An apparatus has been in the process of development at the office of the Geodetic Institute at Potsdam, Germany. This one has as its essential feature the balancing of a column of mercury against a fixed volume of gas. No definite reports of progress are available, but the writer has been led to believe from conversations and correspondence that the apparatus gives promise of being quite effective.

A new type of gravity apparatus has recently been developed in Norway. A description of the apparatus and of the methods employed in its use is contained in articles by K. Wold and G. Jelstrup, which appeared on pages 269 to 279 of *Gerlands Beiträge zur Geophysik,* No. 36, 1932.

It is well known that one or more of the petroleum companies of this country have been working on gravity apparatus and methods, but no information regarding them is in print. It is known, however, that a method has been employed whereby the oscillations of a pendulum kept swinging at a central field base station are transmitted by radio to surrounding stations at which they are compared directly with the oscillations of the field pendulums.[1] With such a method the required accuracy can be obtained by a short series of observations and any number of gravity parties can operate simultaneously in the field within a reasonable distance of the base. This method should be very effective in making an intensive gravity survey of a comparatively large area, but for the usual gravity work the expense of operating the base station with the transmitting apparatus would scarcely be justified.

It may be said without question that notable progress has been made recently in the improvement of gravity methods and apparatus, and it is very probable that even further advance will be made in the very near future. Gravity surveys will undoubtedly play an ever-increasing part in geophysical and geological studies designed to disclose buried structure, a matter of great importance in the search for petroleum, water and minerals. Anticlines, domes, synclines and masses of heavy rock or ore may be indicated by the values of gravity at stations located immediately above or very close to them.

WILLIAM BOWIE
U. S. COAST AND GEODETIC SURVEY

[1] This method was suggested by C. A. Heiland in 1927 in a paper given before the Section of Geodesy of the American Geophysical Union. See Bulletin No. 61 of the National Research Council, pp. 66–71.

SPECIAL ARTICLES

NEW HARDY SEEDLESS GRAPES

A PROJECT[1] in breeding grapes which has for its aim the development of hardy seedless clons of merit has now given 28 seedlings that bear seedless or near-seedless fruits and that are hardy in the climate of central New York. One of these plants has already been reported,[2] but most of them fruited for the first time in 1932.

Seedless grapes of various types occasionally arise directly from seeded grapes, presumably either by mutation, by segregation or by some particular combination of complementary factors. Such plants usually bear viable pollen and hence they may be employed as pollen parents in crosses with seeded plants in the effort to take advantage of any hereditary values which seedlessness may possess in obtaining more seedless individuals among the offspring.

The new seedless grapes thus far obtained in this project are all the progeny of hardy seeded grapes crossed with the tender seedless varieties Sultanina, Rose Sultanina and Black Monukka. According to the investigations of Goodspeed,[3] Susa[4] and Pearson,[5] in these seedless grapes fruits are for the most part produced only after pollination and fertilization, and hence the parthenocarpy is stimulative rather than spontaneous.

Vines of the tender seedless grapes are grown in the courts between greenhouses at the New York Botanical Garden, where they frequently flower at the time when the pollen can be used on hardy grapes in bloom at Geneva. Rather large numbers of seeds (several thousand) were obtained in the crosses, but a large percentage of the F_1 died in the nursery or vineyard, evidently because of tenderness inherited from the vinifera parent. Of the seedlings that survived some have seeded fruits and some have seedless or near-seedless fruits.

The occurrence of seedless grapes in considerable numbers in the F_1 generation of these crosses is a matter of importance to the practical results of the breeding effort. The occurrence of both seeded and seedless individuals in this generation is a result of significance in considering the heredity of seedlessness. It appears that seedlessness of the type here concerned is not a simple character in inheritance and that in these crosses one or both parents are hetero-

[1] By permission of the authorities of The New York Botanical Garden the writer has cooperated with the Department of Horticulture of the State Experiment Station at Geneva, N. Y., in this project.

[2] A. B. Stout, "A New Hardy Seedless Grape," *Jour. Heredity,* 19: 316–323, 1928.

[3] T. H. Goodspeed, Paper presented in Section G, 73rd meeting A. A. A. S., December 28, 1920.

[4] T. Susa, "Sterility in Certain Grapes," Mem. Hort. Soc. N. Y. 3: 223–232, 1927.

[5] Helen Pearson, "Parthenocarpy and Seedlessness in *Vitis vinifera,*" SCIENCE, 76: 594, 1932.

zygous for certain of the complementary factors involved.

A preliminary study of the seed-like structures in the mature fruits of these new seedless grapes shows several degrees of development. In a few cases there are only tiny rudiments of seeds, quite as exist in the fruits of the Sultanina grape. But in most cases there is some development of the tissues of the seed coats, but the structures, even when their size approaches that of a seed, are either without embryo and endosperm or with only traces of them and are so soft and pulpy that they are not noticed when the fruits are masticated in eating. It appears that the type of seedlessness in these plants corresponds to that of the pollen parent, but that the inhibition in the development of the seeds which results in their abortion is less complete in most of them.

The seedless plants already obtained are being utilized as pollen parents in crosses with sister plants that have seeds. The latter are being selfed and crossed to obtain a second generation and they are being used in back crosses with the seedless parents. The results should give further data on hereditary behavior, and, it is hoped, provide more of the seedless grapes.

Several of the seedlings which bear seedless or near-seedless fruits possess considerable merit. For these the clusters are well filled and of good size or even large. In size the berries range from larger than Delaware fruits to nearly the size of Concord. The colors include green, amber, red, mottled red and shades of black. In quality there is considerable variation, but the best are vinous, sweet and meaty. Several ripen early. The most promising of these grapes are being propagated for trial under cultural conditions.

A. B. STOUT

NEW YORK BOTANICAL GARDEN

THE OCCURRENCE OF ROTENONE AND RELATED COMPOUNDS IN THE ROOTS OF CRACCA VIRGINIANA[1]

CRACCA VIRGINIANA, the most abundant species of the genus Cracca indigenous to the United States, has recently been reported as possessing insecticidal properties.[2] This, together with the fact that other species of Cracca, namely, *C. toxicaria* from South America and *C. vogelii* from Africa, have yielded substances related to the rotenone group of fish poisons,[3] has made a chemical study of the American species interesting and desirable. Such an investigation has been in progress and to date the following results have been obtained:

Ether extraction of the roots of the plant yielded from 4 to 6 per cent. of resinous materials having a pleasant characteristic odor. The extract, when tested as a fish poison, showed essentially the same toxicity as pure rotenone. It contained 9 per cent. methoxyl[4] and in many ways resembled the non-crystallizable extractives from derris and cubé roots.[5] Attempts to obtain individual major constituents by distillation, crystallization or the formation of derivatives were for the most part unsuccessful, although four substances were obtained in small quantities. These were rotenone, dehydrorotenone, tephrosin and a colorless crystalline material, $C_{22}H_{24}O_4$, whose M.P. is 131°.

The rotenone was obtained by dissolving one part of the resin in an equal part of *n*-butyl ether and allowing the solution to crystallize for from two to three weeks. The yield was usually about 5 per cent. of the weight of the resin, but apparently much more rotenone was present which did not crystallize because of the complex nature of the mixture. This was shown by the fact that a slightly more dilute solution failed entirely to crystallize or at most gave only traces of crystals, and also by the fact that solutions of the resin in other solvents, from which rotenone readily crystallizes from very dilute solutions, would not crystallize.

Dehydrorotenone was obtained from the resin in approximately 2 per cent. yield by treating the material in a methanolic solution with alkali (50 gm. resin, 200 cc. methanol and 0.5 gm. potassium hydroxide). Sometimes crystallization occurred in a short time, and again a month or more was required for the process to take place. The dehydrorotenone was frequently contaminated with material which appeared to be a dehydro derivative of a somewhat higher molecular weight. The first specimen obtained, for example, melted sharply at 217°. It gave analytical values approximately half-way between that required for dehydrorotenone and dehydrotoxicarol and could not be further purified. Hydrolysis with alcoholic alkali, however, gave a fair yield of derrisic acid, and examination by the optical immersion method[6] showed that much of the material was dehydrorotenone. This particular phenomenon is the same as was recently reported for certain naturally occurring mixtures of dehydrodeguelin and dehydrotoxicarol.[7] Other specimens of the dehydro

[1] From the Insecticide Division of the Bureau of Chemistry and Soils, United States Department of Agriculture, Washington, D. C.

[2] Little, SCIENCE, 73, 315 (1931); *Jour. Econ. Ent.*, 24: 743 (1931).

[3] Clark, *Jour. Am. Chem. Soc.*, 52, 2461 (1930); 53, 729 (1931).

[4] A ligroin (B.P. 40–60°) extract was employed for this purpose.

[5] Clark, SCIENCE, 71: 396. 1930.

[6] The optical identifications involved in this communication were performed by George L. Keenan, of the Food and Drug Administration, U. S. Department of Agriculture.

[7] Clark and Keenan, *Jour. Am. Chem. Soc.*, 55, 422, 1933.