BRIEFS

Short reports on current agricultural research

Tight subsoils and crop

RESPONSES TO IRRIGATION

Experiments with grain sorghum demonstrated that the influence of tight subsoil could be eliminated by maintaining a high soil moisture level in the shallow root zone. That result indicated that the principal manifestation of compacted or tight subsoil was drought.

Under favorable conditions some annual crops develop deep, extensive root systems which spread throughout each small volume of soil. If such initial development occurs before water demand is high, roots may tap new water supplies in the subsoil with sufficient rapidity to meet all the needs of the crop. There is thus little or no response by these crops to irrigation unless nearly all available water is exhausted to great depths.

The grain sorghum experiments showed that tight subsoil retarded the rate of root development by influencing both the depth of rooting and the degree of spreading. Thus deep subsoil moisture was tapped more slowly, and the crop responded to irrigation when the average soil moisture content of the normal root zone was appreciably above the wilting percentage, especially at lower depths. The dynamic nature of the subsoil moisture supply to deep-rooted crops was illustrated by the different responses of sorghum to irrigation in two seasons which had different climatic conditions.

Whether or not a plant is adequately supplied with moisture depends on both the rate of root development and the rate of water use. Those factors, among others, must be considered in the general interpretation of irrigation experiments. —*D. W. Henderson, Dept. of Irrigation, Davis.*

Copper chelates and

COPPER ENZYMES

Copper is an essential element in many of the enzymes that cause oxidations in plants and animals. These enzymes are responsible for such varied functions as producing the darkening in cut apple slices, turning green tea into black tea, destroying vitamin C in stored foods.

Some of these enzymes transfer oxygen directly from the air to the material to be oxidized. The copper probably takes the oxygen from the air, holds it, and then places it on the oxidizable organic substrate. However, no stable compounds of copper are known that will hold oxygen. Very likely the copper has different properties when chelated by an enzyme than does free copper ion in solution. The chemistry of chelated copper is not necessarily the same as the familiar chemistry of copper in solution.

To test these assumptions and to help explain why the copper enzymes do not behave like familiar copper compounds, investigations have been started to synthesize compounds to chelate copper. Present knowledge of the copper enzyme has been used to design simple organic chelates of copper that will have some of the properties of the copper enzymes. This type of compound is known to chelate with copper. If it can be shown that these copper chelates have some of the properties of copper enzymes, this will help advance knowledge of the mechanism of action of the copper enzymes. —*Lloyd L. Ingraham, Dept. of Agricultural Biochemistry, Davis.*

Application of plant analysis to

COTTON FERTILIZATION

Cotton fertilization trials throughout California's cotton growing areas have given valuable information on the best practices for the particular location of the test, but have had limited application to other soils and other conditions.

To obtain information of more general applicability, studies are being conducted to establish a relationship between nutrient content of the plant and response to fertilizer. Results of plant analyses can be applied generally only when they are correlated with responses in the field under a variety of soil and environmental conditions. These relationships are being established by conducting field trials, analyzing leaf petiole samples for the various nutrients at regular intervals, and relating the results to fertilizer response.

With respect to nitrogen, the nitrate level in the plant has been found to be extremely sensitive to fertilizer treatment and to change very markedly as the season progresses. Typically, the plant enters the flowering period around the last of June with 10,000 to 20,000 ppm—parts per million—of nitrate-nitrogen, but this level progressively decreases until often only a trace is detected by the latter part of August. Present indications are that the level should not fall below 2,000 ppm by the peak of bloom about the first of August. Maintenance of high levels late in the season is proving unnecessary.

Similar studies involving phosphorus and potash are being carried out, to help the grower understand better the effects of the fertilizer and to enable him to evaluate his fertilizer program more effectively.—*Dick M. Bassett, Dept. of Agronomy, Davis.*

Biochemical studies in

FRUIT DEVELOPMENT

Chemical energy is required for the chemical reactions which lead to growth and maturity of fruits treated with the auxin—growth regulator—2,4,5-T. A large proportion of the needed energy is made available in the process of respiration, during which hexose sugar is oxidized to carbon dioxide and water. The enzymes mediating a portion of this process are associated with sub-cellular particles termed mitochondria, and the enzyme system has been isolated in its complete form only from maturing fruit tissues of a few species.

Apparently, two problems hindered isolation of the enzyme system: high acidity and the presence of enzymes of the phenolase group and their substrates —those largely responsible for browning when a fruit is cut or injured. Both problems have been overcome, with apricot fruits, by use of a relatively strong alkaline buffer and adequate washing of the preparations with differential centrifugation. Preliminary results show that the buffered and washed particles contain the enzymes capable of oxidizing all the organic acids involved in the respiratory process.

The techniques for isolating this enzyme system from immature fruits provide means of investigating respiratory metabolism during growth and the maturation and post-harvest physiology of fruits. Further studies may reveal the pathways by which the few materials which enter growing fruits are converted into the many and varied compounds characteristic of mature fruits.—*Peter B. Catlin, Dept. of Pomology, Davis.*