Electrical Tests on Nematodes

results of investigations with high-voltage, nonthermal electrical treatments for control of root-knot nematodes

Bert Lear and F. C. Jacob

Electrical treatments for control of root-knot nematodes seem impractical for field use, according to results of limited laboratory experiments at Davis.

As a result of reports of successful experiments—by research workers in Southern Rhodesia—a detailed study was begun in the laboratory at Davis with equipment which could be controlled accurately and treatments easily duplicated.

The infested soil used in the two experiments was a sandy loam with a moisture equivalent of 12%. It was obtained from a metal greenhouse tank in which tomato plants heavily infected with root-knot nematode—*Meloidogyne incognita* var. *acrita*—had been growing for several months. Nematodes present in the soil were mainly second stage larvae although some eggs were present. Enough soil was provided for two experiments so that after the experiment with wet soil—soil moisture 11.0%—was conducted, the remainder was dried—to a soil moisture of 5.9%—for the second experiment. The soil samples were placed in a rectangular plastic box between copper plates 1¼″ apart. Each plate surface was 2.2″ × 2.25″ and the treated volume of soil was about 6.2 cubic inches. As the soil was tamped lightly into the box, an effort was made to obtain uniform density.

The temperature of each soil sample was measured before and after treatment. Before treatment the direct current electrical resistance for each sample was measured. These measurements together with the weight of each sample provide a basis for estimating the uniformity of samples and treatments.

Immediately following treatment, soil samples were transferred to individual clean 4″ clay pots along with enough nematode-free soil to fill the pot. A tomato seedling was transplanted from clean soil to each pot. After five weeks the roots of the tomato plants were washed free of soil and the number of root-knot nematode galls present in the roots were recorded.

Treatments No. 2 and No. 6 were the most severe since for them the maximum voltage was used and the energy dissipated in the soil was larger than for the others. Calculation shows that to administer the equivalent treatments in the field—treating a swath 6′ wide and 2′ deep and moving at two miles per hour—would require a generator of more than 10,000 horsepower capacity.

Gall Counts from Tomato Plants Grown in Root-Knot Nematode Infested Soils Exposed to Various High Voltage, Non-thermal Electrical Treatments

	Treatment				Mean number galls per plant	
	Peak kilovolts	Charge Repetitions	Capacitor mfd.	Energy watt-sec.	Wet soil *	Dry soil **
1.	Check—no treatment				156	244
2.	12	300	0.035	755	150	151
3.	12	30	0.035	76	180	225
4.	8	300	0.035	336	133	195
5.	8	30	0.035	34	160	190
6.	12	10	1.0	720	144	174
7.	12	1	1.0	72	141	158
8.	8	10	1.0	320	167	175
9.	8	1	1.0	32	136	202
10.	11	10	1.0	605	142	...
11.	11	1	1.0	60	123	...

* Soil moisture 11.0%—Mean size sample treated 116 grams.

** Soil moisture 5.9%—Mean size sample treated 123 grams.

The source of electrical energy for the laboratory tests was a half-wave voltage-doubling rectifier fed by a neon sign transformer. A variable auto-transformer on the primary side permitted choice of output voltage.

A very high momentary energy release through the soil samples was obtained by sudden discharge of a capacitor charged to the output voltage of the rectifier. This treatment is readily reproducible. Besides the convenience offered as an electrical storage device, the capacitor facilitates quantitative electrical determination of the energy going into the treatment. A spark gap was used as a switch to discharge the capacitor through the soil sample. A resistance in series with the rectifier and capacitor plus the internal resistance of the power supply quenched the spark after each discharge. The energy dissipated in the spark was small compared to that dissipated in the soil.

The breakdown voltage for wet soil—11.0% between electrodes spaced 1.25″ apart was about 13 kilovolts—higher for dry soil. A value of 12 kilovolts was chosen as the maximum voltage for treatments. Up to 10 discharges from a 1-microfarad capacitor or 300 discharges from a 0.035-microfarad capacitor were delivered in one minute or less to infested soil. The maximum treatments produced a temperature rise of 25F for the wet soil and 21F for the dry soil. Initial soil temperature was about 50F so that temperatures lethal to the nematodes were not reached.

From this study it appears that high-voltage, non-thermal electrical soil treat-

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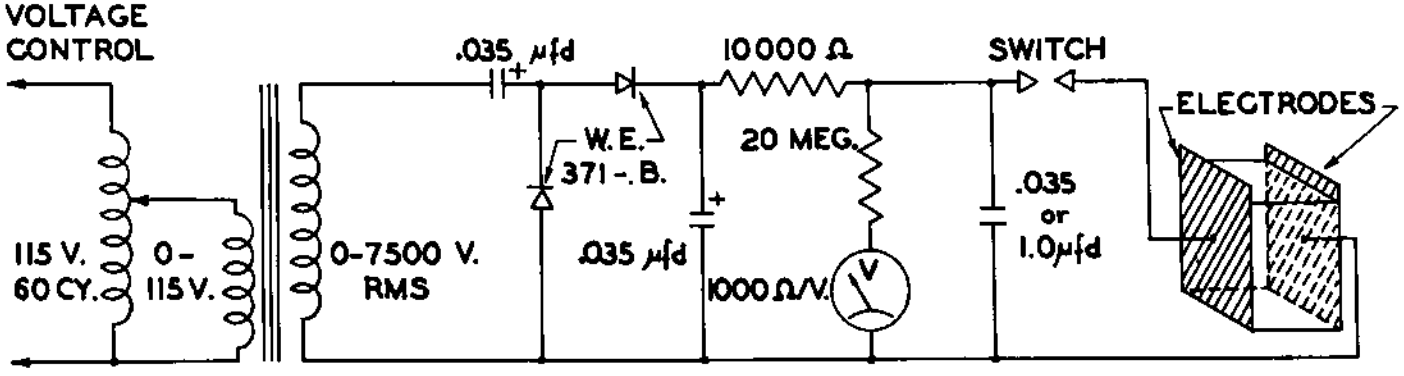
Schematic diagram of power supply for nematode treatments.



Rice Acreage May Be Cut in '56

large carry-over of rice supply into 1955–56 marketing year plus 1955 crop creates special hazard for California growers

Gordon A. Rowe

The long-run outlook for marketing California rice appears to be good, but the short-run outlook is anything but good.

If further acreage limitations are imposed for the 1956 rice crop, California producers will face the possible loss of export markets, reduced incomes from smaller planted acreages, and the need to divert land to other uses where that is possible.

There is good demand for California rice in its major export market—the Asiatic area—particularly the Japanese market, which prefers the type and the high quality of rice produced in California. Furthermore, the Asiatic area is becoming a deficit rice-producing area, while its populations are increasing. At the same time, rice production is not expected to increase materially in the principal Asiatic exporting countries of Burma and Thailand.

Rice Supply on August 1

The 1955 rice crop of the United States amounted to 48 million hundredweight—cwt. When added to the 1954–55 carry-over of 24 million cwt., rough basis, on hand August 1, the 1955 crop created a supply total—for the 1955–56 marketing year—which has been estimated to be 26% above the normal supply established for 1955–56 by the Secretary of Agriculture.

Approximately two million cwt. of the national carry-over on August 1 was in private hands. The remainder was owned by the CCC—Commodity Credit Corporation—and because California had no carry-over at the end of her marketing year on September 30, the entire carry-over was in the southern states. The large carry-over in CCC hands resulted from the purchase of 25.8 million cwt.—approximately 54% of the total 1954 production—of southern rice.

No deliveries of California's 1954 rice crop were made to the CCC because—by April 1, 1955—the crop was largely sold or being held for regular buyers. Apparently little or no additional California milled rice was available after April 1, assuming the movement to island territories and domestic markets was equal to the previous year.

The large carry-over on hand August 1 was 78% larger than anticipated last year when 1955 acreage allotments and marketing quotas were proclaimed.

Unless the noncommitted rice inventory of CCC is reduced substantially before the end of the year, it appears that the Secretary of Agriculture will be required by law to proclaim an acreage allotment for the 1956 crop, which will be below the allotment for 1955.

The CCC-owned, noncommitted inventory of rice on August 3 was estimated at 2,966,000 cwt. rough rice and 10,171,000 cwt. milled rice, although rice handled through private channels had largely been sold.

Sales made by a governmental agency are more limited in scope than those made by private trade, and—although some export concessional sales of CCC-owned rice have been made this year—such sales are limited because of the international political implications involved.

CCC-owned rice obtained under the 1953 and 1954 price-support programs was offered in August for sale for export at 105% of parity plus handling charges as specified by law. However, it is not expected that any appreciable reduction in the CCC noncommitted inventory will result from such sales. In the southern states, new crop milled rice was being offered in August at prices lower than those being asked for the government stocks.

1955–56 Marketing Year

It appears that rice supplies for the 1955–56 marketing year will be at record levels—approximately 15% higher than in 1954–55—despite the fact that acreage allotments were placed on the 1955 crop. In determining the need for rice quotas on the 1955 crop, the total supply of rice for the 1954–55 marketing year was estimated at 66,857,000 cwt. This was 17.6% above normal supply and 7.6% above the marketing quota level.

With a higher than estimated 1955 crop, supplies for this marketing year are estimated to be 26% higher than the normal supply. It may be possible that the normal supply for the 1956–57 marketing year will vary from the amounts established for 1955–56. However, it is likely such adjustment would be downward, in light of the slow movement of southern rice into export markets.

The likelihood for further acreage limitations on the 1956 rice crop is based on the assumption that no appreciable reduction in the CCC-owned inventory of rice will occur during the next several months.

Present legislation requires the Secretary to proclaim marketing quotas when the total supply of rice exceeds the normal supply by more than 10%. Therefore, because the rice supply for the 1955–56 marketing year is 26% above the normal supply figure used in calculating acreage allotments for the crop year 1955, the Secretary will be required to proclaim acreage allotments for the 1956 crop year unless the normal supply increases. However—under present conditions—normal supplies for the 1956–57 marketing year can only be lower than present normal supplies.

Legislation passed in the 84th session of Congress amended Section 352 of the Agricultural Adjustment Act of 1938 to prohibit 1956 national acreage allotments below 85% of the final allotments established for 1955. Consequently, the Secretary of Agriculture cannot establish a national acreage allotment for the 1956 rice crop of less than 1,638,573 acres. California's apportionment of such an allotment would be approximately 306,000 acres in contrast to the final 1955 allotment of 350,299 acres.

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ments are impractical. In these tests a maximum feasible treatment, limited in severity by voltage breakdown of the soil and temperature rise from the dissipated electrical energy, produced no discernible reduction in number of nematodes surviving in the treated samples.

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