

**Determination of, and Factors Affecting Nutrient
Digestibility and Nutritive Value of *Lupinus
angustifolius* (cv. Gungurru) for Growing Pigs**

*A thesis submitted to the University of New England
for the degree of Master of Rural Science*

by

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PREFACE

The work presented in this thesis is original and was completed by the author, a post-graduate student in the Department of Biochemistry, Microbiology and Nutrition, Faculty of Rural Science, University of New England, Armidale, N.S.W., Australia under the supervision of Associate Professor D.J. Farrell.

All experimentation was performed at Wollongbar Agricultural Institute under the supervision of the late Dr. E.S. Batterham.

I certify that this thesis has not already been submitted in substance for any degree and is not being currently submitted for any other degree.

I certify that all sources of assistance received in preparing this thesis have been duly acknowledged.

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G.C. Wigan

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SUMMARY

Lupins are a commonly used dietary feedstuff for pig production in Australia. They are high in energy and do not contain any known anti nutritional factors. The current practice of the feedmilling industry is to coarsely crush lupins, and in some cases the seed-coat is also removed prior to incorporation in stockfeed.

Despite widespread acceptance of lupins as a feedstuff, there is wide variability reported in the literature for its digestible nutrient content and this makes assigning a precise nutritive value to them for diet formulation problematical.

Work by Fernandez and Batterham (1992) and Batterham (unpublished), reported the possibility of an interaction between dietary energy source and the growth (empty body weight gain) performance of pigs offered diets containing lupins and kernels relative to pigs offered a soyabean meal diet of equivalent digestible nutrient intake. The current series of experiments were somewhat similar to those of Fernandez and Batterham (1992) and Batterham (unpublished) as it was necessary to determine whether such an interaction could be repeated.

On this basis, four experiments were designed in which the performance of pigs offered both lupin-seed meal (lupins) and dehulled lupin-seed meal (kernels) could be compared with pigs offered soyabean meal in sucrose- and wheat-based diets.

Experiment 1 was a metabolism experiment in which the digestible energy (DE) for lupins, kernels, soyabean meal (SBM) and wheat was determined (12.3, 15.4, 15.1 and 14.0 MJ/kg, air-dry basis respectively). This technique produced consistent results within treatments, and was demonstrated to be capable of revealing small differences in digestibility of energy between the ingredients.

Experiment 2 utilised chromic oxide to determine the ileal digestibility of amino acids in lupins, kernels, SBM and wheat. This technique was associated with a higher level of variation within treatments and appeared more variable in the current experiments than in other recent experiments at the same facility. In both Experiments 1 and 2 an improvement in nutrient digestibility was associated with the dehulling process.

Experiment 3 was a growth and carcass deposition study, in which the influence of dietary energy source (sucrose or wheat) on utilisation of digestible nutrients was explored. It was found that whilst pigs offered lupins and kernels in sucrose-based diets tended to more efficiently retain digestible nutrients than their SBM counterparts, the opposite occurred when these same ingredients were offered to pigs in wheat based-diets. Dehulling was of no benefit in either wheat- or sucrose-based treatments.

Experiment 4 was designed to explore the influence of, a) dietary energy source on determination of DE, b) fineness of grinding, and c) the accuracy with which DE could be determined using chromic oxide and partial collection of faeces. It was found that assessing the DE of lupins in wheat-based diets led to a 1.2 MJ/kg higher value for DE than when they were in sucrose. There was an obvious tendency for DE values to be higher when the lupins were more finely crushed, and chromic oxide was found to produce a significantly lower (2 MJ/kg) estimate for DE when compared with the total collection method.

In summary, dietary energy source was found to significantly influence both retention of ileal digestible lysine and determination of DE. The important implication of these findings are that in practice the use of lupins in wheat-based diets will produce a lower level of pig performance than soyabean diets of equivalent digestible nutrient density, despite indications to the contrary using sucrose-based diets.