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REPLACING SOME CLOVER WITH COTTON STALKS TO INCREASE THE BALLAST IN FRIESIAN COW'S RATIONS.

By

E.A., GIHAD, I.M. EL-GINDI, AND S.M. ABD EL-BAKI*

Comparative feeding trials with Friesian cows were undertaken to study the effect of increasing ballast content (total indigestible organic matter) of berseem by adding cotton stalks, on milk yield and its constituents using the swing over method.

The control ration was composed of food mixture wheat bran and wheat straw. The 1st tested ration was berseem alone fed ad-libitum. The 2nd tested ration contained berseem to cover the nutritional requirements of cows and milled cotton stalks to raise ballast content up to 4.3 kgs. per 500 kgs. body weight. Six Friesian cows were used for a period of 100 days.

The 1st and 2nd tested rations significantly increased the milk yield more than the control with 7.18+ 1.96 and 10.63+ 3.82% respectively. Fat yield followed the same trend and the corresponding increase was 7.10+ 1.61 and 7.32+1.49% respectively. The increase in fat was slighly higher with the 2nd tested ration than the 1st one.

Feeding berseem and milled cotton stalks not only significantly increased milk and fat yield but also it saved 40.1% of feed intake from berseem alone. The average daily intake of berseem was 131.9 and 78.7 kgs. in the 1st and 2nd tested rations respectively. The average daily intake of milled cotton stalks in the 2nd stested ration was 1.38 kgs.

The average ballast content per 500 kgs body weight of lactating cows was 5.06, 6.74 and 4.29 kgs with the control, 1st and 2nd tested rations respectively.

The 1st tested ration showed a high increase in protein content of milk, while the 2nd tested ration showed the ghihest increase in ash content. The yield of milk constituents followed the same trend of milk yield with the different experimental rations.

It was conculated that milled cotton stalks can be economicaly used as ballast in winter feeding to save the losses in berseem and the amounts of wheat straw fed for ballast. Surplus of berseem and wheat straw may be preserved for summer feeding.

The Egyptian clover or berseem (Trifolium alexanderinum) is the main forage crop in U.A.R. The berseem yield of starch value exceeds the total animal requirements for all livestock in all the country in winter. The surplus of berseem is converted into hay or silage for summer feeding, Gihad (1963).

The farmers always feed their animals from berseem until they feel stuffed, and this causes great losses of berseem. This fact is due to that berseem is poor in the total non-digestible organic matter (ballast),

* Animal Production Dept,, Fac. of Agriculture, Cairo University,

Gihad, 1963, found that the non-digestible organic matter in berseem increased with the successive cuts, being between 2.07 and 7.54 percent. The author stated that straws must be offered to animals fed on berseem alone to increase the total non-digesitble organic matter or "ballast". In this case animals feel stuffed without bloat and decrease the amounts of berseem intake.

In the preceeding paper, Gihad *et al.* (1969), tried to decrease the intake of berseem by adding wheat straw. They used two tested rations for Friesian lactating cows, the first was berseem alone fed ad — libitum and the second was berseem according to the nutritional requirements of animals and wheat straw to raise the ballast content in the diet up to 4.3 kg per 500 kg, body weight. They stated that the 2nd tested ration increased the milk and fat yield than feeding the food mixture and decreased the feed intake of berseem alone with 55 percent. Lahmann (1941) ; Huffman and Duncan (1952) ; Akopov (1953) and Walther (1935), defined ballast as the total indigestible organic matter. The latter recommended that the ration of dairy animals must contain 4.3 kg. of ballast per 500 kg. body weight, while Guillement and Jacquot (1943), defined it as undigestible carbohydrates. Gravis *et al.* (1939) ; Huffman and Duncan (1952) ; Huffman *et al.* (1952) and Akopov (1953), found that increasing the ballast content in lactating cows rations increase milk production and has no effect on fat percent in milk.

The main source of ballast in U.A.R. is wheat and barley straws.

Recently Abou-El-Hassan (1963) and Serafi (1968), used cotton stalks in animal feeding. They stated that cotton stalks are poor in the nutri tive value and contain high crude fibre percentage. The cotton stalks represent most of the farm by-products which are usually used as fuel.

This work was undertaken to study the effect of increasing ballast in Frisian cows rations on the milk and fat yield by replacing some of berseem with milled cotton stalks.

Experimental and Methods

The feeding system included a control ration and two tested ones. The first tested ration was berseem alone fed ad-libitum. The seecond tested ration contained calculated amounts of berseem to cover the nutritional requirements of cows with addition of calculated amounts of milled cotton stalks to raise the ballast content of the ration up to 4.3 kg per 500 kg body weight as recommended by Walther (1935) and Lehman (1941).

The design of the experiment followed the "Swing over method", based on the practicaly linsear relation between advancing time lactation and milk yield. The animal was a control for itself, in a control period followed by two tested rations as recorded by Crichton (1953) and cited by Abou-Hussien (1958).

Animals :

Six Friesian cows were taken from the herd of the Experimental Station of the Animal Production Department, Faculty of Agricultre, Cairo University. They were chosen just after the peak of their lactation period at a relatively high milk yield. They were weighed individually before starting the experiment for computing the maintenance ration, and were also weighed at the end of the experiment to make sure that they were maintaining their weights.

Feeding :

The daily requirements of starch value and digestible protein were calculated for each animal by a knowledge of the average weight, milk yield and fat percent during the week before the experiment according to Ghoneim (1957). The daily control ration per animal was composed of 4-6 kg from food mixture, 2.75 kg. fine wheat bran and 4-6 kg. Wheat straw. During the first tested ration period berseem alone was offered ad-libitum. The daily intake of berseem ranged between 126 and 137 kgs. During the second tested ration period the calculated daily amounts of berseem ranged between 71 and 88 kgs, while the amounts of milled cotton stalks ranged between 0.5 and 2.0 kg. A transition period of 10 days was used for each ration followed by a 15 days experimental peirod. The experiment started on the end of December 1967 and lasted for 100 days. A composite sample of berseem was chemicaly analysed during the two tested rations. The nutritive value and ballast content of berseem was calculated according to Gihad (1963). Cotton stalks were chopped and then milled by using a hammar mill. This was performed to produce a fine product could be utilized by experimental cows.

Ballast calculations :

Ballast was calculated as the total indigestible organic matter following Walther (1935), Lehmann (1941), Huffman and Duncan (1952) and Akopov (1953). The calculated ballast of food mixture, fine wheat bran, wheat straw and cotton stalks were : 25.94% (Darwish, 1963), 13.91% (Ghoneim, 1967), 31.74% (Abou-Hussein, 1958) and 52.99% (Abou-El-Hassan, 1963) respectively. The average ballast content of berseem was 3.4% during the experimental season.

The milk analysis followed the ordinary methods of the A.O.A.C. (1955) and Abou-Hussien (1958).

Results and Discussion

1. *Milk yield :*

The average actual daily milk yield, calculated milk yield and the percentage differences from the control with the two tested rations according to "Swing over method" are shown in Table (1). The average milk

TABLE 1.—MILK YIELD WITH THE DIFFERENT EXPERIMENTAL RATIONS (THE YIELD *a,b,d* and *f* IS THE AVERAGE OF 15 DAYS *i.e.* THE YIELD OF MIDDLE DAY)

No. of the cow	Initial control (a)	1st Tested ration			2nd Tested ration			Finall control (f)	Daily milk decrease $\frac{a-f}{93.18} = g$ (g)
		Actual (b)	Calculated $b+g\times(43-18)$ (c)	% Difference $\frac{a-c}{a} \times 100$	Actual (d)	Calculated $d+g\times(68.18)$ (e)	% Difference $\frac{a-c}{a} \times 100$		
	Kg.	Kg.	Kg.	%	Kg.	Kg.	%	Kg.	Kg.
118	9.69	8.55	9.80	+1.14	7.23	9.73	+0.41	5.93	0.0501
126	12.12	11.55	12.81	+5.69	10.33	12.85	+6.02	8.34	0.0504
3480	9.42	8.55	9.68	+2.76	7.26	9.25	+1.06	6.63	0.0452
3492	9.39	9.51	10.52	+12.03	8.70	10.72	+14.16	6.36	0.0404
3497	9.87	9.42	11.13	+12.77	8.46	11.88	+20.37	4.74	0.0684
3513	11.85	11.85	12.88	+8.69	12.37	14.43	+21.77	8.76	0.0412
Average	10.39	9.91	11.14	+7.18±3.96	9.06	11.52	+10.63±3.82	6.69	0.0493

yield with the initial control ration was 10.39 kg. Feeding berseem alone ad-libitum in the 1st tested ration significantly increased the milk yield with 7.18 ±3. 96%. The same trend was observed with the 2nd tested ration consisted of calculated berseem and milled cotton stalks. Milk yield was significantly increased with 10.63 ± 3.82%, showing a higher increase than with the 1st ration.

2. *Fat yield :*

The average actual daily milk fat yield, calculated milk fat yield, and the percentage differences from the control with the two tested rations according to "swing over method" are shown in Table (2).

The average milk fat yield with the initial control ration was 0.463 kg. The 1st and 2nd tested rations insignificantly increased the fat yield with 7.10 ± 1.661% and 7.32 ± 1.49% respectively.

These results indicated that feeding berseem alone ad-libitum increased the daily milk and fat yield than feeding a control ration. The same trend was observed by supplying the nutritional requirements from calculated amounts of berseem with addition of milled cotton stalks to increase the ballast content in the ration. The two tested rations significantly increased milk yield but the response of the 2nd tested ration was slightly higher than the 1st one. Fat yield followed the same trend with the two tested rations but the increase was less with the first tested one.

3. *Milk composition :*

Chemical analysis of milk with the different experimental rations are shown in Table (3).

Milk constituents fluctuated within narrow limits. Protein was the highest in the 1st tested ration while ash was the highest in the 2nd tested one. These two nutrients showed the highest precentage difference from the control ration, by 22.12% and 15.20% respectively. As for the other nutrients no obvious differences could be detected with the diffferent experimental rations.

The yield of nutrients with the two tested rations followed the same trend of milk yield being almost higher than the control ration.

It was concluded that feeding milled cotton stalks proved an increase in milk constituents when it was used as ballast in dairy rations during feeding berseem. These results were in agreement with Gihad *et al.* (1959).

4. *Feed intake :*

The average daily intake of berseem alone fed ad-libitum in the 1st tested ration was 131.9 kg ranging between 126 and 137 kg as shown in Table (3). The average daily calculated amounts of berseem in the 2nd tested ration was 78.7 kg with addition of 1.38 kg milled cotton stalks. The

TABLE 2.—MILK FAT YIELD WITH THE DIFFERENT EXPERIMENTAL RATIONS (THE YIELD *a*, *b*, *d* and *f*. IS THE AVERAGE OF 15 DAYS, *i.e.* THE YIELD AT THE MIDDLE DAY)

No. of the cow	Initial control (a)	1st tested ration			2nd Tested ration			Final control (f)	Milk fat decrease $\frac{a-f}{93-18} \times 100$ (g)
		Actual (b)	Calculated b+g(43-18) (c)	% Difference $\frac{8-c}{a} \times 100$	Actual (b)	Calculated d+g×(68-18) (e)	% Difference $\frac{a-e}{a} \times 100$		
	Kg.	Kg.	Kg.	%	Kg.	Kg.	%	Kg.	Kg.
118	0.366	0.375	0.410	+12.02	0.298	0.368	+0.55	0.259	0.0014
126	0.566	0.535	0.610	+7.78	0.460	0.610	+7.78	0.341	0.0030
3482	0.416	0.399	0.441	+9.62	0.317	0.432	+3.84	0.247	0.0023
3492	0.410	0.387	0.437	+6.59	0.343	0.443	+8.05	0.263	0.0020
3497	0.450	0.395	0.478	+6.22	0.338	0.503	+11.78	0.200	0.0033
3513	0.568	0.505	0.570	+0.35	0.501	0.631	+11.92	0.376	0.0026
Average	0.463	0.433	0.491	7.10±1.61	0.376	0.498	7.32±1.49	0.281	0.0024

TABLE 3.- MILK COMPOSITION AND YIELD OF NUTRIENTS

Item	Control ration		1st tested ration		2nd tested ration	
	Composition	yield	Composition	% difference	Composition	% difference
	%	kg,	%	%	%	%
Protein . .	3.00	0.312	3.42	22.12	2.90	7.05
Fat	4.43	0.463	4.37	5.06	4.15	2.61
Ash	0.68	0.072	0.67	7.22	0.72	15.20
Phosphorus	0.28	0.029	0.30	14.29	0.26	3.45
Calcium . .	0.13	0.013	0.14	15.40	0.13	10.81

corresponding ranges were 71.1—88.7 and 0.5—2.0 kgs respectively. Therefore, it can be concluded that Friesian lactating cows consumed great amounts ob berseem which exceed their nituritional requirements when it was fed alone adlibitum. This may be due to the low ballast content in berseem. Feeding berseem according to the nutritional requirements and adding milled cotton stalks to increase the ballast content of the ration up to 4.3 kg per 500 kg body weight, not only increased the milk and fat yield than feeding berseem alone but also saved 53.2 kg from daily berseem intake. These savings equal 41.1% from the average daily berseem consumed in the 1st tested ration.

5. *Ballast content :*

Concerning the ballast content (undigestible organic matter) with the different experimental rations as kgs. per 300 kg. body weight, it was 5.06, 6.74 and 4.29 kgs. with the control, 1st and 2nd tested rations respectively as shown in Table (4).

It was noticed that the recommended level of ballast (4.3 kgs. per 500 kg body wt.) could cover the Frisian lactating cows requirements of ballast.

It can be concluded that it is neccessary to feed berseem according to the actual animal requirements and increase its ballast content from roughages, up to the recommended level of 4.3 kg. per 500 kg. body weight. These resutls are in good agreement with Gravis *et al.* (1939), Huffman *et al.* (1952), Akopov (1953) and Gihad (1963).

From the economical point of view the amount of berseem fed in winter would be minimized and the surplus of berseem may be preserved as hay or silage for summer feeding.

TABLE 4.—FEED INTAKE AND BALLAST CONTENT WITH THE DIFFERENT RATIONS

cow No.	Body wt.	Control ration					1st tested ration			2nd tested ration			
		Food mixture	Fine wheat bran	Wheat straw	Ballast content	Ballast per 500 kg. body wt.	Berseem	Ballast content	Ballast per 500 kg. body wt.	Berseem	Cotton stalks	Ballast content	Ballast per 500 kg. body wt.
	kg.	kg	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.	kg.
118	476	4.0	2.75	6.0	4.60	4.83	132	4.96	5.21	77.2	2.00	4.09	4.30
126	384	5.5	2.75	5.0	4.46	5.81	128	4.81	6.26	74.9	0.75	3.23	4.21
3480	406	4.0	2.75	4.0	3.54	4.35	126	4.74	5.84	71.1	1.50	3.49	4.30
3492	420	4.0	2.75	5.0	4.07	4.84	137	5.15	6.13	73.9	1.50	3.61	4.30
3497	507	5.0	2.75	6.5	5.12	5.05	133	5.00	4.93	86.7	2.00	3.34	4.29
3513	418	6.0	2.75	5	4.59	5.49	135	5.08	6.08	88.7	0.50	3.61	4.32
Average	451.8	4.75	2.75	5.25	4.40	5.06	131.9	4.91	6.74	78.7	1.38	3.59	4.29

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احلال حطب القطن محل جزء من البرسيم لزيادة البالاست (المـادة العضوية غير المهضومة) فى علائق أبقـار الفريزيان

* السيد احمد جهاد ـ ابراهيم محمد الجندى ـ سليمان محمد عبد الباقى

الملخص

اجريت تجارب تغذية مقارنة على أبقار الفريزيان لدراسة تأثير زيادة البالاست فى علائق البرسيم وذلك باضافة حطب القطن المطحون كمصـدر للبالاست ـ ودراسة تأثير ذلك على انتاج اللبن والدهن وعلى مكونات اللبن وذلك باستعمال طريقة « العودة الى بدء » .

كانت مكونات العليقة المقارنة علف مخلوط وردة ناعمة وتبن قمح . وكانت مكونات العليقة المختبرة الأولى عبارة عن برسيم للشبع ، والعليقة المختبرة الثانية برسيم محسـوب لتغطية الاحتيـاجات الغذائية ، وطب قطن مطحون لزيادة كمية البالاست الى ٤ر٣ كجم لكل ٥٠٠ كجم وزن حى .

واستخدمت ٦ أبقار فريزيان فى هذه التجربة لمدة ١٠٠ يوم .

عند استعمال العليقة المختبرة الأولى والثانية سببتا زيادة معنـوية فى محصول اللبن عن العليقة المقارنة وكانت على التوالى ١٨ر٧ ، ٩٦ر١ ، ٦٣ر١٠ ، ٨٢ر٣٪ وكذلك زيادة غير معنوية فى محصـول دهن اللبن وكانت ١٠ر٧ ، ٦١ر١ ، ٣٢ر٧ ، ٤٩ر١ على التوالى . والزيادة فى العليقة المختبرة الثانية أعلى من الزيادة فى العليقة المختبرة الأولى بالنسبة لمحصول دهن اللبن .

استعمال حطب القطن المطحون مع البرسـيم ادى كذلك الى توفير ١ر٤٠٪ من كمية البرسيم المأكول يوميا للشبع لكل بقرة .

* قسم الانتاج الحيوانى ـ « فرع تغذية الحيوان» بكلية الزراعة ـ جامعة القاهرة ـ بالجيزة

وكان متوسط كمية البرسيم المأكولة يوميا لكل حيوان للشبع ١٣١ر٩ كجم فى العليقة المختبرة الأولى ، وكمية البرسيم المأخوذة يوميا لكل حيوان فى العليقة المختبرة الثانية ٧٨ر٧ كجم : وكمية حطب القطن المطحون ١ر٣٨ كجم .

كان متوسط كمية البالاست المحسوبة لكل ٥٠٠ كجم وزن حى لأبقار اللبن ٥ر٠٦ ، ٦ر٦٤ ، ٤ر٢٩ للعليقة المقارنة والعليقتين المختبرتين على التوالى .

وقد سببت العليقة المختبرة الأولى زيادة كبيرة فى بروتين اللبن بينما أدت الثانية لزيادة كبيرة فى رماد اللبن ، وكذلك سببتا زيادة فى باقى مكونات اللبن من كالسيوم وفوسفور .

يمكن استنتاج أن حطب القطن المطحون يمكن استخدامه اقتصاديا كمصدر للبالاست فى علائق ماشية اللبن فى موسم الشتاء وذلك لتوفير الزيادة المفقودة عن الاحتياجات الغذائية عند التغذية على البرسيم وذلك لاستعمال الفائض من البرسيم كدريس وسيلاج لاستخدامه فى تغذية الحيوانات فى موسم الصيف .