THE EFFECT ON BUTTER FROM FEEDING ON COTTON SEED AND COTTON SEED MEAL.

BY PROF. N. T. LUPTON.

An investigation was undertaken a few months ago at the Alabama Experiment Station to determine the effect of cotton seed and cotton seed meal on the composition of the butter fat, especially on the volatile acids, the melting point, and the specific gravity of the butter produced.

Several chemists of late years have called attention to changes produced by the use of the feed stuffs mentioned, notably Prof. Harrington, of the Texas Experiment Station and Dr. Wiley, of the Department of Agriculture, Washington, D. C. This subject was thought to be of sufficient scientific and practical importance to justify an extended investigation. For this purpose, a herd of registered Jerseys was divided into two groups, one consisting of ten cattle and the other of a single cow. The cattle of the first group were fed for a preparatory period of ten days on the customary ration used at the station, excluding cotton seed meal and hulls, the single cow was fed on the same ration. At the end of the preparatory period, samples of milk and butter were taken for one week, on Monday, Wednesday and Friday, and carefully analyzed. The milk of the ten cattle composing the first group was mixed and churned as a whole, that of the single cow was kept separate and churned by itself. The first preparatory period was for ten days; after that, the experimental and preparatory periods extended over seven days each.

The daily rations for the different periods which represent the kind and quantity of food actually consumed, were as follows:

1st Period, preparatory and experimental.

Ground oats	5 lbs.
" corn	5 "
Bran	5 "
Nutritive Ratio	1:5.8.

2d Period.

Cotton seed meal	3 lbs.
Ground oats	4 "
Bran	5 "
Ensilage	11
Nutritive Ratio	1:3.75.

3d Period.

Cotton seed meal	4 lbs.
Cotton seed hulls	9 "
Ensilage	4½
Nutritive Ratio	1:5.08.

During the fourth period, the cattle were confined exclusively to raw cotton seed and cotton seed hulls; and during the fifth period to cooked cotton seed and cotton seed hulls. They were allowed as much as they would eat. The nutritive ratios mentioned above are calculated from analyses made of the feed stuffs in use at the station. In compounding the rations, the object was not so much to conform with strictness to the German standard as to bring the cows gradually under the influence of cotton seed, cotton seed meal, and hulls, without injury to their general health.

The results of the analysis of samples of milk and butter, taken immediately after each milking and churning, are given below. The first two tables give the composition of each sample of milk analyzed, also the volatile acids, melting point, and specific gravity of the butter from the same milk; the third table gives the average composition for each experimental period.

Composition of Jersey Milk for each day analyzed.						Butter from same Milk.			
DATE.	Water.	Butter Fat.	Casein.	Sugar.	Ash.	Volatile Acids.	Melting Point.	Specific Grav. at 100° C.	Rations.
Group I.	Pr Ct.	Pr Ct.	Pr Ct.	Pr Ct.	Pr Ct.	Expressed in c. c. one-tenth normal alkali for 5 grms. of fat.	C°.		
									Period I. 5 lbs ground oats. 5 lbs ground corn. 5 lbs. bran.
Nov. 19...	85.76	5.53	3.95	3.96	0.80	30.0	35°.9	0.90257	
" 21...	84.95	5.20	4.05	5.09	0.81	29.6	35°.3	0.90311	
									Period II. 3 lbs cotton seed meal. 4 lbs ground oats. 5 lbs. bran. 11 lbs. ensilage.
Dec. 1....	84.15	5.73	4.06	5.24	0.82	29.7	36°.0	0.90411	
" 3....	83.62	5.51	3.88	6.19	0.80	30.5	36°.3	0.90165	
" 5....	84.26	5.16	3.90	5.98	0.80	31.4	36°.1	0.90265	
									Period III. 4 lbs. cotton seed meal. 9 lbs. cotton seed hulls. 4½ lbs. ensilage.
" 15...	84.53	5.96	3.64	5.12	0.75	28.4	36°.6	0.90081	
" 17...	83.35	6.07	3.60	6.03	0.75	26.9	37°.6	0.90194	
" 19...	84.71	5.79	3.57	5.19	0.74	27.1	38°.1	0.90306	
									Period IV. Raw cotton seed. Cotton seed hulls.
Jan. 5....	84.27	6.41	3.58	5.01	0.73	22.0	43°.6	0.90021	
" 7....	84.59	6.11	3.34	5.22	0.74	21.9	43°.9	0.89721	
" 9.....	84.51	5.84	3.56	5.37	0.72	22.4	43°.4	0.89955	
									Period V. Cooked cotton seed. Cotton seed hulls.
" 19...	85.84	4.87	3.39	5.16	0.74	23.1	42°.7	0.90462	
" 21...	84.89	5.95	3.31	5.08	0.77	22.2	42°.3	0.90057	
" 23...	85.38	5.53	3.31	5.04	0.74	22.1	43°.0	0.90266	

Composition of Jersey Milk for each day analyzed.						Butter from the same Milk.			
DATE.	Water.	Butter Fat.	Casein.	Sugar.	Ash.	Volatile Acids.	Melting Point.	Specific Grav. at 100° C.	Rations.
Group II.	Pr Ct.	Pr Ct.	Pr Ct.	Pr Ct.	Pr Ct.	Expressed in c. c. one-tenth normal alkali for 5 grms. of fat.	C°.		
Nov. 24..	85.53	4.67	3.84	5.23	0.73	31.4	35°.1	0.90188	*Period I.* 5 lbs gronnd oats. 5 lbs ground corn. 5 lbs. bran.
" 28..	84.03	5.93	3.93	5.30	0.81	31.5	33°.4	0.90458	
Dec. 8....	85.71	4.75	3.56	5.30	0.68	....	....	....	*Period II.* 3 lbs. C. S. meal 4 lbs grotnd oats. 5 lbs. bran. 11 lbs. ensilage.
" 10...	85.68	4.53	3.84	5.24	0.71	31.7	36°.5	0.90282	
" 12...	85.63	3.94	3.66	6.02	0.75	30.6	36°.2	0.90022	
" 22...	85.26	4.74	3.42	5.86	0.72	25.5	37°.5	0.90192	*Period III.* 4 lbs. C. S. meal. 9 lbs. C. S. hulls. 4½ lbs. ensilage.
Jan. 2....	84.31	5.85	3.69	5.42	0.73	25.4	41°.3	0.89798	
" 12..	85.17	5.12	3.40	5.60	0.71	20.5	43°.5	0.89751	*Period IV.* Raw cotton seed. Cotton seed hulls.
" 14...	85.10	4.76	3.47	5.98	0.69	19.2	41°.0	0.89929	
" 16...	85.54	4.80	3.34	5.64	0.68	21.4	43°.0	0.89883	
" 26...	86.21	4.87	3.13	5.09	0.70	22.0	43°.3	0.89775	*Period V.* Cooked cotton seed. Cotton seed hulls.
" 28...	86.00	4.88	3.12	5.28	0.72	22.1	43°.3	0.89994	
" 30...	85.39	6.00	3.18	4.72	0.71	21.7	44°.0	0.89803	

Average composition of Jersey Milk during each period.						Butter from same Milk.			
PERIOD.	Water.	Butter Fat.	Casein.	Sugar.	Ash.	Volatile Acids.	Melting Point.	Specific Grav. at 100°C.	Rations.
Group I.									
I.	85.35	5.36	4.00	4.52	0.81	29.8	35°.6	0.90284	5 lbs. each ground oats, ground corn and bran.
II.	84.01	5.47	3.95	5.80	0.81	30.5	36°.1	0.90280	C. S. meal, 3 lbs.; ground oats, 4 lbs.; bran, 5 lbs.; ensilage, 11 lbs.
III.	84.20	5.91	3.60	5.45	0.75	27.5	37°.4	0.90194	C. S. meal, 4 lbs.; cotton seed hulls, 9 lbs.; ensilage, 4½ lbs.
IV.	84.46	6.12	3.49	5.20	0.73	22.1	43°.6	0.89899	Raw cotton seed meal and cotton seed hulls.
V.	85.37	5.45	3.36	5.09	0.75	22.5	42°.7	0.90262	Cooked cotton seed meal and cotton seed hulls.
Group II.									
I.	84.78	5.30	3.89	5.26	0.77	31.4	34°.2	0.90323	5 lbs. each ground oats, ground corn and bran.
II	[illegible]5.67	4.41	3.69	5.52	0.71	31.1	36°.3	0.90152	C. S. meal, 3 lbs.; ground oats, 4 lbs.; bran, 5 lbs.; ensilage.
III.	84.79	5.30	3.37	5.64	0.72	25.45	39°.4	0.89995	C. S. meal, 4 lbs.; cotton seed hulls, 9 lbs.; ensilage, 4½ lbs.
IV.	85.27	4.89	3.40	5.74	0.69	20.4	42°.5	0.89854	Raw cotton seed meal and cotton seed hulls.
V.	85.87	4.92	3.14	5.03	0.71	21.9	43.5	0.89857	Raw cotton seed and cotton seed hulls.

The following table, taken from a record carefully kept at the dairy, gives the aggregate amount of milk and butter produced by the first group, consisting of ten cows, for each experimental period of seven days :

	Pounds of milk.	Pounds of butter.	Pounds of milk for one pound of butter.
Period I.	1,414½	82	17.2+
" II.	1,275	85½	14.9+
" III.	975	91	10.7+
" IV.	896	75	11.9
" V.	716	58	12.3+

As will be observed there is a marked falling off in the quantity of milk and a corresponding increase in the amount of butter produced during the first three periods, as the cattle were getting more under the influence of cotton seed meal.

During the remaining periods the quantities of both milk and butter diminish, the ration being confined to cotton seed and cotton seed meal, without reference to having it well balanced as a milk ration.

The general effects of these valuable feed stuffs, when used in carefully prepared rations, will hereafter be investigated; at present we are concerned only, as previously stated, with their effects on the volatile acids, melting point and specific gravity of the butter fat produced under their influence. For these effects attention is called to the above tabular statements from which the following conclusion is drawn :

Feeding on cotton seed and cotton seed meal increases, in a marked degree the melting point of butter, the increase reaching in these experiments eight or nine degrees, and diminishes to a corresponding extent the volatile acids, while the specific gravity remains virtually the same.

The richness of cotton seed meal in albuminoids renders it of prime importance to mix it with one or more feed stuffs poor in this nitrogenous compound, such as ensilage, hay, or cotton seed hulls.

It may be stated in this connection that no change was observable in the color of the butter from feeding cotton seed and cotton seed meal. The samples, still in the laboratory, are all of a beautiful golden yellow.

It is proper to state that the analytical work in the above tables was done by Dr. J. T. Anderson, first assistant in the chemical laboratory.

AUBURN, ALA., March 27, 1891.

"SOME NOTES ON ELECTROLYTIC QUANTITATIVE SEPARATION OF METALS."

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It may seem somewhat presumptuous after Classen's classic work in electrolytic analysis, to offer any suggestions as to the conducting of this class of quantitative determinations. But there is one point in the work which it may safely be said has been to a certain extent neglected. This point is the influence of electromotive force, or of difference of potential upon the separations.

In Classen's work upon the subject the voltage of the circuit is duly considered, and an elaborate rheostat for regulating the voltage within somewhat crude limits (½ volt) is described. This is in one of the introductory chapters. The rheostat is for use with a 600 watt dynamo. But the author also mentions batteries and describes his method of conducting determinations with these sources of electromotive force. The current strength is then the standard, and it is determined by the volume of oxyhydrogen gas, which the current can liberate in a definite time. In other words, the amperage of the current alone receives direct attention. By using the same sized electrodes, the author states, the conditions are kept sensibly the same. Here we have an indirect recognition of the influence of electromotive force. But the attempted