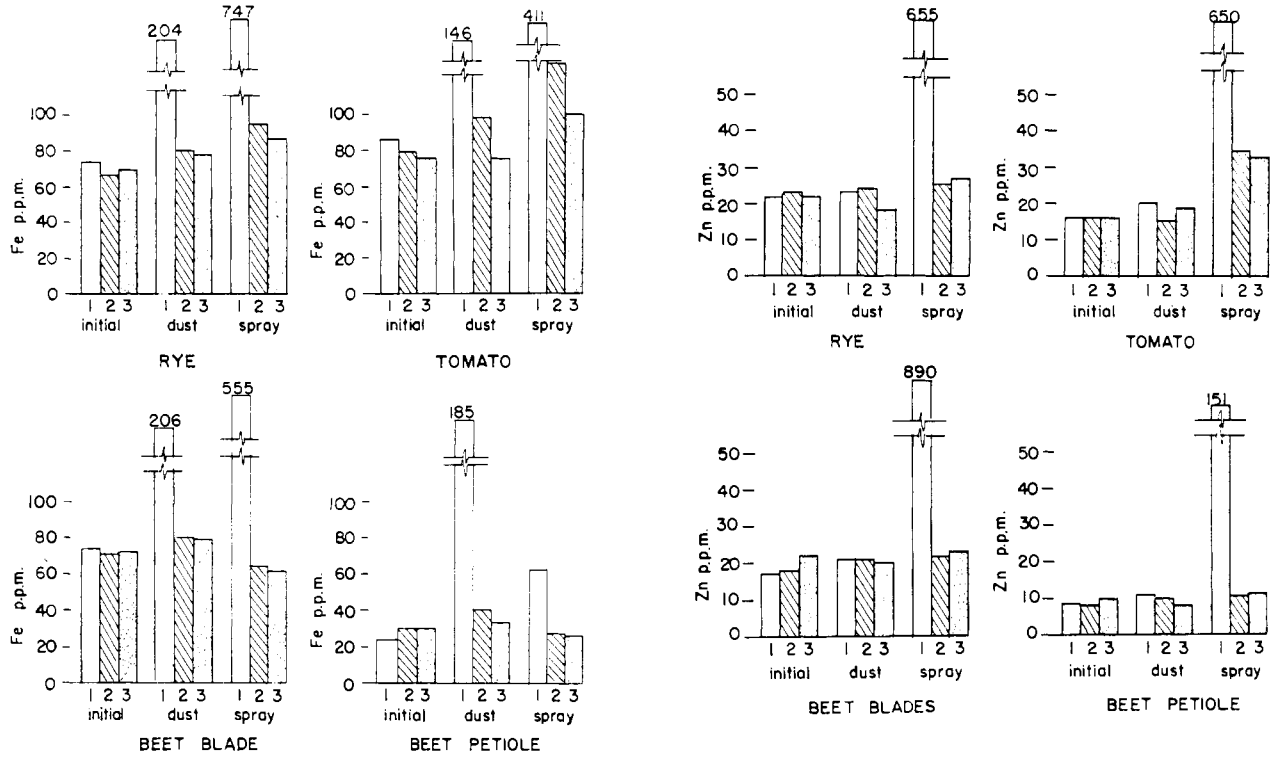

quirement for attainment of this goal, others being proper sampling, selection of proper tissue, and adequate analytical methods.

Literature Cited

(1) Bear, F. E., J. AGR. FOOD CHEM. **2,** 244–51 (1954).
(2) Jacobson, L., *Plant Physiol.* **20,** 233–45 (1945).
(3) Jacobson, L., Oertli, J. J., *Ibid.*, **31,** 199–204 (1956).
(4) Johnson, C. M., Stout, P. R., Broyer, T. C., Carlton, A. B., *Plant and Soil* **8,** 337–53 (1957).
(5) Johnson, C. M., Ulrich, A., Calif. Agr. Expt. Sta., Bull. **766** (1959).
(6) Nicholas, D. J. D., Lloyd-Jones, C. P., Fisher, D. J., *Plant and Soil* **8,** 367–77 (1957).
(7) Smith, P. F., Reuther, W., Specht, A. W., *Plant Physiol.* **25,** 496–506 (1950).
(8) Tukey, H. B., Jr., Tukey, H. B., Wittwer, S. H., *Am. Soc. Hort. Sci. Proc.* **71,** 496–506 (1958).

Received for review October 30, 1959. Accepted March 15, 1960.

PLANT COMPOSITION AND VIGOR

Hemicelluloses and Winter Hardiness in Raspberry Canes

EMMETT BENNETT and WALTER D. WEEKS

Massachusetts Agricultural Experiment Station, Amherst, Mass.

In a general study of winter hardiness in plants, hemicelluloses from winter-hardy and nonwinter-hardy varieties of raspberry canes were isolated and studied to determine a possible relationship. The hemicelluloses were found to be similar in quantitative and qualitative aspects. Xylose was present in by far the greatest amounts. The data on the present basis do not seem to indicate a positive relationship.

VARIETIES OF RASPBERRIES vary in their ability to survive when exposed to extremely low temperatures. The resistance of a given variety is not necessarily constant for the winter season. It may be lost and regained during the same season. The phenomenon of winter hardiness is not generally understood. Excellent reviews on the hardiness of plants have been published by Dexter (*2*) and Levitt (*4*). Hardiness has been related to many plant substances, including hemicelluloses. Although these substances are sufficiently hydrophilic to play an important role in the water relationships of the plant, published reports vary as to the importance of their role in winter hardiness (*1, 5, 8*). To investigate further the possibilities of an indirect relationship, a chemical investigation has been conducted on the hemicelluloses of hardy (Latham) and tender (Milton) varieties of raspberry canes.

Material and Methods

Representative samples of both Latham and Milton canes were collected approximately every two weeks from November through February, dried in a forced draft oven at 75° C., and composited later. Approximately 500 grams of each were extracted successively with a

Table I. Hemicelluloses of Latham and Milton Raspberry Canes on an Ash-, Moisture-, and Lignin-Free Basis

	Latham, %	Milton, %
Hemicellulose	15.12	15.13
Xylose	78.33	66.84
Arabinose	5.70	2.98
Glucose	6.39	6.63
Galactose	2.32	2.32
Uronic acids	11.13	14.23
Specific rotation, $[\alpha]_D^{25}$	−100.6	−64.90

solution of alcohol and benzene in the volume ratio of 1 to 2 and of 0.5% ammonium citrate. Holocellulose was prepared from the extractive-free material by the use of sodium chlorite essentially according to Whistler's (*9*) modification. Hemicelluloses were extracted from the holocellulose with 12% potassium hydroxide at about 25° C. for 20 hours in the presence of nitrogen. The entire fraction was precipitated by adjusting the pH to 3.5 and adding 3 volumes of ethanol. The analytical data are shown in Table I.

Solutions for specific rotations were made by dissolving 0.3 gram in 50 ml. of 4% sodium hydroxide. The readings were made on a Schmidt and Haensch saccharimeter using sodium light at 25° C. The factor 0.34620 was used for conversion to angular degrees. Uronic acids were determined by the method of Phillips, Goss, and Browne (*7*). Hydrolysis of the samples was effected by approximately 1*N* sulfuric acid in a boiling water bath for 15 hours in an atmosphere of nitrogen. The hydrolyzate was recovered in the usual manner after treatment with barium hydroxide and barium carbonate. The sugars were resolved on Whatman filter paper No. 1, using as solvent a mixture of equal parts of ethyl acetate, pyridine, butanol, and water. Under our conditions this system produced a satisfactory resolution of glucose, galactose, xylose, arabinose, and uronic acids in 24 hours. The position of the sugars was determined by spraying the paper with aniline hydrogen phthalate (*6*). The individual sugars were quantitatively estimated as follows:

Bits of paper approximately 50 mm. square known to bear a single sugar were folded in a serrated form about 5 mm. on an edge and placed in a 10 × 75 mm. test tube. The papers were just covered with distilled water, after which the tubes were placed in a water bath at 60° C. for 2 to 3 minutes. The extracts were drained into prepared glass-stoppered 20 × 130 mm. test tubes. The process was repeated five times. The sugars were then determined directly by the Hagedorn-Jensen method (*3*). The content of sugar was calculated by reference to a curve constructed from data obtained under identical conditions from solutions of known concentration. A volume of 10 μl. containing from 20 to 80 γ provides a satisfactory concentration.

Results

From the data shown in Table I it is immediately evident that both varieties have about the same amount of hemicellulose, that they are both chiefly xylans, and that the β form of pentose predominates. No other single sugar was noted except those recorded, although there was evidence to indicate the presence of a trace of a pentose polymer of extremely low R_f value in both samples. The sugars recorded in Table I were identified chromatographically. Although the effect of impurities has not been satisfactorily assessed, preliminary data on the sorption of water under controlled conditions indicate that the greater amount of water is sorbed by the Latham hemicellulose.

Literature Cited

(1) Clements, H. F., *Research Studies State Coll. Wash.* **5,** No. 1, 81 (1937).
(2) Dexter, S. T., "Advances in Agronomy," Academic Press, New York, 1956.
(3) Hagedorn, H. C., Jensen, N. B., *Biochem. Z.* **135,** 46 (1923).
(4) Levitt, J., "The Hardiness of Plants," Academic Press, New York, 1956.
(5) McGinty, R. A., *Proc. Am. Soc. Hort. Sci.* **22,** 341 (1925).
(6) Partridge, S. M., *Nature* **158,** 270 (1946).
(7) Phillips, Max, Goss, M. J., Browne, C. A., *J. Assoc. Offic. Agr. Chemists* **16,** 289 (1933).
(8) Rosa, J. T., Jr., Hooker, H. D., Jr., *Proc. Am. Soc. Hort. Sci.* **17,** 207 (1920).
(9) Whistler, R. L., Bachrach, J., Bowman, D. R., *Arch. Biochem.* **19,** 25 (1948).

Received for review January 22, 1960. Accepted March 23, 1960. Contribution 1228, College of Agriculture Experiment Station, University of Massachusetts.

Correction

Determination of Heptachlor in Fat and Milk

In this article by Charles F. Meyer, Marshall A. Malina, and Percy B. Polen [J. AGR. FOOD CHEM. **8,** 183 (1960)], on pages 185 and 186, Figures 3 and 5 and their corresponding subcaptions should be interchanged. The figures are shown here with their proper captions.

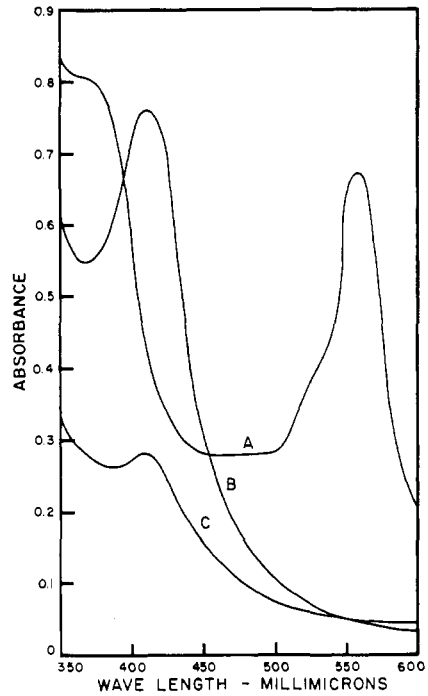

Figure 3. Absorption curves of color complexes (each with 20 γ of reactant)

A. Heptachlor (Polen-Silverman reagent)
B. Heptachlor epoxide (Polen-Silverman reagent)
C. Heptachlor epoxide (Davidow reagent)

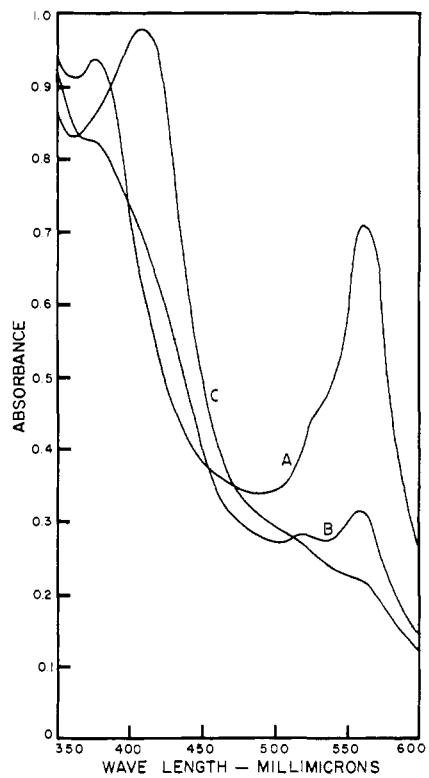

Figure 5. Absorption curves of heptachlor and heptachlor epoxide mixtures.

A. 20 γ of heptachlor and 5 γ of heptachlor epoxide
B. 10 γ of heptachlor and 10 γ of heptachlor epoxide
C. 5 γ of heptachlor and 20 γ of heptachlor epoxide