A PHYTOCHEMICAL STUDY OF HYDRASTIS CANADENSIS (GOLDENSEAL).

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(*Continued from p. 224, March Issue.*)

COMPARISON OF THE ACID-SOLUBLE ASH CONTENT AND THE ABSOLUTE ALKALOIDAL CONTENT OF THE RHIZOME.

In order to offer a comparison between the acid-soluble ash content and the alkaloidal content, it was necessary to reduce the latter to a comparative basis, *i. e.*, compute the percentage of alkaloid on the drug free from moisture and acid-insoluble ash (sand).

Of the thirty-seven samples of drug observed, twenty-six, or 70 per cent, showed that with every increase or decrease of alkaloidal percentage of rhizome there was a like increase or decrease of percentage of acid-soluble ash.

It is difficult to explain the discrepancies for the abrupt increase of acid-soluble ash in March and September 1929.

TABLE IX.—COMPARISON OF ACID-SOLUBLE ASH CONTENT AND ABSOLUTE ALKALOIDAL CONTENT OF THE RHIZOME.

Stock no.	Age.	Month.	Year.	% sol.-ash rhizome.	% alkaloids rhizome.
1	3	September	1927	2.55	3.44
5	3	September	1927	2.75	3.71
35	3	September	1928	2.37	3.19
32	3	September	1928	2.77	3.63
6	4	September	1927	2.88	4.03
31	4	September	1928	2.51	3.36
2	5	September	1927	2.43	3.54
30	5	September	1928	2.49	3.87
53	5	February	1929	3.18	4.56
52	6	March	1929	3.30	4.54
54	6	March	1929	5.00	4.89
55	6	April	1929	3.30	4.94
56	6	May	1929	2.85	4.79
37	6	June	1928	1.83	3.85
58	6	June	1929	2.31	4.42
60	6	July	1929	2.20	3.99
39	6	August	1928	2.21	3.92
4	6	September	1927	2.44	4.19
3	6	September	1927	2.80	3.95
22	6	September	1927	2.99	3.26
66	6	September	1929	2.37	3.43
67	6	September	1929	2.15	3.34
70	6	September	1929	2.51	4.07
65N	6	September	1929	2.39	3.06
65J	6	September	1929	2.44	3.34
65I	6	September	1929	3.06	4.02
65A	6	September	1929	2.53	3.38
65C	6	September	1929	2.48	3.35
65G	6	September	1929	4.27	3.35
65D	6	September	1929	1.50	4.76
65L	6	September	1929	2.18	3.21
42	6	October	1928	3.67	4.04

72A	6	October	1929	2.68	3.88
72C	6	October	1929	2.86	3.99
48	6	October	1928	2.93	4.60
7	12	September	1927	2.89	3.47
68D	14	September	1929	2.125	2.92
		Maximum		5.00	4.94
		Average		2.71	3.85
		Minimum		1.50	2.92

COMPARISON OF THE ACID-SOLUBLE ASH CONTENT AND THE ABSOLUTE ALKALOIDAL CONTENT OF THE ROOT.

The comments made on the relation of the acid-soluble ash to the absolute alkaloidal content of the rhizome may also be applied to the root. An increase or decrease of alkaloidal content of the root is followed by a like increase or decrease of acid-soluble ash content in approximately seven out of ten of the assays included in Table X.

However, it is quite readily seen that the variation of acid-soluble ash for either rhizome or root is quite erratic. Unfortunately, porcelain crucibles were used for ash determinations. After noting the irregularities of the results, the crucibles were examined. The conclusion was that these may have contributed to the irregularities because of their condition.

TABLE X.—COMPARISON OF THE ACID-SOLUBLE ASH CONTENT AND THE ABSOLUTE ALKALOIDAL CONTENT OF THE ROOT.

Stock no.	Age.	Month.	Year.	Acid-sol. root.	Absol. assay root.
33	2	September	1928	4.30	2.33
1	3	September	1927	4.78	2.67
5	3	September	1927	2.23	2.70
35	3	September	1928	4.26	2.48
32	3	September	1928	4.11	2.35
6	4	September	1927	5.09	2.91
31	4	September	1928	4.32	2.20
2	5	September	1927	4.02	2.93
30	5	September	1928	2.69	2.37
53	6	February	1929	5.69	2.77
52	6	March	1929	5.59	2.77
54	6	March	1929	6.02	3.28
55	6	April	1929	6.48	3.44
56	6	May	1929	4.94	3.20
36	6	May	1928	4.76	3.52
37	6	June	1928	3.13	2.36
58	6	June	1929	4.18	3.31
60	6	July	1929	3.80	2.73
39	6	August	1928	2.91	2.39
4	6	September	1927	4.90	2.93
3	6	September	1927	3.88	3.02
22	6	September	1927	4.63	2.63
28	6	September	1928	4.54	2.29
66	6	September	1929	4.20	2.38
67	6	September	1929	3.65	2.41
70	6	September	1929	3.74	2.96
65N	6	September	1929	3.44	2.50
65J	6	September	1929	3.51	2.25

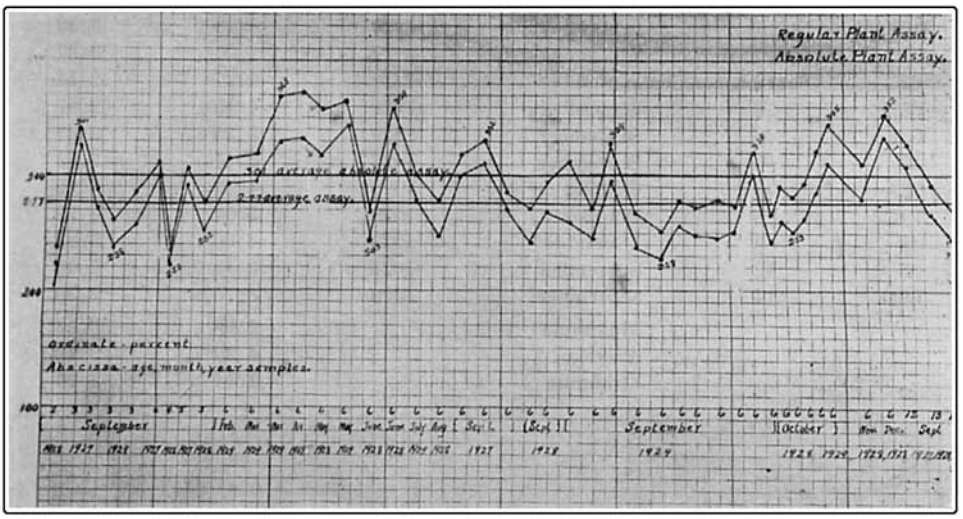

Chart 8.—A comparison of United States Pharmacopœia and absolute assays (Tables VI and VII combined).

	Rhizome.	Root.
Maximum	3.45	3.73
Average	2.82	3.01
Minimum	2.22	2.34

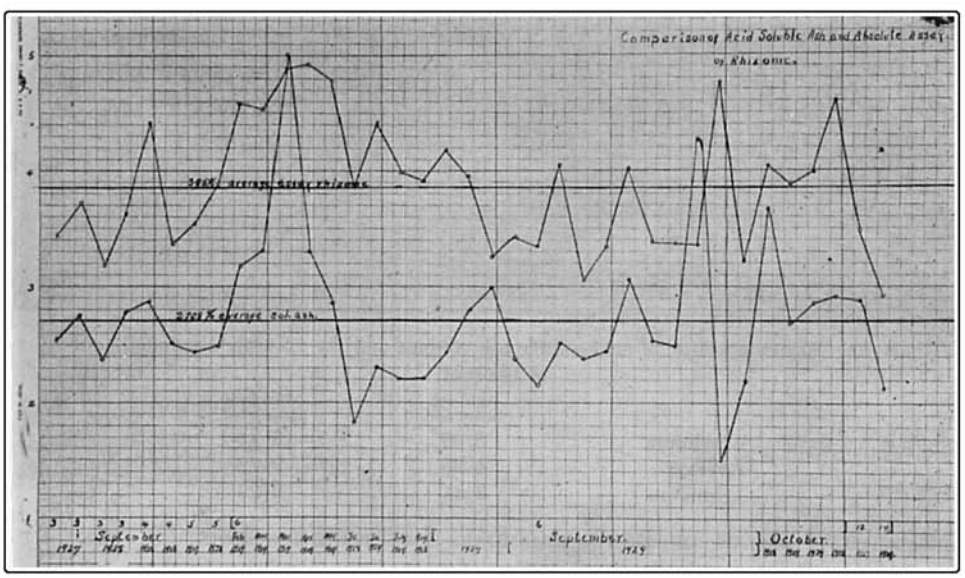

Chart 9.—Comparison of acid-soluble ash content and absolute alkaloidal content of the rhizome.

	Rhizome.	Root.
Maximum	5.00	4.94
Average	2.71	3.85
Minimum	1.50	2.92

65I	6	September	1929	4.93	2.37
65A	6	September	1929	3.90	2.52
65C	6	September	1929	4.03	2.27
65G	6	September	1929	4.27	2.51
65D	6	September	1929	4.45	2.97
65L	6	September	1929	3.35	2.41
42	6	September	1928	2.44	2.73
72A	6	October	1929	4.15	2.92
72C	6	October	1929	5.04	3.23
48	6	December	1928	4.60	3.25
7	12	September	1927	3.13	3.11
68D	14	September	1929	3.76	2.30
		Maximum		5.09	3.44
		Average		4.20	2.72
		Minimum		2.44	2.20

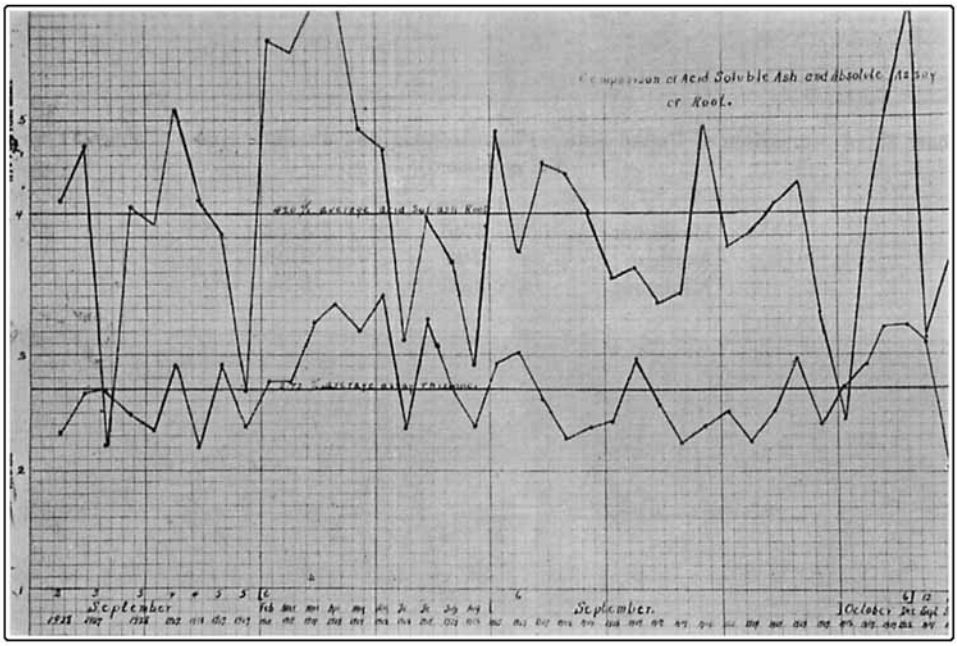

Chart 10.—The comparison of acid-soluble ash content and the absolute alkaloidal content of the root.

	Acid-sol. ash-root.	Absolute assay-root.
Maximum	5.09	3.44
Average	4.20	2.72
Minimum	2.44	2.20

APPROXIMATE ASSAYS OF NON-ALKALOIDAL CONSTITUENTS—MOISTURE CONTENT.

The United States Pharmacopœial method was employed.

Ten grams of the ground drug were weighed in a tared vessel. It was dried at a temperature of 100° C. for five hours and weighed. The drying and weighing were continued until the loss was not more than 0.25 per cent in one hour.

Average moisture content for rhizome was 7.64%
Average moisture content for root was 7.93%

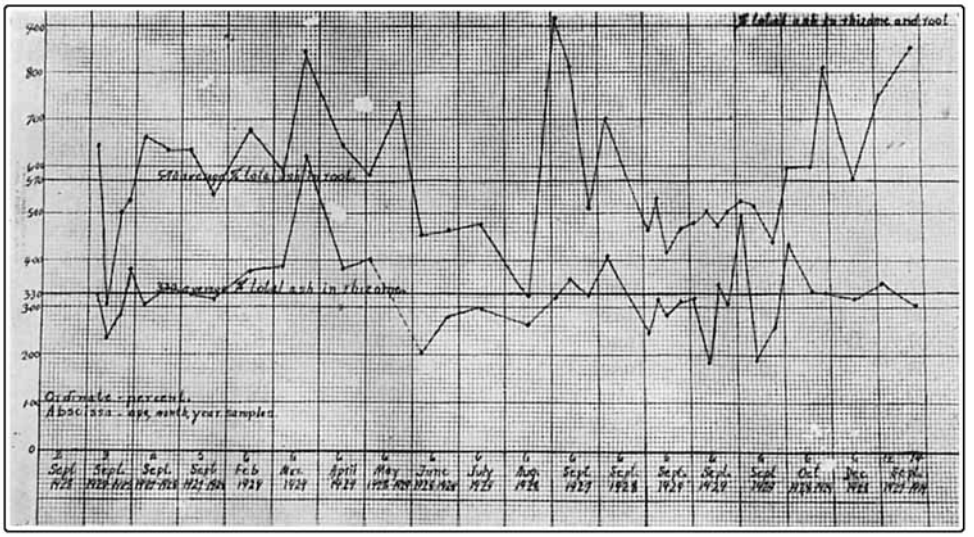

Chart 11.—Percentage of total ash in rhizome and root.

	Total ash, rhizome.	Total ash, root.
Maximum	6.25	8.50
Average	3.30	5.70
Minimum	1.84	4.19

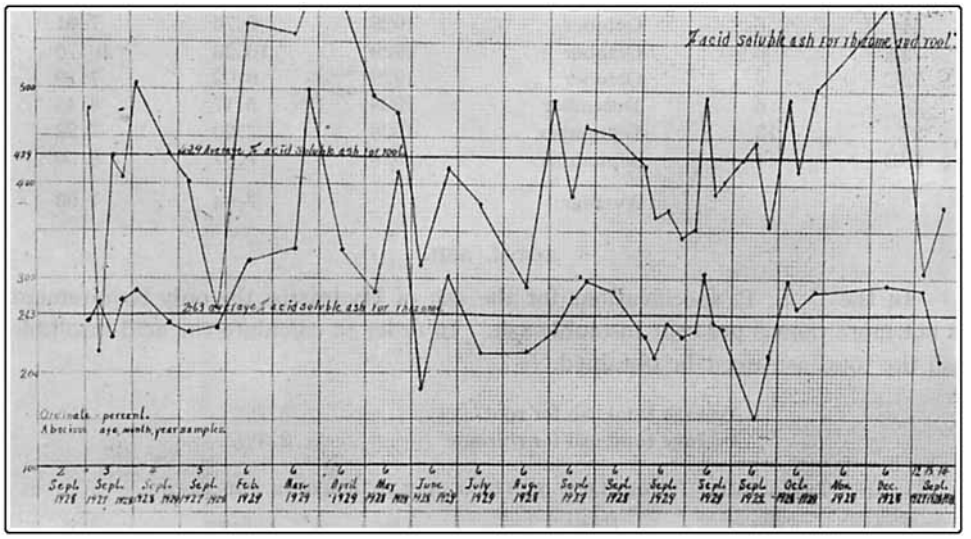

Chart 12.—Percentage acid-soluble ash.

	Acid-sol. ash-rhizome.	Acid-sol. ash-root.
Maximum	5.00	5.97
Average	2.63	4.29
Minimum	1.50	2.69

TABLE XI.—MOISTURE CONTENT.

Stock no.	Age.	Month.	Year.	% moisture, rhizome.	% moisture, root.
35	3	September	1928	7.81	8.51
32	3	September	1928	6.99	7.35
31	4	September	1928	7.71	8.06
30	5	September	1928	7.08	8.06
53	6	February	1929	7.07	7.17
52	6	March	1929	7.95	7.06
54	6	March	1929	7.94	8.05
55	6	April	1929	8.33	6.80
56	6	May	1929	7.78	8.12
37	6	June	1928	8.79	8.20
58	6	June	1929	8.65	9.07
60	6	July	1929	5.41	6.37
39	6	August	1928	8.48	9.28
26	6	September	1928	7.09	7.49
67	6	September	1929	10.28	8.79
66	6	September	1929	6.30	8.03
70	6	September	1929	8.29	11.57
65N	6	September	1929	7.69	10.63
65J	6	September	1929	7.69	8.39
65I	6	September	1929	6.40	9.08
65A	6	September	1929	9.55	7.64
65C	6	September	1929	5.38	4.38
65G	6	September	1929	8.05	6.43
65D	6	September	1929	6.62	5.32
65L	6	September	1929	7.10	8.24
40	6	October	1928	7.58	7.59
41	6	October	1928	6.76	7.91
72A	6	October	1929	10.23	10.70
72C	6	October	1929	9.02	7.19
48	6	December	1928	5.17	8.45
27	13	September	1928	7.20	7.22
68D	14	September	1929	7.87	8.50
		Average		7.64	7.93

TOTAL ASH.

In the U. S. P. specifications for the ash of Hydrastis, the only requirement is not more than 3 per cent insoluble ash. In order to calculate the acid-insoluble ash the total ash must be obtained.

Average total ash for root	5.7%
Average total ash for rhizome	3.3%

TABLE XII.—PERCENTAGE OF TOTAL ASH IN RHIZOME AND ROOT.

Stock no.	Age.	Month.	Year.	Rhizome.	Root.
33	2	September	1928		5.33
1	3	September	1927	3.29	6.45
5	3	September	1927	2.90	3.06
35	3	September	1928	2.81	5.13
32	3	September	1928	3.82	5.28
6	4	September	1927	3.03	6.65
31	4	September	1928	3.40	6.36

2	5	September	1927	3.28	6.35
30	5	September	1928	3.16	5.38
53	6	February	1929	3.76	6.78
52	6	March	1929	3.87	5.88
54	6	March	1929	6.25	8.45
55	6	April	1929	3.82	6.48
56	6	May	1929	4.02	5.83
36	6	May	1928		7.35
37	6	June	1928	2.12	4.55
58	6	June	1929	2.80	4.61
60	6	July	1929	2.97	4.75
39	6	August	1928	2.62	3.25
4	6	September	1927	3.20	9.18
3	6	September	1927	3.60	8.12
22	6	September	1927	3.26	5.10
28	6	September	1928	4.10	7.00
29	6	September	1928		7.41
67	6	September	1929	2.47	4.63
66	6	September	1929	3.15	5.30
70	6	September	1929	2.82	4.19
65N	6	September	1929	3.11	4.66
65J	6	September	1929	3.20	4.79
65I	6	September	1929	1.84	5.07
65A	6	September	1929	3.50	4.72
65C	6	September	1929	3.08	5.03
65C	6	September	1929	4.95	5.25
65L	6	September	1929	2.57	4.39
41	6	October	1928	4.33	5.96
72A	6	October	1929	3.30	5.95
72C	6	October	1929	3.39	8.09
48	6	December	1929	3.18	5.70
7	12	September	1927	3.55	7.50
68D	14	September	1929	3.05	8.51
		Maximum		6.25	8.50
		Average		3.30	5.70
		Minimum		1.84	4.19

ACID-SOLUBLE ASH.

Two grams of drug were ashed according to the U. S. P. method. The insoluble ash obtained was deducted from the value for the total ash. The difference represented the acid-soluble ash.

Average acid-soluble ash for root	4.29%
Average acid-soluble ash for rhizome	2.63%

TABLE XIII.—PERCENTAGE ACID-SOLUBLE ASH.

Stock no.	Age.	Month.	Year.	Rhizome.	Root.
33	2	September	1928		4.30
1	3	September	1927	2.55	4.78
5	3	September	1927	2.75	2.23
35	3	September	1928	2.37	4.26
32	3	September	1928	2.77	4.11
6	4	September	1927	2.88	5.09
31	4	September	1928	2.51	4.32
2	5	September	1927	2.43	4.02

Table XIII.—*Concluded.*

Stock no.	Age.	Month.	Year.	Rhizome.	Root.
30	5	September	1928	2.49	2.69
53	6	February	1929	3.18	5.69
52	6	March	1929	3.30	5.59
54	6	March	1929	5.00	6.02
55	6	April	1929	3.30	6.48
56	6	May	1929	2.85	4.94
36	6	May	1928	4.14	4.76
37	6	June	1928	1.83	3.13
58	6	June	1929	2.31	4.18
60	6	July	1929	2.20	3.80
39	6	August	1928	2.21	2.91
4	6	September	1927	2.44	4.90
3	6	September	1927	2.80	3.88
22	6	September	1927	2.99	4.63
28	6	September	1928	2.87	4.54
66	6	September	1929	2.37	4.20
67	6	September	1929	2.15	3.65
70	6	September	1929	2.51	3.74
65N	6	September	1929	2.39	3.44
65J	6	September	1929	2.44	3.51
65I	6	September	1929	3.06	4.93
65A	6	September	1929	2.53	3.90
65C	6	September	1929	2.48	4.03
65G	6	September	1929	4.27	4.27
65D	6	September	1929	1.50	4.45
65L	6	September	1929	2.18	3.35
41	6	October	1928	2.97	4.91
72A	6	October	1929	2.68	4.15
72C	6	October	1929	2.86	5.04
48	6	December	1928	2.93	5.97
7	12	September	1927	2.89	3.13
68DB	14	September	1929	2.125	3.76
42	6	October	1928	3.67	2.44
		Maximum		5.00	5.97
		Average		2.63	4.29
		Minimum		1.50	2.69

ACID-INSOLUBLE ASH.

The U. S. P. method was employed.

Boil the ash obtained from two Gm. of drug with 25 cc. of dilute hydrochloric acid for 5 minutes, collect the insoluble matter in an ashless filter, wash with hot distilled water, ignite and weigh.

Average acid-insoluble ash for root	0.68%
Average acid-insoluble ash for rhizome	1.39%

The U. S. P. limits the acid insoluble for hydrastis to not more than 3 per cent.

TABLE XIV.—PERCENTAGE OF ACID-INSOLUBLE ASH.

Stock no.	Age.	Month.	Year.	Rhizome.	Root.
33	2	September	1928		0.93
1	3	September	1927	0.74	1.67
5	3	September	1927	0.15	0.83
35	3	September	1928	0.44	0.87

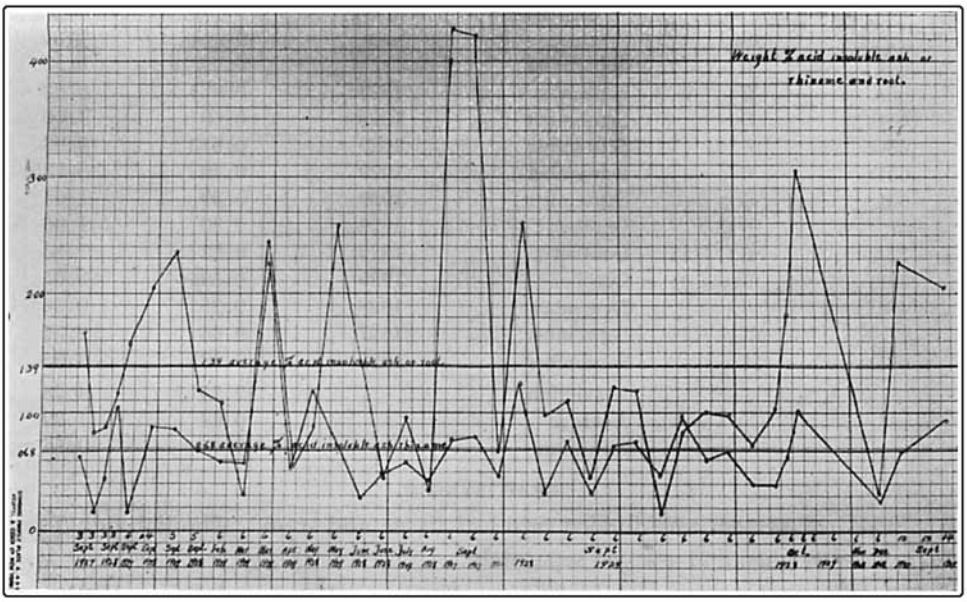

Chart 13.—Percentage of acid-insoluble ash.

	Acid-insol. ash rhizome.	Acid-insol. ash root.
Maximum	2.25	4.28
Average	.68	1.39
Minimum	.15	.15

TABLE XIV.—*Continued.*

Stock no.	Age.	Month.	Year.	Rhizome.	Root.
36	3	September	1928	1.05	1.16
6	4	September	1927	0.15	1.56
31	4	September	1928	0.89	2.05
2	5	September	1927	0.85	2.33
30	5	September	1928	0.67	1.19
53	6	February	1929	0.58	1.09
52	6	March	1929	0.57	0.30
54	6	March	1929	2.25	2.43
55	6	April	1929	0.52	0.53
56	6	May	1929	1.17	0.88
36	6	May	1928		2.59
37	6	June	1928	0.29	1.42
58	6	June	1929	0.49	0.44
60	6	July	1929	0.57	0.95
39	6	August	1928	0.41	0.34
4	6	September	1927	0.76	4.28
3	6	September	1927	0.80	4.22
22	6	September	1927	0.47	0.66
28	6	September	1928	1.23	2.46
67	6	September	1929	0.325	0.975
66	6	September	1929	0.775	1.10
70	6	September	1929	0.313	0.45
65N	6	September	1929	0.725	1.23
65J	6	September	1929	0.765	1.285

TABLE XIV.—*Concluded.*

Stock no.	Age.	Month.	Year.	Rhizome.	Root.
65I	6	September	1929	0.49	0.15
65A	6	September	1929	0.975	0.82
65C	6	September	1929	0.60	1.00
65G	6	September	1929	0.675	0.98
65D	6	September	1929	0.40	0.735
65L	6	September	1929	0.39	1.04
41	6	October	1929	1.36	1.05
72A	6	October	1929	0.62	1.83
72C	6	October	1929	0.524	3.05
48	6	December	1928	0.25	0.33
7	12	September	1927	0.66	2.37
68D	14	September	1929	0.925	2.05
		Maximum		2.25	4.28
		Average		0.68	1.39
		Minimum		0.15	0.15

LEAF SYSTEM.

The leaf system was divided into leaf tissue and stem. The individual portions were weighed and assayed separately.

Stock no.	Month.	Year.	Wt. %, stem.	Wt. %, leaf.	Assay stem.	Assay leaf.	Absolute assay.
36	May	1928	40.0	60.0	0.88	1.80	1.65
37	June	1928	45.5	54.5	0.33	1.60	1.13
44	Aug.	1928	46.9	53.1	0.34	1.32	0.93
45	Sept.	1928	30.0	70.0	0.33	1.45	1.20
56	May	1929	37.7	62.3	0.71	2.19	1.80
58	June	1929	28.4	71.6	0.64	1.84	1.65
60	July	1929	41.4	58.6	0.41	1.44	1.09
63	Sept.	1929	38.6	61.4	0.43	1.59	1.27

The average weight percentage of stem	37.6%
The average weight percentage of leaf tissue	61.4%
The average assay of stem	0.51%
The average assay of leaf tissue	1.65%
The average absolute assay	1.34%

GOVERNMENT SUPERVISION OF PLANT CULTIVATION IN ITALY.

The Italian Minister of Agriculture and Forests has recently published a decree, the purpose of which is to control and stimulate the cultivation of medicinal plants. The decree makes it obligatory that those engaging in the cultivation and processing of medicinal plants be certified horticulturists. The sale of such plants is reserved entirely to pharmacists having a degree in horticulture. A central committee of official horticulturists under the supervision of the Minister of Agriculture has been created to supervise activities in connection with plant cultivation. A fund of 500,000 lire has been established to carry on this mark. (Trade Commissioner Elizabeth Humes, Rome.)

DRUG COÖPERATIVE MOVEMENT IN PORTO RICO.

A coöperative movement among the drug importers and dealers in Porto Rico has taken the name of Sociedad Coöperative Farmaceutica de Puerto Rico. Members pay to the Society a 10 per cent commission on their purchases. From this fund operating expenses are paid and any balance at the end of the year is returned to the members, prorated according to their purchases. Membership is obtained by purchasing a share of stock, par value $100, which may be bought on installments. A member may buy through the Society on credit, up to the amount he has paid on his share. All other transactions are strictly cash. The Society is reported to have at present 167 members. (Trade Commissioner J. R. McKey, San Juan.)