AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF CALIFORNIA

SOIL and WATER

Spring 1968, No. 1



Dr. Milton Jones, of the U.C.D. Agronomy Department stationed at Hopland, is shown discussing results of cooperative Range Fertilization Experiments at the 1968 joint meeting of the Soil Improvement Committee of the California Fertilizer Association and the U.C. Soil Fertility Committee.

Ayers - Booker, Krantz, Marsh, Martin, Quick, Rible, Wildman
Edited by B. A. Krantz, Extension Soils Specialist, University of California, Davis

Cooperative Extension Work in Agriculture and Home Economics, U.S. Department of Agriculture, and University of California cooperating

Spring 1968 - No. ~~33~~

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EDITOR'S NOTE --ANOTHER MERGER

In these days of mergers, we are happy to announce the merger of the former Irrigation and Drainage Letter and the Soils newsletter into a new newsletter, SOIL AND WATER. It will be published four times a year on a quarterly basis. The terminal issue of Soils Newsletter was Winter 1968. The terminal issue of Irrigation and Drainage Letter was January 1965 - No. 23.

The regular contributors are listed at the bottom of the front page. In addition we have invited the staff of the Department of Soils and Plant Nutrition at Berkeley, Davis and Riverside; and the Department of Water Science and Engineering at Davis to submit items for SOIL AND WATER. We hope that this will help farm advisors become better acquainted with the activities of the staff members of these four departments. We also hope this contact will give our department staff members a better appreciation for the soil and water problems in the counties.

BAK

CORRECTION

The number of the last "Soils" newsletter (Winter 1968) was "32" not "3".

SPRINKLER CONFERENCE

Annual Turfgrass Sprinkler Irrigation Conference is to be held at the University Conference Center, Lake Arrowhead, June 21, 22, 23, 1968. Reservations can be made through Carl Downing, Los Angeles County, at $35.00 per person, which includes 6 meals, 2 nights lodging, coffee breaks, and proceedings. Topics will include problems of irrigation systems design, installation, and management.

AWM

DRAINAGE EXPERIMENT

A cooperative drainage experiment has just been installed near Indio. Performance of drain tile in Coachella Valley has been erratic. The water table commonly stands over many of the tile lines. Since the volume of flow carried inside the tile is small, a restriction of water entry into the tile is indicated.

The trial, conducted jointly by USDA-ARS, Soils and Plant Nutrition--UCR, Coachella Valley County Water District and the Agricultural Extension Service, consists of 24 tile lines, each about 400 feet long spaced 50 feet apart. Eighteen of the lines comprise an experimental design, 3 x 3 x 2, using 3 types of tile, 3 gravel envelope materials with 2 replications. The other 6 lines are extra treatments for observation only.

The soil will be saturated by irrigation while valves are closed at each tile discharge. Valves will be opened on selected lines in a planned manner to measure rate of discharge. Water table draw-down will be measured by pre-installed perforated observation wells.

Since only a few tile lines can be operated at one time, several runs will be made with the soil being resaturated between each run.

The three tile types are clay, concrete, and corrugated plastic. The three envelopes are local pit-run, gravel, the same with fines removed, and a pea gravel.

AWM

BOOK REVIEW

Agronomy Monograph no. 11, IRRIGATION OF AGRICULTURAL LANDS, by R. M. Hagan 1967, American Society of Agronomy, 677 South Segoe Street, Madison, Wis., 53711. 1180 pages, bound.

The following gives a brief review of this book. If you want to know the price, please write to me.

"Brought together in one comprehensive volume, authorities from many professional fields have combined to provide a comprehensive volume on the principles and practices that form the basis of scientific irrigation, from the development of water to its use and reuse. As this monograph covers the subject from a variety of viewpoints, it will be useful both to engineers and to soil and crop scientists whose combined efforts are needed to attain an abundant and permanently successful irrigation ariculture."

LJB

SULFUR DEFICIENCY IN CORN --FIRST TIME IN CALIFORNIA

Tom Kearney, in Yolo County, had a problem in seedling corn which we diagnosed as sulfur deficiency. Plant analysis verified the initial visual diagnosis. The deficient plants contained 90 ppm of sulfur and the normal plants 311 ppm, It occurred in a field north of Davis on a Yolo clay loam soil with a pH of 7.0 . This is the first time I have seen sulfur deficiency in corn under field conditions, and to my knowledge this is the first time it has been reported in California.

BAK

NEW STAFF IN SOILS AND PLANT NUTRITION, U.C.D.

Dr. Andre Lauchli will be spending two years at Davis working with Dr. Emanuel Epstein on his new grant entitled "Salinity and ion transport mechanisms of plant cell membranes". Dr. Lauchli is on leave from the University of Basel in Switzerland.

MAN AND HIS EARTH, BY GEORGE D. SCARSETH

The author of this book is one of the greatest teachers I have known. He was my major professor in graduate school and he continued to be an inspiration to me and his other students until his untimely death. Dr. Scarseth passed away on March 20, 1962, but he left a big piece of his rich life in his book, Man and His Earth. The following is a quote from the Iowa State Press, the publisher of his book.

"A scientist-philosopher who loves the land makes a powerful plea for man's intelligent use of the soil. He carries his argument beyond science into the fringes of philosophy where he examines the maturity of man; nature; and man's relationship to it.

In today's ferment when so much of the world's population is hungry, man's favorable relationship with his earth is not only wise but essential.

Scarseth writes both in anecdotal and dramatic fashion to clothe scientific fact in down-to-earth attire. Colorful chapters reveal his ability to make difficult subjects understandable--the kind of ability that only long experience and profound knowledge make possible.

Some of the author's observations,

narrated in appealing style, are based on his soil chemistry work in the backward rural areas of Latin America and Alaska. His research in soil fertility, especially as related to corn as a soil-building and conservation crop, has been called revolutionary and has brought about many innovations. He is distinguished for his scientific contributions to agronomy and the advancement of rural life and economy."

If you have a chance to read this book, I think you would find it fascinating.

BAK

BEWARE OF THE "FERTILITY QUACK"

Has the "fertility quack" called on you? Usually the salesman is a persuasive talker who makes great claims for his product. Evidently he looks upon farmers as easy prey. Samuel R. Aldrich, agronomist at the University of Illinois, offers some ways to spot one of these quacks.

. He claims mysterious benefits from "conditioning" the soil and unlocking the nutrients already in it--often with materials from some unusual natural deposit.

. He makes no guarantee for nitrogen, phosphorus, or potassium. Sometimes he claims benefits from micronutrients but he does not guarantee the micronutrient content. Usually the analysis lists several elements that are not used at all in plant growth.

. He has no research results from an unbiased source to back up his claims. He often has testimonials from farmers in other states.

. When asked what the county agent thinks of the product, the quack often says, "Don't ask him. He probably wouldn't know the value of our product, so he wouldn't recommend it."

. He usually runs down the agronomists at the state university and often says, "They won't test our product."

Aldrich says farmers who have followed fertilizer practices based on research findings of the various universities across the nation have increased their crop yields fantastically in the last 25 years.

Always seek advice before you sign up with a dealership for an unproven product, says Aldrich. Agricultural scientists regularly test new products that show promise of benefiting the farmer. All new products cannot be tested immediately because of limited budget and manpower; but when the supplier has enough confidence in the results to support the research financially, the test can usually be speeded up. Occasionally a university is asked to test a product that it believes has no possible value to the farmer. This type of request is turned down regardless of whether financial support is offered.

Crops & Soils 1968
American Society of Agronomy

HIGH ANALYSIS FERTILIZERS --THEY ARE JUST BEGINNING

A primary goal of research in fertilizer technology is to produce efficiently new top-quality products of higher analysis resulting in lower handling and transportation costs and savings to the grower. For many years, 20% single superphosphate and products derived from the ammoniation of this material were the primary fertilizers. This was followed by the development of diammonium phosphate, 18-46-0, and 46% triple superphosphate. We are presently beginning the era of super phosphoric acid resulting in polyphosphates such as Ammonium Polyphosphate 15-60-0, and the urea-ammonium polyphosphates with a variety of analyses such as 39-13-0, 30-30-0 and 25-35-0. Thus far

urea-ammonium polyphosphates have been produced only on a small pilot scale and tested agronomically in only small quantities. However, the technology and economics of production, and the agronomic tests appear favorable.

Despite the high analysis of the polyphosphates the most exciting possibilities are the "Ultra High Analysis" fertilizers that contain twice as much plant nutrient as the highest grade material used commercially today. The most promising of these possibilities --at least the one we are presently concentrating on in our basic research at TVA--seems to lie in the development of covalently bonded phosphorus nitrogen compounds. Such compounds contain P-N-P linkages rather than the P-O-P linkages of conventional phosphate fertilizers, and most of the nitrogen is in the imide or amide form rather than the ammonium or nitrate form. This configuration makes possible, at least in theory, grades such as 40-83-0 (imidodiphosphoric tetra amide), 55-92-0 (phosphonitrilic hexa amide), or a 37-89-0 which contains a goodly amount of sulfur as well as N and P. Greenhouse tests of these compounds show striking differences in agronomic properties. Some appear to be excellent fertilizers. Others do not, even though they are water soluble.

While it is true that most of the work in this area has been with compounds prepared by laborious laboratory synthesis, direct production from phosphorus, ammonia, and air is under study, with encouraging results. Typical grades made so far by this direct synthesis are 17-85-0 and 20-93-0.

This development is in its infancy, and in all probability many of the problems and pitfalls to be overcome before its fruition have not yet been discovered. Yet the promise that such a dramatic increase in plant food content holds seems great enough to almost assure that they will be overcome by our rapidly advancing technology. It is typical of the many advances that can serve the industry and our agriculture when we keep our research programs strong and our technology moving.

Warren J. Sharrat
TVA-Southwest Field Representative
Located at U.C. Davis

SOILS AND PLANT NUTRITION DEPARTMENT'S PUBLICATIONS, U.C.R.

Some farm advisors have mentioned the difficulty of keeping current on the University's research output. It would help, they say, if we included from time to time in the Soil and Water newsletter a list of department publications. Beginning with this issue, the publications of the Department of Soils and Plant Nutrition, Riverside, will be listed each time the Department's record of publications is brought up to date, i.e. semi-annually. The first period covered with the publications shown below is the first half of 1967.

Dept. No.

836* Bower, C.A., and J.T. Hatcher Adsorption of fluoride by soils and minerals. Soil Science. 103(3): 151-154. March

837* Coleman, N.T. Annual Research Progress Report to USAEC. 26 pp. February 25.

838* Coleman, N.T. and G.W. Thomas. The basic chemistry of soil acidity. Chapter 1, p. 1-41, 1967. In: Pearson, R.W. and F. Adams, Ed., Soil Acidity and Liming. ASA Monograph No. 12, Amer. Soc. Agron., Madison, Wisconsin.

839* Farmer, W.J., and C. Jensen. Diffusion and analysis of C-14 labelled dieldrin in soils. Abstracts West. Soc. Soil Sci. p. 15, 1967 Annual Meetings. June 20.

840 Harding, R. B. Ammonium and potassium fixation. Calif. Citrog. 52 (5):214, 216, 218. March.

841 Jensen, C.R., L.H. Stolzy, and J. Letey. Tracer studies of oxygen diffusion through roots of barley, corn, and rice. Soil Science. 103(1):23-29.

842 Kaddah, M.T., and N.T. Coleman. Salt displacement and titration

Dept. No.

of $AlCl_3$-treated trioctahedral vermiculites. Soil Sci. Soc. Amer. Proc. 31(3): 328-332. May-June.

843 Kaddah, M.T., and N.T. Coleman. Salt displacement of acid-treated trioctahedral vermiculites. Soil Sci. Soc. Amer. Proc. 31(3): 333-336. May-June.

844* Letey, J., L.H. Stolzy, and W. D. Kemper. Soil aeration. Chap. 47, P. 941-945. In: R.M. Hagan, H.R. Haise, and T.W. Edminster (eds.) Irrigation of Agricultural Lands. Amer. Soc. Agron., Inc., Madison, Wisconsin.

845 Morgan, W.C., J. Letey, S.J. Richards, and N. Valoras. Using physical soil amendments, irrigation and wetting agents in turfgrass management. Calif. Agri. 21(1): 8-11. January.

846 Letey, J., and L.H. Stolzy. Limiting distances between root and gas phase for adequate oxygen supply. Soil Science 103(6):404-409. June.

847 Osborn, J.,J. Letey, L.F. DeBano, and E. Terry. Seed germination and establishment as affected by non-wettable soil and wetting agents. Ecology 48(3):494-497. June.

848 Luebs, R.E. and A.E. Laag. Nitrogen effect on leaf area, yield and nitrogen uptake of barley under moisture stress. Agron. Jour. 59: 219-222. May-June.

849 Munnecke, D.E., J.P. Martin, and B. Moore. Effect of ammonium humate and clay preparations on release of methylisothiocyanate from soil treated with fungicides. Phytopath 57:572-575. June.

812A Martin, J.P. Influence of pesticides on soil microbes and soil properties in pesticides and their effects on soils and water. ASA Special Publication No. 8, pp. 95-108. November 1966.

850 Oertli, J.J. Effects of external

Dept. No.

salt concentrations on water relations in plants: III. Concentration dependence of the osmotic differential between xylen and external medium. Soil Science 104(1):56-62. July.

851 Page, A.L., W.D. Burge, T.J. Ganje, and M.J. Garber. Potassium and ammonium fixation by vermiculitic soils. Soil Sci. Soc. Amer. Prod. 31(3): 337-341. May-June.

852 Sree Ramulu, U.S., P.F. Pratt, and A.L. Page. Phosphorus fixation by soils in relation to extractable iron oxides and mineralogical composition. Soil Sci. Soc. Amer. Proc. 31(2): 193-196. March-April.

853 Pratt, P.F., G.H. Cannell, M.J. Garber, and F.L. Bair. Effect of three nitrogen fertilizers on gains, losses, and distribution of various elements in irrigated lysimeters. Hilgardia 38(8):265-283. June.

854 Rhoades, J.D., and N.T. Coleman. Interstratification in vermiculite and biotite produced by potassium sorption: I.Evaluation by simple X-ray diffraction pattern inspection. Soil Sci. Soc. Amer. Proc. 31(3): 366-372. May-June.

855 Rhoades, J.D., and N.T. Coleman. Interstratification in vermiculite and biotite produced by potassium sorption: II. Evaluation by one-dimensional fourier analysis. Soil Sci. Soc. Amer. Proc. 31(3):372-377. May-June.

856* Klotz, L.J., S.J. Richards, and T.A. DeWolfe. Irrigation effects on root rot of young citrus trees. Calif. Citrograph 53(3): 91. January

857* Richards, S.J., P.W. Moore, and J.E. Warneke. Growing citrus in soil containers. Calif. Citrograph 52(8): 339-345. June.

Dept. No.

858* Richards, S.J., J.W. Holmes, and S.A. Taylor. Measurement of soil water. Agronomy Monograph No. 11, Irrigation of Agricultural Lands. R.M. Hagan, H.R. Haiso and T.W. Edminister (eds.). Chap. 15, pp. 275-303.

859 Stolzy, L.H., G.A. Zentmyer, L.J. Klotz, and C.K. Labanauskas. Oxygen diffusion, water, and phytophthora cinnamomi in root decay and nutrition of avocados. Proc. of the Amer. Soc. for Hort. Sci. 90:67-76. June.

860 Wallihan, E.F., M.J. Garber, J.R. Hammond, Wilma L. Printy, D.S. Rayner, and R.G. Sharpless. Iron requirement studies of navel orange trees in solution cultures. Hilgardia. 38(7): 247-264. June.

861* Wallihan, E.F., and M.J. Garber. Iron in citrus production. Calif. Agriculture. 21(6): 6-8. June.

STORY CORNER

There's nothing wrong with the younger generation that the older generation didn't outgrow.

California 4-H Letter

It is better to become bent from hard work than to become crooked from avoiding it.

Some of us are like a fence. We run around a lot without getting anywhere.

From Today's Chuckle
Sacramento Bee 1968

A gentleman took his Great Dane to a veterinarian and complained, "My dog does nothing but chase sports cars."

"Many dogs chase cars," replied the vet. "What in the world is wrong with that?"

"But," said the Dane owner, "mine catches them and buries them in the back yard."

B. A. Krantz
Extension Soils Specialist

AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF CALIFORNIA

SOIL and WATER

Summer 1968 - No. 2



Dr. P. R. Stout and Bert Krantz discuss energy needs in solving food production problems in India and other developing countries. This month Dr. Stout is going to the Oak Ridge National Laboratory for a year to work on plans for a possible agro-industrial complex in the Middle East. (See item 1).

Ayers, Booher, Branson, Krantz, Marsh, Martin, Quick, Rible, Wildman
Edited by B. A. Krantz, Extension Soils Specialist, University of California, Davis

Cooperative Extension Work in Agriculture and Home Economics, U.S. Department of Agriculture, and University of California cooperating

AGRICULTURAL EXTENSION SERVICE UNIVERSITY OF CALIFORNIA

SOIL and WATER

Summer 1968, No. 2

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DR. P. R. STOUT GOING TO OAK RIDGE FOR ONE YEAR

Oak Ridge National Laboratory has begun a year-long study for the U.S. Atomic Energy Commission of the potential of nuclear-powered agricultural and industrial centers for the Middle East.

Several members of the ORNL staff will be named to a study group to explore the technical and economic feasibility of using nuclear power plants to desalt vast amounts of seawater for irrigation and to generate electricity in integrated agro-industrial complexes in arid regions of the Middle East. The study will be conducted in cooperation with the U.S. Department of State and the Interior.

Authorization of the study is, in part, a response to Senate Resolution 155, sponsored by Howard Baker (Tennessee) and adopted last year. The Resolution called on the administration to consider the application of large scale nuclear desalting plants as a means of supporting a stable and durable peace in the Middle East.

The economic potential for integrated agro-industrial complexes was the subject of a generalized study last summer at ORNL. In that study the arid Middle East was one of the regions of the world where further investigation of the agro-industrial complex appeared to be justified. This year's study will use information from the first, but will focus specifically on the Middle East.

The study group will estimate the power and water requirements of the Middle East; survey the sources and availability of raw materials for industrial products; indentify specific locations where the soil, climate and other conditions are suitable for agricultural development using desalted water for irrigation; design and estimate costs for agro-industrial complexes at specific locations, and define the need for experimental or pilot projects to assure the success of larger projects. Specific attention will be devoted to planning for new jobs in industrial plants and on farms in the region.

Dr. Stout will head up the agricultural section of this comprehensive study. Dr. Stout's participation in this study is a part of the international activity of the Department of Soils & Plant Nutrition arranged through the International Agriculture Institute, U. C. Davis, and is financed entirely from external funds.

-BAK-

Cooperative Extension Work in Agriculture and Home Economics, U.S. Department of Agriculture, and University of California cooperating

NEW SOIL SURVEY PUBLICATION DATES

According to the California State Office of Soil Conservation Service the following soil surveys are scheduled to be sent to the printer during the fiscal year listed:

	At Printer
Glenn County	1968
San Benito County	1969
Eastern Fresno Area	1969
Western Riverside Area	1969
Antelope Valley Area	1969
Northern Santa Barbara Area	1970
Sonoma County	1970
Yolo County	1970
Eastern Santa Clara Area	1970
Shasta Area	1971
San Diego Area	1971
El Dorado Area	1971

Field mapping has been completed but publication not yet scheduled in these areas:

Sierra Valley
Mariposa Area
Palo Verde Area
Ventura Area

Field mapping is underway in these areas:

Solano County	Napa County
Tahoe Basin Area	Lassen Area
Nevada Area	Coachella Valley Area
Monterey County	San Bernardino Area
Mendocino National Forest Area	Orange Area

In addition to these SCS soil surveys, two soil surveys made by personnel of the Department of Soils and Plant Nutrition of UC-Davis will be published this year. These surveys are of Yuba County, and of the valley lands in Stanislaus County west of the San Joaquin River.

-WEW-

NEW LANDS ON THE WEST SIDE OF THE SAN JOAQUIN VALLEY

The vast new lands of the San Joaquin Valley - West Side are now being planted as water becomes available under the California water plan.

Water is now being delivered to about 45,000 acres of new lands in west Kern County which have never before been farmed. Their previous use has been limited to spring grazing by wandering bands of sheep and a few cattle in the more favored areas. But now these wide open spaces are giving way to cotton, sugar beets, alfalfa for seed, milo maize, black eye beans, other seed crops, and almonds.

This is but the first of some 600,000 acres of new lands of the San Joaquin Valley - West Side which are expected gradually to be brought under irrigation over the next 20 to 25 years. Full production of the area is not expected until 1990 or later.

Cost of water is high. The 1968 costs are about $24 per acre foot. This coupled with a limited supply of water and difficulties of irrigation by more conventional methods (problems with land subsidence) has helped many of the owners to decide to use sprinklers to properly distribute their water allocation. Here can be seen the very latest in sprinklers for crop irrigation. There are hand move portable systems, side-wheel-roll systems, solid-set semi-permanent systems, and the unique large pivoting type sprinklers irrigating about 130 acres with one circular sweep of a single quarter mile aluminum line on which sprinkler heads are mounted.

These are new lands, never before farmed. California agriculture has continually been losing acreage and production to urban areas as cities, industry, people and freeways expand over prime agricultural lands. New

farming acreage such as this in the West Side must be developed if supply and demand are to stay in balance.

This supply and demand situation is critical to the San Joaquin Valley - West Side development. With such a large acreage potential, growers must carefully fit their crops into the existing production (the supply) and marketing patterns (demand) for crops adapted to the area. Most of the crops adapted are also produced in many other areas. So it is not enough to be able to grow an adapted crop. The crop, after it's grown, must compete with similar crops from other areas and all must be sold at a price that will return a profit to the farmer - producer. This profit can come only after all bills are paid to all people who contributed to the production of the crop. And of those contributing it is truly amazing how many non-farm skills and non-farm supplied have gone into the development and production from the farm lands of the area.

When you go through the area, take a good look at the new roads, new canals, new pipelines, new houses, new buildings, and new electrical installations for power supplies. There may not be many numbers of laborers or people showing in the fields but the numbers of people and capital involved in the supplying of "things" needed is staggering

Here, it is not hard to see why "agriculture is California's biggest industry" and how "one in every three jobs revolves around agriculture."

-RSA-

FOLIAR APPLICATION OF PHOSPHORUS

Occasionally questions are asked regarding the possibility and desirability of foliar applications of phosphorus to plants during the flowering period.

Dr. J. D. Lancaster in Mississippi made a rather extensive study of foliar vs soil application of phosphorus on cotton. He found that foliar application of phosphorus to cotton during the fruiting period frequently increased yields where phosphorus deficiency existed. However, growth was no better than that obtained with soil application alone. Late season foliar feeding was effective in correcting a slight phosphorus deficiency but earlier applications were also necessary to correct a moderate or severe deficiency. In field experiments, a pound of phosphorus applied to the leaves gave only slightly higher increase in yields than if applied to the soil, but the reverse was true in cylinder experiments. One of the problems of foliar applications of phosphorus is that a dilute solution is necessary to avoid injury. Using liquid monoammonium phosphate and sodium polyphosphate solution containing more than 0.45% P caused leaf injury. Ortho phosphoric acid solution containing as little as 0.2% P caused leaf injury and thus was not used in the experiments by Lancaster.

Drs. R. S. Loomis and F. J. Hills at UC-Davis applied varying rates of sodium di-hydrogen phosphate to sugar beets. They obtained leaf burn with a solution containing .77% P and no leaf burn at .45% P which is similar to the results in Mississippi with liquid MAP and sodium polyphosphate. Assuming that crop foliage would hold 30 gallons per acre we could apply about 1 pound of phosphorus per acre per application.

Lancaster concluded that foliar application of phosphorus as well as other macro-nutrients to cotton did not appear to be a practical alternative to soil application, nor was it a necessary supplement for optimum economic yield. (For further details see Mississippi bulletin 708, 1965.)

-BAK-

SOIL & WATER
Summer 1968

MORE SULFUR DEFICIENCY IN CORN

In the last issue, Spring 1968, we reported "SULFUR DEFICIENCY IN CORN, FIRST TIME IN CALIFORNIA." Within a few weeks after writing that item, we found many more corn fields which showed sulfur deficiency in the seedling stage. All of these showed yellowing and stunting in the seedling stage, but most of the fields grew out of it. However, there were a few fields which still showed stunting and yellow interveinal chlorosis at the pre-tassel stage. In all of these fields the sulfur content of the leaf blades was below 100 ppm of SO_4-S. The largest concentration of sulfur deficiency in corn was found in Butte County in the Nord area.

In all of the fields where sulfur deficiency has been noted, the fertilization program has included anhydrous ammonia injected before planting. In some cases a starter fertilizer was used and other not. But in all cases the starter fertilizer contained no sulfur. Since the sulfur deficiency was most apparent in the very early seedling stage, a small amount of sulfur in the starter fertilizer would be expected to take care of most situations. The inclusion of some sulfur bearing nitrogen fertilizer in the preplant nitrogen application would also be expected to correct this problem.

-BAK-

J. F. SLOAN NEW PRESIDENT OF ANI

Jim Sloan, past president of CFA and co-owner of the Sloan Fertilizer Company in Salinas Valley, has been elected the incoming president of Agricultural Nitrogen Institute, a national organization representing the nitrogen industry. Jim's picture appears on the front page of the July-August issue of the Agricultural Nitrogen News. Jim is a UCD graduate and we are glad to see him in this national position.

-BAK-

MEETING OF PACIFIC SECTION OF AAAS AT LOGAN

Four of us in AES from Davis attended the Western Society of Soil Science and the Western section of American Society of Plant Physiologists at Logan. There were many excellent papers presented and the University of California was well represented. The total number of papers by scientists from the University of California in the Soils and Physiology Societies from the various campuses were as follows:

UCD-19, UCR-16, UCLA-6, UCB-5, UCSD-3.

A total of 49 papers which represented 40% of the total papers presented in these two societies. AES was represented on two of these papers.

Dr. D. W. Thorne, vice president in charge of research, Utah State University, spoke at our WSSS banquet. He stated that as soil and plant scientists, we have in the past been concerned mainly with food and fibre production. He admonished us to include concern for the quality of our environment and the maintenance of the quality of our air, water, and soil resources. He pointed out that we are well qualified to handle this job and if we don't, ecologists and others who are less qualified may jump in and attempt to do the job, and agriculture and society may suffer. He said that we must be positive in this endeavor and serve the whole society upon which we depend.

Dr. Thorne also laid great stress on the international responsibility of soil scientists. In making these points he quoted liberally from the President's Scientific Advisory Committee on "World Food Supply." This report states that the potentially arable land on earth is much larger than had been previously supposed and is more than three times the area actually harvested at any given

year. More than half of the potentially arable land lies in the tropics. He pointed out that the soil scientist with his broad knowledge of soils, water, and soil-plant-water relations should play a central role in the necessary research and development of our arable lands. He further stated that he felt that "in recent years, the soil scientist has abrogated his central position in the field of agricultural production for a specialized position that may have more interest to the theoretical scientist but which, in the long run, means that the soil scientist will not maintain a position of relevance to the society that he should be serving."

Dr. Thorne is himself a well known soil scientist. I have a copy of his complete paper if any of you would like to see it.

-BAK-

DEEP DEEP TILLAGE

Any tillage which goes deeper than the normal plowing depth of 6-10 inches has been called deep tillage. A distinction should be made between deep tillage which is practiced mainly to break up compaction pans formed by shallow tillage, and deep tillage which is attempted to modify the soil physical environment in a major part of the plant root zone. Perhaps a better term for this deep deep tillage is "Profile Modification".

Two general characteristics which make the subsoil physical environment less than perfect for plant root growth and water penetration are present in many of our alluvial soils. The first is a high soil density, which results in low porosity and small pore size. The second is the presence of stratified subsoil layers of different textures, or subsoil clay accumulation due to the process we call profile development. Either of these types of subsoil layering can inhibit root and water penetration and thus very effectively reduce the usable depth of the soil.

It is apparent that profile modification, to be most effective in improving the soil physical environment, should aim both at relieving the high subsoil density, and eliminating the subsoil layers which inhibit water and root penetration. Loosening and shattering the compact layers solves part of the problem, but in many soils this effect may be only temporary. In these soils the ultimate improvement may come from a complete mixing of the soil profile to a depth of four or five feet.

In the last several years, thousands of acres of land have been ripped or subsoiled to depths of 5 feet or more to shatter subsoil layers which range from compact claypans to true hardpans. Very little mixing of subsoil layers is accomplished by this treatment. The purpose in ripping these lands is to make orchard soils out of what were formerly used mostly for rainfed (dryland) barley or range. Little is known about the long term beneficial effects of the deep ripping, or whether it can modify the soil environment sufficiently that mature fruit and nut trees will be able to produce competitively on these soils.

Other deep tillage tools which have been used less extensively for the same purpose are the slip plow and the deep moldboard plow. The slip plow was developed originally as a means of obtaining water penetration to help leach salts from saline soils in the Imperial Valley. The deep moldboard plow was developed to uncover good soils which had been buried under layers of sand by flash flooding. The slip plow can shatter uncemented subsoil layers to four or five feet deep and in addition creates some profile mixing in a 15-inch wide zone which is repeated at about 5-foot spacings across a field. The moldboard plow does a more complete job of profile mixing to 4 feet deep, but at a greater cost per acre.

Two large scale field experiments are underway which should cast some light on the question of the relative merits of deep ripping, slip plowing, and moldboard plowing in improving the soil physical environment.

At the USDA Southwestern Irrigation Field Station in Brawley, a replicated trial was set up in February 1968, including ripping, slip plowing and moldboard plowing, all to 42 inches deep. The soil is a Holtville silty clay loam, and is very finely stratified. Leaching of salts is a problem in this soil because of this stratification. Leaching efficiencies, salinity levels, and cotton yields will be compared in the treated plots and in untreated checks for a 5-year period. The research is being coordinated under the leadership of Dr. Malek Kaddah, Dr. Lyman Willardson, and Mr. Arnold MacKenzie of the field station staff.

Another experiment is just now being put in the Shandon area of San Luis Obispo County under the direction of the Agricultural Extension Service. The soil is Huerhuero sandy loam, a soil with a very tough sandy claypan. Mixing of subsoil layers should greatly improve the potential of this soil. Again, deep ripping, slip plowing, and moldboard plowing will be compared to untreated checks. Almond trees will be planted in 1969. Water penetration, soil bulk density, tree growth, and eventually almond yields will be evaluated for several years. The project leaders are John Foott, San Luis Obispo County farm advisor, and William E. Wildman, Extension soils specialist.

-WEW-

NEW LIQUID APPROACH-SUSPENSIONS

For many years California has been a leading consumer of clear liquid fertilizers. These products have been made by the neutralization of ortho or superphosphoric acid with ammonia to produce clear 8-24-0 and 10-34-0 respectively. These products were well suited to an area having generally low potassium requirements. However, today's more intensive farming and the simple depletion of native potassium is resulting in fertilizers requiring a higher content of this nutrient. Only small quantities of potassium can be added before salting-out of the nutrients occur. To overcome the low analysis of clear liquids, suspension fertilizers have been developed containing salt crystals in suspension, but in such a finely divided state that their characteristics are very similar to clear liquids.

One definition of suspension fertilizers is that they are fluid fertilizers containing solids, either soluble salts in saturated solutions or insoluble materials such as the impurities from phosphate rock and phosphoric acid. The rapid settling of these solids can be prevented by the addition of an inexpensive suspending agent. The suspending agent that has received the most attention is a gelling type of attapulgite clay. Upon gelling, this clay prevents the settling of the crystals in the systems and increases the viscosity of the suspension. If settling does occur, the solids do not pack hard, and they are easily dispersed with light agitation. The crystals in most good suspensions are less than 0.003 of an inch in diameter.

There are two general methods of producing and marketing suspensions. One system incorporates a liquid hot-mix plant. In this plant, phosphoric acid and other acids, anhydrous ammonia, triple superphosphate, phosphate rock, and other materials are reacted to release some chemical heat. Because chemical heat is released, these plants are usually referred to as hot-mix plants. The products produced in them are usually sold directly to the farmer. In the other system centralized hot-mix plants are used to produce a base suspension, usually an ammonium polyphosphate suspension (eq. 12-40-0), which is cooled and shipped as a cold suspension. This base suspension is used at

small marketing plants where it is cold-mixed with potassium chloride and urea-ammonium nitrate solution. No heat is released; therefore, this type of plant is usually designated as a cold-mix plant.

Field experience has shown that the storage and handling characteristics of cold-mix suspensions are usually superior to the storage and handling characteristics of hot-mix suspensions, because larger crystals are usually suspended in the hot-mix products. All the P in hot-mix suspensions is usually in the orthophosphate form, which precipitates as large crystals of orthophosphates, such as diammonium phosphate. A substantial portion of the phosphate in the cold-mix suspensions usually consists of several ammonium polyphosphates. Therefore, the crystallization of phosphates that occurs in cold mixes usually occurs as pyrophosphates or tripolyphosphates. These polyphosphate crystals are smaller than the orthophosphate crystals. Another reason for the formation of larger crystals in the hot-mix suspensions is that the hot-mix liquids gradually cool in storage and application. Crystals, therefore, are removed from solution at a low crystallization rate, and this is an optimum condition for the production of large crystals. The temperature of cold mixes increases in transportation, storage, and application, and crystals in these mixes decrease in size and partially go into solution. Therefore, the crystals in the cold-mix suspensions are usually small.

The following tabulation compares typical ratios of clear liquids, suspensions, and solid fertilizers.

Typical Analysis of Clear Liquid, Suspension, and Solid Fertilizers

Ratio	Clear	Suspension*	Solid
3:1:0	24- 8- 0	27- 9- 0	30-10- 0
2:1:0	22-11- 0	26-13- 0	28-14- 0
1:1:0	19-19- 0	21-21- 0	25-25- 0
1:1:1	8- 8- 8	15-15-15	15-15-15
1:2:2	5-10-10	10-20-20	10-20-20
1:3:1	7-21- 7	10-30-10	10-30-10
1:3:2	5-15-10	9-27-18	10-30-20
1:3:3	3- 9- 9	7-21-21	8-24-24

*Suspension fertilizers made with 12-40-0 base suspension, 3% attapulgite clay, 32-0-0, and 0-0-62.

The suspension fertilizers shown in the table above were produced from a base suspension 12-40-0, and they contain 11 to 133 percent more plant nutrients than clear liquids of corresponding ratios.

In future Soil and Water Newsletters we will be concerned with storage characteristics, application problems, incorporation of secondary micronutrients and herbicides into suspensions.

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TVA - Southwest Field Representative. Located at Davis.

ANALYSIS OF WEST SIDE CANAL WATER

Feather River water is being delivered as far south as Kern County now and will be lifted over the Tehachapi Mountains into southern California in the next development stage of the California Water Plan. Questions are being asked frequently these days about the salt content of the canal water. A sample from Kings County was analyzed this month by the Davis AES Lab and the report is as follows:

EC	0.72 mmhos./cm.
Calcium	1.6 meq./l.
Magnesium	1.8 meq./l.
Sodium	3.8 meq./l.

Chloride	3.7 meq./l.
Bicarbonate plus carbonate	1.3 meq./l.
NO_3-N	0 ppm.
Boron	0.3 ppm.
SAR	2.9 ppm.
pH	8.6 ppm.

The total salt content of this sample, approximately 450 ppm., is in line with the quality predicted for the canal water by the time it reaches southern California, according to earlier DWR reports. The 450 ppm. salt level is about 1/2 to 2/3 the salt content of Colorado River water used in southern California.

-RLB-

WHITE OAK IRRIGATION IN TURF

Native white oak trees, Quercus lobata, cannot tolerate the usual turf type irrigation. Several dead or dying oaks were observed recently near Thousand Oaks in a new subdivision. The turf looked beautiful and had obviously been abundantly irrigated.

It is suggested that no sprinkler head should be placed closer to the trunk than the drip line of the tree, that no sprinkler discharge reach more than 2/3 the distance from drip line to trunk, and that any grass under the tree be kept somewhat stressed by shallow and not too frequent irrigations. Two or three times a year a deep irrigation may be helpful.

-AWM-

HOW TOLERANT ARE TURFGRASSES AND FLOWER CROPS TO SALINITY

Salt tolerance data has been developed for a number of turfgrasses and flower crops. Recently this information was compiled by O. R. Lunt in convenient tabular form showing EC_e values associated with yield decreases of 10, 25, and 50 per cent.

SALT TOLERANCE OF TURFGRASSES*

Species	EC$_e$ mmho/cm at 25° C for yield decreases of 10%	25%	50%
Agrostis palustris, Seaside	3.5	6.0	9.0
A. Tenuis, Highland	1.5	2.5	5.0
Cynodon, Tifgreen	2.5	4.5	17.0
Cynodon, Tifway	7.0	11.0	15.5
C. dactylon, "Common"	4.0	7.0	13.0
C. dactylon, Ormond	5.0	7.0	13.0
C. dactylon, U-3	2.5	5.0	13.0
C. magennisii, Sunturf	7.5	12.5	17.5
Festuca elatior arundinacea	4.0	5.5	8.0
Poa pratensis	2.5	4.0	7.5
Puccinellia distans	11.5	16.0	...

SALT TOLERANCE OF FLOWER CROPS*

Species	EC_e mmho/cm at 25° C for yield decreases of 10%	25%	50%
Callistephus chinensis, King	2.0	3.0	5.0
Chrysanthemum morifolium, Albatross	2.0	2.5	8.0
Chrysanthemum morifolium, Bronze Kramer	6.0	...	...
Dianthus caryophyllus, Sims	1.5	3.0	10.0
Euphorbia pulcherrima, Barbara	2.5	6.5	12.0
Ecke Supreme	4.0	15.0	...
Gardenia jasminoides (G. grandiflora), Belmont	1.0	1.5	2.5
Gladiolus grandiflorus, Spotlight	1.5	3.0	6.5
Gladiolus grandiflorus, Valoras	1.5	3.5	7.0
Lilium longiflorum, Croft	1.5	2.5	5.0
Matthiola incana	4.0	7.0	...
Pelargonium horturum	1.5	2.5	5.0
Rhododendron, Mrs. Fred Saunders	1.0	1.0	1.5
Rhododendron, Sweetheart Supreme	1.0	1.5	2.0
Rosa hybrida, Better Times	3.5	5.0	7.0
Saintpaulia ionantha, Mentor Boy	1.5	...	...

*Source: Environmental Biology, compiled and edited by Philip L. Altman and Dorothy S. Dittmer.

Since many of the data were obtained under approximately optimum conditions, the EC_e associated with 10% reductions is lower than would be observed under less ideal growing conditions. Where studies were done in solution or sand culture, equivalent EC_e's have been estimated.

-RLB-

RECLAMATION EXPERIMENT

An experiment to test the use of sprinkler irrigation at low application rates for soil reclamation has been initiated on Berenda Mesa in western Kern County. Sprinklers are operated by time clock to irrigate 12 hours every night. Two application rates are used, each replicated 4 times. The rates are 0.1 and 0.06 inches per hour. Each irrigation plot contains four mulching treatments--nothing, gypsum, straw, and gypsum plus straw. The experiment was seeded to barley.

The soil contains moderate amounts of salt, sodium and boron, and a moderate clay-pan at a depth of about 3 feet. Because of soil settlement problems in this area, most of the new lands are sprinkler irrigated. The objective is to learn how effectively sprinkling can leach the soil and whether leaching by unsaturated flow can proceed simultaneously with crop growth. Cooperating in the experiment are Frank Bingham, Roy Branson, George Ferry, and Al Marsh.

-AWM-

CORRECTION

This is the second issue of SOIL & WATER. The preceding issue, Spring 1968, should have been marked "No. 1" instead of No. 33. Also "Booher" was misspelled and "Branson" was omitted on the front page. We are sorry.

B. A. Krantz
Extension Soils Specialist