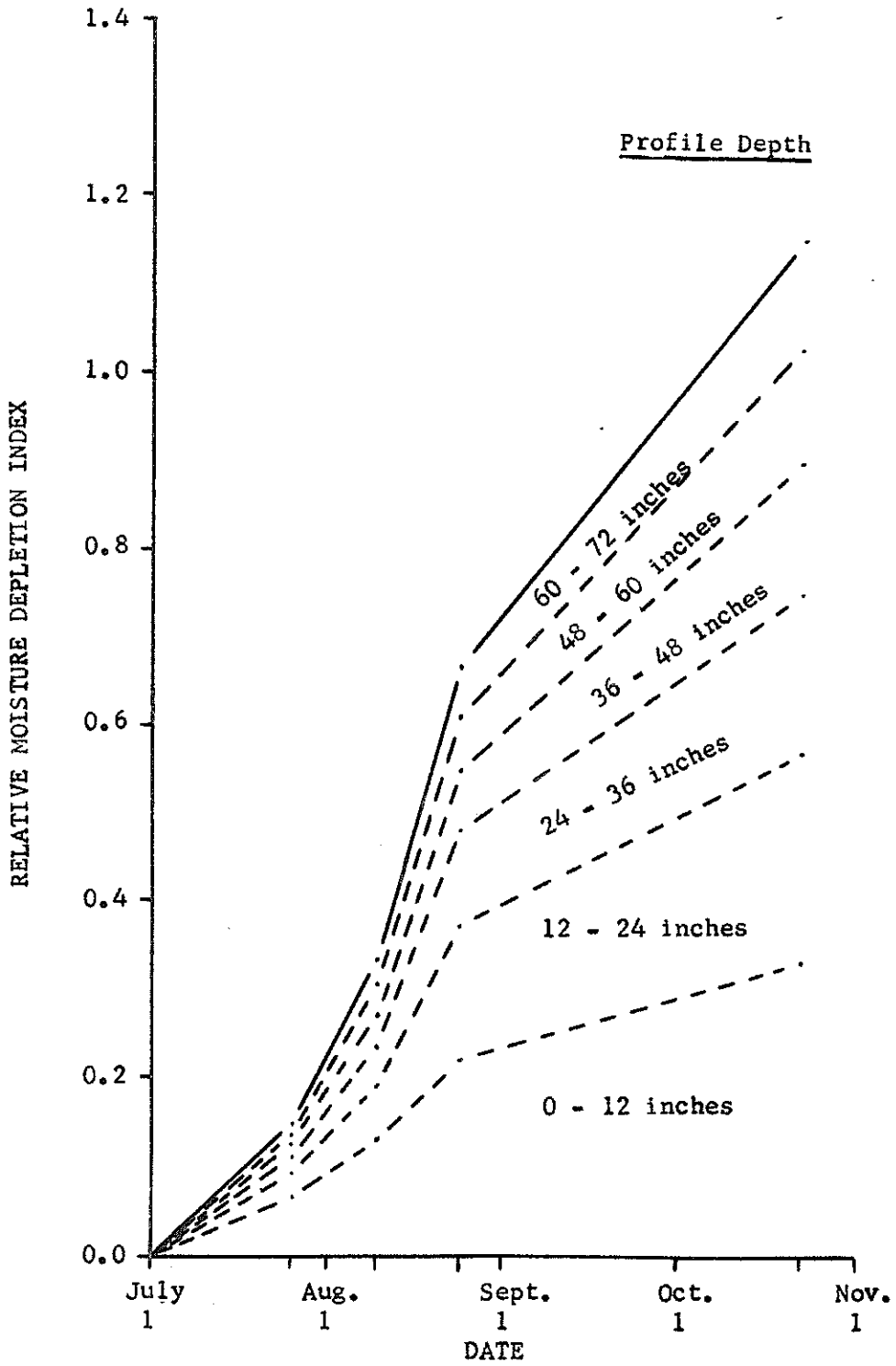

Figure H-15. Relative moisture depletion index for Regime E, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

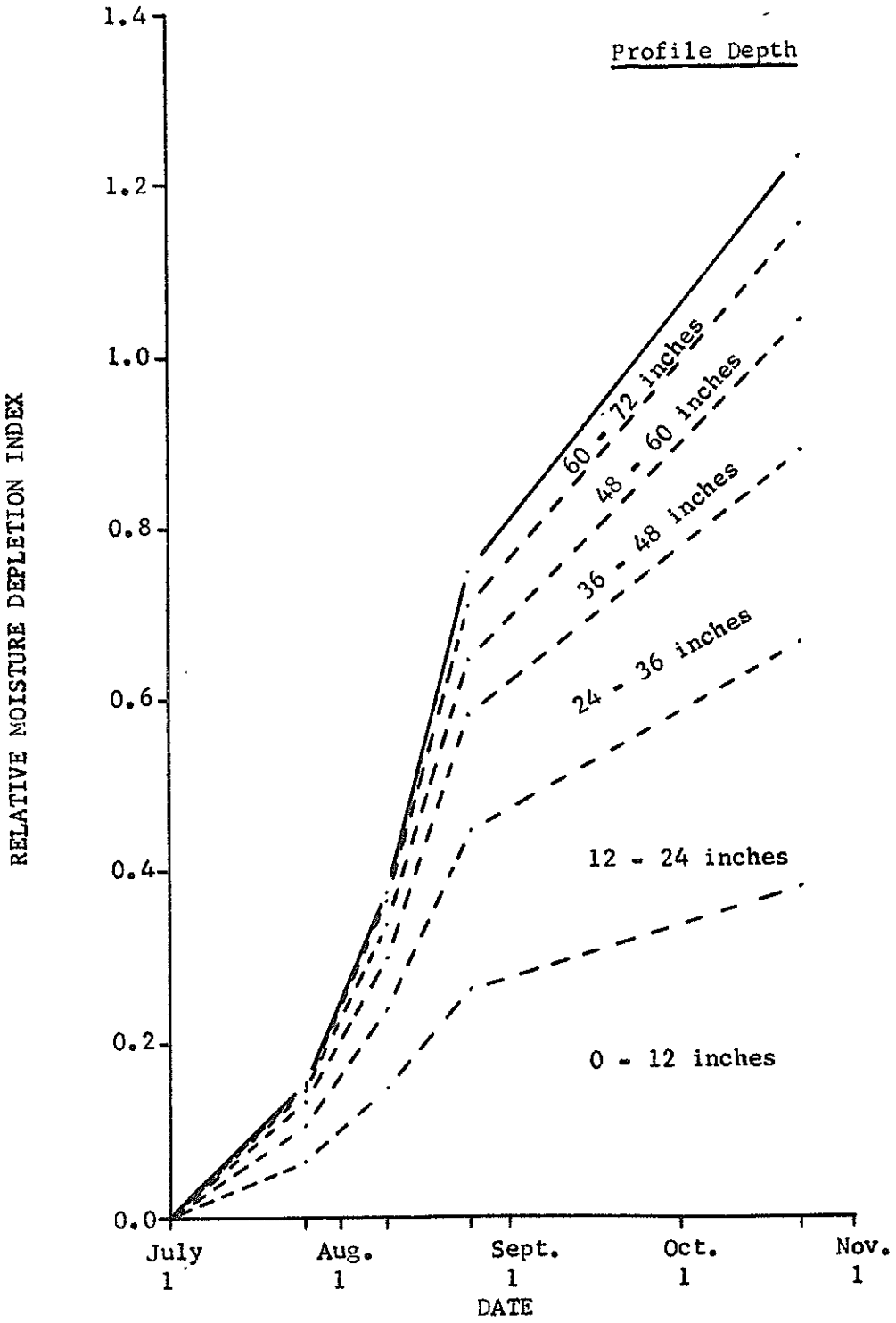

Figure H-16. Relative moisture depletion index for Regime F, cotton irrigation study Experiment B, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

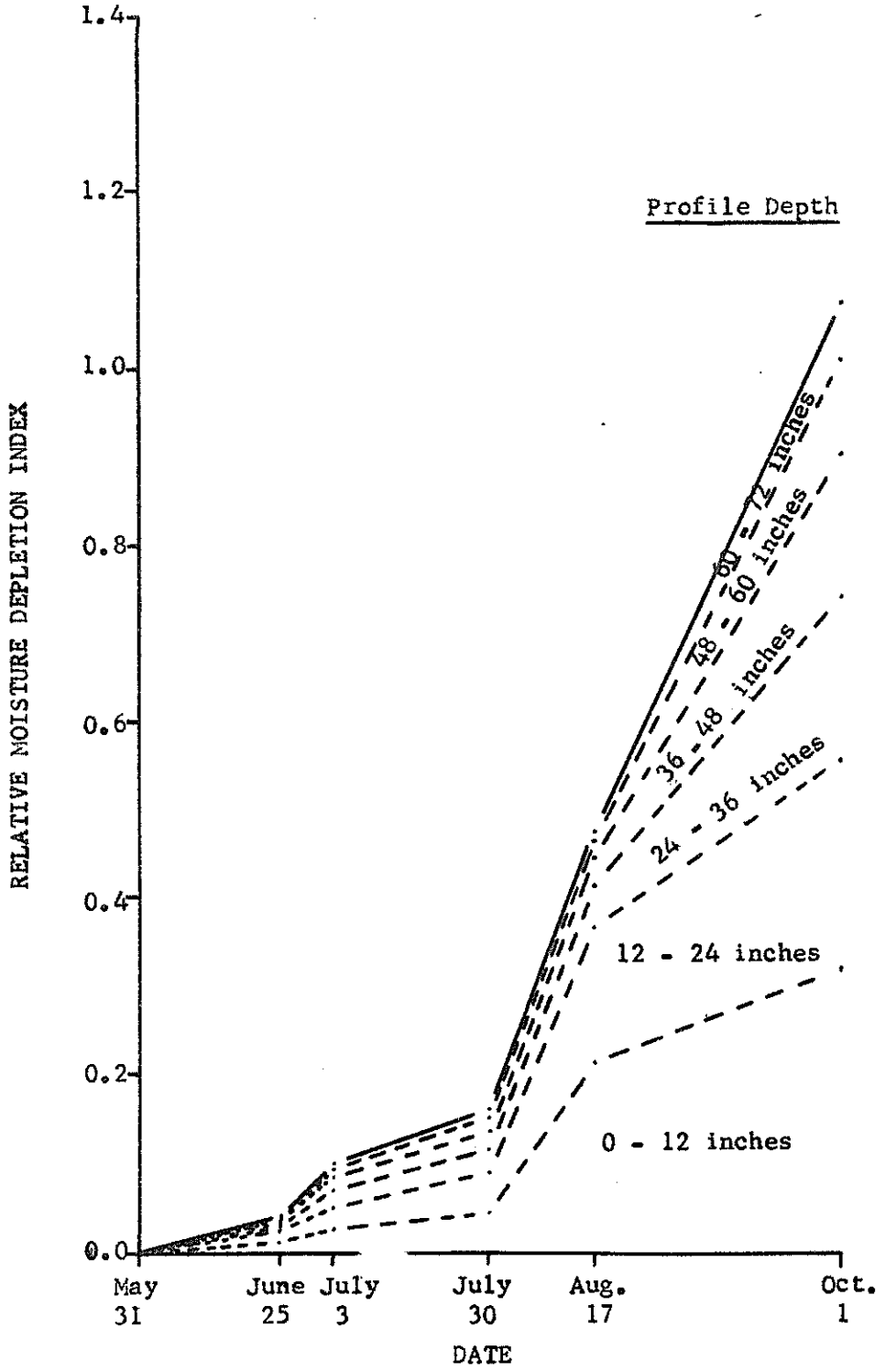

Figure H-17. Relative moisture depletion index, selected irrigation unit of cotton, Case Farm J, Roswell Artesian Basin, New Mexico, 1968.

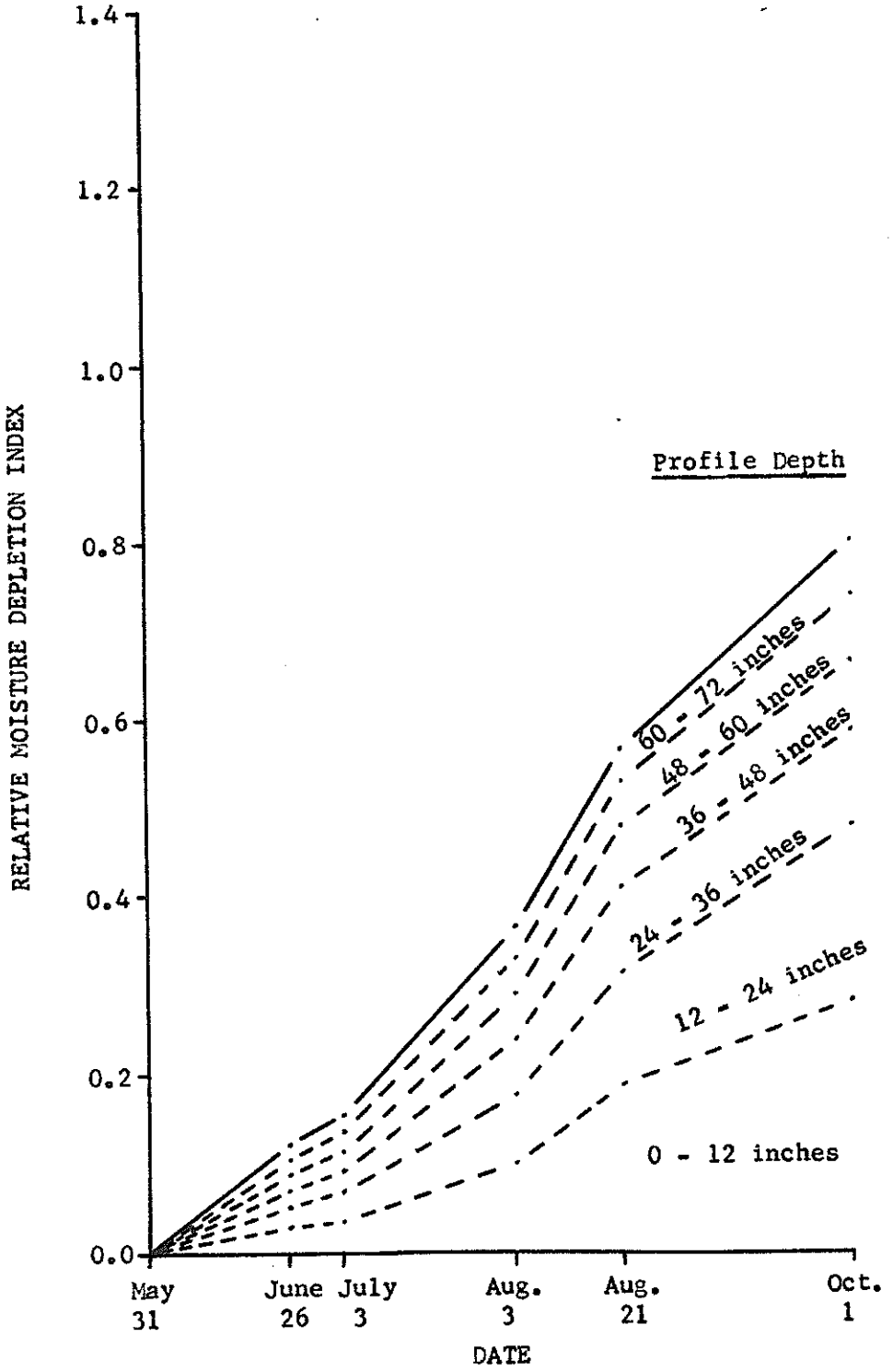

Figure H-18. Relative moisture depletion index, selected irrigation unit of cotton, Case Farm L, Roswell Artesian Basin, New Mexico, 1968.

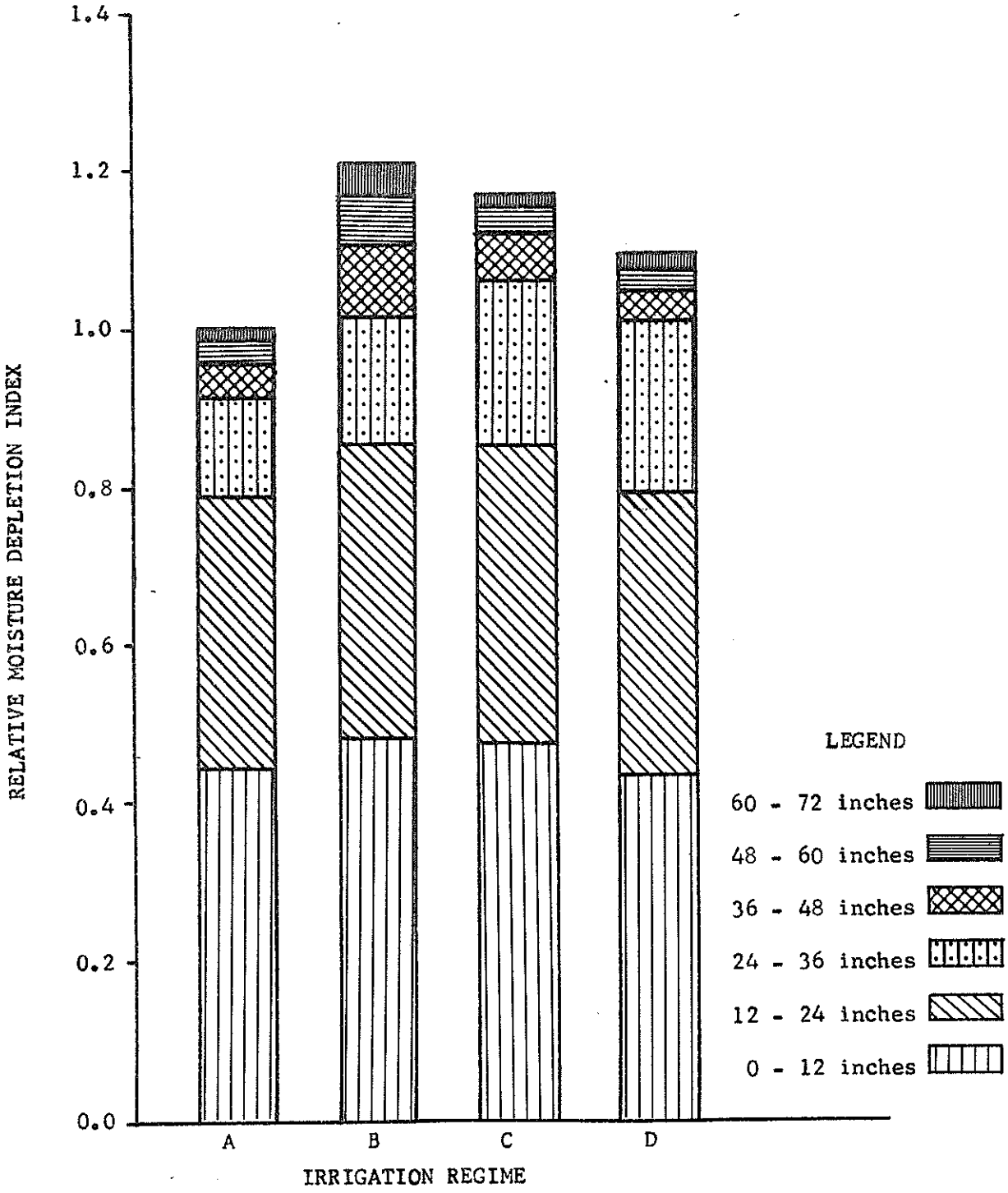

Figure H-19. Relative moisture depletion index by profile depth for four irrigation regimes, alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

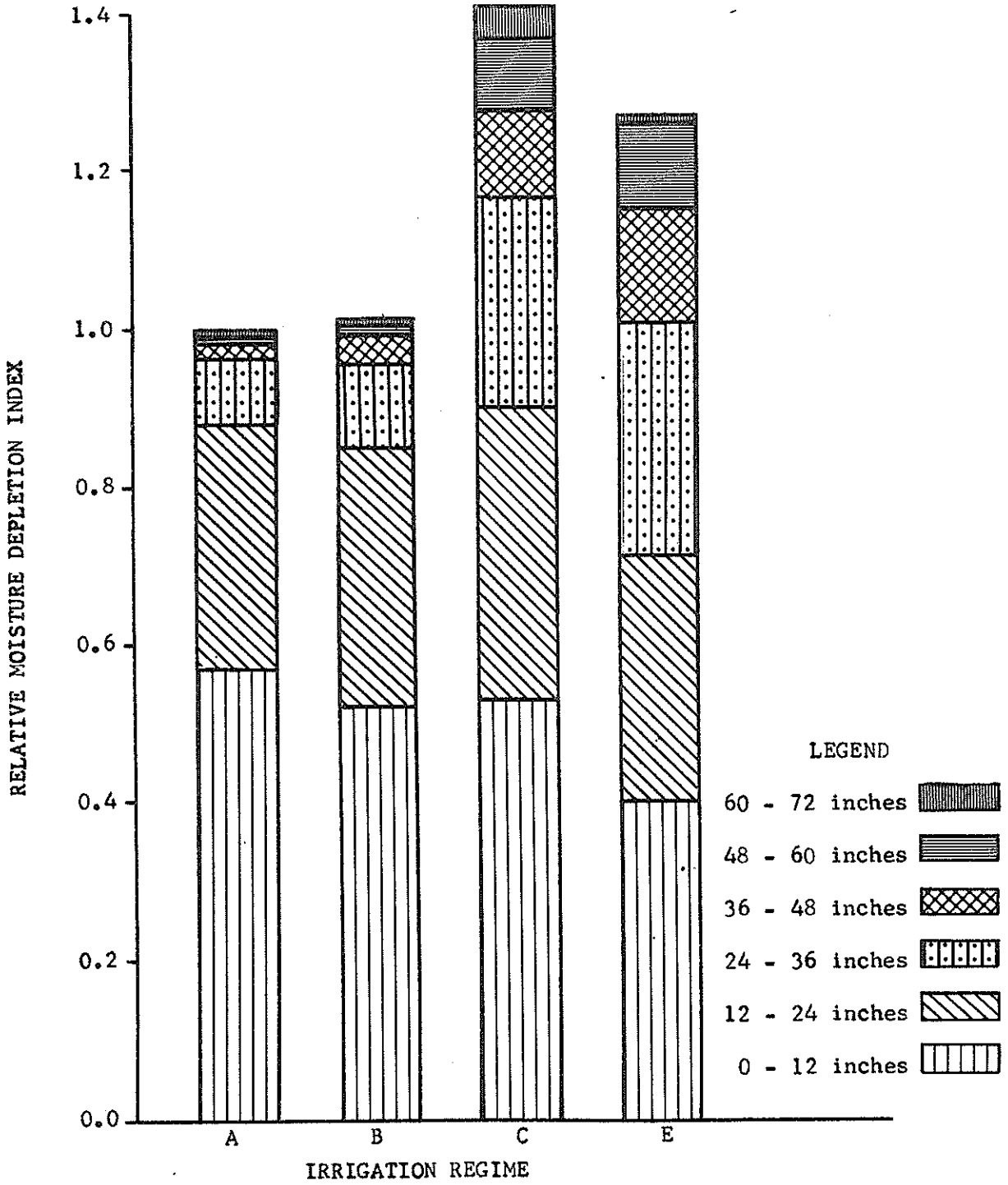

Figure H-20. Relative moisture depletion index by profile depths for four irrigation regimes, alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

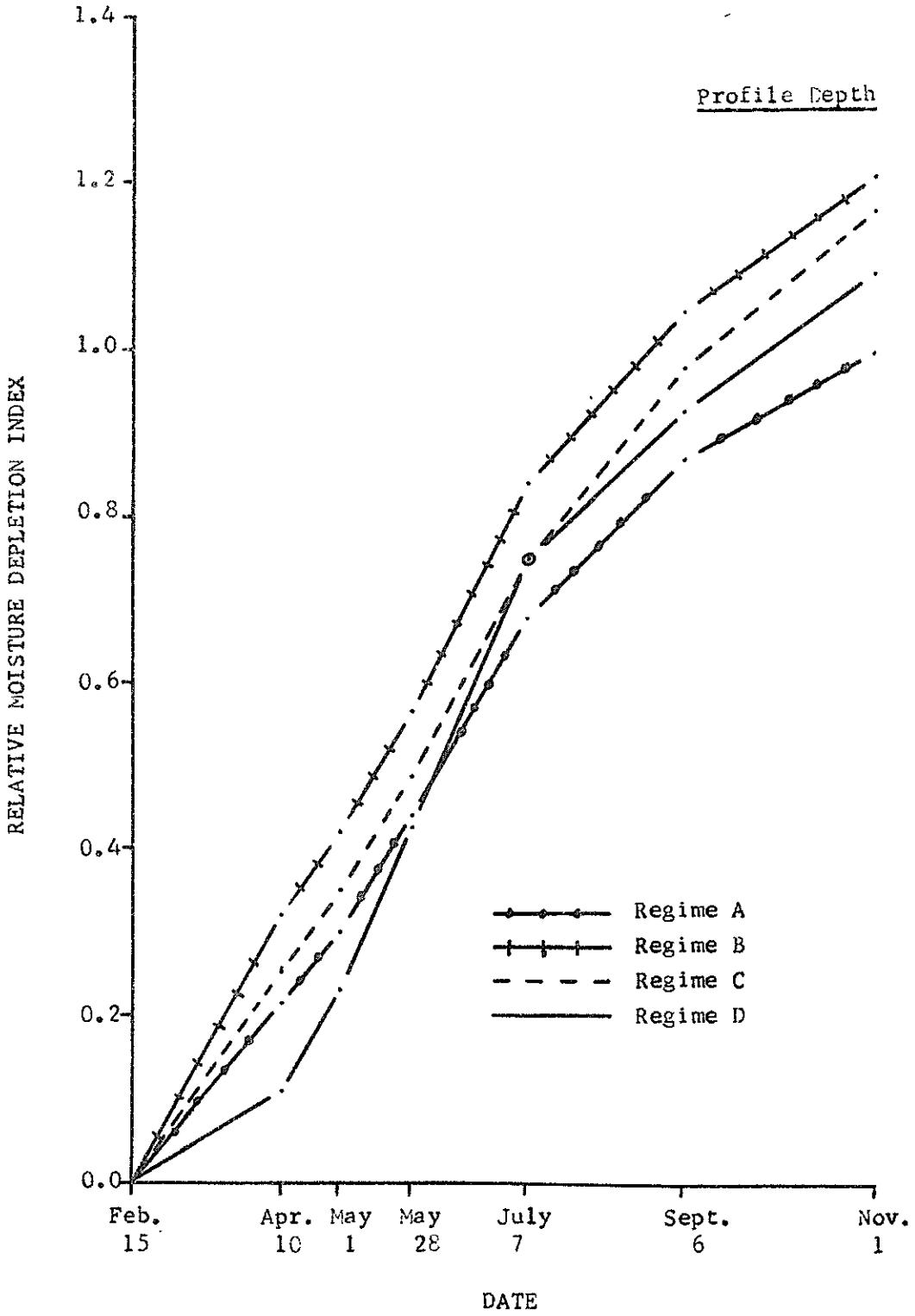

Figure II-21. Relative moisture depletion index for four irrigation regimes, alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1967.

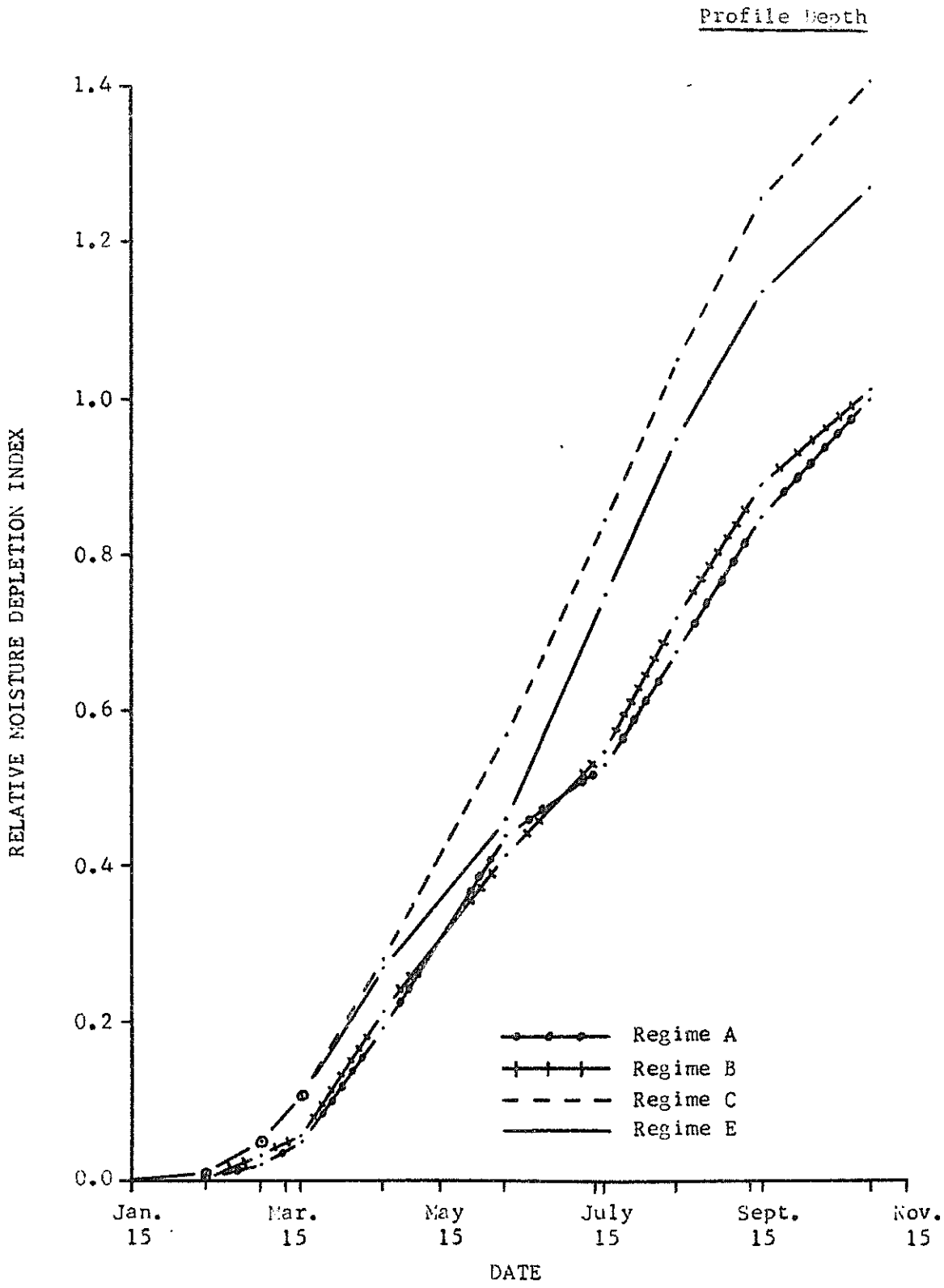

Figure H-22. Relative moisture depletion index for four irrigation regimes, alfalfa irrigation study, Southeastern Branch Experiment Station, Artesia, New Mexico, 1968.

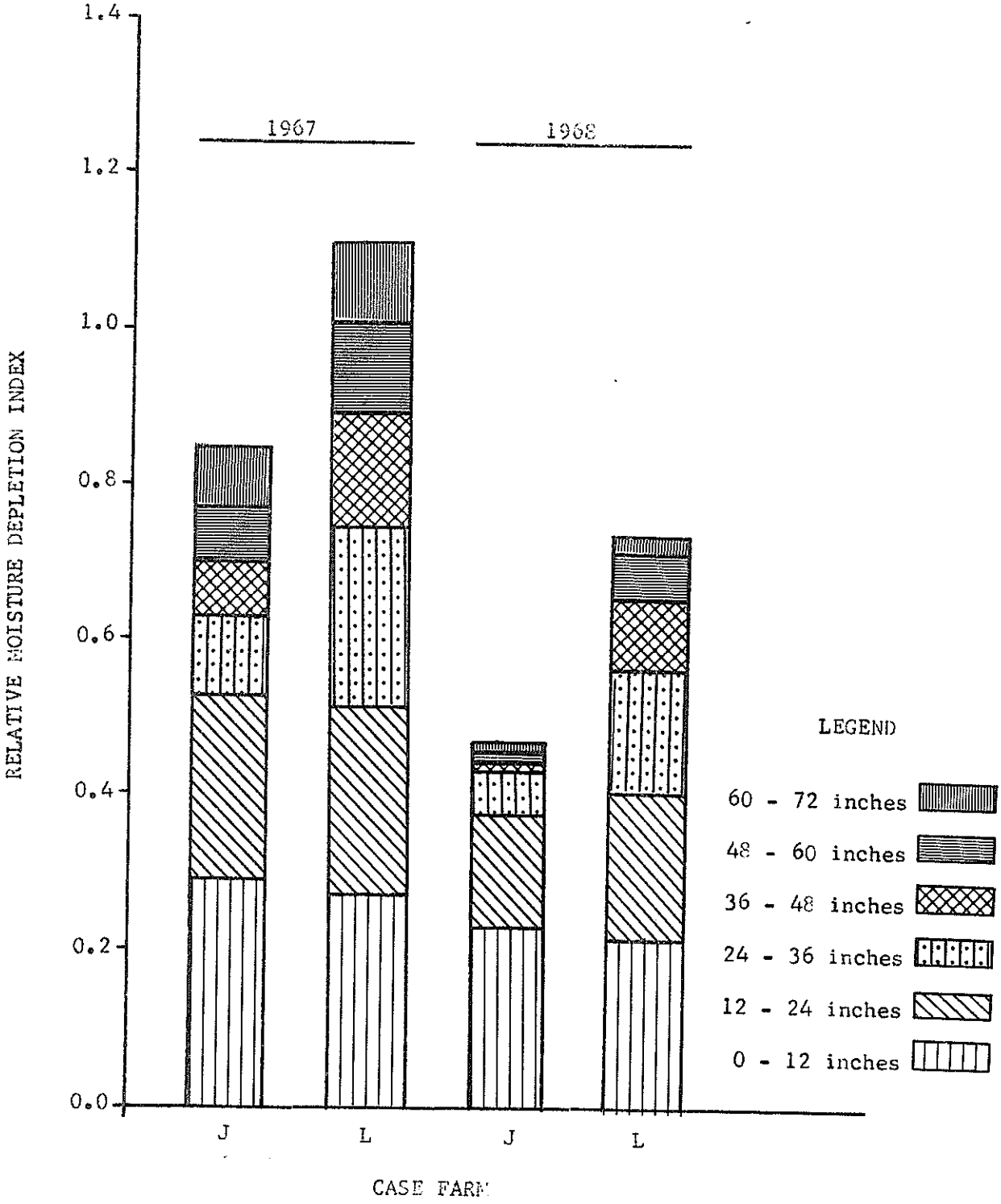

Figure H-23. Relative moisture depletion index, selected irrigation units of alfalfa, Case Farms J and L, Roswell Artesian Basin, New Mexico, 1967-68.