Studies on the Germination of Seeds. Part III.

Transformation of Carbohydrates During Germination of Soy-Bean Seeds.

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With regard to the carbohydrates of the matured soy-bean seeds, Prof. M. Yukawa⁽¹⁾ made a very valuable investigation and found the following substances:—

Total carbohydrates (in anhydride form).....	21.69%
Cane sugar.....	5.90%
Stachyose.....	3.52%
Araban.....	3.80%
Galactan.....	4.64%
Fiber (crude).....	3.85%

The present paper is to treat briefly the transformations of the foregoing substances, and also reducing sugar and starch, which appear in the seedlings of soy-beans during germination.

Method of Analysis.

Reducing sugar:— The samples were extracted with hot 90% alcohol, clarified with lead acetate, and estimated directly by Bertrand's method and expressed as glucose.

Cane sugar:— The samples were treated with alcohol and lead acetate as in the case of reducing sugar, and inverted with dilute HCl. Then, the total reducing power was determined. Cane sugar was calculated by subtracting from this value which the reducing sugar and the stachyose theoretically indicate.

Stachyose:— Stachyose was calculated from the difference between the weight of mucic acid obtained from all the specimens and that from the residues extracted with hot 90% alcohol.

Starch and dextrin:— Starch and dextrin were estimated together as they were difficult to separate. The residues extracted with hot 90% alcohol were digested with malt extract, and then the reducing power corresponding to starch and dextrin was determined in the usual manner.

Araban:— Araban was determined by Ōshima and Kondō's furfural method⁽²⁾. Pentosan and methyl-pentose were also estimated by the same

method, but the amounts of these substances were rather insignificant and not worth mentioning.

Galactan:— Galactan was estimated by the mucic acid method adapted by H. D. Dore⁽³⁾ from the residues extracted with hot 90% alcohol.

Crude fiber:— Crude fiber was determined as usual.

Results of Analysis.

White autumn seeds (larger specimens) of the bean produced in Korea were used as material for the experiment. The seeds, and the seedlings plucked out every 2, 5, 7, and 10 days after sowing in a dark room were analysed. The figures shown in the following table indicate the per cent of the original weights of the soy-bean seeds used:—

Seeds	Seedling (days after sowing)			
	2	5	7	10
Reducing sugar..... 0.5	2.5	4.7	2.7	1.0
Cane sugar..... 5.0	3.1	1.9	0.8	0.5
Stachyose..... 3.7	2.4	0.8	0.5	0.4
Starch and dextrin..... 0.4	2.0	5.5	7.3	9.0
Araban 4.5	4.9	5.2	5.7	6.1
Galactan..... 4.9	4.0	3.5	3.1	2.9
Crude fiber..... 3.6	3.8	4.2	4.8	5.2
Total.....22.6	22.7	25.8	24.9	25.1

Summary.

Reducing sugar, which is scarcely detected in the seeds, is increased the earlier stage of germination and decreased afterwards. Cane sugar and stachyose are decreased gradually. Starch and dextrin are markedly increased. Galactan is decreased; araban and crude fiber are increased. The total amounts of carbohydrates do not show any marked changes, during the development of the seedlings in the periods of the experiment.

References.

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