

THE NUTRITIVE VALUE OF PASTURES IN PIG RAISING.

BY

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Pig-raising in New Zealand is essentially associated with Dairying. The large volumes of dairy bi-products in the dairying districts provide practically the only foodstuffs available in any quantity for pig fattening purposes. Furthermore, these bi products have no other marketable outlet, *on a large scale*, than by conversion into pork and bacon,

While they are thus the mainstay of the New Zealand pig fattener, it is well recognized that as foodstuffs, dairy bi-products are subject to definite disadvantages. Partly due to their composition partly to their, large bulk relative to their dry matter content, and partly to the seasonal nature of their supply, their use in pig raising raises many nutritional, husbandry, and economic problems. Most of these are associated with the question of the supply of supplementary foods,

In this connection, European and American experience provides but little assistance. Their standards of pig nutrition are for our conditions open to question, since they are based on a fundamental economic problem essentially the reverse of our own. They are concerned with the minimum amounts of expensive protein supplements necessary to feed with a large supply of cheap carbohydrate rich foods. We, on the other hand, have an abundant supply of protein rich foods in the form of dairy bi-products, but a short supply of relatively expensive carbohydrate materials,

The use of grain and cereal meals as the bulk of the pigs ration, which overseas experience would indicate to be necessary for maximum utilisation of separated milk, buttermilk and whey, is thus out of the question. Further, the results of investigations, combined with practical farm experience in New Zealand indicates that the use of even limited amounts of grains as supplements to be problematical on economic grounds, because of the separation of the dairying and grain growing areas and the consequent shortage and high price of supplies.

At the same time, pig raising has now developed to a stage when it is clear that not only does future development of the industry depend very largely upon the supply of food supplementary to dairy bi-products, but also, the provision of suitable supplementary food is not only desirable but essential to more successful individual results. Particularly is this so during periods of short supply of our basic foodstuffs. In this connection the question of the suitability of pasture for the purpose is of considerable importance. An abundance of grass in the dairying areas, the fact that the principles of pasture management are fairly well understood on the average, combined with the demonstration of recent years of the practicability of outdoor systems of pig husbandry, provide a sound basis for the exploitation of pastures by the pig should such be economically and nutritionally sound. This situation too,

opens up a wide field of investigation so far as the nutritive value of pasture for pig raising is concerned.

Before proceeding to a discussion of nutritional considerations, it should be emphasised that the energy value of grass may not necessarily be its economic value for pig raising purposes. Even though a lower grade fodder than the more concentrated recognised pig foods, its use by the N. Z. pig raiser may be more economical than reliance upon other more expensive materials. Grass is the cheapest of all foodstuffs to produce, and its efficient utilisation as part of the ration of the pig may conceivably be a considerable factor in lowering production costs.

THE NUTRITIVE VALUE OF PASTURE - GENERAL CONSIDERATIONS.

Studies of the nutritive value of pasture to ruminants have shown that in the young stage of growth, its dry matter has a food value approaching that of the richest concentrated foodstuffs. Its high protein, mineral and vitamin content, combined with its high digestibility, makes it a particularly valuable fodder to cattle and sheep.

In any consideration of its value to the pig, however, it is essential to note the significant physiological difference between this animal and the ruminant. The pig is omnivorous, and not specialised to deal with one class of food. He is provided with a digestive apparatus that is relatively simple as compared with that of cattle, horses and sheep; and one which is as a result, but poorly equipped to digest successfully, fibrous materials.

While it is incorrect to suggest that a pig must necessarily receive a diet composed entirely of concentrates, it is an established principle of pig feeding, that the ration should consist of materials relatively low in fibre content, the most intensive fattening being achieved with the use of very digestible food mixtures (1). Although from the viewpoint of the cow and sheep, well-managed pasture is not a highly fibrous food, it does, for the pig contain a relatively high quantity. Thus the common pig fattening concentrates usually contain less than 5% of crude fibre, while the dry matter of short leafy pasture will contain 15% and upwards (2). That this situation affects the digestibility of pasture by pigs is indicated by the results of Kellner (3) and more recently of Woodman (4), who report that pigs are capable of digesting barely two-thirds as much of the total organic matter of good pasture as are sheep. On these grounds alone therefore, it would appear that grass has a lower food value for pigs than for other farm stock, and that it is hardly likely to compare favourably with more digestible and concentrated foodstuffs.

Secondly, a difficulty in any discussion of the value of pasture to pigs lies in the complication of the problem by the confusion of ideas between mere feeding out-doors, with consequent advantages in respect to health and general ease and efficiency of management, and the actual nutriment derived from pasture. For this reason the reported results of the Waikato Pig Recording Clubs, (5,6,) as to the value of pasture for pigs, must, as measures of actual nutriment derived, be viewed with considerable doubt. This club reports an advantage from the provision of good pasture of 100 lbs. per litter and 14 lbs. per pig increased litter weighed at 8 weeks and a saving of 60 gallons of separated milk per 100 lbs. of live weight increase, in the fattening of porkers.

These figures were derived not from controlled trials, but merely on a selected basis of 'good grazing farms' versus 'poor grazing farms', no account being taken of other existing differences. Quite apart from the possible effect of the varying breeds and strains of pigs concerned and a wide range in initial and final live weights in the case of the porker pigs, it is highly probable that management differences alone were responsible for at least part if not all of the advantages noted. From the experience of the writer the farmer who supplies his pigs with good grazing is almost always a superior husbandryman in other respects.

Lastly the problem is further complicated by the need to distinguish between the nutritive value of grass to pigs of various ages and of various production requirements. The food requirements of an animal varies not only with age but also with the type of production expected from it. Thus the food requirements of, and the value of foodstuff to, an in-pig sow is not necessarily the same as to a young growing pig or a fattening pig.

Definite experimental evidence upon any of these problems under New Zealand conditions is not available. At the same time the fact that pasture has an undoubted nutritive value at least to mature pigs is clear from the well-established practice of many farmers in maintaining their breeding sows solely upon pasture for from 4 to 6 months of the year. Indeed this may be stated to be the rule rather than the exception in the North Island Dairying areas where the sows graze the dairy pastures, frequently without any supplementary food for the period between successive farrowings.

#### EVIDENCE FROM OVERSEAS SOURCES.

While more information is available from overseas pig-raising countries, much represents mere opinion rather than definite and reliable data. Of the latter, a review of the literature on the subject provides much of interest. The following brief summary would appear to be a fair statement of the present position.

- (a) In respect to Mature Pigs, and in particular In-pig Sows, there seems general agreement between British, German and American workers, (1, 8, 11, 16, 18, 19) that the adequate provision of short leafy pasture is sufficient to supply the greater part at least of the maintenance requirements of such animals.

Disagreement with this result has been recently expressed by Cambridge workers, on a basis of digestibility trials, from which they conclude that good pasture, is capable of providing only half of the maintenance requirements of breeding sows. In view of our New Zealand experience and practice in this respect and since the Cambridge results have received considerable prominence in interested circles here, it might be noted that their conclusions were based on the assumption that the appetite of a sow for pasture is only from 12 to 14 lbs. of green herbage daily (4, 12). It is doubtful whether such an assumption is justifiable in the case of sows actually turned out to graze without other food. Although we have no measure of the amount eaten in such cases, the writer has found that sows of from 350 to 450 lbs. live weight find no difficulty in consuming 60 to 80 lbs. of roots, (mangels or carrots) daily, a ration which would indicate

that if necessary her capacity for grass is at least considerably in excess of 15 lb. It is admitted of course that the two foodstuffs are not strictly comparable on a fibre content basis.

- (b) In respect to Sows in Farrow, pasture alone is definitely insufficient for production purposes, a loss in weight of the sow and small and emaciated litters, being the result of such treatment (16). The provision of good pasture to suckling sows and litters in addition to a balanced meal ration is associated with heavier weaning weights though whether the advantage is due to actual nutriment derived, to associated health effects, or to both is not clear (8,20).
- (c) In respect to Young Growing Pigs after the weaning stage, good pasture alone provides but a bare subsistence ration, and is incapable of supporting growth (18,19,27). A ration of at least 2 lbs. of meal per 100 lbs. live weight per day is necessary to maintain thrifty growth even on excellent pasture (19,27). Better results obtain with older pigs (11,17).
- (d) In respect to Fattening pigs, American results over a large number of trials indicate that a saving of upwards of 50% in the protein requirements of the fattening pig can be effected by the provision of pasture in the production of pigs of bacon weight. This represents only 5% of total food requirements. Little or no saving is effected in respect to other food if a normal rate of growth is expected. (19,28,24). A greater saving can be made in the grain portion of the ration by reducing the quantity below full feed, though this reduces rate of growth and raises questions of economy (21,22,23). English trials have similarly failed to demonstrate any advantage in rate of growth or saving in balanced meal rations by the provision of pasture or other green food to fattening pigs. (7,25,26).
- (e) In respect to Health, there is general agreement between all workers as to the beneficial effects of pasture to all pigs -- particularly breeding stock, lactating sows, litters, and young pigs (1,7,8,9,10,29,32,36,37). The benefits appear to be associated with the mineral and vitamin content of leafy grasses and clovers. (29,30,31,32,33,34,35). Pasture is claimed to provide nutritional protection against scours, anemia, respiratory infection, paralysis and rickets. The improved health following its use is reflected in more thrifty growth and economic utilisation of other food, even when pigs are grazing, are subsequently fattened indoors, without access to green materials (7).

As already mentioned, however, many of the advantages in health attributed to the use of pasture, are due at least in part to associated effects following outdoor grazing. Thus the natural exercise of grazing and rooting, (7,40) access to sunlight, (7,39,41), and access to inorganic soil minerals (7,38) have been shown to have a marked influence upon the maintenance of health and the prevention of certain diseases.

Investigations into the value of pasture to fattening pigs under New Zealand conditions.

In order to obtain more definite information upon the claims frequently advanced as to the nutritive value of pasture to fattening pigs under New Zealand conditions two feeding trials were conducted the results of which present several points of interest. They must, however, be regarded merely as preliminary studies of the problem and helpful more from the viewpoint of indicating lines along which further investigations might profitably proceed,

One trial covered the fattening of porkers, (live weight range 40-140 lbs.) and the other the fattening of baconers, (live weight range 40-200 lbs.) Detailed procedure and results will be published shortly. Summarised briefly, the procedure was similar in both trials. Pigs of known breeding were selected and equally balanced into groups according to breed, strain, sex and initial live weight. The "No Grass" pigs were provided with a roomy fattening house and feeding yard, open to the sun. The "Grass Fed" pigs were run on good quality ryegrass white clover pasture, and provided with comfortable sleeping quarters. Apart from the grass, the feeding of the comparable groups was the same. In the porker trial, factory whey supplemented with 2 lbs. per 100 lbs. live weight per day of a meal mixture, was fed in such amounts as the pigs would conveniently consume when fed three times daily. Minerals were also provided. In the Baconer trial, the ration of both groups was separated milk alone fed three times daily in such amounts as would be conveniently cleaned up at a feed. The pigs were removed from the trials when they reached 140 lbs. live weight and 200 lbs. live weight respectively and slaughtered. Slaughter records and details of carcass quality were obtained.

Summary of Results (a) Porker Trial.

- (1) Growth rate. Grass fed pigs showed a daily increase of 0.73 lbs. dressed weight and the 'No Grass' pigs, 0.77 lbs.
- (2) Economy of Food Consumption, Grass fed pigs required 502 gallons + 169 lbs. meal per 100 lbs. dressed weight gain. Corresponding figures for the 'No Grass' pigs were 477 gallons and 158 lbs. meal.
- (3) Carcass Quality. The 'Grass fed' pigs provided carcasses of inferior quality, showing insufficient fat, an undesirable sliminess of the skin, and a roughness of the skin of bellies and flanks. The 'No Grass' pigs were superior in respect to fat, while the skin defects were absent.

(b) Baconer Trial.

- (1) Growth Rate. 'Grass fed' pigs showed a daily increase in dressed weight of 0.75 lbs. and the 'No Grass' pigs, 0.76 lbs.
- (2) Economy of Food Consumption, 'Grass fed' required 533 gallons separated milk + 18 lbs. pollard per 100 lbs. gain in dressed flesh, and the 'No Grass' pigs, 515 gallons + 17 lbs. pollard.
- (3) Carcass Quality. The 'No Grass' pigs all carried more fat, this being with one exception, sufficient

to place every carcass 'Second Grade' on a basis of back fat measurements. All the 'Grass fed' pigs graded first in this respect, though they showed inferior belly measurements compared with the other group.

From these results it is clear that no measureable amount of nutriment was derived from pasture by the pigs in these trials, no significant difference either in growth rate or in economy of food consumption being apparent. This result is in line with overseas experience.

It must be noted, however, that during the last fortnight of the porker trial, and the last month of the baconer trial, both the quantity and quality of the herbage available to the pigs declined with the onset of dry summer weather. From an attempt to measure the approximate amount of herbage consumed by the pigs in the porker trial, by a method of alternate mowing and grazing of paired pens, however, it seemed clear that pigs fed as in these trials actually consumed very little herbage. The method adopted showed that even during the period when first-class material was readily available, a daily consumption of only  $\frac{1}{4}$  lb. green herbage per pig occurred.

This raises the important question as to the influence of the plane of feeding upon pasture utilisation. 'Full feeding' was practised in these trials because this is the method almost invariably adopted by farmers even though good pasture is also provided.

From the results of American experiments already quoted, (21,22,23) it is possible that more pasture would be consumed and an actual saving in other food would occur if the ration of other food were reduced in quantity. It must be noted, however, that such methods have been shown to decrease the rate of growth of the pig, though as already pointed out, this might conceivably be economical under certain conditions. In respect to the carcass quality differences noted, the effects might, in the opinion of the writer, be more legitimately attributed to the outdoor conditions of exercise and greater sunlight, rather than to the pasture itself.

#### Further Observations on the value of Pasture as a Maintenance Ration:

To obtain a more definite measure of the capacity of pigs to derive sufficient nutriment for maintenance requirements from pasture, observations have been made in respect to four mature in-pig sows, and two animals of approximately 90 lbs. live weight, under conditions which imposed a fairly severe test to both pigs and pasture. Live weights of the animals were obtained over a three-day initial period and the animals turned out to graze a 7 acre dairy cow pasture. Water was available but no other food was provided for the 60 day period which followed. The quantity of feed available was low while its quality was definitely poor. The paddock had been grazed by the herd immediately prior to turning out the pigs, and growth was practically at a standstill as a result of an extremely hot dry spell which continued throughout the trial.

Despite this handicap the sows maintained their condition satisfactorily, showing only a small loss in weight over the two months. The loss varied from 18 lbs. to 41 lbs. per sow, with an average of 31 lbs.

Details were as follow :

	Initial Live Weight. lbs. *	Final live Weight. lbs. *	Loss lbs.
SOW "A"	520	502	18
SOW "B"	588	560	28
SOW "C"	534	494	40
SOW "D"	505	464	41

\* Average of three days weights, taken 8 a.m. prior to feeding.

The young pigs which were taken from the fattening pen, and similarly treated also showed the ability to live under such conditions. Although they visibly lost condition they showed surprisingly little loss in body weight, appearing to actually develop frame during the period. After 61 days, Pig A lost 14 lbs. (decreasing from 98 to 84 lbs.) and Pig B 8 lb, (decreasing from 88 to 80 lb.)

These results raise the question of the importance of pasture quality. Even under adverse conditions these pigs were apparently deriving considerable nutriment. It is possible that many of the failures to demonstrate the benefits of pasture by overseas workers have been due to the quality of the herbage employed. This is a point worthy of investigation in New Zealand: the value of pigs, not merely of an indefinite feeding stuff, 'pasture' but rather the value of herbage of known quality and quantity of leaf from swards of definite botanical composition,

#### SUMMARY.

From a general consideration of the problems involved, bearing in mind the limitations imposed by the physiological nature of the digestive tract of the pig, and the relative fibrous nature of even short leafy pasture as a foodstuff, it is not likely that pasture has as high a nutritive value to pigs as to other farm stock.

This suggestion is borne out by the data available from overseas investigations and experience, data which in particular shows :

- (a) That good quality pasture has a greater value to mature than to young pigs.
- (b) That as part of the ration of in-pig sows and sows-in-farrow, it can play a useful and economic part in the breeding of pigs.
- (c) That it has a definite value to all pigs and in particular to breeding stock and young pigs from the point of view of health.
- (d) That in respect to what may be termed its 'fattening value' it is capable of providing part of the protein requirements of the fattening pig on a grain ration. It is not capable, however, of materially reducing the total requirements of other food except under a low plane of feeding, the successful practice of which is dependent upon economic considerations.

The result: of two feeding trials covering both porker and baconer production under New Zealand conditions are in line with this latter estimate of the fattening value of pasture in that;

- (e) The provision of pasture in the production of porker pigs full fed on factory whey supplemented with limited amounts of meal, and in the production of baconers full fed on separated milk, resulted in the saving of no other food, and no improvement in rate of growth, in comparison with pigs similarly fed but without access to pasture.
- (f) The effect and economy of a lower plane of dairy bi-product of feeding upon the utilisation of pasture by fattening pigs, and the special suitability of New Zealand pastures of definite botanical species and quality, are suggested as being worthy of investigation.

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