THE APPLICATION OF SPRAYS TO EXPANDING PLANT SURFACES[1]

DURING the season of 1934, the authors had occasion to make a series of measurements of the surface areas of apple fruits grown in the college orchard at State College, Pa. This work was done in connection with a study of the deposition and retention of lead and arsenic trioxide on the fruit and leaf surfaces of two varieties of apples sprayed with three spray mixtures. From these measurements and from the chemical analyses of the fruit surfaces for the two toxic elements, it was apparent that the expansion of the fruit surfaces during growth was the most important single factor operating against the maintenance of an adequate deposit for the control of chewing insects, particularly the codling moth (*Carpocapsa pomonella* L.). The effect of the growth was particularly great during the early period of development of the fruit, when the surface areas doubled in extent within four or five days. It was reasoned from this work that spray applications would be more effective in maintaining an adequate deposit if the early sprays were applied at more frequent intervals, thus compensating for this rapid increase.

During the season of 1935 ten Stayman Winesap trees in the college orchard were sprayed with a mixture containing lead arsenate 3 pounds, flotation (wettable) sulfur 5 pounds and fish oil 1 quart per 100 gallons of spray mixture. On five of the trees three applications were made at regular intervals of 14 days. On the remaining five trees applications were made at intervals of 4, 10 and 20 days following the first application. Samples of fruit were taken for chemical analyses immediately previous to and following each spray application. More extended measurements of growth rate of fruit of this and other varieties were also taken during this season, from fruit at the tops of the trees as well as from the lower limbs. Study of the results of this experiment led to the following conclusions:

(1) Growth of the fruit at the tops of the trees was considerably more rapid during the greater part of the season than of those at the bottom.

(2) Fruit from the tops of trees of the Stayman Winesap variety increased from 300 square millimeters in area to 950 square millimeters within ten days (between June 1 and June 10). The subsequent increases were progressively less rapid.

(3) In order to provide an adequate deposit on the fruit surfaces during this early period the second cover spray application should follow the first by not more than 5 days. The third application should follow the second by not more than 9 days, while between the third and fourth applications 13 days may elapse. Under conditions of heavy codling moth attack a fifth spray may be necessary, in which case an application 17 days after the fourth should serve to maintain a deposit adequate for protection until early in August.

While the results given above apply only to central Pennsylvania conditions and the details of the method and dates of application may vary with the locality, it is felt that such timing of spray applications is of sufficient importance from an economic and practical point of view to merit consideration by all workers who have to deal with the problem of insect control on materials of this type. The complete results will be published in the near future.

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ON THE STRUCTURE OF PECTIN POLYGALACTURONIC ACID

THE fundamental problem of the structure of an oligopolysaccharide consists in elucidation of the places of union of each monose to the other and in the elucidation of the ring structure of each monose. In the special case of the pectin polygalacturonic acid, this information was lacking. We have now succeeded in demonstrating that carbon atoms 4 and 5 are engaged in the ring formation and in the condensation of each unit with its neighboring unit.

This information was obtained by degradation of the polygalacturonic acid with periodic acid which resulted in the formation of levotartaric acid which has been identified as its acid potassium salt.

For $C_4H_5O_6K$, K = 20.78 per cent.; Found K = 20.70 per cent.

$$[\alpha]_D^{25} = -22.0^\circ \text{ (in water)}$$

and for the undissociated acid,

$$[\alpha]_D^{25} = -15.0^\circ.$$

The special function of the hydroxyl groups of each of the carbon atoms 4 and 5 remains to be established. However, it is safe to predict that the hydroxyl group of carbon atom 4 serves for condensation and that of carbon atom 5 for ring formation.

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BOOKS RECEIVED

DE SCHWEINITZ, DOROTHEA. *Occupations in Retail Stores.* Pp. xviii + 417. Ill. International Textbook Company.

ELDRIDGE, JOHN A. *College Physics.* Pp. x + 616. Illustrated. Wiley. $3.75.

HILL, ALBERT F. *Economic Botany.* Pp. x + 592. 225 figures. McGraw-Hill. $4.00.

VERNON, M. D. *Visual Perception.* Pp. x + 247. 19 figures. Cambridge University Press, Macmillan. $4.50.

WILLIAMSON, E. G. *Students and Occupations.* Pp. xxiv + 437. Holt. $2.50.