Energy and protein value of white lupin (*Lupinus albus L.*) and its mode of utilization in pig feeding

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Two experiments were made to determine more accurately the energy and protein value as well as the mode of utilization of white lupin (*Lupinus albus* L.) in fattening pigs.

A digestibility experiment was made for assessing the energy and protein value of two types of white lupin: the first one belonging to the variety « LUBLANC » (12 p. 100 bitter seed) containing alkaloïds, the second to the variety « KALINA », soft, without alkaloids.

The experiment involved 5 castrated male pigs per type of lupin with a mean body weight of 29.8 kg. They received a semi synthetic diet based on maize starch including 40 p. 100 lupin and were subjected to a 10-day faeces and urine collection period.

The digestible energy values of the varieties « LUBLANC » and « KALINA » were 4 170 and 4 229 Kcal DE respectively per kg dry matter corresponding to an apparent digestibility coefficient of energy (ADCe) of 83.5 p. 100 identical for both types of lupin. The apparent digestibility of nitrogen (ADCn) was 86.5 p. 100 for « LUBLANC » and 85.5 p. 100 for « KALINA ».

Though both types of lupin had similar nutritional characteristics, only the soft one without alkaloids was well ingested by pigs.

Another experiment involving 5 groups of 12 pigs (6 castrated males and 6 females) per diet was carried out between 25 and 100 kg live weight in order to examine the possibilities of replacing partially or totally soybean meal by white soft lupin of the « KALINA » type alone or in association with a lucerne protein concentrate (PX_1), in a diet based on wheat.

As compared to the control diet, wheat soybean meal (20 p. 100) (group 1), lupin incorporated at a level of 15 p. 100 (group 2) may replace half of the soybean meal fraction without changing the performance. On the other hand a total replacement of soybean meal (20 p. 100) by 30 p. 100 lupin properly supplemented with lysine (group 3) and even admixed with antibiotics (group 4) led to significantly lower performance than those of the control group (wheat soybean meal, 20 p. 100). But, total replacement of 20 p. 100 soybean meal by 10 p. 100 lupin associated with 10 p. 100 lucerne protein concentrate (PX_1) adequatly supplemented with lysine (group 5) led to the same performance as those obtained with control diet (wheat-soybean meal 20 p. 100).

According to this study the optimum level of soft white lupin as partially replacing soybean meal in a fattening pig diet based on wheat may temporarily be 10-15 p. 100. Moreover, the combination of 10 p. 100 soft white lupin and 10 p. 100 lucerne protein concentrate (PX_1) supplemented with lysine in a diet based on wheat allowed to replace soybean meal totally without modifying the performance. This is therefore an original solution for satisfying the protein requirements of fattening pigs.

Results of two trials concerning substitution of cassava for barley in bacon pig feeding

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Two trials were made in the growing-finishing pig for studying the utilization of poor quality cassava incorporated at increasing levels (15, 30, 40 p. 100) as a substitution for barley into isoenergetic diets.

In the first trial 90 animals were used between 35 and 100 kg live weight to compare three diets: barley-soybean control diet (group 1), 15 p. 100 cassava (group 2), 30 p. 100 cassava (group 3) i.e. 30 pigs per treatment. The animals housed in piggeries fitted with wholly slatted floors were fed collectively in pens of six animals. Pigs were restricted to 2.6 kg /day in the finishing

period. For the whole experimental period the daily mean gains were 637-638 and 627 g, the feed conversion ratio 3.36-3.34 and 3.41 for the control group, group 2 (15 p. 100 cassava) and group 3 (30 p. 100 cassava), respectively.

No significant difference was observed between the three treatments either over the whole period or over the growing and finishing periods separately.

Carcass quality was the same for dressing out percentage, but rather in favour of cassava groups for backfat thickness. This advantage can be explained by the higher lysine content of the latter.

In the second trial, 108 animals between 30 and 100 kg live weight, were subjected to the same experimental conditions as in the first trial in order to compare three diets: barley-soybean control diet (group 1), 30 p. 100 cassava (group 2), 40 p. 100 cassava (group 3), i.e. 36 pigs per treatment.

Growth and feed conversion ratios were rather close to those recorded during the 1st trial: 660-650-635 g; and a feed conversion ratio of 3.33-3.37 and 3.44 for groups 1, 2, 3, respectively. No significant difference was observed either on the whole period or on the growing finishing period, carcass quality was absolutely the same for the three diets.

In conclusion, these two trials concerning substitution of poor quality cassava for barley allowed to obtain the same growth and carcass quality performance in bacon pigs of 30 to 100 kg whatever the incorporation level of cassava. Thus, the prediction equation of the cassava energy value from its chemical composition, stated by PEREZ (I.N.R.A., 1979) was verified in these two trials.

Energy evaluation of barley for pigs. Prediction from analyses of fibre content

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In order to define more accurately the influence of changes in the composition of barleys on their energy value, a digestibility experiment was made on 28 castrated male pigs with a mean weight of 30 kg. The animals, kept in metabolism crates, were subjected to a 10-day faeces and urine total collection period and received only cereals diets. Seven types of barley, of different morphology and composition were studied: two six-row winter barleys (Astrix and Sympa), two two-row winter barleys (Alpha and Sonja), one spring barley (Aramir) and two naked barleys (CF 113, Nudinka) containing 6.6-6.1-5.5-4.7-4.5-2.4 and 2.2 p. 100 respectively of Weende crude fibre in the dry matter.

A decrease in the digestibility of the dietary components was observed in relation with the hull percentage of the seeds leading to a 10-point difference in the apparent digestibility coefficients of dry matter, organic matter and energy, between the extreme barleys.

Increase in the crude fibre contents led to a highly significant linear decrease ($P < 0.01$) in the apparent digestibility coefficient of energy, corresponding to a — 2.27 point reduction of the A.D.E. per supplementary point of crude fibre in the dry matter (D.M.)

A.D.E. = 91.99 — 2.27 crude fibre p. 100 D.M. $\quad r = -0.965^{**}$

The same was observed with increasing Acid Detergent Fibre (A.D.F.) contents and Neutral Detergent Fibre (N.D.F.) contents:

A.D.E. = 90.43 — 1.69 A.D.F. p. 100 D.M. $\quad r = -0.961^{**}$
A.D.E. = 98.11 — 1.04 N.D.F. p. 100 D.M. $\quad r = -0.881^{*}$

The directly measured digestible energy values (Kcal/kg D.M.) were: 3 377 (Astrix), 3 448 (Sympa), 3 366 (Alpha), 3 580 (Sonja), 3 563 (Aramir) for the hulled barleys and 3 784(C.F.113) and 3 867 (Nudinka), respectively, for the naked barleys, i.e. values comparable to that of wheat. Therefore the crude fibre content seems to be the main factor of variation in the energy value of barley for the pig since in the present study it accounts for 93 p. 100 of the variation in the digestible energy value.

On the basis of the results obtained it is possible to predict the digestible energy value of