pounds in each of them, amenorrhea in the female and impotence in the male, hirsutism in the female and change in the texture and color of the hair in the male, purplish abdominal *lineae striae,* hypertension, plethora, polycythemia and osteoporosis.

Rats 23 to 25 days of age were used for the experiment. They were adrenalectomized by the usual method and placed on a diet of fresh white bread and tap water. In all, seven groups of animals were adrenalectomized and of these some remained uninjected, others picked at random were injected with sera of normal individuals, while the remaining were injected with the serum of each of the patients with Cushing's disease. Injection was started in the majority of rats on the sixth or seventh day, when one or two of that group had died and the remaining animals showed signs of adrenal insufficiency.

The blood was collected from both patients under sterile conditions and the serum was kept frozen. Hexylresorcinol as preservative could not be used, since it appeared to be highly toxic. Also hemolyzed blood had to be in large part discarded because of its toxicity. Even when caution was taken against these factors, human serum seemed toxic to the rats, in light of the observation that with injection of 1 cc of serum the rats died within 12 hours, whereas the uninjected controls remained living. Therefore the dosage of serum administered was from 0.2 to 0.4 cc intraperitoneally twice a day.

The uninjected control group consisting of 13 rats survived for a period, the median of which was 8.3 days. The 14 receiving normal human serum survived for a period of 8 to 13 days, a median of 10.7 days. Two died on the 13th day, one on the 12th, one on the 10th, one on the 9th, two on the 8th and the remaining 7 on the 11th day. The group injected with the serum of Patient B, consisting of 13 rats, died at a median of 14.0 days, 5 having died prematurely due to infection or accident. Two of these survived 19 days, three 17 days, one 15 days, one 14 days, one 12 days, three 11 days and the remaining two 10 days. Of the group of 7 animals injected with the serum of Patient C, two survived 18 days, two 17 days, one 16 days, one 12 days and one 11 days, with a common median for the group of 15.6.

It would appear that the lengthened survival period of completely adrenalectomized animals may be taken as indicative of the presence in these sera of a substance resembling the adrenal cortical hormone.

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THE POTASSIUM CONTENT OF SOIL BENEATH A STRAW MULCH

THERE are three prevalent types of soil management in American apple orchards. Tillage predominates in some sections, sod land with perhaps an occasional discing in others, and to a much more limited extent the mulch system is used. In the latter case the land is kept permanently in a sod (usually of nonlegumes) and straw or other material is spread beneath the branches as a mulch. This mulch is renewed from time to time so that there is practically no growth of grasses within the periphery of the area occupied by each tree.

The mulch system was at first condemned as unsound, and dire predictions were made as to the consequences. But after some forty years of continuous mulch such trees are thrifty, productive, and show no signs of deterioration beyond that shown by trees of similar age grown under other systems of culture.

In some of the fruit regions of the United States and Canada the need of other elements than nitrogen, particularly potassium, has become apparent and in many other sections the question of their need has been raised. Without discussing this somewhat controversial question as such, it may be of interest to report the potassium situation in orchards at the Ohio Agricultural Experiment Station, Wooster, under different systems of culture.

In the orchard area as a whole it was found that potassium is very low. The foliage in certain sections has shown a characteristic scorch that is usually associated with K deficiency, for several years. But when potassic salts were applied the potassium was "fixed" in the surface soil and failed to move downward into the root zone of the trees even after ten years of treatment. This had frequently been shown by others[1] and presents a serious problem of supplying trees with this element.

Since the potassium in plant material is largely water soluble it became a matter of inquiry as to whether the leachings of the straw and other mulch materials had accumulated in the surface of the soil where the superficial roots might absorb it. Preliminary "quick tests" were made by using the Thornton method,[2] and they showed to our surprise that available potassium was very high for two to three feet beneath the mulch. It was also shown that potassium was present in any considerable amount only in the first few inches of soil beneath the surface in the adja-

[1] J. T. Way, *Jour. Roy. Agr. Soc.*, 11: 313–379, 1850; F. E. Bear, "Theory and Practice in the Use of Fertilizers." John Wiley and Sons, pp. 215–217, 1929; J. S. Joffe and L. Kolodny, SCIENCE, 84: 2175, Sept. 4, 1936.

[2] S. F. Thornton, S. D. Conner and R. R. Fraser, Purdue Univ. Agr. Exp. Sta. Cir. 204. Rev. August, 1936.

cent 38-year old bluegrass sod and was notably deficient in the entire cultivated area. These preliminary tests prompted quantitative determinations in the different areas. The quantitative determinations were made by leaching the soil with normal neutral ammonium acetate and then determining the potassium in the leachate by a standard method.[3]

These quantitative results show conclusively that potassium is very high to a depth of from 24 to 32 inches and sometimes to 40 inches beneath the 38-year old mulch. This is highly significant in light of the characteristic fixation of potash salts in the surface inch and a half to two inches of surface soil. In no case was potash fertilizer applied to the mulched trees.

Samples of soil taken from the grass area between the trees showed no such accumulation of available potassium. Those taken from an adjacent unfertilized plot which has been in a three-year rotation of potatoes, wheat and clover showed a very low potassium content even in the first few inches of top-soil.

Another orchard nearby which has been in the different systems for twenty-two years shows similar results. The soil under the mulched trees has a high available potassium content to the depth of the rooting area of the trees, while the soil under the trees kept in the tillage-cover crop system is very low in this element. For example, the soil beneath two trees in the mulch system has a content of 1,000 pounds per acre of available K at a depth of 24 inches, while the soil beneath a tree 40 feet away in cultivation contained less than 175 pounds at the same depth.

The authors offer no explanation at the present time of the occurrence of the potassium to such a depth beneath the mulch. This finding, however, would indicate that fruit trees grown under the mulch system would not need potash applications even on soils greatly deficient in potassium.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN INTERVAL COMPUTER

BEING required by the exigencies of a certain problem to convert large numbers of time intervals as measured in the ordinary way by clock times to hours and decimal fractions of hours, the writer has devised the following instrument for this purpose.

The instrument (of which a portion is shown in Fig. 1) consists of two flat metal discs, an "inner disc" some 3 inches in diameter and an "outer disc" some 7 inches in diameter, so fastened by a bolt through their centers that the inner may be rotated concentrically with the outer. The inner disc is graduated around its periphery from 0 to 24 hours, and each hour is further divided into the smallest time interval it is desired to deal with. (In Fig. 1 the instrument is divided into quarter-hours.)

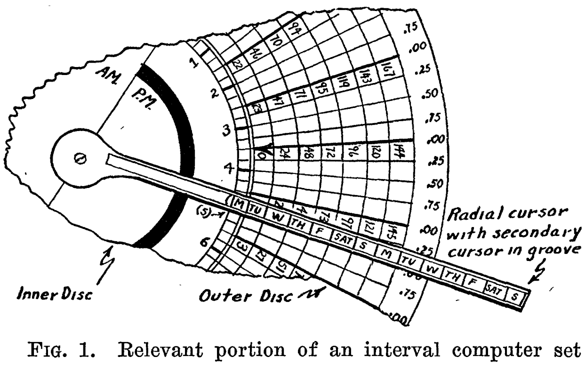

FIG. 1. Relevant portion of an interval computer set to show a start at 3: 30 P.M. on a Tuesday, and a termination at 5 P.M. on any succeeding day.

The outer disc is divided by radial lines into the same divisions, and has also, depending upon the number of days range it is desired to handle, a number of concentric "day-circles" separated from each other by concentric circular lines. Starting at any radius (henceforth known as the "zero radius") and on the innermost day-circle, the short intercepts of the hour-radii are numbered consecutively from 0 to 24 around this innermost day-circle, stepping outward one day-circle and continuing with 25 to 48 on the second day-circle, and so on. Finally the radii between hours are marked on the periphery of the disc with their decimal equivalents, starting at zero with each hour.

On the bolt holding the two discs together is mounted a "radial cursor," of which one edge, if produced, would pass through the center of the pivot, *i.e.*, this edge is a radius. (The edge nearest the bottom of the page in Fig. 1 is the radial edge.) The radial cursor is grooved on its exposed face to carry a sliding "secondary cursor" marked by cross-lines the same distance apart as the width of a day circle, with the spaces between these lines marked with the days of the week as shown in the figure. There should be twice as many intervals as there are day-circles.

In operation the inner disc is rotated with reference to the outer until the time appropriate to the start of the experiment is opposite the zero radius of the outer disc. The secondary cursor is then slid along in its groove so that the day of the start comes opposite the innermost day-circle. In Fig. 1, the instrument is

[3] R. H. Bray and F. M. Willhite, *Ind. and Eng. Chem.*, 1: 3, 144, July 15, 1929; V. H. Morris and R. W. Gerdel, *Plant Physiol.*, 8: 315–319, 1933.