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Faba bean (*Vicia faba* minor) and pea seeds (*Pisum sativum*) as protein sources in lactating ewes' diets.

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ABSTRACT: 18 Massese lactating ewes, divided into 3 homogeneous groups for parity and milk yield, were used to evaluate the replacement effects of soybean meal by Faba bean (*Vicia faba* minor) and Pea (*Pisum sativum*) seeds. During a 70 days trial (beginning after weaning: 30±1.5 days after lambing) animals were fed three isonitrogenous and isocaloric diets. Each diet was characterised by the presence of only one protein feed. The diets consisted of alfalfa hay (1.1 kg/head/d) and a decreasing amount of mixed feed (from 1.1 to 0.7 kg/head/d) to fit animals' requirements. Milk yield, milk chemical composition, animals live weight and BCS, health state and hematochemical parameters were regularly monitored. No diets palatability problems were detected. No significant differences resulted for live weight, BCS, milk yield and milk chemical composition, except for milk protein: higher for faba bean (6.54%) and soybean (6.39%) respect pea (5.66%) diets, $P<0.05$. No differences resulted for blood parameters too and no clinical signs of illness were observed. Therefore faba bean and pea seeds seem to be able to replace the soybean well.

Key words: Faba bean, Pea seeds, Lactating ewes, Milk composition.

INTRODUCTION – In consideration of the request of consumers to avoid of the use of genetically modified (GM) crops in animal feeding and of the banning of GM or chemically treated feeds by European legislation on "organic farming", nutritionists have to reconsider the strategies for protein supply. Faba bean and pea seeds appear to be good alternatives to imported soybean meal, for their crude protein level (25-30% and 22-25% on DM, respectively) and good starch content. However, same characteristics, as high soluble and degradable protein content in pea and faba bean (INRA, 1988; Mustafa *et al.*, 1998; NRC, 2001) or the presence of antinutritional factors in faba bean, could cause negative effects on productive performance or health status in animals. Most of available references regarding the use in ruminants of these protein sources concern cattle beef, lambs and lactating cows, therefore a trial was carried out on lactating ewes fed complete diets containing faba bean or pea seeds compared to diet with soybean meal.

MATERIAL AND METHODS – 18 multiparous (≥3 parity) Massese lactating ewes, homogeneous for parity and milk yield, divided into 3 groups, were fed three isonitrogenous and isocaloric diets with *ad libitum* water and NaCl salt. Diets, formulated according to INRA (1988), differed in protein source presence: FB - faba bean (*Vicia faba* minor, var. Vesuvio); P - pea seeds (*Pisum sativum*, var. Classic); S - solvent-extracted soybean meal. Diets were administered twice daily and based on forage, 1.1 kg/head/d good quality alfalfa hay (CP:173.6, NDF: 338.8 g/kg as fed) and three different mixed feeds (Table 1-2). Animals received decreasing quantity of mixed feed to fit requirements during lactation (from 1.1 to 0.7 kg/head/d). The feeds chemical analysis were carried out according to Martillotti *et al.* (1987); starch content was analysed by enzymatic method (AOAC, 1995). During a seventy days trial period (started after weaning: 30±1.5 days after lambing) milk daily yield was individually detected weekly (n=11), whereas milk chemical characteristics was evaluated every fifteen days (n=6). At the beginning, in the middle and at the end of the trial (n=3), live weight and BCS were individually measured. At the same time, clinical examinations were performed and blood sample, from jugular vein, were collected. Plasma samples were analysed

for parameters reported in table 3. Data were analysed using following linear model for repeated measures:$Y_{ijkl}=\mu+A_i+B_{ji}+C_k+e_{ijkl}$; were A_i= fixed effect of the diet; B_{ji}= random effect of the j^{th} subject in diet; C_k= fixed effect of the time.

Table 1. Ingredients (g/kg as fed basis) of mixed feeds.

Diet	Faba bean	Pea seeds	Soybean meal
Faba bean	320	-	-
Pea seeds	-	560	-
Soybean meal	-	-	160
Corn meal	455	315	565
Beet pulp dehy.	220	120	270
Premix[1]	5	5	5

[1]Contained maize meal and calcium carbonate as support, trace mineral salt and vitamin (per kg: cobalt = 100, iodine = 100 mg, iron = 5,000 mg, manganese = 8,000 mg, selenium = 20 mg, zinc = 12,000 mg; vitamin A = 2,500,000 IU, vitamin D = 800,000 IU, vitamin E = 5,000 mg).

Table 2. Chemical composition (g/kg as fed basis) of the grain legumes and mixed feeds.

	Individual feeds			Mixed feeds		
	Faba bean	Pea seeds	Soybean meal	FB	P	SM
Dry matter	902.6	888.5	889.2	898.4	891.7	890.8
Crude protein	252.4	177.2	420.8	137.3	136.8	136.9
Ether extract	16.0	15.8	18.0	23.5	21.5	25.6
Crude fibre	58.1	47.5	46.2	65.4	53.2	64.4
Ash	35.5	28.3	60.0	28.0	26.0	30.1
Starch	449.2	431.8	34.4	456.4	461.7	382.8
NDF	224.2	151.3	128.5	215.1	170.1	195.1
ADF	103.8	75.0	96.7	102.9	82.1	100.5
ADL	3.1	8.0	4.7	9.4	9.6	11.1
NDIP	26.2	12.1	54.7	25.6	17.1	30.0
ADIP	12.7	4.4	16.4	8.9	5.3	8.5
French M.F.U.*	0.96	0.90	1.02	1.01	0.96	1.03

**French Milk Feed Unit, estimated value.*

RESULTS AND CONCLUSIONS – High pea seeds and faba bean inclusion in mixed feed (56% and 32% respectively) did not cause palatability problem. Administered diets were completely ingested during all trial period. Daily milk yield and milk chemical composition (Table 3) did not show differences except for protein. Milk protein of animal fed diet P were lower ($P<0.05$) than diets FB and S (5.66%, 6.54% and 6.39%, respectively). Similar results, limiting the comparison within faba bean/soybean, were obtained by Di Francia *et al.* (2000) in lactating ewes with similar milk yield and similar diets content of faba bean and soybean meal. The lower milk protein content in animals fed P diet have not been confirmed by milk protein yield. In fact, in this case similar results were obtained among diets (FB: 47.7g/d, P: 49.8g/d, SB: 50.1g/d). Other Authors reported no differences in milk protein composition in dairy cows fed diets based on pea in comparison to soybean meal (Petit *et al.*, 1997) or soybean/canola meal (Corbett *et al.*, 1995). Further investigation are necessary to confirm our results about pea effect on milk com-

position in sheep. The periodical clinical examinations did not evidence health animal problems. All blood parameters (table 3) were within normal range and did not show significant differences among groups. Similar blood urea level among animals fed different diets confirm low influence of diet protein source on this parameter, as reported by Cannas (2001). Average live weight and BCS did not show significant differences

Table 3. Yield and composition of milk, blood parameters, live weight and BCS.

Diets		FB	P	SM	P
Milk yield	ml/d	730	879	784	0.647
Dry matter	%	21.66	19.83	20.33	0.190
Fat	%	6.76	6.39	6.58	0.716
Crude protein	%	6.54[b]	5.66[a]	6.39[b]	0.037
Lactose	%	4.57	4.55	4.25	0.203
Ash %	0.95	0.92	0.94	0.594	
Somatic Cell Count	n x 1000/ml	866	530	834	0.620
Blood parameters:					
Total protein	g/l	67.4	71.4	71.2	0.154
Albumin	g/l	31.1	32.0	32.8	0.126
Urea	mmol/l	7.49	7.68	7.91	0.733
Glucose	mmol/l	3.23	3.13	3.27	0.573
Cholesterol	mmol/l	1.31	1.28	1.45	0.376
Total Bilirubin	µmol/l	2.42	2.21	2.29	0.587
Creatinine	µmol/l	63.8	62.9	68.6	0.346
ALT	U/l	14.3	13.8	12.0	0.265
AST	U/l	64.6	63.4	67.7	0.860
Live weight	kg	52.6	47.2	51.0	0.229
BCS		3.0	3.3	3.0	0.241

[a,b]= P<0.05.

(Table 3). However, animals fed diet S showed a final higher live weight gain twice than other diets (about 4 kg *vs* 2 kg). On the basis of present trial, faba bean and pea seeds appear to be valid substitutes of soybean meal in lactating ewes. Nevertheless further studies are necessary to optimize the use of these legume seeds in diets.

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