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CONTENTS.

The matter of this Bulletin, that has any permanent value, will be carefully revised and made part of the next Annual Report of the Director of this Station.

EXAMINATION OF THE SEED OF ORCHARD GRASS,

Dactylis glomerata.

This species is one of the best meadow grasses. It roots deeply and is less affected by drought than most other grasses, it grows better in the shade than timothy or red-top and is earlier in bloom, it is believed to be more permanent than timothy on land suited to it and gives large crops. If cut before full bloom the hay is nutritious and not coarser or more strawy than timothy.

But little orchard grass is grown in this State. Many who have tried it have either failed to get a good catch or have got a catch altogether too good of grasses other than orchard grass, notably of meadow fescue, *Festuca pratensis*, perennial rye grass, *Lolium perenne*,—perennial only in name—and chess or cheat, *Bromus secalinus*. This fescue is a good meadow grass, but rye-grass and chess are very inferior or worthless.

The failures made in sowing orchard grass and the consequent indifference to it are largely to be explained by the quality of seed which is offered in market. To learn the present state of the trade, this Station has recently examined six samples of seed bought by farmers of seedsmen in the State, six samples purchased in Boston and five in New York. The results of the botanical analyses and germination tests are given in the following table. The per cents of different seeds found in the samples are by *weight* and not by number. No attempt was made to identify other seeds than those named in the table. Many seeds were immature and the duplicate sprouting tests did not in some cases agree closely, but that the conditions of the tests were suitable is shown by the fact that good mature seed sprouted freely in the testing apparatus. Four tests were made of each of the samples from A to G and two tests of each of the others. The highest result in each case is given in the table. The last column of the table is prepared by multiplying the per cent. of pure orchard grass seed by the per cent. of this pure seed that is capable of sprouting and dividing the product by 100.

The results of this examination may be summarized as follows:

1. Of the 17 samples of Orchard grass seed purchased in New York, Boston, and at various places in Connecticut, one sample contained as much as 98.8 per cent. of pure seed the remainder being chaff. Another contained no orchard grass seed whatever, and consisted mainly of Lolium perenne, or perennial rye-grass.

Excluding this sample the other 16 samples contained on the average 77.4 per cent. of pure seed.

2. Seven out of sixteen samples contained notable quantities, from 8.3 to 35.5 per cent., of seed of perennial rye-grass, Lolium perenne, which is less valuable and sells at a lower price. "Tested" Orchard grass seed is quoted at 11 cents per pound and "tested" perennial rye grass at 4½ cents. A single sample contained 14.1 per cent. of a species of Bromus, probably secalinus or chess.

3. In one sample as high as 88 per cent. of the orchard grass seed sprouted, in another as low as 4.5 per cent. and on the average of 16 samples 50.0 per cent.

4. Taking the 16 samples together, the average quantity of pure orchard grass seed which was capable of sprouting was 40 per cent.; i. e. out of every 100 pounds bought, 40 pounds was pure, live seed. Probably the quantity that would produce healthy plants was less than this.

EXAMINATION OF ORCHARD GRASS SEED FROM THE CONNECTICUT, BOSTON, AND NEW YORK MARKETS.

Mark.	Botanical Analysis.					1000 seeds weigh grams.	Sprouting Test.	
	Orchard grass.	Meadow Fescue.	Perennial Rye.	Bromus.	Other Seed, chaff and dirt.		Per cent. sprouting.	Percent. of pure seed in sample capable of sprouting.
A	58.6	....	20.5	....	20.9	.666	41.0	**24.0**
B	69.6	....	....	14.1	16.3	.571	27.5	**19.1**
C	76.1	2.5	8.3	....	13.1	.773	43.0	**32.7**
D	67.2	4.7	8.9	....	19.2	.537	32.5	**21.8**
F	94.7	....	....	....	5.3	.621	40.5	**38.4**
G	43.9	....	23.1	....	33.0	.535	36.0	**15.8**
I	92.9	....	....	....	7.1	.729	54.5	**50.6**
J	87.8	....	....	....	12.2	.495	42.5	**37.3**
K	60.3	....	....	....	29.7	.588	44.0	**26.5**
L	88.2	....	....	....	11.8	.838	79.0	**69.7**
M	none.	....	....	....	....	....	....	**none**
N	65.7	....	31.4	....	2.9	.609	4.5	**3.0**
O	98.8	....	....	....	1.2	.902	35.0	**34.6**
P	92.0	....	....	....	8.0	.555	88.0	**81.0**
Q	97.7	....	....	....	2.3	.740	76.5	**74.7**
R	81.6	....	15.7	....	2.7	.745	77.0	**62.8**
S	62.7	....	35.5	....	1.8	.779	82.5	**51.7**

It is very likely that rye grass is sometimes added as a "make-weight," and it may easily escape detection in a casual examination, but it often grows with orchard grass, and when the two kinds of seeds are harvested together it is impossible by mechanical means to separate them.

Moreover, the trade seed of orchard grass even when pure is known to have a low germinating power both abroad and in this country, so that 30 to 35 pounds per acre of it make only moderate seeding.

The table of analyses shows however that it is still possible, if one will take pains enough and pay enough, to get quite clean seed of this grass of which over 60 per cent. will germinate.

A part of the trouble with the seed market is that while the best seed is naturally the most expensive, cheap seed is always the most popular.

The sample P represents seed for which there is absolutely no market in its pure state ; it is too good for the trade and is mixed again for sale with inferior and less "expensive" seed.

It is obvious however that as compared with sample A, sample P is by far the more economical. In the first place a pound of P will produce more than three times as many plants of orchard grass as A. Again A will seed the land with some rye grass which is quite inferior to orchard grass. And lastly the catch of grass from the A seed will probably be poor, and very likely so poor that the land will have to be re-seeded. In this case it may lie idle for six months or a year and confirm the owner in the idea that orchard grass is not worth a trial.

To any one in the State desiring them, a few seeds each of Orchard grass, Perennial rye grass and Meadow Fescue will be sent by the Station to aid in their identification.

Ash Analysis of White Globe Onions.

From several barrels of White Globe Onions grown at Green's Farms were selected twenty-two bulbs of fair size which weighed five pounds and one ounce.

After drying and pulverizing them, a weighed sample of the powdered material was burned with the usual precautions and the ash submitted to analysis with the following results :

Per cent. Composition of the Pure Ash.

[Station No. 3005.]

Potash	43.49
Soda	1.26
Lime	10.87
Magnesia	4.46
Oxide of iron	1.07
Phosphoric Acid	19.08
Sulphuric Acid	15.98
Chlorine	2.36
Sand and Silica	1.96
	100.53
Deduct oxygen equivalent to chlorine	.53
	100.00

The fresh onions contain .27 per cent. of nitrogen and .48 per cent. of pure ash.

From these data are calculated the quantities of these ingredients contained in one ton, 2000 pounds of onions as follows :

Nitrogen and Mineral Matter in One Ton of Onions (Bulbs).

Nitrogen	**2.70**	**pounds.**
Phosphoric Acid	**.92**	"
Potash	**2.09**	"
Soda	**.06**	"
Lime	**.52**	"
Magnesia	**.21**	"
Oxide of Iron	**.05**	"
Sulphuric Acid	**.77**	"
Chlorine	**.11**	"
Sand and Silica	**.09**	"

ON THE DETERMINATION OF FAT IN CREAM BY THE BABCOCK METHOD.

In his paper describing this method, Wis. Ex. St. Rep. 1890, 110, Dr. Babcock speaks as follows of the determination of fat in cream.

" The chief difficulty in testing cream lies in the sampling. Cream that is sour, or that has been exposed to air until the surface has dried cannot be accurately sampled. The same is true of centrifugal cream that is badly frothed. Sweet cream, from Cooley cans, that is not too

thick to flow readily from the pipette can be tested with satisfactory results. The process, however, must be modified slightly from that used with milk, as the amount of fat in cream is so large that it cannot be measured in the ordinary test bottles if the usual quantity is taken for the test, and besides a much greater error results from the cream which adheres to the pipette than with milk. Both of these difficulties may be overcome by taking two or three test bottles and dividing the test sample into as nearly equal portions as can be judged by the eye. The pipette is then filled with water and this is run into the tubes in the same way as the cream. If three bottles are taken the pipette is filled with water a second time and emptied into the bottles as before. This serves to rinse the cream from the pipette, and at the same time to dilute it to a point where it can be tested in the same way as milk. The bottles are then treated in the usual manner, and the reading of the tubes added together for the per cent. of fat in the cream.

Owing to the low specific gravity of cream, the test sample, if of the same volume, will weigh less than that of milk, and consequently the per cent. of fat as shown by the scale will be less than is found by gravimetric analysis, in proportion as the weight is less than 18 gms. Where a delicate balance is available, this error may be entirely avoided by weighing the cream used in the test, and calculating the per cent. of fat by multiplying the scale reading by $\frac{18}{a}$, a, being the weight of cream taken.

If 17.6 c. c. of cream is taken and the portion adhering to the pipette is rinsed into the test bottle, a close approximation of the true result may be obtained without weighing by correcting the scale reading as follows : For a scale reading of 20 per cent., add .25 per cent. ; for a scale reading of 15 per cent., add 0.1 per cent. Readings between these may be corrected in proportion. Below 10 per cent. no correction is necessary."

Most of the creameries in this State gather cream rather than milk and the cream is usually raised by deep setting in submerged cans at low temperatures. A rapid and accurate method of determining fat in cream which can be used in creameries, is therefore particularly desirable here.

The Babcock method has been thoroughly tested in the last few months by Mr. Winton, chemist of the Station, with a view to its use by cream gathering creameries.

The same apparatus, bottles, acid and method have been employed as are recommended by Dr. Babcock and referred to in Bulletin 106 of this Station, with a single exception. For creamery use it is absolutely essential that all weighing should be dispensed with and that the cream should be measured and not weighed for individual tests. The use of three test bottles for

a single sample of cream adds greatly to the labor when many samples require to be tested. The correction to be made to the reading of the tubes also on account of the specific gravity of the cream adds somewhat to the care, skill and time required.

Mr. Winton has therefore made and used in all the tests given below a pipette for measuring the cream which delivers 6 grams of cream quite accurately, *provided the cream was raised as above described.* The reading from the tube multiplied by three gives the per cent. of fat in the cream without further correction.

The pipette.—The pipette, made by Mr. Winton, is $6\frac{1}{4}$ inches long, narrow at each end, the internal diameter at one end being about $\frac{1}{8}$ of an inch and at the other $\frac{1}{16}$ inch.

It is designed to deliver 6 grams of cream, as the milk pipette is designed to deliver 18 grams of milk. The actual quantity delivered in several preliminary trials was 5.97–5.95–6.00 and 5.93 grams.

The number of grams of water delivered (15° C.) by this pipette in a number of trials was

	6.035
	6.038
	6.028
	6.053
	6.045
	6.035
Average	6.039

The *volume* of cream delivered will be less than that of water because a larger proportion of the cream will adhere to the sides of the pipette.

Method of using the pipette.—The cream is very thoroughly mixed by moderate agitation,—violent shaking may churn it partially or beat it full of small bubbles which are very slow to rise,—and the pipette with one end well below the surface of the cream is sucked full, a little escaping into the mouth. The upper end is closed with the tongue, and the pipette withdrawn, its tip introduced into the neck of the flask and on removing the tongue the cream flows out. *As soon as it has run out*, the adhering drop is blown out and the pipette withdrawn.

The reason for making the pipette to be completely filled with cream rather than to be filled to a mark on its stem is that it is much more difficult to observe in a tube the height of cream than

of milk, the sides of the tube above the cream level being coated with cream and nearly opaque in consequence. By filling the tube full moreover, any bubbles on the cream surface will be removed by the mouth.

Having measured the cream into the testing flasks it is only necessary to add to each, 12 centimeters of water, from a pipette made for the purpose, and then proceed exactly as in the case of milk only multiplying the per cent. of fat, as read from the graduations, by three.

Following is a complete account of the experiments thus far made with this method, with the exception of the first ten samples examined which were quite sour when tested and had not been raised by a uniform method.

The "gravimetric method" referred to below or the laboratory analytical method, which is the standard, consisted in weighing the cream accurately on asbestus fiber in a tube, drying at the heat of boiling water till the weight was constant, and then extracting the fat completely from the tube and asbestus with absolute, alcohol-free ether, evaporating the ether, drying at the temperature of boiling water and weighing the residual fat.

Creamery No. Collected Feb. 10th, 1891.	Solids.	Fat. Babcock Method.	Fat. Gravimetric Method.	Babcock method gave more (+) or less (−) than Gravimetric Method.
3	----	21.3	21.16	+ .14
6	----	21.6	21.30	+ .30
9	----	18.9	18.64	+ .26
11	----	18.2	17.90	+ .30
19	----	20.25	20.34	+ .09
21	----	20.4	20.36	+ .04
22	----	17.7	17.76	− .06
23	----	20.25	20.17	+ .08
25	----	18.45	18.67	− .22
29	----	20.55	20.57	− .02
30	----	22.5	22.90	− .40
Collected Feb. 20, 1891.				
2	27.40	20.4	20.16	+ .24
3	30.14	22.7	22.51	+ .19
4	25.69	18.6	18.49	+ .11
5	27.87	21.0	20.80	+ .20
6	27.40	21.9	22.09	− .19
7	27.52	19.8	19.66	+ .14
8	25.50	18.0	17.72	+ .28
9	28.36	21.0	21.02	− .02
11	31.18	23.9	23.54	+ .36

Creamery No. Collected Feb. 10th, 1891.	Solids.	Fat. Babcock Method.	Fat. Gravimetric Method.	Babcock method gave more (+) or less (−) than Gravimetric Method.
12	27.77	20.5	20.64	− .14
13	26.15	19.0	18.96	+ .04
14	28.70	21.9	21.24	− .04
15	26.38	19.9	19.64	+ .26
16	26.46	20.1	19.79	+ .31
17	26.91	19.8	19.66	+ .14
18	26.57	19.5	19.15	+ .35
19	27.45	20.4	20.23	+ .17
20	27.13	20.4	20.58	− .18
Collected March 27, 1891.				
1	----	19.8 19.8	20.14	− .34
2	----	20.7 20.7	20.98 20.99	− .28
3	----	21.0 21.3	21.37 21.39	− .22
4	----	19.2 19.5	19.76 19.66	− .36
5	----	20.7 20.4	20.27 20.45	+ .19
6	----	22.8 23.1	22.66 23.08	+ .08
7	----	21.0 21.0	20.94 21.00	+ .03
8	----	18.3 18.3	18.25 18.26	+ .04
9	----	18.3 18.3	18.21 18.46	− .03
10	----	20.4 20.4	20.57 20.58	− .17
Collected April 23d, 1891.				
1	27.15	20.4 20.7	20.51	+ .04
4	26.77	20.1 20.4	20.35	− .10
5	26.74	20.7	20.74	− .04
6	27.67	22.2	22.26	− .04
7	29.71	23.4 23.4	23.81	− .41
8	28.53	21.3 21.6	21.60	− .15
9	26.48	19.8	20.36	− .56
10	28.78	21.9	22.16	− .26
11	27.91	20.7 20.1	20.42	− .02
13	27.42	21.0	20.80	+ .20
14	27.77	21.0	20.97	+ .03

Results.—The average quantity of fat as determined in the fifty tests above given, by the Babcock method was 20·46 per cent. and by the gravimetric or standard method was the same, 20.46 per cent.

In 26 cases the former gave a higher result than the latter, in 24 cases the reverse was the case.

In 18 cases the variation of the two methods was a tenth of one per cent. or less ; in 35 cases the variation was less than a quarter of one per cent. In 7 cases the difference exceeded a third of one per cent. and the extreme difference was .56 per cent. The same facts may be expressed as follows :

In 36 per cent. of the tests the variation from the standard method was not more than one-tenth of a per cent.

In 70 per cent. of the tests the variation from the standard method was not more than a quarter of a per cent.

In 86 per cent. of the tests the variation from the standard method was not more than a third of a per cent.

In 98 per cent. of the tests the variation from the standard method was not more than a half of a per cent.

In considering these figures and the accuracy of the method it must be borne in mind that the per cent. of fat is from four to six times as great in cream as in milk and hence a larger difference in the percentage of fat found in cream by the two methods, may not involve any larger proportion of the total quantity of butter fat than a much smaller difference in the per cent. of fat found in milk by the two methods involves in the total quantity of the fat of milk.

To illustrate. If a sample of milk contains 4 per cent. of fat and the Babcock method shows 3.92, the agreement is all that could be desired. The per cent. difference is only .08. That is out of 4 pounds of fat .08 of a pound or 2 per cent. is missing. Now if a sample of cream contains 20 per cent. of fat and the Babcock method shows 19.60, the per cent. difference is .40 which is five times as large as in the case of milk. Yet *proportionally* no more fat is lost than in milk, i. e. two per cent.

In more than four-fifths of the cases above cited the error is considerably less than this.

The results above given lead us to believe that the Babcock method may be made of very great value to cream-gathering creameries. It offers to them a practicable and accurate method of ascertaining the actual quantity of butter fat which each patron furnishes so that payments may be based not on volume of cream supplied but on *actual butter fat*, which is the raw material that the creamery manufactures. This is obviously the most satisfactory method of payment. For this purpose each patron's cream should be weighed and sampled and the fat in it determined by the method described.

Through the courtesy of the managers of one of our creameries it is now proposed to study the practical working of this method in a creamery, having as we believe assured ourselves of its substantial accuracy.