

# CONTRIBUTIONS TO THE STUDY OF OIL-CAKES USED IN FEEDING.<sup>1</sup>

BY C. V. GAROLA.

TRANSLATED AND ABSTRACTED BY DR. G. L. SPENCER, WASHINGTON, D. C.

THESE contributions consist of a series of studies including all the oil-cakes used in the feeding of domestic animals. For the purposes of the Congress the article on cotton-seed oil-cake has been selected for presentation, owing to the general importance of this product.

*Cotton-Seed Oil-Cake.*—Cotton-seed oil-cake is manufactured from the seed of the cotton plant. It is green when fresh, but becomes brown and dark on standing. It usually contains a variable quantity of cotton-seed hulls, dark débris, seed coats, etc. The oil-cakes from cotton-seed may be divided into three classes:

First, those which contain a considerable quantity of filaments of cotton and which are only suitable for use as fertilizers.

Second, those from Egypt and the Levant where the manufacturers clean the seed very thoroughly from the cotton fiber.

Third, oil-cakes manufactured from decorticated seed in America. In these last the hulls are removed from the seeds, hence these cakes are richer and in a more favorable condition for feeding young animals. We have analyzed two of the last named class. These analyses are shown in parallel columns with the results obtained by Décugis and Woelcker:

	Garola.		Décugis.		Woelcker.
	Cotton-seed from Alexandria.	Decorticated cotton-seed.	Cotton-seed oil-cake from Alexandria.	Cotton-seed oil-cake containing some fiber.	Decorticated cotton-seed.
Water .....	12.44	7.78	9.3	9.15	9.28
Nitrogenous matter .....	28.00	47.81	24.1	20.2	41.12
Fat .....	5.86	12.87	6.1	5.3	16.05
Non-nitrogenous extract matter .....	40.64	20.84	54.5	58.6	25.5
Cellulose .....	8.14	3.80			
Ash .....	4.92	6.90	5.96	6.4	8.05
Nitrogen .....	4.48	7.65	3.86	3.4	6.58
Phosphoric acid .....	1.85	3.33	1.62	1.99	6.58
Potash .....	0.98	0.98	1.62	1.99	6.58

<sup>1</sup> Read before the World's Congress of Chemists, August 24, 1893.

The cotton-seed oil-cake from Alexandria is very much esteemed for the feeding of milch cows. It is very advantageous notwithstanding the fact that its cost is a little high. At the time of writing it costs ten francs, fifty centimes, per 100 kilos, f. o. b. cars at Marseilles. We might cite several dairies, where milk is sold, situated in the suburbs of Nancy, where these oil-cakes have given excellent satisfaction.

The older cattle have considerable power for the digestion of cellulose. In my work, "Alimentation des Animaux de la Ferme," published by G. Masson in 1887, I have applied the results obtained in the digestion of woody fibers by cattle as given in the works of Haubner, Sussdorf, and Stoeckhardt:

	Per cent.
(1) Paper pulp, very fine.....	72 to 80
(2) Grass, cut at the time of flowering.....	60 to 70
(3) Paper pulp from straw and wood sawdust.....	40 to 50
(4) Spruce sawdust.....	30 to 40

From these experiments, it appears that the filaments of cotton and the fragments of the seed coating do not present any serious inconvenience to full grown cattle. Such oil-cakes, however, should not be permitted to be fed to young cattle. M. Fagot, a distinguished chemist of Ardennes, has reported several fatal accidents to calves, which have followed the feeding of cotton-seed oil-cake from Egypt. One can easily conceive that the stomachs of the young cattle could not easily dissolve the filaments of cotton and fragments of the hard horny seed coat. As these indigestible particles encumber the third stomach and press upon the rennet, these parts are consequently paralyzed in their action.

Oil-cake from decorticated cotton-seed, which has been sold in the form of a coarse meal at a price of seventeen francs per 100 kilograms, seems perfectly suited for the nourishment of young cattle. I have recommended formerly a mixture of equal parts of wheat bran and linseed meal for the first feeding of lambs. This seems still better suited to the feeding of full grown animals for their fattening and the production of milk. Woelcker in 1888 made a decisive experiment upon the comparative nutritive value of oil-cake from decorticated cotton-seed mixed with its weight of corn flour and oil-cake from linseed in

the fattening of cattle. These beef cattle were divided into two lots and weighed at the beginning of the experiment as follows :

	Kilograms.
Lot No. 1.....	1,482
Lot No. 2 .....	1,437

Each of these lots received the same quantity of chopped beet roots, hay, and straw. As a nutritive supplement he fed to the first lot cotton-seed oil-cake and corn flour, while to the second lot he fed linseed oil-cake. In the six months during which the experiment lasted the first lot consumed :

	Kilograms.
Beet roots.....	1,713
Hay .....	457
Straw.....	234
Corn flour .....	660
Cotton-seed oil-cake (decorticated).....	660

These oil-cakes were fed in a ration of 3.6 kilograms per head per day.

The second lot of cattle consumed during the same time :

	Kilograms.
Beet roots.....	1,714
Hay.....	457
Straw .....	234
Linseed oil-cake.....	1,320

The ration per day per head was 6.8 kilograms. While the increase in the weight of the cattle fed on cotton-seed oil-cake (decorticated) with the addition of corn meal was upwards of 222.7 kilograms, it was only 188.9 kilograms with the linseed oil-cake. Each beef had gained in the first case 1.18 kilos, and in the second only 0.96 kilos.

The ration with cotton-seed oil-cake was, however, more economic. At the present prices, the cotton-seed oil-cake costs nineteen francs and the broken corn sixteen francs at the farm ; the concentrated foods distributed in the first lot costs as follows:

Cotton-seed oil-cake : 660 kilograms	$\times 0.19 = 125.40$ fr.
Corn :..... 660	$\times 0.16 = 105.60$ fr.
	<hr/>
Total.....	231 fr.

The linseed oil-cake costs, on the other hand, 19.5 francs per 100 kilograms, or in all for the second lot 257.40 francs.

From this we see that in one case there was a gain in live weight of forty kilograms with the cotton-seed and at the same time a lower expense of 26.40 francs.

The mixture containing the cotton-seed oil-cake (decorticated) and the corn is thus shown to be largely superior to the pure linseed, and, as this latter according to the unanimous judgment of practical men is one of the best oil-cakes, it is incontestable that the cotton-seed oil-cake merits especial esteem for fattening cattle.

I will also point out an experiment of Mr. Eloire (*Progrès Agricole* du 15 Novembre, 1891), where the same two cows were submitted during two successive periods to a feeding experiment with different foods. During the first period the cows each received:

	Kilograms.
Straw .....	6
Hay .....	6
Cotton-seed oil-cake .....	3
Bran .....	0.75

and they gave on an average 12.5 liters of milk containing thirty-seven grams of butter per 1,000, hence each cow furnished 462.05 grams of butter. In the second period each cow consumed the following:

	Kilograms.
Straw .....	6
Hay .....	6
Linseed oil-cake .....	1.5
Bran .....	0.75

The average yield of milk in this case was 11.1 liters of a richness in butter of 33.4 grams. The butter produced per day by each cow was 370.07 grams. One may see that the cotton-seed oil-cake acted in a very marked degree upon the secretion of milk and the production of butter. As was the case with sesame and coprah especially, it augments the quantity of both the milk and the butter. Thus a favorable comparison is shown between cotton-seed oil-cake and that from linseed as given in the experiments of Woelcker and Eloire.

We can not finish this study of cotton-seed oil-cake without calling attention to the excellent results obtained by Mr. Vitalis

in the feeding of milk ewes at Larzac with cotton-seed from Alexandria:

"The experiments which I undertook lasted three consecutive years," says this agriculturist, "upon my flock at Larzac and were conclusive in a high degree. At the beginning of the experiment, in order to take account of the efficacy of the cotton-seed oil-cake, I selected ten milch ewes and gave to each one a daily ration of 250 grams of the broken oil-cake in two meals, that is, 125 grams in the morning and the same amount in the evening. These sheep, which before the trial had received a ration of one kilogram of second crop hay per day, now only received 300 grams. The increase in the yield of milk was sensible even the first days. The ten animals gave a quantity of milk equal to that produced by fourteen ewes feeding upon the ordinary ration of second crop hay. After such manifestly advantageous results I wished to ascertain if possible whether the reverse would be the case. I separated ten other ewes to which I gave the ration of cotton-seed oil-cake and second crop hay that I had given the first lot, and the first lot I placed upon the ordinary food. The milk gradually increased with the new lot of ewes and decreased to the usual quantity with those submitted to the first experiment."

Mr. Vitalis adds that by the use of cotton-seed oil-cake the price of food per ration has been reduced from ten centimes to six centimes.

He has determined in addition that by the use of the oil-cake the wool, washed in boiling water and soda—per cent. raw wool—was increased sensibly. Before the use of the oil-cake the raw wool yielded thirty-six per cent. at the maximum; afterwards, on the contrary, it yielded 37.4 in 1878, 38 in 1879, and 39.8 in 1880. This progression is quite significant.

The results which we have given show what advantage agriculturists may obtain from the use of cotton-seed oil-cake. It remains for us now to describe how this should be fed.

Cotton-seed oil-cake when mixed with boiling water has a disagreeable taste. On this account it should not be distributed mixed with water. It is admitted that the oil-cake should be broken up into rather fine particles without necessarily reducing

it to a powder. It is the hard particles which the ruminating animals object to eating, since they cause diarrhea on account of their indigestibility. This difficulty may be obviated by care in breaking up the oil-cake a week in advance in such a way that it can be softened by absorbing moisture from the atmosphere without molding. One may avoid molding by placing the cake in a well-ventilated granary.

## CONCERNING THE METHOD OF DETERMINING THE MELTING POINT OF BUTTER.<sup>1</sup>

BY ADOLF MAVER.

TRANSLATED BY W. H. KRUG.

IN my work on the relation between the constitution of butter fat and the feeding of the milch cows I have been considerably engaged with the determination of melting points, and found it important to make some experiments for the special purpose of determining the best method of carrying out these determinations. This work brought me to the following results, of which each will be accompanied by the experimental figures relating thereto.

1. Narrow tubes give lower melting and higher congealing points than wide tubes, and in this manner temperatures which are nearer together and thus assume an apparently greater accuracy as far as they are related to each other.

Experiments were carried on (1) with a certain butter fat, (2) with a fat of known uniform composition (caprylic acid), (3) with a known mixture of two fats (two parts oleic acid and one part palmitic acid).

The results were:

### (1) WITH BUTTER.

In tube of 16mm. internal diam.	In tube of 7mm. internal diam.
Melting point . . . . . 40.4°	39.9°
After rapid cooling to	
low temperature . . 38.9°	38.5°
After slowly warming 36.8°	36.4°

Therefore in every case *ceteris paribus* about 1-2°C. lower in the narrow tubes.

<sup>1</sup>Read before the World's Congress of Chemists, Aug. 21, 1893.