Technical Report No. 115

# SOME HYDROLOGIC AND PHYSICAL PROPERTIES OF THE MAJOR SOIL TYPES ON THE PAWNEE INTENSIVE SITE

Bruce P. Van Haveren and Alan F. Galbraith

Watershed Sciences Department

Colorado State University

Fort Collins, Colorado

GRASSLAND BIOME

U. S. International Biological Program

September 1971

## TABLE OF CONTENTS

ABSTRACT

Experimental design of the soil water transect study is discussed in some detail. Soil bulk density, texture, and water retention data for the soil water transects and irrigation plots are presented. Preliminary water content data collected at the end of the 1970 growing season are also shown and discussed. Observations on snow accumulation and associated soil water recharge are introduced and discussed briefly. Results of the textural analysis, pore space distribution, and water desorption characteristics of the microwatershed soils are presented. The calibration results for the neutron probe are also given.

# INTRODUCTION

The primary goal of the Grassland Biome project is to quantitatively describe biological productivity and nutrient and energy cycling in a grassland ecosystem. The abiotic elements of this ecosystem serve as the driving and governing forces behind productivity. With an average annual precipitation of only 10 to 12 inches, water becomes one of the most important of these forces on the Pawnee Site. Soil, acting as a vast reservoir, receives precipitation and stores it, making water available for both plant and animal use. Infiltration, storage capacity, and evapotranspiration are the major factors that decide how much of the annual precipitation becomes available to biological systems in the grassland ecosystem. Soil physical properties play an important role in all three of these processes.

It is the objective of this study to examine the major hydrologic and physical characteristics of the representative soil types found on the Pawnee Site. This study, designed to augment the water balance study of the eight microwatersheds, has been divided into three areas. A series of soil water sampling transects serves as the basic experimental design for investigation of soil water recharge and depletion, soil water potential, and runoff characteristics for the major soils of the Pawnee Site.

# SOIL WATER TRANSECTS

Three sampling transects are located within the interior basin, one each in the heavy-, medium-, and light-grazed pastures. All three are straight-line transects and are oriented perpendicular to the main axis of the drainage. In addition, another transect was located in a winter-grazed pasture of Section 22 as shown in Fig. 1. Also, a pair of small transects was located in Lynn Lake.

Sampling points were tentatively chosen for each of the transects and were spaced 25 m apart. Soils data were reviewed to determine representativeness of each sampling point. Final sampling points were chosen so that all combinations of grazing treatment, soil type, and "position on slope" were represented.

During the summer of 1970 a neutron probe access tube was installed at each sampling point and the A-, B-, and C-horizons were sampled for bulk density, texture, and water retention analyses.

Measurements of soil water content are taken at the 15, 30, 45, 60, 75, 90, 120, and 150 cm levels on a weekly basis during the growing season and on a monthly basis over the remainder of the year. Data are now available on a weekly basis from July 29, 1970, to September 2, 1970, and on a monthly basis from September 1970 to December 1970. These data are discontinuous due to equipment malfunction and failure.

## IRRIGATION PLOT SOIL WATER MEASUREMENTS

Neutron probe access tubes have been installed in the ten stress plots on the irrigation site. Three tubes have been located in each of the ten plots and are arranged according to Fig. 2.

Sampling of these tubes will follow the same procedure as used on the microwatersheds and soil water transects. Bulk density, texture, and water retention samples were taken at each tube location using the same procedure as used on the soil water transects.

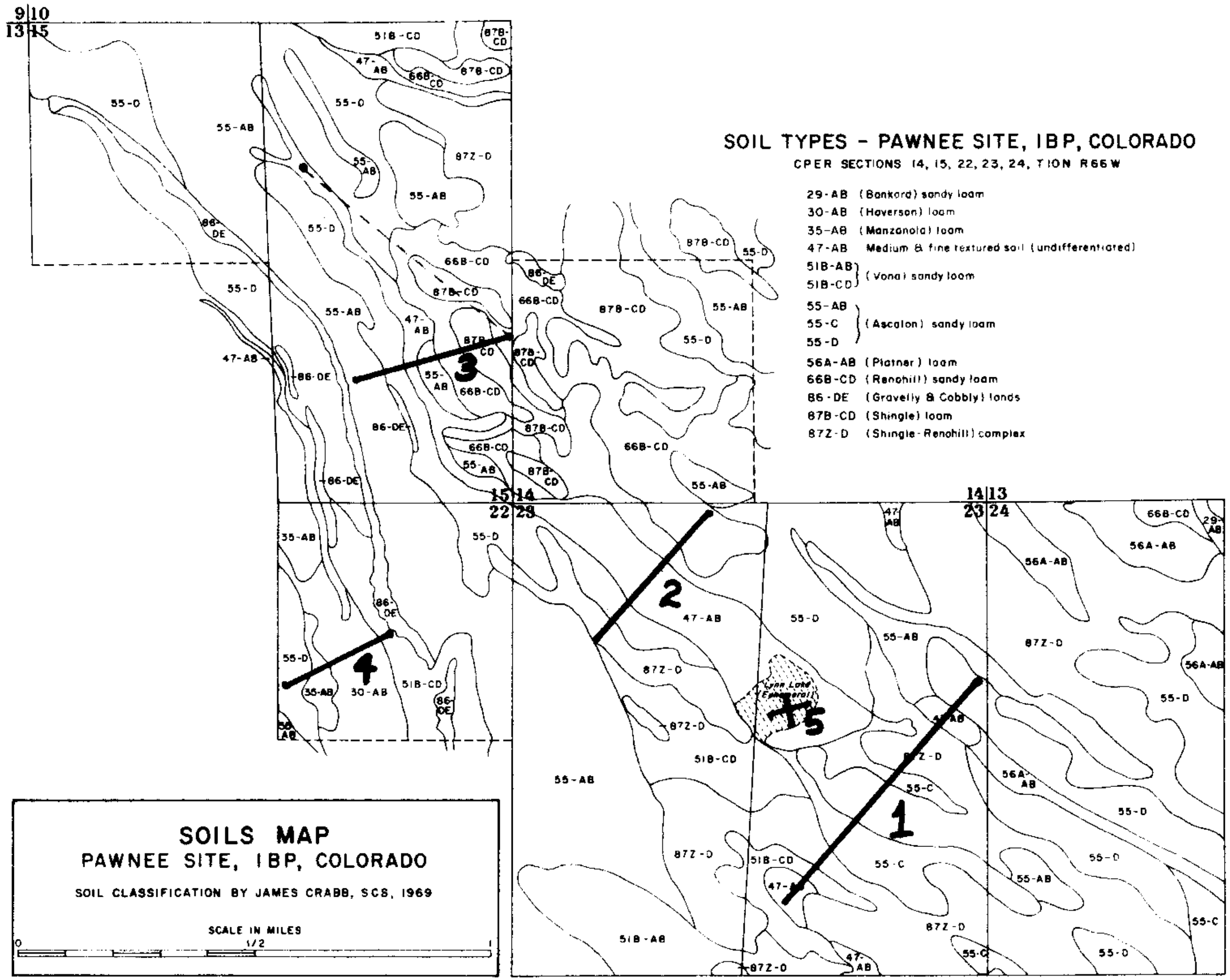


Fig. 1. Soils map showing the soil water transects.

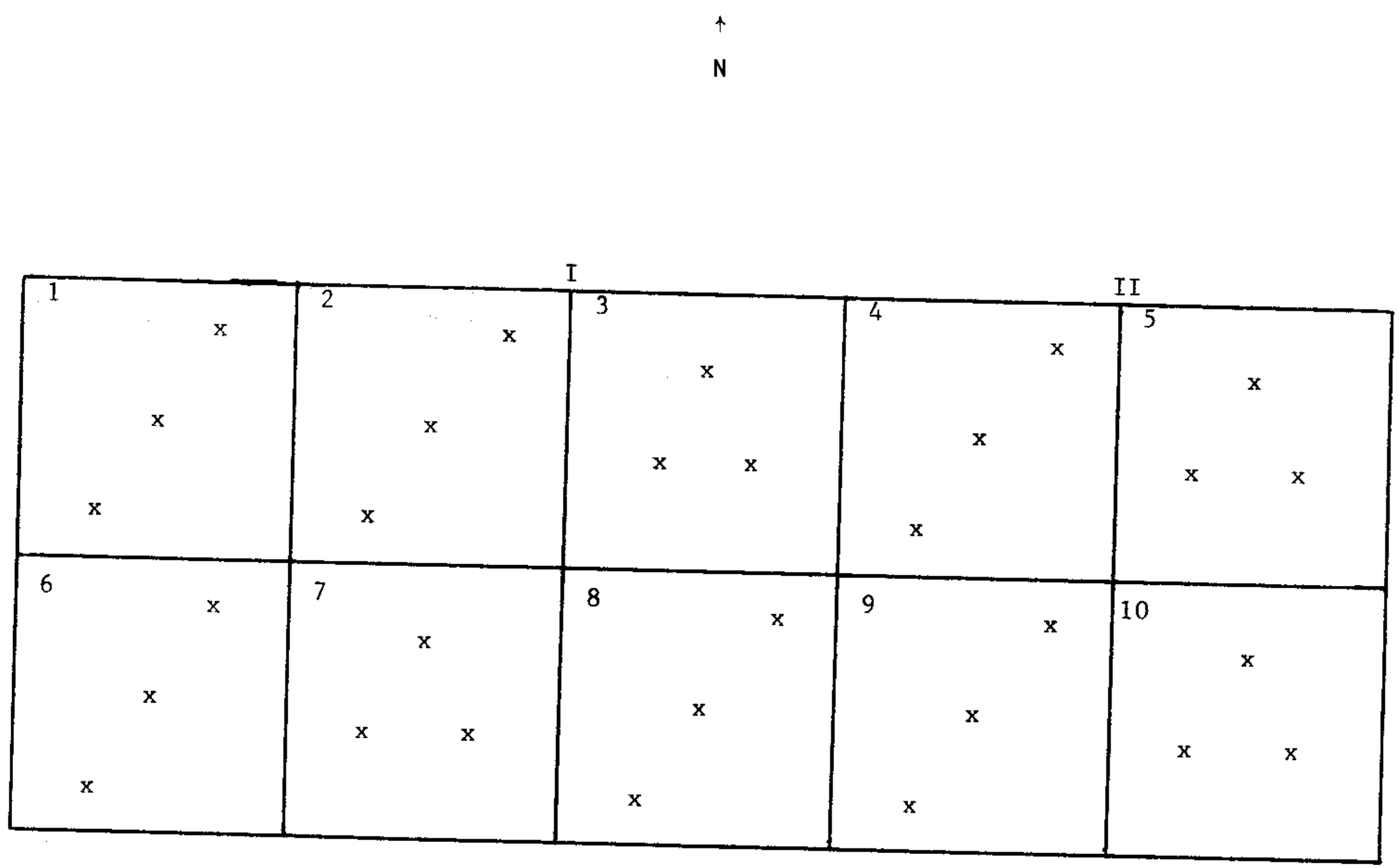


Fig. 2. Location of neutron probe access tubes in the irrigation plots.

Soil water content data for these plots are available on a limited basis for the month of August 1970.

## SOIL WATER POTENTIAL MEASUREMENTS

In the past two decades a large amount of effort has been expended in investigating the free energy status of water in the soil-plant-atmosphere continuum. Recent developments in psychrometric instrumentation have enabled workers in this area of interest to accurately describe the free energy status of water in plant tissues and soils. A thermocouple psychrometer is now commercially available for use in soils. A later technical report will deal with the concept, theory, terminology, and instrumentation involved in measuring water potentials in porous media and biological systems.

Forty soil psychrometers are being included in the design of the soil water transects. Soil water potential measurements will be made at selected sampling points along the medium-grazed transect. Eight plastic access pipes, 15 cm in diameter and 75 cm in length, have been installed along the transect close to neutron probe access tubes. Two pipes are located in each of the four major soil types: Ascalon sandy loam, Renohill sandy loam, Shingle loam, and undifferentiated soil. Each access pipe will initially include a stack of five soil psychrometers at the 2, 10, 20, 40, and 60 cm levels. The sensors will protrude 10 to 15 cm horizontally from the outside wall of the access pipe. Extention of this study to the microwatersheds and irrigation plots is presently under consideration.

Soil water potential measurements will be taken weekly starting in April or May 1971. It is hoped that these data could be used to construct characteristic curves based on *in situ* measurement of both soil water content and soil water potential.

A laboratory calibration procedure is being developed whereby each soil psychrometer will be calibrated in aqueous sodium chloride solutions of known water potentials at various temperatures.

Also, this project, in cooperation with the photosynthesis group, is working on an improved design for soil psychrometers and is setting up a workshop for the construction and calibration of thermocouple psychrometers of all designs for intra-biome use.

## RUNOFF STUDY -- DESIGN AND INSTRUMENTATION

At each access tube site on the light-, medium-, and heavy-grazed transects, two micro-runoff collectors have been installed to collect overland flow. The collectors consist of an ice cream container, 15 cm in diameter and 16 cm deep, fitted with a galvanized metal collecting funnel 7.5 cm wide. The micro-runoff collector is installed in the ground so that the collecting funnel is flush with the soil surface. These units will be in operation beginning in the spring of 1971.

Immediately following a rain event, each collector will be emptied, the total runoff volume measured, and the sample saved for analyses of sediment concentration and particle size distribution.

## SOILS DESCRIPTION

Site descriptions, experimental design, instrumentation, and overall objectives for the hydrology study have been covered in previous

115



Table 1. Soil horizon depths in centimeters for the major soil types on the Pawnee Site.

| Soil Type | Horizon A | Horizon B |
|---|---|---|
| 47 | 0-15 | 15-53 |
| 51 | 0-10 | 10-36 |
| 55 | 0-15 | 15-46 |
| 66 | 0-15 | 15-41 |
| 87B | 0-13 | 13-46 |
| 87Z | 0-15 | 15-53 |

technical reports (Smith and Striffler 1969; Galbraith 1969). In addition, a preliminary study on the mineralogy of the Pawnee Site has provided data on textural properties and background knowledge of the soils on the site (Franklin 1969).

Table 1 gives depths corresponding to each horizon for the major soil types. The C horizon was excluded because of the extreme variability found in the C horizons of all the soil types. Basically, the C horizon was composed of $C_1$ and $C_2$ sub-horizons having approximately the same texture. However, quite often a $C_{ca}$ layer was sandwiched between the $C_1$ and $C_2$ or else was replacing one or the other. When the $C_{ca}$ was present with either the $C_1$ or $C_2$, it was found either above or below the $C_1$ or $C_2$. Textural analysis of these $C_{ca}$ layers showed them to be essentially clay sized material. Many of the $C_{ca}$ samples appeared to hold no sand-sized material whatsoever. There seemed to be no pattern evident in the C-horizon makeup from one soil type to another. In general, the C horizon was made up of at least 60% sand-sized material. Usually, this sand was medium-grained and had the appearance of clean, white beach sand.

Tables 2a, 2b, and 2c give bulk density data for the soil water transects and the irrigation plot. In Table 2a the bulk densities are averaged within soil types for the A and B horizons. It was virtually impossible to obtain a bulk density sample for the C horizon anywhere on the site. The mean values for the A horizon all fell between 1.38 and 1.45 $g/cm^{-3}$, and the mean values for the B horizon fell between 1.40 and 1.50 $g/cm^{-3}$. It is doubtful that the differences between soil type means were significant because of the small sample sizes.

Table 2a. Bulk densities by soil type ($g/cm^{-3}$).

| Soil | Horizon | Mean B. D. | Maximum | Minimum | SD | n. |
|---|---|---|---|---|---|---|
| 47 | A | 1.41 | 1.74 | 1.25 | .173 | 10 |
| | B | 1.47 | 1.61 | 1.33 | .109 | 7 |
| 51 | A | 1.40 | 1.44 | 1.33 | .059 | 3 |
| | B | 1.50 | 1.52 | 1.48 | .021 | 3 |
| 55 | A | 1.42 | 1.58 | 1.22 | .101 | 20 |
| | B | 1.49 | 1.64 | 1.31 | .089 | 17 |
| 66 | A | 1.39 | 1.51 | 1.25 | .081 | 10 |
| | B | 1.45 | 1.65 | 1.05 | .162 | 10 |
| 87B | A | 1.38 | 1.41 | 1.31 | .047 | 4 |
| | B | 1.40 | 1.46 | 1.32 | .062 | 4 |
| 87Z | A | 1.45 | 1.62 | 1.30 | .106 | 11 |
| | B | 1.49 | 1.80 | 1.30 | .126 | 12 |

Table 2b. Bulk densities by grazing treatment ($g/cm^{-3}$).

| Treatment | Horizon | Mean B. D. | Maximum | Minimum | SD | n. |
|---|---|---|---|---|---|---|
| Heavy | A | 1.45 | 1.74 | 1.22 | .132 | 21 |
| | B | 1.52 | 1.80 | 1.40 | .097 | 17 |
| Medium | A | 1.42 | 1.55 | 1.25 | .086 | 19 |
| | B | 1.46 | 1.65 | 1.32 | .092 | 19 |
| Light | A | 1.37 | 1.58 | 1.25 | .086 | 18 |
| | B | 1.43 | 1.61 | 1.05 | .134 | 17 |

Table 2c. Bulk densities for irrigation plots ($g/cm^{-3}$).

| Horizon | Mean B. D. | Maximum | Minimum | SD | n. |
|---|---|---|---|---|---|
| A | 1.35 | 1.50 | 1.20 | .081 | 28 |
| B | 1.40 | 1.56 | 1.23 | .077 | 15 |

Table 2b gives mean values by horizon of bulk density averaged within grazing treatments. For the A horizon, the difference between the mean bulk density of the heavy-grazed soil and that of the light-grazed soil was significant at the .99 level. However, in this case the heavy-grazed mean was only 0.08 g/cm$^{-3}$ larger than the light-grazed mean. This difference does not seem large enough to substantiate the popular claim that grazing animals compact the soil surface, which gives rise to higher bulk densities. These bulk density data are now being run through an analysis of variance procedure to test soil type effect, grazing effect, and the interaction.

Particle size determinations for the sand, silt, and clay classes were made using the hydrometer method (Day 1965). Textural data for the major soils are shown in Table 3. From the textural triangle the following classifications are assigned:

| | | |
|---|---|---|
| 47 | A | sandy clay loam |
| | B | sandy clay loam |
| 51 | A | sandy loam |
| | B | sandy clay loam |
| 55 | A | sandy loam |
| | B | sandy clay loam |
| 66 | A | sandy clay loam |
| | B | sandy clay loam |
| 87B | A | sandy loam |
| | B | sandy clay loam |
| 87Z | A | sandy clay loam |
| | B | sandy clay loam |
| Irrig. Plot | A | |
| | B | |
| | C | |

Table 3. Percent sand, silt, and clay by soil type. All values except n are in percent.

| Soil | Horiz. | Mean % Sand | Max. | Min. | SD | Mean % Silt | Max. | Min. | SD | Mean % Clay | Max. | Min. | SD | n. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 47 | A | 62 | 77 | 38 | 12.3 | 17 | 25 | 5 | 6.7 | 21 | 41 | 15 | 8.3 | 11 |
| | B | 65 | 77 | 49 | 10.4 | 12 | 20 | 5 | 5.3 | 23 | 26 | 15 | 8.7 | 6 |
| 51 | A | 75 | 85 | 57 | 11.6 | 9 | 15 | 5 | 4.2 | 16 | 38 | 5 | 13.5 | 5 |
| | B | 69 | 72 | 67 | 13.6 | 10 | 18 | 8 | 5.0 | 21 | 25 | 12 | 6.1 | 4 |
| 55 | A | 69 | 82 | 47 | 10.3 | 14 | 26 | 2 | 6.0 | 17 | 35 | 5 | 6.8 | 22 |
| | B | 60 | 82 | 37 | 13.8 | 15 | 31 | 0 | 8.7 | 25 | 41 | 15 | 8.7 | 20 |
| 66 | A | 64 | 77 | 47 | 10.8 | 14 | 20 | 8 | 3.8 | 22 | 38 | 8 | 11.9 | 10 |
| | B | 51 | 74 | 8 | 20.2 | 17 | 26 | 8 | 6.1 | 32 | 66 | 18 | 15.3 | 10 |
| 87B | A | 65 | 80 | 52 | 11.6 | 16 | 28 | 8 | 9.1 | 19 | 28 | 12 | 7.0 | 4 |
| | B | 56 | 62 | 44 | 8.1 | 22 | 31 | 18 | 6.2 | 22 | 25 | 20 | 2.2 | 4 |
| 87Z | A | 62 | 77 | 37 | 12.0 | 15 | 23 | 10 | 3.8 | 23 | 45 | 8 | 11.2 | 11 |
| | B | 52 | 80 | 20 | 17.2 | 18 | 41 | 2 | 11.2 | 30 | 43 | 18 | 8.0 | 12 |
| Irrig. Plots (55) | A | 61 | 75 | 37 | 9.6 | 23 | 53 | 13 | 7.2 | 16 | 38 | 10 | 7.6 | 29 |
| | B | 52 | 75 | 21 | 13.2 | 21 | 30 | 13 | 4.7 | 27 | 54 | 10 | 9.9 | 25 |
| | C | 62 | 75 | 36 | 8.6 | 17 | 36 | 7 | 6.3 | 20 | 35 | 10 | 5.3 | 28 |

## WATER RETENTION CHARACTERISTICS OF THE MAJOR SOIL TYPES

The pressure plate method (Richards 1965) of determining absorption characteristics was employed in this analysis. Samples were subjected to applied pressures of 0.0, 0.1, 0.3, 1.0, 3.0, and 15.0 bars and the volumetric water content determined for each of the applied pressures. These data are tabulated in Table 4 and the associated desorption curves are shown in Fig. 3-9. With the exception of the undifferentiated soil (47), all the soil types showed the B horizon to have a higher water holding capacity than the A horizon. These results agree with the textural data for each soil type. The undifferentiated soil showed a higher water holding capacity for the A horizon and a corresponding heavier texture. For the other soil types, the texture of the A horizon was coarser than that for the B horizon and, consequently, had a lower water holding capacity than the B horizon. In considering the water holding capacity of the A and B horizons combined, it appears that the undifferentiated soil had the highest and Vona sandy loam the lowest water holding capacity. The desorption curves for the A and B horizons on the irrigation plots essentially matched those for the Ascalon sandy loam on the transects and, likewise, for the microwatersheds. The irrigation plot soils (mapped as Ascalon sandy loam) appeared to have a slightly higher water holding capacity. This may be due to aeolian deposits of silt-sized material, since there was a noticeably greater percentage of silt in the irrigation plot textured samples than in the other Ascalon samples.

Table 4. Desorption data for the soil water transects and irrigation plot soils.

| Soil Type | Horizon | Matric Potential, -bars 0.0 | 0.1 | 0.3 | 1.0 | 3.0 | 15.0 |
|---|---|---|---|---|---|---|---|
| | | (% $H_2O$ by volume) | | | | | |
| 47 | A | 66.0 | 48.0 | 28.8 | 25.2 | 15.5 | 13.9 |
| | B | 61.3 | 38.6 | 22.1 | 18.7 | 11.7 | 9.9 |
| 51 | A | 60.2 | 33.3 | 17.3 | 14.0 | 8.7 | 7.4 |
| | B | 61.4 | 33.8 | 19.5 | 16.4 | 10.7 | 9.4 |
| 55 | A | 65.2 | 45.9 | 20.0 | 16.2 | 10.0 | 9.0 |
| | B | 65.3 | 43.2 | 24.4 | 20.4 | 12.9 | 11.7 |
| 66 | A | 57.2 | 34.2 | 17.1 | 15.0 | 10.3 | 9.9 |
| | B | 67.6 | 46.4 | 27.6 | 24.5 | 15.3 | 13.4 |
| 87B | A | 59.8 | 35.9 | 22.2 | 20.0 | 11.9 | 11.1 |
| | B | 62.9 | 45.0 | 25.5 | 22.1 | 11.9 | 11.0 |
| 87Z | A | 57.2 | 37.4 | 23.9 | 21.3 | 13.7 | 12.9 |
| | B | 63.7 | 41.9 | 26.2 | 23.8 | 15.0 | 13.7 |
| Irrig. Plots | A | 66.7 | 36.4 | 19.0 | 15.6 | 8.9 | 7.4 |
| | B | 65.9 | 42.0 | 26.3 | 22.5 | 13.2 | 10.9 |

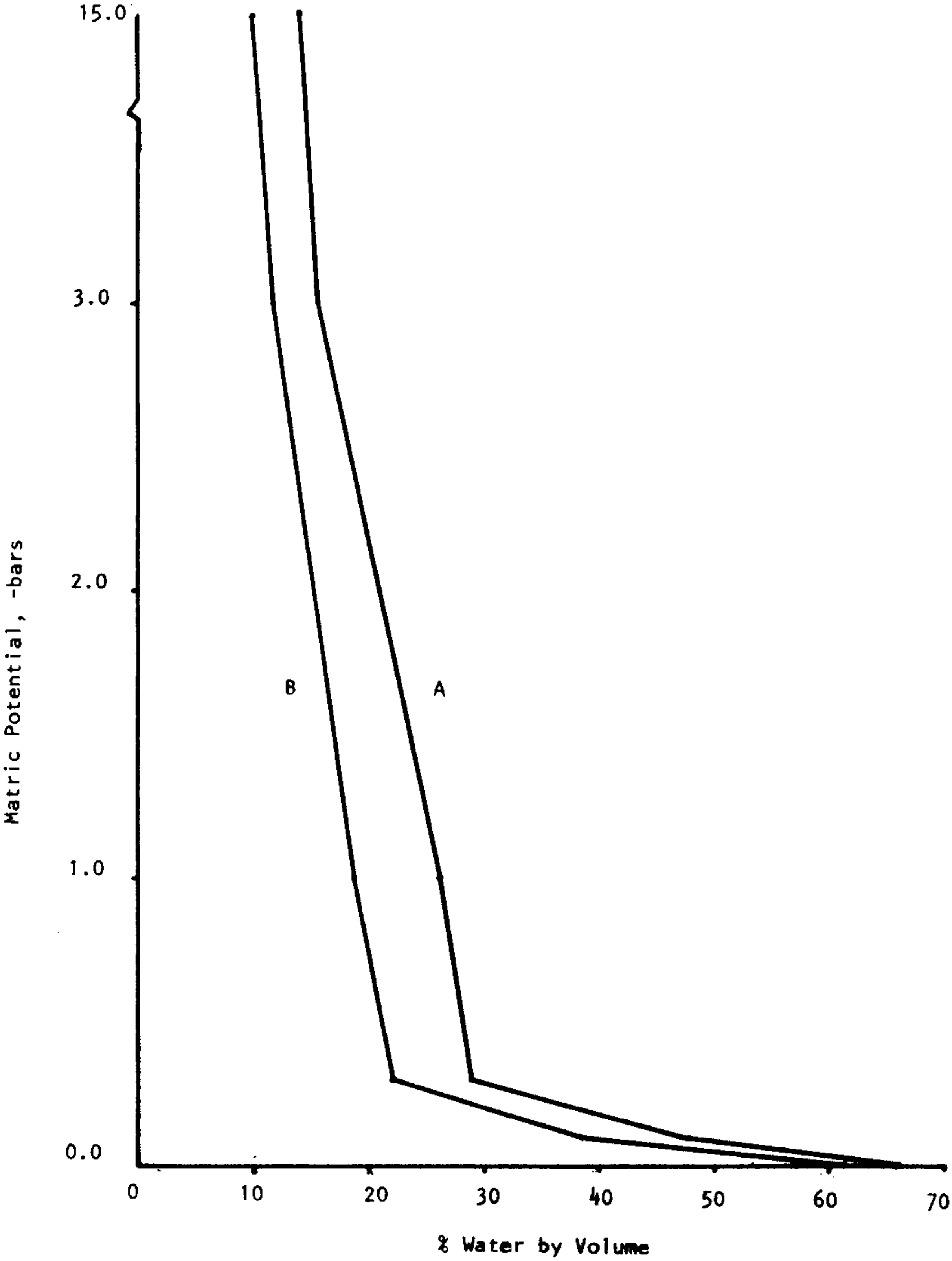


Fig. 3. Desorption curves for undifferentiated soil (47).

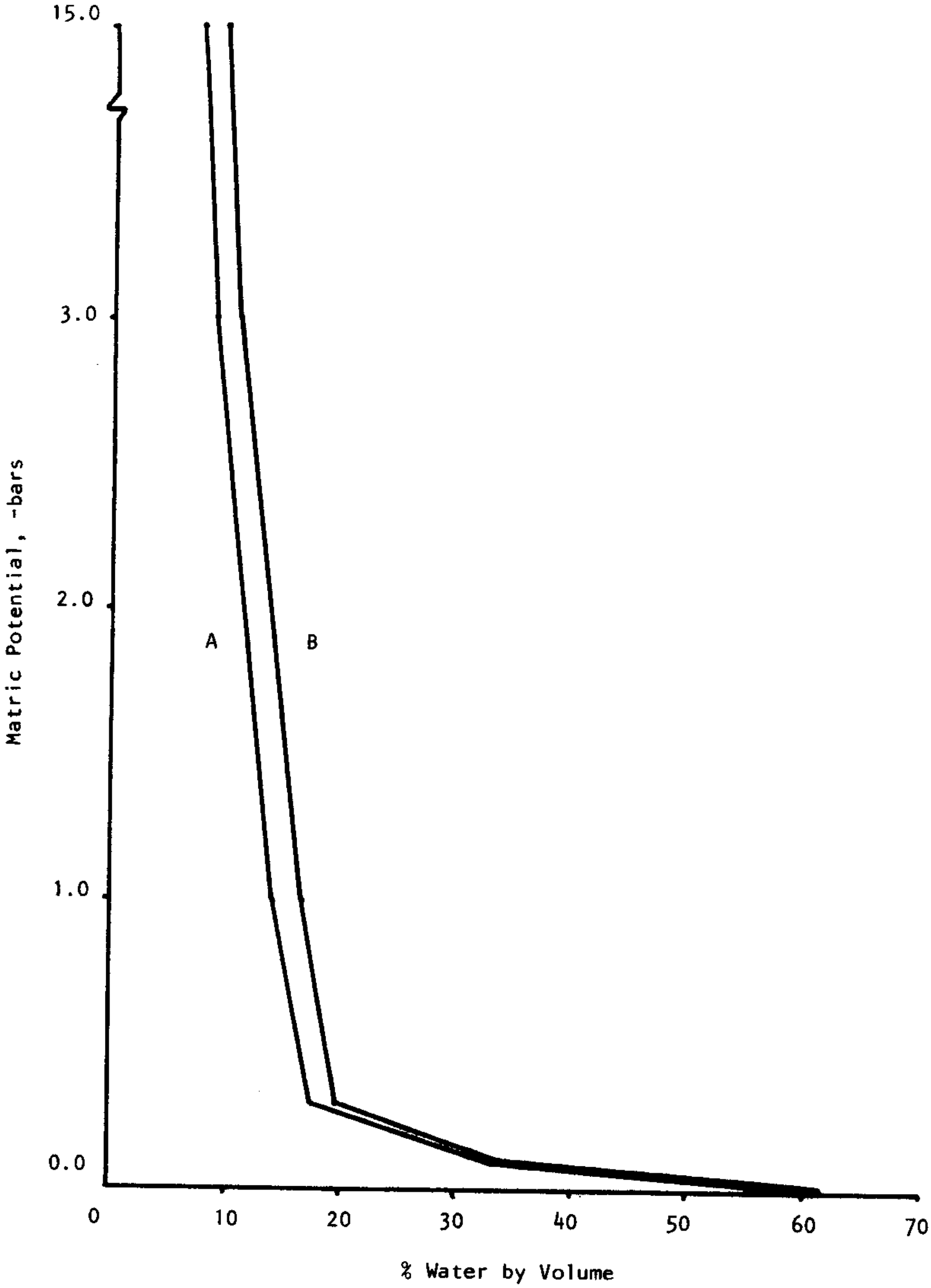


Fig. 4. Desorption curves for Vona sandy loam (51).

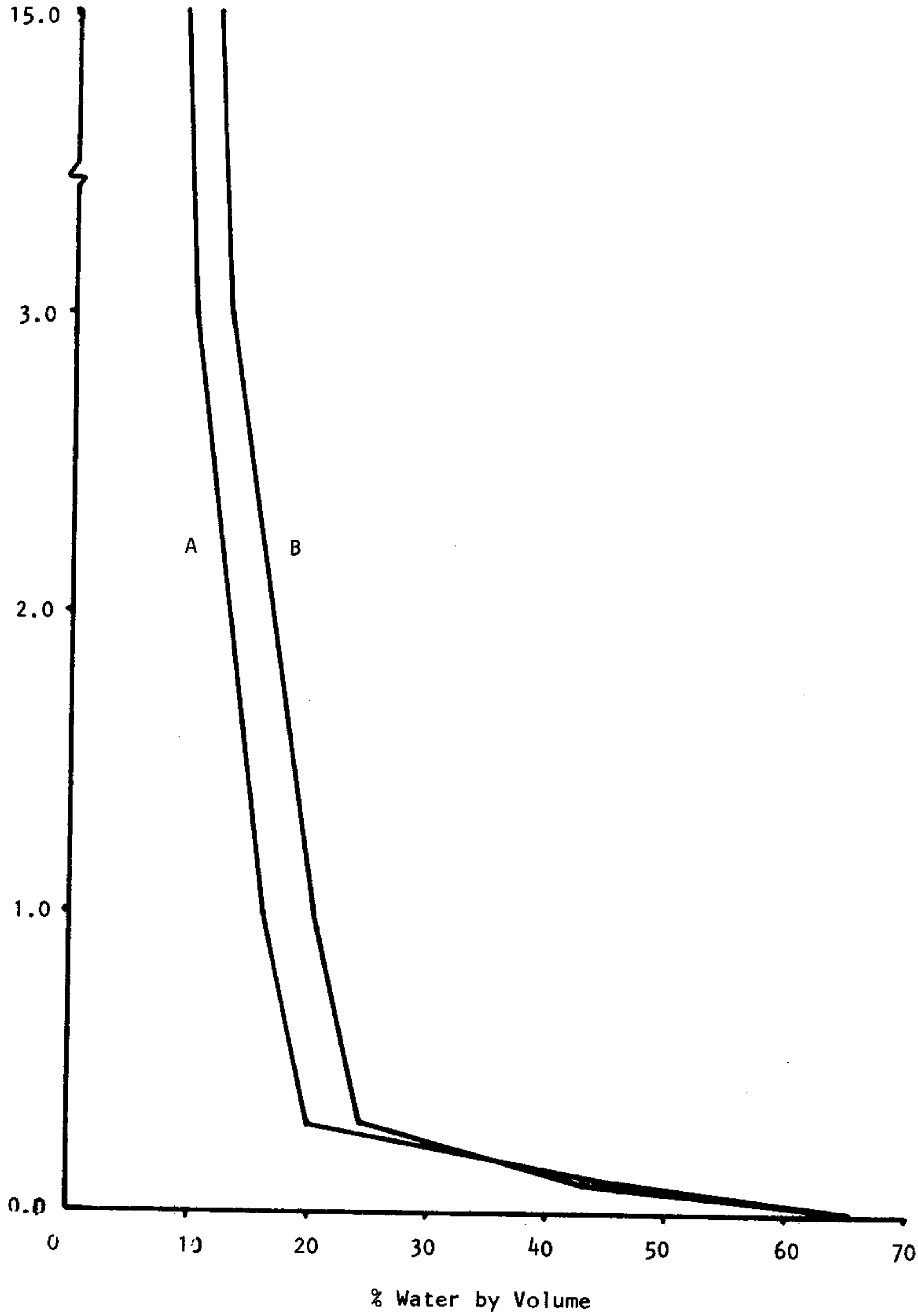


Fig. 5. Desorption curves for Ascalon sandy loam (55).

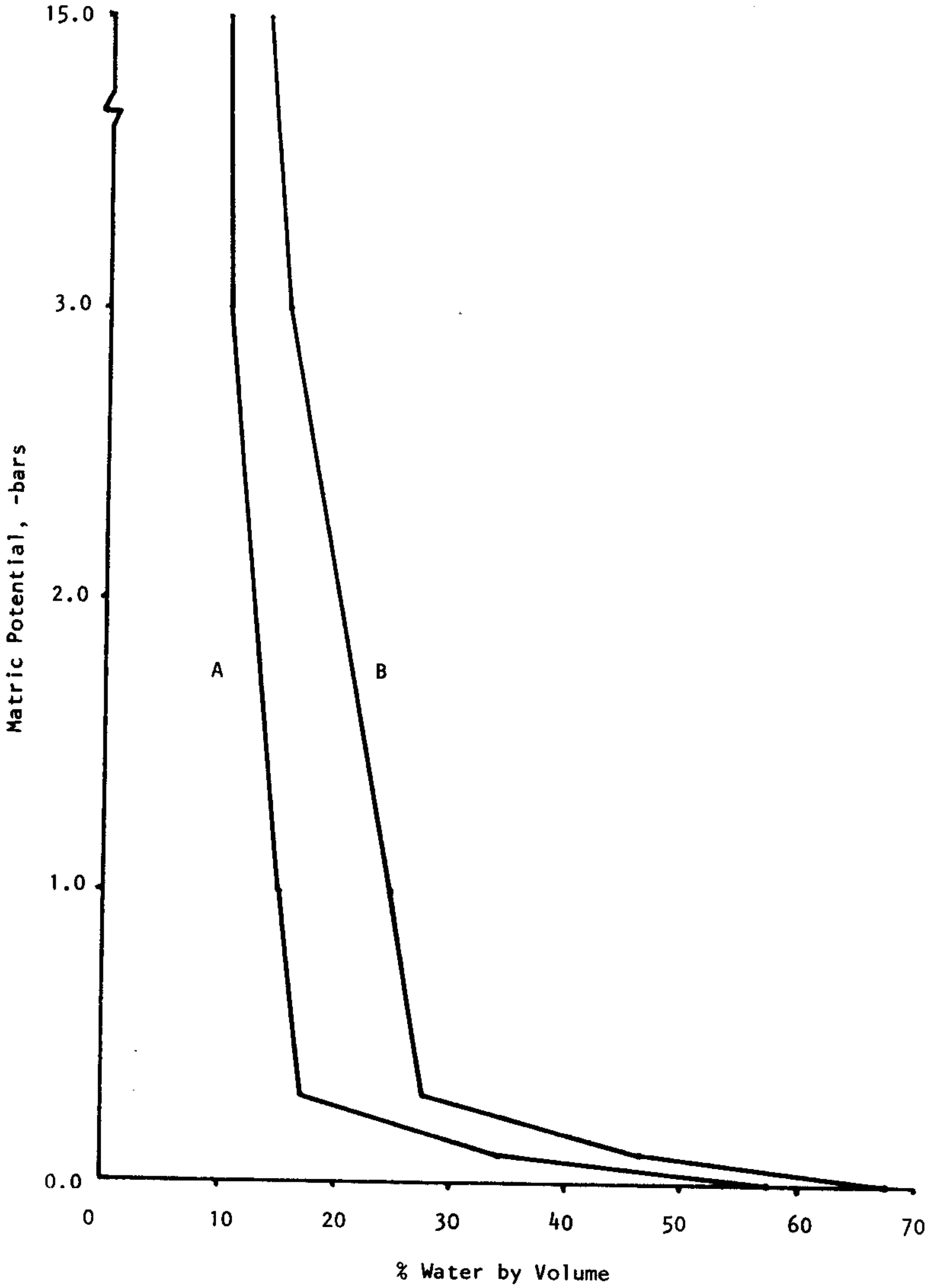


Fig. 6. Desorption curves for Renohill sandy loam (66).

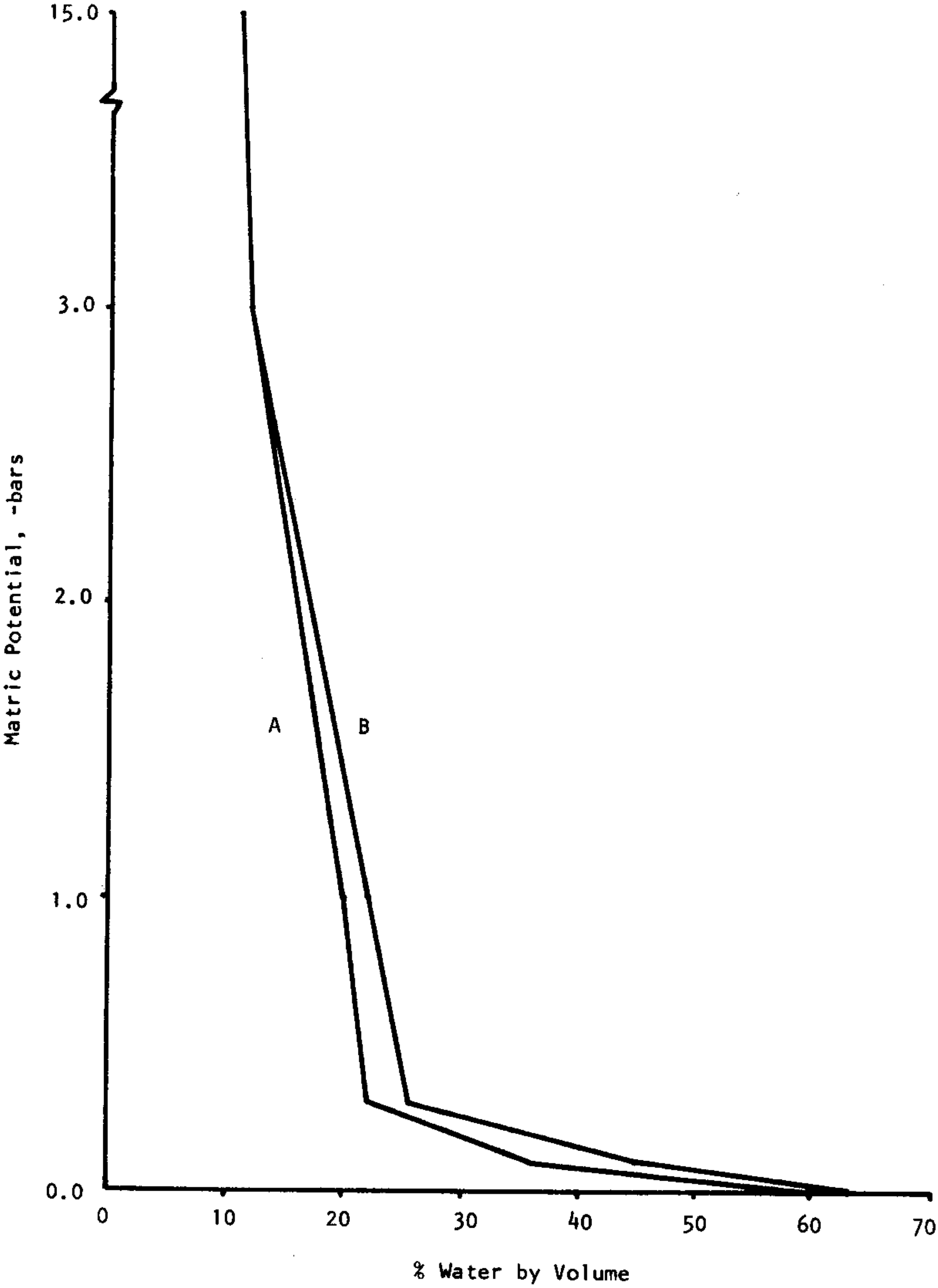


Fig. 7. Desorption curves for Shingle loam (87B).

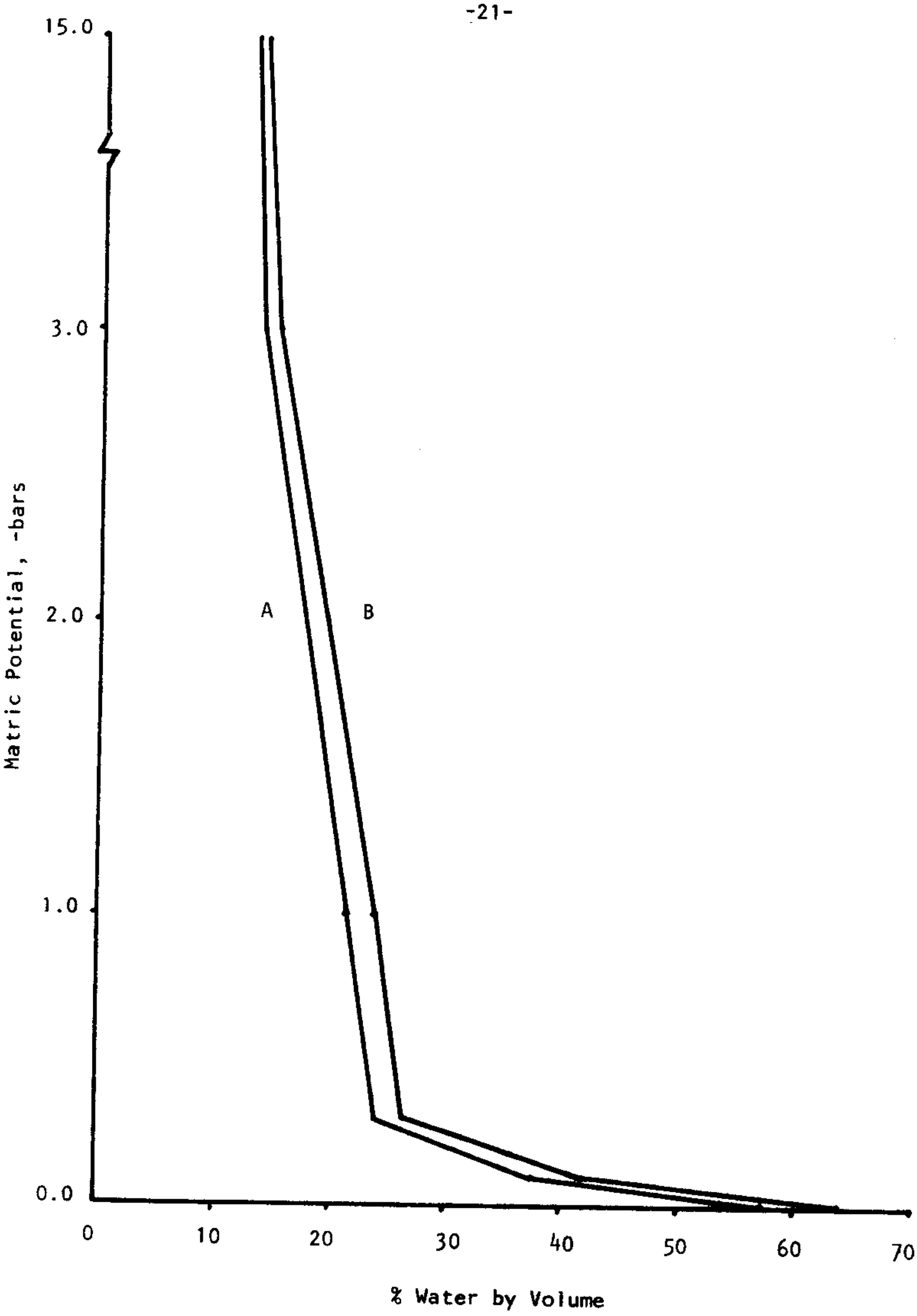


Fig. 8. Desorption curves for Shingle-Renohill Complex (87Z).

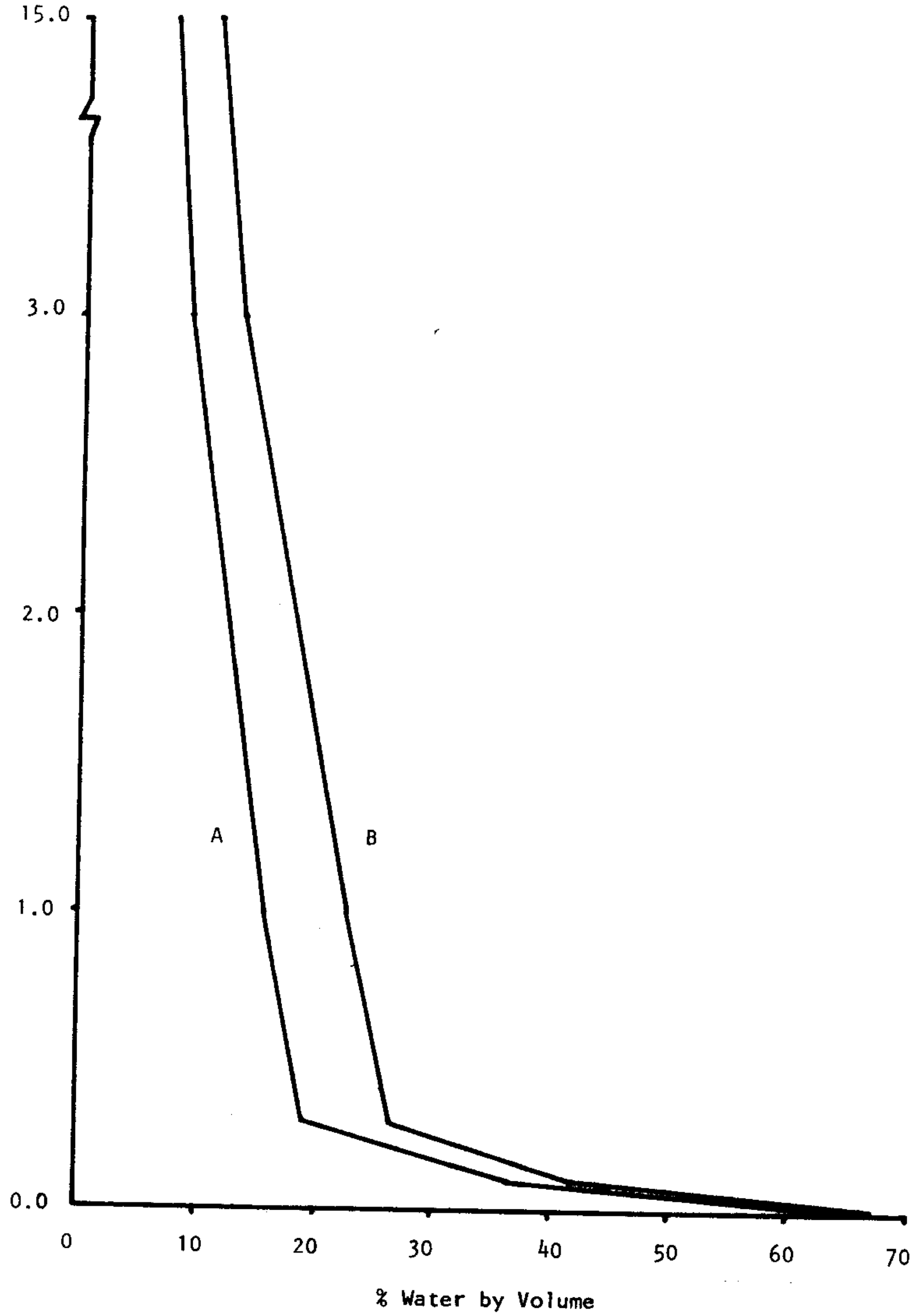


Fig. 9. Desorption curves for the irrigation plot soils (Ascalon sandy loam (55).

## SOIL WATER CONTENT MEASUREMENT -- PRELIMINARY DATA

Fig. 10, 11, and 12 are topographical profiles of the soil water transects on each of the three grazing treatments. It is apparent from comparing the three graphs that the heavily-grazed pasture held more water than the light-grazed pasture and possibly more than the medium-grazed pasture. Differences in the water holding capacity of the various soils is noticeable in some cases. The Shingle-Renohill complex (87Z) seems to have a high water holding capacity. Differences between depletion rates were not readily apparent. It did seem, however, that the sampling sites at the tops of ridges were losing water more rapidly than other lowland sites. The reader must remember that at the time these measurements were begun, very little plant growth was occurring and the soil had dried considerably the previous two months. The low point of the soil water content curve was reached in the beginning of September. By the end of September, considerable recharge had occurred. A series of measurements taken recently showed that the soil is now recharged to about the level that existed in late July and early August.

## SOME OBSERVATIONS ON SNOW ACCUMULATION

Snow redistribution by wind may have an important effect on the recharge characteristics of prairie soils. Preliminary data and field observations for a storm in January 1971 suggest that mesotopography combined with high winds drastically influences snow redistribution on the ground. Initially, snowfall was evenly distributed on the ground.

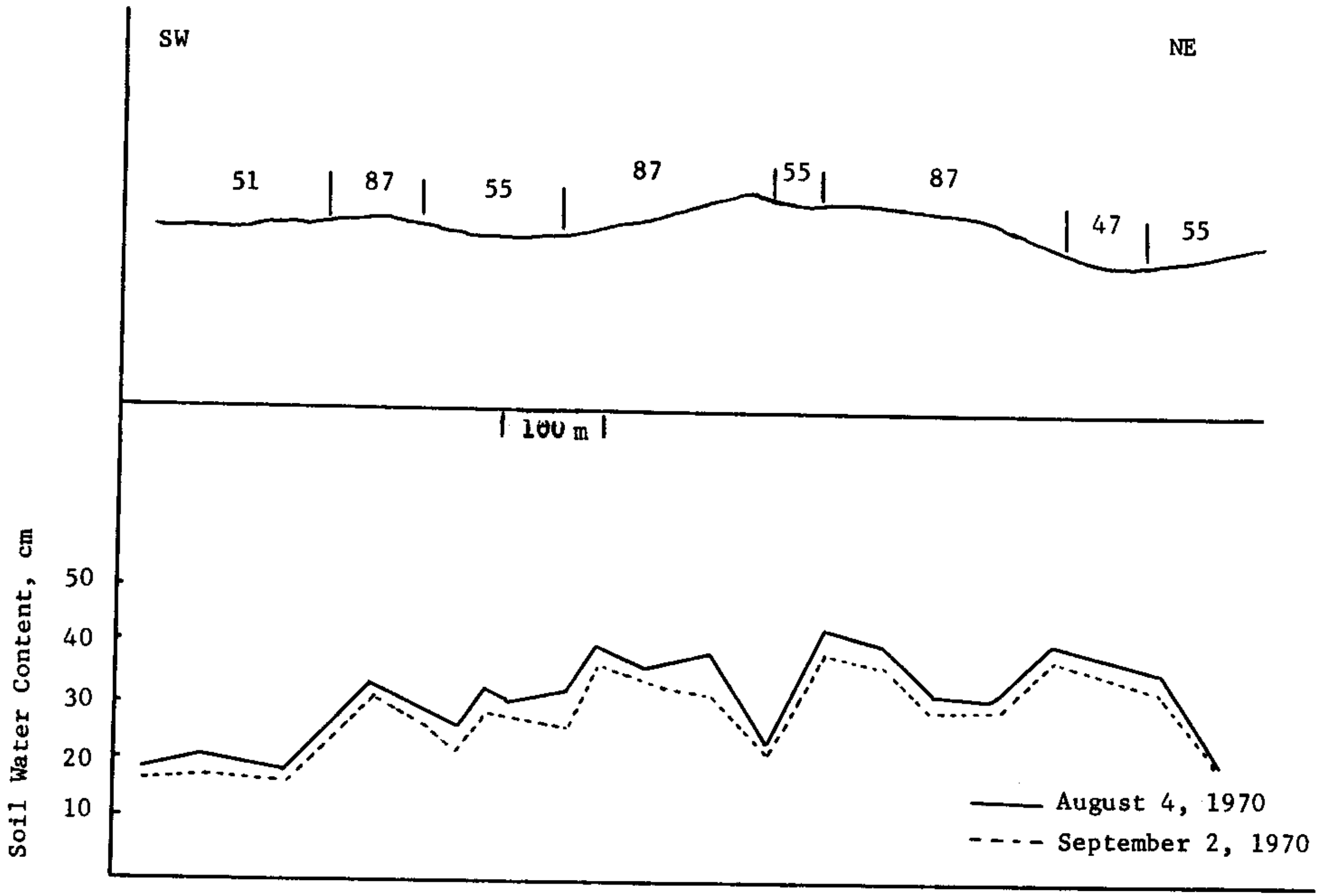


Fig. 10. Topographic profile and soil water contents for the heavy grazed soil transect.

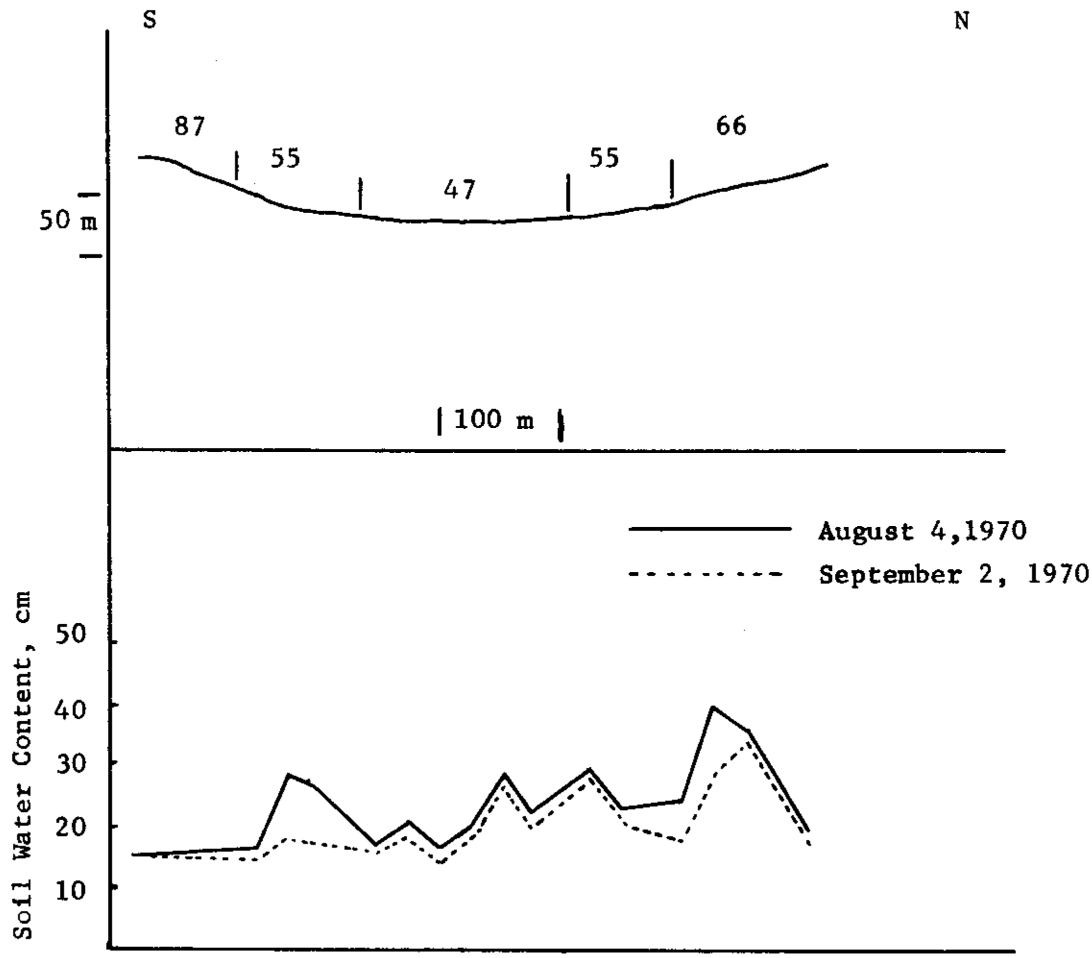


Fig. 11. Topographic profile and soil water content for the light grazed soil transect.

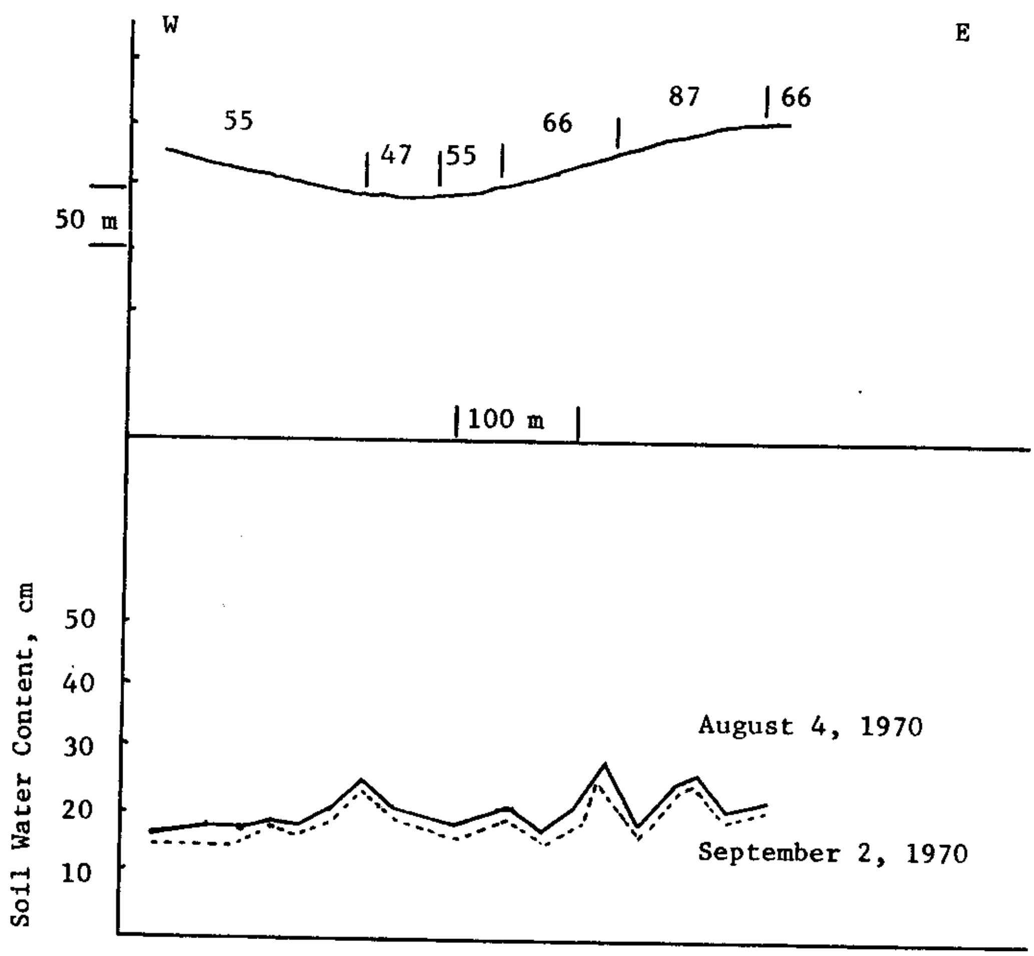


Fig. 12. Topographic profile and soil water content for the medium grazed soil transect.

Within 24 hours strong winds arose and began redistributing the snow. Redistribution appears to be a continuous process as long as the wind is blowing, but is finally abated when snow density and/or metamorphism reach some critical point. For the storm of January 1-3, gravimetric snow water equivalent samples taken at selected points along transects 1, 2, 3, and 5 showed depth water equivalents ranging from 1.0 to 1.4 cm with a mean of 1.2 cm before redistribution occurred. A series of samples taken 24 hours later revealed depth water equivalents ranging from 0.7 to 2.7 cm with a mean of 1.7 cm. The difference between the means is nonsignificant because of the small sample sizes. However, the data point out the extreme variability in water equivalents due to the redistribution of snow on the ground. Precipitation catch for this storm averaged 1.3 cm.

At two sampling points, an attempt was made to investigate the effect of vegetation on snow accumulation. In both cases, one sample was taken from a bare soil situation (i.e., devoid of vegetation) and a second was taken 6 m to the east of the first in a vegetated situation (vegetation at least 5 cm in height). Depth water equivalents for the two sampling points averaged 0.7 cm in the open and 2.1 cm in the vegetation. From these preliminary data it was hypothesized that grazing treatment might have an effect on snow accumulation because of wind transport and redeposition being influenced by vegetation height and density.

Two weeks later, on January 16, the snowpack was essentially stabilized and primed for melt. No visible melt had occurred in the previous 14 days. Samples of snow water equivalent were taken again at preselected snow sampling sites along transects 1, 2, 3, and 5. For the heavy-, medium-, and light-grazed transects, average depth water equivalents were 1.0, 1.5, and 1.4 cm, respectively. Although there was considerable scatter in the data, at best these results indicate a possibility of grazing effect on the snow trapping efficiency of an area.

An attempt was made to classify sampling sites topographically. Classifications assigned were designated upland (or ridgetop), swale, or north, south, east, or west slope. Neutron probe access tube sites were classified in the same manner. Observations of volumetric soil water content were made with the neutron probe technique at the end of December and again at the end of January. Precipitation during this period included only that contributed by the storm discussed above. The average changes in volumetric soil water content, $\overline{\Delta\theta}$, for the designated topographic sites were computed and compared to the average depth water equivalents, $D_w$, obtained for the same sites. The results are shown in Table 5. Interestingly enough, the data suggest that this aspect might be influencing melt characteristics. Additions of water to the profile occurred on the traditionally warmer south and west slopes and in the bottoms or swales where ponded water may have had a better opportunity to infiltrate. The author had the opportunity to observe the melt characteristics on all the sites at the height of the melt period. Ponded water was evident in small depressions on all the sites. It was assumed this was due to frozen soil (soil on the Pawnee Site was frozen to depths as great as 20 cm in early January). The data of

Table 5. Comparison of average changes in volumetric soil water content ($\overline{\Delta\theta}$) to average depth water equivalents (Dw).

| Site | $\overline{\Delta\theta}$ [a] | Dw [b] |
|---|---|---|
| | ------------- cm | ---------------- |
| Upland | -0.2 | 0.7 |
| Swale | 0.6 | 1.3 |
| North | -0.3 | 1.9 |
| South | 1.5 | 1.7 |
| East | -0.1 | 1.8 |
| West | 0.9 | 2.9 |

a/ $\overline{\Delta\theta}$ refers to the difference in volumetric soil water content between the end of December and the end of January.

b/ Dw is the depth water equivalent measured gravimetrically.

Table 5 suggest very little penetration of melt water from the snowpack. The apparent differences between the depth water equivalents and the changes in soil water storage are assumed here to have been vapor losses to the atmosphere.

The drastic effect of mesotopography on snow redistribution was demonstrated quite clearly by the average depth water equivalent computed from samples intentionally taken from lee slopes. This average depth water equivalent was 4.3 cm as compared to the average of 1.3 cm for the entire site.

The preliminary data discussed above suggest that an investigation of snow accumulation should be considered in order to better understand the water balance on the Pawnee Site.

## CHARACTERISTICS OF MICROWATERSHED SOILS

During 1970 all soil sample analyses for the microwatersheds were completed. Analyses included bulk densities (Galbraith 1969), texture analyses, and water retention characteristics. In addition, the calibration for the neutron probe was completed.

### Soils Analysis

An analysis of the particle size distribution for the sand, silt, and clay fractions was made for each of the microwatersheds. Textural classification (Table 6) shows that all soils are within the sandy loam to clay loam range. In general, the B horizon has the highest clay content and the C horizon the highest silt content. Variability in all three texture classes was the greatest in the parent material of the C horizon.

Table 6. Textural analysis of microwatershed soils.

| Microwatershed | Horizon | Sand | | | Silt | | | Clay | | | Classification |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | % | SD | Range | % | SD | Range | % | SD | Range | |
| 1 | A | 69 | 2.2 | 6.0 | 12 | 2.4 | 7.0 | 19 | 1.6 | 5.0 | Sandy Loam |
| | B | 70 | 2.6 | 8.0 | 9 | 1.0 | 2.0 | 21 | 2.3 | 7.0 | Sandy Clay Loam |
| | C | 72 | 7.5 | 23.0 | 9 | 4.5 | 13.0 | 19 | 3.4 | 10.0 | Sandy Loam |
| 2 | A | 62 | 3.4 | 10.0 | 18 | 2.7 | 8.0 | 20 | 2.5 | 7.0 | Sandy Loam |
| | B | 49 | 7.5 | 28.0 | 21 | 4.7 | 14.0 | 30 | 3.9 | 14.0 | Sandy Clay Loam |
| | C | 51 | 8.3 | 25.0 | 20 | 5.4 | 18.0 | 29 | 3.8 | 10.0 | Sandy Clay Loam |
| 3 | A | 65 | 3.2 | 10.0 | 16 | 1.5 | 5.0 | 19 | 2.7 | 8.0 | Sandy Loam |
| | B | 42 | 10.1 | 32.0 | 21 | 5.7 | 18.0 | 37 | 5.2 | 16.0 | Clay Loam |
| | C | 45 | 6.7 | 21.0 | 24 | 4.6 | 15.0 | 31 | 4.4 | 15.0 | Clay Loam |
| 4 | A | 73 | 4.0 | 13.0 | 11 | 3.1 | 9.0 | 16 | 2.3 | 8.0 | Sandy Loam |
| | B | 68 | 3.5 | 11.0 | 9 | 3.3 | 8.0 | 23 | 2.9 | 8.0 | Sandy Clay Loam |
| | C | 62 | 9.3 | 28.0 | 16 | 5.3 | 18.0 | 22 | 4.5 | 11.0 | Sandy Clay Loam |
| 5 | A | 72 | 4.3 | 13.0 | 11 | 2.0 | 5.0 | 17 | 3.6 | 10.0 | Sandy Loam |
| | B | 71 | 3.1 | 8.0 | 9 | 2.4 | 8.0 | 20 | 2.5 | 8.0 | Sandy Loam |
| | C | 68 | 5.6 | 15.0 | 11 | 4.0 | 13.0 | 21 | 2.6 | 7.0 | Sandy Clay Loam |
| 6 | A | 58 | 5.0 | 17.0 | 18 | 4.4 | 15.0 | 24 | 2.3 | 9.0 | Sandy Clay Loam |
| | B | 57 | 5.7 | 19.0 | 16 | 2.2 | 6.0 | 27 | 4.9 | 16.0 | Sandy Clay Loam |
| | C | 52 | 12.4 | 30.0 | 19 | 8.8 | 21.0 | 29 | 5.1 | 14.0 | Sandy Clay Loam |
| 7 | A | 70 | 1.9 | 5.0 | 14 | 1.8 | 6.0 | 16 | 1.8 | 5.0 | Sandy Loam |
| | B | 60 | 2.4 | 8.0 | 15 | 1.4 | 3.0 | 25 | 1.9 | 5.0 | Sandy Clay Loam |
| | C | 57 | 15.8 | 47.0 | 19 | 8.1 | 24.0 | 24 | 8.2 | 25.0 | Sandy Clay Loam |
| 8 | A | 65 | 5.1 | 19.0 | 14 | 3.5 | 13.0 | 21 | 2.5 | 6.0 | Sandy Clay Loam |
| | B | 47 | 9.4 | 23.0 | 19 | 4.6 | 11.0 | 34 | 4.9 | 12.0 | Sandy Clay Loam |
| | C | 58 | 7.8 | 27.0 | 16 | 5.1 | 17.0 | 26 | 3.8 | 13.0 | Sandy Clay Loam |

## Soil Water Desorption Analysis

Water retention characteristics were examined for each of the microwatershed soils. The amount of water retained by the soil from saturation to 15 bars applied pressure was determined by the standard pressure plate method. The results are given in Table 7. Microwatersheds 2, 3, and 8 appear to have higher water holding capacities for the B and C horizons than the other watersheds. The B and C horizons have higher water holding capacities than the A horizons as shown in Fig. 13. Micropore space, defined as water retained at 0.1 bars, exceeds macropore space generally by a factor of 2 for all horizons.

## Neutron Probe Calibration

Calibration of the neutron probe was accomplished by a field gravitational method. The results of separate calibrations for the surface, 20 cm, and depths greater than 20 cm are shown in Fig. 14.

Table 7. Water retention characteristics of Ascalon soil.

| Microwatershed | Horizon | Applied Pressure - Bars 0.0 | 0.1 | 0.3 | 1.0 | 3.0 | 15.0 | Pore Space a/ Macro % | Micro % |
|---|---|---|---|---|---|---|---|---|---|
| | | (Percent $H_2O$ by Volume) | | | | | | | |
| 1 | A | 43.5 | 32.5 | 17.0 | 12.3 | 8.6 | 6.9 | 11.0 | 32.5 |
| | B | 51.2 | 31.0 | 17.6 | 14.0 | 11.1 | 8.7 | 20.1 | 31.0 |
| | C | 47.4 | 31.7 | 16.3 | 12.8 | 9.9 | 7.6 | 15.6 | 31.7 |
| 2 | A | 50.4 | 33.8 | 15.0 | 11.6 | 7.9 | 5.5 | 16.5 | 33.8 |
| | B | 52.4 | 38.7 | 26.3 | 21.7 | 17.1 | 13.1 | 13.8 | 38.7 |
| | C | 53.2 | 40.3 | 27.4 | 22.2 | 17.5 | 12.8 | 12.9 | 40.3 |
| 3 | A | 42.4 | 27.1 | 16.5 | 14.1 | 9.6 | 6.2 | 15.1 | 27.1 |
| | B | 52.7 | 34.1 | 27.7 | 22.7 | 18.3 | 13.6 | 18.5 | 34.1 |
| | C | 54.2 | 35.9 | 27.6 | 21.0 | 16.4 | 12.1 | 18.3 | 35.9 |
| 4 | A | 44.9 | 27.2 | 13.5 | 9.9 | 7.2 | 4.5 | 17.7 | 27.2 |
| | B | 48.6 | 29.6 | 20.6 | 16.0 | 13.3 | 8.5 | 19.0 | 29.6 |
| | C | 47.6 | 27.7 | 17.7 | 13.4 | 11.5 | 7.0 | 19.8 | 27.7 |
| 5 | A | 45.6 | 24.9 | 13.6 | -- | 7.5 | 6.4 | 19.9 | 24.9 |
| | B | 48.9 | 27.9 | 19.1 | 15.5 | 11.3 | 10.5 | 21.1 | 27.9 |
| | C | 50.6 | 30.5 | 19.3 | 15.0 | 11.3 | 10.5 | 20.0 | 30.5 |
| 6 | A | 50.2 | 29.2 | 15.9 | 12.6 | 9.7 | 7.1 | 20.9 | 29.2 |
| | B | 51.3 | 33.2 | 22.8 | 18.5 | 14.1 | 11.0 | 18.0 | 33.2 |
| | C | 51.1 | 31.5 | 20.5 | 16.8 | 12.2 | 10.6 | 19.6 | 31.5 |
| 7 | A | 48.3 | 22.3 | 16.4 | 11.2 | 8.8 | 6.0 | 25.8 | 22.3 |
| | B | 52.3 | 31.7 | 22.6 | 16.1 | 11.6 | 9.2 | 20.5 | 31.7 |
| | C | 55.7 | 37.7 | 30.7 | 22.3 | 17.3 | 11.2 | 17.9 | 37.7 |
| 8 | A | 55.0 | 24.6 | 16.0 | 11.1 | 7.8 | 5.8 | 30.2 | 24.6 |
| | B | 60.1 | 40.4 | 30.7 | 24.6 | 19.1 | 14.1 | 19.5 | 40.4 |
| | C | 60.9 | 44.5 | 36.5 | 29.0 | 22.5 | 17.6 | 16.2 | 44.5 |

a/ Percentages are averages of four to five samples.

Avg 30cm A Horizon 15.49
15b A Horiz 6.05%
Avg 3 B+C Hor 23.96%
15 B+C 11.13

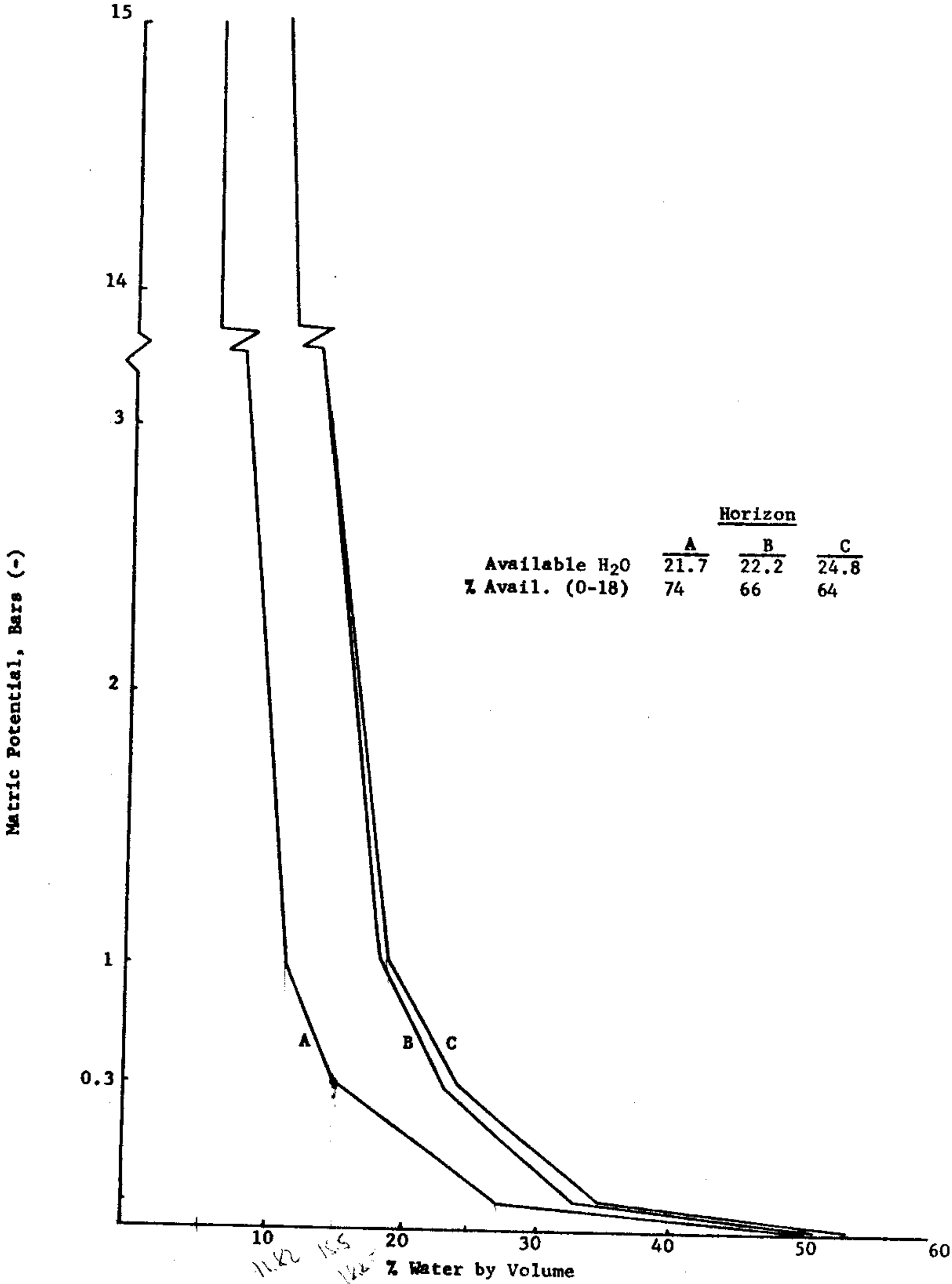


Fig. 13. Water retention of Ascalon soil.

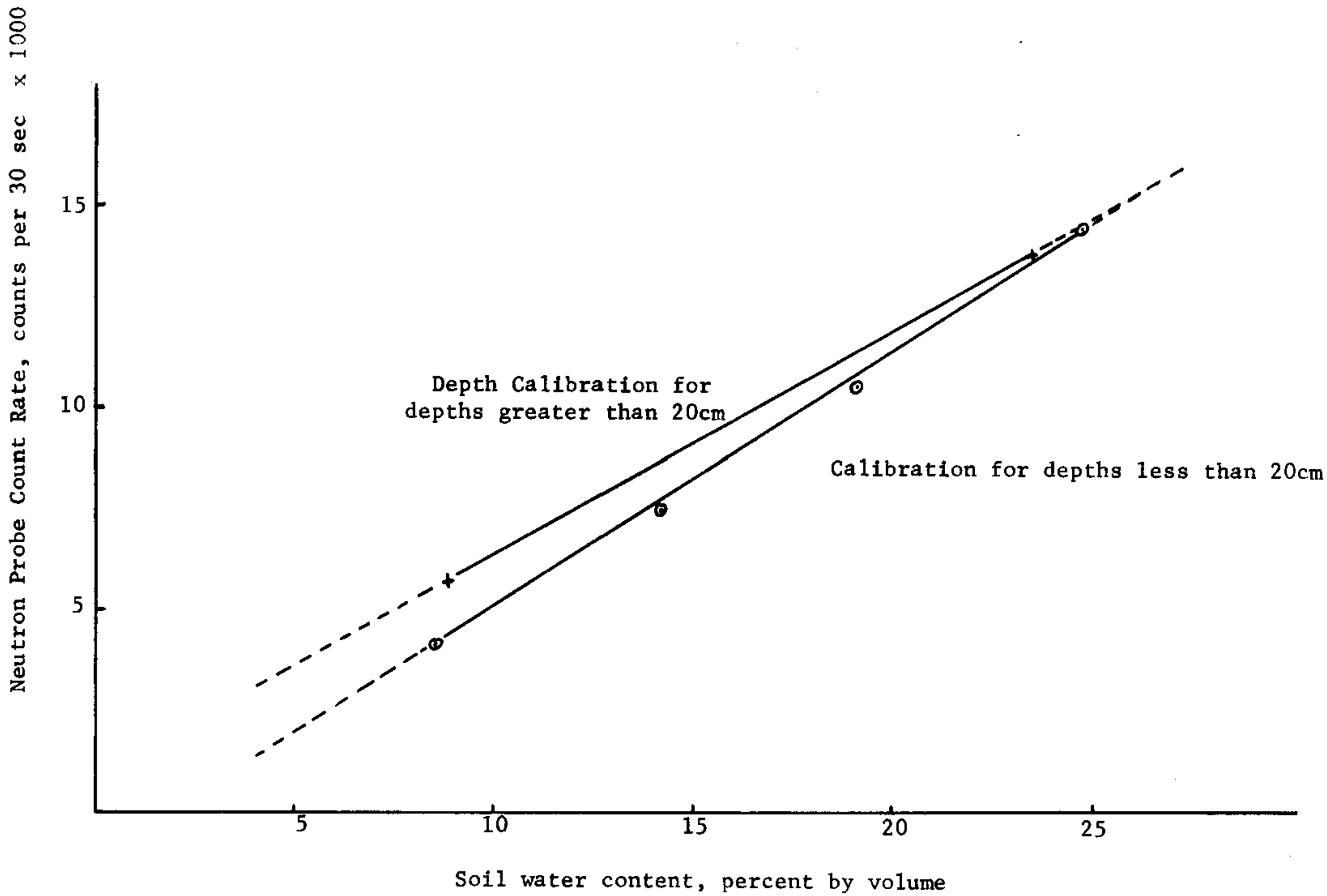


Fig. 14. Depth and surface calibrations for neutron probe.

## LITERATURE CITED

Day, P. R. 1965. Particle fractionation and particle-size analysis, p. 545-567. *In* Methods of Soils Analysis. Amer. Soc. Agron. Monogr. No. 9. Madison, Wisconsin.

Franklin, W. T. 1969. Mineralogy of representative soils at the Pawnee Site. U.S. IBP Grassland Biome Tech. Rep. No. 30. Colorado State Univ., Fort Collins. 10 p.

Galbraith, A. F. 1969. Soil water study of a shortgrass prairie ecosystem -- Pawnee Site. U. S. IBP Grassland Biome Tech. Rep. No. 6. Colorado State Univ., Fort Collins. 51 p.

Richards, L. A. 1965. Physical condition of water in soil, p. 128-152. *In* Methods of Soils Analysis. Amer. Soc. Agron. Monogr. No. 9.

Smith, F. M. and W. D. Striffler. 1969. Pawnee Site microwatersheds: selection, description, and instrumentation. U.S. IBP Grassland Biome Tech. Rep. No. 5. Colorado State Univ., Fort Collins. 29 p.

# APPENDIX

## FIELD DATA

### Soil Moisture Transect Data

Soil Moisture Transect Data collected in 1970 at the Pawnee Site is Grassland Biome Data Set A2U703B. Data were collected on FORTRAN Coding Forms as follows:

Header Card (card 1)

| Columns | Contents |
|---|---|
| 2 - 9 | Date (Month, Day, Year), eq., 08-05-70. |
| 11 | Number of this header card for this transect. |
| 13 - 15 | Maximum depth at which readings were made (cm). |
| 17 | N - defined as 10-J where J = the number of access tubes for which data are recorded on the following cards. |

Sequence of Data Collection Card (card 2)

This card contains a pair of numbers for each of the J access tubes read. The first number of the pair is the tube number (a zero means tube 10) and the second number is the number of the neutron probe used on that tube. The format is (2X, 20I3).

| Data Cards (cards 3 through 10) | |
|---|---|
| Columns | Contents |
| 1 - 3 | Depth (cm) at which the readings on this card were taken. |
| 4 - (3 + 6J) | Counts recorded in 1/2 minute for the J access tubes, in the order that tube numbers appeared on card 2. |

This is followed by more sets of ten cards for this transect until data from the access tubes on the transect are recorded. Data for the remaining transects follow in the same fashion until all transects are recorded.

This data set will be changed to a more efficient format which will be compatible with the data which will be collected in 1971.

A listing of the existing 1970 field data follows.

*** FIELD DATA ***

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890
```

08-05-70 1 150

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | [illegible] | 9 11 | 0 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 03916 | 10496 | 11490 | 08079 | 08978 | 11267 | 11029 | 09424 | 07109 | 09382 | 08-05-70 1 |
| 30 | 07105 | 16241 | 16367 | 10892 | 10245 | 10633 | 16834 | 13071 | 10814 | 12085 | 08-05-70 1 |
| 45 | 07524 | 16274 | 15957 | 11548 | 08740 | 08210 | 16920 | 17292 | 10658 | 11670 | 08-05-70 1 |
| 60 | 08367 | 11434 | 16096 | 13342 | 04170 | 10797 | 17779 | 17608 | 08812 | 10904 | 08-05-70 1 |
| 75 | 08258 | 13204 | 16786 | 14303 | 11111 | 13442 | 16141 | 17508 | 07331 | 11674 | 08-05-70 1 |
| 90 | 07478 | 16664 | 17685 | 15467 | 16058 | 14601 | 14748 | 17097 | 07913 | 15610 | 08-05-70 1 |
| 120 | 07627 | 15754 | 17685 | 17324 | 13698 | 17528 | 17865 | 17666 | 09998 | 17531 | 08-05-70 1 |
| 150 | 11675 | 14655 | 17685 | 18455 | 15486 | 10282 | 17885 | 21269 | 14095 | 19682 | 08-05-70 1 |

08-05-70 2 150

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | 0 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 04383 | 06624 | 04679 | 13690 | 05426 | 03570 | 03539 | 03765 | 03923 | 04716 | 08-05-70 2 |
| 30 | 11246 | 10899 | 10779 | 07572 | 11671 | 06295 | 05005 | 06506 | 08590 | 08081 | 08-05-70 2 |
| 45 | 12974 | 12042 | 13285 | 12290 | 12913 | 08161 | 07652 | 07561 | 09073 | 07009 | 08-05-70 2 |
| 60 | 12231 | 11471 | 12118 | 15345 | 12119 | 08946 | 11300 | 07924 | 09082 | 06939 | 08-05-70 2 |
| 75 | 14767 | 14562 | 10374 | 13283 | 10655 | 07771 | 11691 | 08996 | 08921 | 07734 | 08-05-70 2 |
| 90 | 15286 | 16776 | 10380 | 09967 | 09943 | 09283 | 10653 | 14362 | 09406 | 10354 | 08-05-70 2 |
| 120 | 15502 | 17997 | 13248 | 12493 | 13962 | 13709 | 17383 | 17250 | 12406 | 08170 | 08-05-70 2 |
| 150 | 14274 | 19170 | 13518 | 13890 | 15199 | 10224 | 09977 | 19040 | 17650 | 07259 | 08-05-70 2 |

08-05-70 3 150 4

| | 1 11 | 2 11 | |
|---|---|---|---|
| 15 | 04226 | 03694 | 08-05-70 3 |
| 30 | 06869 | 07870 | 08-05-70 3 |
| 45 | 06329 | 08212 | 08-05-70 3 |
| 60 | 06271 | 06384 | 08-05-70 3 |
| 75 | 05165 | 05571 | 08-05-70 3 |
| 90 | 05624 | 05731 | 08-05-70 3 |
| 120 | 05163 | 07402 | 08-05-70 3 |
| 150 | 15216 | 07059 | 08-05-70 3 |

07-29-70 1 150

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | 0 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 04242 | 08624 | 09424 | 08153 | 07552 | 07423 | 07574 | 09064 | 05627 | 09496 | 07-29-70 1 |
| 30 | 06991 | 14814 | 13781 | 11292 | 09956 | 08902 | 13915 | 13662 | 09851 | 14265 | 07-29-70 1 |
| 45 | 07585 | 16220 | 14526 | 12943 | 06208 | 08384 | 14653 | 18092 | 10266 | 12816 | 07-29-70 1 |
| 60 | 08569 | 12070 | 15632 | 13575 | 09457 | 11052 | 16475 | 17655 | 08281 | 11592 | 07-29-70 1 |
| 75 | 08435 | 13298 | 16696 | 14564 | 10342 | 13764 | 16129 | 18016 | 06740 | 11774 | 07-29-70 1 |
| 90 | 07646 | 16573 | 17562 | 15744 | 16303 | 14023 | 14719 | 17029 | 07733 | 15669 | 07-29-70 1 |
| 120 | 07501 | 15695 | 17562 | 17617 | 13671 | 17053 | 17974 | 17678 | 09903 | 17503 | 07-29-70 1 |
| 150 | 11722 | 14563 | 17562 | 13567 | 15625 | 11223 | 17988 | 20958 | 13482 | 18431 | 07-29-70 1 |

```
07-29-70 2 150
    1 11  2 11  3 11  4 11  5 11  6 11  7 11  8 11  9 11  0 11
 15 05198 07014 05090 04071 06350 04559 04294 04261 04650 05304   07-29-70 2
 30 11943 12589 11663 08256 12688 07746 06416 07446 09128 08161   07-29-70 2
 45 13173 12952 14468 12648 13200 09105 07657 08213 09670 06928   07-29-70 2
 60 12241 12128 12765 15470 12442 08216 11618 08262 09030 07280   07-29-70 2
 90 15288 17572 10462 04834 09996 09607 11263 14583 09353 07784
 75 14894 15054 10732 13123 10716 08243 11951 09405 09189 09888   07-29-70 2
120 15639 18137 13163 12386 13802 13735 16847 17455 12355 06665   07-29-70 2
150 14312 18403 14529 13595 15198 10456 10151 [illegible] 17466 06665   07-29-70 2
07-29-70 3 150 8
    1 11  2 11
 15 05078 05151                                                    07-29-70 3
 30 08024 09156                                                    07-29-70 3
 45 07036 08532                                                    07-29-70 3
 60 06893 06548                                                    07-29-70 3
 75 05434 05695                                                    07-29-70 3
 90 06140 05858                                                    07-29-70 3
120 06146 07552                                                    07-29-70 3
150 15145 07124                                                    07-29-70 3
09-02-70 1 150
    2 11  1 11  0 11  9 11  8 11  7 11  6 11  5 11  4 11  3 11
 15 03923 04031 04053 04057 03621 02820 03044 03978 03127 03134   09-02-70 1
 30 06697 05637 05693 07744 05755 04963 05153 [illegible] 06827 07774   [illegible] 1
 45 07328 05141 05086 08057 06324 07080 06169 10554 11656 10958   09-02-70 1
 60 05747 04979 05023 07915 06705 10725 06492 10471 14407 10426   09-02-70 1
 75 04946 04526 05945 08459 05401 11951 06843 09146 12226 08918   09-02-70 1
 90 05215 05188 08219 08969 13825 10077 08493 [illegible] 09851 09127   [illegible] 1
120 06844 06025 06955 12728 17090 17156 [illegible] [illegible] 12415 12509   09-02-70 1
150 06540 15145 06594 17293 18981 10075 09780 14480 13734 12368   09-02-70 1
09-02-70 2 150
    2 11  1 11  0 11  9 11  8 11  7 11  6 11  5 11  4 11  3 11
 15 05209 03644 06616 04629 06929 05471 06228 05502 06835 07026   09-02-70 2
 30 09195 08973 09473 07896 10303 10273 07233 09261 09785 11054   09-02-70 2
 45 10736 11117 08805 09185 14132 12058 07063 07124 10531 13137   09-02-70 2
 60 10738 11433 08796 07389 15948 14381 10477 07821 11956 15251   09-02-70 2
 75 14433 14541 10513 05383 16590 14749 13309 09673 13442 16509   09-02-70 2
 90 16917 15385 14229 06862 15173 14753 14357 15436 14890 17191   09-02-70 2
120 18035 15208 15458 08840 15475 17948 17088 13612 17619 19119   09-02-70 2
150 18131 14692 17493 13751 20520 17800 10621 15625 18230 19681   09-02-70 2
09-02-70 3 150 8
    2 11  1 11
 15 05911 03906                                                    09-02-70 3
 30 11280 06564                                                    09-02-70 3
 45 13359 07102                                                    09-02-70 3
 60 09873 07743                                                    09-02-70 3
 75 12760 07481                                                    09-02-70 3
 90 16586 07032                                                    09-02-70 3
120 15655 07922                                                    09-02-70 3
150 14391 11507                                                    09-02-70 3
08-04-70 1 150
```

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | 0 11 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 02502 | 04094 | 04804 | 04934 | 03989 | 03762 | 04408 | 08502 | 03898 | 04011 | 08-04-70 | 1 |
| 30 | 07257 | 06908 | 09944 | 14339 | 12520 | 07563 | 09056 | 06901 | 08138 | 06518 | 08-04-70 | 1 |
| 45 | 08149 | 06857 | 12375 | 14613 | 12552 | 07705 | 07822 | 11297 | 12039 | 07398 | 08-04-70 | 1 |
| 60 | 07434 | 07179 | 13568 | [illegible] | [illegible] | 06747 | 09292 | 12711 | 11256 | 06379 | 08-04-70 | 1 |
| 75 | 07235 | 07415 | 14053 | 13931 | 06418 | 06173 | 10838 | 10689 | 09828 | 06602 | 08-04-70 | 1 |
| 90 | 08153 | 09078 | 14270 | 18774 | 10142 | 07960 | 10095 | 07035 | 09678 | 06601 | 08-04-70 | 1 |
| 120 | 08755 | 12411 | 15523 | 16616 | 08847 | 10724 | 16207 | 08046 | 12700 | 08940 | 08-04-70 | 1 |
| 150 | 07446 | 19141 | 17481 | 14569 | 08510 | 12774 | 10895 | [illegible] | 14060 | [illegible] | 08-04-70 | 1 |

08-04-70 2 150 1

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 04391 | 03296 | 03544 | 06645 | 06329 | 02733 | 02747 | 03914 | 05246 | 08-04-70 | 2 |
| 30 | 06339 | 05983 | 07216 | 09441 | 09605 | 05197 | 05353 | 05985 | 07980 | 08-04-70 | 2 |
| 45 | 05632 | 06622 | 08777 | 09444 | 09175 | 06017 | 05746 | 05552 | 06391 | 08-04-70 | 2 |
| 60 | 05799 | 08262 | 07993 | 11252 | 10142 | 05525 | 06380 | 05840 | 04375 | 08-04-70 | 2 |
| 75 | 06914 | 08821 | 07035 | 12744 | 09785 | 06283 | 06827 | 07400 | 04744 | 08-04-70 | 2 |
| 90 | 07203 | 07510 | 06044 | 12634 | 11020 | 07326 | 06828 | 07618 | 05076 | 08-04-70 | 2 |
| 120 | 06882 | 05940 | 06449 | 10204 | 12186 | 07288 | 07549 | 05950 | 06514 | 08-04-70 | 2 |
| 150 | 06508 | 13963 | 06876 | 09482 | 13677 | 07696 | 07244 | 05950 | 06214 | 08-04-70 | 2 |

08-04-70 3 150

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | 0 12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 03073 | 03524 | 04646 | 05135 | 05443 | 04791 | 03488 | 03710 | 05726 | 05177 | 08-04-70 | 3 |
| 30 | 06239 | 08146 | 07881 | 06339 | 06684 | 06984 | 04789 | 08085 | 10501 | 08965 | 08-04-70 | 3 |
| 45 | 09234 | 10283 | 08233 | 06042 | 05727 | 06303 | 05758 | 11334 | 09103 | 10756 | 08-04-70 | 3 |
| 60 | 09096 | 09348 | 07454 | 05753 | 05391 | 05369 | 06586 | 13662 | 07243 | 11512 | 08-04-70 | 3 |
| 75 | 07475 | 07950 | 06869 | 05666 | 07252 | 06368 | 09235 | 12301 | 07138 | 09845 | 08-04-70 | 3 |
| 90 | 07408 | 06805 | 05517 | 05935 | 06962 | 07199 | 11427 | 10097 | 07524 | 09078 | 08-04-70 | 3 |
| 120 | 05448 | 05088 | 05277 | 06761 | 07974 | 09407 | 14190 | 06093 | 06747 | 07388 | 08-04-70 | 3 |
| 150 | 04996 | 06418 | 06651 | 13080 | 07761 | 13149 | 14164 | 05981 | 05328 | 06311 | 08-04-70 | 3 |

08-04-70 4 150 1

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 03832 | 05257 | 02909 | 03817 | 06537 | 06243 | 06450 | 07313 | 05225 | 08-04-70 | 4 |
| 30 | 07176 | 09798 | 05952 | 06821 | 07212 | 07494 | 07021 | 08131 | 09672 | 08-04-70 | 4 |
| 45 | 08279 | 09195 | 07667 | 06287 | 05766 | 06732 | 05704 | 07330 | 10479 | 08-04-70 | 4 |
| 60 | 07517 | 08099 | 09601 | 05540 | 06808 | 06194 | 07029 | 07145 | 10946 | 08-04-70 | 4 |
| 75 | 06981 | 08051 | 09871 | 07936 | 03439 | 06094 | 06895 | 07122 | 09402 | 08-04-70 | 4 |
| 90 | 07010 | 08329 | 09682 | 08541 | 13282 | 06901 | 06841 | 06716 | 09102 | 08-04-70 | 4 |
| 120 | 07187 | 08631 | 17325 | 07782 | 15105 | 15486 | 07194 | 10485 | 09053 | 08-04-70 | 4 |
| 150 | 05973 | 07880 | 18076 | 07707 | 09417 | 17950 | 13765 | 12428 | 13114 | 08-04-70 | 4 |

08-04-70 5 150

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | 0 11 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 03995 | 04323 | 08802 | 09164 | 10041 | 05693 | 07285 | 07281 | 04539 | 05477 | 04-08-70 | 5 |
| 30 | 06180 | 07037 | 12270 | 11575 | 12422 | 06481 | 07188 | 05860 | 04429 | 05245 | 04-08-70 | 5 |
| 45 | 06149 | 07380 | 12072 | 09887 | 12575 | 08047 | 07975 | 06471 | 06249 | 07123 | 04-08-70 | 5 |
| 60 | 06683 | 07090 | 10303 | 09196 | 12173 | 11903 | 08666 | 08850 | 06912 | 07841 | 04-08-70 | 5 |
| 75 | 07301 | 07259 | 08475 | 08852 | 10238 | 12549 | 13716 | 08435 | 07152 | 06266 | 04-08-70 | 5 |
| 90 | 07134 | 07131 | 09267 | 09275 | 10172 | 12169 | 12824 | 13447 | 07586 | 05101 | 04-08-70 | 5 |
| 120 | 07798 | 06622 | 10523 | 11715 | 10226 | 12129 | 10266 | 11278 | 06177 | 05573 | 04-08-70 | 5 |
| 150 | 07225 | 07405 | 15848 | 11989 | 06610 | 04965 | 10971 | 09436 | 07646 | 05573 | 04-08-70 | 5 |

```
08-04-70 6 150 6
    1 11  2 11  3 11  4 11
 15 06292 03942 02746 02445
 30 05955 05971 05953 04164                                                         08-04-70 6
 45 07547 05227 06094 05511                                                         08-04-70 6
 60 07272 05061 05094 07257                                                         08-04-70 6
 75 07107 05218 05594 07924                                                         08-04-70 6
 90 08736 05282 05529 07167                                                         08-04-70 6
120 10910 05560 04855 07018                                                         08-04-70 6
150 06619 06782 05142 06967                                                         08-04-70 6
08-11-70 1 150                                                                      08-04-70 6
    1 11  2 11  3 11  4 11  5 11  6 11  7 11  8 11  9 11  0 11
 15 03583 07347 12945 07097 06149 07339 07824 07125 05949 06851   08-11-70 1
 30 06904 14425 17353 10518 08399 05517 14317 11369 13864 10928   08-11-70 1
 45 07600 15616 18617 11257 08203 07395 15712 15858 10856 09978   08-11-70 1
 60 08144 11355 19837 13097 08725 11077 16756 16656 09340 09663   08-11-70 1
 75 07991 13249 20059 14232 10014 13628 15998 16737 08689 10875   08-11-70 1
 90 07495 16944 21283 15319 16149 14365 14573 16572 05412 14901   08-11-70 1
120 07498 15671 23863 17659 13621 17379 18156 16927 11324 16522   08-11-70 1
150 11713 14738 23806 18803 15569 11062 17623 20189 16358 17346   08-11-70 1
08-11-70 2 150
    1 11  2 11  3 11  4 11  5 11  6 11  7 11  8 11  9 11  0 11
 15 03821 05374 03728 02792 05176 03110 02953 03535 03865 04085   08-11-70 2
 30 11218 10169 09497 04551 12743 05763 05819 06178 08190 04484   08-11-70 2
 45 12342 11570 12324 12145 12365 07214 07171 06935 08714 05864   08-11-70 2
 60 12096 11563 11524 15293 11493 07479 11330 07574 08448 05842   08-11-70 2
 75 14830 14510 10065 12937 10265 07590 11554 09137 08866 07035   08-11-70 2
 90 15377 17104 10115 10059 09818 08913 13462 14096 09192 09948   08-11-70 2
120 15598 17839 13341 12632 14177 13236 17309 17182 12706 07564   08-11-70 2
150 14285 18290 13277 13755 14976 10149 10103 19693 17740 06610   08-11-70 2
08-11-70 3 150 8
    1 11  2 11
 15 04078 04129
 30 06346 07424                                                   08-11-70 3
 45 05803 07565                                                   08-11-70 3
 60 05919 06016                                                   08-11-70 3
 75 04978 05436                                                   08-11-70 3
 90 05666 05650                                                   08-11-70 3
120 06308 07518                                                   08-11-70 3
150 15110 06835                                                   08-11-70 3
08-11-70 4 150                                                    08-11-70 3
    1 11  2 11  3 11  4 11  5 11  6 11  7 11  8 11  9 11  0 11
 15 03295 05114 04373 03709 02539 03278 04045 03029 03315 03784   08-11-70 4
 30 07573 08167 09824 07376 07003 07154 08365 06973 08033 06557   08-11-70 4
 45 08841 07730 12587 08962 07255 07571 07827 11332 11347 09041   08-11-70 4
 60 07836 07806 13409 11975 06601 06549 09146 12965 11343 06290   08-11-70 4
 75 08073 08660 14457 14520 07615 05895 10521 10511 09750 06278   08-11-70 4
 90 08901 10024 14303 13999 07532 08205 10065 06880 09459 06413   08-11-70 4
120 09167 14410 15395 11469 06355 10362 16429 05036 12693 06733   08-11-70 4
150 08263 19149 17294 09905 06572 12181 17062 07840 14875 13474   08-11-70 4
```

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 08-11-70 | 5 | 150 | 1 | | | | | | | | |
| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | | |
| 15 | 03690 | 03028 | 03345 | 03731 | 03748 | 02550 | 02757 | 03837 | 04839 | | 08-11-70 5 |
| 30 | 06107 | 06028 | 06944 | 06450 | 06951 | 05186 | 05236 | 05901 | 07754 | | 08-11-70 5 |
| 45 | 05524 | 06550 | 08521 | 06008 | 06295 | 05843 | 05736 | 05499 | 06174 | | 08-11-70 5 |
| 60 | 05799 | 08080 | 07420 | 08612 | 05981 | 05459 | 06170 | 05760 | 04354 | | 08-11-70 5 |
| 75 | 06837 | 09888 | 06735 | 09957 | 05295 | 05397 | 06725 | 07262 | 04617 | | 08-11-70 5 |
| 90 | 07112 | 07446 | 06093 | 10226 | 07368 | 07203 | 06859 | 07223 | 05199 | | 08-11-70 5 |
| 120 | 06764 | 05842 | 06413 | 07575 | 08671 | 07080 | 07500 | 06899 | 06674 | | 08-11-70 5 |
| 150 | 06466 | 14036 | 06579 | 07012 | 09787 | 07692 | [illegible] | [illegible] | [illegible] | | [illegible] 5 |
| 08-11-70 | 6 | 150 | | | | | | | | | |
| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | [illegible] | [illegible] | [illegible] 12 | 0 12 | |
| 15 | 03225 | 03576 | 04050 | 04581 | 05013 | 04443 | 03120 | 03441 | 04806 | 04621 | 08-11-70 6 |
| 30 | 06647 | 07779 | 07521 | 05737 | 06289 | 06582 | 04752 | 07807 | 09770 | 08584 | 08-11-70 6 |
| 45 | 09141 | 09188 | 08018 | 05255 | 05331 | 05631 | 05520 | 11083 | 08732 | 10511 | 08-11-70 6 |
| 60 | 08628 | 08021 | 07349 | 04892 | 05190 | 05256 | 06342 | 13181 | 06816 | 11127 | [illegible] 6 |
| 75 | 07040 | 07189 | 06549 | 04738 | 06795 | 06181 | 09164 | 11881 | 06879 | 09390 | [illegible] 6 |
| 90 | 07063 | 06496 | 05437 | 05130 | 06767 | 07016 | 11118 | 09796 | 07094 | 09248 | [illegible] 6 |
| 120 | 05295 | 04902 | 05134 | 06173 | 07671 | 09084 | 13837 | 05825 | 06486 | 07267 | 08-11-70 6 |
| 150 | 04989 | 06275 | 06646 | 12559 | 07528 | 12788 | 13972 | 05915 | 05142 | 06133 | 08-11-70 6 |
| 08-11-70 | 7 | 150 | 1 | | | | | | | | |
| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | | |
| 15 | 03431 | 04361 | 02649 | 03531 | 04575 | 05501 | 05534 | 06669 | 04893 | | 08-11-70 7 |
| 30 | 06615 | 08286 | 05734 | 06556 | 05720 | 07211 | 06651 | 07793 | 09403 | | 08-11-70 7 |
| 45 | 07868 | 08915 | 07160 | 06071 | 05490 | 06464 | 06467 | 07036 | 10240 | | 08-11-70 7 |
| 60 | 07382 | 07929 | 09224 | 05334 | 05657 | 06007 | 06793 | 06938 | 10718 | | 08-11-70 7 |
| 75 | 06720 | 07877 | 09384 | 07769 | 06891 | 05778 | 06855 | 06747 | 08996 | | 08-11-70 7 |
| 90 | 07118 | 08040 | 09362 | 08367 | 11221 | 06961 | 06640 | 06637 | 08624 | | 08-11-70 7 |
| 120 | 06989 | 08151 | 07476 | 07570 | 12407 | 15239 | 07094 | 10197 | 08972 | | 08-11-70 7 |
| 150 | 05988 | 07558 | 07731 | 07724 | 07868 | 17452 | 13543 | 11753 | 12710 | | 08-11-70 7 |
| 08-12-70 | 1 | 150 | | | | | | | | | |
| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | 0 11 | |
| 15 | 07479 | 04028 | 08719 | 06724 | 10670 | 05531 | 06461 | 06892 | 04560 | 05439 | 08-12-70 1 |
| 30 | 10169 | 07028 | 12069 | 11275 | 12367 | 06426 | 07123 | 05847 | 04379 | 05167 | 08-12-70 1 |
| 45 | 10111 | 07236 | 12016 | 09680 | 12515 | 08052 | 08016 | 06482 | 06309 | 07018 | 08-12-70 1 |
| 60 | 10661 | 06959 | 10046 | 09001 | 12183 | 11975 | 08998 | 08584 | 07055 | 07700 | 08-12-70 1 |
| 75 | 11398 | 07149 | 08561 | 08661 | 10042 | 12253 | 13921 | 08368 | 07229 | 06107 | 08-12-70 1 |
| 90 | 13090 | 07360 | 08983 | 09949 | 09952 | 11862 | 12909 | 13711 | 07399 | 05160 | 08-12-70 1 |
| 120 | 12546 | 06545 | 10492 | 11710 | 10037 | 11669 | 10175 | 11227 | 06272 | 05503 | 08-12-70 1 |
| 150 | 17720 | 07315 | 15248 | 10764 | 06715 | 04900 | 10748 | 09391 | 07719 | 05503 | 08-12-70 1 |
| 08-12-70 | 2 | 150 | 6 | | | | | | | | |
| | 1 11 | 2 11 | 3 11 | 4 11 | | | | | | | |
| 15 | 06103 | 03902 | 02577 | 02170 | | | | | | | 08-12-70 2 |
| 30 | 05811 | 04819 | 05979 | 03992 | | | | | | | 08-12-70 2 |
| 45 | 07612 | 05122 | 05939 | 05460 | | | | | | | 08-12-70 2 |
| 60 | 07507 | 05149 | 05002 | 07051 | | | | | | | 08-12-70 2 |
| 75 | 07166 | 05157 | 05525 | 07799 | | | | | | | 08-12-70 2 |
| 90 | 08867 | 05319 | 05421 | 06936 | | | | | | | 08-12-70 2 |
| 120 | 10899 | 05555 | 04854 | 06735 | | | | | | | 08-12-70 2 |
| 150 | 06572 | 06732 | 05163 | 06670 | | | | | | | 08-12-70 2 |

08-18-70 1 150 5

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | |
|---|---|---|---|---|---|---|
| 15 | 10324 | 09569 | 09001 | 10325 | 05825 | 08-18-70 1 |
| 30 | 13338 | 09599 | 09812 | 11647 | 06837 | 08-18-70 1 |
| 45 | 14963 | 06721 | 08622 | 08233 | 07393 | 08-18-70 1 |
| 60 | 14621 | 06824 | 09634 | 08122 | 07941 | 08-18-70 1 |
| 75 | 11235 | 07776 | 10340 | 09515 | 08478 | 08-18-70 1 |
| 90 | 12973 | 09337 | 08477 | 10128 | 09634 | 08-18-70 1 |
| 120 | 11787 | 10891 | 11148 | 11170 | 09758 | 08-18-70 1 |
| 150 | 11713 | 11412 | 10980 | 11697 | 09992 | 08-18-70 1 |

09-02-70 4 150

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | 0 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 02316 | 03702 | 04434 | 03915 | 02772 | 03710 | 04274 | 03191 | 03462 | 03834 | 09-02-70 4 |
| 30 | 06524 | 06223 | 09384 | 07675 | 06849 | 06895 | 08494 | 06789 | 08068 | 06485 | 09-02-70 4 |
| 45 | 07490 | 06221 | 11853 | 08450 | 07104 | 07040 | 07231 | 10994 | 11581 | 07452 | 09-02-70 4 |
| 60 | 06768 | 06664 | 13205 | 10897 | 05479 | 06136 | 08818 | 12546 | 11121 | 06284 | 09-02-70 4 |
| 75 | 06569 | 06856 | 13926 | 13330 | 07066 | 05570 | 10061 | 10376 | 09581 | 06147 | 09-02-70 4 |
| 90 | 07222 | 09472 | 13850 | 12846 | 07169 | 07136 | 09706 | 06939 | 09142 | 06175 | 09-02-70 4 |
| 120 | 07755 | 11672 | 15266 | 11518 | 06189 | 09876 | 15996 | 05833 | 12131 | 06566 | 09-02-70 4 |
| 150 | 07311 | 08292 | 17145 | 09494 | 06402 | 11496 | 16315 | 07059 | 14374 | [illegible] | 09-02-70 4 |

09-02-70 5 150 1

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 04011 | 03167 | 03575 | 03987 | 04031 | 02321 | 02854 | 03622 | 05088 | 09-02-70 5 |
| 30 | 05914 | 05859 | 06819 | 06046 | 06721 | 05158 | 05060 | 05599 | 07411 | 09-02-70 5 |
| 45 | 05182 | 06407 | 08191 | 05901 | 06089 | 05754 | 05348 | 05280 | 05927 | 09-02-70 5 |
| 60 | 05366 | 07689 | 07393 | 07913 | 05805 | 05204 | 05760 | [illegible] | [illegible] | 09-02-70 5 |
| 75 | [illegible] | 08230 | 06499 | 09247 | 05129 | 05654 | 06452 | [illegible] | [illegible] | 09-02-70 5 |
| 90 | 06806 | [illegible] | 06247 | 09407 | 06751 | 06596 | 06577 | [illegible] | [illegible] | 09-02-70 5 |
| 120 | 06483 | 06025 | 06361 | 07325 | 07993 | 06367 | 07302 | 05984 | 06572 | 09-02-70 5 |
| 150 | 06594 | 14191 | 06411 | 06876 | 09558 | 07559 | 06773 | 05984 | 06004 | 09-02-70 5 |

09-02-70 6 150

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | 0 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 02870 | 03197 | 03842 | 04315 | 04542 | 04156 | 02839 | 02994 | 04420 | 04040 | 09-02-70 6 |
| 30 | 06364 | 07223 | 07125 | 05495 | 05999 | 06234 | 04573 | 07547 | 09272 | 08875 | 09-02-70 6 |
| 45 | 08560 | 08002 | 07482 | 05105 | 05122 | 05387 | 05394 | 10374 | 08033 | 10227 | 09-02-70 6 |
| 60 | 07917 | 06638 | 06864 | 04975 | 05059 | 04917 | 06121 | 12449 | 06379 | 10656 | 09-02-70 6 |
| 75 | 06562 | 06304 | 06149 | 04912 | 06341 | 05641 | 08994 | 10967 | 06291 | 08873 | 09-02-70 6 |
| 90 | 06715 | 05878 | 05129 | 05295 | 06170 | 06537 | 10622 | 08980 | 06409 | 08852 | 09-02-70 6 |
| 120 | 05123 | 04688 | 04964 | 06649 | 07030 | 08229 | 13613 | 05738 | 06143 | 07846 | 09-02-70 6 |
| 150 | 04873 | 06029 | 06404 | 03744 | 07298 | 11511 | 13523 | 05826 | 05289 | 06320 | 09-02-70 6 |

09-02-70 7 150 1

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 03066 | 04297 | 02301 | 03165 | 04783 | 05109 | 04953 | 06002 | 04563 | 09-02-70 7 |
| 30 | 06312 | 07828 | 05430 | 06156 | 06301 | 06576 | 06055 | 07261 | 09179 | 09-02-70 7 |
| 45 | 07490 | 08316 | 07021 | 05977 | 06180 | 06054 | 05885 | 08895 | 09979 | 09-02-70 7 |
| 60 | 07276 | 07243 | 08586 | 05047 | 06326 | 05524 | 06371 | 08720 | 10330 | 09-02-70 7 |
| 75 | 06462 | 07404 | 08869 | 07130 | 08104 | 05609 | 06382 | 06496 | 09005 | 09-02-70 7 |
| 90 | 06699 | 07046 | 08958 | 07631 | 13016 | 06716 | 06537 | 06589 | 08598 | 09-02-70 7 |
| 120 | 06741 | 07461 | 17149 | 07586 | 14365 | 15254 | 06797 | 09931 | 08669 | 09-02-70 7 |
| 150 | 05823 | 07000 | 17754 | 07730 | 09252 | 17403 | 13433 | 11945 | 12293 | 09-02-70 7 |

09-02-70 8 150

| | 1 11 | 2 11 | 3 11 | 4 11 | 5 11 | 6 11 | 7 11 | 8 11 | 9 11 | 0 11 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 03959 | 04438 | 08660 | 08680 | 08860 | 05512 | 06559 | 06520 | 04205 | 05125 | 09-02-70 8 |
| 30 | 05941 | 06678 | 11947 | 10695 | 11774 | 06212 | 06977 | 05448 | 04448 | 05059 | 09-02-70 8 |
| 45 | 06312 | 06842 | 11395 | 09516 | 12502 | 05100 | 08063 | 05595 | 06231 | 06836 | 09-02-70 8 |
| 60 | 06325 | 06835 | 09823 | 08719 | 11947 | 11731 | 09022 | 08470 | 06684 | 07547 | 09-02-70 8 |
| 75 | 06700 | 06853 | 08336 | 08611 | 09683 | 11869 | 13681 | 08336 | 07122 | 05834 | 09-02-70 8 |
| 90 | 06727 | 07005 | 08959 | 09954 | 10083 | 11517 | 12672 | 13347 | 07266 | 05226 | 09-02-70 8 |
| 120 | 07570 | 06773 | 10680 | 11670 | 09914 | 11253 | 10197 | 10874 | 06226 | 05506 | 09-02-70 8 |
| 150 | 07045 | 07302 | 15012 | 10918 | 06505 | 04798 | 10599 | 09097 | 07585 | 05506 | 09-02-70 8 |

09-02-70 9 150 6

| | 1 11 | 2 11 | 3 11 | 4 11 | |
|---|---|---|---|---|---|
| 15 | 06124 | 03871 | 02765 | 02298 | 09-02-70 9 |
| 30 | 05725 | 04739 | 05737 | 03899 | 09-02-70 9 |
| 45 | 07549 | 05025 | 05652 | 05217 | 09-02-70 9 |
| 60 | 07360 | 05105 | 04739 | 05705 | 09-02-70 9 |
| 75 | 07161 | 05191 | 05106 | 07139 | 09-02-70 9 |
| 90 | 08817 | 05135 | 05071 | 06460 | 09-02-70 9 |
| 120 | 10427 | 05339 | 04694 | 06125 | 09-02-70 9 |
| 150 | 06250 | 06529 | 05028 | 06279 | 09-02-70 9 |

09-03-70 1 150 5

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | |
|---|---|---|---|---|---|---|
| 15 | 09408 | 09482 | 08966 | 09663 | 08422 | 09-03-70 1 |
| 30 | 12972 | 09233 | 10514 | 11394 | 07374 | 09-03-70 1 |
| 45 | 14491 | 06346 | 09303 | 08160 | 07853 | 09-03-70 1 |
| 60 | 14466 | 06406 | 10419 | 08041 | 08485 | 09-03-70 1 |
| 75 | 11551 | 07335 | 11026 | 09420 | 09165 | 09-03-70 1 |
| 90 | 12989 | 09072 | 08851 | 10965 | 09436 | 09-03-70 1 |
| 120 | 12167 | 10684 | 11781 | 11209 | 10287 | 09-03-70 1 |
| 150 | 11621 | 10743 | 11605 | 11451 | 10695 | 09-03-70 1 |

12-12-70 1 150

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | 0 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 06186 | 09934 | 13812 | 09221 | 10912 | 11198 | 11438 | 11396 | 07904 | 12504 | 12-12-70 1 |
| 30 | 06983 | 11641 | 15205 | 10867 | 12517 | 08120 | 15859 | 11845 | 08675 | 13973 | 12-12-70 1 |
| 45 | 07090 | 12582 | 14300 | 10960 | 11156 | 07311 | 14426 | 13909 | 09398 | 09484 | 12-12-70 1 |
| 60 | 07599 | 09985 | 14925 | 11850 | 10823 | 10132 | 14237 | 15239 | 07713 | 08835 | 12-12-70 1 |
| 75 | 07465 | 10695 | 16096 | 12915 | 10071 | 12722 | 13430 | 15752 | 06465 | 09817 | 12-12-70 1 |
| 90 | 07228 | 15600 | 16731 | 14038 | 14973 | 13753 | 14264 | 16044 | 07140 | 13724 | 12-12-70 1 |
| 20 | 07341 | 15620 | 18830 | 17098 | 13326 | 16287 | 17556 | 16619 | 09155 | 16133 | 12-12-70 1 |
| 50 | 11390 | 14188 | 19792 | 15012 | 15191 | 11408 | 17576 | 19193 | 12070 | 17143 | 12-12-70 1 |

12-12-70 2 150

| | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | 0 12 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 06673 | 10278 | 06908 | 05766 | 07532 | 06554 | 06334 | 07927 | 06780 | 07361 | 12-12-70 2 |
| 30 | 09942 | 10287 | 12654 | 07776 | 10137 | 06255 | 08352 | 09500 | 08243 | 07474 | 12-12-70 2 |
| 45 | 10667 | 10539 | 11767 | 11375 | 10232 | 06451 | 04098 | 07301 | 07759 | 05482 | 12-12-70 2 |
| 60 | 10952 | 10567 | 10044 | 14277 | 10601 | 06494 | 10411 | 06935 | 08435 | 05083 | 12-12-70 2 |
| 75 | 14332 | 13873 | 08501 | 12568 | 08680 | 06891 | 10719 | 07876 | 09033 | 05379 | 12-12-70 2 |
| 90 | 14609 | 16364 | 08603 | 09934 | 08367 | 07382 | 10162 | 12695 | 12031 | 07372 | 12-12-70 2 |
| 20 | 15426 | 17620 | 11041 | 12518 | 12766 | 12231 | 16160 | 16570 | 17207 | 06831 | 12-12-70 2 |
| 50 | 13794 | 17864 | 12048 | 13605 | 14273 | 09526 | 10078 | 19760 | 17143 | 06728 | 12-12-70 2 |

```
12-12-70 3 150 -
   1 12  2 12
15 07911 08379                                                     12-12-70 3
30 06823 11372                                                     12-12-70 3
45 05412 08057                                                     12-12-70 3
60 05273 06195                                                     12-12-70 3
75 04690 05087                                                     12-12-70 3
90 04973 05160                                                     12-12-70 3
20 05858 06397                                                     12-12-70 3
50 15158 06332                                                     12-12-70 3
12-12-70 4 150
   1 11  2 11  3 11  4 11  5 11  6 11  7 11  8 11  9 11  0 11
15 05191 08612 08440 06253 05944 09836 09825 06997 07477 05772    12-12-70 4
30 08518 08239 10458 09580 04729 09830 10213 08365 09606 07396    12-12-70 4
45 07757 06372 12190 04712 07327 07400 07308 11361 11723 07984    12-12-70 4
60 06735 06515 13116 10829 06405 06303 08998 12575 11040 06052    12-12-70 4
75 06387 06907 14026 13163 06892 05563 09878 10246 09751 06118    12-12-70 4
90 07124 08404 14178 12966 06954 07465 09633 06763 09239 06092    12-12-70 4
20 07429 11669 15311 11551 06235 09472 16349 05809 12251 06619    12-12-70 4
50 07293 18401 17289 09831 06429 12045 16886 07899 14251 13089    12-12-70 4
12-12-70 5 150 1
   1 11  2 11  3 11  4 11  5 11  6 11  7 11  8 11  9 11
15 08857 05996 07598 07621 07375 06165 06507 07951 08246          12-12-70 5
30 08216 06674 08253 06982 07480 06829 06651 07927 07896          12-12-70 5
45 05362 06408 08314 05763 05933 05407 05487 05541 05994          12-12-70 5
60 05206 07835 07334 17698 05439 05379 05709 05326 04338          12-12-70 5
75 06076 08103 06469 08902 05111 05466 06196 06693 04568          12-12-70 5
90 06455 07237 05996 09222 06551 06638 06563 06895 05080          12-12-70 5
20 06434 05746 06315 06839 07839 06392 07277 05840 06358          12-12-70 5
50 06423 14608 06718 06832 09369 07325 06707 05840 06044          12-12-70 5
12-12-70 6 150
   1 12  2 12  3 12  4 12  5 12  6 12  7 12  8 12  9 12  0 12
15 04882 06201 07389 07519 09253 06519 04411 05518 08876 09796    12-12-70 6
30 06692 09133 08371 06329 07228 11037 05269 08902 14655 15235    12-12-70 6
45 08584 08281 07778 05329 05146 07433 05685 10562 09636 15167    12-12-70 6
60 08183 06834 07227 05062 05135 05176 06422 12598 06813 11262    12-12-70 6
75 06734 06299 06227 04970 06269 05737 09135 11592 06293 09075    12-12-70 6
90 06662 05841 05066 05392 06149 06564 10621 09324 06471 08749    12-12-70 6
20 05213 04666 05014 06452 06700 08159 13506 05776 06177 07443    12-12-70 6
50 04956 06274 06532 13341 07011 11508 13556 05745 05314 06225    12-12-70 6
12-12-70 7 150 1
   1 12  2 12  3 12  4 12  5 12  6 12  7 12  8 12  9 12
15 06460 08319 05594 06251 06381 10543 10720 09770 08073          12-12-70 7
30 09142 10164 09788 07592 07863 09457 09460 08063 10331          12-12-70 7
45 08038 08542 08152 06157 06413 06295 07108 06817 10258          12-12-70 7
60 07275 07613 08809 05369 06593 05512 06947 06756 10379          12-12-70 7
75 06725 07269 08826 07039 08211 05435 06491 06613 09036          12-12-70 7
90 06955 06944 09203 07185 12655 06596 06663 06634 08645          12-12-70 7
20 07107 06933 16825 07259 14662 15326 07034 09979 08671          12-12-70 7
50 05834 06771 17912 07657 09315 17568 13406 11588 12477          12-12-70 7
```