

from them are attempted. The cause of this difficulty appears to lie in a more or less gummy substance which accompanies the pectin and which interferes with its nice action. An increase of the acidity of the natural acid of the strawberry (by addition of tartaric acid) aided materially in the precipitation of a jelly from this fruit, but the characteristic flavor of the strawberry was destroyed just as in the case of pear and peach jellies. Cherry juice is so strongly acid that further acidification of it was not attempted. (Wild red cherries were found to yield an excellent jelly.)

Experiment finally proved that in making strawberry and cherry jellies reliance could not be placed upon the first indication of the jelly-test as is usual in other jellies, but that the concentration must be continued beyond that point, and the results were best, although not ideal, when the temperature of the boiling mixture was allowed to reach 105° C. No attempt is made at present to account for this—merely the fact is stated. If the concentration was continued beyond this temperature merely a sticky gummy mass resulted. Very interesting in this connection is the statement by Belling,<sup>1</sup> who, in making guava jelly, found that the boiling point must be raised to 113° C. Evidently the temperature is no infallible criterion for determining the jelly point.<sup>2</sup> Of course, to a certain degree undoubtedly, different experimenters would reach different conclusions regarding the point at which jelly is to be considered done, since the personal equation must enter more or less into any decision regarding the texture of jelly which is to be called ideal.

#### SUMMARY.

1. A very frequent cause of failure in jelly-making is the use of too much sugar.
2. The percentage of inversion of sugar most desirable in jellies has not been determined.
3. Beet sugar and cane sugar may be used interchangeably in jelly-making.
4. Pectin of fruit juices may be hydrolyzed by the acids present if boiled sufficiently long.
5. The raw fruit juices, so far examined, contain less pectin than do those of the cooked fruit. Sometimes the former are pectin-free.
6. The white inner skin of oranges and of lemons is a prolific source of pectin.
7. To insure results approximately good, the boiling point of strawberry and of cherry jellies must be allowed to increase (as much as two degrees) above that at which the jelly-test is observed.
8. Owing to variations in specific gravity and acid-

<sup>1</sup> *Florida Ag. Exp. Sta. Record*, 106, (1908).

<sup>2</sup> The work of Miss Snow (*Farmers' Bull.* 388, 30) regarding the density of jelly at its boiling point may here be cited.

ity of juice, good jellies cannot be made by rule o' thumb.

RESEARCH LABORATORY,  
DEPARTMENT OF HOUSEHOLD SCIENCE,  
UNIVERSITY OF ILLINOIS.

### THE CHEMICAL AND MINERALOGICAL EXAMINATION OF SOME CHINESE TEA SOILS.<sup>1</sup>

By W. O. ROBINSON AND W. J. MCCAUGHEY.

Received June 3, 1910.

Three samples of Chinese tea soils were submitted to this laboratory for analysis by Dr. Rodney H. True, of the Drug Plant, Poisonous Plant, Physiological and Fermentation Investigations, Laboratory of the Bureau of Plant Industry, U. S. Department of Agriculture. These soils were collected by Vice-Consul H. E. Nightingale, from the northern central part of the Province of Fukien, about 150 miles north of Foochow, at Kienning fu and in the Wu I Shan district.

In this district a tea of very superior quality is grown. The varieties are known as the "Dragons Pool" and "White Coxcomb." These teas are not sold but are given as tribute to the Chinese throne. The growth and picking of the tea is attended with religious ceremony.

The soil is held by the Chinese to be the most important factor in tea cultivation. The object is to produce a rather stunted shrub, for it is held that under these conditions a more desirable flavor is developed in the tea. The culture is very simple, being restricted to digging around the plants twice a year and keeping the weeds pulled. They are seldom, if ever, fertilized.

It is interesting to compare the composition of American soils that have been under cultivation for a comparatively very short time, with these Chinese soils, especially when we consider how very little has been added to these latter by way of fertilizers, and that for thousands of years they have been under a clean cultivation, the tea leaves and weeds having been removed from their place of growth and not returned to the soil. The following analyses represent the compositions of soils that have been under cultivation longer probably than any soils of which we are aware. These soils were weathered from Middle Paleozoic formations. The present altitude is 500-1000 feet. The formation has shown a decided tendency to stand high and probably has been subjected to denudations.

Soil No. 1 came from the Wu I Shan district, which is just south of the Tayuling Mountains.

Soils Nos. 2 and 3 came from Kienning fu, a town on the junction of the Min and Sing ki rivers, about 100 miles above Foochow, in the province of Fukien in South China.

<sup>1</sup> Published by permission of the Secretary of Agriculture.

The following examinations have been made:

1. Chemical, consisting of an analysis for the total constituents and the constituents soluble in hydrochloric acid according to the official method given in Bulletin No. 107 of the Bureau of Chemistry, U. S. Department of Agriculture.
2. Mechanical analysis.
3. Mineralogical examination.
4. An examination made for the purpose of correlating these soils with recognized American types.

The chemical examination shows that the composition is much the same as that of fertile American soils. The phosphoric acid is fairly high, both the total and the acid-soluble. The acid-soluble potash, lime and magnesia are much the same as in the American soils.

The analyses are given in Tables I and II.

TABLE I.—COMPOSITION OF CHINESE TEA SOILS.

Ultimate analysis. Analyses made by W. O. Robinson.

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.
Loss on ignition.....	10.14	6.69	8.29
SiO <sub>2</sub> .....	54.75	73.97	67.36
Fe <sub>2</sub> O <sub>3</sub> .....	9.50	3.65	5.26
Al <sub>2</sub> O <sub>3</sub> .....	22.02	12.48	13.72
TiO <sub>2</sub> .....	0.95	0.53	0.81
MnO.....	0.023	0.014	0.105
CaO.....	0.18	0.28	0.58
MgO.....	0.14	0.52	0.45
Na <sub>2</sub> O.....	0.26	0.34	0.42
K <sub>2</sub> O.....	1.26	1.71	2.32
P <sub>2</sub> O <sub>5</sub> .....	0.51	0.24	0.59

TABLE II.—COMPOSITION OF CHINESE TEA SOILS.

Acid digestion. Official method. Analyses made by W. O. Robinson.

	No. 1. Per cent.	No. 2. Per cent.	No. 3. Per cent.
Loss on ignition.....	10.14	6.48	8.01
Insoluble.....	63.98	81.27	79.28
Fe <sub>2</sub> O <sub>3</sub> .....	8.82	3.03	4.41
Al <sub>2</sub> O <sub>3</sub> + TiO <sub>2</sub> .....	16.43	7.83	6.63
MnO.....	0.022	0.012	0.095
CaO.....	0.11	0.10	0.23
MgO.....	0.09	0.40	0.41
Na <sub>2</sub> O.....	0.09	0.08	0.09
K <sub>2</sub> O.....	0.39	0.44	0.31
P <sub>2</sub> O <sub>5</sub> .....	0.24	0.14	0.32
Nitrogen by moist combustion.....	0.052	0.068	0.154

The solubility of the potash in these soils is interesting. It will be seen that soil No. 3 is highest in total potash and lowest in acid-soluble potash. By inspection of Table IV it is evident that soil No. 3 differs quite widely in mineralogical composition from No. 1 and No. 2, the most striking difference being the large amount of microcline in No. 3. This

TABLE III.—MECHANICAL ANALYSES OF SOILS FROM CHINA, MADE BY C. C. FLETCHER.

No.	Description.	Organic matter. Per cent.	Fine earth.						
			Fine gravel, 2 to 1 mm. Per cent.	Coarse sand, 1 to 0.5 mm. P. ct.	Medium sand, 0.5 to 0.25 mm. P. ct.	Fine sand, 0.25 to 0.1 mm. P. ct.	Very fine sand 0.1 to 0.05 mm. P. ct.	Silt 0.05 to 0.005 mm. Per cent.	Clay 0.005 to 0 mm. Per cent.
(1)	Red clay.....	1.8	5.0	3.4	7.8	4.2	19.4	58.3	
(2)	Loam.....	5.9	14.3	8.4	12.2	8.4	24.0	26.8	
(3)	Loam.....	2.4	6.5	6.4	18.1	14.2	30.6	21.7	

mineral is found in the soil with sharp, unweathered faces and is acid-resistant, facts that account for the low solubility of potash.

The mechanical analysis given in Table III shows that soil No. 1 is a heavy clay and that soils Nos. 2 and 3 are loams.

The results of the mineralogical examination are given in Table IV. Examination by W. J. McCaughey:

TABLE IV.

No. 1. Clay soil. The sands are largely quartz; minerals other than quartz relatively low; of these zircon and mica are most abundant. The mica, for the greater part, is biotite. Hornblende, chlorite and tourmaline are present. Hornblende and biotite show weathering and transformation into chlorite.

No. 2. Loam. Minerals other than quartz in the sands are fairly abundant. Micas (biotite and muscovite) very abundant. Orthoclase abundant, being largely kaolinized. Tourmaline is present. Microcline and zircon are common accessories.

No. 3. Loam. Kaolin, quartz, mica (muscovite and phlogopite), microcline, and magnetite are quite abundant. Hematite is present in some quantity, generally as a coating on soil grains. Partly kaolinized orthoclase is a common accessory. Hornblende, epidote, tourmaline and zircon are present. The mica carries inclusions of apatite and magnetite.

It is the opinion of Professor G. P. Merrill, who has kindly looked over the rock fragments in these soils, that Soils Nos. 1 and 2 have probably resulted from the decay of sandstones, the material having been transported but little and being originally derived from granitic material. Soil No. 3 has probably resulted from the decay of a volcanic mud of the trachyte type. The rock fragments contain quartz and are plainly secondary.

There are no soils yet described in the United States that correspond in general type characteristics to these Chinese soils. The nearest approach are the soils of the Cecil, Chester or Durham series. They most resemble the soils in the southern Piedmont plateau and those in Oklahoma, and this fact, in view of the conditions of the climate in these regions, would appear to make these areas desirable for experimental work on tea culture.

BUREAU OF SOILS.  
U. S. DEPT. OF AGRICULTURE.

## NOTES ON THE DETERMINATION OF NITROGEN BY THE KJELDAHL METHOD.

By P. L. HIBBARD.

Received July 29, 1910.

The routine chemist usually follows some official or prescribed method, with little thought as to the reasons for each step, or the effect of variations. He should know the effect of varying time, temperature, quantity of reagents, and size of apparatus on his results. In view of these needs the following experiments were made. It is to be understood that they cover only part of the ground and that only a few of the possible variations have been tried. Naturally the practice in different laboratories varies to some extent.

*Conditions of the Experiments.*—Substance taken—1.401 grams (ground to pass 1 mm. sieve) with