Irrigation and Drainage Letter

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ERRATIC ELECTRICAL RESISTANCE METER PERFORMANCE

Various users of Ames meters for measuring electrical resistance blocks have experienced jumpy gage performance, especially when performing the "zero adjust" operation. Poor contact between moving parts in the "zero adjust" rheostat causes this and is easily corrected.

Push firmly on the zero adjust nob and turn it rapidly back and forth several times. Check the zero adjust through its entire range and if any jumpiness remains repeat the treatment. The above procedure is usually sufficient to correct the condition. If not, open the case and direct an air blast, preferably dry air from a compressor, across the rheostat to remove dust or wipe the contact area carefully with a cloth moistened with alcohol. Do not bend the sliding finger, or it may fail to make good contact with the coil.

If a gap is observed between the sliding finger and coil, further disassemble the rheostat and bend the sliding finger downward to increase contact pressure.

Occasionally zero (0) readings are obtained in the field for some blocks. Such readings should be rejected as false unless several preceding readings of the same block have gradually been approaching zero. Ascertain the cause and correct it in the field, if possible, so that the true reading will not be lost for that day.

Usually the cause is poor contact at the connection between lead wires and meter, especially when the Jones plug type of connection is used. Clean the probes on the male half of the plug, for which purpose a small wire brush is convenient, then connect it several times to the female half to brighten the contacts. If the trouble still persists, it may be a poor connection between the lead wires and the base of the terminals in the Jones plug. Flexing the plug in various directions may establish temporary contact so that a reading can be obtained.

Subsequently a permanent correction should be made by pulling the pin, sliding back the case of the Jones plug, and resoldering the lead to the terminal.

Single block leads connected to a meter with alligator clamps are generally free from this problem, but the much faster reading and reduction of human error made possible by use of Jones plug connections warrants their use whenever multiple block installations are involved.

COMING EVENTS

October 14, 1959 - - - Conference at Modesto with State Department of Water Resources to discuss water problems of the San Joaquin Valley. San Joaquin Valley and Central Mountain counties will participate.

Marsh - Booher - Houston

INFLUENCE OF EXCHANGEABLE CATIONS ON CERTAIN SOIL PHYSICAL CONDITIONS

This is a condensed title of a paper by J. P. Martin and S. J. Richards to appear in the November-December issue of Soil Science Society of America Proceedings.

There frequently has been concern over the effect certain chemical additions, such as fertilizers and amendments, may have on the physical condition of soils, especially the water intake rate. Often a choice exists in the form of fertilizer to apply, and a question arises concerning the effects of NH_4, Na, Ca, and K ions on soil physical properties. This paper helps illuminate some of these points.

Three soils, Hanford sandy loam, Yolo sandy loam, and Yolo loam were treated in the laboratory to produce various degrees of saturation of the exchange complex with Ca, H, K, Na, NH_4. Laboratory determinations were then made for aggregation, bulk density, hydraulic conductivity, and moisture retention at 1/10-, 1/3-, and 1-bar suction.

Reciprocal variation of Ca and H from 0 to 85% exerted little influence on any of these physical measurements. Exchangeable H per se does not necessarily disperse soil. Increase in exchangeable K or NH_4 in a base saturated soil only slightly reduced aggregation but greatly reduced hydraulic conductivity as measured.* In the Hanford sandy loam, as little as 10% exchangeable NH_4 or 20% K markedly reduced water penetration, though not as greatly as 5% Na. Similar effects were obtained from Yolo loam at slightly higher percentages, but in Yolo sandy loam little effect was measured except at high Na percentages.

Increase in exchangeable H tended to increase the dispersing action of Na, K, and NH_4. In the highly acid Hanford sandy loam, soil aggregation was decreased more, and hydraulic conductivity much more, by exchangeable NH_4 than in base saturated soil. The conditions for maximum effects of NH_4 on physical properties of soil are those under which NH_4 would normally accumulate, i.e., an acid soil, since it does not accumulate in base saturated soils. Changes in soil physical condition induced by changes in cation ratios on the exchange complex are detected most readily by hydraulic conductivity measurements and, therefore, might be expected to exert great influence on water movement under field conditions.

*See item 6 in this letter.

INSERTING TOOL FOR CYLINDRICAL ELECTRICAL RESISTANCE BLOCKS

Electrical resistance blocks will respond sooner if installed properly. This means insertion into a prepared hole of just sufficient size to permit a snug fit against undisturbed soil and roots for the sides and bottom of the block. Only the top of the block should encounter disturbed "backfill."

The use of cylindrical blocks, a soil tube or auger of correct size, and a special inserting tool, facilitate proper installation and require very little time. A soil tube or auger having a diameter to match the blocks (Ames and Wiley blocks have slightly different diameters) should be used to prepare a hole to the desired depth of setting. The block is then pushed to the bottom of the hole, using the special inserting tool. Under some soil conditions it may be desirable to lubricate the hole with water before insertion, especially if the fit is rather snug. This is preferable to having too loose a fit. Backfill to the top using a $\frac{1}{2}$ inch solid wood or metal rod for a compactor.

The inserting tool can be made from simple parts if a shop is available. The attached diagram provides necessary information on materials and construction.

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CANTALOUPE IRRIGATION

"'When' is as Important as 'How Much' in Cantaloupe Irrigation" is the title of an interesting article by Dr. W. D. Pew, Horticulture Department, University of Arizona, which has recently appeared.

The experiment involved four basic irrigation treatments whose timing was guided by soil moisture measurements. Tensiometers were used for the first three treatments and fiber glass electrical resistance blocks for the fourth. Instruments were placed with the sensitive portion 10 inches to the bed side and 10 inches below the seed. Four supplemental treatments were included in which treatments 1 and 4 were carried to about mid-season then reversed. The 1A and 4A treatments were reversed after the 4A had shown drought symptoms for $2\frac{1}{2}$ weeks. The 1B and 4B treatments were reversed 10 days later.

All plots received one germination irrigation and one stand establishment irrigation prior to thinning. These do not appear in the column, Number of Irrigations. The 4A and 4B plots received no further irrigation until they were reversed.

Effects of Soil Moisture Conditions on Cantaloupe Production

Treatment No.	Description	Irrigations No.	Yield crates/acre
1	At tensiometer reading 18-20	16	196
2	" " " 35-40	12	223
3	" " " 75-80	7	201
4	Beckman Hi-range reading 50	1	33
1A	Treat. 1 until irrigations stopped when 4A was reversed	9	123
4A	No irrig. until $2\frac{1}{2}$ weeks of severe drought symptoms, then reversed to Treat. 1	9	115
1B	Treat. 1 until irrigations stopped when 4B was reversed	12	153
4B	No irrig. until 10 days after 4A was reversed, then reversed to Treat. 1	6	31

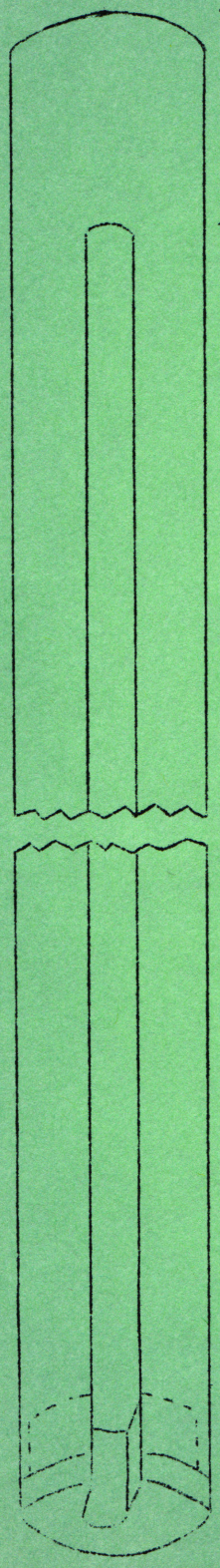
Results in the table above show that maintenance of consistent moisture levels is more efficient than widely fluctuating levels. There is no significant difference in yield between treatments 1, 2, and 3. However, the slight trend suggests that irrigation when readings are between 50 and 60 would be desirable under these conditions. Effects of early drought were not erased by abundant irrigation later, nor did plants which were irrigated frequently in the early stages stand a late season drought without loss of yield.

Progressive Agriculture in Arizona
Spring 1959, p. 10

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DIAGRAM FOR BLOCK-INSERTING TOOL

General Side View

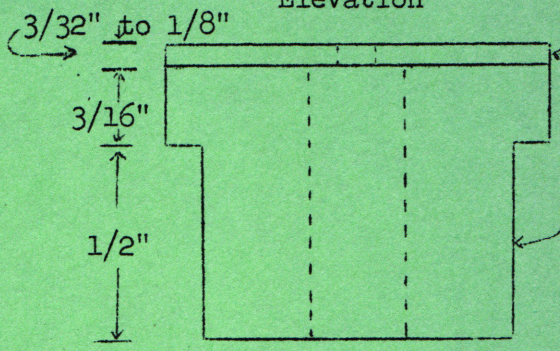


7/8" or 1" O.D. electrical conduit of desired length. Make slot 1/4" wide one side only.

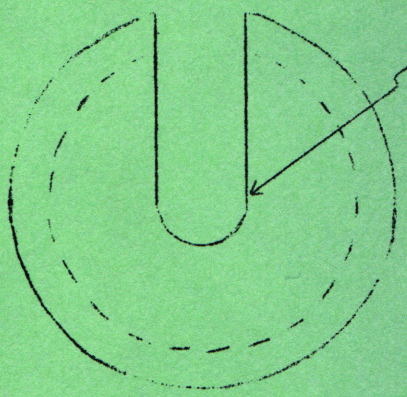
Brass end. See detail at right above.

Detail of Brass End

Elevation



Plan



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EVALUATION OF PHYSICAL CONDITIONS CREATED IN A FIELD SOIL

S. J. Richards

An experiment on the Riverside Campus was initiated to create various soil physical conditions in a Ramona sandy loam, using tillage practices and chemical soil amendments. Dr. G. H. Cannell in Vegetable Crops is carrying out the cropping trials and Dr. L. V. Allison of the U. S. Salinity Laboratory is cooperating on the evaluation of the soil physical and chemical properties. Krilium and sodium carbonate were used as soil amendments and tillage treatments were carried out with a moldboard plow, a rototiller, and a blade which loosened and fractured the soil without inverting it.

Better techniques for evaluating soil physical properties have long been sought. A laboratory procedure was devised to compact fragmented soil samples into 2-inch diameter by 2-inch deep cores. This was done using a mechanically operated compactor after the soil samples had been adjusted to a moisture content equivalent to the 1/3-bar retention.

The plot treatments were started in the spring of 1957. In August 1958 fragmented soil samples were taken, screened through a 2-mm sieve and air-dried for storage. The following table gives the results of the laboratory determination of bulk density, hydraulic conductivity, and water retention at the 1/3-bar suction. Each value in the table is an average for six replicated plots in the experiment.

It is evident that the tillage treatments have not been carried out enough times to have a measurable effect on the soil properties. The hydraulic conductivities correlate with the observed infiltration of irrigation water into the soil. Assuming that the Krilium and sodium treatments resulted in the extreme soil physical conditions, it appears that the soil properties represented by the check treatment might be improved by good soil management or deteriorated by poor management practices. Compacted bulk density and hydraulic conductivity appear to merit further study and use in evaluating the current status and trends of soil physical properties.

	Krilium			Sodium			Check		
	Bulk Den. gm/cc	Hyd. Cond. cm/hr	Pw-1/3 b. %	Bulk Den. gm/cc	Hyd. Cond. cm/hr	Pw-1/3 b. %	Bulk Den. gm/cc	Hyd. Cond. cm/hr	Pw-1/3 b. %
Blade	1.53	3.0	9.0	1.62	0.03	9.6	1.61	0.95	8.5
Plow	1.55	2.0	9.1	1.60	0.33	9.3	1.59	0.92	8.9
Rototiller	1.54	2.3	8.6	1.61	0.09	9.1	1.60	0.88	8.4
Ave.	1.54	2.4	8.9	1.61	0.15	9.3	1.60	0.92	8.6

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IRRIGATION STUDIES IN CELERY - 1958

Glen Cannell, K. B. Tyler, and C. W. Asbel

Variety and Transplanting Date - Utah 10B, June 4.
Experimental Design - 3X3 factorial combining 3 moisture and 3 fertility treatments and replicated 4 times.

Treatments -

Irrigation - Water was applied when the suction values reached 0.2, 0.8, and 5 bars. Tensiometers were used for timing of irrigation at the two lower suction values and resistance units (gypsum) calibrated in terms of suction for the high suction value. Instruments were placed at the 8-inch depth and moisture treatments imposed 3 weeks following transplanting.

Fertilizers - Three rates of 1, 2, and 4 tons per acre of 10-10-10 were used. One half was broadcast and worked in at transplanting. The other half was placed in the bed when final furrows were formed.

Results and Discussion -

Yields were measured on plants not affected by blackheart and are reported on an individual plant as well as a per acre basis (table 1). Yields decreased significantly with increased soil suction. Higher yields resulted from the application of 2 tons of fertilizer per acre than from the 1 or 4 tons at all moisture levels.

Blackheart incidence counts were made at 6 and 12 weeks from transplanting. At the early date no blackheart was found in the high moisture treatments regardless of fertilizer treatments. At the later date (harvest time) blackheart was noted in all treatments. Blackheart was increased in the drier moisture treatments and was also increased with higher fertilizer rates. Both increases were highly significant.

The interaction of moisture and fertilizer was significant at the 0.001 level. The meaning of this interaction is not entirely known. It has been suggested by some investigators that the rate of growth increases the susceptibility of the plants to blackheart, possibly by making the plant more sensitive to contributing factors. If yields are compared at time of harvest essentially the same size plants exist for the 0.2-bar suction medium fertility treatment as for the 0.2-bar suction high fertility treatment (2.48 to 2.56 pounds per plant), yet the percentage blackheart is 5.2 compared to 58.4. Other comparisons giving the same result can be made from the yields. Admittedly yields for good plants are not conclusive evidence that growth rate is not responsible for blackheart but they do indicate that perhaps it is not the only factor involved.

The data show that a variety of soil moisture-fertility conditions can be obtained which will materially reduce blackheart. Apparently a combination of nutrients is essential to reducing the disease. It has generally been believed that calcium in the heart tissue is the controlling factor. If so, this can be brought about by a number of conditions related to the managerial aspects (irrigation and fertilizer practices). This seems to be an important aspect because it allows a celery grower some latitude in management control of blackheart.

Table 1. - Relation of soil moisture conditions and fertilizer treatments on yield, percentage of blackheart, and total water used.

Treatments		Per cent blackheart		Wt. per plant	Marketable Yield	Water used per treatment
Suction	Fertilizer	6 weeks	12 weeks	pounds	tons/acre	surface inches
bars	tons					
0.2	1	0	1.8	2.06	29.3	27.8
0.2	2	0	5.2	2.56	35.3	27.8
0.2	4	0	58.4	2.48	15.0	27.8
0.8	1	2.8	4.2	2.07	28.7	15.8
0.8	2	8.0	52.8	2.11	14.5	15.0
0.8	4	20.8	66.7	1.90	9.2	15.2
5.0	1	0.3	24.0	1.65	18.1	10.8
5.0	2	7.3	66.4	1.75	8.5	10.8
5.0	4	22.2	57.3	1.52	9.4	10.0

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GROWTH RATES OF ORANGE SEEDLINGS IN THE PRESENCE AND ABSENCE OF PHYTOPHTHORA SPP. AT TWO LEVELS OF IRRIGATION AND TWO LEVELS OF SOIL NITROGEN

L. H. Stolzy, P. W. Moore, L. J. Klotz, and T. A. DeWolfe

Damage to fibrous feeder roots of citrus by Phytophthora citrophthora and P. parasitica (citrus brown-rot fungi) has been associated with certain cultural practices in citrus orchards. Two cultural practices associated with a low density of feeder roots are large applications of soil nitrogen and use of excessive irrigation water.

Large closed containers of Vapam-fumigated sandy loam planted to Bessie sweet orange seedlings were used to study the effects of these two Phytophthora spp., soil nitrogen, and two levels of irrigation on citrus seedling responses.

The presence of Phytophthora in the soil significantly reduced length and weight of shoot growth as well as tree trunk circumferences (Table 1 and 2). The effects of Phytophthora were much less on the fall flush of growth in the second growing year than on previous growth. Quantities of roots were also reduced significantly in soil columns containing the fungi.

The two levels of irrigation, 90 mbs. and 600 mbs., designated I_1 and I_2, produced significant differences in weight of top growth during the second summer's growth period. The wet treatments (90 mbs.) produced more total plant growth in both the presence and absence of the fungi than did the dry treatments (Table 2). However, seasonal shoot growth measurements taken in the spring of 1958 were less for the wet treatment than for the dry treatments in the presence of Phytophthora (Table 1). The same type of measurement taken in the fall of 1958 on the summer and fall flush of seedling growth showed no effect from Phytophthora on the wet treatments.

This study would indicate over-irrigation in the spring months could be more harmful than at any other time during the irrigation season. Phytophthora is present in most citrus orchards, but like most fungi it requires certain environmental conditions before it parasitizes roots. A recommended practice for many citrus orchards would be irrigations of shorter duration with the frequency adjusted to the season of the year.

For more detailed results, the reader may wish to refer to the paper on which this summary is based. It will appear in a near future issue of "The Plant Disease Reporter," Crop Research Division, Agricultural Research Service, USDA.

Table 1. Seasonal shoot growth measured at the termination of each flush for two irrigation levels in the presence and absence of Phytophthora spp.

Treat.	Fall 1957			Spring 1958			Fall 1958		
	Phy_o	Phy_+	Total	Phy_o	Phy_+	Total	Phy_o	Phy_+	Total
	cm	cm	cm	cm	cm	cm	cm	cm	cm
I_1	5821	4330	10151	8770	5987	14757	19759	20590	40349
I_2	5202	4362	9564	7330	6816	14146	18420	17779	36199
Total	11023*	8692		16100*	12803		38179	38369	

*Significant difference at 5% level between citrus seedlings growing in soils with and without Phytophthora spp.

Table 2. Weight of aerial portions of citrus seedlings for two periods, grown at two irrigation levels in the presence and absence of Phytophthora spp.

Treat.	1957 and Spring Flush 1958			Summer and Fall Growth 1958		
	Phy_o	Phy_+	Total	Phy_o	Phy_+	Total
	gm	gm	gm	gm	gm	gm
I_1	13793	10140	23933	11150	10959	22109***
I_2	13463	9062	22525	8954	6913	15867
Total	27256***	19202		20104	17872	

***Significant difference at 0.1% level between seedlings irrigated at two different levels and also between seedlings growing in soils with and without Phytophthora spp.