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MODERN DEVELOPMENTS IN EARLY WEANING OF PIGS

D.B. Bellis

Pig Industry Board of Rhodesia

Traditionally, pigs on commercial farms have been weaned at 8-9 weeks of age because experience had shown that at that age, the pig was capable of digesting and utilizing normal foods made up of cereal starches and native proteins. Experience had also shown that at this stage after parturition the sow would exhibit oestrus and conceive her next litter readily within a few days after weaning. It has long been realised, too, that earlier than 8 week weaning has several potential advantages:–

(a) It could improve the productivity of the sow by shortening the interval between parturition and successful mating up to a maximum of 50%.
(b) It could reduce piglet losses.
(c) It could improve the performance of piglets in terms of early growth and overall efficiency of conversion of food into pig meat.

These potential advantages may become progessively more important as weaning age is reduced. How these advantages are translated into extra profitability on commercial pig producing farms will depend firstly on the degree to which the theoretical advantages are achieved in practice, and secondly on the cost of achieving the actual increases in production.

Research into pig nutrition and management, and the tendency for pig farms to become more specialised over the last 20 years, have led to 8 week weaning becoming the exception rather than the rule and 5-6 week weaning is now commonplace in the major pig producing areas in the U.S., Western Europe and Southern Africa. This weaning age is practical because formulation of suitable foods is simple with no special dietary ingredients needed, and requirements for labour, housing and general management are little different to what is required for 8 week weaning.

The first reports on earlier than 5 week weaning (henceforth called early weaning) appeared soon after World War II and the first commercial exploitation took place in the U.S.A. and the U.K. in the early 1950's with the introduction of 7-10 day weaning. These earlier attempts were not particularly successful, but since then new knowledge and new techniques have led to weaning on a commercial scale taking place at ages between 4 and 21 days. This paper reviews the experience on commercial farms to date and pinpoints the main problems yet to be overcome.

Early Experiences

Sow milk substitutes were marketed in the early 1950's by Pfizer in the U.S.A. (Terralac) and by British Oil and Cake Mills in the U.K. (Sowlac), and these were used on many commercial farms, particularly in the U.K. These feeds were based on skim milk powder as a source of protein, and added fat (lard or tallow), pre-cooked cereals and glucose as energy sources. Antibiotics were included at levels of 50-100 ppm to promote growth and maintain health.

Farmers weaned their pigs at ages varying from 4-10 days of age, with the higher age being more popular because it was found that 10-day old pigs would consume solid food. Younger pigs had to be fed their food as a gruel and this was obviously more irksome and demanding on farm labour. The newly weaned piglets were usually housed in the pens in which they had been farrowed, often with a kennel incorporated as a warm sleeping area.

Farm results were extremely good at first with piglet growth and survival rate being very satisfactory. 56 day weights of 30 kg were not uncommon and post weaning deaths were the exception. After a period of 12-18 months, however, health breakdowns occurred. The diseases were those associated with E coli i.e. diarrhoea leading to sub normal growths and deaths due to bowel oedema.

This pattern of health breakdown was consistent over a large number of farms and it is likely that it was due to inadequate hygiene in an intensive environment leading to proliferation of disease-causing organisms. The continued use of antibiotics in an environment was also implicated. A careful study was made on one typical farm, and bacteriological examinations by Hirsch (1957) showed that excessive numbers of haemolytic and antibiotic resistant coliform were present in the gut flora of all pigs. A significant finding was that health and growth of the 10 day old pigs weaned on this farm improved when the antibiotic was removed from all diets. This improvement was evident within three months and coincided with the preponderance of non-haemolytic and antibiotic sensitive organisms in the pigs' intestinal flora.

At this time, other work at several research centres, such as that by Bellis (1961) and Braude, Townsend, Harrington and Rowett (1962) showed that under farm conditions the growth promoting effect of tetracyclines and copper were similar for growing and fattening pigs. This work was extended to early weaned pigs with similar results (Lucas, Livingstone, Boyna and McDonald 1962) and the data (unpublished) in Table 1, obtained by the author, were typical.

Antibiotics that had routinely been included in early weaning diets were, therefore, replaced by copper sulphate, and were used only for short periods at times of clinical disease. The farmers used less intensive systems for early weaning and weaned their pigs a little later. This led to the 21-day or so weaning systems that are common in Europe today.

21-day Weaning.

Semi extensive methods – two main systems are adopted, the first using arks with outside runs on pasture and the second using similar arks but fitted with slatted or weld mesh runs. The outdoor system is usually preferred

Table 1

Effect of copper sulphate and tetracyclines on growth of early weaned pigs

(Effects relative to control of 100)

	From 10 to 25 lb. live-weight	
	Growth Rate	Food Conversion
Control	100	100
Control + 50 ppm Tetracycline	125	112
Control + 250 ppm Copper	137	122
Control + Tetracycline and Copper	142	120

by small pig units, while the latter is more suitable for larger units. Piglets are weaned at about 21 days or when the average piglet weight is 5 kgs. The litter, or sometimes 2 litters, are housed in a small insulated wooden ark having about 0,2 sq.m. sleeping area per pig. The feeding area is in a separate compartment, often under a verandah, and food and water are given ad libitum.

On the oudoor systems the ark is placed in a paddock of about 0,05 ha in the wetter countries of Western Europe, but smaller areas can be used where rainfall is less. The slatted area for housing not on pasture is about 1 sq.m. per pig. A feed used for 21-day weaning would have 23% protein and an energy content of 3,15 K cal/g of M.E. and a typical composition is given in Table 2.

Table 2

Composition of typical 21-day weaning diet

	% by weight
Dried Skim Milk	17
Fish Meal	15
Wheat Meal	40
Oat Flour	15
Whey powder	10
Tallow	3
Vit/Trace minerals (including 250 ppm copper)	+

A feeding system commonly in practice is for the litter to be fed the above feed in meal or pellet form prior to weaning and afterwards until 12.5 kg. per pig has been consumed, when the feed is changed to a normal pig grower diet.

Results show such systems are generally satisfactory, such as those (unpublished) obtained by the author in 1962/3 given in Table 3.

Table 3

Outdoor rearing of 21-day weaned pigs

(Data for 147 litters)

	Winter	Summer
Pigs weaned	1 003	391
Pigs reared	979	383
21-day weight (lb.)	13,0	12,5
56-day weight (lb.)	42,5	44,0
Food conversion (21-56 days)	1,95	1,68

Experience has show that there are few problems with sow reproduction. Average time from weaning to effective service is marginally higher and litter size is generally lower than with later weaning. Herd recording data such as for farms in Eastern England (Ridgeon 1971) show that those farms practising 21-day weaning are more profitable than farms in which the sows are weaned at 35 or 56 days.

Intensive systems – most of the intensive systems of 21-day weaning in Europe are based on the cage rearing systems originally devised in Belgium by van der Heyde (1969, 1970a, b, c). His research showed the fundamental needs of intensively housed early weaned pigs to be:–

(a) Highly hygienic conditions with no contact between dung and food – hence wire floors are preferable to solid floors;
(b) air temperatures of 25°C ± 2°C, relative air humidity 40%-60%;
(c) rearing single litter groups;
(d) carefully designed feeding and watering equipment;
(e) minimum disturbance of the piglets

These conditions are critical for satisfactory performance, and the research and consequent farm experience highlighted the reason why the original attempts at early weaning in intensive conditions were not successful and also why the alternate extensive systems are successful. Many large pig units in Western Europe are now practising cage rearing. Each cage holds a litter of pigs, and the cages may be single or multidecked. The environment of the cage room is fully controlled. The system is relatively new, but there is every indication that it is economical.

7-10-day Weaning.

The Belgian system was originally devised for 7-10 day weaning i.e. the earliest age at which pigs will consume adequate quantities of solid food. Farmers in Belgium and Holland adopted the system and found that, although the pigs grew economically, the system as a whole was not worthwhile because sow reproductivity is not high enough to offset the capital costs involved. There is considerable variation from sow to sow in the period from weaning to oestrus, the incidence of returns to service is too high and

there is an above average incidence of small litters from the 7-10 day weaned sows, particularly those that conceive quickly.

Sow productivity is no higher than with 21 day weaned sows. Thus pig producers originally on 7-10 day weaning have reverted to 21-day weaning, as environmental conditions are not so critical, and less capital expenditure is required. Table 4 shows the composition of a typical 7-day weaning diet.

Table 4

Composition of a typical 7-day weaning diet

	% by weight
Dried Skim Milk	50
Fish Meal	10
Wheat Meal	5
Oat Flour	10
Glucose	10
Whey Powder	10
Tallow	5
Vit/Trace minerals (including 250 ppm copper)	+

4-day Weaning.

A 4-day weaning system was operated in Germany from 1965. The pigs were weaned into housing and environmental conditions similar to those of van der Heyde, but it was found that single cage rearing was essential for the first three weeks after weaning. Pigs were fed a liquified diet based on cultured skimmed cows' milk fortified by fat, vitamins and minerals, and it was found that up to 10 feeds per day were necessary. The German operation was on a large scale – about 100,000 pigs per annum – but data pertaining to the success of the system have not been published. The system was tested on a smaller scale in the U.K. and unpublished results show that growth and survival rate of piglets are very satisfactory. Sow reproductive results in terms of farrowing interval and litter size are poorer than with 7-10 day weaning, and again comparable with production from sows that have been 21 day weaned. Thus the high capital expenditure needed for piglet housing and proper hygiene is not justified.

Problems of Early Weaning

Experience from the U.K., Europe and the U.S.A. is that 21-day weaning is practical and economical. Sow productivity and profitability under farm conditions as shown by Ridgeon are higher than with later weaning. In Southern Africa, there is every reason to believe that 21-day weaning would give similar pig growth and sow productivity results, but the system may not be economical as a whole. This is because overall feed cost of early weaning as compared to later weaning depends on the cereal : protein price ratio. When this is high, as in Western Europe, overall feed costs are lower than with later weaning because less food is fed to sows and more higher protein food is fed to the young pigs. In Southern Africa the ratio is relatively low, and thus not so favourable for early weaning.

Early weaning would be profitable under most feed price conditions if the problems associated with earlier than 21-day weaning could be overcome. These problems are firstly hygiene control at a lower cost in terms of capital and labour, and secondly greater sow productivity.

Disease Control – The basic problem in successful early weaning is the antibody status of the newly weaned pigs as described in detail by Jones (1972). The main porcine immunoglobins against common coliform diseases are IgM, IgG and IgA and these are present in high concentrations in sow colostrum. The post partum absorption of these maternal antibodies is essential to survival of the neo-natal pig, but its serum antibody level drops markedly during the first week of life, and does not rise again until the piglet produces its own serum antibodies from 2-3 weeks onwards. The period from a few days after birth to 3 weeks of age is therefore critical for the young pig. The sow, however, continues to secrete IgA in her milk, and this is active in the piglet's intestinal tract and provides a local defence mechanism throughout lactation. Thus, if piglets are weaned at less than 3 weeks of age, their source of protection against disease is lost, and they succumb to coliform infections unless kept under highly hygienic conditions.

More attention is now being paid to the role of IgA antibody in the gut, and it is likely that this is the predominant immunoglobin in the intestinal immune system, and that it becomes active to a slight extent during the second week of life. Any factor, such as the feeding of killed cultures of E coli, that could stimulate intestinal secretion of IgA could make an important contribution to intestinal defence against pathological organisms. This would make weaning at less than 21 days of age less dependent on hygiene and so could be achieved at less cost in terms of capital and labour.

Sow Reproduction – Experience on farms practising early weaning shows that the earlier a sow herd is weaned, the greater is the average interval between weaning and effective service and the smaller the subsequent litter size. Typical data are shown in Table 5.

Table 5

Reproduction data of early weaned sows

Days from farrowing to weaning	Days from weaning to oestrus	Days from farrowing to conception	Average litter size
(a) 4	18,6	25,4	8,7
(a) 8	12,9	24,9	8,7
(a) 13	14,1	29,2	9,9
(b) 21	7,2	30,7	10,0
(b) 35	5,0	42,1	10,5

(a) Data by van der Heyde (1972)
(b) Data by Bellis (1969)

Thus sow productivity becomes less efficient as weaning age is reduced and, in practical terms, there is no advantage in terms of pigs/sow/annum in weaning at less than 21 days.

The problems associated with reproduction of early weaned sows and the directions in which research may lead to their being overcome are described by Polge (1972). Many of the results obtained from increasing pituitary response by use of hormones are promising, and farm results to date show that such treatment does reduce the period from weaning to effective service. The problem of smaller litters, however, may be more difficult to surmount, because it is likely that reduced litter size in early weaned sows is due to a higher incidence of embrionic mortality rather than to reduced ovulation or to a smaller number of eggs fertilised.

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