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The use of dehulled or fat-supplemented yellow lupin seeds in feeding growing pigs

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ABSTRACT

Two methods of increasing the energy content of yellow lupin seeds for growing pigs were studied: (1) dehulling of seeds and (2) the addition of fat to diets containing lupin. An additional aim of the study was to determine the effectiveness of lysine and methionine supplementation of lupin-containing feeds. Experiment I, lasting 39 days, was carried out on 25 barrows with an average body weight of 27 kg. Experiment II was carried out on 25 barrows weighing from 30 to 100 kg. In both experiments, the animals were fed individually using isoprotein feed mixtures. Daily weight gain, feed utilization, nutrient digestibility, nitrogen balance and, in experiment II, carcass quality were determined.

Supplementing lupin-containing mixtures with lysine and methionine increased daily weight gain by 10% and nitrogen retention by 21% (Experiment I). The addition of fat to cereal-lupin diets led to 7.6% higher daily weight gains in Expteriment I ($P<0.05$), and 14.2% higher gains in Experiment II ($P<0.01$) over the entire period of the experiment. The use of deulled lupin seeds increased weight gain by 4.8% ($P>0.05$) in Expt. I and by 13.5% ($P<0.01$) in Expt. II. It was found that yellow lupin can completely replace soyabean oilmeal in the diets for pigs of over 30 kg body weight, under the condition that the diets are balanced in respect to lysine and methionine. The nutritive value of diets containing mostly barley and yellow lupin can be improved by adding fat or dehulling seeds.

KEY WORDS: yellow lupin, dehulling, fat, amino acids, pigs

INTRODUCTION

Lupin seeds contain negligible amounts of starch, but large amounts of nonstarch polysaccharides (NSP) and α-galactosides, which are digested in the small intestine of pigs to a very small extent but are fermented in large intestine

(Taverner et al., 1983). This may lead to flatulence as well as to insufficient net energy uptake from lupin seeds, despite their high gross and digestible energy value. The data of Fernandez and Batterham (1992) show that the net energy of soyabean oilmeal is equal to 52% of its gross energy content, while that of narrow-leaved lupin only 43%. The high digestibility of lupin nutrients in the entire digestive tract, which is the basis for calculating the energy value of feeds for pigs, may lead to overestimation of the energy value of lupin, especially for younger animals.

This problem is more pertinent in respect to yellow lupin, which in comparison with white or narrow-leaved lupin seeds, contains more seed hull and α-galactosides (Brillouet and Riochet, 1983; Trugo and Almeida, 1988; Saini, 1989). It seems, then, that dehulling seeds, and so elimination most of the NSP, may increase the energy value of these seeds for pigs.

The aim of this study was to compare the effectiveness of two methods of increasing the energy value of yellow lupin seeds for growing pigs: (1) dehulling seeds, (2) adding fat to a diet containing lupin. An additional objective of the study was to assess the effectiveness of supplementing lupin-containing diets with lysine and methionine.

MATERIAL AND METHODS

Animals and diets

Two experiments were carried out.

Experiment I was done on 25 barrows, crossbreds of the the Polish Large White and Polish Landrace, with initial weights of 27.3 kg. The pigs were fed individually for a period of 39 days on the complete isoprotein feeds (Table 1). The soyabean oilmeal that supplemented barley and wheat (group 1) was replaced by lupin (group 2), lupin supplemented with lysine and methionine according to the German standards (DLG, 1987) (group 3), lupin with added soyabean oil (group 4), dehulled lupin (group 5). The diets fed to groups 1,3,4 and 5 had similar lysine and methionine contents. The feeds were given in moist form (1:1 with water) in amounts increased from 1.4 to 2.3 kg per day, twice daily. Nutrient digestibility and nitrogen balance were determined in pigs with body weights averaging 48.8 kg.

Experiment II was carried out on 25 crossbred barrows with an average initial weight of 29.8 kg. During fattening to 100 kg body weight, the pigs were fed individually using isoprotein feed mixtures (Table 2), containing soyabean

TABLE 1

Composition and nutritional value of diets (Experiment I)

Indices	Groups				
	1 (SBM)[1]	2 (SBMF)	3 (L)	4 (DL)	5 (LF)
Ingredients, %					
Barley	55.5	57.5	57.2	52.2	61.2
Wheat	25.0	25.0	25.0	25.0	25.0
Soyabean meal	16.0	–	–	–	–
Lupin, whole	–	14.0	14.0	15.0	–
Lupin, dehulled	–	–	–	–	10.0
Soyabean oil	–	–	–	4.0	–
Minerals[2]	2.5	2.5	2.5	2.5	2.5
Premix	1.0	1.0	1.0	1.0	1.0
L–lysine HCL, g/kg	–	–	0.23	0.23	0.23
DL–methionine, g/kg	–	–	0.06	0.06	0.06
Chemical composition, %					
Dry matter	88.78	88.75	88.87	89.55	89.01
Crude protein	15.65	15.57	15.74	15.73	16.00
Ether extract[3]	2.72	3.10	3.11	6.84	3.08
Crude fibre	4.85	5.64	5.62	5.71	4.43
Nutrient contents, %					
Digestible crude protein	12.30	12.18	12.50	12.36	12.64
Lysine[4]	0.70	0.60	0.77	0.77	0.77
Lysine:crude protein, %	4.47	3.85	4.89	4.90	4.81
Methionine[4]	0.24	0.20	0.25	0.25	0.25
Methionine:lysine, %	34.3	33.3	32.5	32.5	32.5
Met+cys[4]	0.53	0.53	0.58	0.58	0.58
Metabolizable energy, MJ/kg	12.61	12.44	12.50	13.40	12.78

[1] SBM – soyabean meal, L – lupin, LA – lupin + amino acids, LAF – lupin + amino acids + fat, DLA – dehulled lupin – amino acids

[2] bicalcium phosphate (1.3%), limestone (0.9%), salt (0.3%)

[3] determined after HCL hydrolysis

[4] values calculated

oilmeal (group 1), soyabean oilmeal with added fat (group 2), lupin (group 3), dehulled lupin (group 4), lupin with added fat (group 5). The protein, amino acid and mineral content of the feeds was balanced according to the Nutrient Requirements of Pigs (1993). The feed mixtures were given in moist form (1:1 with water) twice daily. Nutrient digestibility and nitrogen balance were determined in pigs with average body weights of 61.8 kg.

Faeces and urine collections were carried out during 5-day periods. Two average samples of faeces, 10% of daily collection, were taken. One was

TABLE 2

Composition and nutritional value of diets (Experiment II)

Indices	Groups				
	1 (SBM)[1]	2 (SBMF)	3 (L)	4 (DL)	5 (LF)
Ingredients, %					
Barley	52.9	48.9	51.7	57.2	47.7
Wheat	25.0	25.0	25.0	25.0	25.0
Soyabean meal	19.0	20.0	–	–	–
Lupin whole	–	–	20.0	–	21.0
Lupin, dehulled	–	–	–	14.5	–
Soyabean oil	–	3.0	–	–	3.0
Mineral feeds[2]	2.0	2.0	2.0	2.0	2.0
Premix	1.0	1.0	1.0	1.0	1.0
L-lysine HCL, g/kg	0.91	0.77	2.20	2.50	2.13
DL-methionine, g/kg	0.07	0.08	0.58	0.56	0.47
Chemical composition, %					
Dry matter	87.74	88.09	87.84	87.99	87.93
Crude protein	16.35	16.34	16.12	16.41	16.20
Ether extract[3]	2.89	5.78	3.26	3.53	6.21
Crude fibre	4.77	4.47	6.41	4.26	6.50
Nutrient contents, %					
Digestible crude protein	12.52	12.99	12.12	12.88	12.81
Lysine[4]	0.84	0.84	0.84	0.84	0.84
Methionine[4]	0.25	0.25	0.25	0.25	0.25
Met+cys[4]	0.54	0.52	0.54	0.52	0.55
Metabolizable energy, MJ/kg	12.17	12.91	11.97	12.45	12.67

[1] SBM – soyabean meal, SBMF – soyabean meal + fat, L – lupin, DL – dehulled lupin, LF – lupin + fat

[2] bicalcium phosphate (0.6%), limestone (1.1%), salt (0.3%)

[3] determined after HCL hydrolysis

[4] values calculated

preserved with sulphuric acid (for N determination), the other was dried to determine the other nutrients and energy. Urine was collected into containers with sulphuric acid added in amunts lowering urinary pH to about 2.

At the end of the experiment, carcass quality was determined using as criteria backfat thickness, loin eye area, ham dissection and loin protein and fat content.

Lupin of the Juno variety was used in both experiments. The seeds were dehulled on a semitechnological scale using a method developed at the Institute of Agricultural and Machinery and Equipment, Olsztyn University of Agriculture and Technology. The cotyledon yield equaled 68% in experiment I, and 63% in experiment II (Table 3).

TABLE 3

Composition of feeds (% DM)

Ingredients	Experiment I			Experiment II		
	soyabean meal	whole lupin	dehulled lupin	soyabean meal	whole lupin	dehulled lupin
Dry matter	90.24	89.17	91.48	87.54	87.09	90.85
Crude ash	8.65	4.13	4.66	7.07	4.99	6.08
Crude protein	42.29	46.85	57.27	48.75	45.01	56.32
Ether extract[1]	3.72	6.44	7.59	2.59	6.77	8.24
Crude fibre	6.11	14.26	3.44	8.04	17.68	3.07
NDF	14.43	22.20	7.61	19.39	24.71	7.85
ADF	8.65	18.32	5.04	10.81	20.89	4.48
Lignin	nd[2]	nd	nd	trace	1.54	0.55
Soluble carbohydrates	nd	nd	nd	12.26	18.16	20.70
Starch	nd	nd	nd	0.21	0.42	0.45
Total alkaloids	–	0.141[3]	0.161[3]	–	0.061[3]	0.066[3]

[1] determined after HCL hydrolysis

[2] not determined

[3] see material and methods

Chemical analysis

The nutrient content in feeds and, faeces, and urinary N were determined using conventional methods. NDF, ADF and lignin (ADL) were determined according to Van Soest and Wine (1967) using a Fibertex apparatus. In protein feeds starch was assayed enzymatically (Keppler and Decker, 1970), while soluble sugars according to Jacórzyński (1986). In experiment I lupin alkaloids were determined according to Skolik and Wiewiórkowski (1959), while in experiment II, according to Wysocka et al. (1989). Gross energy in feeds and faeces was determined by combustion in an adiabatic bomb.

Statistical analysis

The results of the experiments were subjected to statistical analysis of variance and Duncan multiple range test.

RESULTS

Dehulling yellow lupin seeds resulted in significant changes in their chemical composition (Table 3). The nonstarch polysaccharide content in dehulled fraction decreased: raw fiber from 14.1 to 3.4% (Experiment I) and from 17.7 to

TABLE 4

Growth performance, digestibility coefficients and N balance (Experiment I)

Indices	Groups					P level
	1 (SBM)[1]	2 (L)	3 (LA)	4 (LAF)	5 (DLA)	
Ingredients, %						
Initial BW[2], kg	27.10	28.10	27.60	27.10	26.70	
Final BW, kg	53.30	52.72	54.34	55.78	54.68	
BW gain, g/day	671^{cB}	621^{dC}	684^{bcAB}	736^{aA}	717^{abAB}	0,000
Feed : BW gain, kg/kg	2.61^{bB}	2.84^{aA}	2.56^{bcB}	2.33^{dC}	2.46^{cdBC}	0.000
ME[3] : BW gain, MJ/kg	33.0^{bAB}	35.3^{aA}	32.0^{bB}	31.2^{bB}	31.4^{bB}	0.001
DCP[4] : BW gain, g/kg	322^{bAB}	346^{aA}	321^{bAB}	288^{cC}	310^{bBC}	0.000
Digestibility coefficients, %						
Crude protein	78.6	78.2	79.4	78.6	79.0	0.933
Ether extract	46.8^{B}	47.7^{B}	48.7^{B}	72.9^{A}	49.9^{B}	0.000
Crude fibre	36.1	26.9	22.5	29.8	27.9	0.190
N-free extractives	91.0	90.4	90.2	90.6	91.4	0.599
Organic matter	84.1	82.2	82.1	82.7	84.2	0.170
Gross energy	81.4	79.1	78.5	80.4	81.0	0.154
N balance						
Intake, g/day	51.1	50.1	51.0	50.6	52.3	
Retention, g/day	20.7^{abAB}	18.7^{bB}	22.8^{aA}	22.2^{aAB}	22.2^{aAB}	0.027
N retention:N intake, %	40.4	37.3	44.8	43.9	42.5	0.068
N retention:N digested, %	51.5^{ab}	47.7^{b}	56.4^{a}	55.7^{a}	53.7^{ab}	0.043

[1] see Table 1
[2] body weight
[3] metabolizable energy
[4] digestible crude protein
a, b, c – $P<0.05$; A, B – $P<0.01$

3.1% (Experiment II), NDF from 22.2 to 7.6% and from 24.7 to 7.9%, respectively, while lignin from 1.5 to 0.6%. Removal of the seed coat caused a rise in the crude protein content to 56-57% DM, i.e. to a level surpassing the amount of this nutrient in soyabean oilmeal. Dehulled seeds contained somewhat more raw fat, soluble sugars and alkaloids than whole seeds. The seeds used in experiment I contained about twice the amount of alkaloids as those used in experiment II (Table 3). Despite these differences, the pigs were equally willing to eat both lupin-containing diets and were healthy. It seems that the differences in alkaloid content could have resulted from the use of two different analytical methods (see Material and Methods).

In experiment I, total replacement of soyabean oilmeal with lupin seeds without supplementing with lysine and methionine led to a highly significant, 7.5% decrease in daily weight gains, and nitrogen retention ($P<0.05$) as well as to significant decrease ($P<0.01$) of feed conversion rate (Table 4). When lysine and methionine were added to the feed containing lupin, weight gains and feed utilization were slightly higher than in the control group. Of the two methods of increasing the energy content of lupin, the addition of fat was more effective (7.6% greater weight gains) than dehulling seeds (4.8% greater gains). Addition of fat significantly increased feed utilization ($P<0.01$). Nutrient digestibility of the lupin-containing feeds was similar to their digestibility in feeds with soyabean oilmeal. Crude fat in the mixture containing added soyabean oil (group 4) was better digested ($P<0.01$) than in the mixture without added oil (Table 3).

In experiment II (Table 5), the pigs grew more slowly than in experiment I. In the feed mixtures that were balanced for crude protein, lysine and methionine,

TABLE 5

Body weight gain and feed efficiency (Experiment II)

Indices	Groups					P level
	1 (SBM)[1]	2 (SBMF)	3 (L)	4 (DL)	5 (LF)	
Initial BW[2], kg	30.5	29.3	30.5	29.3	29.5	
Final BW, kg	98.9	100.1	98.7	101.1	100.2	
BW gain, g/day						
30-60	493^{bcB}	542^{abAB}	471^{cB}	587^{aA}	587^{aA}	0.001
60-100	716^{bcAB}	749^{bcAB}	701^{cB}	763^{abAB}	773^{aA}	0.018
30-100	607^{bcAB}	645^{abAB}	591^{cB}	671^{aA}	675^{aA}	0.001
Feed : BW gain, kg/kg						
30-60	3.91^{abAB}	3.58^{bcAB}	4.13^{aA}	3.31^{cB}	3.32^{cB}	0.003
60-100	4.11^{abAB}	3.92^{bcAB}	4.20^{aA}	3.84^{bcAB}	3.77^{cB}	0.010
30-100	4.02^{AB}	3.77^{BC}	4.17^{A}	3.60^{C}	3.56^{C}	0.000
ME[3] : BW gain, MJ/kg						
30-60	47.6^{ab}	46.4^{abc}	49.4^{a}	41.2^{c}	42.1^{cb}	0.024
60-100	50.0	50.7	50.4	47.8	47.8	0.175
30-100	48.9^{aAB}	48.8^{aAB}	49.9^{aA}	44.8^{bB}	45.1^{bB}	0.008
DCP[4] : BW gain, g/kg						
30-60	490^{a}	465^{ab}	500^{a}	426^{b}	425^{b}	0.026
60-100	515	510	510	495	483	0.248
30-100	503^{a}	492^{ab}	506^{a}	464^{bc}	457^{c}	0.015

[1] see Table 2
[2] body weight
[3] metabolizable energy
[4] digestible crude protein
a, b, c – $P<0.05$; A, B – $P<0.01$

complete replacement of soyabean oilmeal with lupin seeds did not negatively affect daily gains, while dehulling had a positive effect. In comparison with the gains of pigs fed unprocessed lupin, those fed dehulled lupin grew 24.6% faster ($P<0.01$) during the period of fattening from 30 to 60 kg, 8.8% faster ($P<0.05$) from 60 to 100 kg and 13.5% faster ($P<0.01$) during the entire fattening period. The effectiveness of dehulling lupin seeds was comparable to adding fat to the cereal-lupin diet. Adding fat also led to greater body weigh gains: by 24.6 (30-60 kg BW), 10.3 (60-100 kg BW) and 14.2% (30-100 kg BW). The addition of fat to the cereal-soyabean diet (group 2) had a favourable effect on the growth of animals; throughout the entire period of the experiment, body weight gains were 6.2% higher ($P>0.05$). The use of dehulled lupin (group 4), as well as the addition of fat to the cereal-lupin diet (group 5) significantly reduced feed to gain ratio-by 13.6 and 14.6%, respectively, during the entire period of fattening in comparison with whole lupin (group 3). The addition of fat to the cereal-soyabean diet insignificantly reduced feed to gain ratio (by 6.2%).

No significant differences were found in nutrient digestibility coefficients among the diets under study, with the exception of crude fat (Table 6). Crude fat in rations containing added soya oil was significantly ($P<0.01$) better digested than in diets without added oil. Using dehulled lupin or adding fat the diets containing whole lupin or soyabean meal caused an insignificant rise in the digestibility of crude protein, organic matter and energy.

TABLE 6

Digestibility coefficients of nutrients and N balance (Experiment II)

Indices	Groups					P level
	1 (SBM)[1]	2 (SBMF)	3 (L)	4 (DL)	5 (LF)	
Digestibility coefficient, %						
Crude protein	76.6	79.5	75.2	78.5	79.1	0.204
Ether extract	43.6^{B}	66.8^{A}	41.9^{B}	47.5^{B}	62.7^{A}	0.000
Crude fibre	23.7	25.2	25.0	25.7	31.1	0.387
N-free extractives	88.3	88.7	88.4	88.4	88.7	0.966
Organic matter	80.7	81.9	79.1	81.6	80.4	0.067
Gross energy	77.7	79.6	76.3	78.5	78.2	0.060
N balance						
Intake, g/day	67.6	68.2	67.4	68.0	67.6	
Retention, g/day	22.4	25.0	23.2	25.6	24.0	0.554
N retention:N intake, %	33.1	36.6	34.4	37.6	35.6	0.555
N retention:N digested, %	43.2	46.2	45.7	48.0	44.9	0.776

[1] see Table 2

A, B – $P<0.01$

TABLE 7

Carcass quality (Experiment II)

Indices	Groups					P level
	1 (SBM)[1]	2 (SBMF)	3 (L)	4 (DL)	5 (LF)	
BW[2] before slaughter, kg	98.9	100.1	98.7	101.1	100.2	
Dressing percentage, %	79.3	79.9	79.5	80.2	80.4	0.510
Backfat thickness[3], cm	2.74	3.19	2.63	2.74	2.81	0.401
Loin eye area, cm^2	35.8	37.1	35.6	37.1	37.8	0.399
Weight of ham[4], kg	9.28	9.32	9.25	9.51	9.60	0.832
Meat in ham, %	68.1	67.0	68.7	70.1	70.0	0.731
pH_1	6.32^{abAB}	6.40^{abAB}	6.10^{bB}	6.64^{aA}	6.46^{aAB}	0.018
pH_u	5.38	5.36	5.34	5.36	5.38	0.872
Contents in longissimus dorsi musule						
Dry matter, %	25.12	25.08	24.83	25.48	24.94	0.203
Crude protein, %	22.94	22.32	22.22	22.48	22.63	0.706
Ether extract, %	0.94^{bB}	1.46^{aA}	0.94^{bB}	1.52^{aA}	1.12^{bAB}	0.001

[1] see Table 2
[2] body weight
[3] mean of three measurements
[4] without shank
a, b – P<0.05; A, B – P<0.01

Daily nitrogen retention, determined at a body weight of about 62 kilograms, equaled 22.4 to 25.6 g, and did not differ significantly among groups. However, N retention and utilization of digested nitrogen were somewhat higher ($P>0.05$) in pigs fed the cereal-soyabean ration plus oil (group 2) and in pigs fed the diet containing dehulled lupin (group 4) than in pigs from the other groups.

On the basis of the taken measurements, no differences in carcass quality were found (Table 7). Backfat thickness, loin eye area, ham weight and meat content, loin protein and fat content in pigs fed the cereal-soyabean diet were almost the same as in the pigs fed the cereal-lupin diet. The 3% addition of fat to the cereal-soyabean diet (group 2) insignificantly increased the backfat thickness (0.45 cm), increased the loin eye area and significantly ($P<0.01$) increased loin fat content. Adding fat to the cereal-lupin diet had a similar effect on carcass quality as using dehulled lupin in the diet. In comparison with the pigs in group 3, fed unprocessed lupin, the carcasses of, pigs in group 5 had slightly thicker backfat, greater loin eye area and ham weight. The loin fat content was more affected by feeding dehulled lupin (a 61% nicrease) than by adding fat to the lupin diet (a 19% rise).

DISCUSSION

The increase in crude protein content in dehulled yellow lupin seeds (by 22% in experiment I and 25% in experiment II) is comparable to data obtained by Kwiatkowski and Golec (1987) and Vasquez et al. (1989). Dehulling the seeds eliminated 79% raw fibre, 75% ADF and 67% NDF. In the studies by Brenes et al. (1993), dehulled sweet lupin seeds contained 72% ADF and 73% NDF less than whole seeds. The chemical composition of dehulled seeds shows that the dehulling technique was effective and gave a product close to that obtained by manual remoral of hulls (Zduńczyk et al., 1994).

A significant positive effect of supplementing the barley-wheat-lupin diet with lysine and methionine on body weight gain, feed utilization and nitrogen balance in young growing pigs (Experiment I), confirms the deficit of these amino acids in this type of diet. It results from of the low lysine content of cereals and rather low lysine content and availability in lupin (Batterham, 1992), as well as the low content and digestibility of lupin seed methionine throughout the digestive tract of pigs (Wunsche et al., 1990; Wasilewko et al., 1994). The supplementing cereal-lupin diets with lysine and methionine, is therefore effective which is also confirmed by the results of other studies (Leibholz, 1984; Fernandez and Batterham, 1992; Flis, 1993; Chachułowa et al., 1994; Gdala et al., 1994).

The addition of fat to the cereal-lupin diets affected favourably body weight gain and feed utilization, more in Experiment II in which smaller lupin seeds having more raw fibre were used. The same amount of fat added to the cereal-soyabean diet (Experiment II) only insignificantly increased gains. This means that in a diet with a high yellow lupin content, balanced in terms of the amount and quality of protein, energy was the factor limiting protein synthesis and growth of pigs, more than in the cereal-soyabean diet. The positive effect of increasing the energy level in the diets of pigs on protein synthesis and weight gains has been found in numerous studies (Grela and Jakobsen, 1991; Edwards and Campbell, 1992; De Greef et al., 1994).

Dehulling lupin seeds had a positive effect on their nutritional value. In experiment II, the effect of dehulling was comparable to the addition of 3% soyabean oil to the ration. It seems that removing the seed hulls, leading to a reduction in NDF, among others, contributes to the more intensive digestion of nutrients in the small intestine. This relationship in the case of narrow-leaved lupin was found by Fernandez and Batterham (1992).

A statistically highly significant increase in crude fat digestibility in diets containing added soyabean oil can in part be explained by the fact that the added oil is characterized by higher digestibility than the crude fat that is present in the component of the dietss, as well as by its higher content in these diets.

In summarizing the results of this study, it can be stated that soyabean oilmeal can be completely replaced by yellow lupin in diets balanced in terms of lysine and methionine used in the feeding of pigs weighing over 30 kg. The nutritional value of diets containing yellow lupin and barley can be increased by adding fat or dehulling seeds.

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STRESZCZENIE

Zastosowanie obłuskanych lub uzupełnionych tłuszczem nasion łubinu żółtego w żywieniu rosnących świń

Badano skuteczność zwiększenia wartości energetycznej dawek z nasionami łubinu żółtego dla rosnących świń: (1) poprzez zastosowanie w mieszance nasion obłuskanych lub (2) dodatek tłuszczu do mieszanki z łubinem. Ponadto określono skuteczność uzupełnienia lizyną i metioniną mieszanki z łubinem. Doświadczenie I, trwające 39 dni, wykonano na 25 wieprzkach o średniej masie ciała 27 kg, doświadczenie II – na 25 wieprzkach od 30 do 100 kg masy ciała. W obydwóch doświadczeniach świnie żywiono indywidualnie izobiałkowymi mieszankami. Określano przyrosty dobowe, wykorzystanie paszy, strawność składników pokarmowych dawek, bilans azotu, a w doświadczeniu II także jakość poubojową tusz.

Uzupełnienie lizyną i metioniną mieszanki z łubinem spowodowało większe, o 10%, przyrosty dobowe i większą, o 21%, retencję azotu (doświadczenie I). Dodatek tłuszczu do diet zbożowo-łubinowych wpynął na zwiększenie przyrostów dobowych: w doświadczeniu I o 7,6 ($P<0,05$), w doświadczeniu II o 14,2% ($P<0,01$) – średnio w całym okresie tuczu. Skarmianie obłuskanych nasion łubinu spowodowało zwiększenie przyrostów o 4,8 ($P<0,05$) – w doświadczeniu I, i o 13,5% ($P<0,01$) – w doświadczeniu II. Stwierdzono, że łubinem żółtym można całkowicie zastąpić poekstrakcyjną śrutę sojową w zbilansowanych, pod względem zawartości lizyny i metioniny, mieszankach przeznaczonych dla świń powyżej 30 kg. Wartość pokarmową dawek zawierających łubin żółty z przewagą jęczmienia można zwiększyć poprzez dodatek do nich tłuszczu lub zastosowanie obłuskanych nasion.