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REPORT

ON THE

CHEMICAL ANALYSIS OF GRAPES,

SUBMITTED TO

HON. ISAAC NEWTON,

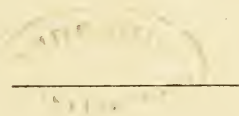
COMMISSIONER OF AGRICULTURE,

BY

CHARLES M. WETHERILL, Ph. D., M.D.,

CHEMIST OF THE DEPARTMENT.

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DEPARTMENT OF AGRICULTURE,
Washington, D. C., October 1, 1862.

DEAR SIR: As those who are engaged in the cultivation of the grape are now employed in securing their vintage, I am desirous of placing in their hands, at an early day if possible, the result of your experiments on grapes, which are now in progress in the laboratory of the Department of Agriculture.

If the analysis is sufficiently advanced to enable this to be done, please furnish me with a report for publication.

Very respectfully,

ISAAC NEWTON,
Commissioner.

Dr. CHARLES M. WETHERILL.

DEPARTMENT OF AGRICULTURE,
Washington, D. C., October 15, 1862.

SIR: In compliance with your note of the 1st instant, I have the pleasure to submit the following report, showing what progress has been made upon the chemical analysis of certain grapes undertaken in the laboratory by your direction. I reserve for my annual official report to you the particulars of the work. Having been detailed temporarily from your Department by the President upon special service of importance, I have been obliged to work upon this research at intervals, and the period of the ripening of the grapes being a definite one, the analysis had to be performed rapidly. This has prevented further detail in some of the experiments, and for this reason particular attention has been bestowed upon the *sugar percentage* of the juice, as affording (other things being equal) a criterion for the alcoholic strength possible in the wine.

You furnished me with grapes from four sources: First, from the gardens of the Department; secondly, from the September exhibition of the Fruit Growers' Society of Eastern Pennsylvania, held at Philadelphia, the specimens having been collected by Mr. William Saunders, of the propagating garden of the Department; thirdly, two specimens from Downington, Pa, through Captain I. H. Diller, of Virden, Ill.; fourthly, one specimen (Cuepern, No. 9,) from Mr. Charles J. Uhlmann, an experienced and scientific grape cultivator of Washington. This grape is interesting as a foreign specimen, having been imported by Mr. Uhlmann three years ago from Sans Souci, near Berlin. Mr. Uhlmann informs me that the vine stands the climate well, and is in a flourishing condition. The other grapes are well known to vine-dressers, and some of them bear a high reputation as wine grapes. I think that the results arrived at cannot fail to interest the friends of the vine, but care must be taken not to draw too sweeping inferences from the analysis of single specimens. The cultivation of the grape, which is destined at no distant period to be welcomed as a source of great national wealth, is yet in its infancy in our country. Investigations, in which chemistry will play an important part, will direct attention to that class of grapes best adapted for wine. It would hasten this result to analyze one variety at a time, selecting many specimens from various localities, and taking in consideration the soil, mode of cultivation, bearing capacity, climatic relations, &c.

I would suggest that arrangements be made to continue this subject with increased facilities next fall.

The accompanying table embodies the results of the analysis of twenty-four varieties of grapes.



No.	Designation of the grapes.	Approximate percentage of juice in the grape.	Specific gravity of the juice.	Percentage of extract of juice dried at 110° centigrade.	Percentage of ash in the juice.	Percentage of dry grape sugar in the juice, by Fehling's test.	Percentage of acid above neutrality in the juice, calculated as dry tartaric acid.
1	Rabe.	79.70	1.079	18.84	0.34	15.87	0.996
2	Baldwin Le Noir.	82.67	1.107	23.43	0.49	20.36	0.933
3	Rebecca.	80.82	1.088	16.63	(*)	11.63	0.514
4	Deveraux.	73.19	1.096	30.86	0.78	11.55	0.803
5	Cathy's August.	70.48	1.082	15.87	(*)	11.70	(*)
6	Black September.	72.60	1.057	10.58	0.80	8.95	1.754
7	Clinton.	76.08	1.096	19.50	0.61	17.07	1.022
8	To Kabon.	79.62	1.077	15.19	(*)	12.63	0.817
9	Cueperu.	85.83	1.079	17.45	(*)	14.12	(*)
10	Cape.	78.90	1.065	13.06	(*)	10.45	(*)
11	Norton's Early Virginia.	77.62	1.089	19.21	(*)	15.90	(*)
12	Diana.	74.82	1.085	17.69	(*)	14.87	(*)
13	Union Village.	86.26	1.043	9.86	(*)	7.73	(*)
14	Montgomery.	88.06	1.047	10.65	(*)	8.40	(*)
15	Cassidy.		1.087	19.30	(*)	15.41	(*)
16	Herbemont.		1.080	23.73	(*)	16.73	(*)
17	Delaware.		1.077	(*)	(*)	13.41	(*)
18	Marion.		1.071	(*)	(*)	13.25	(*)
19	Trimon.		1.055	10.31	(*)	9.57	(*)
20	Ontario.		1.043	(*)	(*)	10.76	(*)
21	Esensburg.		1.062	(*)	(*)	8.35	(*)
22	Anna.		1.073	(*)	(*)	11.98	(*)
23	Schuykill, (Isabella).	77.64	1.069	14.39	(*)	14.60	0.811
24	Bland, (Catawba).	81.60	1.072	14.29	(*)	11.91	0.838

* Not determined.

The first column of numbers represents the approximate percentage of juice in the grape. The results were obtained by pressing the weighed grapes in a muslin cloth, and weighing the residue in the cloth without drying it. The third column contains the percentage of extract or solid matter left by evaporating the juice to dryness, and exposing it to a temperature a little above that of boiling water. I think that these numbers are probably too low, as I observed in all of the extracts that a portion of the sugar had been converted into *caramel*. This fact may perhaps account for a discrepancy in the extract and sugar percentages of Ex. 23, 24. Column four exhibits the percentage of ash in the juice, where a sufficiency of material enabled the determination. Enough ash remains for a qualitative analysis.

Column five embodies the result of the sugar percentage in the juice by Fehling's test. The test solution was prepared carefully according to Fehling's formula, and its percentage of copper was determined by a particular experiment. As 180 parts of grape sugar are equivalent to 92 parts of alcohol, a larger percentage of alcohol in the wine than half the percentage of sugar in the juice is not possible, unless sugar has been added to the juice.

The last column contains the percentage of free acid in the juice calculated as if it were dry tartaric acid. Circumstances permitted only nine acid determinations, which is to be regretted, as the point is an interesting one.

An examination of the table will enable a comparison to be made of the different grapes, and by the aid of Mulder's work upon the chemistry of wine, we may also institute a comparison of these with foreign wine grapes.

Before doing this, however, it will be proper to disclaim any servile imitation of Europe in wines or in any other agricultural products. Perhaps in nothing is the individuality of a nation represented as strongly as in the character of its wines. Take those of France, Germany, Spain, Portugal, and Italy, for example, how strongly marked is the character of each! And so will it be with the wines of America. The wines of the old country have had the benefit of centuries of cultivation, and with this advantage they have, in the opinion of some, received the evil of the grape disease. Let it, then, be the aim of American vine-dressers to strive less after the introduction of foreign vines than the improvement by cultivation of our own native varieties.

In the following comparison, Mulder's remarks relate to the highly cultivated wine grapes of Europe, of the great variety of which an estimate may be formed from his reminding us that Chaptal, when minister of the interior, caused 1,400 different species of vines to be transplanted out of France alone, into the garden of the Luxembourg.

Regarding the percentage of juice in the grape, Berthier's analysis of *Chasselas* and *Pineau*, grown in the neighborhood of Paris, shows a percentage respectively of 73.81 and 72.43.

Of the specific gravity of grape juice, Chaptal found, in that of the Cher and Loire, from 1.0627 to 1.0825, and Fontenelle, in 1822, from 1.029 to 1.1283. In the juice of the grapes of Stuttgart, 1.066 to 1.099. In that of Marbach, 1809, from 1.054 to 1.047. In 1811, from 1.084 to 1.074. In the Neckar district, 1.050 to 1.090, and near Heidelberg, 1.039 to 1.091.

Respecting the percentage of sugar, Mulder gives from 10 to 12 for the percentage of total *extract* of the juice of fine purple grapes of Holland dried at 110°, which, of course, is not all sugar. He estimates the sugar percentage of the wine grapes of Europe between 13 and 30, as follows, viz:

Estimate.

Analyst.	Locality.	Per cent sugar.
Chaptal	Banks of Cher and Loire	15 to 29
Fontenelle.....	South of France.....	18 to 30
Guenzler	Stuttgard	15 to 22
Ruess	Stuttgard	13 to 25
Schnebler and Koehler, ...	Neckar	14 to 24
Klubeck	Styria	17 to 26
Metzger	Heidelberg	14 to 22
Balling	Bohemia	14 to 23

The American vine-dresser may take encouragement from this comparison to persevere in his efforts for the improvement of the wine grapes of our country.

In regard to the laboratory work in progress, I have received this day some fine specimens of the hemp plant from Kentucky for the purpose of analyzing its ash, and for an examination of the plant as to its narcotic principle. It is expected that the specimens of sorghum from the West will not be delayed much longer.

As soon as arrangements now in progress in the laboratory are perfected, I shall be able to perform analyses of soils, manures, muck, mineral ingredients of plants, and such substances as are interesting to the chemistry of agriculture.

Permit me, in closing this report, to express the hope that Congress will see the importance (greater in war than in peace) of placing your Department in a position to render efficient chemical aid to the great agricultural interests of the country. Without a proper share of chemistry in the Department of Agriculture it is difficult to conceive how we can avoid being the blind *followers* of the chemists of similar departments in foreign governments, instead of *leaders* striving to establish a national system of agriculture. Whatever is individual and peculiar to our country must be studied by ourselves; we cannot expect the savans of Europe to make the investigation for us. Many practical questions in American agriculture demand answers; success cannot be expected without the union of chemical science with practical experience. Shall not the Department of Agriculture be placed in a position to endeavor to answer these questions?

I am, very respectfully, your obedient servant,

CHARLES M. WETHERILL.

Hon. ISAAC NEWTON,
Commissioner of Agriculture.

