servations in regard to their diagnostic and/or prognostic significance.

Conclusions. (i) Glutamic oxaloacetic transaminase activity has been measured in human serums by a spectrophotometric method. (ii) The variations in enzyme activity in some disease states have been discussed. (iii) The serum transaminase activity in 16 patients with acute transmural myocardial infarction rose to levels 2 to 20 times normal within 24 hr and returned to normal range within 3 to 6 days thereafter without exception.

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Biuret Toxicity of Urea Foliage Sprays on Citrus

Winston W. Jones

Department of Horticulture, Citrus Experiment Station, University of California, Riverside

Urea was first used as a foliage spray to supply nitrogen on apples in 1943 (*1*). Since that time it has been used as a foliage spray on other crops (*2–4*). When attempts were made to use such sprays on citrus, leaf injury resulted (*5*). This injury was a yellowing of, or loss of chlorophyll from, the distal part of the leaves and has been called "yellow-tip." It was found that the amount of yellow-tip varied with the location and with the age of the leaf. The yellow-tip is a permanent injury; the leaves do not regreen. However, subsequent new leaves do not have yellow-tip unless additional urea sprays are applied. The extent of the yellowing may vary from none to more than half of the leaf.

Since crystalline urea "sets-up" and becomes hard, most of the urea for foliage spray application now on the market has been conditioned in various ways to avoid the hardening. To determine whether yellow-tip is caused by urea or by some impurity in the urea, several spray experiments have been made (*6*). Since yellow-tip had also been observed on trees in the field to which soil applications of conditioned urea had been applied, soil experiments were also made.

One experiment was performed in a grove of mature navel orange trees in August 1953. In this experiment, sprays of 10 lb of crystalline urea per 100 gal of spray were compared with sprays of the same concentration of conditioned urea. Approximately 6 wk after spray applications, yellow-tip was prevalent on the trees sprayed with the conditioned urea but not on the trees sprayed with crystalline urea. This suggested that yellow-tip was the result of something in the conditioned urea and was not caused by urea alone.

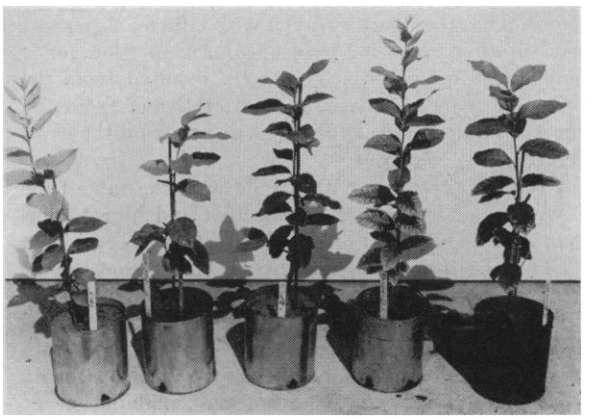

Fig. 1. Foliage sprays of combinations of biuret and urea on young budded lemon trees. Left to right: Check no spray, 0.2-percent biuret, 2-percent crystal urea, 0.2-percent biuret plus 2-percent crystal urea, and pelletized urea. Note yellow-tip (mottling) except on check and 2-percent crystalline urea plants.

Most of the conditioned urea on the market is in the form of pellets. In the making of such pellets, the urea is warmed. It has long been known that on warming, urea is converted to biuret (*7*). Biuret toxicity following foliar application of urea has been reported on pineapples (*8*). Thus biuret was the first suspect as the cause of yellow-tip. Several sources of pelletized urea were examined for biuret by the use of alkaline copper sulfate and were found to contain from 0.5 to 2.5 percent of the dry weight of a biuret-reacting material.

Following the field results, several greenhouse experiments were made to compare pelletized urea, crystalline urea, biuret, and combinations of crystalline urea and biuret. For these experiments, young budded lemon and Valencia orange trees (*9*) were used. Figure 1 shows the results of one spray experiment on

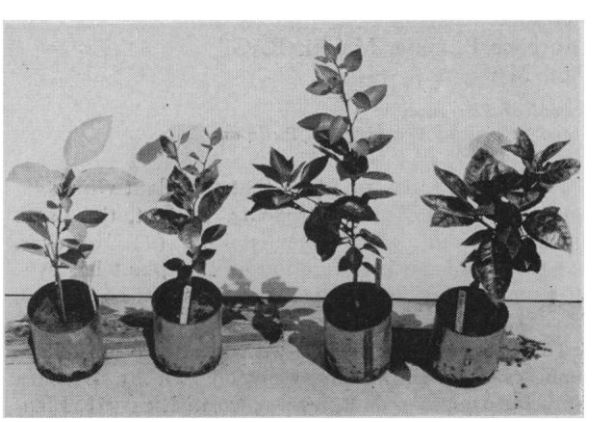

Fig. 2. Soil applications of biuret and urea to young budded lemon trees. Left to right: Check no treatment, 50 ml of 0.2-percent biuret, 50 ml of 2-percent crystal urea, 50 ml of 0.2-percent biuret plus 2-percent crystal urea. Note yellow-tip (mottling) except in check and crystalline urea treatment.

lemons. The trees were sprayed with either a 2-percent urea solution, or a 0.2-percent biuret solution, or a combination of the two. Yellow-tip resulted from the sprays of pelletized urea, from biuret, and from the biuret-crystal urea combination but not from the crystal urea.

A second experiment was made with the same type of young budded trees, but the urea and biuret solutions were applied to the soil. The treatments consisted of 50 ml of either 2-percent urea, or 0.2-percent biuret, or a combination of the two applied to each 1-gal can (Fig. 2). Yellow-tip resulted from all treatments containing biuret but not from crystalline urea. In both the spray applications and the soil applications, more severe yellow-tip resulted from the combination of urea with biuret than from biuret alone, although yellow-tip occurred in both instances.

The results reported indicate that biuret is a material in commercial ureas that induces leaf yellow-tip of citrus from either foliage or soil applications.

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Investigation of the Reported Toxicity to Rats of *Gliricidia sepium,* Jacq.

Laurence E. Gale, Melvin R. Gibson, Paul M. Scott

School of Pharmacy, State College of Washington, Pullman

It has been reported (*1–3*) that the plant *Gliricidia sepium,* Jacq. is toxic to rodents. In fact, the Latin name *Gliricidia* means "rodent poison" (*4*). However, no pharmacologic investigation of this plant has ever been made to substantiate or disprove these claims. This is the purpose of this investigation.

The dried plant material, with the exception of the roots used in this study was collected by Barbara Norby in Quizzaro de San Jose, Costa Rica (*5*). Identification of the plant was by Mrs. Norby and Alexander F. Skutch. It was air-dried in Costa Rica before shipment.

The fresh leaves used in this investigation were from 40 plants grown for 2 yr in our pharmacy greenhouse. The seeds were obtained from the plant collections of Mrs. Norby. The roots used were the oven-dried roots of the 2-yr-old, greenhouse-grown plants.

The plant material was prepared for toxicity tests as follows: (i) The dried, mature leaves, young leaves, seeds, fruits, and roots were ground to a No. 60 powder. (ii) To concentrate the constituents of the leaves, 90 g of the dried, young leaves was successively and totally extracted in a Soxhlet extractor with petroleum ether, ether, and chloroform. The marc from the chloroform extraction was dried and then boiled with 1500 ml of absolute alcohol. An additional 300 ml was added after ½ hr of boiling. The marc from this extraction was treated as the previous one, using 70 percent alcohol instead of absolute alcohol. The remaining marc was subsequently extracted in a Soxhlet using distilled water. The solvents containing the extractive from these extractions were evaporated, and the residues were used in the toxicity studies. (iii) Entire, fresh, compound leaves were mixed in a Waring Blendor with 230 ml of distilled water to a puree consistency. To remove fibrous material, the mixture was strained through a single thickness of cheesecloth.

For comparison of dosage, moisture determinations were made of fresh leaves and the young dried leaves. The fresh leaves had an average moisture content of 79.5 percent; the young dried leaves, 4.5 percent.

The study of the toxicity of *Gliricidia sepium,* Jacq. was divided into four parts. One hundred thirty-five mature albino rats were used in the study, and control groups were maintained for each portion of the work. First, the toxicity of the air-dried, mature leaves, young leaves, seeds, fruits, and roots was determined. The dose of each of the powdered plant parts given to individual groups of rats was 1 g/kg administered for 6 consecutive days. Second, a study was made of the toxicity of the six extracts prepared by phytochemical methods from the young leaves. Expressed approximately, in terms of the dried young leaves, the doses of the extracts administered orally to the rats for 6 consecutive days were petroleum ether, 6 g/kg; ether, 8 g/kg; chloroform, 15 g/kg; absolute alcohol, 15 g/kg; 70-percent alcohol, 10 g/kg; cold distilled water, 10 g/kg. Third, the toxicity of an aqueous mixture of fresh green leaves was evaluated. The doses administered orally to groups of rats for 6 consecutive days were 0.75 g/kg; 1.5 g/kg; 2.0 g/kg; 3.0 g/kg. Fourth, a 45-day extended-toxicity study was performed using the dried, powdered, young *Gliricidia* leaves. The doses of the young leaves that were administered for 45 days were 0.25 g/kg; 0.50 g/kg; 1.00 g/kg. At the end of the 45-day test period, blood samples were taken for hematologic examination, and the animals were sacrificed. The intestinal tract of each animal was examined, and stained tissue mounts were prepared for histologic examination of the heart, liver, kidneys and spleen.

The fresh leaves, dried parts, and extracts of *Gliricidia sepium,* Jacq. used in this investigation appeared to be completely devoid of toxicity to rats. No deaths were observed in any of the groups of animals that could be attributed to the *Gliricidia* administered. The