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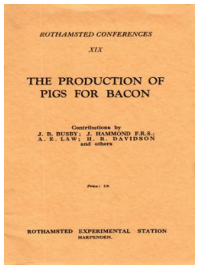
Rothamsted Conferences XIX

Full Table of Content


ROTHAMSTED CONFERENCES

XIX

THE PRODUCTION OF PIGS FOR BACON

Contributions by J. B. BURY; J. HAMMOND F.R.S.; A. E. LAW; H. R. DAVIDSON and others

ROTHAMSTED EXPERIMENTAL STATION HARPENDEN.

The Production of Pigs for Bacon Being the Report of a Conference Held at Rothamsted on March 6th 1935

J. A. Fox

J. A. Fox (1936) *The Production of Pigs for Bacon Being the Report of a Conference Held at Rothamsted on March 6th 1935 ;* Rothamsted Conferences Xix, pp 1 - 30 **- DOI: https://doi.org/10.23637/ERADOC-1-206**

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ROTHAMSTED CONFERENCES

XIX

THE PRODUCTION OF PIGS FOR BACON

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THE PRODUCTION OF PIGS FOR BACON

BEING THE REPORT OF A CONFERENCE HELD AT ROTHAMSTED ON MARCH 6th, 1935, UNDER THE CHAIRMANSHIP OF

JOHN A. FOX, ESQ.,
Chairman of the Pigs Marketing Board

Contributions by

J. B. BUSBY; J. HAMMOND F.R.S.;
A. E. LAW; H. R. DAVIDSON
and others

ROTHAMSTED EXPERIMENTAL STATION
HARPENDEN

B

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CONTENTS

		PAGE
J. B. Busby . .	What the Bacon Factory wants, and how the Danes Secured it . . .	5
J. Hammond, F.R.S.	Carcase Quality and Breeding for it .	10
A. E. Law . . .	Breeding and Feeding of Bacon Pigs .	15
H. R. Davidson .	Does it Pay to Produce Grade A Pigs ?	18
DISCUSSION		26

Earl Radnor, Dr. C. Crowther, Mr. A. E. Marsh, Mr. V. C. Fishwick, Mr. J. H. Wilson and others.

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WHAT THE FACTORY WANTS

By J. B. Busby
(Herts. and Beds. Co-operative Bacon Factory, Ltd., Hitchin)

How many times have we heard said, "The Factories cannot be unanimous and tell the Producer what they want ; if they had done so, Producers would have made provision for doing their part"? I venture to say, can you conceive to-day, any Factory taking a strong line in breeds, or anything that may tend to upset the relations with their clients ?

It is purely an educational standpoint, and although good work has been achieved by many individual efforts, you cannot say that any nationally organised education, embracing all sides has been attempted.

I hope to-day's meeting may be the beginning of some such development.

True, both producer and curer have had advice from almost every angle, and from persons propounding theories, based largely on their special vested interest. I trust you will excuse me if in my paper I appear to be egotistical, but it is with a desire to help if possible.

What Does a Bacon Factory Require ?

May I enumerate the points as follows :

(1) A steady supply of pigs, week in, week out, not a spasmodic and fluctuating one. A factory cannot possibly be successful unless its output is nearly 100 per cent. and steady, and it must receive :

(2) A good length pig of as early maturity as possible, taking all circumstances into account.

(3) The pig produced must have a proper and definite amount of lean meat, and in proportion the requisite amount of fat, whether it be on back or belly.

(4) The pig must kill out at a weight which is as near uniform as possible, governed by my point No. 2, and must show a far greater uniformity than at present is being produced.

(5) Pay definite attention to shoulder and depth of belly, which are points, to which quite naturally our grocer friends attach great importance.

(6) Pay strict attention to feeding, i.e., the feeding of a balanced ration and the rationing of such feeds. Especially is this necessary if you take note of point No. 3.

(7) Pay greater attention to cleanliness.

(8) Far greater attention and education on feeding and selecting of breeding stock ; the only method by which results can be obtained

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is, in my opinion, recording of all breeding stock, governed by a recognised authority.

I may have got these points somewhat out of order, and for this you will perhaps excuse me. Now let me put before you my view as to how the Danes have tackled the problem, which we know they have done very successfully. I, for one, will never admit that we cannot, in this country, achieve equally good, if not better results, given the time, organisation, and to some extent a closer co-operation with those sections of agricultural control, which are allied to pig production, i.e., milk, and cereals and, last of all, fresh pork.

How the Danes Have Secured the Perfect Bacon Pig

(1) I am given to understand the Danes were, in the early stages of their organisation faced with this problem, and only overcame it by controlling every pig when it came bacon weight. We say, "But we have our large pork market to consider." This in my opinion would right itself. In the early days Copenhagen, like London to-day, would not take a singed pig for pork. To-day if an unsinged pig is sent to the Copenhagen market, it fetches less than a singed one, surely a reply to any criticism of our Smithfield experts. Control may also mean centralized pig slaughteries, surely a step in the right direction.

(2) How did the Danes secure what they term their pure bred bacon pig? First, by selecting their own cross-bred sows, called the Landrace, which I feel sure has a touch of Swedish, is a fair length with shorter legs than our Large White, more after the Wessex or Essex Saddleback in length and type. These were then crossed with selected Yorkshire Large Whites from England.

They then select the best type of bacon pig, out of this cross, for their boars, only coming back to the Yorkshire White Boar when needing fresh blood.

They seem to select for boars the longest pigs which show a little shoulder, but which, in my opinion, is counteracted by length, and getting the maturing stage for killing to five months. They are definitely slowed up at present on account of the quota, but we need to pay strict attention to maturity, which conditions here will demand at from six to six-and-a-half months.

(3) The Danes make definite educational arrangements for the correct feeding of proteins to sows, pigs when suckling, and weaners. Hence as far as practicably possible weaners never lose their baby flesh, and once they get started the proper growth of lean meat and muscle development must come. You must lay the foundation of a lean carcase; so many people come all to pieces here. I do not say there are no exceptions in Denmark. I saw some weedy, small pigs there, such as I have seen here; but having a decent percentage of good pigs to start on the Danes pay strict attention to rationing a

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known feed with the highest possible amount of proteins, such as meat with blood meal.

(4) The Danes, in my opinion, realized that the greatest uniformity can be obtained by early maturity, and tend to slaughter pigs before rather than after the normal change takes place for reproduction. Thus they make a definitely low live weight of 200 lb. starved, which would give from 7 score 10 lb. to 8 score dead weight, or 60 lb. to 64 lb. sides of bacon.

(5) This is answered in Point No. 2 as to how the Danes select their pigs by length, which governs shoulder and depth of belly.

(6) The feeding by the Danes I have dealt with in No. 3, but I must say that I saw a few pigs knocked off their feet in Denmark. I do not see how you can get a system that will do for 100 per cent. of the pigs on any producers' premises.

(7) Cleanliness. The Danes pay far greater attention to this than is generally understood here. Cleanliness of sties, greater fall in floor towards draining part of pen, and dryness of sties, eliminating as far as possible draughts ; and great care in having clean feeding utensils and troughs.

Strict attention is given to construction of floors in order to avoid damp striking through, but so far as houses are concerned I believe the Danes only have heated and closed houses out of necessity, owing to their situation and windswept country.

(8) A high standard of agricultural education is provided at the Danish High Schools, and full use is made of the training there received. Boys who look for a responsible position on the land attend these schools as a matter of course, and they apply their knowledge to their farming problems, and in particular to rationing of livestock.

It is difficult to get any idea of their rations, but in my opinion they feed according to the cheapness of cereals and what is available, bearing in mind what has been officially drilled into them.

They have skimmed milk in plenty, which is an early advantage. One ration I did get was as follows :

30 per cent. wheat.
30 per cent. rye.
30 per cent. barley.
10 per cent. meat, blood, and bone meal, with separated milk as liquid.

You may say, " This would finish all my pigs off," but you must understand they have evolved a pig to stand a strong protein.

They generally feed three times per day, assuming, I suppose, a little and often, and if food is not consumed in 20 to 25 minutes, it is taken away.

What a trouble for a few pigs ! But I can assure you that men sending 20 pigs to the factory in six months are as anxious as the big producer to do the job cleanly, and thoroughly to satisfy the English public, who are in their opinion the people to please. When I was over they were praying that the English producer would so far

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neglect the pig business as to defeat our Bacon and Pig Marketing Schemes, and so allow the Danes to come back to 100 per cent. production.

Are we heading for this, or are we to tighten our belts and face the job, which we can do by all pulling together ? It is co-operation, not individualism, that will solve many of our difficulties.

There are one or two things, if time permits—which I would like to put to you for future consideration and discussion.

No. 1. Where do we fall short in our English pig received as against the bacon type produced by Denmark ? This is a very big question and one which we all try to evade ; but do not mistake me in what I may say or put forward. I have no axe to grind, just a simple mind trying to build up my case.

I tried to illustrate in point No. 2 how the Danes attained the almost perfect type of bacon pig by selection of breeding stock in the initial stages by strict recording, etc. As noted in point 8 these are purely educational matters, which we must of necessity take notice of. The Danes, in my opinion, went to an enormous amount of trouble in the selection of the Yorkshire Large White boar, and then from the litters produced, from their cross with the Landrace, picked out only those boars for breeding which gave the required length, depth of belly and good ham. Again with gilts they only picked out a type showing fineness of bone, fair hams, depth of belly commensurate with length of pig, and not too much daylight under the pig. Watching the length of leg as governed by the ham.

" Ah," you will say, " you will soon have the whole pig true to type." Exactly ; and who amongst us all will come into the arena with this, the type of bacon pig required, and give a reasonably intelligent exposition of how to secure it ?

Now then, where are our breed societies ? Many will say, that is the answer, there are too many breeds in the country ; it seems so easy to leave it there : but I venture to suggest that you can get, by selection and recording, a good bacon pig from almost any cross with possibly the exception of two or three, which honestly I do not consider worth persevering with for baconers. We have abundant proof of our producers getting a type with good ham. Why ? Because we have done it from time immemorial. Yet how many of our pigs, even Grade A, Class 1, will compete with Danish in shoulder, where they are 1½ lb. to 2 lb. lighter than our lightest, taking everything into consideration.

This selection of pig to give light shoulder without the loss of stamina or heart room, is in my opinion an achievement that can only be attained by a stricter attention to details I have pointed out, and will not be achieved in one years' hard work and investigation.

These points are, in my mind, where our weakness lies, in getting down to a type of baconer with a light shoulder, and then making it necessary for the producer to send in his pig at a maximum weight of 200 lb. live weight, as outlined in point 4. It is not understood

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properly how much change takes place in a pig after its first stage of maturity for reproducing purposes, and 190 lb. dead weight is altogether too heavy. This is a very big handicap and is not given the attention it should have.

The question of pure bred Large White as against some form of cross, I think must be left to the actual producer as to what he can best get on with, but we must have two-thirds Large White and one-third any other breed, true to type. In my opinion the Wessex or Essex are the nearest to the type desired by the Danes.

I have seen pure bred Large Whites with appalling shoulders, from Grade A Class 1 pigs, so you will see how the type must predominate.

Another matter is the marketing of pigs. I think the time must come for all pigs to go through certain centres agreed upon, and those unsuitable for bacon, as in Denmark, should be sent forward on to the fresh meat markets, so as to get the better proportion of suitable pigs made into bacon. If there is time I will try to give you details later.

In conclusion I think there are two things most important to pig producers, that are a source of annoyance and a cause of a lot of mistrust.

I refer to the belly measurement, which I think should be done away with, and three back fat measurements introduced like the Danish. If it is a question of alteration in basic price why not face it properly, not try to evade it : evasion causes no end of trouble.

Second, the question of tolerance. This is a very vital matter to the producer who, I think, would be much better off with a lower weight in class 1 with a 10 per cent. tolerance.

There is quite a lot to be done on the factory side, and we are, at Hitchin, trying to bring the factory up to date and to the highest possible efficiency. I would like to extend on behalf of the Directors, an invitation to the factory on completion of alterations which we hope will be in about two months.

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CARCASE QUALITY AND BREEDING FOR IT

By John Hammond, F.R.S.
(School of Agriculture, Cambridge)

Before considering the various points of carcase quality in bacon pigs it is advisable to say a few words on breeding. A breeder would do well first to find out what are the weak spots in his pigs from the grading reports of factories, from the reports of the local Pig Recording Society, or from the score cards of the carcase tests carried out by various Societies and Shows. Find out what are the most important faults first and then get a boar which is particularly good in this respect ; where such a boar is to be found can be determined by the same means.

A warning should be given here, however, to make sure that, before condemning the breeding stock, the feeding and management are right (such as getting quick growth in the young stock, making good gains for food fed, i.e., putting on lean meat rather than fat, and feeding sufficient proteins and accessory food factors), for, if these are not, then no matter how well-bred the pigs are they will have no chance of showing what they can do, and buying good stock will not help to put things right.

Now let us consider the various points which go to make up good carcase quality. These are mainly a matter of body proportions and composition, on which unfortunately very little research work has been done in this country since Lawes and Gilbert's fundamental experiments.

The body proportions and composition do not remain constant but change as the pig grows up. In the pork type of pig they change quickly so that they are right (i.e., with small proportion of head and bone and high proportion of loin and lean meat, with just the right amount of fat—½ inch over the loin) for the London trade at 70 lb. carcase weight (=95 lb. live weight), but in the bacon type these same proportions are not attained until 150 lb. carcase weight (=200 lb. live weight). That is, *the proportions required by the consumer are the same for both pork and bacon pigs, but the weight at which the two types arrive at these proportions differs,* the one being early maturing and the other late maturing. The differences between pork pigs and bacon pigs are mentioned because so many of our farmers, who have hitherto been catering for the local pork market, are now beginning to take up the production of bacon pigs and they should realize the difference between the two types. The pork (and lard) type tends to be small and blocky while the bacon type is larger and more rangy. Within any one breed, however, the type

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can be changed by selection, as has been done with the Poland-China in the United States, although for commercial purposes this result can be achieved quicker by crossing with an appropriate breed.

Before considering the carcase itself, there are two factors which are of economic importance in the production of the bacon pig: (1) *The carcase percentage*, or loss from live to carcase weight. This naturally varies with the amount of food in the stomach and with the weight of the pig, ranging from 72 per cent. of carcase to live at 95 lb. live weight, to 80 per cent. at 200 lb. and 82 per cent. at 250 lb. for the average pig. A high degree of fatness increases the carcase percentage, and so for bacon pigs the highest percentage is not always the best and there is an optimum carcase percentage; this is, for a pig of 200-220 lb. live weight, about 73 per cent. calculated on unstarved farm weight and 78 per cent. on starved weight before slaughter.

(2) *The bacon percentage*, or loss from carcase weight to bacon weight. As there is less loss of weight during curing in the fatter than in the leaner carcasses, the lighter carcasses (which are usually the leaner) lose less than the heavier; for example, the average loss varies from 28 per cent. in carcasses of 105 lb. to 21 per cent. in carcasses of 215 lb. Given carcasses of equal weights and degrees of fatness, however, the loss from carcase weight to bacon weight shows a difference of 3 per cent. or more between different breeds and individuals due to the coarseness of bone and weight of head which have to be removed before the carcase is made into bacon.

The various points required in the carcase are as follows, in approximately this order of importance:

(a) *Thin back fat*—the back fat forms a good measure of the fatness of the carcase generally and nowadays the public do not require very fat meat. The fat is always thickest over the shoulder and for requirements to-day the fat here should measure 1½ inches or less. As in the young pig the shoulders are well developed and the loin poorly developed (see below) as compared with a mature animal, so the fat is much thicker at the shoulders than at the loin in a young pig, and the difference in ratio between these two parts gradually narrows as the pig grows up. Thus a back fat gradually tapering from the shoulder to loin is a sign of a carcase which has not yet attained its full maturity and fatness; such carcasses are required for bacon production. Since the pork types are small, short, blocky, and early maturing they usually carry more back fat at 200 lb. live weight than do the larger, longer and later maturing bacon types; by lengthening the pig the chances of getting too thick back fat are reduced (see below). On the same feed gilts usually grade better than hog pigs as regards back fat measurements.

(b) *A thick streak (over 1½ inches) with thickness of lean meat.* A thick streak can be obtained in two ways (1) by fattening to a high degree, and (2) by developing the thickness of the muscle or lean meat. It is the latter which is required by the public and hence

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under the Pig Marketing Scheme a pig only gets into grade A when both the streak is thick and the back fat is thin. It is this development of the thickness of lean meat without getting too much fat in our pigs which is the main problem in pig production to-day.

On examining a large number of pigs cut through at the loin (last rib) one is struck by the great differences between them as regards the thickness of the eye muscle and the amount of fat over it. In some the muscle is shrunken and the space which it should occupy is filled in with fat ; experiments are required to find out why this is so. A probable explanation is, in my opinion, that in such pigs the growth has been slow or checked at the time the muscle should have developed, just as calves which are allowed to lose their baby flesh fail to produce the best beef. In the young pig bone growth reaches its maximum first, then muscle, while later fat makes its maximum growth. This forms one of the reasons for weighing the young pigs (under Pig Recording Society schemes) at 8 weeks old, for it is at just after this time that the lean meat is developing and pigs which grow well then will grade better than those whose growth is checked at this stage. This rapid growth in the young pig is, in addition to the feed factors involved, a breed character both as regards the young pig itself and also with respect to the milking qualities of the sow, for young pigs will not make rapid growth unless the dam has a plentiful supply of milk.

(c) *Firmness of fat.*—Soft oily fat is objectionable to the consumer and as firm a fat as can be produced is required. It is however mainly influenced by feed rather than breed, except in so far as slow-growing pigs tend to have rather softer fat than fast growing ones.

(d) *Absence of "Seedy Cut."* Seedy cut, which consists of black pigment specks in the mammary gland, is quite harmless to eat but is disliked by the trade as it makes the bacon appear to be mouldy, and so the whole belly (of about 8 lb. per pig) has to be removed before it is cured. The mammary glands are formed as a down-growth from the skin, so black-skinned pigs are liable to have this defect. Since white is dominant (i.e., the first cross is mainly white, with a few black spots or patches only) to black in inheritance, those having mainly black pigs would do well to cross their sows with a white boar for bacon production. The black and white breeds would also do well to extend the white areas in their breed, especially on the underline ; this can be done by selection within the breed.

(e) *Good gammons.* What is meant by a good ham can be seen by looking at the changes which appear as the pig grows up ; at birth the ham is nearly all bone and poorly fleshed, while as it grows up the bone becomes proportionally smaller and the meat is "let down" to the hocks. A good ham is one in which these age changes are well developed. Width of the buttock just below the tail is a character which very much requires to be improved in our pigs, as it adds much to the appearance of the gammon when the side is hung up.

(f) *Length for Weight.* Apart from the fact that a pig which is

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long for its weight will tend to be less fat than one which is short for its weight, length is required in order to give a large proportion of back cuts as compared with belly cuts, for the former are higher priced than the latter. A thick streak (or belly) is required (so as to form a good rasher) but not a long one ; this translated into terms of the carcase and live pig means one which is not too deep at the time of slaughter and one which has a clear cut straight underline ; such a pig will appear to be long for its weight. One requires a pig with well sprung ribs rather than a deep flat-sided one. As has been stated before, the depth of the pig increases in proportion to its length as the pig grows up and this increase in depth is associated with increase in fat content of the carcase. One requires to breed the type of pig which at bacon weight (200 lb. live) has only just begun to deepen, but which has not gone so far as the pork type does at this weight ; if the pig has not just begun to deepen, however, it is liable to be deficient in thickness of streak, for thickness of streak is partly a question of maturity. It is the proportions of the body at the weight at which the pig is to be killed, and not the adult proportions, that matters, i.e., the breeding sow may be deep in proportion to length provided her offspring are not too deep in proportion to length at 200 lb. live weight.

(g) *Light Shoulders.* The shoulder is a low-priced part of the carcase as compared with the loin and consequently should be reduced as far as possible. There is a natural tendency in pigs, following their wild boar ancestor, to become heavy in the shoulders and light in the loin and this fault will tend to creep in unless continual selection is made against it.

(h) *Fine Skin.* A coarse skinned pig grows a thick rind which detracts from the bacon when it comes to be sold.

As in most of these commercial characters (1) the inheritance is of the type known as multiple factor or blending, that is, crosses give intermediates which do not split out sharply into the two parent types again on crossing, (2) the qualities of the individual pig are so affected by the kind of nutrition it receives and (3) many of the qualities cannot be determined until the pig is slaughtered, the only means of ensuring a sound breeding policy is that of *the progeny test.* This consists of testing the offspring of the breeding stock for carcase qualities and using the parents of those which test out best to be the source of the next generation of breeding stock. Needless to say when such good breeding boars and sows are found they should be kept and used for as long as possible for producing breeding stock. It is important, when these progeny tests are being made, that the nutrition should be suited to develop the characters that are required, otherwise little progress will be made by selection, for the quality selected for will be limited by the nutrition and not by the breed qualities of the animal.

In conclusion, a few words about the debated question of pure versus cross-breeding. Pure breeding is the only real means by which

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our pigs can be improved permanently, by the methods outlined above, and by which the required characters may be developed to a higher pitch than they have ever attained before. Since, in the process of this pure breeding and selection many animals will be found which do not come up to the standard in one or other respect, these can be made best use of commercially by crossing with another breed which supplies those particular qualities in which the first breed was deficient. Needless to say two bad individuals of different breeds crossed will not produce good pigs, especially when both have the same defects : good qualities can only be brought in by pure breeds, and the type of crossbred animal produced must be dependent on the qualities developed in the pure breeds. No pure breed is absolutely perfect yet, and it is for pure breeds to discover all their weak spots and put them right ; in so far as they do this they will reduce the need for cross-breeding.

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THE BREEDING AND FEEDING OF BACON PIGS

By A. E. Law
(Newborough, Peterborough)

It was not without hesitation I accepted the kind invitation to read a paper setting forth my opinions, and describing the methods of breeding and feeding as practised at Newborough. Many of you will perhaps know that I have attained a certain measure of success in feeding and exhibiting commercial pigs of my own breeding.

This success has not been due to the study of scientific methods, although I should be the last to deny that much practical use can, and should be made of what science can teach us in the management of our pigs.

I would advise anyone proposing to keep pigs, to secure as full a knowledge as possible of the theory, before commencing the practice, and then, if only in a small way to get the best possible equipment, foods, etc., not forgetting well-bred pigs from a reliable source.

Were I commencing now, I should endeavour to carry out the above advice, but I should not advise any of you to make a journey to Newborough to take a pattern for equipment.

My success with bacon pigs, I attribute chiefly to my market experience, endeavouring to purchase pigs for bacon factories that would as nearly as possible satisfy the requirements of curer and retailer. Knowing what is really required has made it easier for me than for many breeders producing bacon pigs.

Breeding for Bacon

We must take this first, and one of the most important essentials in the production of Grade A bacon is the fact that your pigs *must be bred right*. If the pig is not bred right you cannot make a baconer however well you feed.

I have no desire to enter into any argument as to which is the best breed or cross breed for bacon. I do think it would be easier if there were not so many breeds to choose from.

Personally I still favour a *pure-bred Large White*, long in the body, short on the leg, wedge shaped, but the point at the right end, straight top and tight underline (the barrel-shaped pig is never a baconer) shoulders and fore-end fine, but not excessively so, because it often means loss of constitution and light gammons as well. The gammon should be full, especially just above the flank. If you get it there, you can be sure that your pig is lean. It is unnecessary in an assembly of practical men to emphasise *the supreme importance of the boar*.

It is not always the Show-winning boar that gets the best com-

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mercial pigs. *Be sure your boar has a masculine head.* You don't often find a bad boar with a good head.

My breeding sows run on a free range of 30 acres and are with the boar all the year round day and night. Sows come in about 10 days before farrowing to get settled down and accustomed to change of feeding. I prefer indoor treatment for the young pigs, excepting perhaps the summer months, when possibly outdoor farrowing may be preferable. When weaned I always like the young pigs indoors, and not more than 15 or so to run together. The best results are generally obtained with small units. I find it best to treat all pigs for worms at weaning time.

Pigs are weaned at eight weeks excepting in November, December and January, when we usually allow 10 weeks.

Feeding

I always think the feeder who has a good supply of a by-product or waste material that can be used in fairly large proportions can be certain of a profit pig feeding all the time.

Those who only have a standard meal ration will not always show a profit.

Our stand-by is potatoes, which we use practically all the year round. I can mention others quite as useful if used with discretion. Milk either whole or separated, whey from the cheese factories, flesh—one of the finest things to produce heavy weighing lean pigs.

All the above materially cheapen a ration, and are sure to show a good return if carefully used in moderate quantities.

During the war I fed a considerable number of purchased stores on steamed potatoes and fish meal only (95 per cent. potatoes and 5 per cent. fish meal) and for pigs over 16 weeks it is a very useful food if introduced gradually.

My own meal ration, which is ground and mixed at home, consists of wheat and barley 60 per cent. (at present the proportion is 35 per cent. wheat and 25 per cent barley), maize 10 per cent. (usually in the form of maize meal), wheatings 17 per cent., soya meal 8 per cent. and fish meal 5 per cent.

For suckling sows and weaners we use two-thirds of the above plus one-third wheatings and a little fish meal to balance the extra wheatings.

The food for young pigs for the first three months of their life should be the best obtainable, and the amount should be all they can clear up in the first 10 minutes after feeding. After that age I do not advise forcing them if a Grade A baconer is required.

If fed to full capacity you may get your pigs too fat, and sacrifice length of carcase.

The pig required for Wiltshire style bacon is not a finished pig but a three-quarter one.

My general feeding practice is briefly as follows : When meal only is being fed the pigs have two feeds per day. When potatoes are available, two feeds of steamed potatoes are given without water, and

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a drink of meal and water is given about mid-day as much as is required. For green foods I use a little lucerne, clover or kale. In-pig sows at grass have raw potatoes only; it is exceptional for them to receive any meal unless they come off heavy litters in low condition, when 1½ lb. of meal is supplied.

I notice it is generally advised when using fish meal in a ration to discontinue it for the last month of feeding.

This I do not agree with if lean flesh is required.

I would rather increase than decrease, as it is that part of the ration which is chiefly responsible for the formation of lean or muscle.

Many substitutes for fish meal are offered and rations without it showing almost exactly the same analysis, but there must be an indefinable something which analysis does not show.

For young pigs anyway, I think *fish meal cannot be equalled* by any other food.

Soya bean meal can be replaced satisfactorily by home-grown beans, or peas, but an increased percentage is necessary and also at least 8 per cent. of fish meal.

A last word on feeding . . . but a most important one . . . Your man must be willing and take a lively interest, or results will not be satisfactory. A large proportion of my success is undoubtedly due to my man Charles Lake, who rears and feeds my show pigs, and who I honestly believe could feed winners *whatever the ration*.

https://doi.org/10.23637/ERADOC-1-206

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DOES IT PAY TO PRODUCE GRADE A PIGS?

By H. R. Davidson
(Harpenden)

Does it pay to produce Grade A pigs? In order to find an answer to this question it is necessary to investigate two or three different approaches to the problem. Take, for example, the question of the cost of production generally. Only those who have attempted to obtain detailed costs of production for bacon pigs know how very difficult the whole subject is. The fullest investigation of the subject, however, is undoubtedly that which was given to it by the Reorganisation Commission for Pigs and Pig Products whose Report was published in October, 1932. Having studied data from many different sources the general finding of the Commission on this subject was embodied in a formula which allowed the cost of production to vary with the prices of feeding stuffs. This formula stated that the cost of production of a bacon pig could be taken as being equal to a fixed sum of 35/- per pig plus 10.3d. per score for every 1/- per cwt. in the cost of food.

Now if we calculate the cost price of bacon on this basis since the scheme came into operation in November, 1933, we shall find that the contract price for a basic pig was higher than the formula price until about July, 1934. By that time the contract price was approximately the same as the formula price, but this still left something, over for a Grade A pig. Since that time the contract price has remained very low, while the price of feeding stuffs has risen considerably. By October, 1934, the formula cost was 12s. 3d. per score while the contract price (after deducting for the curers' repayment levy) had fallen to 11s. 9d. In January of this year the cost of feeding stuffs was given as 9s. 2½d. per cwt. with a corresponding formula figure for cost of practically 12s. 11d. The contract price, however, was down to 11s. 3d. per score, a loss of about 1s. 8d. per score which the bonus of 1s. per score for Grade A pigs was not large enough to cancel. For February the situation has been less acute, but there was a difference of 1s. 3d. per score which was still too great for the 1s. bonus to overcome.

It is true that under the 1935 contract terms the curers are giving 2d. per score on all pigs delivered during the year to be paid out on a level delivery basis on all pigs delivered in the first four months of the year. If supplies throughout the year are regular this will amount to about 6d. per score on pigs delivered from January to April; on the other hand, as will be discussed later, it is not possible to obtain 100 per cent. Grade A pigs; and a producer can consider

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himself very fortunate to average out all pigs on a "B" basis. Therefore, even taking the bonus as amounting to 6d. per score, the average price to the producer does not show a profit under February conditions. Another way of looking at the level delivery bonus is to realise that in the case of a producer who delivers fairly regular quantities all the year round this bonus is really only equal to an average of 2d. per score for the whole year. In practice this amount is consumed in administrative expenses.

A brief examination of the low contract price shows that this result is due to the low price of bacon. While the present contract terms are based to a certain extent on the Commission's formula they are also dependent directly on the wholesale price of green home-cured Wiltshire bacon. The contract price only agrees with the formula cost of production when bacon is selling at 104s. 4d. per cwt. At present prices of bacon, therefore, the evidence is that it does not pay to produce either Grade C or Grade A pigs.

Turning now to another aspect of the problem let us assume the situation to be such that the contract price of a basic pig remains steadily at something under the formula cost of production, but at a figure under it less than the bonus for a Grade A pig. This would mean that by producing 100 per cent. of Grade A pigs we could rely on making a small profit. In asking ourselves whether we can produce 100 per cent. Grade A pigs let us consider what exactly a Grade A pig actually is. As at present defined by the contract terms this is a pig with a carcase weight lying between certain defined limits, which has firm white fat, which does not show signs of fishy flavour, seedy cut, disease, bruises, emaciation, or physical damage; which is not a sow or pregnant gilt, and which conforms to certain measurements of back fat and belly thickness. While it has been the province of other speakers to define in what quality of bacon carcase consists, I wish to refer to the matter again for a moment.

The cured side of Wiltshire bacon is normally divided into ten different cuts. Of these, two form the gammon, two the fore-end and six the "middle." The "middle" cuts again are grouped into three forming the back and loin, and three which form the belly. The three belly cuts are known as the thick streaky (in front), thin streaky (in the middle) and flank (behind). The ten cuts vary widely in selling price according to their value to the consumer. A general relationship, however, is ascertainable between the price per lb. of of each of the cuts and the price per lb. of the whole side. Roughly speaking, when the price of a bacon side is about 1s. per lb. (*i.e.* when bacon is about 112s. per cwt.) the price of flank should be about 8d. per lb., thin streaky about 11d. per lb., and thick streaky about 1s. 2½d. per lb. The corresponding prices for prime back on the other hand would be about 1s. 7d. per lb. (These prices, by the way, are allowing for 15 per cent. gross profit for the retailer.) The flank, then, is with the exception of the fore-hock, the least valuable cut in the whole side, while the thin streaky comes about sixth out of ten

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in the value per lb. of the cuts. In addition the total weight of both flank and thin streaky only amounts to rather less than 10 per cent. of the total weight of the side.

Now if you will consider for a moment the place at which the belly measurement is taken under the present contract terms you will perhaps see what I am aiming at. The contract states that "the belly measurement shall be the thickness of the belly 1¾ in. from the belly edge opposite the joint between the fourth and fifth vertebrae from the curve." Because the backbone is removed in the process of curing it is not possible to demonstrate on a cured side just where this measurement is taken, but by analogy it will be found to be somewhere close to the division between the flank and the thin streaky.

In the Danish Testing Stations the belly is measured at three points, and where similar measurements have been taken in this country it has usually been found that the smallest measurement is obtained in the flank, while the largest is found in the thick streaky. Under British conditions, therefore, the belly is measured at what is virtually its thinnest point, while in Denmark and Sweden the belly thickness is taken as the average of three measurements from the thinnest to the thickest point. Now, as I see it what we have to compete with in this country is the production of lean sizeable Wiltshire bacon abroad. Do the contract terms suggest that our Grade A pigs are similar to those which produce No. 1 Danish Wiltshire sides ?

For Class 1 pigs, that is those with a cold dead weight of 140 to 170 lb., the Grade A qualifications are that the back fat must not exceed 1¾ in. while the belly measurement must not be less than 1½ in. If, however, one turns to the measurements of Grade 1 pigs in Denmark, which correspond to Class 1, Grade A pigs in this country, it will be found that they do not come up to the standard for Grade A in respect of belly measurement (see Table I). Of 1,880 pigs measured in the Danish Testing Stations last year and which were graded as Grade 1 (*i.e.*, Class 1, Grade A), the average belly measurement was 1.30 ins. This, it must be remembered, is the average figure for three measurements, and will be greater than the single measurement taken in the flank under British conditions. Even so this means that the belly measurement would only qualify for Grade C in this country, the minimum being 1.5 ins. and hence, even if the back fat were satisfactory the whole carcase could only be graded C. In other words, what would be Grade A under Danish conditions would only be Grade C under British conditions. This means that in competition with foreign imports the home producer is under a handicap of two grades or 1s. per score which amounts to about 7s. on the average bacon pig.

Similar results have been obtained in Sweden and the following excerpt from a report by Axelson [1] may be quoted here :

[1] Einige Resultate der Schweinemastkontrolle in Malmöhus Län. Joel Axelson. Z. Züchtg.: B, Tierzüchtg. u. Züchtsbiol, Bd. 28. Heft 2. S. 157-315 1933.

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"*Correlation between the various properties of bacon pigs—thickness of belly and grading.*"

"For the correlations between thickness of belly and grading the following coefficients were obtained:

Large White Breed	Males	$r = -0.189$	± 0.0500
	Females	$r = -0.218$	± 0.0482
	Average	$r = -0.346$	± 0.0615

"From this it will be seen that all three coefficients are negative and significant, and they show therefore that the thinner the belly the higher the grading of the side and *vice versa*. This result appears to contradict the well-known fact that in pig breeding it is a thick belly which is striven after, in order to obtain bacon of higher quality. The result, however, is perfectly correct and finds its explanation in the relationship by which a thicker belly is associated with a thicker back fat, and as the thickness of the back fat is of far greater importance in grading than the thickness of belly it follows that a thicker belly is associated with a lower grading although a thicker belly by itself, purely from the point of quality, is certainly to be desired.

"The same result is obtained if the average value of the belly thickness of the different grades is recorded. These average values are actually as follows:

		Grade I	Grade II	Grade III
Large White Breed	Males	3.22 cm. ± 0.031	3.31 cm. ± 0.027	3.38 cm. ± 0.032
	Females	3.49 cm. ± 0.019	3.67 cm. ± 0.040	3.66 cm. ± 0.059

"These average values show that the thinnest belly measurements are given by the best quality bacon. This result, too, agrees with the earlier Danish and Swedish investigations."

These Scandinavian figures, scientifically arrived at, only confirm what has already been known in this country, namely that in selecting for the British market, foreign bacon producers have placed the greatest of emphasis on a thin back fat and while striving to get as thick a streak as possible they have refused to select on this basis because of its effect on back fat.

It is easy to understand that in the case of the Midland bacon trade a thick belly is essential. In this case the back and loin are removed as well as the ham, and of the part left for curing, the the streaky and flank obviously form a very high proportion. In this case one can appreciate that the thickness of the belly is all important, and that the thicker back fat which is associated with it, although undesirable, is not the major problem that it is in the case of lean sizeable Wiltshire bacon. In fact as Callow has shown in his recently published paper in the *Empire Journal of Experimental Agriculture* on "Carcase Quality in Relation to Growth and Diet" the firmness of fat which is required for the Midland ham trade is only obtained from a well fattened pig. To insist, however, on a Midland standard of belly and a Wiltshire standard of back fat

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would, from the evidence just submitted, seem to be asking the British producer to do something which is not demanded of his Danish competitors and which is biologically very difficult to achieve.

It is not here suggested that the measurement for belly thickness should be done away with. As Dr. Hammond has pointed out, the streak should be as thick as possible but it is the relation of this to the thickness of the back fat which, under present conditions, seems to be uneven.

It has been said that it is not the thickness of streak which is difficult to obtain but rather the required thinness of back fat. This, however, is begging the question, as it is not the actual belly measurement which matters but its relation to the back fat.

Should the price situation be such that a profit can only be obtained from Grade A pigs, and at present bacon prices it does not seem possible to obtain one from Grade C pigs, then on the present grading standards there is no likelihood of producing the 100 per cent. of Grade A pigs necessary to make that profit.

There now remains to be considered the more general problem of whether the pig of typical bacon conformation actually costs more to produce than one of a recognised pork or lard type. Here the evidence is a little conflicting. According to theoretical considerations arising from the very valuable investigations into growth and carcase conformation recently carried out by Hammond, the best type of bacon carcase is achieved by the use of a late-maturing type of pig which is pushed on in the early stages of growth to make as rapid gains as possible. Now it is generally imagined that because heavy feeding leads to greater daily gains, and because, therefore, the maintenance requirements of the pig is reduced, the amount of food consumed per lb. of live weight gain must be less. Actually, however, it is found that lighter feeding leads, as would be expected, to slower growth, but also to a more economical use of food. Findings to this effect were obtained by Henry and Morrison in America, and by workers at the Rowett Research Institute in this country. On the other hand it is known that growth in the early stages is made at the expense of a smaller amount of food than later on, because muscle tissue contains so much more water than fat. Yet this is countered once again by the fact that the high percentage of protein ingredients required in the food of young pigs makes the ration more expensive than is required in the finishing stages. From these somewhat confusing considerations what conclusions can we draw? Perhaps the best answer is to refer to two of the few cases where data on both quality and economy of food consumption have been recorded. The first case relates to a report of an American Testing Station, published in 1932 (see Table II). In this case 20 pens of groups of four pigs each were recorded so that the total consumption of food was known and so that the total retail value of the meat was also ascertained. The difference between food cost and selling value is not the exact net profit, but it is obviously closely

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TABLE I

MEASUREMENTS OF DANISH AND SWEDISH BACON PIGS

Data from Official Reports of National Testing Stations, 1934

		Danish			Swedish		
	Total No. of pigs.	*Inches*	*Belly Grade*	*Car-case Grade.*	*Inches.*	*Belly Grade.*	*Car-case Grade.*
GRADE I							
Average thickness of back fat ..	1880	1.34		C.	1.39		C.
Average thickness of belly ..		1.30	C.		1.32	C.	
GRADE II							
Average thickness of back fat	572	1.57		C.	1.57		B.
Average thickness of belly		1.26	C.		1.38	B.	
GRADE III							
Average thickness of back fat ..	186	1.69		C.	1.71		B.
Average thickness of belly ..		1.30	C.		1.39	B.	

Minimum belly measurements under English Contract grading.

GRADE A, 1.5 inches — GRADE C, 1.25 inches

GRADE B, 1.375 inches — GRADE D, 1.0 inches

TABLE II

Relationship of profit to feeding cost and carcase quality.

Compiled from "Report on Iowa Swine Performance Record," 1932.

Order of pens.	*Difference between food consumed and "cut out" value per 100 lb. live weight gain.*	*Value of food consumed per 100 lb. live weight gain.*	*"Cut out" value per 100 lb. live weight gain.*	*Average of every four groups.*
	s. d.	s. d.	s. d.	s. d.
1.	18 8	24 0	42 8	
2.	17 5	25 0	42 5	
3.	17 3	26 4	43 7	
4.	17 1	26 4	43 4	43 0
5.	17 1	26 2	43 1	
6.	16 9	26 3	43 1	
7.	16 6	26 1	42 9	
8.	16 5	26 11	43 5	43 1
9.	16 4	27 2	43 6	
10.	16 3	27 1	43 5	
11.	15 10	27 11	43 9	
12.	15 3	27 11	43 3	43 6
13.	15 1	27 8	42 10	
14.	14 9	28 3	43 3	
15.	14 7	28 9	43 6	
16.	14 2	27 6	41 3	42 10
17.	13 11	28 2	42 4	
18.	12 7	30 7	43 2	
19.	11 10	31 5	43 3	
20.	11 1	31 9	42 11	42 6

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TABLE III

DANISH TESTING STATIONS, 1934

Pens having more than 13 points out of 15 for bacon type.

Station	*No. of Pens.*	*% of Total.*	*Food per 1 lb gain. Selected Pens.*	*Food per 1 lb. gain. Average of all pens.*	*Difference*
Bregentved ..	6	4.5	3.13	3.35	0.22
Hong	14	12.7	3.30	3.47	0.17
Elsesminde ..	11	14.1	3.25	3.36	0.11
Overlojstrup ..	25	15.4	3.21	3.34	0.13
Haraldskjaer ..	33	15.6	3.20	3.29	0.09

related to it. When a table is made showing the gross profit, the value of food consumed per 100 lb. gain and the value of the carcase, an interesting relationship will be found. The profit is found to be almost exactly proportional to the efficiency of food consumption, and not to the value of the carcase. In fact, the pen with the highest profit (No. 1) was only third from the bottom (42s. 8d.) so far as carcase was concerned. In this case some strains have been good both from the point of view of food consumption and quality, while others have been good in one direction and not in the other. Profit, however, has almost entirely depended on economy of food consumption.

A second, and for our purpose, much more significant example is to be found in the case of the Danish Testing Stations for last year. From these results have been selected all pens which have scored over 13 points out of 15 for bacon quality (see Table III). The average for all pens tested is about 12.6 points. The average amount of food consumed by these pens has been compared with the average for all pens tested. From Table III it will be seen that those pens which obtained highest marks for bacon quality have also a figure for economy of food consumption definitely above the average. The actual amount means a saving of about 19 lb. of food per pig, or something like 1s. 3d. to 1s. 6d. at present costs of feeding stuffs.

Comparing the American and Danish results with one another it does not seem as if they were in agreement. The data from Danish sources, however, correspond more closely to our own conditions, as thickness of back fat is the main criterion of quality followed by length of middle, and thickness of streak. It is possible, too, that the American pigs were much more heterogeneous in type and had not been selected over such a long period. Taking the available evidence it would seem that a type of pig similar to that which has supplied the best foreign imports in the past is more profitable to feed than the less suitable type, and there is ample evidence, to which I have not time to allude here, that from the point of view of fecundity it is as good as any.

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Conclusion

To return to the question asked in the title of my paper, " Does It Pay to Produce Grade A Pigs ? " my reply would be as follows :

(1) Under present conditions where the contract price depends on the price of bacon and where the price of bacon remains so low, the extra return from a Grade A pig is not sufficient to cancel the loss involved in a basic pig.

(2) The present standard of belly measurement is too severe and out of proportion to the demands of the market which we are trying to develop. The percentage of Grade A pigs produced is therefore small and the effort and capital involved in providing stock and accommodation to produce them does not meet with an adequate return.

(3) Given a reasonable standard for a Grade A pig its production will give a more economical return than a pig of poor type. If the Pigs and Bacon Marketing Boards can secure the adjustment of the price of bacon which will be to their mutual advantage and which will make the price of a Grade C pig not less than the cost of production, and if they can reach a rather more reasonable understanding on the question of the contract grading terms, then the production of Grade A pigs will certainly be a paying proposition.

As development of the pig industry in this country can only come from increased production of bacon, and bacon of Grade A quality at that, I consider it incumbent on every pig producer in the country to give his fullest support to the Marketing Scheme in the hope and belief that it will remain in active operation till these improvements are achieved.

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DISCUSSION

Earl Radnor, in opening the discussion, said that he had been greatly helped by the bacon factory in problems of pig production. He stressed the point made by Mr. Law that management at the hands of the pigman was all important. Care and individual attention were quite essential to success. Breeding was a most important point. The Pig Industry Council were agreed that *strain within the breed* was more important than breed itself.

In regard to belly measurements he gathered that the meeting would like to abolish them altogether. He was not in favour of troublesome restrictions, but the curers would probably have strong views about this matter.

Belly measurements were not the whole story, however; he regarded weight of shoulder as a point that needed great attention. He suggested that bad management could give rise to a distended belly and a slack pig was much inferior to one having a level underline. Pigs having a straight underline were also more healthy. In dealing with Mr. Law's point that we must retain some shoulder to get constitution, he suggested that what was wanted was a shoulder that was well let in. This conformation gave lightness with constitution. To encourage eager feeding his pigs were kept on half rations one day a week. This made them clean up well for a week afterwards. The 10 minutes allowed by Mr. Law for the pigs to clear up appeared to be rather a short period; he preferred to give them 20 minutes.

Dr. C. Crowther, Harper Adams College, proposed to discuss only nutritional problems. He suggested that there was at present a great lack of information as to where to get the proper pigs. A comprehensive system of recording was wanted to enable us to obtain the type of pig required. There was also need for an intensive study of the pig diseases that played such havoc with production. Pig production was not simply a matter of scientific feeding; management was all important.

He stressed the advantage that the Danes possessed in separated milk. If we had the milk we could grow the pigs. He suggested that this matter was one for joint consideration by the Pigs and the Milk Boards. In his opinion we knew as much, if not more, than the Danes about feeding pigs without milk. In referring to Mr. Law's advocacy of fish meal, Dr. Crowther stated that he could obtain as good results, and cheaper, by using extracted soya meal, but he must have minerals, of which limestone and salt were the chief. Since soya meal is deficient in Vitamin A a handful of green stuff must be given, or where this is not available, a little cod liver oil. On this type of feeding the growth rate and the quality were quite satisfactory. A good average figure for the ratio of food to live weight gain was 3¾. In drafting the grading scheme the psychological factor

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had been neglected. It would have been better to begin with a relatively easy standard and gradually tighten up. The three main lines of research should be (1) the determination of the most economical growth rate—which need not necessarily be the quickest, (2) scientific study of quality problems, (3) disease.

Mr. A. E. Marsh, Brierley Hill, reminded the conference that the Danes produce only for one trade—the Wiltshire side. In England there are twelve trades, and in producing the bacon scheme the attempt had to be made to meet as far as possible all these various requirements. It would not do to force on the public an article to which they were not accustomed. Seventy per cent. of the pigs killed at Brierley Hill were grade A in the belly. The Midland trade wanted a good belly with a back that was not too fat. The Danes ignored belly for the London trade and paid great attention to length. The result was that English pigs were better bellied than the Danish. Many English pigs had the back fat thinner on the shoulder than on the loin. This was the exact inverse of the Danish measurements. He believed that the Danes were right in keeping their pigs warm and comfortable. English pigs laid fat on the shoulder to keep themselves warm !

Mr. Marsh said that producers must support the bacon scheme if it was to continue, and the quotas should be strictly enforced. His factories were at present killing at much less than capacity. Belly was not so vital except in the Midland trade. Only 50 to 60 per cent. of English bacon was Wiltshire, but we must watch the interests of other curers.

Mr. V. C. Fishwick, Wye. One reason for the inadequate numbers of pigs entering the factories was the form of contract. It was exceedingly difficult to contract fully for the second half of the contracting period. Some modification was required and he suggested monthly deliveries for the last 6 months. He could not agree that elaborate housing was necessary for pigs over the greater part of this country. The pigs must, of course, be warm and dry with no draughts. As a result of his trials he had come to the conclusion that breed made more difference than feeding to the fatness of carcase, although the quality of the fat is influenced by food. If the type is right, a Grade A pig is no more expensive to produce than one of lower quality. He agreed with Earl Radnor as to the advantage of an occasional fast : he gave his on Sunday afternoons.

Mr. Busby. In answer to Mr. Fishwick's point on the difficulty of supplying pigs in the second half of the contract period, stated that since the Board of Trade fixed their Quota regulations on a one-year basis the contract had to be framed on the same basis.

Mr. J. E. Sidgwick, Essex, said that 70 per cent. of his pigs were grade A in the belly but were too fat on the back. A 4 lb. conversion factor was not good enough for him. He kept his pigs on concrete from start to finish and as a supplementary foodstuff gave them a turf to chew.

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Mr. J. H. Wilson, Diss, said that he contracted for 1,000 pigs a year and confirmed Mr. Marsh's figure that about 70 per cent. had grade A bellies, but in a recent consignment he had only 3 grade A pigs out of 200. Since only about half English pigs went for the Wiltshire trade he suggested that there might be two contracts, one for the Wiltshire and another for the Midland trade, the latter requiring thick bellies but being more lenient with back fat. In regard to feeding, his view was that a high percentage of protein at the end of the feeding period gave leaner pigs and improved grading results.

Dr. Hammond agreed with Mr. Wilson and said that New Zealand produced some pigs very thick in the lean. These were kept on grass and skimmed milk and had a protein supplement (meat meal) instead of a carbohydrate one.

Dr. Crowther warned the audience of the danger of hurrying on pigs too fast and laying on too much back fat. He considered it was wasteful to feed high protein rations at the end of the feeding period.

Mr. Law produced some bacon for Mr. Busby to judge. When Mr. Busby had pronounced one sample to be impossible, a second very poor, and a third much better but still not good, he was informed that it was all Danish. Mr. Busby replied that he had seen some very poor pigs in Denmark, and warned English producers against turning out stuff like that displayed which would make British bacon unsaleable.

Mr. H. Mitchell, Harlow, asked why length which was regarded as being so important by breeders received no attention in the grading. He had recently entered 20 pigs and they differed in length by as much as 9 inches. He mentioned that in order to make up a consignment he included a " waster " and got Grade A for it.

Earl Radnor answering the last speaker said that length was indirectly taken into account in the grading.

Chairman's Concluding Remarks. Mr. Fox mentioned a few farmer's experiments that he had conducted on his own farm. In the last month of feeding he had fed less than the actual food requirement and given it in a dry form. The pigs were active and kept down the back fat.

Another point being tested was to feed only maintenance rations as the pig approached factory weight. Referring to the shorter contract Mr. Fox pointed out its danger, namely that if pork and fat pig prices were good, pigs would tend to be sent to the open market, and the factories would be on short supply. He went on to state that the Board would be only too glad to examine suggestions for a shorter contract that were fair to all concerned.

Sir Merrick Burrell in passing a vote of thanks to the Chairman and speakers assured the meeting that the importance of the study of pig diseases is recognised by the Agricultural Research Council and active work is proceeding. Owing to the previous neglect of the subject results must not be expected too quickly.

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Printers St. Albans