Influence of Type of Graftage, Age of Plant,
and Certain Environmental Factors on the Loss
of Water by Young Mango Seedlings

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By

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1. INTRODUCTION

Horticulturists have always assumed that graftage does not affect the transpiration loss of water by seedlings except in the very early stages, less than a year after grafting. Yet no evidence seems ever to have been presented that even in the early period after grafting is there any effect of graftage on transpiration rates. In a letter dated June 19, 1933, Dr. Ben Ashmead, Director, Commonwealth Bureau of Horticulture and Plantation Crops, East Malling Research Station, England, indicated to the writer that there was apparently no published evidence to substantiate this view.

The world-wide importance of the mango (Mangifera indica L.) as a tropical fruit and its value as a potential large-scale crop in southeastern Florida made it a logical subject for investigation, particularly in view of the paucity of information on its water relations.

The objectives of the present research were four:

(1) To determine the magnitude of water loss by young mango

seedlings under greenhouse conditions.

(2) To determine the effect of time (days) after watering on

water losses by seedlings and seedlings grown in sealed and open containers.

(3) To determine how water losses are influenced by the type

of graftings (runner graft, chip bud, and shield bud¹ with a seedling stock) at different plant ages after graftings (approximately 13, 14, 7, and 4 weeks).

(4) To determine the effects of certain environmental factors (air temperature, vapor pressure deficit, wind velocity, light intensity, soil temperature, and leaf temperature) on water losses.

¹See plant age, 14 weeks.

II. REVIEW OF THE LITERATURE

A. Water Loss

Literally thousands of articles have been published during the past three centuries on the various phases of transpiration and the factors affecting it. Many excellent general treatments, summaries, and reviews have appeared periodically, of which those by Millier (1938), Knapton (1937), Reed (1942), Crafts, Carrier, and Steuding (1949), Kramer (1945), Curtis and Clark (1969), Meyer and Anderson (1961), Richards and Tiedeman (1961), and Richards, Knapton, and McCollis (1961) are some of the most recent. Millier (1938) in particular has presented an exhaustive survey of water losses while Crafts, Carrier, and Steuding (1949) have examined the water field of plant water relations with emphasis on the internal phases. Both Crafts, Carrier, and Steuding (1949) and Reed (1942) have taken prominent notice of the historical background underlying present-day investigations on the physiology of water in plants. Meyer and Anderson (1961) and Curtis and Clark (1969) have, like Millier, presented general surveys of transpiration in connection with other plant physiological processes. The older literature relating to the water requirement of plants has been summarized by Briggs and Shantz (1914a, b), Koenigsbach (1916) and Shantz and Plummer (1927).

Hagen (1946) has given an extended review of various climatic factors in relation to crop production. Kramer (1946) has reviewed plant and soil water relationships from the standpoint of plant physiology, while Richards and Hettich (1951) have treated the same subject from the viewpoint of soil physics. Richards, Hagen, and McCalla (1951) have published an extensive summary of the influence of soil temperatures on plant growth and behavior. Haring (1946) and Parker and Bartholomew (1950) have reviewed the effects of light on transpiration and other plant processes.

Bailey, Rothacker, and Cammermeyer (1952) have recently provided a critical comparison of the cobalt chloride paper and gravimetric methods of measuring transpiration, using black oak (Quercus velutina), white oak (Q. alba), tobacco, geranium, and tomato seedlings as test plants. They concluded from their experiments that the cobalt chloride method was of qualitative significance only and could not be used for the quantitative measurement of moisture losses in field studies.

The above-mentioned authors all give more or less detailed accounts of the methods of measurement and types of experiments used in previous water loss studies. They have also presented general information as to the magnitude and variation of transpiration in many species of plants as well as of the effects of certain environmental factors so that elaboration of these points is unnecessary.

In conformity with the statement by Aitkenhead, mentioned in the Introduction, a search of the plant science literature has not revealed a single article concerning the effect of type of graftage on water loss by plants. One must therefore conclude that experimental evidence on this question probably does not exist. A nearly similar situation is true with regard to the water relationships of the mango. While data are available on requirements of the mango as to soil moisture, amount and distribution of rainfall, and air temperature from the stand-point of cultural practices in many parts of the world (Stuebe 1931a), a short paper by Letham and Sharma (1944) on the conductivity and plasticity of young grafted mango shoots, made with inserted (approach-grafted) *Lagera* seedlings in India, constitutes the present extent of knowledge on water loss from mangoes.

B. Leaf Area Measurements

One of the most popular methods of reporting transpiration data has been on a basis of leaf area, since comparisons can be made much more readily than, for example, on green weight per leaf or some similar criterion.

Miller (1931) listed and described five methods for measuring leaf areas: (1) by tracing the outline of the leaf on paper and later measuring the enclosed area by means of a planimeter, (2) by tracing

the outline of the leaf on paper of known weight per unit area, (2) by photographing the leaf on squared paper and either measuring or weighing the enclosed area, (3) by rough measurement of the leaf and determining the area by direct calculation, and (4) by measurement with a planimeter.

Barnes (1932) added three additional methods which had not been described previously: (1) the leaf-product method, (2) the matching method, and (3) the adjustable-platform planimeter method. The leaf-product method involved the measurement of leaf length and width and correlating these values with area. The matching method involved cutting out the form to pasteboard or some other suitable material of the largest leaf measured; then the outlines of a series of smaller leaves were drawn on the template. If a wide range in leaf size was encountered, several templates could be made. The adjustable-platform planimeter method consisted of a portable stand so constructed that a leaf could be placed over a sheet of cellophane attached to it and traced with a planimeter. All three methods were readily adapted to the measurement of attached leaves.

Reynolds and Harris (1930) presented data for the estimation of the areas of mature leaves of McIntosh apple, Elberta peach, and Tullamena prune with the use of the product of leaf length and leaf width. Correlations of McIntosh apple leaf areas with length times width,

length class, and width class were found to be extremely high ($r = .910$, $.931$, and $.914$, respectively).

III. EXPERIMENTAL MATERIALS AND METHODS

This research was conducted at the University of Florida Sub-Tropical Experiment Station, Homestead, Florida. The water loss experiments were performed under greenhouse conditions. Leaf area measurements were made on leaves collected from bearing mango seedlings in Experimental Block T and from pot-grown seedlings in the Experiment Station nursery.

A key to the symbols used in the figures and tables is given in Table I.

A. Water Loss Experiments: 1952

Since a search of the mango literature revealed no indication as to the magnitude of transpiration by pot- or field-grown trees, an exploratory experiment was set up during the latter part of the summer of 1952. The immediate objective was to obtain information on the over-all water losses sustained by young seedlings and their seedling clones when the plants were retained at intervals longer than that of normal horticultural procedure.

Plant Materials

Seedlings¹--four ERI variety mango (Mangifera indica L.) & runner-grafted February 19, 1932, on Turpentine variety rootstocks from seeds planted in August, 1931.

Seedlings--four Turpentine variety mango (Mangifera indica L.) seeds planted in August, 1931.

The seedlings for observation and for use as rootstocks for the budlings were grown in the Experiment Station nursery in asphalt rooting felt tubes of rich potting soil (approximate composition one-half Kentucky clay loam, one-fourth sandy loam, one-fourth peat).

About one week before the water loss investigation was begun, the plants were brought into the greenhouse from the nursery hardening area and repotted in two-gallon glazed crocks with as little disturbance of their root systems as possible. Additional potting soil was used as needed to bring the soil level in each crock to about one inch from the rim. At the time of repotting and for several days thereafter, enough water was applied to maintain the soil sufficiently to give drainage from the small side holes at the bottom of the crocks.

The plants were divided into two groups of two seedlings and two budlings each, one set (pairs No. 3 and No. 7 seedlings, No. 4 and No. 8 budlings)--designated as "open"--being left open, and the other (pairs No. 1 and No. 5 seedlings, No. 2 and No. 6 budlings)--designated

¹Acquired from a previous experiment conducted by Franklin Palmer.

as "closed" - having vinylite plastic covers over the cracks. The plastic covers for each crack consisted of two layers with their openings staggered at 10°. The inner sheet was held down inside the crack rim by a wire ring and the outer tied securely with twine around the outside of the crack. A double sack lined with cotton was placed on the plant stem two inches above soil level and held in position by means of a radiator hose clamp to support the covers. All openings except the outside edges of the plastic sheets were sealed with melted beeswax-paraffin grafting wax.

Provision for watering the sealed pots was made by inserting a 4.5 in. diameter glass tube about four inches into the soil about midway between the plant stem and the crack rim. The open pots were watered evenly over the soil surface. Thermometers for soil temperature measurements were similarly sunk in the soil about two inches deep on the side of the cracks opposite the watering tubes in the "closed" pots and at equivalent spots in two of the "open" pots (No. 3 and No. 4). The openings through which the watering tubes and thermometers were inserted in the "closed" pots were sealed in the manner described above.

In order to follow changes in soil moisture during the course of the experiment, pairs of nylon soil moisture resistance blocks (Simpson 1949) were inserted in three of the cracks, No. 1, No. 2,

and No. 8, one black--designated as "bottom"--being set edgewise about one inch above the bottom of the creek and near the center of the soil mass. The other black--designated as "top"--was placed about one inch below the soil surface. Soil moisture samples were not taken.

Initial weights and essentially comparable soil moisture contents were obtained by watering the eight plants sufficiently to give escape from the small holes at the bottom of the creeks. The pots were permitted to drain for 48 hours before the drain holes were stoppered and the tops of the "closed" areas were sealed off. All weighings for the experiment were made on Fairbanks scales having a capacity of 25 kg. and sensitivity of 25 gms. per division.

The plants were spaced single file in numerical order at intervals of about double the creek diameter along a north-south center bench and near the north end of the greenhouse. An additional range nothing not included in the investigation protected the seed plant (No. 8) from wind effects of wind from a doorway about ten feet away. Two sets of wet bulb-dry bulb thermometers were suspended at plant height near each end of the row with two recording thermographs underneath them. Air temperatures for the entire greenhouse were read from a thermometer on the north side of a post near the center of the house.

To ascertain the effect of length of watering cycle on water losses, all eight plants were watered at intervals of 10 days, beginning

August 18, 1932, with 250 ml. of nutrient solution¹ plus enough tap water to bring each creek back up to its initial weight. Plants No. 3 through No. 8, inclusive, received supplementary waterings with tap water on the fifteenth day of each cycle. On October 22, 1932, all plants received a micro nutrient spray and on November 24, an oil-paraffin solution.² Fungicidal sprays were unnecessary as the plants had received regular semi-monthly applications while they were out of doors. The experiment was terminated December 4, 1932, after the completion of four 15-day watering cycles.³

Collection of Data

The data collected during the course of the experiment may be summarized as follows:

(1) Plant weighing, air temperatures,⁴ wet bulb temperatures, soil temperatures--three times daily Monday through Friday (approximately 8 A. M., 12 M., and 4 P. M.) and twice on Saturday (8 P. M. weighing, etc., omitted).

¹Thirty grams VICT High analysis soluble fertilizer per gallon of water.

²Twenty grams of 50 per cent oil plus 5 gram. paraffin in two gallons of water.

³From September 1 to December 4, 1932, Mr. Dana Roberts collected the data.

⁴Charts from thermographs were changed once a week.

(4) Suspensor resistance bridge readings for soil moisture--

two to three times weekly.

(5) Leaf length, leaf width, number (and condition) of leaves

per plant, stem diameter at two inches above soil level, and height--
taken monthly.

Conversion of Data

At the conclusion of the experiment, the data were converted from plant weights, etc., to forms more suitable for comparison and analysis. Of the 112 days included in the experiment, three weighings, etc., were made on each of 74 days, two on 17 days, one on one day, and none on 18 days. Water losses between weighings were computed for each plant. Since the number of hours between weighings were not the same during a given day or in some cases on successive days, the water loss values were reduced to grams water loss per hour and grams water loss per hour per 10 dm.² Leaf area for three periods of the day, morning (approximately 4 A. M. - 12 M.), afternoon (approximately 12 M. - 4 P. M.), and evening (approximately 4 P. M. - 8 A. M.), and to daily¹ water loss per hour and daily water loss per hour per 10 dm.²

¹Values for days on which no weighings, etc., were made, Sundays and holidays, were obtained by averaging the figures from one weighing to the next over the 60-hour or 72-hour period on the case might be

leaf area (approximately $\frac{1}{2}$ A. M. - $\frac{1}{2}$ A. M.). The corresponding averages¹ were computed for air temperatures ($^{\circ}$ C.), wet bulb temperatures ($^{\circ}$ C.), and soil temperatures ($^{\circ}$ C.). The wet bulb temperatures were subtracted from the air temperatures to obtain depression values which were then converted to vapor pressure deficits (mm. Hg) by means of standard Telford Bureau psychrometric tables.

The total leaf areas of each plant (Table I) at the biweekly collection dates were secured by summing the individual leaf areas (mm.²) calculated from leaf lengths with the equation for the composite leaf sample given in Table II. These values were then plotted against time on a semilogarithmic scale to permit day by day interpolations. Since the plants dropped senescent leaves from time to time, suitable corrections were necessary. If the dates of fall were known, the leaf areas were subtracted from the plant totals for their respective days; if not, they were prorated to whole leaf falls at intervals over the two-week period to which the drop occurred. The corrected leaf area values for each day were used for the conversion of water loss per hour to water loss per hour per 16 cm.² leaf area.

Stem areas (mm.²) shown in Table I, were derived from the corresponding diameters under the assumption that the stems were

¹Daily averages were computed from the period averages weighted by the number of hours between each collection of data.

standard. Soil moisture resistance readings (phana) were converted to a logarithmic scale to facilitate plotting.

After the measurements were completed, it was found that data for the morning, afternoon, and evening periods of 72 days and daily values for 113 days¹ were available for comparison and analysis.

B. Leaf Area Measurements

An spot check during the summer of 1942 to determine the general relationship between leaf area and leaf length or leaf width of young mango seedlings and seedlings showed a high degree of regularity, a series of leaf samples was taken during June and July, 1943. The following collections, all at random, were made:

- (1) Leaves from bearing Haden mango seedlings in Experimental

Block T.

- (a) 200 leaves (four lots of 50) from non-current growth Haden.

- (b) 100 Juvenile² (two lots of 50) from current growth Haden

¹Daily averages were computed from the period averages weighted by the number of hours between each collection of data

²Red or light green in color.

(D) Leaves from one-year-old *Turpentine* mangrove seedlings

in nursery beds

(a) 50 Healthy--from current and non-current growth flitches.

(b) 50 Malformed--from current and non-current growth flitches.

Leaf areas (sq. $\frac{1}{2}$) for the first two lots of mature *Kodon* leaves were obtained by tracing the individual outlines on millimeter grid-section paper and counting the squares. Areas of leaves in the remaining lots were secured by means of planimeter tracings, each measurement representing being the average of at least three tracings. Leaf lengths (cm.) and widths (cm.) for the *Kodon* lots and leaf lengths alone for the *Turpentine* lots were recorded at the same time. The data were subjected to regression analysis.

5. Water Loss Experiment--1952

On the basis of the information derived from the 1951 experiment as to the relative magnitude of moisture losses from sealed and open containers, the 1952 water loss experiment was limited to plants in sealed pots but expanded to include the influence of type of graftage, age of plant, and site environmental factors.

Plant Materials

Scion - Citrus variety orange (Mangrove Indica L. 3)

Rootstock (and seedling checks) - *Taraputia* variety orange

from seeds planted July, 1961

Table 1 shows the types of grafts,¹ dates of grafting, and number of plants included in the 1963 water loss experiment. The scions were obtained from young vigorous bearing trees. The rootstocks and seedling checks were grown in the Experiment Station nursery in asphalt rooting felt tubes and Fig. 10 shows of nursery potting soil.

Except for differences in the height of the unions, approximately 15 cm. above soil level, and the extent to which the rootstocks were cut back after the unions had opened,² 15 to 20 cm. above the union, the usual nursery practices with regard to propagation and after-care of the seedlings were followed. In spite of semi-monthly fungicidal sprays as a part of the nursery maintenance program, the leaves on the seedlings and a few of the seedlings were malformed as a result of infection by anthracnose (Colletotrichum gloeosporioides) and orange rust (Puccinia mangiferae).

¹Mr. Ray Nelson, Superintendent, University of Miami Experimental Farm, Richmond, Florida, propagated the seedlings.

²The abnormally long rootstock stubs protected the union checks from breakage during handling.

Experimental Procedure

Preliminary Operations.—About ten days before the water

less test period, the plants were brought into the greenhouse and carefully repotted into round No. 18 cans. After the plants were given a thorough soaking to prevent the soil from crumpling, the bottoms of the cans were removed with a crank-driven tin snips. Double thicknesses of unbleached muslin cut into ten inch squares were then slipped under the cans and fastened into place with rubber bands. The plants were set on a bench in the greenhouse and separated into six blocks containing 18, 18, 18, 18, 18, and 18 treatments, respectively. The blocks and treatments were randomized according to a pattern previously worked out with playing cards. In order to minimize differences in exposure to light and wind, the blocks were oriented north and south along the outer bench of the greenhouse. Two rows of three parallel rows were placed on either side. The space between rows was about eight inches and between sets about two feet, the latter space being reserved for instruments. Later, this arrangement was found to be too crowded for easy manipulation. Preliminary determinations for number of leaves, leaf lengths (cm.), stem diameters (cm.), and heights (cm.) were made on each plant at this time.

Twelve thermocouples, consisting of 22 ga. copper-constantan glass-encased wires about three feet long with oxygen-gas filled

junctions (baron flux), were inserted at depths midway between the top and bottom of the soil and as close to the tap root as practicable in each of 12 containers, two per block, for the measurement of soil temperatures. A similar number of thermocouples of 10 ga. copper-constantan glass-insulated wires about five feet long with oxygen-gas fused junctions (baron flux) were threaded through well exposed leaves on the same plants for leaf temperature measurements. The junctions were pushed through the leaf blades from below at a point near the center of the leaf longitudinally in close proximity to the midrib and held in position by means of grafting wax applied above and below. The wires were led down along the stems, small lumps of wax being used to hold them in place on the upper parts and rubber bands on the lower. Figure 1 shows the leaf and soil thermocouples in place together with the Lucas and Northrup thermocouple potentiometer used for measuring temperatures. The thermocouples were placed in as many different treatments as possible and the individuals carrying them spaced out within each block as far as to provide a representative distribution over the test area.

Tension table.—Soil moisture samples were not taken. A soil moisture tension table (Loomer and Shaw 1941) having a water column height of 40 cm.¹ (an effective water table 40 cm. below the

¹A soil moisture tension measured as 40 to 100 cm. of water is regarded as the upper limit of the field capacity range (Richards and Wadleigh, 1952).

Fig. 1. --Flux of *Hydra magus* feeding and Leidy and Hardrup thermocouple potentiometer circuitry arranged for measuring heat and acid temperature. (Both thermocouple wires are connected to the instrument.) (Wires connected outside on inside of bag.)

working surface) was constructed on the greenhouse bench, however, to assure that all of the containers would have the same relative moisture content.

The tension table consisted of a 36 by 36 in. square sheet of 16 ga. galvanized steel with a 1/16 in. hole drilled to the center. A series of four steel angle irons was placed on top of the boards of the greenhouse bench for support. A short length of 1/4 in. copper tubing soldered to the underside of the table in line with the hole in the sheet, a Tygon tubing sleeve, and a piece of 1/8 in. glass tubing with an "H" bend at the lower end and just long enough to clear the ground by two to three inches completed the column proper. The upper portion of the tension table consisted of a 31 by 31 in. square of galvanized window screening and an aluminum surface of 1/2 in. thick aluminum cladding cut so as to overlap the screen wire by at least three inches on all sides. Both layers were carefully laid; the aluminum sheet was sealed around the edges with automobile window sealer compound so as to prevent the entrance of air bubbles. An open-bottomed wood frame box 34 by 34 by 34 in. with three stationary sides and top of wall board and one side removable, covered with plastic cold-frame cloth, was placed over the tension table in order to keep down evaporation losses. As constructed, the tension table would hold 18 plants without making a rowing.

The procedure for operating the tension table consisted of flooding the surface with water and applying gentle suction to the water column tube with a water aspirator until all air bubbles were removed from the system. The excess water was allowed to drain away and, provided the system remained saturated after a half hour or more with the box door closed and sealed with damp cloths, the table was ready for use. If the water column broke within the period mentioned, the leak was found and plugged with molten compound. Shortly before they were to be put on the tension table, the plants were plunged up to the rim into a tub of water until the soil was saturated. They were then set in place and the inside of the box sprayed with a fine stream of water to reduce evaporation. The box door was closed and sealed around the edges with damp cloths. The water column was inspected from time to time to be sure it had not broken during the 30 to 48 hours¹ which the plants remained on the tension table. Insofar as possible complete blocks of plants were set on the table together so that any differences between treatments came would be manifested between blocks and not among treatments in a given replication. Tension table operations were

¹Thirty to 48 hours were regarded as being a sufficient length of time to permit the soil moisture in the containers to come to equilibrium with the 48 cm. tension used.

from August 2, 1953, and were completed for all six blocks by August 18.

Procedure for sealing pots. -- Immediately upon their removal from the location table, the containers were placed in individual 8 by 4 by 12 in. polyethylene dresser bags.¹ The tops of the bags were tied as low and as tightly as possible around the plant stems with large rubber bands. Bell thermocouple wires for the 12 plants carrying them were run up along the stems and out through the open end of the bags. When the containers were sealed, they were not reopened except for watering or when the cotton-tail clippers on the weed bench were broken; the bottoms of the bags so that they had to be replaced. As soon as they were bagged, each plant was weighed on the same set of scales used the previous year, all subsequent operations being based on this initial weight.

Experimental arrangement and instrumentation. -- Figure 2 shows the experimental arrangement of the plants and instruments on a greenhouse bench. The field cages approximately 14 in. high were set in three rows of two each in an open spot on the ground inside the greenhouse far enough away from the bench so as not to be shaded. Three blocks of plants could be accommodated on the bench and two double

¹Polyethylene plastic is moisture proof but has pores large enough to permit the interchange of gases.

Fig. 2. — General view of 1953 winter house experimental. The benches table is at the left, the succulent and hydroponic cups in the center, and the table and hydroponic plants at the right. These kinds of plants are in the greenhouse house, the remaining three being in house provided in the house and are in the plants.

rows on either side of the bench without crowding, one block location always being left vacant. During the entire water loss test period, each block was set in a different spot after each weighing than the one it had previously occupied. All blocks were systematically shifted around so that each of them was subjected in essentially the same degree to the differences in exposure to light, air currents, and temperature which existed in the greenhouse. A hygrothermograph for air temperature and relative humidity records was set on a box about midway between the two double rows of plants on the bench. A portable fan-type integrating anemometer was mounted on a tripod about 18 in. high over the double row on the side of the bench directly opposite the greenhouse door. The anemometer and the Leeds and Northrup automatic temperature compensation thermocouple potentiometer were located at the north end of the blocks on the bench. A pair of wet bulb-dry bulb thermometers were suspended at plant height near the center of the rows.

Watering schedule. -- The plants were watered at intervals of four to five days just after the afternoon weighings from the time they were taken off the tension table until August 18. After this date, they were watered according to the following schedule:

(2) August 19--All blocks¹

¹Twenty ml. of a 8 per cent solution containing ammonium nitrate and Gieseler's complete plant food (8-8-28) in the proportions 18:78 was given each plant.

(b) August 13--Blocks 1, 2, 3
August 14--Blocks 4, 5, 6

(1) August 17--Blocks 1, 3, 5
August 18--Blocks 4, 5, 6

(c) September 2--All blocks

The procedure for weighing was to cut the plant on the scales, record the weight, loosen the rubber band from around the stem, pour sufficient tap water over the surface to bring the weight up to its initial or corrected¹ value, and reweigh the rubber band.

Collection of Data

Beginning on August 13, 1958, the day the first group of plants was removed from the tension table, the following data were collected:

(1) Three times daily (starting times approximately 7:30 A. M., 11:30 A. M., and 3:30 P. M.²)--soil and leaf temperatures (11 each), wet bulb-dry bulb temperatures, air temperature and relative humidity (from hygrothermograph), wind movement since the previous weighing, light intensity (portable light meter), and individual plant

¹Additional weight of a new plastic bag or muslin bottom covers plus the initial value.

²Only 10 to 15 min. were required to complete a data collection.

weights.¹

(D) Once weekly--individual leaf lengths (cm.), stem diameter (cm.), height (cm.), and number of leaves for each plant; hypothermograph chart changed.

The experiment was terminated September 8, 1932.

Conversion of Data

Losses in plant weights between successive weighings were related to water loss per hour (gms.) for three periods of the day, morning (8 A. M. - 12 P. M.), afternoon (12 M. - 4 P. M.), and evening (4 P. M. - 8 A. M.), and daily water loss per hour (gms.: 8 A. M. - 8 A. M.). Corresponding averages for the three periods of the day were obtained for air temperature ($^{\circ}$ C., from hypothermograph readings), vapor pressure deficit (mm. Hg., calculated from hypothermograph relative humidity readings and wet bulb-dry bulb temperatures by means of standard Telford Bureau psychrometric tables), wind movement (Lb. m. per hour), light intensity (photons per cm.²), soil temperature ($^{\circ}$ C.), and leaf temperature ($^{\circ}$ C.). The total leaf area (cm.²) per plant (Table 4) for each of the weekly data collection dates was derived from the summation of the individual leaf areas calculated from leaf

¹The data were converted to the order given four data collections were made daily for the period Aug. 15 through Aug. 20, inclusive, but were related to a three times daily schedule for purposes of analysis.

lengths with the use of equations 4 and 5 given in Table 24. The resulting figures were plotted against time on semi-logarithmic paper so that the leaf area values for each day of the experiment could be obtained directly. Corrections for leaves which had fallen off between collection dates were generated leaf by leaf¹ if the actual date of dropage was unknown. Stock² stem areas (cm.²) were derived from the corresponding diameters, under the assumption that the stems were circular in cross section.

¹In cases where a dropped leaf could not be found, the area of the oldest leaf on the plant was subtracted as a unit.

²Stem diameters were measured on the stock at the height of the middle of the union area for the seedlings and at 18 cm. above ground level for the seedling clones.

IV. RESULTS AND DISCUSSION

A. Water Loss Experiments--1962

Rate of Water Loss

Daily rates per hour. --In conformity with previous reports

for a number of species by Briggs and Shantz (1944a, b; 1947), Klemmholz (1944), and other workers, the rate of water loss from young orange trees showed wide variations from day to day and from plant to plant. These points are well illustrated in Figures 3 to 7 and Tables 3 and 4 for daily water loss per hour (gm.) over four 18-day cycles in 1962 and their average. It may be noted that for the first six or eight days after the plants were watered the rates ranged from 1.76 to 4.44 gm./hr. for the seedling and from 1.88 to 4.48 gm./hr. for the seedling to "closed" containers watered at 18-day intervals. The rates of plants in "open" containers varied from 1.88 to 8.12 gm./hr. for the seedling and from 2.88 to 8.12 gm./hr. for the seedling. The corresponding values for plants watered at 14-day intervals were 1.88 to 3.88 gm./hr. for the seedling and .72 to 7.28 gm./hr. for the seedling in "closed" containers; in "open" containers, the rates varied from 1.72 to 10.76 gm./hr. for the seedling and from 2.88 to 10.81 gm./hr. for the seedling.

The general pattern of daily water loss rates for the four plants

Fig. 3. --Daily water loss per hour (gms.) of *Elm* average leaf-
 bugs and *Taraxacum* seedlings grown in closed and open containers for
 the watering cycle of August 15 to September 11, 1953. (1 - seedling
 "closed", 2 - seedling "closed", 3 - seedling "open", 4 - seedling "open",
 5 - seedling "closed", 6 - seedling "closed", 7 - seedling "open",
 8 - seedling "open".)

Fig. 4. --Daily water loss per hour (gms.) of *Urtica* range seedlings and *Taraxacum* seedlings grown in closed and open containers for the watering cycle of September 12 to October 9, 1952. (1 = seedling "closed", 2 = seedling "closed", 3 = seedling "open", 4 = seedling "open", 5 = seedling "closed", 6 = seedling "closed", 7 = seedling "open", 8 = seedling "open".)

Fig. 3. --Daily water loss per hour (gms.) of *Lili* orange seedlings and *Persea* seedlings grown in closed and open containers for the watering cycle of October 19 to November 4, 1961. (1 - seedling "closed", 2 - seedling "closed", 3 - seedling "open", 4 - seedling "open", 5 - seedling "closed", 6 - seedling "closed", 7 - seedling "open", 8 - seedling "open".)

Fig. 8. - Daily water loss per hour (gms.) of *Lili* orange seedlings and *Tournefortia* seedlings grown in closed and open environments for the watering cycle of November 7 to December 6, 1952. (1 - seedling "closed", 2 - seedling "closed", 3 - seedling "open", 4 - seedling "open", 5 - seedling "closed", 6 - seedling "closed", 7 - seedling "open", 8 - seedling "open".)

Fig. 7. --(Daily water loss per hour (gms.) of 33E average bud-
lings and *Persea* seedlings grown in closed and open containers for
the average of four watering cycles in 1964. (1 = seedling "closed",
2 = budling "closed", 3 = seedling "open", 4 = budling "open", 5 = seed-
ling "closed", 6 = budling "closed", 7 = seedling "open", 8 = budling
"open".)

watered at intervals of 24 days (Figures 3 to 7, top and Table 4) was rather uniform from cycle to cycle. In the first cycle, August 18-September 11, the rates of all four plants were high the first day, somewhat lower the second and third, higher on the fourth, and then gradually tapered off to the twenty-eighth day with minor increases and decreases along the way. In the second cycle, September 13-October 7, the rates gradually increased from an initial level about half that of the first cycle up to a maximum on the fourth to sixth days, after which they decreased. The rates of the third cycle, October 13-November 6, resembled those of the first except that the maximum did not occur until the seventh day. The rates of the fourth cycle, November 8-December 4, were similar to those of the second cycle except that maximum rates were somewhat lower, occurred on the fourth and fifth days after watering, and were also more variable over the entire cycle. When the average of four cycles were considered, the rates for each plant exhibited maxima on the fourth or fifth and on the eleventh or twelfth days after watering, the second peak being somewhat lower than the first. The days after watering on which the minimum rate occurred for any given plant varied from the twenty-third to the twenty-sixth. Moderate increases in rates at the very end of the cycle were observed for both seedlings and the "open" bedding.

The two right-hand columns in Table 3 show the differences

in rates between pairs of plants, "open" and "closed" seedlings and seedlings. These data are of interest mainly to illustrate the decided variability in the performance of pairs of plants from day to day, as evidenced by the numerous minus values. In general, however, the differences between the rates of the seedlings was smaller on a given day than that between the rates of the seedlings, except after about the nineteenth or twentieth day in the third and fourth species. As may be seen from the slopes of the curves in Figures 3 to 7, top, the bulk of the variation, and hence of the differences, between seedlings or seedlings can be attributed to the "open" members of each pair.

The values of daily water loss per hour for the first plants watered at intervals of 14 days (Figures 3 to 7, bottom, and Table 4), exhibited certain marked differences from those of the plants watered at 28-day intervals. With few exceptions, the former had much higher initial and maximum rates of loss. A comparison of the rates during the 14 days after watering for the 28-day cycle plants and the "a" species for the 14-day plants showed that the latter were losing water somewhat faster in most cases. Furthermore, the day-to-day variations in rate were usually greater for the 14-day cycle plants. Somewhat less regularity was observed in the number of days after watering before the 14-day cycle plants reached their maximum rate of water loss.

The differences in rates of 14-day cycle seedlings and seedlings, given in the right-hand columns of Table 4, showed wide variation although lower negative values were obtained than with the 28-day plants. Unlike the latter, however, the difference between the rates of the 14-day seedlings was as likely to be larger as smaller on a given day than that between the rates of the 14-day seedlings.

Certain generalized inferences may be drawn from the data on daily water loss per hour presented thus far. Under the conditions of the experiment, the "closed" seedlings of both the 28-day and 14-day watering cycle groups were usually found to have somewhat lower rates of water loss than the "closed" seedlings. On the other hand, the "open" seedlings were generally observed to have somewhat higher rates of water loss than the "open" seedlings. The rates of the 14-day cycle plants were generally higher than those of the 28-day plants for the corresponding portion of their cycles. The difference in rates between the "open" and the "closed" pairs was noted to be lower, with many more negative values, for the 28-day plants, an indication of greater plant variability. Roughly 10 to 20 per cent of the water loss from the "open" plants appeared to be the result of evaporation. The lag period in the two sets after the plants were watered and before the water loss rates reached a maximum appeared to be a function of the soil moisture stress obtained in the preceding cycle, since the 14-day

cycle plants required one or two days less to attain a maximum rate in many instances.

Daily water loss per hour per unit leaf area.—When plant size differences

were removed by converting the daily water losses per hour to daily water loss per hour per 10 dm.² leaf area, the figures presented a quite different aspect. As shown in Figures 9 to 12 and Tables 7 and 8, the rates were much reduced and their ranges correspondingly restricted. For example, the "open" seedling of the 18-day watering cycle group had rates varying from 1.49 to 4.71 gm./hr./10 dm.² leaf area during the first six to eight days after watering, while those of the corresponding "closed" seedling ranged from 1.51 to 3.46 gm./hr./10 dm.² leaf area. While the rate curves on a leaf-area basis for each plant of both the 18-day and 14-day watering cycle groups were flatter than their per-plant counterparts, the position of the maxima and minima were unchanged.

The chief contrast between the two sets of data lay in the effect on the difference between the "open" and "closed" plant pairs produced by removing plant size variations. For the 18-day cycle pairs, the seedlings showed larger differences from day to day with fewer negative values than the seedlings, the values for the latter being negative about 40 per cent of the time. The seedling pair again exhibited larger differences from day to day in the 14-day cycle group than the seedlings,

Fig. 4. --Daily water loss per hour per 100 dm.² leaf area (gms.) of *Calli margin* seedlings and *Turpentine* seedlings grown in closed and open containers for the watering cycle of August 12 to September 11, 1962. {1 = seedling "closed", 2 = seedling "closed", 3 = seedling "open", 4 = seedling "open", 5 = seedling "closed", 6 = seedling "closed", 7 = seedling "open", 8 = seedling "open".}

Log(10) of total bacteria

Fig. 9. --Daily water loss per hour per 10 dm.² leaf area (gms.) of Hill mango seedlings and Turpentine seedlings grown in closed and open containers for the watering cycle of September 12 to October 9, 1952. (1 - seedling "closed", 2 - seedling "closed", 3 - seedling "open", 4 - seedling "open", 5 - seedling "closed", 6 - seedling "closed", 7 - seedling "open", 8 - seedling "open".)

Landing (total) and area (gms)

Fig. 14. --Daily water loss per hour per 10 cm.² leaf area (gms.) of *Sili* orange seedlings and *Turpentine* seedlings grown in closed and open containers for the watering cycle of October 4 to November 4, 1953. (1 = seedling "closed", 2 = seedling "closed", 3 = seedling "open", 4 = seedling "open", 5 = seedling "closed", 6 = seedling "closed", 7 = seedling "open", 8 = seedling "open".)

Fig. 11. —Daily water loss per hour per 10 dm.² leaf area (gwt.) of *Zizania* seedlings and *Taraxacum* seedlings grown in closed and open containers for the watering cycle of November 7 to December 4, 1961. (0 = seedling "closed", 1 = seedling "closed", 2 = seedling "open", 3 = seedling "open", 4 = seedling "closed", 5 = seedling "closed", 6 = seedling "open", 7 = seedling "open", 8 = seedling "open".)

Length/width² and area (mm²)

Fig. 12. --Daily water loss per hour per 10 dm.² leaf area (gms.) of *Lili margin* seedlings and *Terquettia* seedlings grown in closed and open containers for the average of four watering cycles in 1912. (1 = seedling "closed", 2 = seedling "closed", 3 = seedling "open", 4 = seedling "open", 5 = seedling "closed", 6 = seedling "closed", 7 = seedling "open", 8 = seedling "open".)

Length (mm) and weight (g)

and roughly 38 per cent of the values were negative. The beading pairs, on the other hand, had negative values on 101, and were different on two, out of 111 days.

It is manifestly impossible for a plant in an open container to lose water by transpiration from its leaves and not lose water by evaporation from the soil film. The only logical interpretation of these data is that the plants used in this experiment had a wide variation in their rates of water loss per unit leaf area. Further inferences are unwarranted alone, as to the rates of the becomings of the 14-day watering cycle group, either the "open" beading may have had a rather low rate or the "closed" beading a rather high rate of water loss per unit area. Alternatively, both conditions might have existed.

Water loss per hour for three periods during the day. --Water loss per hour data were available for the morning, afternoon, and evening periods of 73 days. As the data showed a much wider day-to-day range among the eight plants within a given period than daily water loss per hour values, they were averaged. The data are presented graphically in Figures 17, 18, and 19 and numerically in the left hand data columns of Tables 11, 12, and 13. The average rates of water loss per hour were usually higher in the afternoon period than in the morning, while those of the evening were far smaller than either of the other two. For example, the morning rate of loss on September 17

was 17.44 gm./hr., the afternoon, 23.54, and the evening, 1.47. About 48 per cent of the water loss during the day occurred in the morning, 41 per cent in the afternoon, and 9 per cent in the evening. On November 26, the morning rate of loss was 14.50 gm./hr., the afternoon, 18.42, and the evening, 6.33. About 36 per cent of the water loss during the day occurred in the morning, 39 per cent in the afternoon, and 9 per cent in the evening. While the exact values varied from day to day, the water losses during the evening period rarely exceeded 10 per cent of the daily totals.

The rates for each period showed the same pattern during the course of the watering cycles as the daily water loss per hour rates, although they were masked somewhat by the wide day-to-day range.

Effects of Environmental Factors on Rates of Water Loss

Effects of environmental factors on rates of daily water loss

per hour. --The average daily values for air temperature ($^{\circ}\text{C.}$), vapor pressure deficit (mm. Hg), and soil temperature ($^{\circ}\text{C.}$) during the four 10-day watering cycles are given in Figures 13 and 14 and Table 3. When curves of the environmental factors are compared with those for daily water loss per hour (on either a per-plant or unit-land-area basis), it is noted that shifts in water loss rate maxima and minima from cycle to cycle may be traced for the most part to corresponding changes in vapor pressure deficit and air temperature. The curves for

Fig. 12. --Daily average air temperature ($^{\circ}$ C.), vapor pressure deficit (mm. Hg), and soil temperature ($^{\circ}$ C.) for watering cycles of August 15 to September 11, September 12 to October 9, and October 10 to November 4, 1933.

Fig. 14. --Daily average air temperature ($^{\circ}$ C.), vapor pressure deficit (mm. Hg.), and soil temperature ($^{\circ}$ C.) for watering cycle of November 7 to December 4, and average of four watering cycles in 1952.

soil temperature generally followed those for air temperature, but on certain occasions they differed markedly—as, for example, on the eighth to eleventh days after watering in the first cycle and from the fifteenth to seventeenth days in the fourth cycle—and produced corresponding changes in the water loss curves.

As shown in Figures 18 and 19 and Table 18, the log soil moisture resistances (*W*_{ms}) of the two "closed" containers of the 20-day watering cycle group (plants No. 1 and No. 2) usually increased at a somewhat slower rate than those of the "open" plant (No. 3). Apparently, soil moisture was being depleted most rapidly from the "open" container (No. 3) and least rapidly from the "closed" one in which the hilling was given (No. 1). If the approximate soil moisture resistance values listed by Thompson (1947) for field capacity, 1800 ohms, and permanent wilting point,¹ 500, 600 ohms, of moderately heavy soils are converted to their logarithmic values, 3.256 and 3.457, respectively, and applied to these data, the soil moisture of the "open" container (No. 3), as measured by the "B" block, reached field capacity between the second and eleventh day after watering in the first cycle, between the eighth and the eleventh in the second cycle, between the eighteenth and twentieth in the third cycle, and on the fifteenth in the

¹Full discussions of field capacity and permanent wilting point are given by Richards and Wadleigh (1951).

Fig. 75. --Log soil moisture resistance (absc.) of pairs of nylon soil moisture resistance blocks inserted in containers holding a LAR maggot feeding on a *Turpentine* seedling, for the waiting cycles of August 13 to September 11 and September 12 to October 9, 1951. (1 = seedling in "closed" container, 2 = seedling in "closed" container, 3 = seedling in "open" container; B = block located 1 inch above bottom of container, T = block located 1 inch below soil surface.)

log. Ser. modulus (continued)

Fig. 17. ---Average water loss per hour (gms./h), air temperature ($^{\circ}$ C.), vapor pressure deficit (gms. Hg), and soil temperature ($^{\circ}$ C.) for the morning period of 15 days in 1963. (Observations of watering cycles are marked by dashed vertical lines.)

log 2nd instar (untransformed)

fourth cycle. The permanent wilting point was reached between the eleventh and sixteenth day after watering in the first cycle, between the eighteenth and twentieth in the second cycle, on the twenty-seventh in the third cycle, and between the twenty-fifth and twenty-seventh in the fourth cycle. The soil moisture of the "closed" container in which the seedling was grown (No. 1) reached field capacity between the second and eleventh day after watering in the first cycle, between the eighth and eleventh in the second cycle, between the thirteenth and sixteenth in the third cycle, and between the eleventh and thirteenth in the fourth cycle. The permanent wilting point was not attained at any time. The "closed" container (No. 2) in which the seedling was grown reached field capacity between the eleventh and sixteenth day after watering in the first cycle, between the thirteenth and fifteenth in the second cycle, between the twenty-second and twenty-fifth in the third cycle, and between the twenty-fifth and twenty-seventh in the fourth cycle. The permanent wilting point was not reached.

The top soil moisture resistances of the top blocks (marked T in the graphs) followed roughly the same pattern as the bottom blocks but, as may be noted in the figures, they were decidedly more erratic in their performance from cycle to cycle. This resulted in part from their location with respect to the main root masses, since the bottom blocks were completely surrounded with roots whereas the top blocks

had comparatively few roots around them. The continual loss of moisture from the soil to the closed or open atmosphere was doubtless also a contributory factor. In the case of the "closed" containers soil moisture was constantly being evaporated and subsequently being condensed on the plastic covers. The water thus removed was not lost to the plants but dripped back on the soil around the edges of the containers, thus in effect redistributing the moisture to the detriment of the central portion of the upper quarter of the soil mass where the "top" container blocks were located. The "open" growth (Pl. N), on the other hand, lost soil moisture directly to the air.

If it is assumed that the 14-day watering cycle plants depleted the soil moisture of their respective containers in about equally as to the permanent wilting point in a number of days equivalent to the performance of the 18-day plants, the higher rates of water loss in each cycle, like the shorter lag periods before maximum rates of water loss were attained, appeared to be a function of the soil moisture stress reached in the preceding cycle. Outward evidence as to the effect of soil moisture stress was lacking since none of the plants wilted during the course of the experiment³ and six of the eight put on new fall growth

³The plants were rewatered on December 8, 1952, at the end of the fourth cycle and then were permitted to go without further additions until they died. On February 4, 1953, two full months later, the "open" plants were showing severe drought symptoms, as evidenced by their shriveled stems, parched, leathery leaves, and partial desiccation, while the "closed" individuals appeared to be normal in every respect.

of growth in September and October.

Effect of environmental factors on rates of water loss at different times of the day. --Average water loss per hour (gms.), air temperature ($^{\circ}$ C.), vapor pressure deficit (mm. Hg), and soil temperature ($^{\circ}$ C.) values are presented in Figures 17, 18, and 19 and Tables 11, 12, and 13 for the morning, afternoon, and evening periods of 15 days during 1951. Since visual examination of the curves for average rate of water loss and the environmental factors showed many apparent discrepancies, the data were subjected to regression analysis.

The regression analyses for the three periods of the day taken separately and the totals of the three periods of the day taken separately ("within periods") are given in Table 14. The total (multiple) correlation coefficients, expressing the relationships between average water loss per hour and air temperature, vapor pressure deficit, and soil temperature, of the four sets were all far larger than could be explained on the basis of sampling variation. The partial correlation coefficients, expressing the relationships between average water loss per hour and one environmental factor while holding the other two constant, for soil temperature in the morning, vapor pressure deficit in the evening, and soil temperature in the "within periods" were all significantly larger than sampling variation. The partial correlation coefficient for vapor pressure deficit in "within periods" was much larger than could be

Fig. 14. --Log cell moisture resistance (above) of pairs of open cell moisture resistance blocks inserted in containers holding one EMI mouse bedding and two Turpentine shavings, for the waterlogging cycles of October 18 to November 1 and November 7 to December 4, 1951. O = swelling in "closed" container, I = swelling in "closed" container, S = swelling in "open" container, B = block located 1 inch above bottom of container, T = block located 1 inch below cell surface. }

Fig. 14. --Average water loss per hour (gm./h.) at temperatures ($^{\circ}$ C., h. vapor pressure deficit (mm. Hg), and soil temperature ($^{\circ}$ C.) for the afternoon period of 73 days in 1952. Coordinates of watering cycles are marked by dashed vertical lines.)

Fig. 13. ---Average water loss per hour (gm./hr.) at temperatures ($^{\circ}$ C.) in vapor pressure deficit (mm. Hg), and wet temperatures ($^{\circ}$ C.) for the cooling period of 70 days in 1962. (Boundaries of watering cycles are marked by dashed vertical lines.)

accounted for by sampling variation. With two exceptions, the simple correlation coefficients, representing the relationships between average water loss per hour and each of the environmental factors separately, were likewise highly significant. The evening soil temperature comparison was non-significant while the morning soil temperature comparison was significant.

With the exceptions noted, the foregoing statements imply that the three environmental factors, individually and collectively, had a definite bearing on the magnitude of water loss rates for any period of the day or for the periods taken as units and lumped together. The sizes of the correlation coefficients within any given group in Table 14, in either a horizontal (period to period) or vertical (factor to factor) direction, indicates which factor had the greatest influence on the water loss rates. For example, air temperature accounted for a greater proportion of the evening water loss rates than either vapor pressure deficit or soil temperature when the environmental factors were compared singly. However, if air temperature and soil temperature were held constant, vapor pressure deficit had the largest influence on rates. Vapor pressure deficit had a greater influence on both the morning and the afternoon rates than either air or soil temperature, when the factors (and periods) were considered separately, and played a somewhat larger role in determining the afternoon rates than those of the morning period.

Then the effects of the environmental factors were compared as a unit, they accounted for a larger proportion of the rates in the afternoon than in either the morning or evening.

The data in Table 14 are informative, but they do not give any indication as to whether or not a given environmental factor had an appreciable influence on the differences in water loss rates of the three periods. Two sets of analyses were run, tests of significance for the partial regression coefficients comparing pairs of periods and analyses of covariance for the individual environmental factors.

The tests of significance for the partial regression coefficients comparing pairs of periods are shown in Table 15. The figures reveal that the regression of water loss rates on soil temperature, while holding air temperature and vapor pressure deficit constant, had a highly significant influence on the comparative rates of water loss of the morning and evening periods. The variations in water loss rates of the morning and evening periods were thus affected by changes in soil temperature, when the other two factors were held constant, to such an extent that the chances of their being the result of sampling error were less than one in 100. Similarly, the odds were somewhat less than one in 20 that the regressions of water loss rates on soil temperature, while holding air temperature and vapor pressure deficit constant, for the afternoon and evening periods and of water loss rates on vapor pressure deficit,

while holding air and soil temperature constant, for the afternoon and evening periods were the result of sampling variations. All of the other comparisons showed that sampling variations were great enough to obscure any effects which might have been present.

The analyses of covariance for rates of water loss and the individual environmental factors are presented in Tables 14, 17, and 18, for air temperature, vapor pressure deficit, and soil temperature, respectively. Each analysis consists of three parts: (a) the comparison of mean rates of water loss for the morning, afternoon, and evening periods after the rates have been adjusted to a common level of the given factor; (b) the proportion of the unexplained variability of the unadjusted period means removed by the analysis; and (c) a comparison of rates of water loss adjusted to a common level of the given factor within each of the three periods. The calculations for air temperature, Table 14 A, permit the conclusion that the adjusted mean rates of water loss for each period were sufficiently different as to practically eliminate the possibility of chance variation. In the absence of an analysis of variance, this test showed that the rates of water loss for the three periods differed by highly significant amounts, thus bringing out the visual impression given by the water loss data in Tables 11, 12, and 13. Table 14 B indicates that the analysis of covariance removed a large proportion of the unexplained variability of the (unadjusted) mean rates

of water loss. The figures in Table 14 C show that the effect of air temperature on rates of water loss was not the same during the morning, afternoon, and evening periods.

It is obvious from these observations and the evidence presented in Table 14 E that air temperature alone did not exert a controlling influence on rates of water loss, but that other environmental factors, measured and unmeasured, also played a substantial role. Similar conclusions may be drawn for vapor pressure deficit and soil temperature, Tables 17 and 18, respectively.

The effects of the three environmental factors on rates of water loss at different times of day may be summarized by saying that air temperature, vapor pressure deficit, and soil temperature all had a profound influence whether they were examined individually or collectively. When one factor was varied while the other two were held constant, the effect was negligible except in a few instances. The individual factors were found to affect the magnitude of rates of water loss during the morning, afternoon, and evening periods after the rates were adjusted to a common level for each factor, but no one of them exerted a controlling influence. The effect of a given environmental factor on rates of water loss varied from period to period, indicating that other factors which had not been measured were contributing to a greater or lesser degree.

B. Leaf Area Measurements

With the exception of the malformed leaves collected from young *Turpentine* seedlings, all of the samples, whether from *Haden* or *Turpentine* trees, showed a remarkable consistency in leaf shape. Few leaves were disproportionately long for their width or unusually wide for their length, in spite of broad ranges in both categories, if they were uninjured. Leaves malformed by means of disease infection, wind, insect depredations, mechanical injury, and the like were found to be of every conceivable size and shape; yet they too showed a sufficient degree of regularity to warrant a mathematical study of the relationship between leaf area and length.

The leaf measurements for 154 mature *Haden* leaves are given in Table 19, for 140 juvenile *Haden* leaves in Table 21, for 50 healthy (uninjured) *Turpentine* leaves in Table 23, and for 50 malformed *Turpentine* leaves in Table 25. The data were analyzed in two ways. First, multiple regressions were run on the mature *Haden* and juvenile *Haden* samples to compare the linear relationships of leaf area, length, and width. Second, curvilinear regressions were run on 50 leaves of each of the four samples and on a composite sample of 100 leaves, 50 from each of the two *Haden* and the healthy *Turpentine* groups, to compare the logarithmic relationship of leaf area and leaf length.

As shown in Tables 20 and 22 for mature and juvenile *Haden*

leaves, respectively, the relationships between leaf area, length, and width, between leaf area and length while holding width constant or vice versa, between leaf area and length, and between leaf area and width were all far larger than could be accounted for on the basis of variations in sampling.

The simple correlation coefficients have particular interest since they infer that leaf area may be estimated from either length or width with a probable accuracy of at least 80 per cent for both sets of leaves separately. The areas of a mixed sample including both mature and juvenile *Halen* leaves cannot be estimated from leaf lengths on a linear basis, however, as illustrated by Figure 26, since the relationship is definitely curvilinear.

The leaf areas and lengths of 16 leaves each from the two *Halen* samples analyzed previously plus two lots of the same size of healthy *Turpentine* and malformed *Turpentine* specimens were converted to logarithmic form as given in Tables 23, 24, 25, and 26. The data for each set were then reanalyzed. When the results showed that at least 80 to 93 per cent of the existing variation could be accounted for, the three samples of undamaged leaves were combined (Table 27). As the figures in Table 28 indicate, leaf areas of undamaged leaves may be estimated from leaf lengths, via a logarithmic transformation, with a probable accuracy of at least 78 per cent, provided the equation for the

Fig. 15. --Leaf area (cm^2) and leaf length (cm) of 100 mature and 100 juvenile leaves from seven-year-old Haden orange seedlings.

Leaf area (cm^2)

composite sample is used. Similarly, the areas of malformed leaves may be estimated with a probable accuracy of about 90 per cent by means of the equation for malformed leaves. The very high degree of correlation to the two sets may be seen in Figures II and III, portraying the composite sample and malformed *Taraxacum* leaves respectively.

C. Water Loss Experiments--1953

The observations made during the course of the 1953 experiment were divided for study purposes into two partially overlapping groups. Water loss data for 11 of the 19 days between August 13 and September 5, 1953, on which three measurements daily were available, were selected for detailed examination of treatment effects. Mean water loss values of 64 plants and averages of environmental factor readings on 19 days were utilized for comparing the influence of six environmental factors on water loss. All calculations and comparisons were made on the hourly values or averages.

Water loss data for 13 days were reduced for analysis by combining them into groups¹ based on three days after watering and on three weighing periods a day. The resulting analysis designs were a split-plot for daily water loss per hour with dates and types of gradings as

¹The data were analyzed as the sum of values for four watering periods.

Fig. 21. --Leaf areas (mm.^2) and leaf lengths (mm.) of a composite leaf sample containing 50 mature leaves from seven-year-old *Nidus* mangrove seedlings, 50 juvenile leaves from seven-year-old *Nidus* seedlings and 50 healthy leaves from seven-year-old *Turpentine* seedlings.

Fig. 21. --Leaf areas (cm^2) and leaf lengths (cm) of 50 malformed leaves from one-year-old *Taraxacum officinale* seedlings.

main plots and three days after watering as sub-plots and a split-split-plot with three periods daily as sub-sub-plots. The designs comprised the original randomized block layout of the experiment with one or two systematic subdivisions (days and periods) superimposed on it. Figures 13 and 14 are schematic drawings of the split-plot and split-split-plot, respectively. Four sets of analyses were necessary since the shielded type of graftage was available for only the May 3 data. This treatment had to be compared separately in designs similar to the above but which contained four main plots (four types of graftage for a single date) instead of 12 (three types and four dates of graftage).

The analyses of variance were complicated by an unequal number of replications for the types of graftage on each date of graftage, the ship beds and shield beds having four, the veneer grafts, five, and the seedling checks, six. Since it was thought desirable to retain the entire replications of the veneer grafts and seedling checks, over and above the four required for equality, the analyses were made with unequal but proportional replicate numbers in which the variations among replications (blocks) were absorbed into experimental error. In addition to the increase in experimental error, the effects of the unequal number of replications were also manifested in the degree of precision attached to the comparisons involving the different types of graftage, the seedling

Fig. 12. --Diagrammatic sketch of split-plot design used for analyses of variance of the 1963 water loss experiment. Main plots (dates and types of graftings), sub-plots (days after watering). See Table 1 for explanation of symbols.

DATE / TIME		BEFORE	AFTER	WATERING	REF. NO.
1st	GRAPH				
	0				
	5				
	10				
2nd	0				
	5				
	10				
	15				
3rd	0				
	5				
	10				
	15				
4th	0				
	5				
	10				
	15				
5th	0				
	5				
	10				
	15				
6th	0				
	5				
	10				
	15				
7th	0				
	5				
	10				
	15				
8th	0				
	5				
	10				
	15				
9th	0				
	5				
	10				
	15				
10th	0				
	5				
	10				
	15				
11th	0				
	5				
	10				
	15				
12th	0				
	5				
	10				
	15				
13th	0				
	5				
	10				
	15				
14th	0				
	5				
	10				
	15				
15th	0				
	5				
	10				
	15				

4 WATERING PERIOD

Fig. 14. --(Diagrammatic sketch of split-split-plot design used for analysis of variance of the 1953 water loss experiment: main plots (dates and types of grafts), sub-plots (days after watering), sub-sub-plots (times of day). See Table 1 for explanation of symbols.

DATE: 10/1/78

W/T: 10/1/78

W/T: 10/1/78

1

DATE/TIME: 10/1/78 10:00

blocks having the highest and the shield beds¹ the lowest.

Mean water loss per hour values and averages for six environmental factors were computed for the morning, afternoon, and evening periods of 12 days. The data so collected precluded the use of means of water loss per hour for types of graftage, dates of graftage, or replications, since a single reading was made for air temperature, vapor pressure deficit, wind movement, and light intensity at every weighing. Twelve readings, two per replication, were made for soil temperature and leaf temperature, but they showed a rather small variation from block to block at any given time of day. Consistent differences in these factors between blocks for a particular location on the greenhouse bench or house which might otherwise have existed were masked by shifting the blocks as units after every weighing.

Notes of Water Loss

Daily rates of water loss. --An examination of the daily water

loss per hour data for 44 young mango seedlings and seedlings prior to analysis revealed the existence of large and variable differences similar to those found the preceding year. As portrayed in the figures in Table II representing the sums of four watering periods, and in the first data

¹As this type was available for only one date of graftage, comparisons involving it would be less precisely estimated than those with the chip beds which had the same number of replications per date of graftage but were available for four dates.

column of Table 16 showing means on a single watering period basis, the range and magnitude of daily water loss per hour were also markedly different for the various treatments. The order of mean rates for three types of graftage at any given date of graftage (Table 16) was seedling check, runner graft, and chip bud in the approximate ratio of 2.5:1, 5:1. Similarly, the order of mean rates for four dates of graftage was May 8, April 14, July 4, July 11 in the approximate ratio 5:1, 5:1, 1:1, and for the three days after watering, it was second, third, and first, with respective ratios of 1, 5:1, 1:1.

After the daily water loss per hour data were subjected to analysis of variance, Table 16, it was found that the ranges in rates among types of graftage (C), dates of graftage (D), and days after watering (T) were all far too large to have been caused by chance variation. The completed analysis of variance, Table 16, showed there were highly significant differences between the runner grafts (T) and chip buds (C) and between the budlings and the seedling checks (C₀). There was also a highly significant difference between the April 14 (A) and May 8 (B) dates of graftage combined as compared to the July 4 (C) plus July 11 (D) dates although the variations between April 14 and May 8 were non-significant, as were those of the July dates. In the days-after-watering comparisons, the first day was highly significantly different from either the second or the third. Likewise, when the first and third days were

combined, their average performance was highly significantly different from the second day, but that of the first plus the second compared to the third was non-significant. For the interactions of one group of main treatments with another, the dates $\underline{y_2}$, types of graftage ($D \times G$), dates of graftage $\underline{y_1}$, days after wounding ($T \times D$), and types of graftage $\underline{y_2}$, days after wounding ($T \times G$) comparisons were non-significant, highly significant, and significant, respectively. The additional breakdown corroborated previous statements made for the main effects and their interactions.

In interpreting the foregoing results, it must be recognized that the daily water losses per hour were subject to bias in the sense of plant size, as shown by the stem-area and leaf-area values in Table 4. The seedling checks were larger plants than the graftings, while the leaf areas of the younger grafts were also larger than those of the whip buds, except in one or two cases. In general, the seedling checks having the greatest squares of leaf area were assigned, purely by random selection, to the two earlier dates of graftage. The graftings were also readily divisible into two groups, those of the two earlier dates of graftage forming one set and those of the two later dates another.

The influence of plant size on the variations in rate for each day after wounding was not discernible. The differences in rate in this case were probably the result of soil moisture conditions in the first few days

after the plants were watered, as Henselinkson (1951) and Leventhal (1948) both noted that soil moisture was depleted by transpirational losses at a very high rate during the 48-hour period immediately following irrigation. It would appear from a comparison of the soil moisture regimes for the 1952 and 1953 water loss experiments that the magnitude of rate increases was a function of the soil moisture stress developed prior to watering as well as day to day environmental conditions.

The graphic and numerical presentations of the three daily water loss per hour interaction tables, $D \times G$, $T \times G$, and $T \times D$, in Figures 23A and Tables 31 for means and Tables 27C-E for totals help to explain the conclusions reached in the analysis of variance. For example, it may be noted that the type-of-graftage rates within a given date (Table 31A) varied in a regular pattern, as did the date-of-graftage values within a given type, the net result being that differences which might have existed tended to cancel themselves out when taken over the entire 12 treatments. The same regularity did not exist, however, in either of the other two interactions. The differences in rate were highly significant for the date-of-graftage $\times$ days-after-watering interaction (Table 31B). The values for each day after watering showed a straight line (linear) trend against date of graftage (right hand Figure 23A), but the reverse plot, of dates against days (not shown), revealed an equal

Fig. 15. --A. Daily water loss per hour (gms.) means (limits of single watering interval) for three sets of treatment comparisons from the 1955 water loss experiment: Type of graftage ra, date of graftage, days after watering rs, date of graftage, and type of graftage rs, days after watering.

B. Daily water loss per hour per cm.² stem area (gms.) means (limits of single watering interval) for three sets of treatment comparisons from the 1955 water loss experiment: Type of graftage ra, date of graftage, days after watering rs, date of graftage, and type of graftage rs, days after watering.

A.

B.

tendency towards straight line and curvilinear (quadratic and cubic) trends. The differences in rate were significant for the type-of-graftage vs. days-after-watering interaction (Table 11B). The trend of type of graftage against days after watering was distinctly curvilinear, indicating that the rates rose to a maximum, not necessarily the same for each type of graftage, and then dropped.

The major inferences¹ which may be drawn from the daily water loss per hour data are that rates of loss by runner grafts, chip buds, and budding checks are different when dates of graftage are ignored, and rates of loss by plants of four dates of graftage fall into two separate groups when types of graftage are ignored. The rates of the plants taken as a group differ according to the number of days after watering.

In addition to the analysis on a per-plant basis, the daily water loss per hour data for 12 treatments were converted to rates per cm.² stem stem area and to rates per 10 dm.² leaf area for the purpose of removing the plant size bias mentioned previously. The converted values were subjected to analysis of variance.

The means for main treatments of daily water loss per hour per cm.² stem stem area are shown in the second data column of

¹Based on a statistical probability of the differences noted being the result of chance is less than one per cent of the observations.

Table 10; the corresponding means for interactions are listed in Table 12 and illustrated in Figure 13B. The analysis of variance is given in Table 13.

The daily loss per hour per 10 dm.² leaf area data were analyzed twice, once with four chip-bed replications and once with three chip-bed replications. As may be seen from a perusal of the right hand data columns of Table 10 for main treatment means and Tables 12 and 14 for means of the interactions, the water loss rates were influenced to a marked degree by the chip-bed treatments, particularly for the July 4 and July 21 dates of graftage (Tables 12 and 14). A study of the original data showed that two plants, number 73 in the July 4 group and number 74 in the July 21 group (Table 6), had extremely small leaf areas during part or all of the test period so that a very small daily loss of water produced an extremely high rate per unit leaf area, many times higher than that of any other plant in the entire experiment. Since removal of just these two plants would have given disproportionate numbers, it was necessary to remove an entire replication, or one plant from each date of graftage, before reanalyzing the data. The analysis of variance for daily water loss per hour per 10 dm.² leaf area with four chip-bed replications is given in Table 13 and that with three chip-bed replications¹

¹This analysis and the chip-bed (PC) treatment with three replications have both been given asterisks to indicate confusion with the analysis with four chip-bed replications.

in Table 29. The means of the interactions for the latter are shown graphically in Figure 18.

The relationships of the four daily water loss analyses are summarized in Tables 30 and 31 for main treatment means and "F" values, respectively. [The latter were obtained from the analysis of variance tables by dividing the mean square for a given treatment or interaction by the appropriate mean square for error. Since the "F" values are ratios, their magnitude indicates the level of probability for each comparison.]

It may be noted in Table 30 for "F" values that converting daily water loss values to a unit-stem-area basis changed the conclusion previously reached for values on a per-plant basis in but two cases of note. The comparison between venose glands and chip buds showed that differences in rates of the two treatments on unit-stem-area basis were apparently the result of chance variation; on the other hand, the budlings vs. seedling check comparison revealed a much higher probability level (i.e., very highly significant) than was found on a plant basis. The days-after-watering vs. date-of-grafting interaction was non-significant on a unit-stem-area basis.

All of the comparisons for daily water loss per hour per 1.0 dm.² leaf area (4 chip-bud replications) were non-significant except that between budlings and seedling checks. As may be seen from the full

Fig. 24. --Daily² water loss per hour per 10 dm.² leaf area (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the 1953 water loss experiments. Type of graftage xy, date of graftage, days after watering yz, date of graftage, and type of graftage yz, days after watering.

analysis of variance, Table 3b, the experimental error (a) mean square, used for testing date-of-graftage and type-of-graftage treatment effects, was about the same magnitude as the corresponding sum of squares in the other three analyses, or roughly 50 times normal size. In contrast, several of the comparisons for daily weight loss per hour per 10 dm.² leaf area (three trip-hat replications) were either significant or highly significant, the most notable being bollings yy, seedling checks and first yy, second and first yy, third days after watering. The analyses showed that plants of any date of graftage had essentially the same rates of loss per unit leaf area but there were differences in the rates of the two types of bollings and of the seedling checks.

It may be noted from the values in Tables 3b and 3c and the lines in Figures 13a and 14 that the order of rates for the three types of graftage changed markedly from the per-plant to the unit-leaf-area basis. Any of four factors may have contributed: a lower unit-leaf-area rate for the seedling checks as compared to the bollings on the basis of varietal characteristics, differences in rates as the result of a larger cross-sectional stem area at the union in the case of the bollings, variations in rate as the result of differences in total leaf area per plant, or variations in rate as the result of pathological conditions. Unlike the data for daily water loss per unit leaf area of ERI bollings and Turpentine seedlings in the 1932 experiment, which showed few differences

attributable to the variation in such (compare leaf areas in Table 2 with rates of loss in Figures 2 to 7 or 8 to 14), the Haden seedlings of the 1953 experiment had a higher rate of water loss per unit leaf area than the Tropicana seedling clones.

The differences in rate noted between seedlings and seedling clones were undoubtedly influenced by pathological conditions since many of the leaves on the latter plants were infected with anthracnose (*Colletotrichum gloeosporioides*) and orange rust (*Ectoma mangiferae*). DeFrance (1918), Childers, Marshall, and Brady (1943), and Leventhal and Hamilton (1944), among others, have reported that rates of water loss were adversely affected by disease or insect depredations.

Except for the extremely high rates of water loss found for plants with very small leaf areas, the chip-budded Haden plants showed lower rates per unit leaf area than the veneer grafts in spite of the fact that the latter had a larger total leaf area per plant in nearly all cases (Table 4). It is assumed, however, that the seedlings of a given date of graftage had the same potential rate of water loss per unit area, the differences in actual rates noted between veneer grafts and chip buds appeared to be a function of the relative areas of contact of the stem surfaces¹ formed after graftage at the point of union between

¹See comments by Buda (1954) on the anatomical features of graft unions.

action and reestablish.

As noted at the beginning of the discussion of daily water-loss rates, the shield-bud treatment was available for the May 3 graftage data only. A separate group of analyses were made on the data gathered from the plants of the May 3 graftage data for daily water loss per hour on a per-plant basis, on a multi-stem-stock-area basis, and on a multi-leaf-area basis. The original data (sum of four watering periods) are shown in Table 40, the means for main treatments in Table 41, the means for interactions in Tables 42, 43, and 44 and Figure 37, a summary of "F" values in Table 45, and the analyses of variance in Tables 46, 47, and 48.

In general, the analyses for four types of graftage on the May 3 data gave the same conclusions as those for three types of graftage and four dates on a per-plant basis, multi-stem-area basis, or multi-leaf-area basis. The major exceptions were the reversal in order of mean rates of water loss on a multi-leaf-area basis (Figure 37G and Table 41) for the veneer-graft and ship-bud treatments and the non-significance of the veneer-graft vs. ship-bud comparison. It may be seen in Table 49 that differences in rates of the three types of budlings and the seedling checks were far larger than could be expected on the basis of chance variation. The shield-bud rates were definitely unlike the seedling-check rates on a per-plant or multi-stock-stem-area basis but had a

Fig. 18. --A. Daily water loss per hour (gms.) means (basis of single watering interval) for one treatment comparison from the May 5 graftage date of the 1955 water loss experiments. Type of graftage xx, days after watering.

B. Daily water loss per hour per cm.² stem area (gms.) means (basis of single watering interval) for one treatment comparison from the May 5 graftage date of the 1955 water loss experiments. Type of graftage xx, days after watering.

C. Daily water loss per hour per 10 dm.² leaf area (gms.) means (basis of single watering interval) for one treatment comparison from the May 5 graftage date of the 1955 water loss experiments. Type of graftage xx, days after watering.

A. Type of Graftage vs. Days after Littering

(unadjusted)

B. Type of Graftage vs. Days after Littering

(unadjusted, also adjusted)

C. Type of Graftage vs. Days after Littering

(unadjusted, also adjusted)

rather low probability level on a unit-leaf-area basis. When compared with chip buds, the shield-bud rates differed by a significant amount on a leaf-area basis only. When compared with veneer grafts, they differed by a probability level of 1 in 100 on a per-plant basis only. A similar level of probability was attached to comparisons of the veneer grafts vs. seedling checks and chip buds vs. seedling checks on a unit-leaf-area basis. The differences in rates in recent graft vs. seedling check comparisons on a per-plant basis were probably the result of sampling errors.

In spite of the complex interrelationships shown by the May 3 graftage data analyses, certain inferences may still be made. Regardless of the basis on which they are judged, the rates of budlings and seedling checks are distinctly different. Within the group of budlings, the shield-bud rates differ from those of the chip buds but do not differ from those of the veneer grafts on a unit-leaf-area basis, while the reverse is true on a plant basis. The differences in mean rates of water loss of the three types of budlings on a unit-leaf-area basis, Table 41, appear again to be attributable to variations in the amount of treatment xylem tissues between series and treatments.

Rate of water loss during the morning, afternoon, and evening periods of the day. --Data for 40 young orange budlings and seedlings in 12 main treatments—three types and four dates of graftage—were examined to ascertain the relative effect of time of day on hourly rates

of water loss during three days after watering. As noted in 1962, the magnitude of water loss per hour was found to vary greatly in the morning, afternoon, and evening periods from one day to the next. The values in 1963 were higher as a rule, however, in the morning than in the afternoon, while the evening rates were approximately a tenth of the daytime values.

The figures for water loss per hour were analyzed in the same manner as those on daily water loss per hour; i. e., analyses of variance were conducted for rates on a per-plant, root-surface-area basis, and root-leaf-area basis, with two sets for the last (one with four chip-bed replications, the other with three). The data for water loss per hour (sum of four watering periods) are shown in Table 45, the means for main treatments in Table 46. The means for first order¹ interactions in Figures 18, 19, and 20 and Tables 51 to 55;² a summary of "F" values in Table 56, and the separate analyses of variance in Tables 56 to 65.

The conclusions inferred previously from the analyses of daily water loss per hour have been established, in general, for similar main treatments in the water-loss-per-hour analyses. Although the individual

¹Interactions between main treatments.

²The means for the water loss per hour per 10 dm.² leaf area (four chip bed replications) first order interactions are not given.

Fig. 13. --Water loss per hour (gms.) means (basis of single watering interval) for six sets of treatment compartments from the 1923 water loss experiment. Type of graftage xx, date of graftage, days after watering xx, date of graftage, type of graftage xx, days after watering, time of day xx, date of graftage, type of graftage xx, time of day, and time of day xx, days after watering.

Fig. 19. --Water loss per hour per cm.² stem area (gms.) means (basis of single watering interval) for six sets of treatment comparisons from the 1933 water loss experiments. Type of graftage rs, date of graftage, days after watering rs, date of graftage, type of graftage rs, days after watering, time of day rs, date of graftage, type of graftage rs, time of day, and time of day rs, days after watering.

Fig. 34. --^aWater loss per hour per 15 dm.² leaf area (gms.) means (range of single watering interval) for the sets of treatment comparisons from the 1963 water loss experiments. Type of graftage xx, date of graftage, days after watering yy, date of graftage, type of graftage yy, days after watering, time of day yy, date of graftage, type of graftage yy, time of day, and time of day yy, days after watering.

Type of Greeting vs. Date of Greeting
(Length of test averaged)

Type of Greeting vs. Date of Greeting
(Length of test averaged)

Type of Greeting vs. Days after talking
(Length of test averaged)

Type of Greeting vs. Days after talking
(Length of test averaged)

Type of Greeting vs. Time of Day
(Length of test averaged)

Type of Greeting vs. Time of Day
(Length of test averaged)

values are larger, the relative order of the mean values for types of graftage and dates of graftage have remained unchanged (compare Tables 30 and 31), and where the values were highly significant or non-significant in the daily set, they have remained so, with one exception, when analyzed against time of day (compare Tables 30 and 31). The exception, the runner-graft $\underline{y}_2$, date-of-graftage comparison on a per-plant basis, was highly significant in the daily set but non-significant in the time-of-day set. Similarly, the type-of-graftage $\underline{y}_2$, date-of-graftage (D x Q) comparison (see left Figures 18 to 20 and Tables 31A, 31A, 31A, and 31A for means and Table 32 for "F" values) remained non-significant. The days-after-vascular comparisons and interactions with type of graftage and date of graftage (see right and center left Figures 18 to 20 and Tables 31B, C, 31B, C, 31B, C for means and Table 32 for "F" values) showed no marked variations from the conclusions reached earlier.

As shown in Table 30 for means and in Table 32 for "F" values, day-time values (morning and afternoon) differed greatly from those in the evening. The morning and afternoon values also differed from each other by a highly significant amount. The date-of-graftage $\underline{y}_2$, time-of-day interaction (right center Figures 18 to 20 and Tables 31D, 31D, 31D, and 31D for means and Table 32 for "F" values) was highly significant on a per-plant or unit-stock-items-area basis but non-significant on a

unit-leaf-area basis. The type-of-graftage yz, time-of-day interaction (bottom left Figures 28, 29, and 30 and Tables 51E, 52E, 53E, and 54E for means and Table 55 for "F" values) showed highly significant differences on any basis (except leaf area with four ship-bud replications). The last interaction, days after wounding yz, time of day (bottom right Figures 28, 29, and 30 and Tables 51F, 52F, 53F, and 54F for means and Table 56 for "F" values) was found to be highly significant when analyzed on a per-plant basis, significant on a unit-stem-phen-area basis, and non-significant on a unit-leaf-area basis.

The reason for the time-of-day yz, date-of-graftage interaction being highly significant on a per-plant or unit-stem-phen-area basis but non-significant on a unit-leaf-area basis is readily apparent in the center right graphs in Figures 28, 29, and 30. In the first two cases, both morning and afternoon rates vary in more or less parallel fashion from one date in the week, while the evening rates show a very different pattern. On the other hand, all three lines in center right Figure 30 are nearly parallel. Similarly, the bottom graphs in Figures 28, 29, and 30 for the interactions of type of graftage yz, time of day and time of day yz, days after wounding display unmistakable trends. For example, the seedling checks (C2) show a more pronounced drop in rate from afternoon to evening in the bottom left graphs of Figures 28 and 29 than in either of the budlings, and in Figure 30 the rates of the two budlings

both fell more sharply than that of the seedling checks. Variations in the slopes of the lines in the bottom right graphs in Figures 28, 29, and 30 for the interaction of time of day xx, days after watering explain the conclusions which were reached in the analysis of variance.

A separate group of analyses were made for the May 5 data of graftage water loss data so that comparisons might be available for the shield-leaf type of graftage. These analyses of variance were conducted, one each for the May 5 figures on a per-plant, multi-stem-stem-area, and multi-leaf-area basis. The data for water-loss-per-hour (sum of four watering periods) are presented in Table 60, the means for main treatments (five types of graftage) in Table 61, the means for first order interactions in Figures 31A, B and 32 and Tables 62, 63, and 64, the "F" values in Table 65, and the analysis of variance in Tables 66, 67, and 68.

Except for the means being larger in size, the data for water loss during three times of the day revealed conclusions essentially different from those shown by the daily water loss values for the May 5 graftage data main treatments or interactions in only three instances. The runner-graft xx, ship-leaf comparison was highly significant for water loss per hour on a multi-leaf-area basis; the days-after-watering comparison was highly significant for water loss per hour on any basis; and comparisons of the first xx, second and first xx, third days after

Fig. 31. --d. Water loss per hour (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the May 3 graftage date of the 1943 water loss experiment. Type of graftage ra, days after watering, type of graftage ra, time of day, and time of day ra, days after watering.

3. Water loss per hour per cm.² stem area (gms.) means (basis of single watering interval) for three sets of treatment comparisons from the May 3 graftage date of the 1943 water loss experiment. Type of graftage ra, days after watering, type of graftage ra, time of day, and time of day ra, days after watering.

A

B

Fig. 22. --Water loss per hour per 10 dm.² leaf area (gms.) means (means of single watering interval) for three sets of treatment comparisons from the May 8 graftage date of the 1953 water loss experiment: Type of graftage xx, days after watering, type of graftage yy, time of day, and time of day zz, days after watering.

watering were highly significant for water loss per hour on a wilt-stick-stem-area basis (compare Tables 4b and 4f). The interaction of type of graftage with days after watering was uniformly non-significant. The time-of-day rates were highly significant throughout (Table 4f), but the morning vs. afternoon comparison was significant for water loss per hour only on the basis of wilt leaf area.

The interaction of types of graftage with time of day was highly significant throughout, but that for days after watering vs. time of day was non-significant. The graphic presentations of the means for the interactions (single-watering-period basis) in Figures 11A, 11B, and 11, for water loss per hour on a per-plant, wilt-stick-stem-area, and wilt-leaf-area basis, respectively, reveal the reasons for the significance or non-significance of the various comparisons.

It is of considerable interest in these and the preceding graphs for interaction means to note the relative order of the types of graftage rates from one basis of measurement to another. For example, the shield-leaf rates are the lowest of the four in Figures 11A and 11B but are the next to the lowest in Figure 11. The seedling-chest rates are the highest in the first two sets of graphs and the lowest in the third. As stated earlier, the low rates per wilt leaf area for the seedling chests may have been the result of a varietal characteristic, a reflection caused by fungus diseases on the leaves, or by a relatively small area of water

conducting tissue in the stem.¹ The status of the shield bud among the budlings may be attributed in a less well-headed union or a smaller area of continuous xylem tissue from rootstock to union.

In a recapitulation of rates of water loss by young mango budlings and seedlings, it may be stated that budlings and seedlings differ markedly in their rates of water loss, the former having lower rates on a per-plant basis and the latter on a unit-leaf-area basis. There are also clear cut differences between runner grafts and chip buds on a unit-leaf-area basis, the former having the higher rates. Shield buds have lower rates of water loss than either of the other two types of budlings, but the differences are clear cut only when the rates are on a unit-leaf-area basis. The plants of the four dates of graftings fall into two groups—April 1-4-May 3 and July 4-July 11—when their rates are on a plant basis, but they do not differ on either a unit-stem-atom-area or a unit-leaf-area basis. The rates of water loss by budlings and seedlings are higher in the morning than in the afternoon. The mean water loss on a per-plant basis for the morning is about 44 per cent, for the afternoon, 41.3 per cent, and for the evening, 14.3 per cent of the daily total.

Two factors whose relations must be recognized, if only

¹ Benda (1916) has shown the diameter of xylem vessels to be larger in tissues laid down by plants subsequent to grafting than prior to it.

finally, are the size and composition of plant sample for each type of graftage and the environmental conditions under which the 1953 water loss experiment was conducted. As shown in Table 3, five runner-graft, four chip-bud, and six seedling-stock replications were available for each of four dates of graftage, and four shield-bud replications for one date of graftage; thus, the true mean value of water loss were most precisely estimated for the seedling stocks and least so for the shield buds.

Considering the wide range in water loss from one plant to another within the same type (and date) of graftage shown by the 1953 and 1954 experiments, the inferences from the data should not be applied indiscriminately to all young orange plants under all environmental conditions. On the other hand, the inferences which have been made could serve as a general guide in such circumstances if at the same time due recognition is taken of the fact that their general validity must be substantiated over a series of similar experiments, preferably in different years and under a variety of environments. As they stand, the conclusions are regarded as being applicable to the particular varieties, types of graftage, ages of plants, and environmental conditions of the two years' experiments.

Effect of Certain Environmental Factors on Rates of Water Loss

As stated in the Introduction, one of the major objectives of the water loss experiments was to ascertain the effect of six environmental factors on rates of water loss of young mango seedlings and cuttings. It was not possible, for reasons given previously, to compare the rates for different types and dates of graftage with environmental factors, but the differences between treatments were minimized insofar as possible within the limits of the experiment, since the plants in each block or replication were shifted from one location to another on the greenhouse bench and house after every weighing.

Mean water loss per hour and average air temperature, vapor pressure deficit, wind movement, light intensity, soil temperature, and leaf temperature values are presented in Tables 12, 13, and 14 for the morning, afternoon, and evening periods, respectively, of 19 days in 1955. They are illustrated in Figures 14, 15, and 16.

As one may readily see from the figures, the effects of the environmental factors, taken either collectively or individually, on the rates of water loss for any period of the day were rather complex, so much so that interpretations based on visual observation alone were considered to be of little value. The data for each period and the totals of each period ("within periods") were subjected to multiple regression analysis. A summary of the correlation coefficients, means, partial

Fig. 15. $\pm$ Mean water loss per hour (gms.), air temperature ($^{\circ}$ C.), vapor pressure deficit (mm. Hg), wind movement (10 m. m. / hr.), light intensity (lumens/cm.²), soil temperature ($^{\circ}$ C.), and leaf temperature ($^{\circ}$ C.) for the morning period of 19 days in 1913.

Flowing

100.0

Fig. 34. --blow water loss per hour (gms.), air temperature ($^{\circ}$ C.), vapor pressure deficit (mm. Hg), wind movement (10 cm. / hr.), light intensity (lumens/cm.²), soil temperature ($^{\circ}$ C.), and leaf temperature ($^{\circ}$ C.) for the afternoon period of 14 days in 1953.

Fig. 18, --blow water loss per hour (gms.), air temperature ($^{\circ}$ C.), vapor pressure deficit (mm. Hg), wind movement (10 cu. m. / hr.), light intensity (microns/cm.²), soil temperature ($^{\circ}$ C.), and leaf temperature ($^{\circ}$ C.) for the evening period of 19 days in 1963.

regression coefficients, and multiple regression equations is presented in Table VI.

The total correlation coefficients, expressing the relationship between mean water loss and the six environmental factors taken collectively, were found to be large enough that the combined effect of the environmental factors on mean water loss rates could not have been the result of sampling variation during any of the three periods of the day or their combination. They showed that approximately 84 per cent of the variations in mean water loss rates could be accounted for in the morning period, 87 per cent in the afternoon, 82 per cent in the evening, and 81 per cent in "within period". The "within period" coefficient was the average correlation of the three periods. The total as well as the partial and the simple correlation coefficients, which are discussed in the following pages, all showed that the environmental factors were interrelated to a rather high degree. The six factors did not account for more than a relatively small proportion of the variability in rates of water loss at any given time of day. In other words, unknown factors had at least as great an effect on rates of water loss as those which were measured.

It may be noted in Table VI that the means of rates of water loss and of the environmental factors were substantially alike in the morning and afternoon, whereas those in the evening were much smaller

in nearly all cases. A certain amount of overlapping in the range of the individual values around their means undoubtedly existed.

The partial correlation coefficients, expressing the relationships between mean water loss rates and one of the environmental factors while holding the remaining five constant, were found to be highly significant for light in the evening period and non-significant for all of the others.

The marked influence of light on the variations in the evening water loss rates appeared to be a consequence of the time at which the light intensity readings for this period were taken. The evening light intensity values were averaged from readings made about four o'clock in the afternoon and about eight o'clock in the morning and reflected the fact that the evening period actually included between four and five hours of daylight.

The influence of soil temperature seemed to be manifested more strongly than that of several of the other factors as a result of a daily lag behind air temperature (and thus of other atmospheric factors) of from two to three hours and to the amount of four to five degrees at the time of the afternoon weighing. At the morning weighing, air and soil temperatures usually coincided within a few tenths of a degree and, at the noon-time weighing, the former was normally several degrees higher.

While the effects of air temperature, vapor pressure deficit,

wind movement, and leaf temperature were all too small to show a significant influence on water loss rates at any time of the day. The relative size of their partial correlation coefficients differed from one period to another. For example, wind movement ($r_{Y1, 11414}$) showed the smallest effect of any factor in the morning, but the largest in the afternoon, and the next to the smallest in the evening.

The simple correlation coefficients, expressing the relationship between mean water loss per hour and each of the six environmental factors, showed that soil temperature or leaf temperature when taken separately had a highly significant influence on water loss rates in the morning. Air temperature and vapor pressure deficit were found to have a significant effect on rates in the morning and in the evening. Vapor pressure deficit, wind movement, and leaf temperature were all significant in the afternoon. The "within periods" column revealed that the average correlations of the periods for five of the six factors were too large to be attributed to sampling variation; wind movement, alone of the factors, was non-significant.

The foregoing results indicate that no one factor was responsible for more than a small portion of the combined influence of environmental conditions on mean water loss rates at any given period of the day, despite the fact that the total environmental effect was significant for any period and highly significant over the whole day. Taken individually,

the factors often exerted decisive influence over water loss rates. Only one of the six, vapor pressure deficit, showed a consistent effect on rates during each of the three periods, but all of the factors except wind movement were influential over the entire day.

The partial regression coefficients, representing the change in mean water loss rate with unit increase of one environmental factor while holding the other five constant, reflected the marked variability in the effect of an environmental factor from one period to the next. Wind movement, alone of the six factors, did not have a depressing influence on water loss rates at some time of the day. The large number of negative coefficients served to explain the lower mean rate of water loss in the afternoon period, despite higher mean values for four of the six environmental factors, as compared to that of the morning.

Since the correlation coefficients in Table VI provided evidence that the effect of a given environmental factor, or of all six factors collectively, on rates of water loss differed in the morning, afternoon, and evening periods, two additional tests were made on the data to confirm the conclusions drawn previously: (a) Tests of significance were made on the partial regression coefficients for each factor to compare pairs of periods, morning vs. afternoon, morning vs. evening, and afternoon vs. evening, Table VI. (b) The values for the six environmental factors taken separately were subjected to analysis of covariance, Tables VI to VII.

The tests of significance made on the partial regression coefficients (Table 73) revealed that an effect not attributable to sampling variation (with odds of less than one in 20) existed only in the case of the afternoon vs. evening comparison for light intensity. In this instance, the influence of light intensity on rates of water loss was definitely different in the afternoon than in the evening, provided the other factors were held constant.

The analysis of covariance for the individual environmental factors, presented in Tables 74 to 79 for air temperature, vapor pressure deficit, wind movement, light intensity, soil temperature, and leaf temperature, respectively, revealed what would take place when the rates of water loss for each period were compared with each factor after the allowance was made for day-to-day variations of the given factor. As mentioned in the discussion on analysis of covariance for the 1952 data, each analysis—except that for light intensity—consisted of three parts: (a) the comparison of mean rates of water loss for the morning, afternoon, and evening periods after the rates were adjusted to a common level of the given factor; (b) the proportion of the unexplained variability of the unadjusted period means removed by the analysis; and (c) a comparison of rates of water loss adjusted to a common level of the given factor within each of the three periods. The analysis for light intensity included a fourth section in which the trend of rates

of water loss within each period was tested against that of the period mean.

The analysis for air temperature, Table 74A, permits the conclusion that the adjusted mean rates of water loss for each period were sufficiently different as to practically eliminate the possibility of chance variation. This test bears out the interpretation given previously to the results for time of day in the analysis of variance, Table 64. Table 74B indicates that the analysis of covariance removed a large proportion of the variability of the (unadjusted) mean rates of water loss. The figures in Table 74C show that after the rates of water loss within a given period were adjusted to a common air temperature the remaining differences could be attributed to chance. The direction of the influence of air temperature from one day to another time did not differ for the same time of day, although other environmental factors also played a substantial role.

The analysis for vapor pressure deficit, Table 75, affords conclusions similar to those just mentioned for air temperature except that the effects of vapor pressure deficit on rates of water loss within each period were far greater than could be expected by chance alone. These data show that the effect of vapor pressure deficit on rates of water loss was not only different during the morning, afternoon, and evening, but it also varied from day to day. It is obvious that

environmental factors other than vapor pressure deficit exercised a controlling influence over rates of water loss. The analysis for wind movement, Table VI, presents the same conclusions as those for air temperature except that the increase in precision in the analysis of covariates, Table VII, was non-significant. The latter result would indicate that the effects of wind movement on rates of water loss are too variable to reduce the unexplained variations in the mean rate for each period by significant amounts. The analysis for light intensity, Table VI, reveals the same conclusions as those for air temperature; however, as shown in Table VII, the water loss rates within each period followed a trend different from that of the period means, the divergence being highly significant. In this case, the influence of light intensity not only varied from day to day for the same time of day, but the trend was also different from the effect on rates in the three periods. Any effect which this factor might have had was obscured by other environmental factors. The analyses for soil temperature and leaf temperatures, Tables VI and VI, respectively, provide conclusions identical to those for air temperature.

The results of the analyses of covariates permit the inference that none of the six environmental factors which were measured exercised a controlling influence on rates of water loss despite their being highly significant in most instances. Adjustment of rates of water loss

to a common level of a given factor removed a substantial proportion of the unexplained variation. Enough of the latter remained, however, to indicate that other environmental factors were probably of at least equal importance. In the case of vapor pressure deficit, the effect of this factor on rates of water loss differed from one period to the next to a highly significant degree, and with light intensity, the direction of the effect varied as well. The influence of the remaining factors on rates was non-significant, but divergences during the morning, afternoon, and evening periods were readily apparent. To sum up the situation, the analyses of covariance emphasized the interpretations made previously; i. e., the effects of the environmental factors on rates of water loss are interrelated to a rather high degree, and the six factors which were measured did not account for more than a relatively small proportion of the variability in rates at any given time.

V. SUMMARY AND CONCLUSIONS

1. Young rubber-grafted *EIO* mango seedlings and *Tournefortia* mango seedlings grown in closed and open containers under greenhouse conditions showed lower rates of water loss per hour when watered at 14-day intervals than at 10-day intervals over a period of 112 days from August 18 to December 4, 1944.

2. Daily rates of water loss per hour were found to reach a maximum between four and eight days after watering and a minimum between 23 and 27 days after watering.

3. The daily rates of water loss per hour for plants grown in closed containers were generally lower for seedlings than for seedlings, but the reverse was true for plants in open containers.

4. When daily water loss per hour was converted to a unit-leaf-area basis, the rates were found to vary widely from plant to plant.

5. Average rates of water loss per hour were higher as a rule in the afternoon than in the morning and very low in the evening but varied widely from day to day; approximately 40 per cent of the water loss over a 24-hour period occurred in the morning, 30 per cent in the afternoon, and 10 per cent in the evening.

6. The average water losses on a per-plant basis during a typical day (September 17, 1944) shortly after watering were 74.4 gms.

to the morning, 15.8 gms. to the afternoon, and 17.1 gms. in the evening.

7. Multiple regression analyses were run on average loss per hour and three environmental factors--air temperature, vapor pressure deficit, and soil temperature--for the morning, afternoon, and evening periods of 15 days in 1952.

8. The combined influence of air temperature, vapor pressure deficit, and soil temperature on average water loss per hour during the morning, afternoon, and evening periods was found to be highly significant.

9. With certain exceptions, each of the three environmental factors was found to have a highly significant effect on average water loss per hour during these periods.

10. Despite the validity of the previous statements (8 and 9), no one of the three environmental factors was found to have a controlling influence on rates of water loss at any time; in most instances, the factors measured did not account for more than a small proportion of the variability in rates, and a high degree of interrelation existed among the factors.

11. Multiple regression analyses made on samples of mature and juvenile leaves collected from bushy Eucalyptus mangrove trees showed total correlations of .916 and .981 between leaf area and leaf length and width.

12. Curvilinear regression analyses made on samples of mature and juvenile leaves of bearing *Baden* mango trees and of uninjured and malformed leaves of young potted *Turpentine* mango seedlings revealed correlations ranging from .815 to .975 between log leaf area and log leaf length.

13. The water losses of 14 young *Baden* mango seedlings and *Turpentine* mango seedlings, under greenhouse conditions, to 13 treatments, four types of graftings (veneer graft, chip bud, shield bud,¹ seedling check) and four dates of graftings (April 14, May 4, July 4, July 11), were measured during the morning, afternoon, and evening periods of 15 days between August 13 and September 4, 1955; the data on water loss per hour were reduced for purposes of statistical analysis to three days after watering by combining corresponding days to each of four watering intervals.

14. The daily rates of water loss per hour of veneer grafts and chip buds were found to differ by highly significant amounts on a per-plant or a unit-leaf-area basis when dates of graftings were ignored; the rates of shield buds differed from veneer grafts on a per-plant basis and from chip buds on a unit-leaf-area basis.

15. The daily rates of water loss per hour of three types of

¹ May 4 graftings data only.

seedlings and seedling checks differed by highly significant amounts when dates of graftage were ignored.

14. The daily rates of water loss per hour of the four dates of graftage comprised two groups, April 14-May 8 and July 4-July 11, on a per-plant basis but did not differ on the basis of either unit root area or unit leaf area.

15. The daily rates of water loss per hour of all plants on the first day after watering were lower than those on either the second or the third day by highly significant amounts.

16. The rates of water loss per hour over three periods a day of runner grafts and chip beds were found to differ by highly significant amounts on a unit-leaf-area basis when dates of graftage were ignored; the rates of shield beds differed from those of runner grafts on a per-plant basis and from chip beds on a unit-leaf-area basis.

17. The rates of water loss per hour of these types of graftage differed from those of seedling checks by highly significant amounts when dates of graftage were ignored.

18. The rates of water loss per hour of the four dates of graftage comprised two groups, April 14-May 8 and July 4-July 11, on a per-plant basis.

19. The rates of water loss per hour of all plants on the first day after watering differed from those on the second day on a per-plant,

unit-leaf-area-*area*, or unit-leaf-*area* basis but differed from these on the third day only on a per-plant basis.

22. Slightly significant differences were found in the rates of water loss per hour of plants during the morning and afternoon periods as well as of plants in the daytime and the evening.

23. The mean daily loss of water on a per-plant basis was 19.3 gms. and on a unit-leaf-*area* basis, 46.3 gms. Forty-four per cent of the mean daily loss of water occurred in the morning, 41.2 per cent, in the afternoon, and 14.8 per cent, in the evening.

24. Multiple regression analyses were conducted on mean water loss per hour and six environmental factors--air temperature, vapor pressure deficit, wind movement, light intensity, soil temperature, and leaf temperature--for the morning, afternoon, and evening periods of 19 days in 1963.

25. The total correlation coefficients for mean water loss per hour and six environmental factors taken collectively were significant for each of the morning, afternoon, and evening periods.

26. The partial correlation coefficients for mean water loss per hour and one environmental factor while holding the remaining five constant were highly significant for light in the evening period.

27. The simple correlation coefficients for mean water loss per hour with each environmental factor taken separately were highly

significant for soil temperature and leaf temperature in the morning; they were significant for air temperature in the morning and evening, for vapor pressure deficit in the morning, afternoon, and evening, for wind movement in the afternoon, and for leaf temperature in the afternoon.

34. Despite the validity of the previous statements (25, 26, and 27), no one of the six environmental factors was found to have a controlling influence on rates of water loss at any time; in most instances, the factors measured did not account for more than a small proportion of the variability in rates, and a high degree of interrelation existed among the factors.

TABLE I

KEY TO SYMBOLS USED IN TABLES AND FIGURES

D - Dates of graftings (A, B, C, D)

A - April 14

B - May 8

C - July 4

D - July 21

G - Types of grafts (T, C, S, CK)

T - tassel graft (3 replications)

C - chip bud (4 replications)

TC - chip bud (3 replications)

S - shield bud (4 replications)

CK - seedling check (4 replications)

T - Days after watering (1, 2, 3)

F - Times of day (a, b, c)

a - morning

b - afternoon

c - evening

D x G, T x D, etc., are interactions of the appropriate treatments

d.f. = degrees of freedom

n.s. (non-significant) - The variations or differences in the values (facts) being compared are small enough that they are probably the result of sampling errors.

* (significant) - The differences are sufficiently large that there is less than one chance in twenty that they are the result of sampling errors.

** (highly significant) - The differences are sufficiently large that there is less than one chance in 100 that they are the result of sampling errors.

TABLE 1 -- continued

Student's "T" and tabular values for "T" were obtained from Snedecor (1961).

$R_{Y, 123456}$ = Total (multiple) correlation coefficient of dependent variable (Y) and independent variables ($X_1, X_2, X_3, X_4, X_5, X_6$).

$r_{Y1, 123456}$ = partial correlation coefficient of dependent variable (Y) and independent variable (X_1) while holding the remaining independent variables (X_2, X_3, X_4, X_5, X_6) constant.

r_{Y1} = simple (linear) correlation coefficient of dependent variable (Y) and independent variable (X_1).

$b_{Y1, 123456}$ = partial regression coefficient of dependent variable (Y) on independent variable (X_1) while holding the remaining independent variables (X_2, X_3, X_4, X_5, X_6) constant.

$\hat{Y}$ or $\hat{Y}_i$ = expected or predicted values of dependent variable (Y).

$\bar{Y}, \bar{X}_i$ = means of Y and X_i , respectively, found by dividing the corresponding total by the number of items included in it.

j = dates for first watering interval: August 28, 31, 12, 1962.

k = dates for second watering interval: for blocks 1, 2, 3: August 28, 29, 30; for blocks 4, 5, 6: August 29, 30, 31, 1962.

l = dates for third watering interval: for blocks 1, 2, 3: August 28, 29, 30; for blocks 4, 5, 6: August 29, 30, 31, 1962.

m = dates for fourth watering interval: September 2, 4, 5, 1962.

TABLE 1

LEAF AREA (10 DM²) FOR PLANTS USED IN
1961 WATER LOSS EXPERIMENT

Date of Measurement	Leaf Area (10 dm. ²)			
	Plant Number			
	1	2	3	4
Aug. 7 ^a	1.979	1.430	1.350	1.640
Aug. 20	1.979	1.430	1.350	1.640
Sept. 11	1.979	1.430	1.350	1.630
Sept. 20	1.980	1.430	1.340	1.640
Oct. 9	1.980	1.430	1.350	1.630
Oct. 23	1.993	1.430	1.350	1.630
Nov. 6	1.979	1.430	1.350	1.630
Nov. 20	1.979	1.430	1.350	1.630
Dec. 4	1.990	1.430	1.350	1.630

	1	2	3	4
Aug. 7	1.130	1.110	1.000	1.130
Aug. 20	1.130	1.110	1.000	1.160
Sept. 11	1.640	1.130	1.230	1.130
Sept. 20	1.640	1.110	1.200	1.640
Oct. 9	1.640	1.110	1.640	1.100
Oct. 23	1.640	1.070	1.640	1.100
Nov. 6	1.710	1.070	1.640	1.100
Nov. 20	1.640	1.070	1.200	1.000
Dec. 4	1.640	1.070	1.100	1.100

^aValues for each date were calculated from leaf lengths with the following equations: $\log \text{leaf area (cm}^2\text{)} = (2.3708 \log \text{leaf length (cm)} - 1.1281) \times 10^{-3}$ and plotted on semi-logarithmic scale against time (days) to provide for interpolation between dates; dropped leaves were subtracted *pro rata* over the period in which they were lost.

TABLE 3

DATES OF GRAFTAGE, TYPES OF GRAFTAGE, AND NUMBER OF PLANTS STUDIED IN 1963 WATER LOSS EXPERIMENT

Date of Graftage	Type of Graftage	Number of Plants ^a
April 14	Tener graft ^b	4 (8)
	Clay bud ^b	4 (4)
	Seedling check	4 (4)
May 2	Tener graft ^b	4 (8)
	Clay bud ^b	4 (4)
	Shield bud ^b	4 (4)
	Seedling check	4 (4)
July 4	Tener graft ^b	4 (8)
	Clay bud ^b	4 (4)
	Shield bud ^b	2 (2)
	Seedling check	4 (4)
July 11	Tener graft ^b	4 (8)
	Clay bud ^b	4 (4)
	Shield bud ^b	2 (2)
	Seedling check	4 (4) 22 (44)

^aNumbers in parentheses denote plants available for statistical analysis at the conclusion of the experiment Sept. 3, 1963.

^bPrepared by Mr. Roy Nelson, Superintendent, University of Miami Experimental Farm, Richmond, Florida, in accordance with procedures outlined by Lynch and Richard (1961).

TABLE 4

STEM AREAS AND LEAF AREAS OF SIXTY-FOUR PLANTS OF 1989 WATER LOSS EXPERIMENT

Plant No.	Plant Code ^a Designation	Stem Area ^b (cm. ²)	Leaf Area (cm. ²) ^c			
			Aug. 29	Aug. 31	Aug. 29	Sept. 3
35	3-a-Y	1.39	949	949	918	942
36	3-a-Y	1.43	948	948	948	948
63	6-a-Y	2.19	989	989	989	989
66	6-a-Y	1.27	1182	1148	1182	1382
85	8-a-Y	1.74	948	948	948	948
1	1-a-G	1.88	478	478	478	478
34	3-a-G	1.27	881	881	881	881
36	4-a-G	1.27	689	689	689	689
77	8-a-G	1.84	681	681	689	828
14	1-a-Ch	.98	1942	1942	1948	1948
19	2-a-Ch	1.89	1788	1788	1788	1788
39	3-a-Ch	1.84	2394	2343	2177	2114
45	4-a-Ch	.78	2439	2439	2439	2439
68	8-a-Ch	.87	1888	1888	1888	943
48	6-a-Ch	.98	1288	1288	1233	1238
8	1-B-Y	1.34	714	714	714	714
17	2-B-Y	2.11	718	718	718	718
46	3-B-Y	2.04	947	947	947	947
88	4-B-Y	1.94	848	848	848	848
76	6-B-Y	1.43	888	788	828	828
11	1-B-G	2.88	738	738	738	738
29	2-B-G	.99	191	191	191	191
41	3-B-G	8.88	237	237	238	238
49	4-B-G	1.77	798	798	798	798
8	1-B-Ch	.94	1818	1818	1818	1818
14	2-B-Ch	1.89	2271	2271	2271	2271
32	3-B-Ch	.83	1483	1483	1483	1483
82	4-B-Ch	2.78	2478	2468	2461	2871
88	5-B-Ch	1.33	2878	2843	1998	1998
47	6-B-Ch	.92	1867	1867	1867	2814

TABLE 4 -- Continued

Plant No.	Plant Code ^a Designation	Stem Area ^b (cm. ²)	Leaf Area (cm. ²) ^c			
			Aug. 14	Aug. 14	Aug. 20	Sept. 3
4	1-C-Y	1.41	148	148	148	148
38	1-C-Y	2.27	318	318	318	318
46	4-C-Y	1.70	843	876	772	768
87	5-C-Y	1.51	118	273	424	483
89	6-C-Y	1.31	33	317	682	483
14	1-C-C	1.84	142	328	488	448
22	1-C-C	1.41	343	347	348	347
32	1-C-C	1.27	8	8	9	18
23	4-C-C	1.91	347	479	809	874
12	1-C-Cb	1.39	1117	1488	1823	1137
34	1-C-Cb	1.35	769	769	769	769
51	1-C-Cb	.83	746	854	874	812
74	4-C-Cb	1.34	1828	1794	1468	1643
68	1-C-Cb	.73	1131	1141	1241	1191
48	4-C-Cb	1.68	1491	1491	1491	1491
4	1-D-Y	1.38	134	134	148	143
58	1-D-Y	2.49	309	343	488	514
54	1-D-Y	1.41	388	314	388	388
63	4-D-Y	1.43	234	221	238	248
87	1-D-Y	1.44	417	421	411	424
7	1-D-C	2.83	388	388	419	423
14	1-D-C	1.39	389	389	371	411
74	1-D-C	1.48	3	27	143	423
83	4-D-C	1.81	148	384	424	488
3	1-D-Cb	1.84	1448	1484	1847	1841
14	1-D-Cb	2.19	951	958	983	984
17	1-D-Cb	1.48	1581	1518	1579	1579
44	4-D-Cb	1.77	648	648	648	648
41	1-D-Cb	.99	483	483	483	483
44	4-D-Cb	.83	838	817	847	838

TABLE 4 -- Continued

Plant No.	Plant Color Designation	Stem Area ^b (cm^2)	Leaf Area (cm^2) ^a			
			Aug. 28	Aug. 24	Aug. 20	Sept. 5
9	1-B-0	1.84	178	178	178	181
72	3-B-0	1.87	249	249	271	277
81	4-B-0	1.33	718	712	714	714
78	5-B-0	1.84	313	348	388	388

^aBlack cm., date of grafting (A = April 14, B = May 9, C = July 4, D = July 21); type of grafting (F = vascular graft, C = chip bud, Ch = seedling check, S = shield bud).

^bTaken as essentially constant over 15-day experimental periods measured on cloth at nodes on budlings and 18 cm. above soil on seedling checks.

^cCalculated from leaf lengths (mm.) with aid of equations shown in Table 2b; interpolations or extrapolations from the dates shown were made from log leaf area plotted against days for each plant. All leaf area values were multiplied by 10^{-3} (to convert from cm^2 to 10 dm^2), for the analysis of variance so that the water loss data would be in terms of grams per plant, per cm^2 stem area, per 10 dm^2 leaf area.

TABLE 3

DAILY WATER LOSS PER HOOR (GMS.) DURING FOUR 24-HOUR WATERING CYCLES IN 1944 FOR TWO TURPENTINE MANGO SEEDLINGS AND TWO VINER-GRAFTED TILL (ON TURPENTINE) SEEDLINGS GROWN IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date	Days after Watering	Seedlings		Viner Grafts		Differences (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings (1-2)	Viner Grafts (3-4)
I	1	8.77	7.32	4.12	4.18	1.45	1.66
Aug. 18-	2	4.34	4.81	2.64	4.77	1.43	1.97
Sept. 11	3 ^a	4.34	4.81	2.64	4.77	1.43	1.97
	4	8.04	7.14	3.79	4.74	4.25	2.98
	5	4.94	7.81	3.71	4.34	2.87	4.88
	6	3.78	4.79	4.78	6.47	1.00	2.92
	7	2.12	3.64	2.29	2.64	.41	2.71
	8	2.44	2.92	2.48	3.74	1.04	1.67
	9	1.88	2.38	1.88	2.92	.41	1.04
	10 ^a	1.88	2.38	1.88	2.92	.41	1.04
	11	2.88	1.84	2.84	2.92	-.42	.66
	12	2.88	2.84	2.29	2.78	1.46	1.86
	13	1.47	2.29	1.48	2.92	.43	1.66
	14	1.47	1.88	2.88	2.68	.21	0.88
	15	2.88	2.88	2.88	2.92	0.04	.66
	16	1.88	.41	1.84	1.38	-.46	-.14
	17 ^a	1.88	.41	1.84	1.38	-.46	-.14
	18 ^a	-1.41	.41	1.84	1.38	-.46	-.14
	19	1.26	1.98	1.88	2.11	.64	.43
	20	1.26	1.88	1.84	1.84	.42	-.43
	21	.43	.83	1.26	1.46	0.64	.21
	22	1.88	1.47	1.28	.83	.42	-.42
	23	.41	1.84	1.84	.83	1.64	-1.88
	24 ^a	.41	1.84	1.88	.83	1.68	-1.88
	25	.83	.43	1.84	.83	-.41	-.41

TABLE 2.—Continued.

Watering Cycle and Date Watering	Days after Watering	Feedings		Yankee Drafts		Differences (Open-Closed)	
		Closed	Open	Closed	Open	Feedings	Yankee Drafts
		(1)	(2)	(3)	(4)	(5)-(1)	(4)-(2)
I	16	.63	.42	.63	.31	-.31	-.42
Aug. 16-	27	.63	1.39	1.39	.63	.42	-.42
Sept. 11	18	.63	1.64	.82	1.66	.31	1.66
(Cont.)							
II	1	3.53	3.79	3.97	3.64	.42	1.64
Sept. 12-	2	4.80	6.63	4.17	6.73	1.39	1.66
Oct. 9	3 ^d	4.80	6.63	4.17	6.73	1.39	1.66
	4	4.38	7.80	6.43	6.33	1.39	3.71
	5	4.65	8.15	3.43	9.30	1.66	1.66
	6	4.44	8.13	3.43	8.33	1.66	8.71
	7	5.80	8.60	3.79	8.43	-.60	1.67
	8	6.66	7.65	4.17	7.37	1.66	3.13
	9	3.13	4.17	3.79	3.79	1.66	1.66
	10 ^d	3.13	4.17	3.79	3.79	1.66	1.66
	11	3.13	3.37	3.79	3.43	3.16	1.67
	12	3.13	4.77	3.79	6.43	1.66	8.79
	13	2.18	3.37	3.77	3.67	1.17	.66
	14	1.66	1.98	3.39	3.66	.66	.66
	15	1.67	3.93	3.39	3.66	1.33	.31
	16	1.67	3.66	1.98	3.66	.63	-.33
	17 ^d	1.67	3.66	1.98	3.66	.66	.33
	18	1.67	3.66	3.66	3.66	.63	6.66
	19	1.39	1.66	1.66	1.44	.31	-.66
	20	.63	1.66	1.66	1.67	.63	.31
	21	.62	.63	.62	1.66	.31	.62
	22	.63	1.66	1.66	.63	.31	-.41
	23	-.63	.63	.73	.63	3.66	-.41
	24 ^d	.63	.63	.73	.63	6.66	-.41
	25	1.39	1.67	.63	1.66	.42	.63

TABLE 8 -- Continued

Watering Cycle and Date Watering	Days after	Seedlings		Young Grains		Difference (Open-Closed)	
		Closed Open	Grain	Closed Open	Grain	Seedlings	Young Grains
		(1)	(2)	(3)	(4)	(1)-(3)	(2)-(4)
II	26	.83	1.38	.83	1.84	.42	.31
Sept. 12-	27	.42	1.28	1.28	1.84	.83	.42
Oct. 9	28	.48	1.38	.48	1.87	.42	1.28
(Cont.)							
III	1	2.08	2.83	1.48	2.88	0.60	.45
Oct. 18-	2	1.98	1.88	1.48	2.78	-.50	1.28
Nov. 6	3 ^a	1.98	1.88	1.48	2.78	-.50	1.28
	4	2.08	2.88	1.28	2.27	-.42	1.66
	5	3.88	3.33	2.28	8.08	-.22	2.71
	6	4.17	3.78	1.88	4.79	-.42	2.91
	7	8.83	8.83	4.88	7.88	0.88	2.92
	8	4.88	3.78	2.52	4.88	-.83	1.66
	9	2.17	3.78	2.88	8.88	1.88	2.88
	10 ^a	2.17	3.78	2.88	8.88	1.88	2.88
	11	8.88	8.83	4.17	6.67	.83	2.88
	12	2.78	2.84	2.88	8.88	-.22	2.88
	13	2.78	1.84	1.28	2.28	-.82	1.66
	14	2.88	2.92	1.44	3.33	.42	1.87
	15	2.88	2.88	1.48	2.98	-.42	1.66
	16	2.92	4.88	3.82	4.77	1.44	1.77
	17 ^a	2.92	4.88	2.83	4.77	1.66	1.77
	18	1.67	3.92	1.44	3.92	1.28	1.66
	19	2.88	3.78	2.78	3.78	1.67	1.88
	20	2.88	3.88	2.88	3.92	1.48	.82
	21	1.67	3.88	2.78	2.78	1.87	8.88
	22	1.88	2.92	2.78	2.28	1.88	-.41
	23	1.18	2.88	2.88	1.77	1.58	-.72
	24 ^a	1.18	2.88	2.88	1.77	1.58	-.72
	25	1.28	2.88	2.88	2.88	1.28	8.88
	26	.83	2.78	1.67	1.67	1.48	8.88
	27	.83	1.68	1.28	1.28	.98	8.88
	28	1.28	2.27	2.88	2.98	1.92	.28

TABLE 2. — *Continued.*

Weaning Cycle and Date Weaning	Days after Weaning	Seedlings		Young Grains		Differences Seedlings	Young Grains
		Closed	Open	Closed	Open		
		(1)	(2)	(3)	(4)	(3-1)	(4-2)
IV	1	3.79	4.34	3.33	4.34	-.55	1.00
Nov. 7-	2	3.83	3.87	3.80	3.94	-.07	1.44
Dec. 4	3 ^a	3.83	3.87	3.80	3.93	-.07	1.44
	4	4.79	3.64	3.33	3.31	.46	1.00
	5 ^a	4.79	3.60	3.33	3.31	.46	1.00
	6	3.83	3.74	3.30	4.33	-.47	3.30
	7	3.80	3.80	3.44	3.80	-.44	1.36
	8	4.84	3.83	3.79	3.34	-.95	3.30
	9	3.79	3.87	2.84	4.33	-.84	3.80
	10 ^a	3.73	3.87	2.69	4.34	-.96	4.30
	11	4.17	4.17	3.79	3.43	0.40	3.75
	12	3.79	3.80	3.79	3.84	1.33	3.34
	13	3.80	3.33	3.87	4.34	.03	3.75
	14	3.43	3.43	3.34	3.34	1.33	-.03
	15	1.34	3.33	1.44	3.34	.41	1.34
	16	1.83	3.33	1.34	3.79	.03	1.34
	17 ^a	1.83	3.33	1.34	3.79	.03	1.34
	18	3.80	3.33	3.80	4.17	.03	1.83
	19	1.37	3.33	2.80	3.33	1.46	.03
	20	1.83	1.44	1.34	1.47	.50	.43
	21 ^a	1.33	1.44	1.34	1.47	.31	.43
	22	1.47	1.44	3.13	1.80	-.33	.74
	23	.79	1.33	1.80	1.33	.55	.33
	24 ^a	.79	1.33	1.80	1.33	.55	.33
	25	.83	1.37	1.33	1.33	.34	0.33
	26	1.33	3.34	1.44	1.47	.03	.03
	27	1.33	1.33	3.33	1.33	.33	0.33
	28	3.33	1.44	.03	1.47	.63	.03
Average of 4 Cycles	1	3.43	4.43	3.34	4.34	.73	1.30
	2	3.67	4.33	3.73	4.33	.71	1.33
	3	3.67	4.33	3.73	4.33	.71	1.33
	4	4.43	3.44	3.44	3.34	.79	3.17
	5	4.44	3.37	3.37	3.33	.93	1.94

TABLE 2 -- Continued

Watering Cycle and Date Watering	Days after Watering	Seedlings		Younger Grubs		Observations (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings (2-1)	Younger Grubs (2-2)
Average of 4 Cycles (Week.)	6	4.34	3.55	3.55	3.89	.76	3.83
	7	4.34	4.11	3.62	3.15	-.13	3.14
	8	4.11	4.43	3.97	3.14	.32	3.39
	9	3.73	3.87	3.29	4.04	-.64	4.77
	10	3.73	3.87	3.29	4.04	-.64	4.77
	11	3.62	4.14	3.18	3.14	-.46	4.56
	12	3.14	4.22	3.48	3.14	1.64	3.55
	13	3.24	3.73	3.49	3.29	-.46	4.46
	14	3.44	3.63	3.13	3.63	.50	.57
	15	3.63	3.84	1.63	3.73	.31	.99
	16	1.79	3.33	3.00	3.44	.63	.66
	17	1.79	3.33	3.44	3.44	.63	.66
	18	1.71	3.33	1.63	2.63	.63	.66
	19	1.84	3.84	2.44	3.44	1.50	.62
	20	1.33	3.89	1.63	1.93	.76	.34
	21	1.44	1.63	1.33	1.73	.66	.30
	22	1.33	1.79	1.63	1.44	.50	-.13
	23	.74	1.44	1.66	1.11	.76	-.47
	24	.74	1.44	1.80	1.11	.74	-.47
	25	1.44	1.67	1.60	1.35	.63	.66
	26	.77	1.61	1.18	1.13	.63	4.66
	27	.77	1.64	1.38	1.37	.67	.66
	28	.90	1.73	1.13	1.40	.79	.63

*Shade or holiday when no seedlings were taken.

TABLE 4

SALT WATER LOSS PER ROOT (GMS.) DURING EIGHT 14-DAY
WATERING CYCLES IN 1962 FOR TWO TURPENTINE MAJOL
SEEDLINGS AND TWO YEMER-GRAFTED 2LL
(ON TURPENTINE) SEEDLINGS GROWN IN
OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date Watering	Days after Watering	Seedlings		Yemera Grafts		Difference (Open-Closed)	
		Closed Cym	Open Cym	Closed Cym	Open Cym	Seedlings	Yemera Grafts
		(1)	(2)	(3)	(4)	(7-8)	(5-6)
1-6 Aug. 15-27	1	4.12	8.38	2.71	4.38	4.12	2.47
	2	2.42	4.43	2.12	8.79	2.21	3.37
	3 ^a	2.42	4.43	2.12	8.79	2.31	3.37
	4	8.27	2.38	8.84	2.43	2.35	2.35
	5	4.54	4.89	2.24	2.85	1.48	1.47
	6	2.58	4.17	2.60	2.84	.42	.84
	7	2.78	2.92	4.17	4.17	.22	4.58
	8	1.84	1.84	2.25	2.93	8.28	.42
	9	1.87	1.77	2.88	2.88	.28	.28
	10 ^a	1.87	1.77	2.88	2.88	.28	.18
	11	2.28	1.44	2.28	1.88	-.88	-.28
	12	1.25	2.75	2.92	2.22	1.42	.41
	13	1.88	1.88	1.47	.82	8.88	-.86
	14	2.92	2.75	2.92	4.79	.85	1.87
1-6 Aug. 27- Sept. 13	15	4.28	8.84	8.84	8.22	2.44	2.49
	16	1.82	7.92	4.28	4.27	4.44	2.89
	17 ^a	1.22	7.96	4.28	4.27	4.44	2.89
	18 ^a	1.82	7.96	4.28	4.27	4.44	2.89
	19	8.88	18.96	4.82	2.47	8.88	2.18
	20	4.79	8.77	4.84	2.28	2.98	1.41
	21	2.72	4.84	4.88	2.42	2.28	1.82
	22	2.84	2.96	4.88	4.88	.42	.28
	23	1.47	2.88	2.29	2.29	.22	8.28
	24 ^a	1.47	2.88	2.29	2.29	.88	8.88
	25	2.28	1.87	2.72	2.29	-.41	-.44
	26	1.47	1.47	1.44	1.47	8.28	.88
	27	1.88	1.88	2.92	2.88	.42	-.42
	28	1.47	2.92	2.88	4.17	1.22	2.89

TABLE 6 -- Continued

Watering Cycle and Date Watering	Days after Watering	Seedlings		Younger Seedlings		Collarrotted (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings	Younger Seedlings
II-a	1	2.72	3.04	2.54	2.84	2.07	2.00
Sept. 12-22	2	4.20	3.22	4.20	3.24	2.72	2.00
	3 ^a	4.88	3.22	4.40	3.04	2.72	2.00
	4	2.42	12.01	4.07	12.01	2.20	2.94
	5	0.42	0.72	7.07	12.40	2.22	2.11
	6	2.00	2.27	2.04	0.94	4.17	2.42
	7	2.70	2.00	2.94	2.42	1.22	1.44
	8	2.92	2.00	4.70	0.00	2.00	.21
	9	2.20	2.91	2.20	2.91	.42	.41
	10 ^a	2.00	2.91	2.20	2.91	.42	.41
	11	2.22	2.00	2.12	2.00	0.00	= .42
	12	2.00	2.12	2.12	2.00	.12	= .42
	13	1.20	2.12	2.10	1.70	.00	= .40
	14	1.70	2.20	1.12	2.42	.40	1.22
II-a	15	4.17	4.00	2.70	2.00	1.12	1.21
Sept. 24-	16	4.22	0.00	4.70	7.02	2.12	2.12
Oct. 9	17 ^a	4.20	0.00	4.70	7.02	2.12	2.12
	18	4.02	12.41	2.40	12.41	2.00	0.01
	19	0.00	0.70	4.24	0.22	2.72	2.72
	20	2.04	7.00	2.12	1.00	2.04	2.72
	21	2.20	2.22	1.04	2.12	1.02	2.00
	22	2.00	4.00	2.70	0.00	0.00	2.22
	23	2.20	2.92	2.20	4.00	0.00	2.72
	24 ^a	2.20	2.92	2.20	4.00	0.00	1.71
	25	2.00	2.72	2.70	4.12	1.00	.40
	26	1.20	1.07	1.00	2.00	.40	.20
	27	1.00	2.00	2.22	2.70	.40	= .42
	28	1.00	.01	2.70	.01	= .42	-1.07
III-a	1	2.00	2.12	1.40	2.00	1.04	1.00
Oct. 18-22	2	2.20	2.22	1.20	2.70	.24	1.10
	3 ^a	2.20	2.22	1.20	2.70	.24	1.20
	4	2.00	2.12	1.40	2.00	1.04	.42
	5	2.70	0.40	1.00	2.92	1.00	2.04

TABLE 4 -- Continued

Watering Cycle and Date Watering	Days after Watering	Seedlings		Young Grafts		Difference (Days-Grafts)	
		Closed Cyns (3)	Closed Cyns (7)	Closed Cyns (4)	Closed Cyns (5)	Seedlings (3-4)	Young Grafts (5-6)
III-a	6	3.75	3.83	3.80	3.94	2.15	1.46
Oct. 18-23	7	3.83	3.78	3.78	4.44	3.78	3.29
(Cont.)	8	3.78	3.83	3.80	3.80	2.15	2.95
	9	3.78	3.45	3.80	3.44	1.80	2.95
	10 ^a	3.78	3.80	3.80	3.80	1.80	2.90
	11	3.94	4.28	3.53	7.80	3.39	3.77
	12	3.13	3.78	3.85	3.83	.42	3.33
	13	3.83	3.83	.63	3.33	.84	2.78
	14	3.75	4.17	3.39	4.80	1.47	3.39
III-b	18	1.88	3.78	1.46	3.78	.82	3.79
Oct. 26-	19	3.46	7.71	2.78	7.93	3.31	9.23
Nov. 6	17 ^a	3.80	7.71	2.78	7.92	2.51	8.22
	18	2.80	3.94	1.47	4.17	1.44	3.80
	19	4.17	7.33	2.80	7.80	2.91	8.00
	20	4.78	7.33	1.80	7.80	2.44	8.33
	21	3.94	4.44	2.92	3.84	1.80	3.93
	22	4.17	4.80	2.92	3.84	2.80	2.92
	23	3.80	4.80	3.13	4.28	1.14	1.18
	24 ^a	3.44	4.80	3.13	4.28	1.14	1.18
	25	2.78	3.78	3.33	3.13	1.88	- .25
	26	2.80	3.92	3.33	2.80	.62	- .83
	27	1.44	2.80	2.80	2.68	1.84	- .42
	28	3.78	4.88	3.33	4.17	.83	.84
IV-a	1	4.80	4.28	3.78	3.83	1.67	3.13
Nov. 7-28	2	4.28	3.42	3.39	3.31	1.84	3.32
	3 ^a	4.28	3.42	3.39	3.31	1.84	3.82
	4	4.81	3.88	3.92	4.67	2.37	3.78
	5	4.81	3.88	3.92	4.67	2.37	3.78
	6	3.78	3.84	3.80	3.42	1.38	3.84
	7	3.82	4.17	1.38	3.94	1.78	3.78
	8	3.33	3.31	2.88	3.42	1.88	3.44
	9	3.81	4.88	1.67	4.28	1.37	2.42
	10 ^a	2.81	4.88	1.67	4.80	1.37	2.42

TABLE 4 -- Continued

Watering Cycles and Dates Watering	Days after Watering	Seedlings		Tumour Grafts		Difference (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings	Tumour Grafts
		(6)	(7)	(8)	(9)	(7-6)	(9-8)
20-a	11	3.23	4.17	3.48	4.84	1.44	3.85
Nov. 7-18	22	3.89	3.33	3.90	3.33	.43	.43
(Cont.)	23	1.87	3.89	1.47	3.80	.41	1.82
	24	1.22	3.49	1.43	3.49	1.27	.85
27-b	12	2.58	3.33	2.28	3.79	1.26	3.40
Nov. 21-	14	2.19	3.79	2.28	3.39	1.20	2.64
Dec. 4	17 ^a	2.19	3.79	2.28	3.39	1.42	3.44
	18	4.35	4.38	3.68	3.68	1.40	3.68
	19	4.17	4.80	3.88	3.39	2.81	4.79
	20	3.39	3.48	.72	3.33	.32	3.29
	21 ^a	3.39	3.48	.72	3.33	.31	3.29
	22	3.99	3.18	1.11	3.33	.44	3.41
	23	3.87	3.79	.89	4.84	1.11	3.87
	24 ^a	3.87	3.79	.89	4.84	1.11	3.87
	25	3.79	3.79	.43	4.38	1.20	3.68
	26	3.13	4.17	1.87	3.80	1.44	3.33
	27	3.13	4.17	1.38	4.38	1.44	3.13
	28	2.80	3.13	1.54	4.38	.83	3.84
Average of 4 x Cycles	1	3.63	4.87	2.88	5.19	2.34	3.84
	2	3.84	4.99	2.92	5.46	2.31	3.48
	3	3.44	4.99	2.41	5.46	2.31	3.48
	4	4.48	7.18	4.88	7.68	2.78	5.92
	5	4.73	4.78	4.34	4.79	2.33	3.43
	6	4.61	4.84	3.38	4.38	2.62	3.83
	7	3.89	5.33	3.38	4.99	1.42	1.62
	8	2.97	4.48	2.97	4.74	1.81	1.77
	9	3.79	3.84	3.39	3.80	.76	1.81
	10	3.79	3.84	3.39	3.80	.76	1.81
	11	3.92	3.68	2.41	4.12	.72	1.71
	12	3.24	3.87	2.74	3.80	.83	1.84
	13	1.48	3.11	1.84	3.11	.66	.87
	14	3.18	3.19	1.74	3.66	1.84	1.43

TABLE 4 -- Continued

Watering Cycle and Date Watering	Days after Watering	Readings		Yanaro Counts		Differences	
		Closed	Open	Closed	Open	Readings (7-8)	Yanaro Counts (9-11)
Average of 4 h Cycles	13	3.18	3.83	3.38	3.33	1.88	2.15
	14	3.84	4.74	3.34	3.38	3.18	3.33
	17	3.88	4.74	3.34	3.38	3.18	3.33
	18	3.83	7.18	3.34	3.47	3.34	3.43
	19	4.83	8.34	4.83	8.33	3.83	4.37
	20	3.88	4.48	4.18	4.38	2.88	3.15
	21	3.87	4.43	3.48	4.48	2.38	3.33
	22	3.18	4.47	2.78	4.74	1.38	3.34
	23	2.88	3.48	2.18	3.78	.78	1.43
	24	2.34	3.48	2.18	3.78	.78	1.43
	25	2.38	3.38	2.64	3.48	.78	.83
	26	2.34	2.81	2.87	2.81	.47	.72
	27	1.78	2.78	2.88	2.78	.88	.43
	28	2.34	2.87	2.87	2.87	.43	1.18

*Weekdays or holidays when no readings were taken.

TABLE 7

DAILY WATER LOSS PER HOUR PER 10 CM.² LEAF AREA (GMS.)
DURING FOUR 16-DAY WATERING CYCLES IN 1912 FOR TWO
TURPENTINE MANGO SEEDLINGS AND TWO YUCCA-
GRAFTED LEM. (ON TURPENTINE) SEEDLINGS GROWN
IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date Watering	Days after Watering	Seedlings		Yucca Grafts		Difference (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings	Yucca Grafts
		(3)	(1)	(2)	(4)	(3-2)	(4-3)
1	1	1.89	3.81	2.43	3.73	1.74	.30
Aug. 18-	2	2.31	4.41	1.94	3.87	2.38	.91
Sept. 11	3	2.34	4.41	1.96	3.87	2.38	.90
	4	2.48	3.48	2.49	4.56	1.99	1.45
	5	2.41	3.44	2.39	4.56	2.16	2.37
	6	1.93	3.89	2.42	4.83	1.82	1.49
	7	1.66	2.81	1.68	3.81	1.15	1.41
	8	.99	2.38	1.48	3.34	1.33	.81
	9	.99	1.93	1.31	1.74	.91	.48
	10	.99	1.99	1.31	1.96	.91	.48
	11	1.38	1.54	1.48	1.74	.86	.31
	12	1.59	2.81	1.68	3.34	1.71	.66
	13	.89	1.83	1.31	1.74	.94	.48
	14	.89	1.48	1.45	1.33	.41	-.59
	15	1.18	1.64	1.48	1.74	.86	.31
	16	.83	.33	1.14	.93	-.59	-.33
	17	.83	.33	1.14	.93	-.59	-.33
	18	.83	.33	1.18	.93	-.59	-.33
	19	.67	1.81	1.83	1.37	.38	.34
	20	.48	1.49	1.63	.43	.63	-.39
	21	.44	.64	.87	.68	.33	.91
	22	.44	1.33	.87	.88	.47	-.37
	23	.33	1.14	1.31	.88	.94	-.41
	24	.33	1.14	1.31	.88	.94	-.41
	25	.44	.87	.93	.38	-.11	-.38
	26	.33	.33	.44	.13	1.88	-.34
	27	.44	.99	.87	.88	.88	-.37
	28	.44	.83	.36	1.13	.38	.48

TABLE 7 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings		Young Grafts		Difference (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings (3-1)	Young Grafts (4-2)
II Sept. 18- Oct. 9	1	1.46	3.88	1.72	3.31	1.39	.36
	2	2.42	4.76	2.92	3.57	1.52	.68
	3	2.42	4.76	2.92	3.31	1.52	.39
	4	3.34	4.13	3.79	4.74	3.74	.97
	5	2.69	4.71	2.79	3.94	2.24	.19
	6	3.68	4.71	2.79	4.61	2.26	.82
	7	2.83	4.13	2.68	3.87	1.18	.68
	8	2.92	3.82	2.92	3.94	3.92	1.02
	9	1.69	3.41	1.89	1.99	1.72	.18
	10	1.69	3.48	1.89	1.94	1.76	.07
	11	1.68	4.24	2.48	3.88	3.48	.24
	12	1.68	2.94	2.84	2.84	2.28	.08
	13	1.17	3.78	1.44	1.78	1.61	-.16
	14	.82	1.67	1.68	1.29	.88	-.28
	15	.89	2.48	1.68	2.21	1.87	-.28
	16	.88	1.78	1.58	.99	.98	-.28
	17	.88	1.74	1.58	.96	.88	-.48
	18	.88	2.12	1.68	.94	1.34	-.48
	19	.66	1.68	1.82	.67	.68	-.28
	20	.43	1.23	1.82	.76	.88	-.26
	21	.22	.82	.29	.47	.28	.18
	22	.43	.84	.72	.28	.43	-.48
	23	.23	.64	.68	.23	.19	-.48
	24	.73	.82	.68	.23	.19	-.43
	25	.68	1.24	.88	.62	.72	.86
	26	.43	1.68	.68	.64	.87	-.14
	27	.22	1.68	.87	.78	.78	-.99
	28	.43	.99	.28	.49	.86	.48
III Oct. 18- Nov. 4	1	1.87	1.68	1.81	.86	.28	-.18
	2	2.82	1.49	1.81	2.12	.47	.12
	3	1.82	1.49	1.81	2.12	.47	.12
	4	1.28	2.48	.87	.96	.87	.68
	5	1.81	2.48	1.68	2.07	.85	.47

TABLE T -- Continued.

Weaning Cycle and Date Weaning	Days after Weaning	Feedings		Tanner Grafts		Differences (Open-Closed)	
		Closed	Open	Closed	Open	Feedings (1-2)	Tanner Grafts (3-4)
III Oct. 18 - Nov. 4 (Cook.)	6	2.13	2.90	1.31	1.90	.00	.67
	7	2.96	4.43	2.09	3.10	1.67	1.10
	8	2.12	2.90	2.06	1.87	.66	1.16
	9	1.50	2.90	1.70	2.07	1.66	.30
	10	1.50	2.90	1.70	0.87	1.00	.30
	11	2.23	4.43	2.92	2.76	0.10	1.16
	12	1.04	2.01	1.70	2.07	.93	.32
	13	1.04	1.07	.07	.90	.12	.00
	14	1.56	2.52	1.02	1.50	.06	.96
	15	1.20	1.60	1.02	1.21	.40	.19
	16	1.40	2.66	2.11	1.90	2.10	1.10
	17	1.40	0.66	2.11	1.90	0.10	1.10
	18	.03	2.52	1.02	1.23	2.66	.10
	19	1.02	0.90	1.07	1.06	2.96	1.56
	20	1.02	2.02	1.70	1.30	2.00	1.30
	21	.02	2.02	1.09	2.12	2.00	1.77
	22	.02	2.52	1.09	.90	2.01	1.96
	23	.06	1.90	1.70	.75	2.62	1.02
	24	.06	1.90	1.70	.75	2.62	1.00
	25	.40	1.90	1.40	.06	1.66	1.00
	26	.40	1.02	1.17	.00	1.62	1.40
	27	.40	1.02	.07	.02	.93	1.30
	28	.60	2.02	1.70	1.12	1.92	1.02
IV Nov. 7 - Dec. 4	1	1.70	2.66	2.23	1.01	1.00	1.02
	2	1.66	2.91	1.70	1.66	2.07	1.11
	3	1.00	2.91	1.70	1.66	1.07	1.11
	4	2.27	0.97	2.30	2.10	2.60	1.10
	5	0.29	2.97	2.30	2.10	2.60	1.10
	6	1.07	0.90	2.40	1.09	0.09	.66
	7	1.20	1.60	2.02	1.02	.40	.01
	8	2.10	2.16	1.07	2.07	.90	.10
	9	1.70	2.01	2.40	1.09	2.12	.60
	10	1.70	2.01	2.40	1.09	2.12	.66

TABLE 7 — Continued

Watering Cycle and Date	Days after Watering	Seedlings		Young Plants		Differences (Open-Closed)	
		Closed	Open	Closed	Open	(2-1)	(4-3)
IV	11	1.79	2.91	1.48	2.13	1.32	.34
Nov. 7-	12	1.79	2.91	1.89	2.88	2.12	.43
Dec. 4	13	1.38	3.48	1.77	1.41	1.44	.48
(Cont.)	14	1.17	2.92	2.88	.84	1.76	+1.14
	15	.99	1.82	1.82	1.83	.83	.83
	16	.76	2.74	.94	1.12	.99	.38
	17	.76	2.74	.94	1.12	.99	.34
	18	1.28	2.48	1.48	1.72	1.28	.37
	19	.89	2.48	1.78	1.28	1.48	+ .37
	20	.68	2.14	.72	.48	.84	+ .84
	21	.68	1.14	.72	.69	.84	+ .84
	22	.80	1.37	.78	.74	.37	+ .81
	23	.37	1.84	.78	.88	.49	+ .18
	24	.37	1.88	.78	.88	.49	+ .14
	25	.48	1.22	.87	.82	.92	+ .28
	26	.68	1.68	1.82	.49	1.88	+ .33
	27	.68	.99	.87	.42	.84	+ .38
	28	.88	1.19	.88	.49	.88	.11
Average of 6 Cycles	1	1.89	2.84	1.99	2.12	1.48	.14
	2	1.98	2.84	1.91	2.18	1.84	.34
	3	1.98	2.84	1.91	2.34	1.84	.33
	4	2.48	4.38	2.41	2.98	1.98	.87
	5	2.84	4.72	2.84	1.28	2.18	.71
	6	2.18	4.12	2.29	2.12	1.74	.84
	7	2.21	2.31	2.11	2.88	1.18	.44
	8	2.11	2.87	2.84	2.84	1.48	.48
	9	1.79	2.81	1.48	1.92	1.48	.83
	10	1.29	2.41	1.48	1.92	1.48	.32
	11	1.83	2.37	2.32	2.41	1.84	.19
	12	1.62	2.29	1.82	2.42	.77	.68
	13	1.14	2.18	1.32	1.88	1.83	.34
	14	1.82	2.18	1.88	1.19	1.87	+ .21
	15	1.84	1.98	1.27	1.88	.84	.83

TABLE 7 -- Continued

Watering Cycle and Date Watering	Days after	Readings		Yanest Counts		Difference Readings	Yanest Grade
		Closed (1)	Open (2)	Closed (3)	Open (4)	(3-1)	(4-2)
Average of 8 Cycles (Cont.)	18	.96	1.27	1.40	1.28	.97	= .18
	19	.95	1.27	1.40	1.25	.97	= .18
	19	.85	1.21	1.27	1.20	.90	= .27
	19	.79	0.85	1.42	1.23	1.24	= .20
	20	.40	1.27	1.18	.87	.99	= .14
	21	.82	1.29	.90	.79	.77	= .18
	22	.40	1.42	1.27	.82	.82	= .40
	23	.87	1.18	1.18	.60	.80	= .60
	24	.87	1.18	1.18	.40	.81	= .60
	25	.80	1.18	.90	.40	.70	= .80
	26	.44	1.20	.80	.40	.70	= .80
	27	.89	1.00	.87	.60	.89	= .80
	28	.40	1.10	.80	.91	.89	= .11

TABLE 2

DAILY WATER LOSS PER HOUR PER 10 DM.² LEAF AREA (GMS.)
DURING EIGHT 14-DAY WATERING CYCLES IN 1951 FOR TWO
TURPENTINE MANGO SEEDLINGS AND TWO YOUNGER-
GRAFTED BELL (ON TURPENTINE) SEEDLINGS GROWN
IN OPEN- AND CLOSED-TOP CONTAINERS

Watering Cycle and Date	Days after Watering	Seedlings		Younger Grafts		Differences (Open-Closed)	
		Closed (6)	Open (7)	Closed (8)	Open (9)	Seedlings (7-8)	Younger Grafts (9-10)
I-6 Aug. 18-29	1	3.48	4.37	3.34	3.93	.76	.36
	2	3.83	3.83	2.82	3.64	.80	-.56
	3	3.83	3.83	2.83	3.64	.80	-.18
	4	4.66	4.83	4.86	3.96	-.43	-.62
	5	4.37	3.41	4.63	3.64	-.86	-1.17
	6	3.13	2.21	4.38	3.73	-.91	-1.77
	7	3.37	1.88	3.76	1.98	-.84	-1.81
	8	1.64	1.88	2.38	1.26	-.66	-.89
	9	1.37	.94	2.38	1.21	-.43	-1.04
	10	1.27	.96	2.38	1.21	-.43	-1.04
	11	1.38	.78	1.87	.88	-1.66	-.98
	12	1.11	1.64	2.43	1.86	.55	-1.87
	13	1.11	.66	1.88	.38	-.68	-1.11
	14	2.88	1.77	2.63	2.14	-.89	-.35
I-6 Aug. 29- Sept. 11	16	3.82	4.28	8.26	3.87	1.26	+1.37
	16	1.38	4.17	3.86	2.98	2.87	-.88
	17	1.27	4.28	3.86	2.98	2.83	-.88
	18	1.24	4.84	3.86	2.98	2.86	-.88
	19	4.13	3.48	8.87	4.82	.92	+1.38
	20	3.64	4.28	8.44	3.88	.62	-1.94
	21	3.79	3.87	2.98	2.92	.10	-1.63
	22	2.87	1.66	2.98	2.14	-.91	-1.81
	23	1.17	1.18	2.86	1.87	-.62	-.99
	24	1.14	1.14	2.86	1.87	2.86	-.99

TABLE 9 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings		Young Grafts		Subsequent (Open-Grafted)	
		Clipped	Open	Clipped	Open	Seedlings	Young Grafts
		(6)	(7)	(8)	(9)	(7-8)	(8-9)
1-6	26	1.38	.79	2.46	1.87	-.43	-.49
Aug. 29-	26	1.68	.79	1.58	.79	-.10	-.54
Sept. 11	27	.79	.80	2.48	2.27	.92	-.44
(Cont.)	28	1.82	1.24	1.87	1.99	.12	.88
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Dec.	1	2.88	2.44	4.19	3.77	.59	-.62
Sept. 12-16	2	2.71	2.69	4.13	3.71	.58	-.62
	3	2.71	2.69	4.13	3.68	.58	-.68
	4	2.21	4.52	4.19	4.52	1.31	-1.33
	5	2.71	2.64	4.07	4.07	.60	-1.08
	6	2.99	2.84	4.19	3.88	.69	.42
	7	2.88	2.89	2.87	2.24	-.14	-1.32
	8	1.79	2.89	4.32	3.84	.56	-1.54
	9	1.88	1.22	2.88	2.18	-.20	-1.67
	10	1.68	1.22	2.48	2.14	-.18	-1.68
	11	1.68	1.68	2.82	.98	-.43	-1.54
	12	1.28	1.48	2.82	.94	-.18	-1.68
	13	.98	.92	1.94	.48	-.44	-1.28
	14	1.84	.92	.99	.94	-.14	-.88
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Dec.	16	2.81	2.88	3.28	1.62	.62	-1.24
Sept. 16-	16	2.77	2.91	4.32	2.84	.14	-1.68
Oct. 9	17	2.77	2.91	4.32	2.79	.14	-1.22
	18	4.12	4.24	4.88	2.68	.88	-1.24
	19	3.62	2.68	4.12	2.48	.62	-1.88
	20	2.14	2.94	2.88	2.88	.61	-.42
	21	1.88	1.28	1.48	2.18	2.58	.88
	22	1.28	1.78	2.48	1.42	.60	-.61
	23	2.12	1.21	2.84	1.88	-.92	-.78
	24	2.12	4.22	2.84	1.24	-.92	-.48

TABLE 2 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings		Young Grafts		Differences (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings (7-8)	Young Grafts (9-10)
II-b	26	1.51	1.55	2.28	1.28	.04	-0.26
Sept. 26-	26	.75	.47	1.47	.43	-.08	-0.66
Oct. 9	27	1.15	1.53	2.86	.82	+.18	-2.18
(Cont.)	28	.87	.28	2.45	.28	-.03	-0.18
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III-a	1	1.65	1.28	1.51	.74	.25	-.07
Oct. 18-23	2	1.58	1.32	1.22	.86	.17	-.42
	3	1.58	1.32	1.22	.86	.17	-.42
	4	1.68	1.28	1.51	.43	.23	-.47
	5	1.89	2.21	1.49	.84	.32	-.03
	6	1.89	2.29	2.28	1.17	.08	-1.08
	7	2.21	2.97	2.28	1.79	1.28	-1.87
	8	1.89	2.29	2.28	1.86	.28	-.08
	9	1.89	2.21	2.28	1.46	.32	-.62
	10	1.89	2.21	2.28	1.46	.32	-.62
	11	1.97	2.66	2.28	2.28	.87	.12
	12	1.86	1.86	2.28	1.73	-.04	-.02
	13	1.88	1.28	.87	.99	.12	.42
	14	1.54	1.73	2.14	1.28	.58	-.12
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III-b	18	1.13	1.11	1.36	1.11	.02	-.28
Oct. 24-	19	2.23	2.14	2.62	2.28	-.07	-.18
Nov. 4	17	2.23	2.14	2.62	2.28	-.07	-.18
	18	1.86	1.62	1.64	1.23	.12	-.32
	19	2.47	2.59	2.28	2.23	.45	-.12
	20	2.64	2.69	2.24	2.23	.16	-.12
	21	2.24	2.62	2.73	1.73	.29	-1.28
	22	2.64	2.64	2.73	1.73	.68	-1.68
	23	2.88	1.86	2.73	1.27	-.17	-1.88
	24	2.24	1.88	2.73	1.27	-.16	-1.88

TABLE 8 -- Continued

Weaning Cycle and Date Weaning	Days after Weaning	Readings		Tissue Grads		Differences (Open-Closed)	
		Closed	Open	Closed	Open	Readings (2-5)	Tissue Grads (6-8)
III-6	26	1.66	1.54	1.13	.99	+.04	+3.16
Oct. 24-	26	1.67	1.50	1.13	.74	+.27	+3.37
Nov. 6	27	.64	1.83	1.34	.63	-.24	+1.73
(Cont.)	28	1.17	1.89	1.13	1.33	-.21	-1.69
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IV-6	1	1.46	1.64	1.22	1.73	+.12	+.79
Nov. 7-10	2	1.56	1.56	1.66	1.54	+.20	+.83
	3	1.80	1.39	1.66	1.64	+.20	+.31
	4	1.61	1.59	1.73	1.97	-.07	+.74
	5	1.66	1.56	1.73	1.97	-.02	+.74
	6	1.33	1.63	1.54	1.64	+.17	+.38
	7	1.73	1.71	1.17	1.17	+.63	6.99
	8	1.97	1.14	1.54	1.64	+.17	+.38
	9	1.69	1.64	1.66	1.37	+.63	+.39
	10	1.69	1.66	1.66	1.37	+.66	+.39
	11	1.99	1.71	1.54	1.36	+.18	+.38
	12	1.66	1.34	1.34	.99	+.18	+1.36
	13	1.66	.89	1.64	.74	+.14	+.82
	14	.73	1.63	1.34	.79	-.30	+.34
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IV-6	15	1.66	1.39	1.17	1.31	+.14	+.64
Nov. 21-	16	1.36	1.13	1.07	.97	+.10	+.20
Dec. 4	17	1.36	1.13	1.17	.97	+.10	+.20
	18	1.62	1.42	1.54	1.07	+.65	.55
	19	1.21	1.73	1.34	1.14	-.24	+.39
	20	1.38	1.09	.66	.97	+.39	.81
	21	1.38	1.09	.66	.97	+.39	.81
	22	1.64	1.32	1.34	1.04	+.34	1.60
	23	1.61	1.09	.93	1.32	+.62	.22
	24	1.61	1.38	.93	1.04	+.65	.33

TABLE 2 -- Continued

Watering Cycle and Date	Days after Watering	Seedlings		Young Plants		Differences (Open-Closed)	
		Closed Cycle	Open Cycle	Closed Cycle	Open Cycle	(7-6)	(8-6)
IV-4	35	1.43	1.37	.78	1.30	+.52	.82
Nov. 21-	36	1.88	1.76	1.84	1.48	+.36	+.40
Dec. 4	37	1.85	1.74	1.57	1.30	+.27	.13
(Cont.)	38	1.85	1.71	.97	1.30	+.33	.33
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Average of 4 x Cycles	1	2.41	2.47	2.89	2.84	.36	+.53
	2	2.38	2.44	2.84	2.78	.32	+.50
	3	2.39	2.44	2.84	2.74	.32	+.49
	4	2.99	3.18	3.99	3.81	.38	+.89
	5	2.66	2.67	3.94	3.79	+.15	+.81
	6	2.84	2.43	2.97	2.34	.67	+.63
	7	2.32	2.34	2.97	1.99	.62	+.38
	8	2.82	1.91	2.69	1.67	.89	+.84
	9	2.48	1.81	2.68	1.82	+.86	+.66
	10	1.44	1.81	2.68	1.31	+.35	+.57
	11	2.81	1.83	2.18	1.34	+.88	+.82
	12	2.36	1.38	2.81	1.22	+.81	+.89
	13	2.83	.91	1.48	.73	+.75	+.70
	14	1.43	1.41	1.78	1.21	+.57	+.67
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Average of 4 x Cycles	15	1.96	2.23	2.79	1.98	.81	+.81
	16	2.41	2.67	2.97	2.38	.66	+.71
	17	2.69	2.69	2.97	2.97	.00	+.72
	18	2.27	2.54	2.64	2.73	.09	+.58
	19	2.54	2.69	2.67	2.98	.33	+.72
	20	2.81	2.83	2.67	2.38	.31	+.62
	21	1.98	2.84	2.24	1.84	.42	+.70
	22	1.97	1.91	2.84	1.63	+.86	+.91
	23	1.74	1.44	1.97	1.24	+.74	+.73
	24	1.73	1.44	1.97	1.24	+.73	+.73

TABLE 4 -- Continued

Watering Cycle and Date Watering	Days after Watering	Seedlings		Young Grafts		Differences (Open-Closed)	
		Closed	Open	Closed	Open	Seedlings	Young Grafts
		(5)	(7)	(8)	(9)	(7-8)	(9-1)
Average of	25	1.53	1.36	2.63	1.19	- .16	-1.56
4 1/2 Cycles	26	1.38	1.87	1.93	.91	- .55	-1.51
(Cont.)	27	1.17	1.54	2.27	.98	- .80	-1.31
	28	1.46	1.47	2.28	1.18	- .71	-1.52

TABLE 9

AVERAGE DAILY VALUES FOR AIR TEMPERATURE, VAPOR PRESSURE DEFICIT, AND SOIL TEMPERATURE DURING FOUR 20-DAY WATERING CYCLES IN 1952

Watering Cycle	Days after Watering	Date 1952	Air Temp. ($^{\circ}$ C.)	V. P. D. (mm. Hg)	Soil Temp. ($^{\circ}$ C.)
I	1	Aug. 16	26.1	7.45	26.6
	2	16	29.2	6.46	27.4
	3 ^a	17	29.1	6.45	27.4
	4	18	26.6	7.43	26.6
	5	19	22.5	12.94	26.7
	6	20	23.6	9.43	26.4
	7	21	21.7	7.49	26.9
	8	22	20.6	5.89	26.1
	9	23	22.6	7.42	26.6
	10 ^b	24	22.6	7.42	26.6
	11	25	29.6	4.47	27.9
	12	26	30.3	4.48	28.4
	13	27	30.2	10.27	21.1
	14	28	31.6	8.53	26.7
	15	29	33.6	12.46	21.6
	16	30	32.4	10.11	29.1
	17 ^b	31	32.4	10.11	29.1
	18 ^b	Sept. 1	32.4	10.11	29.1
	19	2	25.2	14.34	21.4
	20	3	22.6	10.36	20.5
	21	4	21.1	7.38	26.4
	22	5	22.6	9.61	21.6
	23	6	23.6	6.87	27.1
	24 ^b	7	26.6	6.87	27.1
	25	8	24.7	4.98	29.6
	26	9	27.1	2.61	24.7
	27	10	26.9	4.61	27.9
	28	11	26.6	6.47	24.1

TABLE 3 -- Continued

Watering Cycle	Days after Watering	Date 1961	Air Temp. (° C.)	T. P. D. (mm. Hg)	Soil Temp. (° C.)
II	1	Sept. 12	30.0	7.39	29.1
	2	13	30.4	8.19	27.8
	3 ^h	14	30.4	8.29	27.8
	4	15	30.4	9.11	28.8
	5	16	31.1	9.34	28.4
	6	17	31.4	10.89	29.8
	7	18	29.8	8.38	27.1
	8	19	30.8	7.88	28.2
	9	20	28.9	1.44	23.7
	10 ^h	21	28.9	1.44	23.7
	11	22	30.8	4.19	25.1
	12	23	31.4	4.13	24.8
	13	24	30.8	4.89	28.4
	14	25	30.9	4.17	24.7
	15	26	28.7	8.99	27.7
	16	27	30.4	9.44	24.8
	17 ^h	28	30.4	9.44	24.8
	18	29	31.2	4.84	29.4
	19	30	29.4	2.89	27.8
	20	Oct. 1	28.2	8.99	27.7
	21	2	26.8	1.83	24.4
	22	3	27.4	8.83	28.4
	23	4	26.9	2.88	23.8
	24 ^h	5	26.9	2.88	23.8
	25	6	28.8	4.17	27.4
	26	7	27.4	2.30	24.7
	27	8	28.7	4.21	27.8
	28	9	28.1	1.88	24.4

TABLE 9 -- Continued

Watering Cycle	Days after Watering	Date 1951	Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
II	1	Oct. 28	24.4	5.75	22.4
	2	31	24.4	4.44	22.2
	3 ^a	12	22.4	4.44	22.2
	4	13	23.1	2.77	22.0
	5	14	22.4	3.08	22.2
	6	15	27.4	2.29	22.5
	7	16	29.1	5.75	24.2
	8	17	29.4	4.99	23.9
	9	18	27.0	2.11	23.5
	10 ^b	19	27.2	2.21	23.5
	11	20	27.9	2.95	23.4
	12	21	28.4	2.28	24.2
	13	22	23.4	2.43	23.0
	14	23	24.4	2.82	24.1
	15	24	22.7	1.24	23.3
	16	25	27.3	2.49	23.9
	17 ^b	26	27.3	2.49	23.9
	18	27	29.2	2.97	23.2
	19	28	22.1	4.24	22.0
	20	29	22.2	2.21	19.9
	21	30	24.0	4.60	20.0
	22	31	24.3	2.60	22.4
	23	Nov. 1	24.2	4.60	21.0
	24 ^b	2	24.2	4.60	21.0
	25	3	22.9	2.76	22.2
	26	4	22.0	5.22	21.7
	27	5	24.2	2.18	23.1
	28	6	22.7	4.22	22.0

TABLE 9 -- *Continued*

Watering Cycle	Days after Watering	Date 1983	Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
IV	1	Nov. 7	24.8	3.34	21.1
	2	8	25.8	3.34	19.1
	3 ^a	9	26.5	3.34	19.1
	4	10	27.2	3.43	22.2
	5	11	27.3	3.43	22.2
	6	12	28.3	3.18	22.3
	7	13	28.3	2.42	20.7
	8	14	28.3	2.76	22.2
	9	15	26.9	2.36	19.8
	10 ^b	16	26.9	2.36	19.8
	11	17	26.8	4.31	21.1
	12	18	26.6	4.47	21.2
	13	19	26.1	3.44	21.1
	14	20	21.3	1.82	19.0
	15	21	20.8	2.44	14.8
	16	22	21.6	1.96	14.6
	17 ^b	23	21.6	1.96	14.4
	18	24	22.6	4.29	19.3
	19	25	23.2	3.77	24.0
	20	26	22.9	4.87	18.3
	21 ^b	27	22.9	4.87	20.3
	22	28	24.3	3.47	20.9
	23	29	23.2	3.91	18.8
	24 ^b	30	23.8	3.01	18.8
	25	Dec. 1	20.1	3.30	18.4
	26	2	22.9	4.35	19.9
	27	3	22.0	3.38	17.9
	28	4	22.9	1.94	19.3

TABLE 7 -- Continued

Watering Cycle	Days after Watering	Date 1962	Air Temp. (° C.)	V. P. D. (mm. Hg)	Soil Temp. (° C.)
Average of 4 Cycles	1		27.9	4.19	28.7
	2		26.4	3.20	24.4
	3		26.4	3.29	24.4
	4		29.1	4.34	26.3
	5		29.5	7.95	29.1
	6		29.4	4.52	27.5
	7		29.4	3.49	26.4
	8		28.3	4.93	24.4
	9		27.5	3.38	23.5
	10		27.5	3.56	23.5
	11		27.9	4.48	24.2
	12		27.9	3.49	24.6
	13		28.1	3.75	23.9
	14		27.1	4.29	26.1
	15		26.9	3.47	24.9
	16		27.9	4.34	23.5
	17		27.9	4.34	23.5
	18		27.9	3.15	23.2
	19		27.5	3.24	23.4
	20		28.7	3.94	24.6
	21		26.2	4.19	24.6
	22		26.2	4.55	23.1
	23		26.2	4.23	23.7
	24		26.2	4.23	22.7
	25		26.1	4.69	24.5
	26		23.5	3.88	23.5
	27		24.6	3.17	23.7
	28		29.4	3.55	23.4

^aSince the number of hours per period and per day varied, the average daily values were obtained by multiplying each of the figures for the morning, afternoon, and evening periods by the number of hours in each period and adding by the number of hours in the day. For example, the air temperature for Aug. 21 was $(28.3 \times 4) + (24 \times 3) + (26.5 \times 17) / 24 = 24.7$ and on Aug. 23, $(21.5 \times 3.5) + (22.2 \times 45.5) / 49 = 22.1$.

^bWeekdays or holidays when no readings were taken; the figures presented have been calculated as for Aug. 15 in the above example.

200 RESISTANCE FORMS OF NYLON 666. HOSTILE BLOCKS ACCORDING
 DIVIDED FOR 24-DAY WATERING CYCLES IN 1952

TABLE 18

Watering Cycle	Days after watering	Date 1952	Plant Number			
			1		2	
1			Top	Bottom	Top	Bottom
			Top	Bottom	Top	Bottom
I	3	Aug. 16	R. 1031	L. 0000	L. 1702	L. 0000
	11	20	L. 1010	L. 0471	L. 2506	L. 0000
	14	20	L. 1031	L. 1021	L. 0071	L. 1701
	19	Sept. 8	L. 0021	L. 0001	L. 2010	L. 1010
	21	4	L. 0000	L. 0032	L. 0071	L. 0001
	23	6	L. 1010	L. 1031	L. 0000	L. 0031
	26	9	L. 1001	L. 0000	L. 0000	L. 0000
	27	10	L. 1001	L. 1702	L. 1702	L. 1000
	28	11	L. 1001	L. 1701	L. 0071	L. 1702
II	1	12	L. 0000	L. 1010	L. 0000	L. 0031
	4	16	L. 0000	L. 1010	L. 0071	L. 0000
	6	17	L. 0071	L. 1010	L. 0000	L. 0000
	8	17	L. 1010	L. 0000	L. 0071	L. 0000
	11	20	L. 0071	L. 1702	L. 0071	L. 0001
	13	24	L. 1702	L. 1010	L. 0000	L. 1021
	15	26	L. 0000	L. 1010	L. 0071	L. 0001
	16	27	L. 0071	L. 1702	L. 1010	L. 1010
	18	1	L. 0021	L. 0000	L. 0000	L. 1020
	21	4	L. 0031	L. 0000	L. 0031	L. 1702
	23	6	L. 0000	L. 1001	L. 0071	L. 0000
	26	9	L. 0000	L. 1001	L. 0071	L. 0000
	27	10	L. 1702	L. 1001	L. 0000	L. 0000

TABLE 18 -- Continued

Weathering Cycle	Days after Weathering	Date 1962	1		2		3	
			Top	Bottom	Top	Bottom	Top	Bottom
EI	1	Oct. 10	0	0	0	0	0	0
	4	12	0	0	0	0	0	2, 4771
	6	15	0	0	0	0	0	2, 4771
	9	17	2, 3810	2, 3810	2, 4771	2, 4771	0	2, 4771
	11	20	2, 7844	2, 4820	2, 4771	2, 4771	1, 4770	2, 4771
	12	22	2, 7762	2, 1762	2, 4771	2, 4771	2, 7762	2, 4771
	14	25	4, 4771	2, 3542	2, 1762	2, 4771	4, 3542	2, 7762
	16	27	4, 7762	4, 3232	2, 4771	2, 4771	2, 4771	2, 7762
	18	29	0, 0000	4, 4771	2, 1762	2, 1762	2, 4771	2, 7762
	22	31	2, 1000	4, 4021	2, 1000	2, 4771	4, 3542	4, 3542
	25	Nov. 3	4, 4771	4, 0000	4, 7762	4, 4771	4, 4021	4, 3542
	27	5	4, 4771	4, 4762	4, 0000	4, 3542	4, 3542	4, 4771
TF	1	7	0	0	0	0	0	0
	4	10	0	0	0	0	0	0
	6	12	2, 3810	2, 3810	0	0	0	0
	9	15	2, 4020	2, 4771	2, 1000	2, 4771	2, 4000	2, 4771
	13	19	2, 1421	2, 0000	2, 3000	2, 4021	2, 3810	2, 4000
	15	21	4, 4762	2, 3811	2, 4021	2, 4000	2, 4021	2, 4000
	18	24	4, 4771	4, 4014	2, 4000	2, 4021	2, 4000	2, 4000
	19	25	4, 4042	4, 3810	2, 4021	2, 4000	2, 4021	4, 3760

TABLE 10 -- Continued

Watering Cycle	Days after Watering	Date 1953	1		2		3	
			Top ^a	Bottom	Top	Bottom	Top	Bottom
IV	20	26	8.1139	4.4770	5.4070	3.1743	4.1139	3.8949
(Cont.)	21	28	8.2044	4.5033	5.4090	3.4071	4.3649	4.8752
	25	Dec.	8.4181	4.8034	4.2819	3.7382	4.4621	5.4150
	27		8.4071	4.8009	4.3810	3.7843	4.4601	4.8756

^a"Top" and "Bottom" refer to location of soil moisture measurement blocks in each container, one being two inches below the soil surface and the other ten inches above the bottom.

^bOver the two upper thirds of the instrument scale so that the actual values were unknown.

TABLE 12

AIR TEMPERATURE, VAPOR PRESSURE DEFICIT, SOIL TEMPERATURE, AND WATER LOSS PER ROOT FOR THE MORNING PERIOD OF SEVENTY-THREE DAYS DURING 1942^a

Watering Cycle	Date	Water Loss/ Hr. (gms.) (W_r)	Air Temp. (°C.) (T_a)	V. P. D. (mm. Hg) (D_g)	Soil Temp. (°C.) (T_g)
	Aug. 18	11.78	26.8	7.8	25.8
I	18	17.91	23.8	10.8	25.4
	19	15.88	21.4	11.8	25.1
	20	12.48	23.4	12.1	27.7
	21	20.47	22.4	9.8	29.7
	22	8.12	20.1	6.7	28.8
	23	7.88	21.4	6.8	28.7
	24	12.97	21.4	8.7	29.4
	27	4.86	21.2	11.8	29.2
	28	4.74	21.8	7.8	29.4
	29	11.84	22.1	8.8	26.2
	Sept. 1	12.81	22.8	12.8	26.1
	2	12.82	22.1	10.4	28.8
	4	7.84	22.2	8.7	28.2
	5	8.44	22.1	10.8	28.3
	6	8.21	20.4	7.8	28.7
	7	4.28	22.8	6.4	28.7
	10	8.88	22.2	7.8	27.2
	11	.78	22.1	8.4	24.4
II	12	11.28	21.2	7.8	26.4
	13	25.82	21.1	10.8	27.8
	14	22.97	20.2	9.7	27.1
	17	25.84	20.7	10.1	27.8
	18	12.91	20.2	7.1	27.8

TABLE 11. — Continued.

Watering Cycle	Date	Water Loss/ Ev. (gms.) (T)	Air Temp. (° C.) (D ₁)	V. P. D. (mm. Hg) (D ₂)	Soil Temp. (° C.) (D ₃)
II (Cont.)	Sept. 17	18.13	21.4	7.2	26.1
	28	9.37	21.1	7.3	26.9
	29	9.49	21.4	7.3	27.7
	30	7.95	20.8	8.3	27.8
	31	7.66	21.9	7.8	27.9
	Oct. 1	8.49	21.3	8.9	28.6
	2	17.97	21.6	8.8	27.8
	3	16.99	22.3	8.9	28.3
	4	21.87	21.8	6.9	27.1
	5	8.58	26.9	6.5	26.8
	6	7.17	26.8	6.5	26.8
	7	9.84	27.8	8.5	28.7
	8	1.73	26.3	7.8	23.9
	9	8.28	27.8	8.5	26.3
	10	6.87	28.9	3.8	23.3
	11	6.87	26.9	2.6	23.8
	12	12.13	26.3	3.8	28.4
	13	13.89	27.1	3.9	28.1
	14	18.34	27.8	6.3	26.7
	15	9.87	28.4	8.8	24.8
III	16	17.83	28.7	8.4	28.7
	17	16.74	25.8	3.8	26.8
	18	8.47	28.1	1.7	22.8
	19	7.66	28.8	3.4	22.8
	20	6.73	26.3	1.7	23.1
	21	28.16	27.1	3.1	23.4
	22	22.80	26.8	3.9	28.8
	23	23.44	23.3	6.3	20.2
	24	23.87	23.4	6.8	17.6

TABLE II -- *Continued*

Watering Cycle	Date	Water Loss, ¹ Gr. (gms.) (°)	Air Temp. (° C.) (°C _a)	T. P. D. (mm. Hg) (°C _d)	Soil Temp. (° C.) (°C _s)
III (Cont.)	Mon.	3	24.78	24.8	24.3
		4	24.14	23.8	24.7
		8	24.37	23.4	24.9
		4	24.22	24.7	24.4
IV		7	23.44	23.4	23.8
		12	23.44	23.7	23.9
		13	23.44	23.7	23.8
		14	23.44	23.8	23.7
		17	22.34	23.4	23.2
		18	21.28	23.1	23.3
		19	21.77	23.4	23.1
		20	21.77	23.9	23.9
		22	21.83	23.2	23.4
		24	21.78	23.4	23.7
		26	21.40	23.9	23.4
		28	21.00	23.6	23.3
		30	21.00	23.6	23.3
		31	21.04	23.4	23.1
		3	21.03	23.4	23.3
		4	21.03	23.4	23.3
V		8	21.94	23.7	23.7

¹Air temperatures are averages of two thermometers and two thermographs; vapor pressure deficits are calculated values from two dry bulb-wet bulb installations; soil temperatures are averages of six soil thermometers; and water losses per hour are averages of eight plants.

²Vertical lines mark the boundaries of watering cycles.

TABLE 11

AIR TEMPERATURE, VAPOR PRESSURE DEFICITS, SOIL TEMPERATURES, AND WATER LOSSES PER HOUR FOR THE AFTERNOON PERIODS OF SEVENTY-THREE DAYS DURING 1931^a

Watering Cycle	Date	Water Loss/ Hr. (gms.) ($\bar{W}$)	Air Temp. (° C.) ($\bar{T}_a$)	V. P. D. (mm. Hg) ($\bar{D}_a$)	Soil Temp. (° C.) ($\bar{T}_s$)
	Aug. 15	15.55	30.3	9.5	25.5
I	16	17.55	31.5	12.5	24.4
	17	22.55	33.1	15.3	25.5
	18	17.55	33.7	12.4	26.3
	21	13.75	34.9	14.1	26.1
	22	4.55	35.9	3.5	26.2
	24	—	36.9	5.5	26.3
	25	3.12	35.3	11.3	25.7
	27	5.35	34.9	14.5	26.7
	28	11.54	36.3	15.5	26.1
	29	14.57	36.4	15.5	26.7
	Sept. 2	15.35	36.5	15.4	26.4
	3	12.55	35.4	17.4	26.5
	4	9.37	36.5	5.2	26.2
	5	9.37	34.9	11.1	25.5
	6	3.96	34.9	6.5	25.5
	9	1.25	29.4	4.2	25.3
	10	3.54	33.5	11.5	25.5
	11	7.27	29.4	4.4	27.1
II	13	13.94	32.5	9.5	26.4
	15	27.77	34.3	15.5	25.4
	16	24.77	34.4	14.4	23.3
	17	23.94	34.4	17.3	25.3
	18	12.55	35.4	5.5	25.5

TABLE 12 -- Continued

Watering Cycle	Date	Water Loss/ (Hr. (gm.) (T)	Air Temp. (° C.) (T _a)	T. P. G. (mm. Hg) (T _g)	Soil Temp. (° C.) (T _g)	
II (Cont.)	Sept.	25	16. 67	54. 8	13. 1	23. 3
		26	16. 43	53. 8	13. 4	20. 9
		27	12. 68	54. 7	14. 3	22. 8
		28	8. 12	52. 1	9. 6	20. 4
		29	8. 43	51. 3	8. 8	19. 7
		30	12. 39	52. 1	10. 1	20. 4
		31	13. 92	54. 6	13. 4	22. 7
		32	4. 87	53. 6	11. 1	22. 4
	Oct.	1	8. 84	52. 3	11. 8	21. 7
		2	2. 53	53. 6	3. 8	24. 8
		3	4. 64	50. 8	7. 7	20. 8
		4	4. 18	52. 3	11. 4	20. 4
		5	7. 39	53. 3	8. 9	21. 8
		6	2. 78	52. 4	8. 8	20. 8
III		10	8. 43	51. 6	4. 8	24. 8
		12	6. 87	53. 8	3. 3	28. 8
		14	11. 87	54. 6	4. 3	28. 8
		16	11. 46	50. 8	5. 8	28. 8
		18	20. 42	53. 9	12. 6	29. 3
		17	18. 12	51. 6	9. 6	24. 8
		20	16. 88	50. 8	6. 7	23. 1
		21	13. 12	51. 6	8. 8	24. 6
		22	6. 87	54. 7	4. 8	23. 7
		23	12. 88	55. 8	4. 8	25. 1
		24	6. 28	57. 3	3. 8	24. 4
		25	8. 83	57. 6	3. 6	28. 3
		26	14. 77	58. 8	7. 9	28. 4
		27	13. 84	58. 8	9. 1	23. 8
		28	8. 12	57. 4	8. 8	23. 9

TABLE II -- Continued

Watering Cycle	Date	Water Loss/ Hr. (gms.) (T)	Air Temp. (° C.) (X ₂)	V. P. E. (mm. Hg) (X ₃)	Soil Temp. (° C.) (X ₅)
III (Cont.)	Nov. 3	8.56	29.8	9.3	24.6
	4	8.83	29.1	9.4	24.2
	5	7.29	28.7	10.6	27.1
	6	12.83	29.4	10.9	26.6
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IV	7	12.29	28.6	9.6	24.2
	12	12.86	28.1	8.8	24.8
	13	9.27	26.6	6.9	21.9
	14	12.71	28.1	8.8	24.9
	17	28.21	27.8	6.9	23.6
	18	12.63	27.6	9.6	24.3
	19	7.83	28.6	7.1	23.6
	20	6.86	26.9	3.7	22.2
	21	9.27	23.6	4.3	18.6
	24	7.29	26.3	6.7	21.7
	28	14.42	27.3	7.8	23.1
	29	9.27	26.3	6.7	20.6
	Dec. 1	8.83	26.6	8.6	21.3
	2	6.86	26.3	6.8	21.6
	4	3.76	26.8	8.6	23.6
<hr/>					
	8	7.86	27.6	6.1	20.7

*Air temperatures are averages of two thermometers and two thermographs; vapor pressure deficits are calculated values from two dry bulb-wet bulb installations; soil temperatures are averages of six soil thermometers; and water losses per hour are averages of eight plants.

^bHorizontal lines mark the boundaries of watering cycles.

TABLE 13

AIR TEMPERATURES, VAPOR PRESSURE DEFICITS, SOIL TEMPERATURES, AND WATER LOSSES PER HOUR FOR THE EVENING PERIOD OF SEVENTY-THREE DAYS DURING 1932^a

Watering Cycle	Date	Water Loss/ Hr. [gms.] (T)	Air Temp. (° C.) (T_1)	V. P. D. (mm. Hg.) (D_2)	Soil Temp. (° C.) (T_2)
	Aug. 18	2.72	26.5	5.6	26.5
I	19	.56	29.0	5.6	29.4
	19	1.22	26.1	13.2	26.5
	20	.34	21.4	6.5	21.2
	20	.66	26.6	4.2	26.5
	20	.77	27.9	5.0	27.5
	20	.46	26.0	3.0	27.5
	24	.34	27.4	6.5	26.4
	27	0.85	21.9	9.1	20.0
	28	.31	21.4	7.6	20.2
	29	.76	23.3	12.6	21.0
	Sept. 2	.88	22.4	14.0	20.0
	3	.74	22.1	9.9	20.0
	4	.34	20.3	4.3	20.0
	5	.13	20.0	7.4	20.0
	5	.14	27.0	4.3	27.1
	9	.33	24.3	3.4	24.3
	10	.18	26.3	6.9	25.3
	11	1.35	25.1	3.4	25.5
II	12	.85	26.0	4.0	26.5
	13	.81	29.5	3.0	28.4
	14	1.77	26.7	8.2	23.3
	17	1.87	21.3	11.4	25.6
	18	1.87	20.4	4.5	26.7

TABLE 13 -- Continued

Watering Cycle	Date	Water Loss, Hr. (gms.) (T)	Air Temp. (° C.) (X ₁)	T. P. D. (mm. Hg) (X ₂)	Soil Temp. (° C.) (X ₃)
II (Cook.)	Sept. 29	.18	28.1	3.1	28.9
	30	.37	28.3	3.2	27.9
	31	.33	28.5	3.4	28.7
	Oct. 1	.30	28.1	3.9	28.4
	2	.48	28.9	3.3	28.3
	3	.43	28.3	3.2	27.7
	4	.77	28.4	3.1	28.6
	5	.64	28.3	3.9	27.3
	6	.39	28.2	4.4	27.2
	7	.37	28.1	3.4	28.1
	8	.48	27.8	4.7	28.3
	9	4.68	28.4	4.8	28.7
	10	.18	27.6	3.3	28.1
	11	.67	28.0	4.4	28.5
	12	.36	28.4	3.4	28.3
	13	.37	28.3	3.6	28.3
III	14	.38	28.5	3.4	28.6
	15	.18	28.6	3.6	28.6
	16	.37	28.4	4.4	28.4
	17	.48	27.9	4.3	28.6
	18	.78	27.4	3.1	28.2
	19	.48	28.6	3.4	28.6
	20	.31	28.3	3.6	28.1
	21	.38	28.3	3.4	28.2
	22	.48	28.3	.6	28.1
	23	.38	28.5	1.4	28.6
	24	.37	28.6	3.6	28.3
	25	.37	28.4	4.8	28.2
	26	.42	28.4	3.9	28.6

TABLE 13 -- Continued

Watering Cycle	Date	Water Loss/ hr. (gms.) (%)	Air Temp. (° C.) (° F.)	P. P. D. (mm. Hg) (C_2)	Soil Temp. (° C.) (° F.)
III {Cont. }	Nov. 3	.11	18.1	4.9	12.9
	4	.34	14.9	9.9	12.3
	5	.37	12.1	4.3	12.2
	6	1.21	19.2	9.9	12.2
IV	7	.64	13.9	4.4	10.9
	12	1.18	14.4	2.9	12.9
	13	.79	14.2	2.4	10.7
	14	.37	14.9	2.2	12.9
	17	.66	14.4	4.2	11.1
	18	.32	13.7	3.6	10.7
	19	.33	13.3	2.4	11.2
	20	.76	13.1	1.7	10.3
	21	.88	15.9	1.4	13.9
	24	.29	12.9	2.4	17.4
	25	.32	12.3	2.4	17.9
	26	1.62	15.9	4.9	11.3
	Dec. 1	.32	10.9	3.9	14.2
	2	.33	11.1	2.4	10.9
	4	.57	10.7	1.9	10.7
		.29	12.17	2.9	11.9

*Air temperatures are averages of two thermometers and two thermographs; vapor pressure deficits are calculated values from two dry bulb-wet bulb installations; soil temperatures are averages of six soil thermometers; and water losses per hour are averages of eight plants.

^bHorizontal lines mark the boundaries of watering cycles.

TABLE 14

SUMMARY OF CORRELATION COEFFICIENTS, MEANS, PARTIAL REGRESSION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATIONS FOR MORNING, AFTERNOON, EVENING, AND TOTAL PERIODS, OVER SEVENTY-THREE DAYS IN 1961^a

Variable		Morning	Afternoon	Evening	Total Periods ^b
<u>Correlation Coefficients</u>					
Total:	$R_{p,123}$	.929544	.921544	.959144	.916644
Partial:	$r_{p1,23}$	.1263	.1859	.0467	.0883
	$r_{p2,13}$	.3683	.2935	.3479	.346644
	$r_{p3,12}$	.76144	.8775	.8943	.83344
Simple:	r_{p1}	.321344	.619344	.801444	.52744
	r_{p2}	.421344	.579144	.581844	.452444
	r_{p3}	.329344	.316344	.3587	.381344
<u>Means</u>					
$\bar{X}_1$ (Air temp., °C.)		26.1	26.8	27.1	26.8
$\bar{X}_2$ (V. P. D., mm. Hg)		6.4	5.4	4.7	6.7
$\bar{X}_3$ (Soil temp., °C.)		24.4	26.7	28.1	24.8
$\bar{Y}$ (Water loss/hr., gms.)		19.12	20.54	.92	7.49
<u>Partial Regression Coefficients</u>					
$b_{p1,23}$		.7545	1.5639	.0263	.3464
$b_{p2,13}$		.4811	.8701	.8747	.6396
$b_{p3,12}$		-0.8317	-1.1181	-.1416	-.7441

TABLE 14 -- ContinuedMultiple Regression Equations

Morning:	$\bar{Y} = +.758 X_1 + .431 X_2 + 1.333 X_3 + 24.118$
Afternoon:	$\bar{Y} = +1.266 X_1 + .893 X_2 + 1.318 X_3 + 6.737$
Evening:	$\bar{Y} = +.8543 X_1 + .8747 X_2 + .143 X_3 + 3.473$
Within Periods:	$\bar{Y} = +.358 X_1 + .418 X_2 + .761 X_3 + 21.774$

Tabular Values for R₁ or r₁

<u>d.f.</u>	<u>No. Variables</u>	<u>.82</u>	<u>.81</u>	<u>Period</u>
48	4	.334	.305	Morning, Afternoon, Evening
71	3	.327	.303	
113(248)	4	.174	.134	Within Periods
117(248)	3	.158	.105	

^bSince the analysis is run on water loss/hr. and environmental factors within each period, the degrees of freedom are (73 - 1) + (33 - 1) + (33 - 1) = 216 total; for (p = 4), d.f. = 215; for (p = 3), d.f. = 216.

TABLE II

TESTS OF HOMOGENEITY FOR THE PARTIAL ADJUSTMENT COEFFICIENTS REPRESENTING RELATIONSHIPS OF WATER LOSS PER HOUR ON THREE EXPERIMENTAL FACTORS, COMPARING PAIRS OF PERIODS (MORNING, AFTERNOON, AND EVENING, IN 1951)

Independent Variable	Comparison	Differences between Partial Regression Coefficients	Standard Error of Difference	χ^2
Air Temp. ($^{\circ}$ C.)				
$\bar{X}_1$	morning $\overline{X_2}$, afternoon	.0184	.0013	.433
$\bar{X}_2$	morning $\overline{X_2}$, evening	.0166	.0123	1.137
$\bar{X}_{21, 12}$	afternoon $\overline{X_2}$, evening	-.0116	.0074	1.831
V. P. $\bar{X}_1$ (mm. Hg)				
$\bar{X}_1$	morning $\overline{X_2}$, afternoon	.0180	.0030	.347
$\bar{X}_2$	morning $\overline{X_2}$, evening	.0163	.0052	1.070
$\bar{X}_{21, 12}$	afternoon $\overline{X_2}$, evening	.0165	.0014	3.346
Soil Temp. ($^{\circ}$ C.)				
$\bar{X}_1$	morning $\overline{X_2}$, afternoon	.0115	.0039	.401
$\bar{X}_2$	morning $\overline{X_2}$, evening	1.0181	.0087	2.40100
$\bar{X}_{21, 12}$	afternoon $\overline{X_2}$, evening	.0173	.0036	2.324

$\chi^2_{.05}$ for 49 d.f. = 1.903, $\chi^2_{.01}$ for 49 d.f. = 3.647.

TABLE 14 -- Continued

6. Analysis of Covariance among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods

Source of Variation	d. f.	$\sum y_i^2$	$\sum xy_i$	$\sum y_i^2$	Sum of Squares	Errors of Estimates	Sum of Squares	d. f.
Identifying	71	876.21	109.36	1434.46	1281.96	1281.96	71	71
Adjustment	70	869.43	103.96	1381.43	1216.94	1216.94	71	71
Breeding	71	869.21	26.49	146.93	13.94	13.94	71	71
Total	212	2554.85	239.81	1762.82	1312.84	1312.84	212	212

Errors of Estimates

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Deviations from average (overall)	210	1287.79		
regression within periods				
Deviations from individual period				
regression	211	1312.81	1312.81	1.5
Differences among period regression	1	13.94	13.94	8.14

$$s_{y_i}^2 = (\sum y_i^2 / \sum x_i^2)$$

TABLE 13

ANALYSIS OF COVARIANCE FOR WATER LOADS PER HOUR AND 200-L. TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF SEVENTEEN-DAYE DATA IN 1962

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d. f.	$\sum y_i^2$	$\sum y_i^2$	$\sum y_i^2$	Errors of Estimate Sum of Squares ^a d. f.	Mean Square
Day (total)	218	4622.78	5668.33	8489.33	1974.56	217
Periods	3	388.42	594.89	971.19	1918.47	218
Within periods	117	2018.35	628.44	1747.17	4381.81	218
For test of significance of adjusted period means						14.33
						$F = \frac{218 \times 74}{17 \times 35} = 118.4$

B. Sources of Prediction in Analysis of Error Variations

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, $\sum y_i^2$	214	1747.17	17.51	
Residuals due to regression, $(\sum y_i^2) / 200^2$	1	226.46	226.46	14.86
Errors due adjusted means	213	1520.71	16.45	

TABLE 14 -- (Continued)

C. Analysis of Components among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods					
Source of Variation	d. f.	$\sum y^2$	$\sum xy$	Errors of Estimates Sum of Squares d. f.	
Among Affixures	79	3261.48	299.39	1354.49	71
	72	3464.40	346.52	2028.13	71
Among Items	72	2146.48	176.78	17.86	71
Total	214	5407.95	476.16	1372.35	213
Errors of Variation					
	d. f.		Sum of Squares	Mean Square	F
Deviation from average (average regression within periods)	214		2015.49		
Deviation from individual period regression			1275.86		
Difference among period regression		$\frac{213}{2}$	$\frac{1275.86}{111.5}$	$\frac{11.44}{46.314}$	3.46

$$s_{xy}^2 = (\sum xy)^2 / \sum y^2$$

TABLE 19

LEAF LENGTHS, LEAF WIDTHS, AND LEAF AREAS OF 100
MATURE LEAVES OF SEVEN-YEAR-OLD
BADEN MANGO BUSHES

Leaf No.	Leaf Length (mm.) (L_1)	Leaf Width (mm.) (W_2)	Leaf Area (mm. ²) (A)
1	26.0	5.9	153.44
2	29.9	7.1	182.44
3	17.6	3.7	65.00
4	31.2	5.6	84.27
5	27.4	5.5	150.70
6	27.2	5.7	155.08
7	21.4	4.3	66.12
8	17.2	4.8	67.92
9	28.4	4.6	130.64
10	29.2	4.6	135.92
11	28.8	2.6	75.78
12	29.3	4.5	67.68
13	22.6	5.9	84.98
14	24.3	5.8	79.78
15	27.6	5.6	155.17
16	28.2	4.2	118.64
17	17.6	2.6	65.27
18	23.4	4.8	72.28
19	26.4	5.4	97.14
20	27.3	5.7	155.79
21	22.2	5.6	113.25
22	28.2	5.1	143.94
23	22.4	4.6	79.44
24	28.4	5.7	162.48
25	28.3	5.1	144.93
26	28.2	5.6	158.77
27	22.4	5.2	64.34
28	19.6	4.9	57.44
29	24.2	4.2	61.76
30	25.4	5.6	142.24

TABLE 19 -- *Continued*

Leaf No.	Leaf Length (mm.) (L_2)	Leaf Width (mm.) (L_3)	Leaf Area (mm. ²) (A)
21	26.6	3.6	95.76
22	26.3	4.6	121.78
23	26.3	4.3	113.89
24	27.7	4.6	127.82
25	24.3	3.4	82.82
26	19.3	4.1	79.22
27	19.3	4.7	91.11
28	23.9	3.3	78.87
29	23.7	3.3	78.21
30	24.3	3.6	87.48
31	27.3	4.1	112.91
32	27.1	4.1	111.71
33	23.3	3.3	76.89
34	23.3	3.2	74.59
35	22.3	3.3	73.59
36	23.3	3.2	74.59
37	23.3	4.4	102.72
38	22.3	4.4	98.12
39	22.9	3.1	70.99
40	21.3	4.3	91.69
41	24.3	4.3	105.03
42	24.3	3.4	82.82
43	23.3	4.1	95.76
44	21.9	4.9	107.49
45	27.3	3.3	90.99
46	22.7	3.4	77.18
47	23.3	4.3	100.21
48	23.3	3.3	76.89
49	24.3	3.3	80.19
50	23.3	4.3	100.21

TABLE 10 -- Continued.

Leaf No.	Leaf Length (mm.) (X_2)	Leaf Width (mm.) (X_1)	Leaf Area (mm. ²) (Y)
42	24.8	4.9	93.74
43	26.4	5.8	93.48
44	27.4	6.1	107.53
44	24.8	7.7	187.53
46	23.8	4.9	79.76
46	24.8	4.7	120.70
47	27.3	4.7	68.81
48	24.8	5.8	33.88
48	23.7	4.8	104.13
70	23.7	5.4	87.48
71	28.8	4.3	109.59
72	29.1	2.9	84.41
73	24.8	4.7	113.14
74	28.8	5.8	109.88
75	17.3	4.4	49.87
76	26.3	4.4	89.68
77	28.8	6.1	105.48
78	28.3	5.8	113.87
79	22.9	5.1	74.99
80	22.9	4.8	79.53
81	24.3	5.4	89.58
82	21.4	4.8	69.83
83	23.3	4.8	104.39
84	23.8	4.3	89.48
85	25.8	5.8	87.98
86	24.3	5.9	105.74
87	24.8	5.7	127.66
88	26.8	4.8	125.14
89	29.4	5.4	104.48
90	23.3	4.8	89.43

TABLE 17 -- *Continued*

Leaf No.	Leaf Length (cm.) (x_1)	Leaf Width (cm.) (x_2)	Leaf Area (cm. ²) (y)
91	28.3	3.7	105.91
92	28.5	3.6	98.77
93	28.6	3.2	90.32
94	28.6	3.6	97.66
95	28.7	3.6	95.51
96	29.3	4.1	120.83
97	29.3	4.0	116.73
98	28.7	3.6	99.66
99	28.8	3.2	92.16
100	28.8	3.7	91.66
101	29.4	4.6	135.24
102	28.6	2.8	79.71
103	28.8	4.6	132.78
104	21.2	4.6	69.52
105	28.6	4.7	67.62
106	28.8	4.6	98.28
107	28.7	4.2	82.66
108	28.6	3.7	88.92
109	28.6	3.6	104.22
110	28.1	3.7	88.65
111	28.2	4.6	71.16
112	21.2	4.7	69.64
113	28.2	2.6	66.42
114	28.3	4.6	102.18
115	28.7	7.6	121.18
116	28.8	3.1	78.14
117	19.4	2.2	59.61
118	28.6	2.6	98.22
119	28.3	3.2	77.46
120	28.2	4.7	66.26

TABLE IV -- Continued

Leaf No.	Leaf Length (mm.) (L_1)	Leaf Width (mm.) (W_1)	Leaf Area (mm. ²) (A)
121	34.9	2.1	132.48
122	32.9	2.2	97.32
123	32.2	4.2	133.24
124	34.2	2.4	21.12
125	32.0	4.9	73.97
126	35.2	2.2	32.48
127	34.1	4.7	124.22
128	31.2	4.2	64.24
129	30.1	2.2	120.22
130	33.3	3.1	73.73
131	19.0	4.7	89.48
132	31.1	2.2	89.22
133	32.3	2.2	92.12
134	19.0	2.2	72.22
135	32.6	2.2	73.18
136	31.0	4.4	63.64
137	32.9	2.7	83.64
138	34.1	4.9	76.32
139	39.2	2.4	119.22
140	33.9	2.2	122.48
141	33.2	2.4	122.22
142	31.7	4.0	34.19
143	37.1	2.7	122.22
144	39.0	4.2	127.12
145	30.7	2.2	71.12
146	2.10	2.2	147.42
147	32.7	4.9	22.71
148	32.7	2.2	77.24
149	30.0	2.2	122.12
150	34.2	2.1	62.22

TABLE 19 -- Continued

Leaf No.	Leaf Length (mm.) (L_1)	Leaf Width (mm.) (W_1)	Leaf Area (mm. ²) (A)
121	19.3	4.8	84.96
122	24.3	3.2	76.13
123	22.3	5.4	121.16
124	27.3	4.8	130.99
125	34.3	4.3	147.91
126	27.3	3.3	91.23
127	32.3	4.3	99.36
128	31.3	4.3	94.99
129	25.3	4.3	109.43
130	24.3	3.1	82.42
131	24.4	3.9	94.76
132	25.3	3.4	77.42
133	21.3	6.2	130.87
134	22.3	4.2	128.92
135	22.3	6.3	140.39
136	27.1	3.2	174.43
137	28.2	4.3	120.12
138	28.4	3.9	110.69
139	22.7	6.4	145.28
140	28.3	3.2	90.47
141	22.1	3.7	74.96
142	28.4	4.3	117.29
143	22.4	2.1	69.04
144	22.1	4.3	84.77
145	28.3	3.2	74.71
146	22.1	3.7	74.44
147	24.2	4.4	94.68
148	28.4	3.3	64.32
149	24.3	3.2	76.12
150	19.3	3.2	61.28

TABLE 29 -- Continued

Leaf No.	Leaf Length (cm.) (X_L)	Leaf Width (cm.) (X_W)	Leaf Area (cm. ²) (A)
181	26.9	3.4	91.81
182	23.7	3.9	91.97
183	28.2	3.4	114.82
184	21.7	4.0	86.81
185	24.4	3.4	114.26
186	23.2	3.8	91.36
187	17.7	3.7	64.97
188	21.8	3.8	82.82
189	27.2	3.7	112.52
190	28.9	3.4	99.32
191	24.8	3.4	98.14
192	23.2	3.4	78.18
193	21.4	4.0	84.64
194	23.2	3.8	88.32
195	24.4	3.4	84.82
196	28.4	3.2	91.67
197	28.2	4.1	88.82
198	21.1	3.4	64.72
199	23.8	3.8	79.84
200	18.4	4.2	69.68

TABLE 26

MEANS, REGRESSION COEFFICIENTS, CORRELATION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATION REPRESENTING RELATIONSHIPS AMONG LENGTH, WIDTH, AND AREA OF 100 MATURE LEAVES FROM SEVEN-YEAR-OLD MANGO TREES

<u>Regression Coefficients</u>		
Leaf length = X_1	$b_{y1.2} = 4.18$	$s = 18.8800$
Leaf width = X_2	$b_{y2.1} = 14.44$	$s = 12.9400$
Leaf area = T	$(b_{y2} \text{ at } 100 \text{ d.f.} = 2.401)$	
<u>Means</u>		
	$\bar{X}_1 = 14.15$	
	$\bar{X}_2 = 8.34$	
	$\bar{T} = 93.175$	
<u>Regression Equation</u>		
$\hat{T} = 4.18 X_1 + 14.44 X_2 + 90.13$		
<u>Correlation Coefficients</u>		
Total (multiple):	$R_{y.12} = .984000$	d.f. 197
Partial	$r_{y1.2} = .984000$	197
	$r_{y2.1} = .984000$	197
Simple	$r_{y1} = .912000$	198
	$r_{y2} = .981000$	198
Tabular Values Necessary for Significance at .01 Level:		
R or r at 100 d.f. and 2 variables = .122		
r at 100 d.f. and 2 variables = .181		

TABLE 21

LEAF LENGTH, LEAF WIDTH, AND LEAF AREA OF 100
JUVENILE LEAVES FROM SEVEN-YEAR-OLD
BADEM MANGO BUDGERS

Leaf No.	Leaf Length (cm.) (X_1)	Leaf Width (cm.) (X_2)	Leaf Area (cm. 2) (Y)
1	19.4	4.9	95.96
2	18.3	5.9	108.03
3	18.9	4.2	81.42
4	18.9	4.9	93.61
5	14.9	3.4	51.46
6	17.9	3.4	60.86
7	18.4	4.1	75.64
8	14.3	3.3	47.19
9	17.4	3.9	67.86
10	19.4	3.9	76.76
11	14.1	3.4	47.94
12	12.9	2.9	37.41
13	9.9	1.9	18.81
14	9.2	1.1	10.12
15	9.1	1.9	17.29
16	19.3	3.3	63.69
17	14.3	3.9	55.83
18	17.9	4.9	87.81
19	14.3	3.9	55.83
20	17.3	3.9	67.41
21	17.9	3.9	70.21
22	17.1	3.9	66.81
23	14.9	3.9	58.61
24	14.3	2.9	41.41
25	14.4	3.9	56.52
26	17.3	3.1	53.61
27	18.9	3.9	74.61
28	9.9	1.9	18.81
29	11.3	2.3	25.99
30	18.3	2.1	38.43

TABLE 21. -- Continued.

Leaf No.	Leaf Length (mm.) (L_1)	Leaf Width (mm.) (W_1)	Leaf Area (mm. ²) (A)
31	13.3	2.4	28.92
32	14.4	3.4	48.96
33	14.4	3.1	38.88
34	13.4	2.4	28.42
35	12.4	2.3	17.54
36	14.4	2.4	26.39
37	14.4	3.4	34.59
38	14.4	2.4	28.42
39	15.4	3.1	38.84
40	11.4	2.3	17.81
41	13.4	2.7	28.18
42	13.4	3.4	32.74
43	7.3	1.3	4.32
44	17.4	3.3	44.91
45	14.4	3.2	38.88
46	14.4	2.4	27.74
47	14.4	3.3	34.84
48	14.3	3.1	31.23
49	19.2	4.1	62.14
50	12.4	2.4	19.87
51	13.4	2.4	18.39
52	12.1	2.4	18.84
53	11.4	2.2	18.44
54	13.4	1.4	18.94
55	9.4	1.4	12.86
56	14.3	3.1	38.84
57	4.4	1.4	4.94
58	13.9	2.4	22.74
59	4.3	1.1	3.42
60	4.2	0.9	2.39

TABLE 21. -- Continued.

Leaf No.	Leaf Length (cm.) (L_L)	Leaf Width (cm.) (W_L)	Leaf Area (cm. ²) (T)
61	6.7	1.6	8.88
62	6.7	1.6	8.88
63	6.7	1.6	8.17
64	6.7	1.6	11.42
65	6.7	2.2	12.88
66	12.6	2.4	17.33
67	13.6	2.6	20.62
68	16.6	2.6	27.68
69	17.7	4.7	44.82
70	20.1	4.2	53.76
71	13.7	2.7	21.83
72	17.6	3.4	27.81
73	14.1	2.6	25.81
74	14.3	3.2	28.77
75	14.6	2.7	24.60
76	9.3	2.1	12.29
77	17.6	3.4	18.62
78	4.6	1.7	11.29
79	4.1	1.7	4.99
80	2.2	1.6	4.90
81	4.7	1.6	4.97
82	13.7	2.6	20.80
83	16.3	2.6	18.78
84	13.4	2.7	13.94
85	18.4	2.1	20.76
86	17.6	2.6	20.87
87	24.6	4.2	33.30
88	16.3	3.6	40.71
89	20.3	3.6	40.71
90	20.6	4.6	49.87

TABLE 21 -- Continued

Leaf No.	Leaf Length (cm.) ($\overline{X}_L$)	Leaf Width (cm.) ($\overline{X}_W$)	Leaf Area (cm. ²) ($\overline{V}$)
91	28.8	3.8	42.24
92	28.1	4.2	48.22
93	28.8	3.9	48.92
94	23.1	3.4	39.14
95	22.3	2.7	30.48
96	22.2	2.4	22.82
97	28.2	3.8	48.48
98	4.1	1.2	4.92
99	3.8	1.8	3.36
100	4.4	3.9	2.19

TABLE 12

MEANS, REGRESSION COEFFICIENTS, CORRELATION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATION EXPRESSING RELATIONSHIPS AMONG LENGTHS, WIDTHS, AND AREAS OF 126 JUVENILE LEAVES FROM SEVEN-YEAR-OLD MANGO TREES

<u>Regression Coefficients</u>		
Leaf length = X_1	$b_{YX_1} = 1.22$	$t = 4.2146$
Leaf width = X_2	$b_{YX_2} = 11.14$	$t = 9.1946$
Leaf area = Y	$b_{YX_1 \text{ at } 97 \text{ d.f.}} = 2.4875$	
<u>Means</u>		
	$\bar{X}_1 = 13.43$	
	$\bar{X}_2 = 2.88$	
	$\bar{Y} = 87.183$	
<u>Regression Equation</u>		
$\hat{Y} = 1.22 X_1 + 11.14 X_2 + 21.174$		
<u>Correlation Coefficients</u>		
Total (multiple): $R_{Y,12}$	$= .968700$	d.f. 97
Partial:	$r_{YX_1,2} = .454400$	97
	$r_{YX_2,1} = .488100$	97
Simple:	$r_{Y1} = .562800$	98
	$r_{Y2} = .576100$	98
<u>Tabular Values Necessary for Significance at .01 Level</u>		
R or r at 100 d.f. and 3 variables = .397		
t at 100 d.f. and 3 variables = .354		

TABLE 23

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF FIFTY MATURE LEAVES OF SEVEN-YEAR-OLD HAGEN MANGO BUDGERS

Leaf No.	Leaf Length (mm.) (L)	log Leaf Length (log L)	Leaf Area (mm. ²) (A)	log Leaf Area (log A)	Predicted Leaf Area ^a (log A')	Predicted Leaf Area (A')
1	38.2	1.4672	183.44	2.0022	2.0017	132.38
2	38.9	1.4707	183.68	2.1042	2.1434	138.47
3	37.8	1.3304	48.80	1.6809	1.7819	60.32
4	35.2	1.3134	84.37	1.9233	1.8844	71.42
5	37.4	1.4579	110.70	2.0448	2.0602	117.70
6	37.2	1.4334	100.09	2.0216	2.0401	118.38
7	35.4	1.3348	60.12	1.8137	1.8683	73.88
8	37.2	1.3800	47.28	1.6772	1.6737	47.07
9	38.4	1.4832	128.64	2.1072	2.0904	128.40
10	39.2	1.4669	126.72	2.1026	2.1282	123.48
11	38.2	1.3842	36.70	1.3647	1.3842	28.40
12	38.2	1.3378	57.68	1.8322	1.4030	60.09
13	32.8	1.3079	68.80	1.9073	1.4021	61.60
14	34.2	1.3846	90.76	1.9879	1.9462	93.30
15	37.0	1.4314	120.37	2.0790	2.0208	113.70
16	38.2	1.4802	122.64	2.0404	2.0924	122.70
17	37.8	1.3428	48.27	1.6817	1.6874	60.49
18	32.4	1.3719	72.20	1.8300	1.9414	87.28
19	34.4	1.3909	97.14	1.9874	1.9764	94.77
20	37.2	1.4242	102.70	2.0100	2.0482	114.10
21	37.2	1.4342	120.51	2.0420	2.0482	114.10
22	38.2	1.4818	128.44	2.0642	2.0987	124.47
23	33.4	1.3304	70.86	1.8004	1.8974	70.86
24	34.4	1.4214	100.41	2.0270	2.0264	100.70
25	38.2	1.4832	100.61	2.0226	2.0800	100.13

TABLE 22 -- Continued

Leaf No.	Leaf Length (mm.) (X)	log Leaf Length (log X)	Leaf Area (mm. ²) (Y)	log Leaf Area (log Y)	Predicted Leaf Area ^a (log $\hat{Y}$)	Predicted Leaf Area (Y)
26	30.3	1.4831	104.77	2.0213	2.0008	103.13
27	33.4	1.5242	84.30	1.9260	1.9343	88.93
28	19.8	1.2960	47.40	1.6770	1.7930	61.94
29	23.5	1.3719	62.96	1.7991	1.8130	66.09
30	32.4	1.5099	103.01	2.0140	2.0740	118.47
31	26.4	1.4216	93.00	1.9726	1.9516	100.70
32	29.5	1.4709	103.90	2.0099	2.0097	104.40
33	20.8	1.3168	50.66	1.7056	1.6816	56.50
34	27.7	1.4420	118.00	2.0719	2.0719	119.83
35	34.6	1.5383	98.37	1.9936	1.9397	90.30
36	19.8	1.2960	50.80	1.7070	1.7790	60.10
37	19.8	1.2960	40.30	1.7050	1.7790	60.10
38	26.9	1.4275	95.16	1.9799	2.0306	106.95
39	23.7	1.3767	90.64	1.9530	1.9430	97.70
40	34.8	1.5413	94.40	1.9790	1.9730	94.00
41	37.3	1.5716	114.00	2.0581	2.0521	118.30
42	37.1	1.5700	114.30	2.0570	2.0570	114.80
43	23.0	1.3617	89.31	1.9460	1.9390	93.00
44	25.0	1.3990	91.90	1.9637	1.9897	96.50
45	22.0	1.3429	79.97	1.9029	1.9321	91.67
46	23.3	1.4630	92.00	1.9670	2.0000	100.15
47	30.8	1.4900	133.70	2.1230	2.1010	126.90
48	22.0	1.3433	30.00	1.4763	1.5003	33.00
49	23.0	1.3604	83.30	1.9164	1.9633	89.00
50	21.8	1.3386	66.97	1.8237	1.9463	70.10

^aValues obtained by solving the regression equation with the corresponding log X.

TABLE 54

LEAF LENGTH, LOG LEAF LENGTH, LEAF AREA, LOG LEAF AREA, LOG PREDICTED LEAF AREA, AND PREDICTED LEAF AREA OF FIFTY JUVENILE LEAVES OF SEVEN-YEAR-OLD
HAGEN MANGO BUDGERS

Leaf No.	Leaf Length (cm.) (X)	Log Leaf Length (Log X)	Leaf Area (cm. ²) (Y)	Log Leaf Area (Log Y)	Predicted Leaf Area ^a (Log Y')	Predicted Leaf Area (Y')
1	19.4	1.2878	89.94	1.9538	1.7293	83.41
2	18.5	1.2687	83.88	1.9232	1.4993	31.44
3	18.4	1.2674	81.62	1.9112	1.4939	49.99
4	20.8	1.3181	84.82	1.9282	1.7610	87.84
5	14.9	1.1733	31.94	1.5044	1.4734	29.94
6	27.8	1.3434	64.84	1.8104	1.4438	44.34
7	28.4	1.3498	49.38	1.6938	1.4344	48.48
8	24.2	1.2868	34.38	1.5387	1.4548	54.48
9	27.4	1.3404	43.43	1.6387	1.6389	43.34
10	14.4	1.1576	15.94	1.4434	1.4104	31.45
11	14.1	1.2463	12.84	1.1144	1.0404	10.34
12	13.9	1.1384	18.33	1.3614	1.3337	11.44
13	9.2	0.9628	9.34	0.9713	1.0144	10.39
14	4.2	0.6243	2.44	0.4883	0.4824	2.44
15	4.1	0.6148	9.94	0.9986	0.8834	7.43
16	14.9	1.1733	18.83	1.2643	1.1293	13.44
17	14.8	1.1722	27.33	1.4368	1.4003	24.34
18	27.9	1.3439	64.84	1.8141	1.4434	44.34
19	14.9	1.1733	43.98	1.6402	1.5538	34.36
20	27.3	1.4389	49.36	1.6939	1.4138	40.99
21	27.8	1.3434	48.38	1.6863	1.6393	43.88
22	19.1	1.2814	47.33	1.6763	1.5641	36.99
23	14.8	1.1722	18.88	1.2698	1.3999	14.88
24	14.3	1.1583	64.91	1.8149	1.4104	21.43
25	14.4	1.1576	44.13	1.6436	1.4334	44.43

TABLE 24 -- *Continued*

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm. ²) (Y)	log Leaf Area (log Y)	Predicted Leaf Area ^a (log Y)	Predicted Leaf Area (Y)
26	18.8	1.2753	38.59	1.4779	1.3154	35.48
27	18.8	1.2753	12.91	1.1079	1.0887	12.51
28	8.9	0.9494	9.39	0.9737	0.9737	9.41
29	11.2	1.0493	15.19	1.1818	1.1966	15.73
30	18.3	1.2636	15.65	1.1949	1.1897	15.73
31	13.8	1.1383	28.98	1.3583	1.3774	23.88
32	18.4	1.2668	43.81	1.6418	1.6779	48.63
33	13.4	1.1248	32.88	1.5139	1.5463	34.54
34	13.8	1.1383	38.42	1.4883	1.3774	23.88
35	13.8	1.0779	17.14	1.2348	1.2684	18.58
36	14.8	1.1634	38.39	1.4818	1.4473	27.97
37	14.4	1.1584	34.39	1.5344	1.5883	37.88
38	14.8	1.1684	38.43	1.4883	1.4139	23.87
39	18.4	1.2678	38.84	1.4893	1.3884	23.83
40	11.4	1.0548	17.81	1.2488	1.2497	17.83
41	13.8	1.0989	38.78	1.5177	1.3834	28.68
42	13.8	1.1139	23.88	1.3888	1.3818	21.75
43	9.2	0.9679	4.53	0.6558	0.7581	8.86
44	17.8	1.2438	44.95	1.6823	1.6293	42.48
45	28.8	1.4541	28.38	1.4538	1.4798	38.19
46	14.8	1.1783	27.74	1.4434	1.4678	29.35
47	13.8	1.1178	34.34	1.5431	1.5738	37.38
48	18.8	1.2787	31.33	1.4948	1.4993	32.86
49	19.8	1.2984	33.14	1.5284	1.5144	33.81
50	18.6	1.2684	19.87	1.2983	1.3189	28.44

^aValues obtained by solving the regression equation with the corresponding log X.

TABLE 20

LEAF LENGTH, LOG LEAF LENGTH, LEAF AREA, LOG LEAF AREA, LOG PREDICTED LEAF AREA, AND PREDICTED LEAF AREA OF FIFTY HEALTHY LEAVES OF ONE-YEAR-OLD TULPENTIN MANGO SEEDLING

Leaf No.	Leaf Length (mm.) (X)	Log Leaf Length (log X)	Leaf Area (cm. ²) (Y)	Log Leaf Area (log Y)	Predicted Leaf Area ^a (log $\hat{Y}$)	Predicted Leaf Area (Z)
1	18.3	1.2633	84.48	1.9261	1.3448	84.48
2	24.3	1.3856	84.84	1.9286	1.9479	93.80
3	24.7	1.3927	94.80	1.9773	1.9818	96.90
4	22.6	1.3536	77.37	1.8900	1.8887	76.62
5	22.7	1.3548	96.82	1.9861	1.8479	73.79
..						
6	27.6	1.4405	64.87	1.8105	1.6844	48.76
7	26.6	1.4237	89.42	1.9504	2.0129	103.88
8	24.6	1.3909	81.71	1.9171	1.9768	96.18
9	24.9	1.3952	116.77	2.0682	1.9888	97.46
10	24.3	1.3892	100.97	2.0046	1.9746	94.37
..						
11	23.4	1.3682	97.81	1.9939	2.0129	103.88
12	23.4	1.3682	88.12	1.9436	1.8968	78.58
13	25.8	1.4089	87.78	1.9408	1.7787	69.67
14	25.7	1.4080	61.81	1.7908	1.7848	60.98
15	22.9	1.3599	61.44	1.7916	1.9189	82.37
..						
16	23.4	1.3682	78.77	1.8966	1.9842	88.21
17	26.8	1.4254	124.87	2.1978	2.0197	106.48
18	21.4	1.3294	78.29	1.8927	1.8888	76.62
19	26.8	1.4254	78.48	1.8979	1.8788	68.88
20	21.4	1.3294	72.71	1.8616	1.8888	76.62
..						
21	19.4	1.2882	58.41	1.8618	1.3418	34.13
22	18.3	1.2633	34.19	1.5359	1.3737	27.44
23	18.3	1.2633	49.36	1.6953	1.4396	41.88
24	18.9	1.2754	22.48	1.3516	1.8980	79.62
25	12.1	1.0842	32.87	1.5160	1.5473	38.34

TABLE 38 -- Continued

Leaf No.	Leaf Length (mm.)	log Leaf Length (mm.)	Leaf Area (mm. ²)	log Leaf Area	Predicted Leaf Area ^a	Predicted Leaf Area
(3)	(4)	(5)	(6)	(7)	(8)	(9)
26	14.8	1.1703	31.15	1.4949	1.1596	34.32
27	16.8	1.2262	44.43	1.6479	1.5100	39.43
28	16.7	1.2249	48.77	1.6889	1.4949	38.43
29	16.5	1.2179	46.49	1.7644	1.7364	33.88
30	21.0	1.3222	62.66	1.7997	1.4683	48.35
31	23.9	1.3787	78.19	1.8939	1.9487	64.34
32	23.4	1.3691	84.39	1.9263	1.9043	60.22
33	19.3	1.2866	48.69	1.6813	1.7409	60.47
34	19.0	1.2788	50.42	1.9418	1.7833	66.67
35	16.0	1.2049	61.66	1.7913	1.4383	42.79
36	21.3	1.3284	46.74	1.9093	1.9039	71.28
37	14.6	1.1664	37.66	1.9761	1.3117	33.69
38	24.1	1.3816	94.76	1.9767	1.9423	91.27
39	18.1	1.2577	66.13	1.9071	1.7099	81.46
40	16.4	1.2146	39.81	1.4040	1.4349	42.54
41	19.3	1.2866	41.76	1.7916	1.7649	66.47
42	16.7	1.2273	43.66	1.6403	1.4364	33.64
43	16.6	1.2270	39.42	1.6403	1.6701	27.17
44	26.3	1.4179	66.63	1.6636	1.9066	64.69
45	21.7	1.3346	76.33	1.8839	1.8696	73.97
46	17.0	1.2304	43.83	1.6666	1.6643	49.69
47	22.6	1.3541	77.46	1.8946	1.9643	69.31
48	23.3	1.3669	79.66	1.8993	1.9273	64.66
49	14.7	1.1673	34.33	1.8366	1.8366	33.96
50	16.1	1.2046	53.23	1.7216	1.3639	16.94

^aValues obtained by solving the regression equation with the corresponding log X.

TABLE 24

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF FIFTY MALFORMED LEAVES OF TURPENTINE MAPLE FEEDINGS

Leaf No.	Leaf Length (mm.) (2)	Log Leaf Length (3)	Leaf Area (mm. ²) (4)	Log Leaf Area (5)	Log Predicted Leaf Area ^a (6)	Predicted Leaf Area (7)
1	22.9	1.3593	104.97	2.0211	1.9366	86.39
2	22.2	1.3474	84.66	1.9288	1.9403	88.76
3	21.6	1.3369	75.42	1.8779	1.8968	77.77
4	14.6	1.1662	66.34	1.8247	1.6423	43.94
5	13.7	1.1367	66.79	1.8212	1.3996	39.94
6	26.3	1.4198	32.67	1.5192	1.6619	33.77
7	9.4	0.9733	21.16	1.3243	1.3369	21.66
8	8.6	0.9343	24.66	1.3932	1.3873	24.60
9	9.8	0.9912	22.79	1.3576	1.3667	23.18
10	12.6	1.1026	29.16	1.4639	1.6666	36.92
11	16.2	1.2084	22.18	1.3483	1.3937	24.66
12	7.6	0.8809	18.12	1.2586	1.1933	18.61
13	7.6	0.8791	17.63	1.2443	1.1646	18.38
14	21.9	1.3401	27.61	1.4402	1.4641	30.66
15	6.6	0.8169	14.66	1.1661	1.1923	19.66
16	19.6	1.2969	66.22	1.7366	1.6366	43.92
17	16.7	1.1873	44.91	1.6493	1.6399	43.42
18	27.6	1.4404	66.21	1.7366	1.7337	64.34
19	16.6	1.2233	62.36	1.7977	1.7743	59.47
20	23.6	1.1229	28.66	1.4532	1.6795	37.39
21	16.6	1.1864	47.96	1.6807	1.6366	42.66
22	19.6	1.2969	66.22	1.6366	1.6187	44.66
23	17.7	1.2466	36.66	1.7624	1.7636	67.94
24	19.7	1.2963	66.13	1.7791	1.6181	44.67
25	16.3	1.1862	62.62	1.7394	1.6291	42.61

TABLE 14 -- *Continued*

Sn.	Lead Length (mm.) (3)	Log Lead Length (2)	Lead Area (mm. ²) (1)	Log Lead Area (2)	Predicted Lead Area ^a (2)	Predicted Lead Area (3)
35	11.0	1.0407	44.71	1.6497	1.4723	39.42
37	13.0	1.1098	54.37	1.7378	1.7033	50.38
38	9.6	0.9825	23.39	1.3671	1.3507	33.43
39	7.0	0.8431	11.42	1.1200	1.1111	14.38
39	11.4	1.0565	33.23	1.5246	1.4666	29.38
40	11.0	1.0414	23.14	1.3668	1.4486	27.78
42	13.2	1.1198	44.37	1.6434	1.6603	43.76
42	11.1	1.0455	29.17	1.4625	1.4446	28.07
44	9.2	0.9643	7.23	0.8670	0.9584	9.90
45	13.4	1.1248	69.58	1.7728	1.7118	51.47
46	6.7	0.8294	23.63	1.3768	1.3999	19.94
47	4.7	0.6721	4.84	0.6351	0.6698	7.41
48	9.9	0.9986	23.18	1.3697	1.3713	23.62
49	9.7	0.9888	29.23	1.4656	1.3879	31.68
49	11.9	1.0758	29.15	1.4697	1.4684	31.28
49	6.4	0.8046	14.39	1.1506	1.1818	18.54
49	7.9	0.8976	13.42	1.1383	1.1758	14.38
49	8.6	0.9326	7.15	0.9648	0.9455	9.17
49	4.9	0.6909	31.18	1.4948	1.1364	13.44
49	13.7	1.1367	31.41	1.5144	1.3964	36.74
46	13.9	1.1414	59.79	1.7766	1.4364	37.31
47	9.8	0.9933	17.42	1.2419	1.3293	31.33
48	9.8	0.9934	37.33	1.5681	1.3718	33.38
49	9.1	0.9588	14.70	1.1679	1.3143	30.64
50	4.4	0.6433	13.88	1.1419	1.0984	12.64

^aValues obtained by solving the regression equation with the corresponding log X.

TABLE 23

LEAF LENGTHS, LOG LEAF LENGTHS, LEAF AREAS, LOG PREDICTED LEAF AREAS, AND PREDICTED LEAF AREAS OF 100 LEAVES, FIFTY EACH OF MATURE AND JUVENILE SPECIMENS FROM SEVEN-YEAR-OLD MAJIN MANGO TREES AND HEALTHY SPECIMENS FROM TURFIGHTING MANGO HEDGELANDS

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm. ²)	log Predicted Leaf Area* (log Y)	Predicted Leaf Area (Y)
1	22.8	1.4579	103.44	2.1129	129.78
2	25.9	1.4137	152.88	2.1770	180.23
3	17.8	1.2504	48.88	1.6724	47.43
4	21.3	1.3284	84.32	1.9471	78.32
5	25.4	1.4078	118.78	2.0752	120.47
6	27.3	1.4366	158.88	2.2038	161.43
7	21.6	1.3348	68.12	1.8388	73.38
8	27.2	1.2388	43.28	1.4390	48.38
9	28.4	1.4533	138.84	2.1349	138.93
10	25.3	1.4045	123.28	2.1873	143.43
11	19.8	1.1983	38.28	1.5878	34.2
12	28.3	1.3509	87.88	1.9383	83.13
13	23.8	1.3779	88.88	1.9132	82.88
14	24.3	1.3888	96.28	1.9739	94.48
15	27.8	1.4424	128.17	2.0798	119.88
16	28.3	1.4531	113.84	2.1358	131.83
17	17.8	1.2508	49.27	1.6528	48.27
18	23.4	1.3729	73.88	1.9668	88.48
19	24.8	1.3939	87.14	1.9371	92.87
20	27.3	1.4362	103.78	2.0686	122.78
21	27.3	1.4362	118.33	2.0686	122.78
22	23.3	1.3678	118.94	2.1238	132.98
23	22.4	1.3504	78.88	1.8784	78.88
24	28.4	1.4518	104.48	2.0959	112.78
25	28.3	1.4531	108.88	2.0744	123.38

TABLE 27 -- *Continued*

Leaf No.	Leaf Length (cm.) (3)	log Leaf Length (log 4)	Leaf Area (cm. ²) (1)	log Predicted Leaf Area ^a (log 7)	Predicted Leaf Area (2)
35	23.3	1.4681	104.77	2.0194	103.84
37	23.4	1.4693	94.84	1.9783	97.64
44	25.0	1.3983	47.44	1.7787	49.87
39	26.3	1.4209	62.94	1.8003	63.14
36	27.4	1.4407	193.93	2.2791	193.43
41	28.4	1.4514	93.49	2.0387	113.76
32	28.5	1.4519	123.91	2.1339	133.99
33	34.0	1.5340	124.84	2.1301	134.94
34	32.7	1.4639	114.86	2.1627	124.67
38	34.0	1.5343	44.37	1.7451	51.83
34	39.0	1.5900	44.84	1.7441	47.44
37	39.0	1.5900	44.38	1.7411	47.44
38	39.0	1.5903	76.14	2.0273	126.77
37	33.7	1.5247	70.44	1.7399	49.39
40	34.0	1.5343	94.41	1.9803	74.38
41	37.3	1.5345	114.86	2.0356	131.43
42	37.1	1.4838	114.18	2.0614	130.43
43	35.0	1.5417	89.81	1.9417	49.8
44	35.0	1.5412	91.99	1.9431	91.87
45	32.0	1.5079	79.97	1.9138	62.67
46	33.3	1.4631	91.69	2.0144	103.38
47	34.0	1.4644	123.76	2.1302	134.96
48	31.3	1.5353	44.44	1.6414	48.46
49	33.9	1.5784	43.34	1.7091	51.82
50	31.0	1.5354	44.97	1.6999	79.43
42	38.4	1.5878	84.36	1.7642	87.84
43	38.3	1.5867	33.83	1.6148	33.83
45	38.0	1.5742	81.42	1.7147	82.17
46	44.0	1.5910	84.83	1.7847	81.83
48	34.9	1.5753	32.94	1.6998	31.97

TABLE 27 -- *Continued*

Leaf No.	Leaf Length (cm.) (X)	log Leaf Length (log X)	Leaf Area (cm. ²) (Y)	log Predicted Leaf Area ^b (log Y)	Predicted Leaf Area (Y)
66	17.8	1.2504	64.33	1.8128	67.23
67	18.4	1.2669	69.49	1.7162	81.7
68	16.7	1.2233	34.39	1.5389	34.39
69	17.6	1.2465	43.62	1.6384	43.62
69	18.4	1.1675	17.76	1.2325	24.66
71	14.1	1.1496	11.46	1.0746	17.37
72	13.9	1.1384	19.13	1.2853	22.27
73	9.3	0.9683	9.76	0.9873	10.76
74	8.2	0.9145	3.94	0.5785	1.77
74	8.1	0.9088	7.78	0.7968	4.47
76	18.0	1.2539	18.43	1.1483	13.43
77	16.3	1.2122	37.23	1.5669	46.43
78	13.9	1.2389	14.84	1.1763	47.47
79	14.3	1.2322	42.79	1.5969	38.43
79	13.8	1.2355	42.46	1.6296	43.66
79	17.6	1.2456	46.39	1.6636	48.27
79	19.1	1.2816	47.23	1.7616	58.66
79	16.6	1.2253	38.89	1.6162	41.33
79	14.3	1.1533	24.71	1.4894	28.66
79	14.6	1.1664	28.17	1.4796	36.18
79	18.5	1.2703	30.17	1.5373	34.5
79	14.6	1.1689	12.91	1.1116	12.79
79	8.9	0.9494	9.39	0.9762	9.56
79	11.2	1.0492	18.17	1.3108	14.66
80	18.2	1.2604	18.63	1.1569	13.62
81	13.6	1.1383	16.96	1.4246	25.22
82	18.4	1.2669	43.61	1.7967	66.66
83	18.4	1.2669	32.66	1.5167	39.16
86	13.6	1.1353	28.42	1.4566	23.36
89	12.6	1.1032	17.16	1.2396	19.66

TABLE 27 -- *Continued*

Leaf No.	Leaf Length (mm.) (X)	Log Leaf Length (Log X)	Leaf Area (mm. ²) (Y)	Log Predicted Leaf Area ² (Log $\hat{Y}$)	Predicted Leaf Area (Y)
86	14.8	1.1684	26.39	1.4731	29.73
87	14.8	1.1681	24.39	1.4646	40.24
88	14.8	1.1681	29.42	1.4689	27.44
89	14.4	1.1575	26.94	1.4282	24.88
90	12.8	1.0648	17.91	1.3260	18.83
91	12.8	1.0609	18.78	1.3266	21.31
92	12.8	1.1139	22.39	1.3687	23.24
93	7.2	0.8273	4.32	0.7900	4.19
94	17.8	1.2439	44.91	1.4689	45.37
95	18.8	1.1781	20.28	1.3609	22.94
96	14.8	1.1703	25.74	1.4029	20.12
97	14.8	1.2172	24.84	1.4997	28.46
98	12.2	1.1047	21.23	1.3222	22.81
99	19.2	1.2828	82.18	1.2812	84.39
100	12.4	1.1004	15.87	1.2028	22.92
101	19.2	1.1947	23.46	1.3222	22.81
102	24.2	1.3086	44.84	1.4741	24.41
103	24.2	1.2927	94.80	1.4902	27.94
104	22.8	1.3424	77.29	1.4784	28.29
105	21.7	1.3168	90.81	1.4682	23.22
106	17.4	1.2409	44.49	1.4412	49.44
107	20.4	1.4092	82.42	1.6288	104.1
108	24.4	1.3609	42.71	1.4970	27.44
109	24.9	1.3942	112.77	1.4989	28.78
110	24.8	1.3922	102.97	1.4922	24.8
111	22.4	1.4082	87.81	1.6288	104.28
112	22.4	1.2922	89.12	1.4988	28.48
113	17.8	1.2988	27.24	1.2618	27.48
114	19.2	1.2942	81.21	1.7711	84.82
115	22.9	1.3199	81.41	1.6174	82.87

TABLE 27 -- Continued

Leaf No.	Leaf Length (mm.) (X)	Log Leaf Length (Log X)	Leaf Area (cm. ²) (Y)	Log Predicted Leaf Area ^B (Log $\hat{Y}$)	Predicted Leaf Area ($\hat{Y}$)
116	21.4	1.3291	70.77	1.8544	69.27
117	21.8	1.4314	124.87	2.0934	124.70
118	21.4	1.3304	70.39	1.8509	71.04
119	20.8	1.3110	70.40	1.8500	64.83
120	21.4	1.3304	72.71	1.8513	71.04
121	18.4	1.2651	36.91	1.5640	35.00
122	18.8	1.2703	34.19	1.5377	34.49
123	18.5	1.2622	40.34	1.6059	38.42
124	18.9	1.2714	50.48	1.7004	34.02
125	18.1	1.2561	32.07	1.5099	32.04
126	14.8	1.1700	31.13	1.4959	31.11
127	18.7	1.2694	44.45	1.6424	34.02
128	18.7	1.2699	38.77	1.5903	34.03
129	18.3	1.2625	38.48	1.5894	30.05
130	22.0	1.3422	62.45	1.7932	60.19
131	22.7	1.3547	76.19	1.8807	69.24
132	22.4	1.3501	84.39	1.9244	60.28
133	19.3	1.2866	48.00	1.7812	54.09
134	19.0	1.2799	51.42	1.7305	54.49
135	18.5	1.2676	51.42	1.6994	59.48
136	21.3	1.3264	62.38	1.7979	70.38
137	19.4	1.2894	37.08	1.5693	29.24
138	24.1	1.3810	94.79	1.9771	92.79
139	19.1	1.2877	44.13	1.6405	48.85
140	16.4	1.2140	30.91	1.4924	29.14
141	19.5	1.2904	61.74	1.7912	69.39
142	14.7	1.1675	43.48	1.6368	30.04
143	18.4	1.2658	38.42	1.6314	34.00
144	20.5	1.3075	48.03	1.6800	50.17
145	22.7	1.3539	78.70	1.8951	74.52

TABLE 17 -- Continued

Leaf No.	Leaf Length (mm.) (X)	log Leaf Length (log X)	Leaf Area (mm. ²) (Y)	log Predicted Leaf Area ^a (log Y)	Predicted Leaf Area (Y)
146	17.0	1.2304	43.63	1.6323	47.63
147	22.6	1.3541	73.42	1.8664	80.17
148	23.2	1.3655	78.89	1.8981	86.13
149	14.7	1.1673	34.32	1.4863	32.38
150	16.1	1.2063	13.23	1.1215	13.32

^aValues obtained by solving the regression equation with the corresponding log X.

TABLE 25

STIMULANT EFFECT OF CORRELATION COEFFICIENTS AND CIRCULAR PERIODIC INDICATIONS EXPRESSED RELATIONSHIPS BETWEEN LOGGING AND AREAS OF MAPPED LARVAE

Type of Leaf	No. of Larvae	Correlation Coefficient	Correlation Regression Equation
Michaux Radix	50	$r^2 = .742146$	(1) $\log \bar{Y} = 1.9818 \log X - 0.7420$
Artemisia Radix	10	$r = .963366$	(2) $\log \bar{Y} = 2.2327 \log X - 1.1462$
Healdy Ternipalms	10	$r = .899366$	(3) $\log \bar{Y} = 2.4003 \log X - 0.8134$
Composite Sample of Above Three Types	100	$r = .937766$	(4) $\log \bar{Y} = 2.2366 \log X - 1.2343$
Midformed Ternipalms	10	$r = .946966$	(5) $\log \bar{Y} = 1.8607 \log X - 0.1737$

$r_{Y, X}$ at 4, 6, ∞ , 100; $r_{Y, X}$ at 100; 4, 6, ∞ , 200.

DAILY WATER LOAD PER HOUR (GAL.)—SUM OF FOUR WATERING PERIODS

A. Water Load Data		Date of Counting							
		April 18 (A)				May 2 (B)			
		Young Draft		Selling		Young Draft		Selling	
Replication No.	Days after Watering	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	1	9.42	8.24	17.56	17.56	17.56	12.17	12.17	17.14
	2	9.85	6.59	16.16	16.16	12.89	13.38	13.38	17.99
	3	7.48	6.88	16.74	16.74	12.18	12.71	12.71	17.45
	Replication total	26.75	20.71	50.50	50.50	42.63	38.26	38.26	52.58
2	1	6.85	9.34	16.09	16.09	16.99	5.79	5.79	17.87
	2	7.97	10.54	16.26	16.26	13.59	6.56	6.56	18.66
	3	6.46	9.12	14.84	14.84	16.97	6.12	6.12	17.68
	Replication total	21.28	29.00	47.23	47.23	47.55	18.47	18.47	54.21
3	1	7.16	6.25	17.18	17.18	12.46	2.49	2.49	15.19
	2	6.77	7.89	17.38	17.38	12.97	4.48	4.48	14.15
	3	6.85	7.52	14.56	14.56	12.59	3.94	3.94	14.43
	Replication total	20.78	21.66	49.12	49.12	38.02	10.91	10.91	43.77
4	1	7.76	5.41	17.09	17.09	12.47	6.51	6.51	21.89
	2	6.75	9.27	19.04	19.04	13.56	16.76	16.76	21.23
	3	9.56	6.46	15.43	15.43	13.75	16.51	16.51	23.17
	Replication total	24.07	21.14	51.56	51.56	40.78	39.78	39.78	66.29

TABLE 14 -- Continued

A. Water Loss Data

(Cont.)

Replication	Days after starting	Date of Gradings				Date of Gradings			
		April 14-15		May 3-10		April 14-15		May 3-10	
No.		Year-Grads (\$)	Clay Red (\$)	Grading Check (\$20)	Year-Grads (\$)	Year-Grads (\$)	Clay Red (\$)	Grading Check (\$20)	
4	1	15.28	.....	5.79	1.30	.....	.....	10.21	10.21
	2	14.56	.....	11.19	14.10	.....	.....	20.46	20.46
	3	14.33	.....	11.13	13.49	.....	.....	5.93	5.93
Replication total		43.97	.....	18.11	28.89	.....	.....	26.60	26.60
4	1	.....	.....	25.21	.....	.....	.....	14.26	14.26
	2	.....	.....	17.93	.....	.....	.....	15.26	15.26
	3	.....	.....	15.46	.....	.....	.....	14.26	14.26
Replication total		.....	.....	58.60	.....	.....	.....	43.78	43.78
Totals		136.27	25.28	101.23	183.45	98.53	98.53	101.67	101.67
Date of Gradings totals						103.77			

B. White Lane Data

Reproduction No.	Days after Hatching	Date of Grading					Seedling Check (RM)	July 31, 54			Seedling Check (RM)
		Yarrow (Y)	Yarrow Credit (Y)	Clay Bird (CB)	Seedling (RM)	Yarrow Credit (Y)		Yarrow Credit (Y)	Clay Bird (CB)	Seedling (RM)	
1	1	2.49		3.97	10.42			4.54	3.55	13.08	
	2	2.46		4.20	10.33			4.00	4.84	11.46	
	3	3.30		8.47	11.83			4.31	4.32	13.42	
	Reproduction total	8.25		16.64	32.58			12.84	12.71	37.96	
2	1	3.50		2.89	8.32			8.48	3.55	7.33	
	2	4.42		4.20	10.33			7.14	5.04	9.42	
	3	4.79		4.30	11.34			4.32	3.72	8.02	
	Reproduction total	12.71		11.39	30.00			19.94	12.31	24.77	
3	1	5.23		.60	6.81			2.59	3.13	5.14	
	2	6.31		.40	6.44			4.09	1.06	11.36	
	3	6.79		1.39	7.88			3.74	1.00	16.36	
	Reproduction total	17.33		2.39	21.13			10.42	5.19	32.86	
4	1	5.15		4.38	18.40			4.32	4.80	6.03	
	2	3.79		3.36	20.34			3.71	5.31	6.77	
	3	4.73		4.30	18.84			3.77	7.01	6.82	
	Reproduction total	13.67		12.04	57.58			11.80	17.12	19.62	

TABLE IV -- (continued)

B. Water-Less Data (Cont.)		Date of Grafting					
Replication No.	Days after grafting	July 4, '61			July 11, '61		
		Yarrow Greys	Chips Red	Chips	Yarrow Greys	Chips Red	Chips
		(g)	(g)	(g)	(g)	(g)	(g)
1	1	4.16	.....	4.46	4.34	.....	1.16
	2	4.43	.....	4.23	8.67	.....	4.23
	3	8.87	.....	8.67	8.77	.....	4.23
	Replication total	17.47	.....	17.32	18.78	.....	17.34
4	1	.....	.....	18.26	.....	.....	12.46
	2	.....	.....	16.13	.....	.....	12.56
	3	.....	.....	18.26	.....	.....	12.57
	Replication total	.....	.....	52.65	.....	.....	37.59
Totals		49.37	42.48	86.93	78.65	59.48	144.46
Date of grafting begins		314, 13					
Grand total		1595.43					

TABLE 10 -- Continued

C. Date of Grafts 21; Type of Grafts (D = G)						
Type of Grafts	April 14	May 3	Date of Grafts		July 21	(G) Totals
	(A)	(C)	July 4	(D)	(G)	
(V)	156, 174(18) ^a	145, 40	43, 41	76, 46	445, 50(56)	
(G)	14, 154(14)	91, 53	43, 48	94, 48	281, 81(86)	
(GK)	243, 24(18)	341, 45	255, 16	144, 44	598, 24(28)	
(G) Totals	413, 77(80)	576, 97	344, 11	214, 13	1,324, 54(144)	
D. Date of Grafts 22; Days after Watering (F = G)						
Days after Watering	April 14	May 3	Date of Grafts		July 21	(F) Totals
	(A)	(C)	July 4	(D)	(F)	
1	146, 79(18)	216, 37	74, 47	43, 46	824, 89(90)	
2	178, 17	207, 34	147, 48	168, 16	393, 37	
3	255, 13	174, 24	113, 11	158, 17	353, 41	
(G) Totals	579, 77(80)	597, 95	334, 11	269, 79	1,580, 54(144)	
E. Type of Grafts 23; Days after Watering (F = G)						
Type of Grafts	Days after Watering		Type of Grafts		Days after Watering	
	(V)	July 3rd	(G)	(D)	(F)	(F) Totals
Days after Watering						
1	146, 24(18)	44, 47(14)	101, 89(24)	824, 89(90)		
2	243, 17	94, 46	137, 48	393, 37		
3	156, 14	95, 24	114, 11	353, 41		
(G) Totals	415, 54(56)	233, 11(18)	352, 87(24)	1,570, 54(144)		

^aFigures in parentheses denote number of leaves lost/died in total.

COMPARISON OF MEAN DAILY WATER LOSS PER HOUR, MEAN DAILY WATER LOSS PER HOUR PER CM. STEM AREA, AND MEAN WATER LOSS PER HOUR PER 10 CM. LEAF AREA (TWO ANALYSES FOR EACH TREATMENT) (WHOLE WATERING PERIOD DATES)

Treatment	Daily		Daily		Daily		Daily	
	Water Loss (grs.)	Water Loss (grs./100 sq. cm.)	Water Loss (grs./100 sq. cm.)	Water Loss (grs./100 sq. cm.)	Water Loss (grs./100 sq. cm.)	Water Loss (grs./100 sq. cm.)	Water Loss (grs./100 sq. cm.)	Water Loss (grs./100 sq. cm.)
Type of Grubbing (G)								
Transverse (T)	1.10(140)		1.18(144)		4.07(148)		4.07(148)	
Clay bed (C)	1.47(154)		1.47(154)		4.07(154)		4.07(154)	
Seedling clods (S)	3.10(165)		3.04(165)		4.07(165)		4.07(165)	
Date of Grubbing (D)								
April 14 (A)	2.15(182)		2.08(182)		3.10(182)		3.10(182)	
May 8 (M)	3.36		3.36		3.36		3.36	
July 4 (J)	1.78		1.37		3.36		3.36	
July 22 (B)	1.43		1.23		3.36		3.36	
Days after Transplanting (T)								
1	2.04(144)		1.74(144)		3.04(144)		3.04(144)	
2	3.48		1.74		4.07		4.07	
3	4.37		1.67		3.44		3.44	
Grand Mean	2.14(173)		1.84(173)		4.07(173)		4.07(173)	

*Contains three instead of four clay bed replications.

by figures in parentheses denote number of leaves per meter.

TABLE 31

MEAN DAILY WATER LOSS PER HOUR (GMS.) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASE

A. Date of Geotage $\times$ Type of Geotage (D $\times$ G)

Type of Geotage	April 14	May 8	July 4	July 21	(D) Means
	(A)	(B)	(C)	(D)	
(Y)	2.27(240) ^a	2.29	1.84	1.28	1.73(245)
(C)	1.84(240)	2.28	1.91	1.68	1.91(232)
(Ch)	2.21(230)	4.19	2.88	2.28	2.31(288)
(D) Means	2.11(230)	2.25	1.75	1.41	2.14(235)

B. Date of Geotage $\times$ Days after Watering (T $\times$ G)

Days after Watering	April 14	May 8	July 4	July 21	(T) Means
	(A)	(B)	(C)	(D)	
1	2.16(240)	2.51	1.88	1.46	2.25(240)
2	2.25	2.45	1.79	1.70	2.48
3	2.12	2.38	1.92	1.62	2.25
(D) Means	2.11(230)	2.24	1.75	1.41	2.24(238)

C. Type of Geotage $\times$ Days after Watering (T $\times$ G)

Days after Watering	(Y)	(C)	(Ch)	(T) Means
1	1.76(240)	1.58(14)	2.18(16)	2.26(240)
2	2.03	1.80	2.82	2.48
3	1.78	1.18	2.28	2.22
(D) Means	1.72(240)	1.45(190)	2.30(280)	2.24(220)

^aFigures in parentheses denote number of leaves per mean.

TABLE XI

MEAN DAILY WATER LOSS PER HOUR PER CM. ² STEM AREA (CM²) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage <u>vs.</u> Type of Graftage (D $\times$ G)						
		April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D) Means	
Type of Graftage						
	(T)	1.54(40) ^a	1.76	.68	.75	1.19(246)
	(G)	1.87(46)	1.27	.31	.65	.97(252)
	(G)	4.14(12)	3.37	2.32	1.75	2.81(286)
(D) Means		1.84(302)	1.54	1.37	1.13	1.64(718)
B. Date of Graftage <u>vs.</u> Days after Watering (T $\times$ D)						
		April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D) Means	
Days after Watering						
	1	1.50(40)	2.28	1.25	1.85	1.74(246)
	2	2.70	2.46	1.42	1.20	1.94
	3	1.30	2.32	1.46	1.58	1.87
(D) Means		1.84(142)	1.54	1.37	1.13	1.64(702)
C. Type of Graftage <u>vs.</u> Days after Watering (T $\times$ G)						
		(T)	(G)	(G)	(T) Means	
Days after Watering						
	1	1.13(40)	.84(4)	2.25(16)	1.74(246)	
	2	1.23	1.51	2.14	1.74	
	3	1.28	1.53	2.29	1.87	
(D) Means		1.19(142)	.94(102)	2.16(218)	1.84(702)	

^aFigures in parentheses denote number of hours per mean.

TABLE 33

MEAN DAILY WATER LOSS PER HOUR PER 10 CM.² LEAF AREA
(GMS.) FOR THREE SETS OF TREATMENT COMPARISONS
(FIRST ORDER INTERACTIONS) ON SINGLE
WATERING PERIOD BASE

A. Date of Girdling $\times$ Type of Girdling (D $\times$ C)						
		April 14 (A)	May 8 (B)	July 4 (C)	July 31 (D) Means	
Type of Girdling						
	(Y)	3.34(300) ^a	3.33	3.43	3.37	4.43(240)
	(C)	3.48(48)	4.34	11.93	3.43	4.47(180)
	(Cn)	2.39(73)	2.33	2.44	2.40	2.37(280)
(D) Means		3.34(344)	3.40	3.39	4.18	4.43(700)
B. Date of Girdling $\times$ Days after Watering (T $\times$ D)						
		April 14 (A)	May 8 (B)	July 4 (C)	July 31 (T) Means	
Days after Watering						
	1	3.34(40)	3.17	3.35	3.29	3.34(240)
	2	3.31	3.73	9.43	4.44	4.39
	3	3.13	3.38	4.73	4.39	3.74
(D) Means		3.19(180)	3.43	8.39	4.18	4.43(700)
C. Type of Girdling $\times$ Days after Watering (T $\times$ C)						
		(Y)	(C)	(Cn)	(T) Means	
Days after Watering						
	1	3.39(80)	4.37(34)	2.37(14)	3.34(140)	
	2	4.33	7.33	3.33	4.79	
	3	3.77	4.33	2.33	3.74	
(D) Means		4.34(240)	4.47(114)	2.37(284)	4.43(714)	

^aFigures in parentheses denote number of items per mean.

TABLE 34

MEAN DAILY^a WATER LOSS PER HOUR PER 10 CM.² LEAF AREA (GMP^b) FOR THREE SETS OF TREATMENT COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE WATERING PERIOD BASIS^c

A. Date of Graftage <u>ys</u> , Type of Graftage (D x G)						
		April 14 (4)	May 5 (5)	July 4 (6)	July 21 (G) Means (D)	
Type of Graftage						
(Y)		3.86(10) ^b	3.83	3.42	3.39	4.09(14)
(YGY ^d)		3.18(14)	3.76	3.73	3.69	3.19(14)
(YG)		3.34(7)	3.31	3.44	3.40	3.37(21)
(D) Means		3.46(13)	3.30	3.39	3.31	3.19(12)

B. Date of Graftage <u>ys</u> , Days after Watering (T x D)						
		April 14 (4)	May 5 (5)	July 4 (6)	July 21 (T) Means (D)	
Days after Watering						
1		3.98(14)	3.84	3.48	3.33	3.95(14)
2		3.31	3.37	3.94	3.73	3.33
3		3.82	3.33	3.97	3.40	3.18
(D) Means		3.54(13)	3.18	3.78	3.31	3.19(12)

C. Type of Graftage <u>ys</u> , Days after Watering (T x G)					
		(Y)	(YG)	(GY)	(T) Means
Days after Watering					
1		3.93(14)	3.45(14)	3.38(14)	3.56(14)
2		4.32	3.39	3.51	3.31
3		3.35	3.33	3.33	3.19
(G) Means		3.87(14)	3.14(14)	3.19(14)	3.19(12)

^aCalculated from instead of from clip leaf replications.

^bFigures in parentheses denote number of leaves per mean.

TABLE 78

SUMMARY OF "D" VALUES OBTAINED FROM ANALYSIS OF
 TABULARY OF DAILY WATER LOSS PER HOUR, DAILY
 WATER LOSS PER HOUR PER CM.² STEM AREA, AND
 DAILY WATER LOSS PER HOUR PER 18 CM.² LEAF
 AREA (TWO ANALYSES)

Source of Variation	Daily Water Loss/Hr.	Daily Water Loss/ Hr./Cm. ² Stem Area	Daily Water Loss/ Hr./18 Cm. ² Leaf Area	Daily Water Loss/ Hr./18 Cm. ² Leaf Area ^b
W²				
A, B $\times$ $\overline{W_2}$, C, D	44.32 ^a	45.46	n. s.	n. s.
A $\overline{W_2}$, B	n. s.	n. s.	n. s.	n. s.
C $\overline{W_2}$, D	n. s.	n. s.	n. s.	n. s.
(W)				
D _W	36.46	45.77	n. s.	n. s.
D _W	n. s.	n. s.	n. s.	n. s.
Remainder	11.46	n. s.	n. s.	n. s.
Q				
V, G $\times$ $\overline{Q_2}$, Gk	21.70	129.71	4.44 ^a	36.43
V $\overline{Q_2}$, G	48.62	n. s.	n. s.	8.49
T				
L, S $\times$ $\overline{T_2}$, I	n. s.	n. s.	n. s.	n. s.
L $\overline{T_2}$, I	22.18	13.25	n. s.	13.70
(T)				
L, S $\times$ $\overline{T_2}$, I	23.32	21.95	n. s.	7.44
L $\overline{T_2}$, I	34.63	11.91	n. s.	5.24 ^a
(T)				
T _L	22.32	11.91	n. s.	5.24 ^a
T _Q	36.43	21.95	n. s.	7.44
T $\times$ D				
T _L $\times$ D	1.97	n. s.	n. s.	n. s.
T _Q $\times$ D	1.65 ^a	n. s.	n. s.	n. s.
(T $\times$ D)				
T $\times$ D _L	1.89 ^a	n. s.	n. s.	n. s.
T $\times$ D _Q	1.42 ^a	n. s.	n. s.	n. s.
Remainder	1.13 ^a	n. s.	n. s.	n. s.

TABLE 18 -- Continued

Source of Variation	Daily Water Loss/ltr.	Daily Water Loss/ ltr./Cm. ² Plant Area	Daily Water Loss/ ltr./10 Cm. ² Leaf Area	Daily Water Loss/ ltr./10 Cm. ² Leaf Area ²
T x Q				
T _L x Q	n. s.	n. s.	n. s.	1.99
T _Q x Q	4.33	3.72*	n. s.	n. s.

*Contains three instead of four ship bed replications.

²Subscripts L and Q refer to linear and quadratic regression components, respectively. Items in parentheses denote additional breakdowns of treatments immediately preceding them.

*Unless marked otherwise (single-starred or n. s.), the probability level is less than .01.

TABLE 24

ANALYSIS OF VARIANCE (HOW OF FOUR WATERING PERIODS OF DAILY WATER LOSS PER HOUR FOR FIVE PLANT TREATMENTS (FOUR DATES AND THREE TYPES OF CULPITUM) AND TREES-PLANT TREATMENTS (THREE DATES AFTER WATERING)

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a , 10	, 01
A. Preliminary Analysis						
Total	179	4935.4466				
Main Effects	29	4977.8999				
Treatments	11	3332.4090	303.479	18.1366	1.77	3.44
β	3	1406.7309	469.243	15.1666	5.80	4.23
α	6	1926.1787	321.037	16.8966	3.19	5.80
$\beta \times \alpha$	6	112.6809	18.779	ns.		
Error (a)	49	1403.0401	28.633			
Sub-Plots	129	156.1679				
γ	3	38.7413	12.971	16.8966	3.59	4.23
$\gamma \times \beta$	6	15.1227	2.527	3.8166	3.19	3.97
$\gamma \times \alpha$	6	5.7242	0.954	3.496	3.46	3.91
$\gamma \times \beta \times \alpha$	12	77.1876	6.432			
Error (b)	367	111.1188				

TABLE 26 — Continued.

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a , 95	Tabular F Value ^a , 91
B. Completed Analysis						
D	1	1404.7939			4.64	5.17
A, B, C, D	3		1325.335	46.3199		
A, B, D	1		21.909	2.466, n.s.		
C, D, D	1		6.514	n.s.		
(D) ²	1	1404.7939				
D ₁	1		966.607	31.9199		
D ₂	1		51.843	n.s.		
Residuals	1		423.878	13.6199		
C	2	1925.1347				
V, W, C	1		1291.293	66.3099		
V, C, W, C ₂	1		645.846	31.7999		
Error (a)	48		25.955			
T	4	18.7423			1.74	4.30
V, W, C	1		37.848	32.1199		
V, C, W, C ₂	1		1.179	n.s.		
(T) ²	4	18.7423				
V, W, C	1		23.716	21.5199		
V, C, W, C ₂	1		14.853	13.1199		
(T) ²	4	18.7423				
V, W, C	1		14.853	23.3199		
V, C, W, C ₂	1		22.716	21.5199		

TABLE 18. — Continued

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Value .05	Tabular F Value .01
B. Completed Analysis						
(Cont.)						
T = B	4	18.1127				
T _L × B	3	3.8439		2.449	2.774	2.99
T _H × B	3	4.9113		2.795	2.834	2.99
(T × B)	4	18.1127				
T = D _L	2	3.4923		2.725	2.494	4.42
T × D _L	2	4.9774		2.439	2.494	4.42
T = D _H	2	4.7823		2.391	2.334	4.42
Residuals						
T = G	4	3.3262				
T _L × G	2	.7878		.393	n.s.	
T _H × G	2	4.5388		2.479	4.424	4.42
Error (G)	168			.714		

Analysis corresponding to d.f. for lines and respective error.

Subscripts L and G refer to linear and quadratic regression components, respectively. Lines in parentheses denote additional breakdown of treatments immediately preceding term.

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF DAILY WATER LOSS PER HOUR PER CM.² STEM AREA FOR TREES IN MAIN PLOT TREATMENTS (POOR, DATE, AND THREE TYPES OF ORNAMENT) AND TREES IN 878-PILOT TREATMENTS (TREES DATA AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values 05 .05 .01
A. Preliminary Analysis					
Total	179	3048.5091			
Main Plots	89	4798.5287			
Treatments	11	3816.5554	345.405	13.7928	1.39
B	3	1217.1415	405.713	16.2788	2.80
C	2	3573.5539	1786.777	84.7988	8.49
D & G	4	243.9323	60.983	2.4	
Error (a)	68	1865.9337	27.440		
Sub-Plots					
T	129	70.9884			
T x B	3	15.6553	5.218	14.3288	2.39
T x C	4	4.5947	1.148	2.4	
T x D & G	4	4.0538	1.013	3.2388	2.44
Error (b)	121	45.5421	.376		
Error (N)	10				

TABLE VI -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)
B. Completed Analysis					
1	1	1817.1478			
A, B, C, D	1			47.6800	7.10
A, B, C	1			n.s.	
A, B, D	1			n.s.	
C, D	1				
2	2	1117.1478			
3	3			40.7700	
4	4			n.s.	
5	5			3.6300	
6	6	2873.6579			
7	7			118.7700	
8	8				
9	9				
10	10				
11	11				
12	12				
13	13				
14	14				
15	15				
16	16				
17	17				
18	18				
19	19				
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93	93				
94	94				
95	95				
96	96				
97	97				
98	98				
99	99				
100	100				

TABLE 26

ANALYSIS OF VARIANCE OF POOR WATERING PROVIDED OF SALT WATER 1000 P.P.M. FOR 10 DAL. 1 LEAF AREA FOR TWELVE MAIN PLOT TREATMENTS (FOUR DATES AND THREE TYPES OF GRAFTING) AND THREE SUB-PLOT TREATMENTS (THREE DATES AFTER WATERING)

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Treatment Value at 5%
A. Preliminary Analysis					
Total	179	76,191.8369			
Main Plots	89	76,878.9337			
Treatments	13	13,613.4166	1047.189	n. s.	
D	3	1,937.8633	645.947	n. s.	
G	4	1,743.3078	435.826	3.446	3.86
D x G	4	7,342.8465	1835.615	n. s.	
Error (a)	67	63,555.4129	948.592		
Sub-plots	120	4,364.8478			
T	2	183.6541	91.782	n. s.	
T x D	4	193.7673	48.441	n. s.	
T x G	4	31.9494	7.986	n. s.	
T x D x G	12	1,954.8764	162.775		
Error (b)	108				

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Treatment Y Values (S.E.)
B. Completed Analysis					
ϕ	1	7, 195, 9079			7, 19
$\gamma, \delta, \theta, \zeta$	1				
γ, θ, ζ	1	9231, 920	9231, 920	4, 659	
γ, θ, ζ	1	1597, 474	1597, 474	2, 27	
Error (N)	49	2224, 970			
θ	1	153, 614			
$\delta, \zeta, \theta, \zeta$	1				
δ, ζ, θ	1	9, 950	9, 950	5, 35	
δ, ζ, θ	1	91, 474	91, 474	4, 85	
Error (N)	49	193, 604			
$\theta, \zeta, \theta, \zeta$	1				
θ, ζ, θ	1	94, 974	94, 974	3, 65	
θ, ζ, θ	1	9, 421	9, 421	5, 35	
Error (N)	49	14, 790			

Systems corresponding to d.f. for lines and respective error.

Means in parentheses denote statistical breakdown of treatments individually providing

data.

ALTERNATE ANALYSIS OF VARIANCE ITEM OF FOOD WASTAGES PERIODS OF DAILY WASTES
LOSS PER HOUR FOR 18 Hrs. 1 DAY ABLE FOR TWELVE MAIN PLOT TREATMENTS
(FOOD WASTES AND THREE TYPES OF ORIENTATIONS) AND THREE SUB-PLOT
TREATMENTS (TRACE DATE AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)
A. Preliminary Analysis					
Total	187	5977.5764			
Main Plots	80	5176.3554			
Treatments	11	1901.4093	172.907	1.3046	2.46
D	3	183.2675	61.089	n.s.	
C	2	1403.3381	701.669	53.56	3.11
D x C	6	363.3534	60.559	n.s.	3.12
Error (a)	44	1444.9313	32.839		
B. Sub-Plots					
T	112	667.3547			
T x D	3	60.5785	20.193	1.3046	4.42
T x C	6	31.5535	5.259	3.6	
T x D x C	6	54.8835	9.1473	3.049	3.11
Error (b)	120	407.3899	3.395		
Total	187				

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Values (5% .01%)
B. Completed Analysis					
G	1	1454.5241			
T ₂ × G	1	145.161	145.161	8.0200	8.94
T ₂ × G × C	1	1383.946	1383.946	76.6500	7.29
(G) ²	1	1454.5241			
T ₂ × C	2	1467.479	733.740	41.4700	
T ₂ × C × G	2	1.357	.678	n.s.	
Error (G)	44	35.827			
T	1	35.8716			
T ₂ × T	1			12.7000	4.90
T ₂ × T × C	1			n.s.	
(T)	1	35.8716			
T ₂ × T × G	2			8.140	
T ₂ × T × G × C	2			7.6400	
T × G	4	58.0325			
T ₂ × G	2	57.1179			
T ₂ × G × C	2	.465			
Error (T)	130	4.776			
				3.09	4.81

Squares replications for all G had treatments included of first.

Hydates corresponding to d.f. for (G) and respective error.

Glucose-6-phosphate 1, and 2 refer to linear and quadratic regression components, respectively. Error is permutation Monte Carlo additional treatments of treatments including preceding ones.

TABLE 42

DAILY WATER LOSS PER HOUR (GMS.) FOR PLANTS OF THE MAY 2
CRAFTAGE DATE (SUM OF FOUR WATERING PERIODS)

A. Water Loss Data					
Replication No.	Days after Watering	Type of Growth			
		(V)	(C)	(H)	(CM)
1	1	12.86	12.78	1.24	17.24
	2	12.59	12.28	2.14	17.99
	3	12.48	12.91	2.28	17.68
Replication total		37.93	37.97	5.66	52.91
2	1	12.98	8.97	2.28	17.87
	2	12.88	4.88	2.88	18.84
	3	12.98	4.22	2.82	17.62
Replication total		38.84	18.07	7.98	54.31
3	1	12.40	2.47	4.87	19.74
	2	12.87	4.42	4.97	14.13
	3	12.82	2.94	7.82	14.42
Replication total		38.12	9.83	17.66	48.29
4	1	12.49	9.27	4.22	21.88
	2	12.28	12.74	8.28	20.28
	3	12.71	12.81	8.42	22.97
Replication total		47.48	34.82	20.92	65.13
5	1	8.94	.....	.....	18.21
	2	14.14	.....	.....	18.44
	3	12.68	.....	.....	8.94
Replication total		35.76	.....	.....	45.59
6	1	.....	.....	.....	14.24
	2	.....	.....	.....	14.24
	3	.....	.....	.....	14.24
Replication total		.....	.....	.....	42.72
Totals		148.48	98.62	58.89	262.55
Grand total					648.44

TABLE 48 -- Continued

B. Type of Garbage vs. Days after Tossing (T = 0)					
Days after Tossing	Type of Garbage				(T) Totals
	(F)	(C)	(S)	(O)	
1	54.38(5) ^a	38.86(4)	14.53(3)	94.18	197.33(12)
2	64.19	36.81	19.21	108.84	229.05
3	61.19	34.38	29.28	99.67	224.52
<hr/>					
(C) Totals:	159.48(14)	99.45(12)	63.09(10)	302.69(18)	641.71(37)

^a Figures in parentheses denote number of items included in totals.

TABLE 42

COMPARISON OF MEAN DAILY WATER LOSS PER HOUR, MEAN DAILY WATER LOSS PER HOUR PER CM.² STEM AREA, AND MEAN DAILY WATER LOSS PER HOUR PER 10 CM.² LEAF AREA FOR PLANTS OF THE MAY 8 ORCHARD DATE MAIN TREATMENTS (SINGLE WATERING PERIOD BASE)

		Daily Water Loss/Hr (gms.)	Daily Water Loss/Hr /Cm. ² Stem Area (gms.)	Daily Water Loss/Hr /10 Cms. ² Leaf Area (gms.)
Type of Grafts (G)				
Tender graft	(T)	3.49(40) ^a	2.76(48)	3.83(48)
Clay bud	(C)	2.29(44)	2.23(48)	4.34(48)
Shield bud	(S)	3.19(44)	79(48)	2.94(48)
Knelling check	(CK)	4.79(72)	3.59(72)	3.51(72)
Days after Watering (T)				
	1	2.60(76)	2.98(76)	3.08(76)
	2	3.01	2.11	3.60
	3	2.85	2.02	3.43
Grand Mean		3.43(228)	2.63(224)	3.59(228)

^aFigures in parentheses denote number of stems per mean.

TABLE 42

MEAN DAILY WATER LOSS PER HOUR (GMS/L) FOR PLANTS OF THE
MAT 3 GRAFTAGE DATE FOR ONE TREATMENT COMPARISON
(FIRST ORDER INTERACTION) ON SINGLE
WATERING PERIOD BASIS

Type of Graftage vs. Days after Watering (T = 6)

	(T)	(C)	(B)	(C-)	(T) Means
Days after Watering					
1	3.83(20) ^a	1.88(14)	1.64(14)	3.93(14)	3.68(78)
2	3.51	2.19	1.38	4.84	3.01
3	3.18	2.14	1.38	4.13	2.81
(C) Means	3.50(18)	2.08(42)	1.45(42)	4.17(71)	2.83(218)

^aFigures in parentheses denote number of hours per mean.

TABLE 43

MEAN DAILY WATER LOSS PER MOON PER CM.² STEM AREA (DMA) FOR PLANTS OF THE MAT 2 CRAPPAGE DATE FOR ONE TREATMENT COMPARISON (FIRST ORDER INTERACTION) ON SINGLE WATERING PERIOD BASIS

Type of Geotextile vs. Days after Watering (T x G)

	(T)	(G)	(G)	(G)	(T) Means
Days after Watering					
1	1.77(38) ^a	1.43(34)	.71(34)	3.44(34)	1.98(74)
2	1.88	1.74	.81	3.73	2.13
3	1.44	1.31	.87	3.57	2.03
(G) Means	1.74(38)	1.57(34)	.79(34)	3.54(72)	2.03(138)

^aFigures in parentheses denote number of Dams per mean.

TABLE 44

MEAN DAILY WATER LOSS PER HOUR, PER 16 CM.² LEAF AREA (GMS.) FOR PLANTS OF THE MAY 3 GRAFTAGE DATE FOR ONE TREATMENT COMPARISON (TREATMENT ORDER INTERACTION) ON SINGLE WATERING PERIOD BASIS

Type of Graftage 22, Days after Watering (T x G)

	(T)	(G)	(TG)	(TG)	(T) Means
Days after Watering					
1	3.31(38) ^a	4.14(36)	3.76(34)	3.34(34)	3.68(34)
2	4.33	3.39	3.17	3.34	3.60
3	3.88	3.87	3.34	3.31	3.63
(G) Means	3.83(40)	4.14(40)	3.44(40)	3.31(34)	3.71(34)

^a Figures in parentheses denote number of stems per mean.

TABLE 46

SUMMARY OF "F" VALUES OBTAINED FROM ANALYSES OF VARIANCE OF DAILY WATER LOSS PER HOUR, DAILY WATER LOSS PER HOUR PER CM.² STEM AREA, AND DAILY WATER LOSS PER HOUR PER 10 CM.² LEAF AREA FOR PLANTS OF THE MAY 8 CRAFTAGE DATE

Source of Variation	Daily Water Loss (Mr.)	Daily Water Loss/ Mr. /Cm. ² Stem Area	Daily Water Loss/ Mr. /10 Cms. ² Leaf Area
Q ^a	4.34 ^b	13.33	4.70 ^a
T, C, & <u>12</u> , Ch	17.76	36.36	9.14
T, C, &	9.94	n.s.	3.93 ^a
(C)			
T, C <u>12</u> , &, Ch	n.s.	4.89	11.46
T <u>12</u> , C	n.s.	n.s.	n.s.
& <u>12</u> , Ch	23.86	32.17	n.s.
(C)			
T, Ch <u>12</u> , &, C	21.46	23.74	n.s.
T <u>12</u> , Ch	n.s.	18.80	3.14 ^a
& <u>12</u> , C	n.s.	n.s.	3.93 ^a
(C)			
T, & <u>12</u> , C, Ch	4.33	14.48	n.s.
T <u>12</u> , &	9.99	n.s.	n.s.
C <u>12</u> , Ch	11.80	21.74	12.62
T	39.87	n.s.	4.83 ^a
1, 2 <u>12</u> , 3	n.s.	n.s.	n.s.
1 <u>12</u> , 3	21.46	n.s.	17.84
(T)			
1, 3 <u>12</u> , 2	13.81	n.s.	3.13 ^a
1 <u>12</u> , 2	9.91	n.s.	n.s.

^aNone in parentheses denote additional breakdowns of treatments immediately preceding them.

^bUnless marked otherwise (single-starred or n.s.), the probability level is less than .01.

TABLE 44

ANALYSIS OF VARIANCE (BIBS OF FOOD, WATERING PERIODS), WITH PLANTS OF THE MAT 3
CULTURE DATE OF DAIRY WATER LOSS FOR FOUR MAJOR TREATMENTS
(TYPES OF GRASSLAND) AND THREE SUB-PLANT TREATMENTS (DATE AFTER WATERING)

Source of Variation	d. f.	Sum of Squares	Mean Square	F	F Value ^a at 5%
A. Preliminary Analysis					
Total	36	1760.7764			
Main Effects	18	1413.5761			
Q	3	1381.8494	460.553	8.1684	8.42
Error (q)	15	673.1037	44.862		
Sub-Whole	18	68.3963			
T	3	25.3312	15.8204	8.1684	8.42
T x Q	6	8.1613	1.3602	n. s.	
Error (N)	15	36.6773	2.4451		
B. Completed Analysis					
Q	3	1381.8494	460.553	12.1684	4.34
T	3	25.3312	8.4437	3.6684	4.34
T x Q	6	8.1613	1.3602	n. s.	
Error	15	36.6773	2.4451		
Q	3	1381.8494	460.553	12.1684	4.34
T	3	25.3312	8.4437	3.6684	4.34
T x Q	6	8.1613	1.3602	n. s.	
Error	15	36.6773	2.4451		

Source of Variation	d. f.	Sum of Squares	Mean Square	F	Tabular F Value , .05	Value , .01
B. Completed Analysis (Cont.)						
(2) T, C, T, A, C	2	1,000.8494				
T, C, T, A, C	1		948.7944	21.4444		
T, C, C	1		156.2000	3.8333 n.s.		
A, C	1		95.4479	n.s.		
(3) T, A, T, C, C	2	1,001.8494				
T, A, T, C, C	1		103.7943	4.3333		
T, C, C	1		402.7943	9.9333		
A, C	1		595.4007	11.9000		
(4) T, A, T, C, C	2	10.1011				
T, A, T, C, C	1		402.7943	n.s.	4.17	7.56
T, C, C	1		25.4070	21.9000		
(5) T, A, T, C, C	2	10.1011				
T, A, T, C, C	1		16.1913	33.8133		
T, C, C	1		9.9098	7.5333		

signifies corresponding to d. f. for item and corresponding error.

Signifies in parentheses denotes additional breakdown of treatments (immediately preceding item).

ANALYSIS OF VARIANCE (BOM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 3 GRAFTAGE DATE OF DAILY WATER LOSS PER HOUR PER CM² STEM AREA FOR FOUR MAIN PLOT TREATMENTS (TYPES OF GRAFTAGE) AND THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a 05	01
A. Preliminary Analysis						
Total	84	1893.5136				
Main Plots	18	1894.8700				
G	3	1130.8913				
Error (a)	15	464.3985	30.9599	11.12**	4.42	7.46
Sub-Plots	36	50.6328				
T	2	4.8555	2.4278	n.s.	1.32	
T x G	6	2.9918	.5019	n.s.		
Error (b)	32	31.3855	1.014			
B. Completed Analysis						
G	3	1130.8913				
V, C, S, TB, CB	1		1028.1638	16.15**	4.42	7.46
V, C, S	2	103.6179	51.809	n.s.	1.42	
(CB) ^b	2	1130.8913				
V, C, TB, A, CB	1		104.9746	4.39**		
V, TB, C	1		38.8788	n.s.		
S, TB, CB	1		916.0184	32.17**		

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)
B. Completed Analysis (Cont.)					
(1) $T, C, \frac{1}{2}C, \& C$	3	1156.0018			
$T, C, \frac{1}{2}C, \& C$	1		646.1576	23.1400	
$\frac{1}{2}C, \& C$	1		646.1576	23.1400	
$\& C$	1		33.6931	n.s.	
(2) $T, \& C, \frac{1}{2}C, C$	3	1156.0018			
$T, \& C, \frac{1}{2}C, C$	1		607.2372	24.4600	
$\& C, \frac{1}{2}C, C$	1		102.0185	3.6100	
$\frac{1}{2}C, C$	1		442.2760	24.1900	
T	3	4.6626			
$T, \& C, \frac{1}{2}C$	1		.0489	n.s.	
$\& C, \frac{1}{2}C$	1		4.6626	4.17	7.86

*Values corresponding to d.f. for lines and corresponding error.

Values in parentheses denote additional breakdown of treatments (nominally) presenting:

None

TABLE 40

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAT A
 DRAFTED DATE OF DAILY WATER LOGS FOR EACH PER 10 DAY $\times$ LEAF AREA FOR FOUR
 MAIN PLOT TREATMENTS (TIMES OF GRAPPLING AND TREES FOR-PLANT
 TREATMENTS (DAYS AFTER WATERING)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a (.05)
A. Preliminary Analysis					
Total	34	1814.8740			
Main Plots	38	1704.9768			
C	3	838.8724	279.6241	4.309	4.43
Error (C)	35	876.1044	25.0315		
Sub-Plots	34	215.8972			
T	2	43.2740	21.6370	6.974	6.37
T $\times$ C	6	58.6708	9.7784	N.S.	
Error (C)	30	114.9524	3.8317		
B. Completed Analysis					
C	3	838.8724			
Y, C, S, D, C	1		437.881	6.1000	6.40
Y, C, S	1		340.914	4.840	5.31
10 ³	3				
Y, C, S, S, C	1		671.6814	11.4500	N.S.
Y, S, C	1		108.1592	N.S.	
S, D, C	1		48.9474	N.S.	

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (5)
(a)					
Y, C, T, C, S	3	334.8334			
Y, T, C, S	3		176.3376	3.816, n.	
Y, T, C, S	3		502.1871	8.104	
C, T, S	3		348.1876	5.7339	
(b)					
Y, S, T, C, C, S	3	334.8334			
Y, T, C, S	3		2.7646	n. s.	
Y, T, C, S	3		64.6614	n. s.	
C, T, S, C, S	3		779.3364	12.6366	
(c)					
Y, T, C, S	3	43.3736			
Y, T, C, S	3		3.7346	n. s.	
Y, T, C, S	3		43.3361	17.8366	
(d)					
Y, T, C, S	3	43.3736			
Y, T, C, S	3		34.3332	5.139	
Y, T, C, S	3		13.9855	4.816, n.	

Squares corresponding to d. d. for items and corresponding error.

Items in parentheses denote additional breakdowns of treatments (see relationship preceding)

There

WATER LOSS PER ROOT (GALLS, L.—SUM OF FOUR WATERED PLANTS)

A. Water Loss Data		Date of Drainage					
		April 14 (2)			May 8 (2)		
Application No.	Days since last watering	Younger Growth	Clay Red	Chalk	Younger Growth	Clay Red	Chalk
1							
(1)	1	26.96	19.97	47.97	26.93	26.96	48.99
(2)		21.96	17.93	43.93	21.95	23.96	43.93
(3)		1.96	21	4.94	2.91	1.96	3.92
Day material		30.98	37.93	56.94	50.93	51.93	96.93
2							
(1)	1	24.94	16.96	46.93	20.96	24.96	44.96
(2)		24.97	21.96	53.98	27.98	40.96	59.96
(3)		2.91	23	4.93	2.94	2.97	3.98
Day material		52.94	59.95	105.93	50.93	68.93	107.93
3							
(1)	1	21.97	17.98	46.94	24.94	26.98	47.94
(2)		18.93	18.93	46.99	29.93	26.94	44.93
(3)		2.97	2.93	3.94	2.93	2.93	3.93
Day material		42.97	38.93	94.93	56.93	55.93	95.93
Replication total		145.91	139.98	299.93	167.93	177.92	299.91
4							
(1)	1	25.92	20.93	41.92	24.98	23.97	46.97
(2)		26.97	22.97	57.98	29.93	23.98	53.91
(3)		1.93	1.93	3.92	1.96	1.92	3.96
Day material		53.95	45.93	103.92	56.93	49.93	104.93

TABLE 47 -- Continued

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A. Water Loss Data (Cont.)			Date of Drafting					
Replication No.	Days after Watering	Time of Day	April 18 (5)			May 1 (5)		
			Yarrow Grub (7)	Chy Red (5)	Seedling Chalk (28)	Yarrow Grub (7)	Chy Red (5)	Seedling Chalk (28)
1 (Cont.)	1	6:0	20.97	24.79	44.86	21.75	18.21	43.24
		6:30	21.55	27.29	44.81	22.47	22.29	42.29
		6:45	1.88	2.12	2.42	2.94	1.89	8.42
	Day total		43.79	54.20	92.09	45.16	42.39	94.95
2	1	6:0	14.98	24.48	41.11	24.90	19.29	44.88
		6:30	14.78	27.88	38.85	24.84	14.78	37.44
		6:45	1.88	2.12	4.12	2.49	.48	8.24
	Day total		31.64	54.48	84.08	52.23	34.55	90.56
3	1	6:0	18.46	17.41	42.84	22.88	11.48	38.89
		6:30	19.39	18.31	42.39	22.29	9.78	38.88
		6:45	.84	.92	2.78	1.17	.31	1.17
	Day total		38.69	36.64	87.91	46.34	21.56	79.94
4	1	6:0	24.78	27.84	48.74	22.99	14.79	38.88
		6:30	18.78	18.32	41.83	44.43	18.21	43.23
		6:45	.89	1.24	3.42	1.87	.88	1.88
	Day total		44.45	47.40	93.99	69.30	33.88	83.99

A. Water Loss Data
(Cont.)

Replication after No. Watering Day		Days Threat of Day	Date of Driftage								
			April 14 (2)			April 15 (2)		May 1 (2)			
			Yarrow Growth	Chlorophyll	Red	Chlorophyll	Yarrow Growth	Chlorophyll	Red	Chlorophyll	
3	(Cont.)	(a)	19.00	21.34	22.77	24.42	26.82	28.27	30.27	31.50	
		(b)	19.00	19.00	24.42	26.82	28.27	30.27	31.50	32.73	34.00
		(c)	20.00	1.34	2.77	4.42	6.82	8.27	10.27	11.50	12.73
		Day total	58.00	41.68	49.96	55.66	61.91	66.81	71.00	73.73	78.23
	Replication total			174.00	124.02	149.88	166.99	185.64	200.41	214.51	226.46
4	(Cont.)	(a)	21.34	21.34	22.77	24.42	26.82	28.27	30.27	31.50	32.73
		(b)	21.34	21.34	22.77	24.42	26.82	28.27	30.27	31.50	32.73
		(c)	2.00	1.34	2.77	4.42	6.82	8.27	10.27	11.50	12.73
		Day total	44.68	43.68	48.54	53.26	60.46	64.76	70.81	75.23	78.23
	Replication total			134.02	131.68	145.38	160.94	181.74	199.76	217.51	233.20
5	(Cont.)	(a)	22.77	22.77	24.42	26.11	27.77	29.77	31.77	33.77	35.77
		(b)	22.77	22.77	24.42	26.11	27.77	29.77	31.77	33.77	35.77
		(c)	2.00	1.34	2.77	4.42	6.82	8.27	10.27	11.50	12.73
		Day total	47.54	46.81	53.61	56.64	62.36	68.81	73.81	79.04	84.00
	Replication total			142.61	140.32	160.94	170.00	187.08	204.41	217.64	231.73
6	(Cont.)	(a)	24.42	24.42	26.11	27.77	29.77	31.77	33.77	35.77	37.77
		(b)	24.42	24.42	26.11	27.77	29.77	31.77	33.77	35.77	37.77
		(c)	2.00	1.34	2.77	4.42	6.82	8.27	10.27	11.50	12.73
		Day total	50.84	50.18	55.64	59.96	66.36	72.81	78.81	85.04	91.00
	Replication total			152.52	150.84	166.99	179.88	199.08	215.64	231.73	248.00

A. Water Loss Data
(Cont.)

Replication after 300 hours	Days after beginning	Time of day	Date of Girdling			
			April 14/53		May 3/53	
			Yeast Growth (%)	Yeast Growth Chip End (%)	Yeast Growth Chip End (%)	Girdling Chip End Change (%)
5	1	140	32.48	.....	23.24	.....
		160	34.49	.....	24.76	.....
		180	3.77	.....	1.86	.....
	Day collected		35.38	.....	25.78	.....
2	140	140	44.46	.....	44.46	.....
		160	33.46	.....	24.04	.....
		180	1.79	.....	1.06	.....
	Day collected		12.32	.....	12.32	.....
3	140	140	34.46	.....	23.97	.....
		160	27.32	.....	24.76	.....
		180	3.38	.....	1.49	.....
	Day collected		27.75	.....	24.24	.....
4	140	140	.....	.....	24.03	.....
		160	.....	.....	.....	.....
		180	.....	.....	.....	.....
	Day collected		.....	.....	.....	.....

A. Water Loop Data

(Cont.)

Replication No.	Days after inoculation	Threat at inoculation	April 14 (1)			May 6 (2)			Seedling Check
			Yarrow Growth		Chy. Prod.	Yarrow Growth		Chy. Prod.	
			(%)	(%)		(%)	(%)		
4 (Cont.)	2	(6)	.....	.....	54.45	.....	.....	65.72	
	(4)	(6)	.....	.....	59.63	.....	.....	59.15	
	(6)	(6)	.....	.....	5.78	.....	.....	5.12	
Day 10 total		.....	.....	79.86	.....	.....	79.99		
5									
	(6)	(6)	.....	.....	42.18	.....	.....	42.64	
	(4)	(6)	.....	.....	42.11	.....	.....	37.23	
	(6)	(6)	.....	.....	3.34	.....	.....	4.28	
Day 10 total		.....	.....	87.63	.....	.....	84.15		
Replication total		.....	.....	169.49	.....	.....	166.34		
Totals		793.47	908.78	1539.28	1053.42	577.14	1434.13		
Date of grafts total		2003.83			1074.40				

TABLE 40 -- Continued

B. Water Loss Data									
Days after Replication No.		Date of Grubbing							
		July 4 (6)				July 11 (6)			
		Days Waiting	Thrs. after Replication	Yarrow Draft (N)	Clay Rod (S)	Seedling Clock (20)	Yarrow Draft (N)	Clay Rod (S)	Seedling Clock (20)
1	1	(6)	(6)	9.87	15.40	28.61	18.22	15.22	42.66
		(6)	(6)	9.88	15.67	30.64	14.55	15.55	37.23
		(6)	(6)	5.1	34	1.25	35	32	4.84
	Day total	(6)		14.84	15.38	32.35	33.12	35.79	38.73
2	1	(6)	(6)	6.99	11.50	26.71	18.22	15.42	33.47
		(6)	(6)	7.77	14.22	35.82	13.38	13.79	41.39
		(6)	(6)	1.11	33	5.84	18	25	4.15
	Day total	(6)		15.84	25.54	38.77	33.78	35.27	38.84
3	1	(6)	(6)	9.67	17.83	29.48	15.48	14.42	37.86
		(6)	(6)	9.88	15.47	28.65	11.97	11.47	29.17
		(6)	(6)	5.1	35	2.84	54	1.55	5.16
	Day total	(6)		14.84	11.29	37.35	28.55	28.45	32.23
	Replication total			42.81	65.99	102.78	79.13	79.41	101.56
4	1	(6)	(6)	14.11	10.25	26.86	18.22	13.98	33.89
		(6)	(6)	9.74	9.11	28.88	13.28	9.79	37.50
		(6)	(6)	5.1	34	1.87	5.28	42	1.83
	Day total	(6)		14.11	15.89	38.79	37.55	24.16	39.76

B. Water Loss Data (Cont.)		Date of Grouting					
No.	Water Loss Rate (gals./hr.)	Days after Injection	Time of Injection	July 8 (5)			July 11 (5)
				Volume Grout (cu.)	Chip Bed (cu.)	Grout (cu.)	Grout (cu.)
1 (Cont.)		2	(a)	14.43	4.23	18.14	14.43
			(b)	12.19	18.39	32.38	18.92
			(c)	.19	.08	1.13	1.12
		Day injected		11.14	13.44	45.44	14.14
3			(a)	14.43	18.93	32.47	18.18
			(b)	4.23	6.92	28.94	12.47
			(c)	.93	1.20	2.14	1.27
		Day injected		14.33	16.23	18.17	16.17
5			(a)	14.43	4.89	21.29	18.73
			(b)	12.23	8.89	18.97	14.26
			(c)	1.14	0.08	1.14	1.09
		Day injected		14.13	4.38	18.28	16.13
7			(a)	18.89	1.11	18.77	18.41
			(b)	13.87	5.09	19.61	14.14
			(c)	.92	.20	4.28	2.21
		Day injected		18.18	4.11	22.78	18.17

TABLE 49—Continued.

B. Water Loss Data (Cont.)		Date of Discharge					
		July 4, 1951			July 11, 1951		
Replication after No. Replication	Time of Day	Transfer Quail		Seeding Chick		Transfer Quail	
		(T)	(C)	(T)	(C)	(T)	(C)
3 (Cont.)	1	17.79	6.59	23.59		18.46	4.94
	2	17.79	8.09	14.74		8.57	4.23
	3	2.49	3	2.31		.64	2.15
	Day total	37.27	16.67	38.63		19.15	11.32
Replication total		43.98	18.58	127.18		48.77	24.59
4	1	9.49	25.64	26.53		13.88	25.82
	2	7.49	9.29	31.64		19.72	13.88
	3	3	1.24	8.48		1.34	1.24
	Day total	19.26	36.17	66.65		34.94	40.94
5	1	19.79	18.59	41.84		19.48	16.13
	2	14.48	13.34	32.48		22.19	15.17
	3	3	3	4.33		.49	.74
	Day total	37.51	35.26	78.65		42.15	32.04
6	1	19.77	14.97	33.73		13.52	16.52
	2	19.44	19.33	33.49		19.38	24.77
	3	2.47	2.42	5.74		4.15	1.87
	Day total	41.68	36.72	72.96		37.05	43.16
Replication total		48.95	49.78	153.77		51.25	108.45

B. Water Loss Data (Grain)		Date of Gradings					
Days From Replication after No. Water		July 8 '62		July 11, '62		July 11, '62	
Day	Time	Yarrow Grate	Chip End	Seeding Check	Yarrow Grate	Chip End	Seeding Check
Day	Time	(1)	(2)	(3)	(4)	(5)	(6)
1							
	040	7.78	.....	18.48	11.87	.....	8.48
	040	13.98	.....	18.58	14.13	.....	11.97
	040	1.24	.....	1.13	.....	.....	.....
Day subtotal		11.99	.....	38.19	26.00	.....	18.45
2							
	040	34.14	.....	31.09	20.21	.....	14.14
	040	8.79	.....	18.95	13.15	.....	13.11
	040	.....	.....	1.14	0.00	.....	0.00
Day subtotal		42.93	.....	51.17	33.36	.....	27.25
3							
	040	13.87	.....	10.39	14.89	.....	13.14
	040	14.98	.....	21.27	13.51	.....	12.08
	040	2.17	.....	1.89	2.45	.....	1.21
Day subtotal		30.92	.....	33.55	30.85	.....	26.43
Replication total		10.13	.....	118.31	89.36	.....	11.18
4							
	040	.....	.....	14.09	.....	.....	28.18
	040	.....	.....	18.33	.....	.....	23.44
	040	.....	.....	1.00	.....	.....	1.00
Day subtotal		.....	.....	33.42	.....	.....	52.62

B. Water Loss Data.
(Cont.)

Replication	Days after sowing	Days between sowings	Date of Grafting				Seedling Chick (No.)	Young Graft Chick (No.)	Young Graft Chick (No.)	Seedling Chick (No.)
			July 4, 1935	July 11, 1935	July 18, 1935	July 25, 1935				
1	3	34	.....	.....	42.45	.....	.....	.....	.....	40.80
(Cont.)	34	34	.....	.....	38.46	.....	.....	.....	.....	38.17
	34	34	.....	.....	3.43	.....	.....	.....	.....	3.33
Day interval			.....	.....	12.74	.....	.....	.....	.....	77.28
2	34	34	.....	.....	32.83	.....	.....	.....	.....	32.60
	34	34	.....	.....	32.23	.....	.....	.....	.....	32.93
	34	34	.....	.....	3.93	.....	.....	.....	.....	3.87
Day interval			.....	.....	12.87	.....	.....	.....	.....	77.40
Replication total			.....	.....	113.23	.....	.....	.....	.....	107.79
Totals			108.70	147.42	1186.93	434.17	302.30	887.43		
Date of grafting total				1759.36				1483.77		
Graft total								9822.31		

C. Date of Grazings 20: Type of Grazings (20 = 00)					
Type of Grazings (21) (22) (23) (24) Totals	April 14 (25)	May 3 (26)	Date of Grazings July 4 (27)		July 21 (28)
	(29)	(30)	(31)	(32)	(33) Totals
194. 404(40)	1999. 43	388. 79	404. 17	404. 17	2513. 81(84)
500. 20(54)	577. 24	343. 48	317. 20	317. 20	1545. 24(54)
1027. 20(54)	1688. 13	1135. 52	733. 43	733. 43	3564. 24(54)
2004. 80(114)	1994. 54	1798. 38	1446. 79	1446. 79	9232. 31(84)
D. Date of Grazings 20: Days after Watering (20 = 00)					
Days after Watering 1 2 3 (24) Totals	April 14 (25)	May 3 (26)	Date of Grazings July 4 (27)		July 21 (28)
	(29)	(30)	(31)	(32)	(33) Totals
1	804. 80(48)	1012. 24	817. 88	494. 29	2945. 40(108)
2	1021. 70	1149. 40	938. 24	425. 40	3495. 28
3	891. 28	1097. 88	684. 24	348. 88	2923. 48
2004. 80(114)	2094. 28	2259. 52	1798. 38	1446. 79	9232. 31(84)
E. Type of Grazings 20: Days after Watering (20 = 00)					
Days after Watering 1 2 3 (24) Totals	Yarrow Creek (21)	Chapin Road (22)	Type of Grazings Sawling Creek (23)		(24) Totals
	(25)	(26)	(27)	(28)	(29) Totals
1	719. 80(60)	682. 10(48)	1620. 40(76)	1620. 40(76)	2992. 40(108)
2	908. 12	682. 44	1929. 48	1929. 48	3495. 28
3	848. 52	887. 18	1499. 88	1499. 88	3125. 28
2004. 80(114)	1994. 28	2259. 52	2048. 14(76)	2048. 14(76)	9232. 31(84)

F. Days of Oathgiving 22. Time of Day (P = 0)

Time of Day	Days of Oathgiving			(7) Totals
	April 14 (4)	May 5 (5)	July 4 (6)	
(a)	1482, 12(10)	1517, 11	872, 89	3871, 24(10)
(b)	1296, 45	1545, 20	889, 18	4430, 83
(c)	113, 33	111, 30	18, 13	242, 76
(7) Totals	3891, 13(10)	3173, 51	1778, 116	8842, 10(10)

G. Type of Oathgiving 23. Time of Day (P = 0)

Time of Day	Type of Oathgiving		(7) Totals
	Various Courts (7)	Single Just. Sitting Court (8)	
(a)	1999, 14(10)	810, 40(40)	2809, 54(50)
(b)	1188, 47	705, 48	1893, 95
(c)	181, 30	85, 34	266, 64
(7) Totals	3368, 33(10)	1600, 114(14)	4968, 147(14)

H. Days after Vetting 24. Time of Day (P = 7)

Time of Day	Days after Vetting			(7) Totals
	1	2	3	
(a)	1447, 74(10)	1715, 42	1894, 20	4056, 24(10)
(b)	1345, 48	1447, 42	1413, 43	4205, 33
(c)	129, 19	115, 31	151, 21	395, 71
(7) Totals	2921, 14(10)	3277, 55	3458, 84	9656, 10(10)

Figures in parentheses denote number of items included in total.

COMPARISON OF MEAN WATER LOSS PER HOUR, MEAN WATER LOSS PER HOUR PER CM.² STEM AREA, AND MEAN WATER LOSS PER HOUR PER 10 CM.² LEAF AREA (FRO ANALYSES) FOR MAIN TREATMENT PLANTS OF COKE WASTEWATER PLANTS

Treatment	No. Plants/ Mean	Water Loss/ Hr (gms.)	Water Loss/ Hr (Gm.) ²		Water Loss/ Hr (10 Gm.) ²		Water Loss/ Hr (10 Gm.) ²	
			Mean Area (Gm.)	Mean Area (Gm.)	Mean Area (Gm.)	Mean Area (Gm.)	Mean Area (Gm.)	Mean Area (Gm.)
Type of Graftage (G)								
	Tomato graft (T)							
	Chip bud (C)	3.49	3.24		7.69		1.49(100)	
		3.38	1.98		14.86		4.34(100)	
	Budding stock (CS)	3.39	3.34		8.45		4.64(100)	
Date of Graftage (G)								
	April 14 (A)							
	May 8 (M)	3.38	4.70		8.44		4.34(100)	
	July 4 (J)	3.34	3.34		12.79		3.67(100)	
	July 21 (J)	3.37	3.35		11.34		4.34(100)	
Days after Watering (T)								
	1	4.05	3.21		9.24		4.64(100)	
	2	4.34	3.33		3.35		4.34(100)	
	3	4.34	3.38		7.33		3.67(100)	
Time of Day (T)								
	Morning (M)	3.34	3.38		13.81		4.64(100)	
	Afternoon (A)	3.38	4.33		12.35		4.34(100)	
	Evening (E)	3.39	4.3		7.67		3.67(100)	
Grand Mean	21.65	4.41	3.47		8.44		4.64(100)	

*Circles three hundred of leaf chip bud replications, corrected numbers of hours per mean being in parentheses.

TABLE 11

MEAN WATER LOSS PER HOUR (GMS.) FOR SIX SETS OF
TREATMENT COMPARISONS (FIRST ORDER
INTERACTIONS) ON SINGLE WATERING
PERIOD BASE

A. Date of Grafting <u>xx</u> , Type of Grafts (D x G)						
		April 14 (A)	May 8 (B)	July 4 (C)	July 21 (D) Means	
Type of Grafts						
	(T)	4.38(180) ^a	3.85	3.98	3.41	3.64(138)
	(G)	3.48(144)	4.40	3.73	3.38	3.63(173)
	(Gx)	3.13(115)	3.48	3.38	4.28	3.52(154)
(D) Means		3.79(148)	3.74	3.54	3.67	4.43(178)
B. Date of Grafting <u>xx</u> , Days after Watering (T x D)						
		April 14 (A)	May 8 (B)	July 4 (C)	July 21 (T) Means	
Days after Watering						
	1	4.91(198)	3.68	3.48	3.78	4.05(134)
	2	3.78	4.64	3.84	3.43	4.04
	3	4.73	4.88	3.37	3.83	4.34
(D) Means		4.32(148)	4.19	3.38	3.67	4.41(176)
C. Type of Grafts <u>xx</u> , Days after Watering (T x G)						
		(T)	(G)	(Gx)	(T) Means	
Days after Watering						
	1	3.31(240)	3.53(192)	3.43(288)	4.05(128)	
	2	3.98	3.14	4.47	4.84	
	3	3.63	3.90	3.70	4.34	
(D) Means		3.64(128)	3.49(176)	4.05(144)	4.41(132)	

TABLE II -- Continued

D. Date of Graftage <u>22</u> . Time of Day (P x D)						
		April 14	May 8	July 4	July 31 (P) Means	
Time of Day		(A)	(B)	(C)	(D)	
	(a)	7.78(186)	8.76	4.88	4.43	4.84(716)
	(b)	7.21	8.87	4.68	4.19	4.52
	(c)	.47	.74	.44	.43	.58
(D) Means		8.12(148)	6.18	3.34	3.17	4.47(2146)

E. Type of Graftage <u>22</u> . Time of Day (P x G)					
		(C)	(D)	(E)	(P) Means
Time of Day					
	(a)	8.48(148)	4.75(152)	8.51(200)	4.84(716)
	(b)	8.80	8.79	8.48	4.52
	(c)	.43	.58	.41	.58
(G) Means		7.64(716)	7.83(714)	4.77(144)	4.47(2146)

F. Days after Watering <u>22</u> . Time of Day (P x T)					
		1	2	3	(T) Means
Time of Day					
	(a)	4.33(148)	7.17	4.49	4.84(716)
	(b)	4.41	4.87	8.10	4.52
	(c)	.80	.49	.48	.58
(T) Means		4.74(150)	4.84	4.34	4.47(2146)

*Figures in parentheses denote number of lines per mean.

TABLE 22

MEAN WATER LOSS PER HOUR PER CM.² STEM AREA (D.M.B.)
FOR SIX SETS OF TREATMENT COMPARISONS (FIRST ORDER
INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage vs. Type of Graftage (D x G)

Type of Graftage	April 14	May 6	July 4	July 11	(D) Means
	(A)	(B)	(C)	(D)	
(F)	2.91(112) ^a	2.81	1.27	1.24	2.24(125)
(G)	2.92(144)	2.27	.74	2.18	1.96(174)
(H)	7.27(214)	6.60	4.27	2.27	5.24(222)
(D) Means	4.56(240)	4.42	2.14	2.12	3.47(216)

B. Date of Graftage vs. Days after Watering (T x D)

Days after Watering	April 14	May 6	July 4	July 11	(T) Means
	(A)	(B)	(C)	(D)	
1	4.56(142)	4.17	2.22	1.92	3.21(130)
2	2.29	4.88	2.72	2.42	3.42
3	4.24	4.52	2.64	2.19	3.38
(D) Means	4.56(240)	4.42	2.54	2.12	3.47(216)

C. Type of Graftage vs. Days after Watering (T x G)

Days after Watering	(F)	(G)	(H)	(T) Means
1	2.18(142)	1.92(144)	1.18(214)	1.71(130)
2	2.49	2.12	4.12	3.23
3	2.22	1.87	4.22	2.38
(G) Means	2.24(125)	1.96(174)	2.54(222)	1.97(140)

TABLE XI -- ContinuedD. Size of Grafts 22, Time of Day ($P = 5$)

Time of Day		April 14 (14)	May 5 (20)	July 4 (23)	July 31 (24)	(P) Means
	(a)	7.13(140)	4.88	4.32	3.79	5.14(138)
	(b)	4.64	4.13	4.30	3.79	4.32
	(c)	.87	.33	.66	.18	.48
(T) Means		4.74(140)	4.48	4.34	4.18	3.47(138)

E. Type of Grafts 23, Time of Day ($P = 5$)

Time of Day		(P)	(C)	(CA)	(P) Means
	(a)	3.41(140)	3.81(131)	3.18(138)	3.14(138)
	(b)	3.09	3.66	7.78	4.82
	(c)	.35	.23	.74	.48
(T) Means		3.76(138)	3.89(132)	3.54(134)	3.47(138)

F. Days after Vascular 24, Time of Day ($P = 7$)

Time of Day		1	2	3	(P) Means
	(a)	4.74(140)	5.42	5.09	5.14(138)
	(b)	4.48	5.48	4.88	4.82
	(c)	.42	.41	.31	.48
(T) Means		3.71(138)	5.45	5.34	3.47(138)

*Figures in parentheses denote number of Means per mean.

TABLE 93

MEAN WATER LOSS PER HOUR PER 10 DM.² LEAF AREA (GMS.)
FOR SIX SETS OF TREATMENT COMPARISONS (FIRST ORDER
INTERACTIONS) ON SINGLE WATERING PERIOD BASIS

A. Date of Graftage 12, Type of Graftage (D x G)

Type of Graftage	April 14 (A)	May 3 (B)	July 4 (C)	July 21 (D) (D)	Means
(T)	7.15(131) ^a	7.24	4.59	5.54	7.28(121)
(C)	5.89(144)	7.46	23.23	23.73	14.89(174)
(Cn)	4.20(214)	4.21	4.69	4.48	4.44(214)
(D) Means	4.74(140)	4.23	10.59	11.24	6.41(214)

B. Date of Graftage 12, Days after Watering (T x D)

Days after Watering	April 14 (A)	May 3 (B)	July 4 (C)	July 21 (D) (D)	Means
1	3.44(140)	4.13	22.89	23.54	9.24(121)
2	4.67	7.21	11.23	23.91	9.24
3	8.78	4.49	3.43	7.37	7.23
(D) Means	4.44(140)	4.48	10.59	17.54	9.23(121)

C. Type of Graftage 12, Days after Watering (T x G)

Days after Watering	(T)	(C)	(Cn)	(T) Means
1	7.47(144)	17.70(171)	4.57(211)	9.24(121)
2	8.24	19.29	4.89	9.24
3	7.28	21.48	4.13	7.23
(G) Means	7.68(120)	14.89(174)	4.44(214)	6.41(121)

TABLE 83 -- Continued**D. Date of Grafting xx, Time of Day (P x Q)**

		April 14	May 8	July 4	July 21 (P) Means	
		(Q)	(Q)	(Q)	(Q)	
Time of Day						
	(Q)	9.13(188)	9.96	17.79	14.37	12.81(728)
	(Q)	9.54	9.33	12.48	18.44	12.18
	(Q)	.88	.76	1.58	1.18	.87
(P) Means		8.84(188)	8.48	16.59	17.16	9.47(728)

E. Type of Grafting xx, Time of Day (P x Q)

		(Q)	(Q)	(Q)	(P) Means
Time of Day		(Q)	(Q)	(Q)	(Q)
	(Q)	11.36(248)	15.64(753)	4.64(248)	12.81(728)
	(Q)	10.43	15.82	4.39	12.17
	(Q)	.87	.84	.87	.87
(Q) Means		7.49(728)	14.89(874)	4.64(248)	9.47(728)

F. Days after Weltering xx, Time of Day (P x T)

		1	2	3	(P) Means
Time of Day		(T)	(T)	(T)	(T)
	(Q)	12.95(248)	12.83	12.63	12.81(728)
	(Q)	12.48	12.79	7.88	12.18
	(Q)	.87	.76	1.38	.87
(T) Means		9.24(728)	9.48	7.23	8.47(728)

*Figures in parentheses denote number of times per mean.

TABLE 34

MEAN^a WATER LOSS PER ROOT PER 16 CM.² LEAF AREA (GMS. P.
 FOR SIX SITS OF TREATMENT COMPARISONS (FIRST ORDER
 INTERACTIONS) ON SINGLE WATERING PLOTS BASE

A. Date of Graftage yy, Type of Graftage (Q x Q)

Type of Graftage	April 14	May 5	July 4	July 21	(Q) Means
	(A)	(B)	(C)	(D)	
(T)	7.48(180) ^b	7.24	4.88	5.46	7.48(181)
(P-C) ^a	6.56(184)	7.49	6.54	4.94	6.52(187)
(C)	6.50(184)	6.31	5.13	4.98	6.44(184)
(Q) Means	6.51(184)	6.54	5.47	5.43	6.53(181)

B. Date of Graftage yy, Days after Watering (T x D)

Days after Watering	April 14	May 5	July 4	July 21	(T) Means
	(A)	(B)	(C)	(D)	
1	6.49(148)	6.54	5.29	5.95	6.54(171)
2	4.48	4.70	5.44	7.48	4.83
3	6.51	5.58	5.48	5.47	5.87
(D) Means	6.13(154)	5.54	5.47	6.03	6.13(151)

C. Type of Graftage yy, Days after Watering (T x Q)

Days after Watering	(T)	(P-C)	(C)	(T) Means
1	7.47(148)	6.53(146)	4.87(218)	6.54(171)
2	6.56	7.14	4.87	6.58
3	7.58	6.47	4.58	6.57
(Q) Means	7.45(154)	6.53(151)	4.48(214)	6.53(151)

TABLE 54 -- Continued**D. Date of Graftage vs. Time of Day (P = D)**

		April 14	May 8	July 4	July 21 (P) Means	
		(A)	(B)	(C)	(D)	
Time of Day						
	(a)	8.10(144)	8.17	8.24	10.52	8.64(173)
	(b)	8.10	8.43	7.44	9.12	8.28
	(c)	.43	.71	.78	.78	.78
(D) Means		8.23(144)	8.34	8.47	8.43	8.55(174)

E. Type of Graftage vs. Time of Day (P = C)

		(F)	(GC)	(Ck)	(P) Means
Time of Day					
	(a)	11.55(144)	9.54(144)	8.48(144)	9.84(173)
	(b)	10.43	8.44	8.13	8.28
	(c)	.87	.68	.87	.78
(D) Means		11.49(144)	9.35(144)	8.44(144)	9.35(174)

F. Days after Watering vs. Time of Day (P = T)

		1	2	3	(P) Means
Time of Day					
	(a)	8.14(134)	8.43	8.71	9.44(172)
	(b)	7.72	8.29	7.94	8.28
	(c)	.43	.41	.44	.78
(T) Means		8.14(172)	8.37	8.37	8.55(173)

^aContains three instead of four ship hull replications.^bFigures in parentheses denote number of plants per mean.

TABLE 10

STANDARD OF "F" VALUES OBTAINED FROM ANALYSIS OF
VARIANCE OF WATER LOSS PER HOUR, WATER LOSS PER
HOUR PER CM.² STEM AREA, AND WATER LOSS PER
HOUR PER 12 DM.² LEAF AREA (TWO ANALYSES)

Source of Variation	Water Loss/Hr.	Water Loss/ Hr. /Cm. ² Stem Area	Water Loss/ Hr. /12 Dm. ² Leaf Area	Water Loss/ Hr. /12 Dm. ² Leaf Area ^a
D^b				
A, B $\overline{YB}$, C, D	48.12 ^b	48.12	n. s.	n. s.
A $\overline{YB}$, B	n. s.	n. s.	n. s.	n. s.
C $\overline{YB}$, D	n. s.	n. s.	n. s.	n. s.
(D)				
D _L	21.58	64.64	n. s.	n. s.
D _G	n. s.	n. s.	n. s.	n. s.
Remainder	15.96	42.13	n. s.	n. s.
G				
T, C $\overline{YB}$, Ch	58.48	111.79	4.12 ^a	12.81
T $\overline{YB}$, C	n. s.	n. s.	n. s.	12.89
T				
L, $\overline{YB}$, S	n. s.	4.12 ^a	4.12 ^a	n. s.
L $\overline{YB}$, S	138.72	94.48	n. s.	27.29
(T)				
L, $\overline{YB}$, S	138.48	111.71	n. s.	27.09
L $\overline{YB}$, S	12.12	4.12 ^a	n. s.	n. s.
(T)				
T _L	18.11	2.09	n. s.	n. s.
T _G	118.46	111.71	n. s.	27.09
T $\pm$ G				
T _L $\pm$ G	n. s.	n. s.	n. s.	n. s.
T _G $\pm$ G	2.11 ^a	4.12	n. s.	n. s.
(T $\pm$ G)				
T $\pm$ D _L	4.12 ^a	2.09	n. s.	n. s.
T $\pm$ D _G	n. s.	n. s.	n. s.	n. s.
Remainder	n. s.	n. s.	n. s.	n. s.
T $\pm$ G				
T _L $\pm$ G	n. s.	n. s.	n. s.	n. s.
T _G $\pm$ G	4.12	14.23	n. s.	n. s.

TABLE 25 -- *Continued*

Source of Variation	Water Loss/Hr.	Water Loss/ Hr./Geo. ² Stem Area	Water Loss/ Hr./10 Dia. ² Leaf Area	Water Loss/ Hr./10 Dia. ² Leaf Area ^a
<i>P</i>				
<i>a, b</i> $\overline{y_0}, \overline{y_1}$	5125.45	1722.14	25.89	1243.23
$\overline{y_0}, \overline{y_1}$	9.24	3.26	n.s.	19.84
(<i>P</i>)				
F_L	1742.87	1395.8	25.45	1237.84
F_Q	423.76	346.84	7.55	175.42
<i>F</i> = <i>D</i>				
F_L = <i>D</i>	45.45	45.99	n.s.	n.s.
F_Q = <i>D</i>	22.29	12.89	n.s.	n.s.
(<i>F</i> = <i>D</i>)				
F = D_L	42.89	24.89	n.s.	n.s.
F = D_Q	4.51 ^b	n.s.	n.s.	n.s.
Remainder	29.51	7.42	n.s.	n.s.
<i>F</i> = <i>G</i>				
F_L = <i>G</i>	75.32	155.22	4.24 ^b	29.71
F_Q = <i>G</i>	22.75	42.42	n.s.	7.60
<i>F</i> = <i>T</i>				
F_L = <i>T</i>	6.72	4.14 ^b	n.s.	n.s.
F_Q = <i>T</i>	2.42 ^b	2.74 ^b	n.s.	2.92 ^b
(<i>F</i> = <i>T</i>)				
F = T_L	n.s.	n.s.	n.s.	n.s.
F = T_Q	n.s.	7.54	n.s.	2.92 ^b

^aContains three instead of four ship bed replications.

^bSubscripts L and Q refer to linear and quadratic regression components, respectively. Dots in parentheses denote additional breakdown of treatments immediately preceding them.

^cUnless marked otherwise (single-starred as n. s.), the probability level is less than .01.

TABLE 16

ANALYSIS OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF WATER LOSS PER HOUR FOR FIVE MAIN PLOT TREATMENTS (FIVE DATES AND THREE TYPES OF GRAFTAGE). THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (THREE TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Values ^a 1.05	1.01
A. Preliminary Analysis						
Total	639	135,938,6833				
Main Plots	99	46,777,5813				
Treatments	11	32,086,8789				
D	3	16,378,8504		18.16**	3.97	3.68
G	3	17,663,3374		19.02**	3.96	3.68
D x G	6	1,942,8407		2.19	3.21	3.34
Error (A)	48	16,611,2723				
Sub-Plots						
T	120	7,893,1843				
T x D	6	938,1279		66.78**	3.97	3.68
T x G	6	102,7398		3.97*	3.17	3.30
T x G	6	13,2744		1.04*	3.46	3.31
T x (D x G)	120					
Error (B)	94	743,9739		1.83*		
Sub-Sub-Plots						
D	300	47,382,3448				
D x D	6	64,746,2002		108.44**	3.95	3.68
D x G	6	8,787,6863		21.87**	3.13	3.27
D x G	6	4,018,3740		96.85**	3.66	3.38

Table 24 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values (.05)
A. Preliminary Analysis					
(Cont.)					
Substrate-Matrix (Cont.)					
P vs T	4	955.3795	238.845	4.4644	2.46
P vs B vs Q	12				3.36
P vs T vs Q	12				
P vs T vs Q	83446	18,367,8795	22,6415		
P vs T vs Q vs G	24				
Error (a)	198				
B. Completed Analysis					
(Cont.)					
P	1	14,376.8345			
A, B, T, G, Q	1		13,561.655	45.5424	4.46
A, T, B	1		671.777	2.976, a.	8.17
G, B	1		77.415	0.2	
Q	3	14,376.8345			
B ₂	3		9,313.437	31.3144	
T ₂	3		635.253	2.156, a.	
Interaction	1		4,032.313	13.6744	
Error (a)	48		133.955		
Q	1	13,653.346			
T, G, T, Q	1		15,564.303	55.4924	
T ₂ , G	1		783.654	2.676, a.	
Error (a)	48		253.955		

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)
B. Completed Analysis					
(Cont.)					
(7)	1	84, 154, 2002	84, 002 738	1748, 8700	
P_L	1		12, 648, 468	423, 7600	
$P = Q$	1				
$P_L \times D$	4	4, 767, 4865	1, 448, 758	48, 4800	3.35
$P_L \times Q$	2	4, 538, 838	486, 384	18, 3500	
$P_Q \times D$	2	3, 308, 181			
$(P \times Q)$	4	4, 707, 4868			
$P \times D_L$	2	3, 704, 1248	1, 802, 163	48, 4800	
$P \times D_Q$	2	278, 2113	179, 504	4, 810	
Residuals	1	4, 782, 1802	891, 874	27, 8500	
$P \times Q$	1	6, 038, 193			
$P_L \times Q$	2	6, 678, 309	3, 337, 688	78, 3800	
$P_Q \times Q$	2	3, 209, 956	679, 983	28, 7800	
$P \times T$	2	283, 2709			
$P_L \times T$	2	348, 2348	178, 948	8, 7800	
$P_Q \times T$	2	218, 8402	187, 438	3, 410	
$(P \times Q)$	4	886, 2739			
$P \times T_L$	2	21, 9758	18, 986	8, 40	
$P \times T_Q$	2	223, 4637	208, 703	8, 8000	
Error (e)	344		17, 8488		

*Values corresponding to d.f. for error and respective error.

Subscripts L and Q refer to linear and quadratic regression components, respectively. Means in parentheses denote additional breakdown of treatments immediately preceding them.

ANALYSIS OF VARIANCE TESTS OF FOUR WATERED PLANTS OF WATER LOSS PER HOUR PER CM. STEM AREA FOR THREE WASH-PLANT TREATMENTS FOUR DATES AND THREE TYPES OF GRAFTING. THREE SUB-PLANT TREATMENTS THREE DATES AFTER GRAFTING AND THREE SUB-PLANT TREATMENTS THREE DATES OF GRAFT

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Total F Value ^a (.05)	Total F Value ^b (.01)
A. Preliminary Analysis						
Total	829	111,894.8634				
Main Plots	99	48,574.2220				
Treatments	21	38,879.4884	1,851.4042	18.8400	1.99	4.88
D	3	11,181.2697	3,727.0900	3,727.09	3.60	4.22
C	3	14,598.2233	4,866.0744	4,866.07	3.79	5.00
D x C	6	2,141.9834	357.1639	1.4188		
Error (a)	78	10,704.3750	137.3637			
Sub-Plots	120	1,421.8109				
T	3	481.8874	160.6291	16.0629	3.99	6.83
T x D	6	91.7317	15.2886	1.5289	2.19	4.99
T x C	6	184.9361	30.8227	3.0823	3.84	5.61
T x D x C	12	876.2967	73.0247			
Error (a')	105					
Sub-Sub-Plots	340	61,483.8779				
T	3	39,699.9619	13,233.3206	13,233.32	3.83	4.48
T x D	6	4,308.2943	718.0490	718.05	3.13	3.87

TABLE 51 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Value at
B. Completed Analysis (Cont.)					
T	2	103.8574	51.928	4.824	4.90
1, 2, 3, 4 $\frac{1}{2} \times \frac{1}{2}$	1		51.928	94.4844	
CT	2	103.8574	51.928	101.7144	
1, 2, 3, 4 $\frac{1}{2} \times \frac{1}{2}$	1		51.928	9.0244	
CT	2	103.8574	51.928	8.0244	
T ₁	1		51.928	100.7144	
T ₂	1		51.928	100.7144	
T x T ₁	1	91.7217	91.722	8.48	
T ₁ x T ₂	1	28.8598	28.860	2.68	
T ₂ x T ₁	1	44.8122	44.812	4.144	3.78
CT x T ₁	1	91.8217	91.822	8.484	
CT x T ₂	1	43.9262	43.926	4.044	3.59
T x T ₁	1	7.4232	7.423	0.68	4.92
T x T ₂	1	20.8234	20.823	1.92	
Residual	8	180.9812	22.623		
T x T ₁	1	1.222	1.222	0.11	
T ₁ x T ₂	1	149.7136	149.714	14.0344	
T ₂ x T ₁	1				
Total (B)	102				
B	2	20.499	10.249	1.08	4.71
4, 5, 6, 7, 8 $\frac{1}{2} \times \frac{1}{2}$	1		10.249	1.08	
	1		10.249	1.08	

TABLE 24

ANALYSIS OF VARIANCE (SUM OF SQA. SQUARES PERIODS) OF WATER LOSS PER ROOT PER 10 CM. LEAF AREA FOR TWELVE MAIN PLOT TREATMENTS (FROM WATER AND THREE TYPES OF GRAFTS), THREE SUB-PLOT TREATMENTS (THREE DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS (THREE TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Value ^a
A. Preliminary Analysis					
Total	537	4,535,381.1431			
Main Plots	31	1,585,158.4156			
Treatments	11	215,319.6658			
D	3	48,333.1824	30,558.4174	n.s.	
G	3	138,384.1977	34,577.3894	n.s.	
D x G	6	162,891.8243	34,578.099	3.864	1.46
Error (a)	46	1,145,190.6751	24,978.617	n.s.	4.12
Sub-Plots					
T	123	292,150.9420			
T x D	3	18,886.1620			
T x G	6	8,278.9614			
T x D x G	6	16,738.6131			
Total (b)	123	315,268.1255			
Sub-Sub-Plots					
D	3	2,481,248.1691			
D x D	3	253,443.6466			
D x G	6	36,148.3644			
Total (c)	3	62,394.6797			
Sub-Sub-Sub-Plots					
D	3	129,512.523			
D x D	3	5,828.064			
D x G	6	22,722.623			

TABLE 10 -- (Continued)

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Value (5)
A. Preliminary Analysis					
(Cont.)					
Sub-Sub-Plots (Cont.)					
$\bar{y} \times \bar{t}$	4	21,948.1226	5,487.026	n.s.	
$\bar{y} \times \bar{p} \times \bar{c}$	12				
$\bar{y} \times \bar{t} \times \bar{c}$	12				
$\bar{y} \times \bar{t} \times \bar{c}$	8 (442,480, 619, 6856)		7,311.765		
$\bar{y} \times \bar{t} \times \bar{p} \times \bar{c}$	24				
Error (e)	235				
B. Completed Analysis					
$\bar{c}$	1	134,265.7979			
$\bar{y} \times \bar{c} \times \bar{p} \times \bar{c}$	1		95,945.114	4.134	7.14
$\bar{y} \times \bar{c}$	1		12,480.928	3.65e. n.	
Error (e)	43		24,155.619		
$\bar{t}$	2	16,018.5033			
$\bar{y} \times \bar{t} \times \bar{p} \times \bar{c}$	1		6,334.348	4.134	6.90
$\bar{y} \times \bar{t}$	1		1,779.757	n.s.	
$\bar{y} \times \bar{p} \times \bar{c}$	2	16,018.5033			
$\bar{y} \times \bar{p} \times \bar{c}$	1		6,744.783	3.35e. n.	
$\bar{y} \times \bar{p}$	1		5,231.797	1.65e. n.	
$\bar{y} \times \bar{c}$	2	16,018.5033			
$\bar{y} \times \bar{c}$	1		3,334.348	1.65e. n.	
$\bar{y} \times \bar{c}$	1		6,744.783	3.35e. n.	

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Value 5%
B. Completed Analysis					
(Cont.)					
T x Q	4	14,728.4131			
T ₁ x Q	2	14,113.4231	8,056.712	2.346	4.32
TQ x Q	2	8,434.7460	3,352.498	1.036	n.s.
Error (A)	108		1,711.793		
P	2	223,443.8443			
A, B, $\frac{AB}{B}$, n	1			15.9766	4.75
A, $\frac{AB}{B}$, n	1		412.637	n.s.	
Q ²	1	123,443.8443			
P ₁	1			205,145.190	26.4596
P ₂	1			94,213.186	7.3766
P = Q ₁	4	14,155.7444			
P ₁ x Q	2	14,791.4577	5,568.423	n.s.	3.45
P ₂ x Q	2	23,237.9712	4,768.597	n.s.	
P = Q ₂	4	32,194.4719			
P ₁ x Q ₁	2	44,893.7933	21,443.185	4.164	4.75
PQ x Q	2	11,945.8182	10,521.846	n.s.	
P = $\frac{PQ}{Q}$	4	21,745.8126			
P ₁ x T	2	141.2195	70.609	n.s.	
PQ x T	2	16,795.9712	10,813.797	n.s.	
Error (C)	164		7,211.793		

Squares corresponding to d.f. for den and numerator error

Subscripts 1 and 2 refer to linear and quadratic regression components, respectively
 (n.s. in parentheses denotes additional breakdowns of treatments immediately preceding them)

ALTERNATE ANALYSIS OF VARIANCE ITEM OF FOUR WATERING PERIODS OF HEAVY LOSS
PER BORN PER 10 DM² LEAF AREA FOR TWELVE MAIN PLOT TREATMENTS (FOUR
DAYS AND THREE TYPES OF GRAPPLING, THREE SUB-PLOT TREATMENTS
(THREE DAYS AFTER WATERING, AND THREE SUB-SUB-PLOT
TREATMENTS THREE TIMES OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values
					.05 .01
A. Preliminary Analysis					
Total	55	195,106.7905			
Main Plot	55	46,581.8185			
Treatments	14	24,427.4873	1,747.674	4.3344	2.04 2.48
D	3	1,397.3331	465.776	n.s.	
G	3	16,177.4587	5,392.483	13.0344	3.43 3.12
D x G	6	3,446.6946	574.4324	n.s.	
Error (4)	44	18,798.4559	427.237		
Sub-Plots					
T	133	4,961.3719			
T x D	4	1,449.9485	362.487	14.5644	3.09 4.52
T x G	4	244.2489	61.062	n.s.	
T x D x G	4	100.8146	25.204	1.168 n.s.	2.46
Error (4)	120	4,051.7646	33.764		
	333				
Sub-Sub-Plots					
P	104	147,161.4836			
P x D	3	114,446.9415	38,148.977	351.7344	3.63 4.48
	4	647.3766	161.842	1.468 n.s.	

TABLE III -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)
A. Preliminary Analysis (Cont.)					
Sub-Sub-Plots (Cont.)					
$T \times Q$	4	T, 138, 81.96	L_1 794, 764	12, 4000	2.50
$T \times T$	4	938, 9927	234, 948	1, 676	2.50
$T \times Q \times Q$	10				
$T \times T \times Q$	10				
$T \times T \times Q$	8(100)	1A, 197, 9998	79, 619		
$T \times T \times Q \times Q$	20				
Error (4)	160				

B. Completed Analysis

Q	2	1A, 799, 4807	L_1 659, 246	18, 0000	4.50	2.50
$T \times T \times Q \times Q$	1		L_2 779, 193	21, 5000		
$T \times Q \times T \times Q$	1		452, 282			
Error (4)	40					
T	2	1, 447, 9439	L_1 379, 754	26, 2700	5.70	4.90
$T \times T$	1		49, 8700	1, 4500		
$T \times T \times T$	1					
$T \times T \times T \times T$	1		128, 400	2, 43		
$T \times T \times T \times T$	1		L_1 321, 900	27, 0000		
$T \times T \times T \times T \times T$	1					
$T \times T \times T \times T \times T$	1		128, 400	2, 43		
$T \times T \times T \times T \times T \times T$	1		L_1 321, 900	27, 0000		

Series of Variables	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values (.05)
B. Completed analysis					
T = D	1	104.1689			
T ₁ = D	2	23.788	9.233		
T ₂ = D	2	234.887	79.626		3.99
T = G	4	376.8146			
T ₁ = G	2	289.8872	144.943		3.99
T ₂ = G	2	86.9274	43.463		
Errors (B)	100	48.7194	48.717		
T	4	114.446, 6413	773.915	18.1400	
T ₁ = D	2		118.133, 889	1003.1100	3.97
T ₂ = D	2				4.78
(T)	4	114.446, 6413			
T ₁	2		95.464, 828	1272.8400	
T ₂	2		25.862, 911	278.4200	
T = G	4	2, 138.4379			
T ₁ = G	2	6, 885.0929	3, 422.546	29.7100	
T ₂ = G	2	1, 123.7032	566.853	7.8000	
T = T	4	728.9827			
T ₁ = T	2	404.942	202.481	3.9900	3.83
T ₂ = T	2	859.991	264.106	3.990	4.60

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values .05 .01
B. Completed Analysis (Contd.)					
(μ = $\bar{Y}$)	4	934.9627			
T_L vs P	1	48.8403	48.840	m. s.	
T_D vs P	1	673.3583	673.359	8.9200	
Error (e)	120		73.619		

*Three replications for chip tool (P) treatments instead of four.

†Values corresponding to d.f. for item and respective error.

*Subscripts 1 and 2 refer to linear and quadratic regression components, respectively. Means in parentheses denote additional breakdowns of treatments immediately preceding them.

TABLE 48

WATER LOSS PER BOWL (GALL.) FOR PLANTS OF THE MAT 1
GRAFTAGE DATE (SUM OF FOUR WATERING PERIODS)

A. Water Loss Data						
Replication No.	Days after Watering	Time of Day	Type of Graftage			
			(F)	(C)	(B)	(Co)
I	1	(a)	34.83	38.84	4.84	48.55
		(b)	51.18	28.94	5.88	43.82
		(c)	2.81	2.80	0.88	3.12
		Day subtotal	78.12	68.60	7.41	95.49
	2	(a)	32.16	24.94	13.21	44.60
		(b)	37.79	48.98	18.44	59.24
		(c)	3.84	2.47	8.88	3.79
		Day subtotal	73.18	76.39	34.43	107.64
	3	(a)	34.34	38.19	7.32	47.41
		(b)	29.31	38.14	6.12	41.53
		(c)	2.21	2.21	.43	3.79
		Day subtotal	65.86	75.53	14.84	72.73
	Replication total		217.16	220.52	47.08	215.86
II	1	(a)	38.36	30.17	8.37	48.29
		(b)	29.53	12.38	8.48	32.41
		(c)	2.88	.43	.43	3.83
		Day subtotal	69.19	42.98	17.28	64.53
	2	(a)	51.71	18.21	11.61	43.24
		(b)	33.47	23.89	14.88	59.23
		(c)	2.94	1.40	.31	3.65
		Day subtotal	88.12	43.50	26.80	66.12
	3	(a)	48.99	19.23	8.43	44.68
		(b)	28.84	14.72	7.88	37.84
		(c)	2.49	.83	1.27	3.64
		Day subtotal	79.32	34.78	17.58	66.16
	Replication total		244.59	157.44	68.34	217.13

TABLE 48 -- Continued

A. Water-Loss Data					Type of Grafts			
Exptl. No.		Days after Watering	Time of Day		(F)	(C)	(D)	(Ch)
3	1		(a)		25.88	21.42	18.89	32.49
			(b)		29.29	9.79	28.78	23.88
			(c)		2.17	.31	1.86	2.17
		Day subtotal			57.34	31.52	49.53	78.54
	2		(a)		22.76	14.17	23.72	18.88
			(b)		44.42	23.21	28.31	48.32
			(c)		1.37	.89	.42	1.88
		Day subtotal			78.55	38.27	52.45	69.08
	3		(a)		18.72	12.37	21.63	24.24
			(b)		24.41	8.32	28.43	18.48
			(c)		2.46	1.32	2.78	2.24
		Day subtotal			45.59	22.01	52.84	44.96
	Replication total				213.18	121.80	155.81	232.58
4	1		(a)		28.48	27.38	14.32	83.20
			(b)		24.97	28.84	12.49	71.66
			(c)		2.74	1.48	1.24	7.78
		Day subtotal			56.19	57.70	28.05	162.64
	2		(a)		47.24	22.17	17.88	88.78
			(b)		27.46	28.87	13.26	42.78
			(c)		2.79	1.32	.32	4.81
		Day subtotal			77.49	52.36	31.46	136.37
	3		(a)		29.81	28.47	17.82	66.83
			(b)		24.97	22.87	18.88	78.19
			(c)		2.68	2.24	.91	7.88
		Day subtotal			57.46	53.61	37.61	152.90
	Replication total				231.11	225.34	135.96	542.82

TABLE 48 -- Continued

B. Type of Graffiti <u>vs.</u> Days after Watering Totals (Tx Q)					
Type of Graffiti					
Days after Watering	(V)	(W)	(X)	(Y)	(T) Totals
1	313.38(10) ^a	178.14(12)	93.85(13)	318.76(14)	1113.78(39)
2	389.00	309.38	128.88	608.18	1534.84
3	345.87	198.00	187.84	819.38	1550.89
(Q) Totals	1848.25(30)	877.40(34)	387.49(39)	1636.13(46)	3653.18(171)
C. Type of Graffiti <u>vs.</u> Time of Day Totals (P x Q)					
Type of Graffiti					
Time of Day	(V)	(W)	(X)	(Y)	(P) Totals
(a)	318.33(10)	183.86(12)	108.34(13)	348.13(14)	1158.46(39)
(b)	498.11	379.32	188.91	778.86	1897.11
(c)	38.68	85.34	33.34	74.18	142.42
(Q) Totals	1855.12(30)	877.14(34)	387.49(39)	1636.13(46)	3653.18(171)
D. Days after Watering <u>vs.</u> Time of Day Totals (P x T)					
Days after Watering					
Time of Day	1	2	3	(P) Totals	
(a)	344.88(10)	348.48	371.22	1763.48(39)	
(b)	378.82	378.48	349.84	1897.11	
(c)	43.38	42.74	34.83	142.42	
(T) Totals	1118.78(39)	1534.84	1188.89	3653.18(171)	

^aFigures in parentheses denote number of items included in

total.

TABLE 41

COMPARISON OF MEAN WATER LOSS PER HOUR, MEAN WATER LOSS PER HOUR PER CM.² STEM AREA, AND MEAN WATER LOSS PER HOUR PER 10 CM.² LEAF AREA FOR PLANTS OF THE MAT & GRAFTAGE DATE MAIN TREATMENTS (SINGLE WATERING PERIOD BASIS)

		Water Loss/Hr. / Loss/Hr. (grs.)	Water Loss/Hr./ Cm. ² Stem Area (grs.)	Water Loss/Hr. / 10 Cm. ² Leaf Area (grs.)
Type of Graftage (CG)				
Tenax graft	(T)	2.85(100) ^a	2.22(100)	7.54(100)
Chip bud	(C)	4.82(144)	3.20(144)	9.62(144)
Shield bud	(S)	2.28(144)	1.29(144)	4.13(144)
Seedling shoot	(CK)	2.44(214)	2.40(214)	6.23(214)
Days after Watering (T)				
	1	4.25(220)	2.97(220)	8.94(220)
	2	3.81	4.80	7.42
	3	3.12	3.64	6.23
Time of Day (P)				
Morning	(a)	2.82(220)	2.44(220)	7.83(220)
Afternoon	(b)	7.46	5.27	9.88
Evening	(c)	.62	.49	.58
Grand Mean		3.54(344)	2.81(344)	6.84(344)

^aFigures in parentheses denote number of lines per row.

TABLE 22

MEAN WATER LOSS PER BUSH (GMS.) FOR PLANTS OF THE
MAT 8 GRAFTAGE DATE FOR THREE SETS OF TREATMENT
COMPARISONS (FIRST ORDER INTERACTIONS) ON SINGLE
WATERING PERIOD BASIS

A. Type of Graftage $\times$ Days after Watering ($T \times Q$)

	(T)	(Q)	(TQ)	(Q ²)	(T) Means
Days after Watering					
1	8.37(40) ^a	8.80(40)	1.78(80)	7.21(72)	8.87(228)
2	8.48	8.38	2.44	8.38	8.80
3	8.48	8.81	2.33	7.87	8.80
(Q) Means	8.78(32)	8.85(144)	1.58(64)	7.82(72)	8.85(244)

B. Type of Graftage $\times$ Time of Day ($P \times Q$)

	(P)	(Q)	(PQ)	(Q ²)	(P) Means
Time of Day					
(a)	8.78(48)	8.72(48)	3.98(48)	11.23(72)	7.81(216)
(b)	8.38	8.71	3.17	10.77	7.44
(c)	.82	.48	.41	1.83	.68
(Q) Means	8.78(144)	8.81(144)	2.58(48)	7.44(72)	8.58(264)

C. Days after Watering $\times$ Time of Day ($P \times T$)

	1	2	3	(T) Means
Time of Day				
(a)	7.17(72)	8.81	9.58	7.84(216)
(b)	8.38	8.34	7.12	7.64
(c)	.82	.84	.73	.73
(T) Means	6.97(216)	8.81	8.11	8.58(264)

^aFigures in parentheses denote number of times per mean.

TABLE 45

MEAN WATER LOSS PER HOUR PER CM.² STEM AREA (GHR.)
FOR PLANTS OF THE MAT 8 CRAFTAGE DATE FOR THREE
SETS OF TREATMENT COMPARISONS (FIRST ORDER
INTERACTIONS) ON SINGLE
WATERING PERIOD BASE

A. Type of Craftage vs. Days after Watering (T x G)					
	(T)	(G)	(G)	(TG)	(T) Means
Days after Watering					
1	3.19(42) ^a	2.34(40)	1.33(48)	4.79(11)	3.07(128)
2	3.37	1.73	1.78	7.34	4.33
3	3.38	3.43	1.81	8.77	3.54
(G) Means	3.32(124)	2.50(144)	1.82(144)	4.30(214)	3.37(354)

B. Type of Craftage vs. Time of Day (P x G)					
	(T)	(G)	(G)	(PG)	(P) Means
Time of Day					
(a)	4.94(50)	3.41(48)	1.84(50)	9.78(18)	6.54(118)
(b)	4.81	3.88	2.13	9.38	6.39
(c)	.45	.18	.18	.87	.49
(G) Means	3.32(150)	3.52(144)	1.54(144)	4.90(214)	3.37(354)

C. Days after Watering vs. Time of Day (P x T)				
	1	2	3	(P) Means
Time of Day				
(a)	5.50(74)	4.87	5.54	5.64(120)
(b)	4.73	4.55	4.69	5.39
(c)	.87	.48	.63	.49
(T) Means	3.32(120)	4.58	3.44	3.37(354)

^aFigures in parentheses denote number of stems per mean.

TABLE 44

MEAN WATER LOSS PER HOUR PER 10 CM.² LEAF AREA (GMS.)
FOR PLANTS OF THE MAY 2 GRAFTAGE DATE FOR THREE
SETS OF TREATMENT COMPARISONS (FIRST COLUMN
INTERACTIONS) ON SINGLE WATERING PERIOD DATE

A. Type of Graftage vs. Days after Watering (T x Q)					
	(T)	(Q)	(Q)	(QT)	(T) Means
Days after Watering					
1	4.76(50) ^a	8.45(48)	8.18(48)	4.68(12)	8.93(218)
2	7.98	12.14	7.88	4.75	7.43
3	7.34	9.14	5.17	4.18	6.33
(Q) means	7.14(18)	9.44(14)	6.13(14)	4.31(12)	6.89(48)

B. Type of Graftage vs. Time of Day					
	(T)	(Q)	(Q)	(QT)	(T) Means
Time of Day					
(a)	10.73(48)	14.49(48)	9.14(48)	4.14(12)	9.43(218)
(b)	12.21	12.88	8.84	4.84	9.07
(c)	.77	.98	.50	.89	.57
(Q) means	7.14(18)	9.44(14)	6.13(14)	4.31(12)	6.89(48)

C. Days after Watering vs. Time of Day (P x T)				
	1	2	3	(T) Means
Time of Day				
(a)	9.09(16)	12.41	9.41	9.83(218)
(b)	8.14	12.84	8.29	9.09
(c)	.44	.64	.81	.57
(T) means	5.91(16)	7.43	6.17	6.89(18)

^aFigures in parentheses denote number of hours per week.

TABLE 48

SUMMARY OF "F" VALUES OBTAINED FROM ANALYSES OF VARIANCE (SUM OF FOUR WATERING PERIODS) OF WATER LOSS PER HOUR PER 10 CM.² LEAF AREA FOR PLANTS OF THE MAY 4 GRAFTAGE DATE

Source of Variation	Water Loss/Hr.	Water Loss/ Hr./Cm. ² Stem Area	Water Loss/ Hr./10 Cm. ² Leaf Area
G^2	8.26 ^b	12.22	8.12 ^b
T, G, S $\frac{1}{2}$, G ₂	12.87	22.21	19.22
T, G, S	4.87 ^a	n. s.	n. s.
(H)			
T, G $\frac{1}{2}$, S, G ₂	n. s.	4.84 ^a	n. s.
T $\frac{1}{2}$, G	n. s.	n. s.	12.22
S $\frac{1}{2}$, G ₂	21.74	24.88	n. s.
(I)			
T, G ₂ $\frac{1}{2}$, G, S	22.89	21.42	8.65 ^a
T $\frac{1}{2}$, G ₂	n. s.	14.27	8.73 ^a
G $\frac{1}{2}$, S	n. s.	n. s.	8.12 ^b
(J)			
T, S $\frac{1}{2}$, G, G ₂	8.42 ^a	12.87	n. s.
T $\frac{1}{2}$, S	7.68	n. s.	n. s.
G $\frac{1}{2}$, G ₂	22.12	27.62	14.87
T	24.84	12.88	8.84
L, S $\frac{1}{2}$, S	n. s.	4.77 ^a	n. s.
L $\frac{1}{2}$, S	43.21	24.24	19.27
(7)			
L, S $\frac{1}{2}$, S	43.62	18.78	14.78
L $\frac{1}{2}$, S	4.84 ^a	14.41	n. s.
(8)			
T _L	4.84 ^a	14.41	n. s.
T _O	43.62	28.87	14.78
F			
n, S $\frac{1}{2}$, S	222.41	242.70	272.62
n $\frac{1}{2}$, S	422.41	422.70	422.62
n $\frac{1}{2}$, S	n. s.	n. s.	2.82 ^a
(9)			
F _L	412.2	422.92	42.87
F _O	122.4	122.84	12.22

TABLE 22 -- Continued

Source of Variation	Water Loss/ No./No.	Water Loss/ No./Cm. ² Stem Area	Water Loss/ No./100 Cm. ² Leaf Area
$P = Q$	24.99	23.76	8.18
$P_L = Q$	23.24	21.74	14.83
$P_Q = Q$	4.74 ^a	9.81	n.s.
$P = T$	n.s.	n.s.	n.s.
$P_L = T$	n.s.	n.s.	n.s.
$P_Q = T$	n.s.	n.s.	4.24 ^a

^aSubscripts L and Q refer to linear and quadratic regression components, respectively. Same in parentheses denote additional breakdowns of treatments immediately preceding them.

^bUnless marked otherwise (single-starred or n.s.), the probability level is less than .01.

TABLE 16

ANALYSIS OF VARIANCE (SOM OF FOUR WATERING PERIODS) WITH PLANTS OF THE MAY 9
CRAFTAGE DATE OF WATER LOSS PER ROW FOR FOUR MAIN PLOT TREATMENTS
(TYPES OF CRAFTAGE), THREE SUB-PLOT TREATMENTS (DAYS AFTER WATERING),
AND THREE SUB-SUB-PLOT TREATMENTS (ROWS OF DATA)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a .10	Tabular F Value ^a .01
A. Preliminary Analysis						
Total	179	92, 948, 8233				20.7
Main Plots	16	16, 287, 9193				
Q	4	11, 361, 2166				
Error (a)	12	5, 926, 6079	3, 797, 103	6, 2666	5.59	8.42
Sub-Plots	66	669, 5374				
T	2	613, 6663				
T x Q	8	26, 2596	324, 125	14, 6466	1.62	5.39
Error (b)	16	155, 6667	4, 837	6, 6		
Sub-Sub-Plots	134	16, 661, 2676				
P	2	26, 669, 2377				
P x Q	8	4, 663, 6632	16, 793, 666	326, 4266	2.69	4.62
P x T	4	261, 6666	66, 217	14, 1966	2.19	3.16
P x T x Q	12	4, 663, 1667	66, 267	6, 6		
Error (c)	100		48, 621			

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)	Tabular F Value (.01)
B. Completed Analysis						
(1)						
Overall	1	11, 341, 2133				
T, C, D, E, G	1	7, 138, 4933		11, 3749	4, 56	4, 56
T, C, E	2	4, 202, 9113		4, 179	3, 55	4, 55
(2)						
T, C, D, G	1	11, 341, 2133				
T, D, E, G	1	40, 2712		n. s.		
T, D, G	1	1, 122, 8974		1, 127, 897	2, 45n. s.	
D, E, G	1	11, 404, 2314		11, 404, 231	21, 94n.	
(3)						
T, C, D, E, G	1	11, 341, 2133				
T, D, E, G	1	4, 202, 9113		4, 234, 893	21, 94n.	
C, D, E, G	1	7, 138, 4933		1, 204, 154	2, 45n. s.	
C, D, E	1	11, 341, 2133		404, 437	n. s.	
(4)						
T, C, D, E, G	1	11, 341, 2133				
T, D, E, G	1	4, 202, 9113		4, 204, 813	2, 52n.	
C, D, E, G	1	7, 138, 4933		4, 173, 153	2, 46n.	
C, D, E	1	11, 341, 2133		4, 441, 249	23, 12n.	
(5)						
T, C, D, E, G	1	413, 4452				
T, D, E, G	1	11, 341		11, 349	2, 2.	
C, D, E, G	1	402, 107		402, 107	49, 51n.	
C, D, E	1	413, 4452				
T, D, E, G	1	413, 4452		413, 4452	43, 51n.	
C, D, E, G	1	10, 4916		10, 4916	4, 14n.	
C, D, E	1					

TABLE 44. — Continued.

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Value (.05)	F Value (.01)
B. Completed Analysis (Cont.)						
P	2	25, 875, 2077				
a, b 20-4	1		25, 875, 2075	41.00	2.94	5.99
a 20-5	1		63, 8833	8.4		

Values corresponding to d.f. for lines and corresponding error.

Signs in parentheses denote additional breakdowns of treatments immediately preceding them.

ANALYSIS OF VARIANCE (GROW OF POON WATERING PERIODS) WITH PLANTS OF THE MAY 1
GRANTAGE DATE OF WATER LOSS PER HOUR PER CM² IRRIGATION AREA FOR FOUR MAJOR
PLOT TREATMENTS (TYPES OF GRANTAGE), THREE SUB-PLOT TREATMENTS
(DAYS AFTER WATERING), AND THREE SUB-SUB-PLOT TREATMENTS
(TYPES OF SOIL)

Source of Variation	d. f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a (.05)
A. Preliminary Analysis					
Total	109	36,873.4437			
Main Effects	18	13,351.8136			
G	3	10,576.1713			
Error (a)	15	5,423.3423	3,615.5615	13.3000	3.42
Sub-Effects	26	235.7755			
T	3	214.5123			
T x G	6	74.3316			
Error (b)	26	218.3437	8.3978	1.7500	1.75
Sub-Sub-Effects	114	32,315.8553			
P	2	15,052.3866			
P x G	6	6,579.7973			
P x T	6	148.3876			
P x T x G (c)	12	5,918.7230			
Error (d)	98	182.1878	1.8593	1.3000	1.30

TABLE 47 -- Continued

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Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Values 100 50
B. Completed Analysis					
1	1	16, 878, 1713			
2	1	5, 865, 4637	5, 865, 465	13, 2140	
3	1	3, 831, 8264	383, 135	8.4	
4	1	16, 804, 1713			
5	1	1, 796, 5354	1, 796, 535	4, 940	
6	1		211, 938	8.9	
7	1		6, 837, 618	15, 6340	
8	1	16, 876, 1713			
9	1		4, 164, 315	11, 9340	
10	1		4, 243, 346	14, 1740	
11	1		348, 170	8.4	
12	1	16, 876, 1713			
13	1		4, 036, 325	13, 8740	
14	1		1, 812, 465	3, 430.4	
15	1		5, 835, 395	15, 4940	
16	1	134, 9333			
17	1		32, 8643	4, 490	
18	1		173, 894	24, 2340	
19	1	134, 9333			
20	1		132, 441	18, 7940	
21	1		103, 891	14, 4540	

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Values .05 .01
B. Completed Analysis (Cont.)					
(F)	2	18, 953, 3616			
$\sum_{i=1}^n \sum_{j=1}^m x_{ij}^2 =$	1		18, 953, 379	853, 9500	
$\sum_{i=1}^n \sum_{j=1}^m x_{ij} =$	1		16, 976	n. s.	
$P = 0$	6	4, 978, 7433			
$P_L = 0$	2	5, 873, 2381	1, 979, 166	97, 9500	
$P_D = 0$	3	662, 9519	220, 983	9, 8100	

*F-values corresponding to d.f. for Num and corresponding error.

^bSubscripts L and D refer to linear and quadratic regression components, respectively. Some in parentheses denote additional breakdown of treatments immediately preceding them.

2000

ANALYSIS OF VARIANCE (HOW OF FIVE WATERING PERIODS) WITH PLANTS OF THE SAME GRAFTAGE DATE OF WATER LOSS PER HOUR PER 1 CM. LEAF AREA FOR FIVE MAJOR FLOW TREATMENTS (TYPE OF GRAFTAGE, THREE SUB-PLANT TREATMENTS)

DATE AFTER WATERING, AND THREE SUB-PLANT TREATMENTS

(1 TIME OF DAY)

Source of Variation	d.f.	Sum of Squares	Mean Squares	F	Tabular F Value ^a (.01)
A. Preliminary Analysis					
Total	179	81,791,2443			
Model	18	18,935,9463			
Error	3	3,455,5829			
Error (a)	18	3,843,3812	213,517	8.236	8.42
Sub-Model	18	3,461,2034			
T	2	3,128,9458			
T x Q	4	338,2576			
Error (b)	20	1,287,4949	64,372		8.10
Sub-Sub-Model	114	59,547,3946			
P	3	47,813,3070			
P x Q	6	4,379,8124			
P x T	6	783,8668			
P x T x Q	12	6,897,4649			
Error (c)	70	16,842			

Source of Variation	d. f.	Sum of Squares	Mean Square	F	Tabular F Values 5%
B. Completed Analysis					
D	1	9,463,1679			
	1	6,339,1666			
	1	3,207,6266			
	1	9,463,1679			
100 ²	1				
	1				
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TABLE 66 -- Continued

Source of Variation	d.f.	Sum of Squares	Mean Square	F	Tabular F Value (.05)
B. Completed Analysis (Cont.)					
(T)	1	1,136.9331			
T _L	1		37,331	16.4 ₁	
T _O	1		1,008.716	16.7968	
P	2	67,913.3879			
a, b, $\frac{cd}{b}$, a	1		66,746.889	518.4699	4.99
a, $\frac{cd}{b}$	1		162.498	2.928	

Squares corresponding to *df* for item and corresponding error.

Techniques L and O refer to linear and quadratic regression components, respectively. Since in previous items additional breakdown of treatment immediately preceding them,

TABLE 69

AIR TEMPERATURE, VAPOR PRESSURE DEFICIT, WIND MOVEMENT, LEAF TEMPERATURE, LEAF TEMPERATURE, LEAF TEMPERATURE, AND WATER LOSS/LH. FOR THE MORNING PERIOD OF MARCH DATA IN 1957

Date	Water Loss/LH. (gms.)	Air Temp. (°C.)	V. P. D. (mm.Hg)(10 ⁻³ m. m./hr.)	Wind Movement (m. m./hr.)	Light Intensity, ²⁰ (%)	Leaf Temp. (°C.)	Leaf Temp. (°C.)
Aug.	6.534	33.4	14.37	14.766	1,454	34.9	31.9
17	6.109	31.6	13.97	13.766	1,377	33.6	31.1
18	6.747	33.9	16.36	14.933	1,333	35.4	31.6
20	6.793	32.6	13.79	13.914	1,743	33.3	30.9
21	9.248	35.9	16.76	16.543	1,443	36.3	33.7
23	7.439	31.6	14.33	13.667	1,378	34.3	31.6
24	7.823	31.6	16.19	16.666	1,397	34.3	31.4
26	6.936	31.6	14.67	17.447	1,966	35.6	31.1
26	6.633	30.3	12.33	14.679	1,393	33.3	31.1
27	7.866	30.9	13.46	13.636	1,466	37.6	33.6
28	6.793	33.1	6.97	16.737	1,339	37.3	35.6
29	1.486	33.6	3.72	13.483	1,689	36.6	34.3
30	6.936	35.3	6.93	14.66	1,966	36.3	35.9
31	6.666	37.6	4.19	13.766	1,377	36.1	35.9
Sept.	1.463	32.6	3.46	12.466	1,413	36.9	35.3

TABLE 49 -- Continued

Date	Water Level (ft.)	Air Temp. (° C.)	W. P. D. (mm. depth in m. /hr.)	Wind (m.p.h.)	Light Intensity (c.p.)	Soil Temp. (° C.)	Leaf Temp. (° C.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Sept. 1	4.138	18.7	14.18	11.75	1,410	23.9	26.3
2	4.782	20.4	9.81	.87	.500	24.7	28.3
4	4.138	18.9	9.81	4.976	.500	27.9	28.1
5	4.417	20.4	9.81	4.373	4,900	27.9	30.1

*Figures for air temperatures and vapor pressures deficit were obtained from hypothermograph records, read from potentiometer (from three daily) continuous readings, 11.00 hours from potentiometer (from three daily) continuous readings, and soil and leaf temperatures, each from twelve thermometers, and other bar./hr. from the average of study plants.

^bSoil heat results = 18.714 x 10⁻⁶ calories/cm.²

AIR TEMPERATURE, VAPOR PRESSURE DEFICIT, WIND MOVEMENT, LEAF TEMPERATURE, SOIL TEMPERATURE, LEAF TEMPERATURE, AND WATER LOSS PER GRAM AFTERNOON PERIODS OF MEASURED DATA IN 1942

Date	Water Loss (No. Air Temp.		V. P. D.		Wind Movement		Light Intensity		Soil Temp.		Leaf Temp.	
	(gms.) (°F.)	(°C.) (°F.)	(mm. Hg) (°C.)	(°F.)	(ft. or m.) (°C.)	(°F.)	(ft-cd) (°C.)	(ft-cd)	(°C.) (°F.)	(°C.) (°F.)	(°C.) (°F.)	
Aug. 12	2, 475	24.3	16.45	15.720	1.825	26.4	26.3	26.3				
17	6, 400	26.7	20.90	20.820	2.800	22.6	24.1	24.1				
18	4, 844	24.4	24.40	4.840	2.240	24.4	23.3	23.3				
20	4, 920	24.4	23.91	15.920	2.824	24.7	24.1	24.1				
21	9, 113	24.4	20.40	20.400	2.770	21.6	24.3	24.3				
22	4, 720	24.3	20.70	2.720	1.450	25.4	23.0	23.0				
24	2, 823	26.7	18.20	17.440	1.730	21.7	22.3	22.3				
26	9, 317	24.0	23.75	16.321	2.476	23.0	24.0	24.0				
28	5, 917	24.0	27.10	21.940	.619	25.0	23.3	23.3				
27	10, 400	25.1	26.05	19.000	1.485	23.0	26.0	26.0				
29	2, 210	26.9	17.00	2.240	1.819	26.3	26.4	26.4				
30	2, 911	26.5	4.97	6.430	.797	24.9	23.4	23.4				
30	4, 479	23.3	18.00	2.240	1.837	26.0	26.3	26.3				
30	6, 420	26.3	7.30	16.000	.619	23.4	26.0	26.0				
Sept. 1	5, 492	25.1	27.00	17.700	1.732	24.7	23.0	23.0				

TABLE II (Continued)

Date	Water Level (ft.)		Air Temp.		V. R. D.		Wind		Light		Full Temp.		Leaf Temp.	
	(ft.)	(° C.)	(° C.)	(° C.)	(mm. Hg)	(mm. Hg)	(mi. or, (sec/min.))	(mi. or, (sec/min.))	(C.D.)	(C.D.)	(° C.)	(° C.)	(° C.)	(° C.)
Aug. 1	7.490	26.1	27.14	27.14	1.173	1.173	1.173	1.173	1.173	1.173	24.9	24.9	24.9	24.9
2	6.492	25.6	22.21	22.21	1.143	1.143	1.143	1.143	1.143	1.143	26.8	26.8	26.8	26.8
4	6.493	25.7	13.14	13.14	1.173	1.173	1.173	1.173	1.173	1.173	21.9	21.9	21.9	21.9
6	5.495	24.9	14.11	14.11	1.173	1.173	1.173	1.173	1.173	1.173	21.9	21.9	21.9	21.9

^aWindmills for air temperatures and vapor pressure deficits were obtained from Appalachian graph records, wind from particles (three thousand) monometer readings, light from particles light meter readings, soil and leaf temperatures each from twelve thermocouples, and water level, ft., from the average of six gauges.

^bOne level reading = 10, 144 $\times 10^{-4}$ inches/sec.

TABLE VI

AIR TEMPERATURE, VAPOR PRESSURE DEFICITS, WIND MOVEMENT, LIGHT INTENSITY, REL. TEMPERATURES, LEAF TEMPERATURES, AND WATER LOSS/AREA, FOR THE STRESS PERIOD OF MEASURED DATA IN 1932

Date	Water Loss/Gr.		Air Temp.		V. P. D.		Wind Movement		Light Intensity		Rel. Temp.		Leaf Temp.	
	(gms.)	(%)	(°C.)	(°F.)	(mm. Hg)	(10 ⁻³ m. m.)	(m.p.s.)	(m.p.s.)	(candlepower)	(candlepower)	(°C.)	(°F.)	(°C.)	(°F.)
Aug.	11	.457	26.3	79.3	4.43		.179		.948		26.8	79.2	26.3	79.1
	12	.369	27.3	81.1	4.18		.346		1.018		26.6	79.9	26.1	78.9
	13	.423	27.7	81.9	4.43		.113		.838		26.2	79.2	26.7	79.7
	20	.422	27.4	81.3	4.19		1.990		1.046		26.6	79.9	26.3	79.3
	21	.370	27.3	81.1	4.44		1.199		.937		26.6	79.9	26.4	79.5
Sept.	22	.540	27.3	81.1	4.18		2.423		.318		26.4	79.5	26.8	79.8
	24	.445	26.4	79.5	4.46		.023		.418		26.6	79.9	26.6	79.9
	25	.443	26.8	80.2	4.70		.340		1.033		26.2	79.2	26.1	79.0
	26	.392	26.3	79.3	4.39		.089		.323		26.7	79.7	26.1	79.0
	27	.400	26.1	78.9	4.67		.076		.309		26.3	79.3	26.4	79.5
Sept.	28	.720	26.4	79.5	4.19		.365		.397		26.3	79.3	26.7	79.7
	29	.390	26.6	80.0	4.67		.036		.411		26.3	79.3	26.8	79.8
	30	.340	26.6	80.0	4.69		.028		.343		26.1	79.0	26.8	79.8
	31	.400	26.9	80.4	4.39		1.131		.407		26.6	79.9	26.4	79.5
	1	.700	27.3	81.1	4.42		1.017		.333		26.3	79.3	26.4	79.5

TABLE VI -- Continued

Date	Water Level (ft.)	Air Temp. ($^{\circ}$ C.)	(T_a)	(T_w)	Mean. H ₂ O (lit. concn. /m.)	Mean. H ₂ O (lit. concn. /m.)	Light Intensity (x ₁₀)	Sol. Temp. ($^{\circ}$ C.)	(T_s)	Lat. Temp. ($^{\circ}$ C.)	(T_l)
Sept. 3	2.400	18.5	18.5	18.47	1.343	1.343	1.305	18.4	18.4	17.6	17.6
3	2.421	18.6	18.6	18.70	1.395	1.395	1.377	18.6	18.6	17.6	17.6
4	2.446	18.6	18.6	18.69	1.405	1.405	1.358	18.3	18.3	18.6	18.6
5	2.424	18.3	18.3	18.48	1.422	1.422	1.481	18.5	18.5	18.7	18.7

Averages for air temperatures and water pressures deficit were obtained from appropriate graph records, and from potentiometer (three times daily) continuous readings. Light intensities from potentiometer light meter readings, and soil and leaf temperatures each from separate thermocouples, and water loss/H₂O, from the average of study plants.

¹Open leaf reading = 18, T_{ld} = 17.6 (concns./m.)

TABLE 12

SUMMARY OF CORRELATION COEFFICIENTS, MEANS, PARTIAL REGRESSION COEFFICIENTS, AND MULTIPLE REGRESSION EQUATIONS FOR MORNING, AFTERNOON, EVENING, AND WINTER PERIODS, OVER FORTY-SEVEN DATES IN 1957^a

Variable		Morning	Afternoon	Evening	Winter Periods ^b
<u>Correlation Coefficients</u>					
Totals	$\bar{r}_{Y, 123456}$	.7493**	.7726**	.8716**	.8732**
Partial:	$r_{Y1, 123456}$	.1984	.6404	.4344	.1397
	$r_{Y2, 123456}$	.3891	.3859	.1113	.1947
	$r_{Y3, 123456}$	.4477	.4646	.1944	.1779
	$r_{Y4, 123456}$	.3227	.1472	-.000540	-.0008
	$r_{Y5, 123456}$	.5349	.5385	.4743	.4389
	$r_{Y6, 123456}$	.2784	-.6143	.3277	.1575
Samples:	r_{Y1}	.4979**	.8764	-.4794**	-.4876**
	r_{Y2}	.4527**	.8149**	-.4993**	-.5049**
	r_{Y3}	.3841	-.0854*	.5485	.5393
	r_{Y4}	-.4579	.2761	.1415	.5544**
	r_{Y5}	-.4427**	.6456	.3822	-.4134**
	r_{Y6}	-.4674**	.4579*	.1415	.8360**
<u>Means</u>					
$\bar{X}_1$ (air temp., °C.)		30.7	30.1	26.9	31.0
$\bar{X}_2$ (W. P. Q., mm. Hg)		11.94	21.92	8.11	14.00
$\bar{X}_3$ (Wind movement, in 10 mi. m./hr.)		25.30	19.72	.94	14.481
$\bar{X}_4$ (light intensity, lumens/cm. ²)		1.899	1.747	.494	1.461
$\bar{X}_5$ (soil-temp., °C.)		27.6	31.6	29.1	29.0
$\bar{X}_6$ (leaf temp., °C.)		30.2	33.1	32.7	30.4
$\bar{Y}$ (Water loss/hr., gms.)		4.44	5.40	.40	4.14

TABLE VI -- Continued

Variable	Morning	Afternoon	Evening	Within Periods ^b
<u>Partial Regression Coefficients</u>				
$b_{y1, 23456}$	.36433	-.34616	.14574	-.16324
$b_{y2, 13456}$	-.36108	.33366	.03044	.12978
$b_{y3, 12456}$	.04034	.03196	.03308	.02134
$b_{y4, 12356}$	.35934	-.31285	1.38083	-.08381
$b_{y5, 12346}$	.05017	-.41527	.03334	-.09874
$b_{y6, 12345}$	.47843	1.31287	-.08865	.42187

Multiple Regression Equations

$$\text{Morning: } \hat{Y} = .794 X_1 - .346 X_2 + .04034 X_3 + .3597 X_4 \\ + .097 X_5 + .478 X_6 + 39.837$$

$$\text{Afternoon: } \hat{Y} = 4.95 - .046 X_1 + .188 X_2 + .0304 X_3 \\ - .313 X_4 - .413 X_5 + 1.313 X_6$$

$$\text{Evening: } \hat{Y} = .107 X_1 + .0304 X_2 + .0331 X_3 + 1.188 X_4 \\ + .0333 X_5 - .0881 X_6 + 3.988$$

$$\text{Within Periods: } \hat{Y} = -3.838 - .196 X_1 + .114 X_2 + .0113 X_3 \\ + .1838 X_4 - .0887 X_5 + .413 X_6$$

^aTabular values for R or r:

d.f.	No. Variables	.15	.11
12	7	.781	.802
17	3	.484	.578
47	7	.432	.591
53	3	.373	.555

^bSince the analysis is run on water loss/hr. and environmental factors within each period, the degrees of freedom are $(17 - 1) + (18 - 1) + (17 - 1) = 34$ total; for $(n = 7)$, d.f. = 63; for $(n = 3)$, d.f. = 53.

TABLE 13

TABLE OF ESTIMATES FOR THE PARTIAL REGRESSION COEFFICIENTS REPRESENTING THE RELATIONSHIPS OF WATER LOSS PER HOUR ON SIX ENVIRONMENTAL FACTORS, COMPARING PAIRS OF PERIODS (MORNING, AFTERNOON, AND EVENING), IN 1983

Independent Variable	Comparison	Differences between Partial Regression Coefficients	Standard Error of Difference	p
Air temp. (T_a) $b_{T_a, 21004}$	morning T_a -afternoon T_a , evening T_a	1, 146148 - 327648 -1, 812307	.4361 .4397 .5081	1, 891 (1, 891) .813 1, 993 (1, 877)
V. P. R. (T_p) $b_{T_p, 11004}$	morning T_p -afternoon T_p , evening T_p	- . 886384 - . 309681 - . 324403	.3678 .2134 .1791	1, 983 (1, 328) 1, 298 (1, 328) 1, 181 (1, 420)
Wind (W) $b_{W, 11004}$	morning W -afternoon W , evening W	- . 821198 - . 832728 - . 691346	.2773 .2628 .3448	.684 .814 .518
Light intensity (I_L) $b_{I_L, 12004}$	morning I_L -afternoon I_L , evening I_L	. 822324 - . 579314 -1, 493286	.7643 .8778 .8598	.826 1, 813 (1, 895) 3, 154 (1, 843)
Soil temp. (T_s) $b_{T_s, 13004}$	morning T_s -afternoon T_s , evening T_s	1, 312342 - 874631 - 1, 476811	.6862 .4934 .8981	1, 741 (1, 1) 1, 167 (1, 208) 1, 368 (1, 233)
Leaf temp. (T_L) $b_{T_L, 13004}$	morning T_L -afternoon T_L , evening T_L	- . 437489 - 1, 329761 1, 363428	.7943 .4864 .8287	.488 1, 811 (1, 181) 1, 443 (1, 138)

Hyphens in parentheses indicate approximate probability of χ^2 d.f. = 1; $\chi^2_{.95}$ = 3, 178.

TABLE 74

ANALYSIS OF COVARIANCE FOR WATER LOADS PER ROOM AND AIR TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1953

A. Analysis of Covariance and Test of Significance for Adjusted Period Means						
Source of Variation	d. f.	$\sum x_i^2$	$\sum y_i^2$	Sum of Squares and Products	Sum of Squares ^a d. f.	Mean Square
Day (Period)	64	983.56	493.56	964.234	477.379	7.46
Periods	1	145.56	493.56	256.144		
Within periods	59	256.14	145.11	140.288	115.955	1.96
For test of significance of adjusted period means				161.624	2	80.812
				$F = \frac{80.812}{1.96} = 41.23$		

B. Summary of Prediction in Analysis of Error Variations				
Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, $\sum y_i^2$	64	145.333	2.271	
Reduction due to regression, $(\sum x_i y_i)^2 / \sum x_i^2$	1	27.442	27.442	12.14
Error for adjusted means	63	117.891	1.871	

C. Analysis of Components among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods

Source of Variation	d. f.	Sum of Squares and Products		Errors of Estimates	
		$\sum x_i^2$	$\sum y_i^2$	Sum of Squares	d. f.
Morning	16	79.89	79.28	44.848	17
Afternoon	16	143.89	42.38	61.932	17
Evening	16	21.92	4.37	2.548	17
Total	48	245.70	125.03	111.328	51
Errors of Variation			d. f.	Sum of Squares	Errors of Estimates
Deviation from average (overall regression within periods)			16	111.328	
Deviation from individual period regressions			$\frac{N}{k}$	$\frac{111.328}{4}$	$\frac{2.199}{4}$
Differences among period regressions					

$$s_{y_i}^2 = (\sum y_i^2 / \sum x_i^2)$$

TABLE IV

ANALYSIS OF COVARIANCE FOR WATER LOADS PER HOUR AND TYPICAL PERIODS DEFECTS IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF NINETEEN DAYS IN 1983

A. Analysis of Covariance and Test of Significance for Adjusted Periodic Means					
Source of Variation	d. f.	Sum of Squares SS_{ij}	Sum of Squares and Products SSP_{ij}	Errors of Estimate Sum of Squares ^a d. f.	Mean Square
Day Periods	24	1097.88	985.48	884.976	37
Periods	3	1715.29	775.48		
Within periods	64	1181.41	187.41	104.752	1.6
For test of significance of adjusted period means					$\frac{1.6 \times 64}{75.977} = 13.114$
B. Sources of Variation in Analysis of Seven Variables					
Source of Variation	d. f.	Sum of Squares	Mean Square	F	
Within periods, unadjusted, SP_{ij}^2	64	1403.289	21.942		
Reduction due to regression, $(\beta_1 SP_{ij}^2)/\beta_1$	1	16.121	16.121		16.18
Error for adjusted means	63	1387.168	22.019		

TABLE 7B -- *Continued*

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods					
Source of Variation	d.f.	$\log_e$	$\log_e y$	Sum of Squares and Products $\log_e^2$	Errors of Estimates (Sum of Squares) d.f.
Meaning	18	371.69	73.89	62,476	46,881 17
Afternoon	18	814.66	131.68	79,768	88,781 17
Evening	18	25.41	5.89	102	719 17
Total	54	1181.41	207.51	142,346	136,581 51
Errors of Estimates					
Source of Variation	d.f.	Sum of Squares		Mean Square	
Deviation from average (error) regression within periods	42	195,813			
Deviation from individual period regressions	12	185,821			
Differences among period regressions	2	17,146		8,573	
		185,821		17,146	
				18,122	

$$s_{\log_e^2}^2 = (\log_e y)^2 / (\log_e^2)$$

100

and, thus, the consequences for Africa. Looney first notes why it has been difficult to find housing, employment, and services provided for refugees as they enter the country. Then, he discusses how the African League first began and why it has been successful in its efforts to help refugees. He also discusses the role of the United Nations in the process and the role of the African League in the process. Finally, he discusses the role of the African League in the process and the role of the United Nations in the process.

Source of Variation	d. f.	$\sum x_i$	$\sum x_i^2$	Sum of Squares and Products	Sum of Squares	Mean Square
Day Period	24	51, 198	79, 100	408, 871	241, 369	10
Periods	2	2, 248	15, 104	100, 542	100, 542	50, 271
Within periods	24	12, 147	12, 208	148, 210	138, 428	5.8
Total	50	65, 593	106, 212	657, 623	680, 339	13.6

Test for adjusted period means

$$F = \frac{100,542}{2,248} = 44.70$$

Source of Variation	d.f.	Sum of Squares	Mean Square	F	p. Value
Between periods, unadjusted, dy^2	14	133.138	9.510		
Between due to regression, $(b_0y)^2/\text{day}$	1	9.421	9.421		
Error for adjusted means	11	133.138	12.103		

TABLE 16 -- Continued

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods

Source of Variation	d.f.	Sum of Squares and Products		Errors of Estimates	
		$\sum y_i^2$	$\sum y_i x_i$	Sum of Squares	d.f.
Morning	18	18, 103, 50	113, 00	61, 779	17
Afternoon	18	8, 193, 40	89, 90	61, 663	17
Evening	18	20, 66	2, 36	603	17
Total	54	18, 147, 56	105, 26	123, 045	51

Source of Variation

d.f.

Sum of Squares

Mean Square

Deviation from average (overall) regression within periods

Deviation from individual period regression

Differences among period regression

D. Analysis of Errors of Estimates from Three Regressions

Source of Variation	d.f.	Sum of Squares		F
		Sum of Squares	Mean Square	
Day (period)	28	391, 509	13, 981	109, 44
Partial means ^a	1	1, 814		
Average within periods	28	123, 045		
Residuals	1	283, 646	283, 646	

$$MS_D = (\sum y_i^2) / \sum y_i^2$$

^a Obtained from linear test of H_0 analysis.

TABLE II

ANALYSIS OF COVARIANCE FOR WATER LOADS PER BOON, AND LIGHT INTERCEPTS IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF RECREATION DAYS IN 1960

A. Analysis of Covariances and Test of Significance for Adjusted Period Means

Sources of Variation	d. f.	Sum of Squares	Mean Square	Sum of Squares	Mean Square
Day (total)	84	94.08	1.12	264.512	3.14
Periods	1	18.25	18.25		
Within periods	84	75.83	.90	137.142	1.63
				178.792	2.10
For test of significance of adjusted period means					
$F_{.05} = \frac{18.25}{1.461} = 12.49$					

B. Sources of Prediction in Analysis of Error Variances

Sources of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, σ^2	84	143.248	1.70	
Reduction due to regression, $(\sigma_1\sigma_2)^2/\sigma_3^2$	1	14.913	14.913	8.77
Error for adjusted means	83	127.335	1.53	

C. Analysis of Covariance among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods

Source of Variation	d.f.	Sums of Squares and Products		Errors of Estimates	
		$\sum x_i^2$	$\sum x_i y_i$	Sum of Squares	d.f.
Morning	18	36, 90	52, 978	61, 866	17
Afternoon	18	15, 90	79, 960	75, 307	17
Evening	18	6, 17	1, 997	228	17
Total	54	58, 77	133, 935	138, 399	51

Source of Variation	d.f.	Errors of Estimates	
		Sum of Squares	Mean Square
Deviation from average (overall regression within periods)	33	127, 353	
Deviation from individual period regressions	18	104, 251	5, 790
Differences among period regressions	1	1, 395	1, 395

D. Analysis of Error of Estimates from Three Regressions

Source of Variation	d.f.	Sum of Squares	Mean Square	F
Day (total)	30	303, 313		
Period means ^b	1	3, 353		n. s.
Average within periods	30	127, 543		
Residuals	1	171, 300	171, 300.00	71, 30

$$t_{99}^2 = (\sum x_i y_i^2 / \sum x_i^2)$$

^bCorrected from line two of A. Analysis.

TABLE 19

ANALYSIS OF COVARIANCE FOR WATER LOADS PER ROOM AND HOOL TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF HINCHEN DAYS IN 1963

A. Analysis of Covariance and Test of Significance for Adjusted Partial Means

Source of Variation	d. f.	Sum of Squares $\sum y_{ij}^2$	Sum of Squares and Products $\sum y_{ij}^2$	Error of Estimate (Sum of Squares) ^a d. f.	Mean Square
Day (period)	84	394.36	531.36	668.162	7.9
Periods	2	165.34	45.13		
Within periods	34	124.14	55.17	135.162	3.941
Total				348.324	174.162
F test of significance of adjusted partial means					$F = \frac{174.162}{1.541} = 113.66$

B. Test of Precision in Analysis of Error Variance

Source of Variation	d. f.	Sum of Squares	Mean Square	F
Within periods, unadjusted, $\sum y_{ij}^2$	84	143.389	1.706	
Reduction due to regression, $(\sum y_{ij})^2 / \sum y_{ij}^2$	1	34.177	34.177	19.99
Error for adjusted means	83	118.762	1.431	

C. Analysis of Correlations among the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods

Source of Variation	d.f.	Sums of Squares and Products		Errors of Estimates	
		$\sum y^2$	$\sum xy$	$\sum y^2$	$\sum xy$
Morning	18	24, 89	24, 89	52, 676	16, 467
Afternoon	18	11, 69	27, 89	79, 908	68, 328
Evening	18	18, 14	1, 17	109	836
Total	54	54, 72	52, 95	241, 594	145, 631
<hr/>					
Source of Variation		d.f.		Errors of Estimates	F
				Sums of Squares	Mean Square
Deviation from average (overall) regression within periods		51		124, 766	
Deviation from individual period regressions		3		(86, 82)	2, 894
Differences among period regressions		1		1, 928	1, 928
					d. s.

$$s_{y|x}^2 = (\text{regression})^2 / \text{regression}$$

TABLE 75

ANALYSIS OF COVARIANCE FOR WATERS LOADED PER HOUR AND LEAF TEMPERATURES IN THE MORNING, AFTERNOON, AND EVENING PERIODS OF SEVENTEEN DAYS IN 1953

A. Analysis of Covariance and Test of Significance for Adjusted Period Means

Source of Variation	d.f.	$\sum y_j^2$	$\sum y_j^2$	Error of Estimate Sum of Squared ^a d.f.	Mean Square
Day (block)	84	273.18	248.99	297.774	3.5
Periods	2	134.84	144.47		
within periods	16	131.84	117.43	153.747	9.6
For test of significance of adjusted period means				$\frac{153.747}{161.761}$	= 0.95

B. Sources of Variation in Analysis of Error Variance

Source of Variation	d.f.	Sum of Squares	Mean Square	F
within periods, unadjusted, $\sum y_j^2$	84	143.138	1.704	
Reduction due to regression, $(\sum y_j)^2 / \sum y_j$	1	29.343	29.343	18.14
Error for adjusted means	83	113.795	1.371	

TABLE 79 -- (Continued)

C. Analysis of Covariates using the Periods and Analysis of Errors of Estimates from the Average Regression Within Periods					
Source of Variation	d.f.	MS_e	SS_e	Errors of Estimates Sum of Squares	d.f.
Morning	18	68.79	123.74	28.424	17
Afternoon	18	64.79	116.62	24.427	17
Evening	18	29.14	52.45	12.824	17
Total	54		342.81	65.675	51
Errors of Estimates					
Source of Variation	d.f.	Sum of Squares	F		
Deviation from average (overall) regression within periods	43	163.943			
Deviation from individual period regressions	51	14.624			
Difference among period regressions	2	4.118			
		19.742			

$$MS_e = MS_e / MS_e$$

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This dissertation was prepared under the direction of the chairman of the candidate's supervisory committee and has been approved by all members of the committee. It was submitted to the Dean of the College of Agriculture and to the Graduate Council and was approved as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

June 7, 1934

Dean, College of Agriculture

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