THE EFFECT OF FORMALDEHYDE TREATMENT OF HIGH-PROTEIN OIL SEEDS ON MILK YIELD, MILK FAT AND MILK FATTY ACID CONTENT

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Introduction

Formaldehyde-treated oil-seed meals fed to dairy cows increase milk and fat production and affect milk fatty acid composition, compared to control animals fed no supplement /Mattos and Palmquist, 1974; Stasiniewicz, 1982; Wrenn et al., 1977; Bitman et al., 1975/. However, comparing the effect of formaldehyde-treated and untreated oil-seed meals in dairy cows gives less apparent results /Mattos and Palmquist, 1974; Stasiniewicz, 1982/.

The present experiment was undertaken to study effects of formaldehyde-treated and untreated soybean and two rapeseed meals /a traditional cv. Górczański and an improved cv. Start 00/ on dairy performance and milk fatty acid composition.

Material and methods

The experiment was carried out on 42 Black and White dairy cows from 6 to 105-th days postpartum. The animals were assigned by analogue method to 7 groups /of 6 cows

each/ and fed according to the Polish Feeding Standards. A basic ration consisting of 30 kg maize silage and 3 kg hay was formulated to meet maintenance and lactation requirement of a cow yielding 10 kg milk daily. A standard concentrate mixture /15% crude protein, 6 MJNE · day^{-1}/ was fed at 0,5 kg per kg milk produced in excess of 10 kg milk daily, in a control group /K/. In experimental groups the standard concentrate mixture was partly replaced with full-fat soybean /S/ or rapeseed meal /R/ - cv. Górczański /Rg/ and Start /Rs/. The daily ration of concentrate mixture contained 2 kg S or 1,5 to 2 kg R. The meals /S, Rg and Rs/ were fed in either untreated /N/ and formaldehyde-treated /C/ form. S and R were treated with experimentally determined amount of formaldehyde /4 g per 100 g seed protein/ sufficient to give the most effective protection of seed fat from rumen biohydrogenation. Throughout the experiment milk yield was measured daily, while fat, protein and milk solids content weekly.

Fatty acids and formaldehyde content in milk were measured twice: at the begining and the end of the experiment.

In addition, the experimental rations were tested on growing bulls and rumen NH_3-N, blood urea-N, nutrient digestibility and N balance were determined.

Results and discussion

Protection of seed fat from rumen biohydrogenation was 76, 68 and 70% respectively for S, Rg and Rs.

Cows fed S and R /both types N and C/ had higher / $p < 0,01$, $p < 0,05$/ milk and fat yield than those from /K/ group /tab.1/. This could be a result of increased fat intake from a ration /Mattos and Palmquist, 1974; McLeod et al., 1977; Stasiniewicz, 1982/. Cows from SC, RgC, RsC groups produced more milk of higher fat content than those from corresponding SN, RgN, RsN groups although differences were not always statistically significant. The results obtained in others experiments on R and S were not clear /Stasiniewicz, 1982; Mattos and Palmquist, 1974/.

An increase in C_{18} and a decrease in C_6 and C_{16} acids in milk noted in these studies was also obserwed by Mattos and Palmquist /1974/, Stasiniewicz /1982/, Wrenn et al. /1977/ in dairy cows fed oil seeds. Significant increase of $C_{18:2}$ content in milk fat resulted from feeding C feeds, compared to cows fed N feeds. The highest $C_{18:2}$ content was found in SC and RsC groups. Milk fat of cows from RgN and RgC groups contained erucic acid /8-9%/.

No traces of formaldehyde were detected in milk of the cows fed formaldehyde treated oil-seeds.

The cows fed C feeds had lower relative nitrogen retention / % N intake / compared to those fed N feeds - 32 vs. 35%, respectively. Formaldehyde treatment of S, Rg, Rs decreased protein digestibility from 76 to 62%; and this observation confirmes the results of other studies /Faichney and Weston, 1977; Mattos and Palmquist, 1974; Nishimuta et al., 1973/. Rumen NH_3-N and blood urea-N concentration /9,5 and 13,3 mg/dl respectively/ were lower in bulls fed C meals, as compared to those fed N meals /12,0

and 15,3 mg/dl, respectively/.

It can be concluded that feeding S and R feeds / of both N and C types / to dairy cows had positive effect on production and caused some changes in fatty acid composition of milk fat. C-type meals improved milk and fat production, as well as $C_{18:2}$ content in milk fat as compared to N feeds.

Conclusion

Start 00 meal can be considered a valuable protein and energy substitute for soybean meal. The traditional rapeseed cultivares are less useful because of their high erucic acid content and its passage to milk fat.

References

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Table 1 Results of experiment

Specification	Groups					
	control /K/	SN	SC	RgN	RgC	RsN	RsC
Milk yield /kg/day/:							
initial	18,34	20,09	20,63	18,28	19,98	18,60	20,09
final	12,06	14,82	16,65	14,29	17,32	14,15	17,08
average	16,10 Aa	17,71BbCc	18,90Cd	17,52AbCc	18,05BCc	17,29ABb	18,13BCc
FCM	13,80 Aa	16,47ABb	18,57Bc	16,33ABb	18,59Bc	16,42ABb	18,44BC
Drop of milk yield /%/:							
	34	26	19	22	13	24	15
Content in milk /%/:							
total solids	11,27 Aa	11,63ABb	12,27Cd	12,06BbCd	12,20Ccd	12,00BbCc	12,24Ccd
fat	3,43 Aa	3,72ABb	3,93Bbc	3,73ABb	4,12Bc	3,80ABb	4,07Bc
protein	2,95 a	3,05a	2,95a	3,13a	2,95a	2,94a	2,87a
$C_{18:2}$ content in the milk fat:							
before experiment /a/							
	2,44	2,49	2,55	2,42	2,45	2,43	2,43
final experiment /b/							
	2,01	4,42	6,30	2,55	3,14	2,44	3,58
ratio b/a	0,32	1,77	2,47	1,05	1,28	1,00	1,47

Values in the same line followed by different letters are significantly differents: capitals- $P \leqslant 0,01$, small letters - $P \leqslant 0,05$, without letters - significance of differences was not calculated