PIG PRODUCTION SYMPOSIUM

1. DEVELOPMENTS IN THE NUTRITION OF PIGS

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Summary

Some of the recent developments in the nutrition of pigs in Australia are discussed and reference is made to the practices of creep feeding and early weaning of piglets, to restricting feed levels and ration quality for growing pigs, and to the effects of feed intake and ration quality on weight changes of sows during the reproductive cycle. Promising results with the linear programming technique of least cost ration formulation are mentioned.

I. INTRODUCTION

Rapid changes have taken place in both size and structure of the Australian pig industry during recent years. The total pig population reached 2.29 million on March 31, 1969, an increase of 78 per cent in 10 years. While it is difficult to document changes in nutritional practices, it is evident that the industry no longer relies on liquid milk by-products as the main source of food. The use of mixtures comprising cereal grain, protein rich ingredients, minerals and vitamins, as a complete ration, is now common place in Australia, as in most overseas countries. These mixtures comprise for the largest cost item in pig production, amounting to about 70 per cent of the value of gross output.

During this rapid period of growth in the industry, it has been necessary to rely on research carried out overseas as the main guide. Expansion in Australian research has not kept pace with the growth of the industry. This is evident from details published in the Index of Current Research on Pigs (A.R.C. 1963, 1969) set out in Table 1.

A similar problem exists as far as the composition of foodstuffs is concerned. Owing to the lack of detail on the composition of Australian foods, it is usual to rely on overseas tables, such as the United States-Canadian Tables of Feed Composition (N.A.S. 1964), particularly for information on probable amino acid composition.

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TABLE 1
Research publications and pig population

Country	1962-63		1968-69	
	Pigs (Million)	Publications (No.)	Pigs (Million)	Publications (No.)
Australia	1.44	24	2.06	17
Canada	4.99	55	5.70	65
U.K.	7.25	157	7.99	313

Thus, a review of nutritional developments must rely heavily on overseas work. Standard references are those published in the U.K. by the Agricultural Research Council (A.R.C. 1967) and, in the U.S.A., by the National Academy of Sciences (N.A.S. 1968). Since breeds and market requirements in Australia correspond more closely to those in the U.K., the former publication is considered the more suitable indication of nutrient requirements.

Developments in nutrition must also include references to feeding practices since these influence requirements. An excellent review (Braude 1967) stresses the importance of this subject. Due to the lack of documentation as far as the Australian scene is concerned, these references are in the nature of comment and are liable to some bias in favour of Queensland.

II. NUTRITION OF GROWING PIGS

(a) Birth until eight weeks of age

It is conventional to regard this as the suckling period during which the pigs obtain either the whole or major part of their requirements from the sow. While this is so in the majority of cases, developments include the provision of supplementary creep feed mixtures and early weaning. Changes have followed the trend to intensive production, in this case, farrowing in the confinement of pens or crates. Nutritional factors have thus assumed relatively greater importance.

The amount of creep feed consumed is a major influence on the weight of pigs at eight weeks of age (Lodge and McDonald 1959). Since these creep mixtures are required to supplement rather than replace sows milk, they need not be complete diets. Nevertheless, they have become increasingly sophisticated, developing from single ingredients such as skim milk, pollard or crushed grain to mixtures which sometimes appear unduly complex for their purpose. An obvious requirement is that they be sufficiently palatable to be consumed from an early age. This does not appear to be a function of their complexity.

Despite knowledge of the advantages, it has taken a number of years for the practice of creep feeding to become commonly adopted. As a result of this adoption, it is suggested that the average weight of pigs on weaning at eight weeks of age is now some 4.5 kg greater than was usual a decade ago. An average weight of about 18.1 kg (40 lb) following the consumption of 11 to 14 kg of creep feed appears typical of the position in many herds. Similar results were reported from Queensland (Todd 1964).

Early weaning, that is weaning before pigs reach eight weeks of age, is an important development. It cannot yet be described as common but has been adopted with success on many modern piggeries. Weaning at five weeks of age is recommended (Todd 1968) but very early weaning, while possible, appears to present some difficulties under average farm conditions. Success under strictly controlled conditions of nutrition and housing has been reported overseas (Keating 1967).

A few producers in Queensland are trying early weaning, normally at two to three weeks of age. The use of specially designed rearing cages has facilitated the achievement of the high standard of hygiene and management required with these systems.

An important advantage of early weaning is a reduction in the farrowing interval and consequent increase in the productivity of the sow. There is some evidence that, as the weaning age is reduced, there is an increase in time between weaning and subsequent successful mating (Self and Grummer 1958) but, although local published evidence is unavailable, this does not appear to have been a problem under good management.

Artificial rearing from birth or following hysterectomy has been reported from Queensland (Henry 1965). Although nutritional developments make this possible, utilising milk substitutes, managerial and other problems are still very great.

A detailed review of the nutrition of the young pig exists (Lucas & Lodge 1961) and estimated requirements have recently been set out (A.R.C. 1967).

(b) From eight weeks to 90 kg liveweight

The majority of pigs being grown during this period are destined for slaughter either as porkers or baconers, and only a small proportion are likely to be retained as potential breeding stock. Nutritional developments have, therefore, been influenced by the requirements of processors and consumers as well as by other economic and managerial considerations.

The trade, reflecting consumer preference, has implemented its requirements in Queensland by the considerable price differential of 11 cents per kg (5 cents per lb) carcass weight between grades, which are based on measurements of backfat along the midline of the split carcass.

This. has led to the widespread adoption of some form of restriction of energy intake. This is in contrast to the position in the U.S.A. where feed intake and growth rate tend to be maximised in view of a much lower quality premium. (Moss, Williams & Saunders 1965). Levels of intake have been suggested (Todd 1968) but it is known that considerably lower levels are being used on many properties. While lean carcasses may result, these levels may represent little more than maintenance and, as a result, not only is growth rate likely to be very inferior but food conversion efficiency also suffers. Research station evidence (unpublished data) suggests that the cost of production may be too high in relation to the quality premium when digestible energy intake for pigs of over 60 kg falls below 5600 kcal.

The need to develop strains of pigs capable of full feeding without becoming overfat is acknowledged but is considered by some to be infeasible (Braude 1967).

The trend to intensive housing has made necessary more attention to ration composition. A number of problems associated with the quality of the protein supplement have arisen during the last few years. Meat works by-products, in particular meat and bone meal, are readily available in most states. They were widely used and even recommended some years ago as the only protein supplement in rations (Anon. 1958) but, despite the low cost per unit of crude protein, results were very variable and disappointing. Recently, it has been found that the quality of the protein, as measured by available lysine, decreases as temperature and duration of cooking increases (Kondos 1969).

Imported protein supplements such as fishmeal proved very satisfactory (Todd and Daniels 1965) and it is evident from the tonnage of fish and soybean-meal being imported that the products are now widely used, despite their high price, in rations for both pigs and poultry.

It is clear that ration formulation should no longer be based on level of crude protein as such, but should consider each amino acid individually (A.R.C. 1967).

Attention has been drawn to the need to study the interaction between different nutrients and to determine response curves (A.R.C. 1967). Overseas data is not likely to be sufficient guide. In this connection, it is of interest that a study of the interaction of level of feeding protein and lysine with growing pigs (Blair et *al.* 1969) did not examine the response at levels of feeding commonly used in Queensland. Since energy intake is generally strictly limited, it is important to study protein and amino acid requirements in this situation.

Conventional protein usage is reflected in Queensland regulations — "The Agricultural Standards (Stock Foods) Regulations of 1964" — which require that grower rations contain not less than 16 per cent crude protein and baconer rations 14 per cent. Even assuming the use of good quality protein rich ingredients, these levels may be insufficient. As far as growth rate and food conversion are concerned, the requirements have been stated to be 18.5 to 20 per cent of the dry matter in the diet for pigs up to 50 kg, and 15 to 16.5 per cent from 50 to 90 kg. Increases within the range of 20 to 23.5 per cent crude protein are likely to lead to improvements in carcass quality (A.R.C. 1967). This aspect appears to have been recognised by some producers who now feed rations containing higher levels of protein than were common some years ago.

With the increased interest in protein quality and the importance of this to the growing pig, the differences in the grains being used have been recognised (Beames & Sewell 1969) and in practice their use is being adjusted accordingly.

Recent developments in Queensland have included the use of the linear programming technique of least cost ration formulation. Although few details of the amino acid composition of Australian feedstuffs exist, the best information obtainable on the probable composition of various ingredients has been used (N.A.S. 1964). Requirements have been set out, and mixtures designed to supply these requirements at the lowest possible cost have been calculated (Harrison & Todd 1968). Results have been very encouraging and suggest that, despite the limited information, this is the most satisfactory approach to designing mixtures for growing pigs.

III. NUTRITION OF BREEDING STOCK

The past decade has been a widespread shift in sow management from extensive to intensive conditions and this has increased our need for an understanding of sow nutrition and its long term effects on production.

A review of experimental work (A.R.C. 1967) shows that our knowledge in this field is still incomplete. A contributing factor to this is the difficulty in obtaining statistically significant results with the limited number of experimental animals normally available. Braude (1962) suggests 80 to 100 lactating or pregnant sows per treatment or, if litter performance is used as a measure of production, at least 40 litters per treatment would be required.

There has been considerable work done on the weight changes of sows during pregnancy (Clawson et *al.* 1963; Lodge, McDonald and MacPherson 196 1; Salmon, Legagneur and Rerat 1962). Briefly, these show that sows generally gain considerable weight during pregnancy even after allowances are made for foetal and related tissue, true growth and growth of mammary tissue. This gain in weight is usually lost during lactation and shortly after weaning. It has been found that this gain is the result of more efficient conversion by pregnant than by non-pregnant sows. (Salmon-Legagneur and Rerat 1962). The last third of pregnancy is associated with increased nitrogen retention if protein is available but, generally, soon after farrowing there is a compensating period of high nitrogen excretion (Lenkeit et *al.* 1956).

Smith (1960) concluded (a) that the practice of building up sow body reserves during gestation and dissipating these during lactation is energetically inefficient, and (b) that high energetic efficiency can be achieved only where sows are fed to gain weight throughout both gestation and lactation. There conclusions demand moderate to low intakes during gestation and high intakes during lactation. This is the basis of current practices in sow feeding.

In some cases, restriction of total daily intake to levels of 1.6 to 1.8 kg has been found necessary to prevent sows becoming overfat with resultant lowering of breeding performance. In reducing energy intake, the daily intake of protein, vitamins and minerals may also have been reduced. It may be advisable to increase the concentration of some of these nutrients in sow rations, but considerable work is required to clarify the situation.

The work of Elsley, MacPherson and Lodge (1968) has shown that sows given low intakes during gestation, even with high levels during lactation, lost initial adipose fat depots after four litters and any increases in bodyweight then could only be achieved at the further expense of the weight and size of the litter at birth. Other workers have observed a decrease in average birth weight but not in litter size (Todd 1964). Stevens (1968) suggested that prolonged low level feeding may contribute to the incidence of the "Thin Sow Syndrome."

Comparatively little experimental work has been done on the nutritional requirement of the boar, probably because no impairment of fertility has been observed with a wide range of rations. In practice, it is necessary to feed a boar according to his work load, having due regard to the fact that both under and over conditioned boars may be disinclined to work.

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