Irrigation and Drainage Letter

UNIVERSITY OF CALIFORNIA
Agricultural Extension Service

April, 1960, No. 15

CONTENTS

1. Aid for Jones Plug Contacts
2. DWR Speakers Available
3. Gravity vs. Sprinkler Irrigation
4. Can See; Can't Read
5. Irrigation of Strawberries
6. Alfalfa Irrigation, Imperial Valley
7. Water Use by Lemons

AID FOR JONES PLUG CONTACTS

Poor contacts between Jones Plug prongs and receptacles continue to plague some users of Ames gypsum blocks (see I & D Letter No. 12). This is usually caused by dirt, corrosion, or bending. If the prongs, when new, are dipped in a commercial grade of vaseline cut with cleaning solvent to the consistency of thick oil and are scrubbed from time to time with a toothbrush dipped in this material, pretty good conductivity and contact can be maintained.

If something better is needed, add 15 ml. of "Versilube No. F 50 Silicone Fluid" to 1 ounce of "Fine Silver Powder No. 130." Clean the electrodes thoroughly and coat completely but thinly with the silvered silicone. This material is useful for all contacts and switches.

Information from Frank G. Mackaness, Manager of Rural Services, Portland General Electric Co.

SPEAKERS AVAILABLE FROM DEPARTMENT OF WATER RESOURCES

Farm advisors who would like to obtain speakers to address group meetings on local and state water problems will be interested in the following excerpt from a letter received from Harvey O. Banks, Director of Department of Water Resources: "We have several on the staff who can be assigned as speakers upon invitation from interested agencies. The names of these people are as follows: James F. Wright, Deputy Director; William H. Fairbank, Assistant Director; Porter A. Towner, Chief Counsel; William L. Berry, Chief, Division of Resources Planning; Walter G. Schulz, Chief, Division of Design and Construction; John R. Teerink, District Engineer, Southern California District Office; John E. Hunt, Financial Adviser; Robin R. Reynolds, Chief, Office of Program and Planning; and myself. It is to be understood that we are available on invitation only, and requests for speakers should be addressed to me as Director of Water Resources. We are prepared to talk on any aspect of water problems in the State and the State Water Program. Generally, we try to emphasize local aspects and problems when speaking before local groups.

"If we can assist the farm advisors in your organization please do not hesitate to call upon us."

GRAVITY VS. SPRINKLER IRRIGATION

Discussion frequently arises concerning the relative merits of gravity and sprinkler irrigation. Claims are advanced for one over the other which often are based on comparisons in different fields, different years, or different soil conditions. Even when placed side by side at the same time, other variables sometimes creep in but are not evaluated, such as inadequacy of wetting or greater soil-water stress prior to irrigating for one of the methods. It is proper to compare the two methods for ease or difficulty of accomplishing an adequate irrigation, but it is not proper to compare yield results when the irrigation management has permitted one method to adequately wet the soil while the other method falls short of it.

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is critism implied of similar products which are not mentioned.

Marsh - Booher - Houston

A recent paper (Finkel & Nir, Soil Science 88:16-24, July 1959) describes research on gravity vs. sprinkling in which most of the variables were either controlled or measured. The application differences involved half the quantity of water applied at twice the frequency to the sprinkled plots as compared to the gravity-irrigated plots, providing for the same total quantity with no runoff permitted. No mention was made of length of time plots remained flooded, nor were records of soil moisture condition reported. Alfalfa was the test crop, and records were obtained over a 2-year period.

Yields from sprinkled plots averaged about 8% greater the first year and 12% greater the second year than from gravity-irrigated plots. Infiltration rates obtained by the standard ring method at the end of each season favored the sprinkled plots 20.2 to 7.5 cm/hr. The first season and 18.4 to 3.1 cm/hr. the second season.

Using the diffusion cup method, concentrations of O_2 and CO_2 in the soil air at 1, 2, and 3 ft. depths were measured before and after each irrigation. Irrigation in general resulted in an increase of CO_2 and a decrease of O_2 in the soil air, but the magnitude of these changes was significantly greater in the gravity-irrigated plots. The authors think the aeration differences may have been the main cause for the yield differences. The soil was a deep, alluvial, calcareous clay loam on less than 1% slope.

Interesting as these results may be, the choice between the two methods should be made locally on the basis of environmental conditions affecting the operator's ability to accomplish a satisfactorily complete, uniform, efficient and economical irrigation without introducing unfavorable side effects. (See item 5 in this letter, "Irrigation Studies with Strawberries.")

CAN SEE; CAN'T READ

Speaker: Can all of you see this table (projected)?

Man up front: Can see; can't read!

Most of us have been exposed to projected material like this at meetings of various types; some of us have been guilty of using it. If projected material and visual aids cannot be read by all of the audience, then why show them? Surely they should be more than a prompter, or reminder, for the speaker.

In using slides, follow these specifications:

1. Keep them simple--only one central idea on a slide.

2. Use large type or, preferably, lettering.

3. Don't photograph typewritten material from an area greater than 3.5" by 5".

4. Screen width should be not less than 1/6 length of seating space.

(From instructions for contributors to American Society of Agronomy meetings. For complete treatment, see "Presenting Information with 2 x 2 Slides" by H. W. Smith, Agronomy Journal 49:109-113, 1957.)

File Number 4.1023

IRRIGATION STUDIES WITH STRAWBERRIES

Glen H. Cannell, R. Bringhurst, V. Voth, and E. Proebsting

Irrigation studies in relation to various other managerial practices for strawberries were carried out at the South Coast Field Station in 1959. A complete statistical treatment of the data has not been completed at this time; however, trends with indications of important results are shown.

Treatments:

Irrigation

a. Water application - sprinkler and furrow

b. Irrigations were made at 0.2-, 0.8-, and 5-bars suction when these values were indicated by soil moisture instruments placed at an 8-inch depth. Tensiometers were used in the 0.2- and 0.8-bar suction levels and stainless steel cylindrical electrod type gypsum blocks in the 5-bar moisture treatment.

Fertilizer

a. 50 lbs. N (ammonium nitrate)

b. 100 lbs. N (ammonium nitrate)

Both levels of fertilizer were side dressed along the beds at approximately 3 equal intervals during the harvest period.

Mulch (Plastic)

a. Clear polyethylene (2 mil) placed on the beds in early February, 1959. Plants were positioned through slits made in the plastic.

b. No plastic.

Temperature values were measured at the 3-inch depth under the mulch treatments for the 0.2-bar moisture-furrow treatment.

Procedure and Results:

Treatments were combined in a factorial-type design and transplants placed in the plots in early August, 1958. All plots were treated similarly during the fall and winter. Irrigations during this period of time were made using sprinklers. Moisture treatments were imposed following placement of plastic (mid Feb., 1959). A good root system was well developed in all plots at the 8-inch depth when moisture treatments were started. Berries were picked on a weekly basis, with rotted berries being separated at time of picking.

Yield and rot data as a function of all treatments may be observed in table 1. Yields increased with decreasing soil suction, except for the 0.2-bar nonplastic treatment. This treatment developed chlorotic iron deficient symptoms. Early yields were seriously decreased by this effect. Larger early yields were obtained under the plastic treatment. Part of this effect is due to higher temperatures (approximately 8 to 15° F. daytime, and 5 to 10° F. nighttime) creating better growing conditions.

Rots were decreased by the plastic treatment. Rots were not substantially affected by sprinkler versus furrow irrigation under plastic. They were increased considerably by sprinkler application on the nonplastic plots, particularly for the wet treatment.

Nitrogen fertilizer treatments were not effective in changing yields, possibly because of total nitrogen in the soil prior to treatments.

Berry size was decreased with increasing soil suction. Smaller berries were also associated with plastic mulch treatments during the latter part of the season.

Table 1.--Yields for 8 and 16 weeks (final pick) - total rots at 16 weeks.

Suction Bars	Plastic		No Plastic	
	50 lb.N	100 lb.N	50 lb.N	100 lb.N
Yield at 8 weeks - Tons/acre - rots removed				
.2-F*	9.5	10.3	6.6	6.3
.2-S	9.2	8.9	6.4	7.1
.8-F	8.7	8.1	7.9	7.6
.8-S	8.2	8.4	6.6	7.0
5-F	8.5	8.6	6.2	6.4
5-S	7.8	7.8	6.4	6.3
Yield at 16 Weeks - Tons/acre - rots removed				
0.2-F	21.6	22.7	19.1	19.5
0.2-S	20.6	19.4	18.5	20.2
0.8-F	19.3	17.5	22.4	21.1
0.8-S	18.7	19.0	19.3	20.1
5.0-F	18.1	18.1	17.1	17.3
5.0-S	18.0	17.2	18.5	17.4
Total Rots - Tons/acre - for 16 weeks				
0.2-F	2.0	2.8	7.8	8.3
0.2-S	2.7	2.9	10.6	10.9
0.8-F	1.5	1.0	4.8	5.8
0.8-S	1.4	1.6	5.5	5.6
5.0-F	1.2	0.9	2.2	2.7
5.0-S	0.9	1.1	2.8	2.6

* F - furrow irrigation
S - sprinkler irrigation

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File Number 3.1023

ALFALFA IRRIGATION TRIAL IN IMPERIAL VALLEY*

This is a preliminary report of an alfalfa irrigation trial at the Imperial Valley Field Station* in which the effect of irrigation treatments on alfalfa yield, stand maintenance, and soil salinity have been measured.

Loss of stand and low yields during the mid-summer period are a problem in the hot desert valleys. Irrigation or certain irrigation practices, together with diseases, have been suspected as contributing causes.

Treatments

The trial was conducted on Imperial silty clay having low profile permeability and a water table at 4-5 feet. Alfalfa was seeded December 1, 1958 in 15' by 300' plots. Nine plots provide for 3 treatments with 3 replications. Treatments were arranged in a randomized block design. Each plot was an individual border having inlet and outlet controls which permitted ponding to a depth of a few inches for a selected period. Surface drainage was fairly rapid when the outlet was opened, so that the rate of recession about equaled the rate of advance. Water quantities were not measured. Differential treatments started April 8, 1959. They were:

(1) Normal low (NL) - irrigate when 12-inch tensiometers read 70 to 80 centibars (cb); hold water on plots 3 hours.

(2) Frequent low (FL) - irrigate when 12-inch tensiometers read 30 to 35 cb; hold water on plot 3 hours.

(3) Frequent high (FH) - irrigate as (2); hold water on plot 6 hours.

Irrigation timings departed from the prescribed soil suction figures when necessary to coordinate with cuttings which were uniformly timed for all plots.

Effect on Yield

	Yield in tons per acre of oven-dry hay						
	cutting date in 1959						Total[1] 5-14 to
Treatment	4-7	5-14	6-12	7-9	8-10	9-9	9-9
NL	1.11	1.28	1.15	.79	.87	.35	4.44
FL	.97	1.17	1.67	1.19	.98	.67	5.68
FH	1.13	1.30	1.71	1.03	.65	.33	5.02

[1] 4-7 cutting date omitted because differential treatments were not started until after that date.

The table above shows yields for most of the season. The (FL) frequent low treatment not only yielded better, in spite of a poorer start, but held up far better during the high temperature period. Soil suction values apparently were too great on the normal low (NL) plots for best production during the hottest period. Yield on the frequent high (FH) plots fell off because of stand loss as shown on the following page.

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* Conducted jointly by S. J. Richards, W. F. Lehman, D. C. Erwin, H. Schulbach, and A. W. Marsh.

Effect on Stand

Treatment	Plants per square foot 5-20-59	9-18-59	Estimated % watergrass 4-7 to 6-12	7-9	8-10	9-9
NL	44.2	15.9	0	26	40	45
FL	51.4	25.6	0	0	0	0
FH	47.5	1.2	0	0	30	65

A reasonably uniform and good stand existed on all treatments on May 20. By September 18 the stand had been badly depleted on the FH treatments, and partially depleted on the NL plots. The FL plots still had an adequate stand.

Effect on Salinity

Salinity measurements were made on soil samples taken from 2 locations in each plot in March before differential treatments started, in July and in November. The July values fell between the March and November values shown in the following table:

Soil Salinity by Treatments and Depth - $EC_e \times 10^3$

Depth Inches	NL 3/59	NL 11/59	FL 3/59	FL 11/59	FH 3/59	FH 11/59
0-2	3.1	3.7	2.5	1.8	3.0	3.8
8-18	7.7	12.0	6.1	12.7	9.2	14.3
18-28	10.5	15.1	8.9	13.4	11.6	15.9

It is obvious that salinity increased for all treatments to values greater than desirable, and that treatments had little differential effect. Results from a March 1960 sampling are not yet available. Plots will be continued another year.

WATER USE BY YOUNG LEMON TREES RELATIVE TO SOIL COMPACTION AND TREE GROWTH

Citrus Experiment Station, 1957 and 1958

S. J. Richards and L. V. Weeks

Soil compaction is becoming a subject of widespread interest. An exploratory experiment with young lemon trees grown in soil containers out-of-doors has shown that soil compaction within the range studied is not correlated with vegetative growth if the irrigation program is based on tensiometer readings. Evidence is found for adapting an irrigation program to plant vigor as well as to climate and soil variables.

Experimental

Watertight soil containers 3 ft. in diameter and 4 ft. deep were filled with a sandy loam top-soil. Two levels of soil compaction were attained by adding the soil in layers and hand-tamping more in one set of nine containers relative to the remaining nine. The same amount of soil was used in both treatments, but in the high bulk density series a 5-inch layer of sand was used in the bottom of each container to occupy the difference in volume. The cylinders were recessed in surrounding soil to their full depth and were arranged in three rows, north to south. The two soil compaction treatments were alternated on a diagonal pattern. Mercury manometer tensiometers were installed to read soil suction at 6- and 24-inch depths. Five rooted lemon cuttings per container were planted in May 1956. Deionized water was used for irrigation, since no drainage outlet was provided. Evaporation at the soil surface was minimized by a surface layer of graded sand.

A single irrigation program was based on tensiometer readings. After the roots were well established, one surface-inch of water was added when the 6-inch tensiometer read 60 cb., and when both the 6- and 24-inch instruments approached 60 cb., 3 to 4 surface-inches of water were added. Infiltration of the irrigation water required three to five times longer in the high bulk density series relative to the low bulk density.

In August 1957 the bulk density was measured when soil cores were removed to install aluminum tubes for neutron soil-moisture equipment. Some settling in the soil had occurred, but the mean bulk density values were 1.59 and 1.43 gm/cc for the high and low bulk density series, respectively.

In October 1957, four of the five young trees in each container were cut off and weighed. The weight of the fifth was estimated by using an average ratio of weight to trunk circumference for the trees harvested. During the 1958 irrigation season, growth of the remaining tree in each container was measured by the increase in trunk circumference.

Results

No correlation was found between the soil bulk density values and the growth of the young trees. The total irrigation water applied in 1957 for each container showed a correlation at the 5% level with the total weight of five trees per container at the end of the 1957 irrigation season. The total irrigation water applied in 1958 showed a correlation at the 1% level with the increase in trunk circumference of the single tree remaining in each container.

Discussion

The results of this experiment with young lemon trees show that, within the limits of soil bulk density values obtained, possible adverse effects of high bulk density on plant growth can be minimized if soil moisture is maintained within a specified range based on tensiometer readings. Under field conditions, compacted soil may have greater importance because reasonable irrigation practices cannot always be adapted to the slower infiltration resulting from high soil bulk density.

Seasonal water use in individual containers varied by $\pm$19% of the mean for groups of five trees in 1957, and by $\pm$42% for single trees in 1958. When such large variations in water use occur with the same weather conditions, it appears that plant vigor can have an appreciable influence on the irrigation requirements. This is more likely to be evident in the case of plants with diseased roots or plants with nutritional unbalance.

An irrigation program based on following soil moisture conditions with instruments will automatically adapt to plant vigor as well as climatic and soil variables.