of securing a closer relationship between Hunter color difference measurements and Agricultural Marketing Service grades for color. It involves the use of a clear plastic dish (Fig. 1) fitted with a tight cover, the latter being coupled to a ¼-in. shaft located vertically at the center of the cover. The bottom and top of the dish are tightly connected by means of thumbscrews mounted on the outside perimeter of the sides of the dish and extending through an aluminum plate mounted to the cover of the dish. The shaft is connected to a laboratory-type variable-speed electric motor located above the meter. This motor may, in turn, be connected to the power source through a variable-speed transformer. By proper manipulations of the transformer, a speed may be selected, which reduces the oscillations of the galvanometer of the meter to a minimum and thus averages and "integrates" the color values of the product. The speed of turning of the dish is variable depending upon the nature of the product.

The entire assembly is mounted off-center to the source of light from the meter and may be either directly behind or to one side of the meter to take advantage of the area relationships of the light from the meter.

Products to be viewed by the meter are placed in the dish, the cover clamped on, and the assembly connected to the motor. To prevent scratching of the meter "viewing" plate, the assembly is raised approximately 3/16 in. above the plate. This causes no change in the readings.

Typical results by the three methods of sample presentation are shown in Table 1. This method is readily adaptable to use with other types of reflection meters.

References

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Improved Homogenizer for Plant Tissues

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An improved homogenizer suitable for rapid homogenization of small samples of plant tissue has been designed. This apparatus combines the advantages of the conical form used by Takahashi (*1*) and the plastic pestle described by Brendler (*2*). The conical form of pestle and mortar is advantageous because the pestle continues to fit tightly in the mortar after wear. The plastic pestle has been found to be more satisfactory than glass since the former is essentially unbreakable and very easily made in any laboratory.

The mortar is a 12-ml heavy-walled, conical centrifuge tube. This tube should be carefully selected for uniformity of taper and absence of irregularities and defects in the conical tip. If desired, a pouring lip may be added by the usual glassworking techniques.

The pestle was made by pouring about 1.8 ml of a mixture of monomeric methyl methacrylate and a catalyst into the centrifuge tube; the pestle shaft was suspended in this mixture and polymerization allowed to take place. The liquid methyl methacrylate (*3*) contained an inhibitor, 0.006 percent hydroquinone, which was removed by three extractions with approximately 0.5*N* NaOH and three extractions with distilled water The water remaining in the methyl methacrylate was removed with $CaCl_2$.

Luperco CDB (*4*) was used to catalyze the polymerization of methacrylate. This catalyst, which is a mixture of equal parts of 2,4-dichlorobenzoyl peroxide and dibutyl phthalate, was used at a concentration of approximately 250 mg/25 ml of methyl methacrylate. To prevent the plastic from adhering to the centrifuge tube, the inside of the tube had previously been coated with a soap film and dried thoroughly. The shaft portion of the pestle was a 15-cm length of steel piano wire 3/32 in. in diameter. The portion of the shaft to be embedded in plastic was deeply notched by means of a file to provide a slip-proof union with the plastic.

The shaft was pushed through the exact center of a No. 4 tapered cork stopper. The stopper supporting the shaft was inserted in the centrifuge tube, and the shaft pushed down about ½ in. into the liquid plastic. The shaft was then centered in the plastic by carefully manipulating the cork, and the entire unit was put in an oven at 40 to 45°C and left 3 days for polymerization.

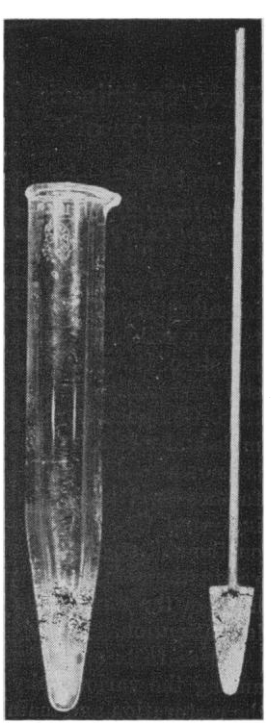

Fig. 1. Glass mortar (left) and plastic pestle with steel shaft (right).

Since there was some shrinkage during the curing process, a small amount of refitting was necessary. This was accomplished by inserting the free end of the shaft in the chuck of a heavy-duty stirring motor and holding a strip of sandpaper against the tip of the rapidly turning pestle. Slight touches of sandpaper against the other high points on the pestle soon resulted in a good fit, preferably somewhat tighter at the shoulders than at the tip. The final fitting was accomplished by pouring a suspension of carborundum powder in water into the tube, inserting the pestle, and rotating the pestle at medium speed in this mixture. The carborundum served two purposes. It completes the fitting and removes the glaze from the mortar wall. This latter step strikingly increases the efficiency of the homogenizer.

If desired, a spiral groove may be cut into the pestle from the shoulder to the tip in such a direction that the rotation of the pestle tends to carry the homogenate to the bottom of the mortar. The complete homogenizer is shown in Fig. 1.

This motor-driven homogenizer works best if sample sizes are kept to 500 mg or less. A 300-mg sample of leaf disks from the interveinal area of tobacco leaves can be completely macerated in about 30 sec. This homogenizer has been found to be very durable, and a large number of samples may be homogenized with a minimum of refitting. It is assumed that it would be equally effective for macerating animal tissues.

References and Notes

1. W. N. Takahashi, *Phytopathology* **41**, 481 (1951).
2. H. Brendler, *Science* **114**, 61 (1951).
3. Rohm and Haas Co., Philadelphia, Pa.
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New Techniques for the Study of Restoration of Compacted Soil

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About 5 years ago we (*1*) visited an airport where investigations were being made on methods of maintaining soil in a compacted condition for a firm landing strip. It appeared then that even firmly compacted soil eventually becomes restored to its normal structure. Compaction of soil that is caused by farm animals and machinery may persist for years, but it also is known to disappear in time. The effects of physical factors—wetting and drying and freezing and thawing—and the effects of bacterial and fungal growth on the soil structure have been subjected to some investigation. In contrast, the specific effects of animals in the restoration of deteriorated soil have had less attention.

These facts suggested a study of the relationships among the various physical and biological factors in the restoration and maintenance of soil structure. First we sought to devise satisfactory methods for destroying the structure of soils. In an exploratory series of experiments, surface soils from a fertile garden and from an old compost heap were mixed with water into thin mud and molded into cores in 1-pt paper cartons. These cores were removed from the cartons, air dried, and buried just below the surface near the places from which the soil was dug. In the course of a winter the cores literally disappeared as compacted objects. Wetting and drying, freezing and thawing, and extensive tunneling by earthworms and other animals all seemed to be factors in the structural restoration.

Fig. 1. Core with alfalfa meal additive, exhumed after 4 mo. Most of the original core had been removed by earthworms. Light-colored material from the core had been deposited as casts throughout the adjacent region.

In a second series of experiments, soil of lower organic content from the B horizon of Miami silt loam of a badly eroded garden, was mixed with water and molded into cylindrical cores of about 3.5 in. by 3.5 in. in diameter and in height. These core dimensions have become standard for all our experiments. The cores were buried to a depth of 3 in. in three separate sites: (i) a dense woodland, (ii) the garden from which the soil was taken, and (iii) an old field that had not been cultivated for 10 yr. After 2 yr the cores in the woodland were little changed. There was little penetration by roots and almost no evidence of shrinkage cracks or tunneling by animals. The forest appeared to have insulated the cores from the severe effects of moisture and temperature changes. In contrast, the cores buried in the two open areas showed, after 1 yr, many horizontal shrinkage cracks and some vertical ones. The cores in the old field, after 1 yr, had been pierced by the roots of grasses and weeds. There was some tunneling by wireworms. Platy structures had developed, with fungi growing on the surfaces of the plates. Nematodes, mites, and collembolans were