WHOLE SOYABEANS, A PROTEIN SUPPLEMENT FOR SWEET POTATO IN PIG RATIONS

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ABSTRACT

Two experiments are reported using a total of 46 pigs. In the first, raw or cooked soyabeans were fed with raw sweet potato to growing pigs and compared to a sorghum-based control ration. Performance on the control ration was superior to that on either of the soyabean rations. Cooking of soyabeans markedly improved performance. In the second experiment cooked soyabeans and cooked sweet potato were fed, either unsupplemented or supplemented, with salt or salt and bone ash and compared with a sorghum-based control ration. The pigs fed the control ration again showed superior performance. The addition of salt but not bone ash markedly improved performance over that of the unsupplemented group.

INTRODUCTION

THE two sources of high quality protein having the greatest potential in Papua New Guinea as stockfeed are fishmeal and soyabean. The present paper contains the results of two experiments designed to provide basic information on feeding whole soyabeans and sweet potato. There are no references in the literature on feeding this combination to growing pigs.

The value of soyabean as a high quality leguminous supplement for pigs has been recognized for many years (Woll 1900). It was soon discovered that cooking improved the value of soyabeans for pigs (Osborne and Mendel 1917).

The mechanism by which raw soyabeans exert their growth inhibiting activity has been investigated by a number of workers. Among the factors found to be involved are inhibition of trypsin production (Kunitz 1946) a toxic haemagglutinin (Leiner and Pallansch 1952) poor digestibility of soyabean oil (Combs and Wallace 1969) and low availability of amino-acids (Guggenhein and Goldberg 1964). Other workers have suggested that poor growth is due to greatly increased pancreatic trypsin production with subsequent loss of enzymatic protein in the faeces (Guggenhein and Goldberg 1964). These authors also found that the addition of antibiotics to the ration prevented the growth depressant action of raw soyabean. Copper, widely used as a growth promotant, reduced the activity of raw soyabean (Young *et al.* 1970).

In addition to the problem of growth inhibition, feeding whole soyabeans reduces the degree of saturation of the fat depots, thus causing soft fat (Wahlstrom, Libal and Berns 1971). This in the past has reduced consumer acceptance; however with the current emphasis on meat containing unsaturated fatty acids, this could be advantageous.

The experiments described in this paper were designed to confirm the value of cooking whole soyabeans and to investigate the addition of two simple mineral supplements to cooked soyabean and sweet potato rations.

MATERIALS AND METHODS

Experiment 1

Three litters of eight weaner pigs were used in a trial with three treatments. The treatments were: 1) control ration based on sorghum and a protein supplement; 2) raw whole soyabeans and raw sweet potato; 3) cooked soyabean and raw sweet potato. Rations two and three were fed according to a modified Lehmann regime in which sweet potatoes were offered *ad libitum* and soyabeans to a maximum of 1.2 pounds daily. Details of the rations are shown in *Table* 1.

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Table 1.—Daily consumption of feeds in experiment 1 (lb)

Ration Number	Sorghum	Concentrate[1]	Soyabean[2]	Sweet potato
1	1.83	0.46	—	—
2	—	—	0.24	3.10
3	—	—	0.36	3.38

[1]Hut Mills, Melbourne, percentage composition, crude protein 55% salt 2%.

[2]Contains per pound—34.00 I.U. Vit. A; 5,800 I.U. Vit. D_3 28 I.U. Vit. E; 12 mg Vit. B2.

Pigs were housed and fed individually and records kept of daily food consumption and liveweight gain over the duration of the experiment, which was conducted over a fifty day period after weaning.

Differences between treatment means were analysed for variance (Steele and Torrie 1960). Food conversion ratios were analysed by a non-parametric method (Wilcoxon and Wilcox 1964) as very large values were found in the raw soyabean treatment.

Experiment 2

Four litters of weaner pigs were used to study the effects of supplementing a ration of cooked soyabean and cooked sweet potato with two mineral supplements. Cooked sweet potato was used in this experiment as other unpublished work had shown the value of cooking.

The two supplements were plain salt or a 1:2 mixture of salt and bone ash. Supplements were available *ad libitum*. The soyabean rations were compared to a commercial grower ration.[1] The soyabean rations consisted of one part by weight cooked soyabean to four parts cooked sweet potato and were estimated to contain 18 per cent crude protein.

RESULTS AND DISCUSSION

Experiment 1

Details of food consumption are shown in *Table* 1. Results are shown in *Table* 2. Pigs fed soyabean and raw sweet potato had a significantly inferior growth performance to those fed the control ration. This may have been caused by the soyabean or the raw sweet potato. It should be noted that the soyabean treatments were not supplemented in any way, which would in itself have reduced food consumption and weight gain. Pigs fed cooked soyabean grew significantly faster and consumed significantly more feed. The raw soyabean appeared to be quite unpalatable and relatively little was eaten. This may have been the most important factor reducing growth rate.

Table 2.—The effect of raw or cooked soyabeans fed with sweet potato on growth performance of pigs

	Control	Treatment	
		Raw Soyabeans	Cooked Soyabeans
n	8	8	8
Ave. daily wt. gain (lb)[1]	0.73	0.13	0.44
Ave. daily dry matter consumption (lb)	2.08	1.28	1.54
Food conversion ratio[2]	2.93	—[a]	3.90[a]

[1]Means with the same superscript are not significantly different (< 0.05).

[2]Data for raw soyabeans excluded as contain infinite values.

Experiment 2

Results of the experiment are shown in *Table* 3. Pigs fed the control ration grew significantly faster and consumed more feed. The food conversion ratio of pigs on the control ration was significantly worse than that of pigs on soyabean-sweet potato rations supplemented with salt. This may have been due to the high oil content of the soyabean.

There was no difference in performance between pigs fed either salt alone or salt and bone ash, suggesting that salt was the principal factor responsible for improved performance with these rations.

Supplementation of soyabean-sweet potato rations with salt significantly improved liveweight gain. That this was not due solely to increased consumption is suggested by the significantly lower food conversion ratio of the pigs receiving salt and bone ash. Evvard *et al.* (1925) first showed that the addition of salt to pig rations could improve growth performance. The growth rate of pigs in the unsupplemented group in this experiment was higher

[1]Kaiani Feed Mills, Lae. Grower ration containing 18% crude protein.

Table 3.—The effect of mineral supplementation of cooked soyabean/cooked sweet potato rations

	Soyabean plus sweet potato	Soyabean plus sweet potato plus salt	Soyabean plus sweet potato plus salt plus bone ash	Control ration
n	5	6	6	5
Ave. daily wt. gain (lb)[1]	0.63	0.93[a]	0.93[a]	1.10
Estimated Ave. daily dry matter consumption (lb)	1.92[a]	2.50[a]	2.30[a]	3.56
Feed conversion ratio (dry matter basis)	3.09[b]	2.65[ab]	2.43[a]	3.26[b]

[1]Means with the same superscript are not significantly different ($P < 0.05$)

than that of treatment 3 in *Experiment* 1. This difference may be largely due to the cooking of sweet potato in *Experiment* 2. Henke (1949) found that growth performance of pigs was improved by cooking of dietary sweet potato.

The results of these findings confirm that cooking soyabean improves its utilisation and that the addition of salt can further increase utilisation to the point where performance is not greatly below that of pigs fed a fully balanced ration.

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