S. Afr. J. Anim. Sci. 6, 155–162 (1976)

EFFICIENCY THE KEY TO FUTURE PIG PRODUCTION

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The continued production of pigs and pig products will no doubt greatly depend on the demand for pork, the efficiency with which we produce pork in South Africa and on our willingness and ability to exploit to the utmost the pigs potential as a meat producer.

This paper reviews the pig situation in South Africa at present, postulates on the future of our pig industry and makes some suggestions on ways and means to improve production efficiency.

Table 1 gives information on the production of the main feed ingredients used in animal feed oncentrate mixtures in South Africa from 1960 up to the present time. It is pleasing to note that the production of maize, which is normally included at a rate of 70% and more in concentrate feeds, has more than doubled since 1960. The situation for protein-rich feedstuffs is however not so rosy. The production of fish meal, our most important protein rich feedstuff, has remained virtually static. The production of oilcakes has, however, shown a sharp increase during the last few years. The production of concentrate mixtures has increased dramatically, thus indicating a tendency toward a more intensive form of animal production which ought to lead to a higher degree of production efficiency. However, we are in the fortunate position that the expansion in concentrate production does not make large inroads in our maize supplies. Expressed as a percentage of maize produced, concentrates manufactured increased from 10,4% to only 16.8%. The production of oilcakes has, however, not kept up with the expansion that took place in the manufacture of concentrates. In the near future grain does not seem to pose any problem as will be substantiated in a later table, but the availability of protein rich feeds poses a real problem in the very near future.

The total annual meat production has increased from 709 000 tons to 964 000 tons, representing an increase of about 36% during the last 15 years. During this period beef production increased only slightly, mutton production remained virtually static, pig meat production rose by about 62%, but meat from poultry showed a dramatic increase from 46 000 tons to 224 000 tons, an increase of 487%. Further discussions on production traits will follow at a later stage.

Table 1

*Production of maize, protein concentrates and animal feed concentrates**

Year	Maize		Fish meal		Oil cakes		Concentrate mixtures		Concentrates as a %of maize
	1000 Tons	Index	1000 Tons	Index	1000 Tons	Index	1000 Tons	Index	
1961–65	5229	100	238	100	68	100	545	100	10,4
1966–70	6321	121	327	138	72	107	902	165	14,3
1971–75	8671	166	–	–	–	–	1341	246	15,5
1974	11105	212	254	107	162	239	1866	342	16,8

* Data from Abstract of Agricultural Statistics, 1976

Table 2

*Production of meat per annum**

Year	Beef and Veal		Mutton and Goats meat		Poultry slaughtered		Pig meat		Total Production	
	1000 Tons	Index	1000 Tons	Index	1000 Tons	Index	1000 Tons	Index	1000 Tons	Index
1960/61-64/65	462	100	146	100	46	100	55	100	709	100
1965/66-69/70	441	95	180	123	80	174	70	128	771	109
1970/71-74/75	509	110	167	115	160	347	87	158	923	130
1974/75	503	109	148	101	224	487	89	162	964	136

* Data from Abstract of Agricultural Statistics, 1976

Table 3

*Maize Consumption**

Year	Gross human Consumption		Animal Consumption		Total Consumption		Consumption as a % of production	
	1000 Tons	Index	1000 Tons	Index	1000 Tons	Index	%	Index
1960/61-64/65	2224	100	1150	100	3496	100	67	100
1965/66-69/70	2562	115	1753	152	4446	127	70	104
1970/71-74/75	2721	122	2394	208	5263	151	61	91
1974/75	2883	130	2750	239	5791	166	52	78

* Data from Abstract of Agricultural Statistics, 1976

Data on the consumption of maize are presented in Table 3.

The gross human consumption of maize rose by only 30% while the animal consumption rose by 239% and total consumption by 66%. On the credit side it is significant to note that there has been a decrease in maize consumption when expressed as a percentage of production. Whether this tendency will continue will depend on future maize production and to what extent maize is used in future animal production. From the production trends mentioned above I do, however, feel confident that the grain supplies for animal use will be adequate for the not too distant future.

Meat consumption has decreased from 41kg per capita to 36kg since 1960. The consumption of beef and mutton has shown a gradual decrease (Table 4), while there has been a slight increase in pork consumption and a phenomenal increase in the consumption of broiler meat.

The drop in beef and mutton consumption is most likely a result of less meat being available and also due to the sharp rise in beef and mutton prices (Table 5).

The production of pig meat and especially broiler meat has, however, kept up with the demand, with the further advantage that price increases for these products has been relatively less than for beef and mutton, thus

Table 4

*Meat Consumption**

Year	Beef and Veal		Mutton and Goats meat		Pigs meat		Broiler meat	
	1000 Ton	Per capita, kg	1000 Ton	Per capita, kg	1000 Ton	Per capita, kg	Year	Per capita, kg
1960/61–64/65	512	28,7	146	8,2	54	3,0	1965	1,39
1965/66–69/70	515	25,2	182	8,9	67	3,3	1970	3,24
1970/71–74/75	582	24,8	171	7,3	84	3,6	1974	5,34
1974/75	530	20,7	154	6,0	87	3,4	1975	5,93

* Data from Abstract of Agricultural Statistics, 1976.

Table 5

*Meat prices**

Year	Beef		Mutton		Pig meat		Poultry and poultry products
	cent/kg	Index	cent/kg	Index	cent/kg	Index	Index
1960/61 64/65	26,6	100	41,1	100	35,5	100	99
1965/66 69/70	39,6	149	45,9	112	38,3	108	96
1970/71 74/75	63,6	239	81,0	199	56,4	159	117
1974/75	89,3	336	111,0	270	78,9	222	141

* Data from Abstract of Agricultural Statistics, 1976.

Table 6

*Feed prices**

Year	Maize meal		Laying mash		Pig meal	
	cent/kg	Index	cent/kg	Index	cent/kg	Index
1960/61 64/65	3,25	100	4,79	100	4,87	100
1965/66 69/70	3,73	115	5,15	108	5,25	108
1970/71 74/75	5,67	174	8,21	171	7,60	156
1974/75	5,81	179	8,85	185	9,47	194

* Data from Abstract of Agricultural Statistics, 1976.

making these products a cheaper source of meat to buy. A note of caution must however be sounded as far as pork is concerned. The data in Table 5 show that there was a steep rise in the price of pig meat during 1974/75, although not as drastic as was the case with beef and mutton, but that poultry products did not show the same alarming tendency. It is therefore possible that a bigger demand for pork coupled to higher production costs are pushing up the price of pork, but that our poultry industry is still able to produce enough meat at a comparatively low price.

The price index of maize meal, laying mash and pig meals has risen from 100 in 1960 to a present level of 179, 185 and 194 respectively (Table 6). During the same period the price index of beef, mutton, pig meat and poultry products, in that order, rose to 336, 270, 222 and 141. The relatively small rise in the price of poultry products can be ascribed to:-

1) Poultry can be produced in large numbers in a farily short time.
2) Intensive large scale units are becoming more common, resulting in mass handling and distribution.
3) The advent of large units bring about improved management, better housing facilities, better breeding and health control.
4) An improved growth rate and a better feed conversion efficiency is achieved.

Results from the past eleven tests conducted at the National Poultry Testing Station has shown that mean body mass to 56 days of age has increased from 1,5kg to 1,98kg, while feed efficiency improved from 2,31 to 2,05.

The message to our pig farmers is therefore loud and clear. Produce enough pork of a high quality and produce it efficiently, so that it can be sold at a competitive price. An increase in production efficiency will also stretch our grain reserves and dwindling supplies of protein-rich feedstuffs.

A possitive approach would therefore be to suggest ways and means to increase efficiency in our pig industry. First of all it is, however, necessary to asses the present situation. Data on the performance and production efficiency of our South African pig herd are summarized in Table 7.

Although the figures quoted in Table 7 are not strictly comparable as performances were achieved under different conditions, I nevertheless think they serve the purpose for a comparison of this nature. The data presented reveal that on average 14,7 piglets are reared per sow annually (column 3). Our efficient pig farmers are however capable of rearing up to 20 piglets per annum (column 5), which compares favourably with overseas data as will be evident from Table 8.

Table 7

Performance and production efficiency of South African pig herds

Source	Data from Irene Experiment	Data from Meat Board Pig Scheme			Data from an above average farmer
Column	1	Bad performers 2	Average performers 3	Excellent performers 4	5
Piglets reared per sow per annum	18,4	–	14,7	–	20,0
Meal consumed (sow+boar+litter) Total to 85 kg slaughter mass					
1) kg meal/kg live mass	3,37	4,68	3,90	3,81	3,18
2) kg meal/kg carcass mass	4,32	6,00	5,00	4,89	4,22
3) kg meal/kg dissectable lean	10,80	–	–	–	–

The overall efficiency with which feed is converted into live or carcass mass on a specific farm is dependent on the feed conversion ability of the pigs (which is heritable), the number of piglets reared by the sow and on factors influenced by management, such as the degree of environmental control exercised, disease control and to what degree feed wastage is controlled. The efficiency figures presented in Table 7 therefore take into account all the above-mentioned factors. The figures in Table 7

Table 8

Present and future efficiency of feed utilization, based on requirement of feed of offspring of one sow in one year (Braude, 1970)

	Present Pig			Future Pig		
				Without artificial rearing	With artificial rearing	
	Average	Good	Excellant		10 years hence	20 years hence
No. of pigs	14	18	22	24	28	30
Meat consumed (sow+boar+litter)						
Total to 90kg slaughter mass						
kg meal/kg live mass	3,89	3,44	3,17	2,83	2,50	2,28
kg meal/kg dead mass	5,40	4,58	4,06	3,54	3,13	2,85
kg meal/kg lean meat	10,79	8,49	7,00	5,70	5,04	4,60
Total lean meat/sow/year, kg	459	663	906	1083	1264	1354

reveal that the degree of efficiency attained varied from 23,7% (4,22 kg meal/kg carcass mass) in column 5 to only 16,7% in column 2. A more meaningful way to express the observed differences for the purpose of this paper would however be to calculate the difference in the amount of feed required to produce the total amount of pig meat annually produced in South Africa. At a conversion of 5 kg of meal required per kg of carcass mass produced, we would have used 445 000 tons of pig feed to produce the 89 000 tons of pig meat produced in South Africa in 1974/75. On the other hand, if the conversion factor is only 4,22 the total amount of feed required would be only 375 000 tons which implies a saving of 69 420 tons of pig feed (11%) or 48 594 tons of grain (if we accept our pig feeds contain 70% of maize meal). Should the human consumption of pig meat remain at 3,4kg per capita it would mean that enough pork for an additional 48 300 people can be produced on the amount of pig feed presently used in South Africa.

Although there does not seem to be an imminent grain shortage, our protein rich feed supplements are already proving inadequate as stated previously, thus emphasising the need for more efficient production.

Braude (1970) has projected expected performances by the pig for the future (Table 8).

Braude's data for the present day pig compare favourably with the South African data in Table 7. In future he believes that we can rear up to 24 piglets per sow annually without artificial rearing. With artificial rearing, where post weaning mortality can be reduced to a minimum, he feels that up to 30 piglets per sow are possible. This fact coupled with continued improvements in growth rate, feed conversion efficiency and an increase in the ratio of lean meat in the carcass could, in the not too distant future, result in dramatic improvements in efficiency. According to Braude's calculations the amount of meal required per kg live mass will improve from 3,17 to 2,28, that 2,85 kg of meal will be required to produce a kg of carcass mass and that only 4,6 kg of meal will be required to produce a kg of lean meat. Braude believes that the annual output of lean meat per sow can be increased from a present figure of 906 kg to 1354 kg; a staggering increase of 49%. Braude also calculated that if the present average standards are maintained, and the expected increase in human population and its pork consumption occur (in the United Kingdom), then at the end of the second decade about 55% more sows and feed would be needed than at present. On the other hand, if the specified targets are attained by the end of the second decade, 28% fewer sows and 10% less feed will be required.

I feel continued pig production in South Africa will in future be dependent on the progress made in increasing production efficiency. How then can we improve the efficiency on our pig farms? This I feel can be achieved through:-

1. Genetic improvement of our stock.
2. Correct feeding.
3. Improved management and the implementation of modern systems and research findings.

Genetic improvement

Genetic improvement of a specific production trait is dependent on the heritability of the trait.

The pig farmer is rather fortunate in this respect as most of the more important production traits are highly heritable (Table 9).

Table 9

Heritability Estimates

	h^2,%
Number of piglets born	15
Number of piglets weaned	12
Growth rate (weaning to 90 kg)	30
Feed conversion efficiency	30
Eye muscle area	50
Backfat thickness	50

The heritability of the reproduction traits, number of piglets born and weaned are low (15 and 12% respectively), but post weaning growth rate and feed conversion ability have a heritability of 30% and carcass quality traits, such as eye-muscle area and backfat thickness are highly heritable at 50%.

Data from the National Committee for Pig Breeding in Denmark (Rietmann and Boyazoglu, 1975) clearly show the progress that can be made when selecting for daily gain, backfat thickness and carcass lean.

Table 10 shows that since 1950 the Danes were able to increase daily growth rate from 667 to 719 g (an increase of 8%), in the same time average backfat was decreased from 34 mm to 21 mm (a decrease of 38%), while the amount of lean tissue in the carcass was also increased, eye-muscle area from 29,8 to 33,5 sq cm. and the percentage of meat in the side of a bacon carcass from 60% in 1968/69 to 62,5% in 1971/72.

Although selection work aimed at improving fertility for production of large viable litters is slow, owing to the low heritability in pigs, the Danes through selection over eighty years have considerably improved the natural fertility of their Landrace pigs. The average litter size in their elite herds over the past few years has been 11,2 to 11,3 born and 9,5 weaned (Rietmann & Boyazoglu, 1975). The latest available South African figures (Report on Pig Recording and Health Scheme, 1971) show that the average litter size in 1970 was 10,1 piglets born alive of which 8,0 survived to an age of three weeks. I therefore feel there is definite scope for improvement in South Africa in this respect.

Age at weaning

It is evident from Table 8 that the number of piglets reared annually from a sow is an important factor in the efficiency with which pork is produced. Litter size, as mentioned above, is not highly heritable, therefore alternative methods of increasing the number of piglets reared per sow in one year will have to be investigated.

Weaning at an earlier age seems to be the best method of increasing the number of piglets reared annually.

Table 10

*Improvement in production traits for the Danish Landrace since 1950**

	Daily mass gain kg	Average backfat, mm	Area of l. dorsi sq. cm.	%meat inside	SFU/ kg gain
1950–51	667	34,0	–	–	3,14
1955–56	680	32,1	–	–	3,01
1960–61	696	28,5	29,8	–	2,91
1965–66	676	24,6	30,1	–	2,93
1968–69	681	23,4	31,8	60,0	2,94
1969–70	686	22,4	32,4	60,7	2,88
1970–71	733	21,1	33,3	61,6	2,93
1971–72	719	21,0	33,5	62,5	2,97

*Data from Rietmann & Boyazoglu, 1975.

Table 11

Number of piglets per sow per year related to numbers of litters per year and number born per litter, assuming 20% loss during rearing period (Braude, 1972)

		No. of litters per sow per year			
No. of pigs per litter	Weaning age (days)	2,8 10	2,5 21	2,3 35	2,0 56
12		26,9	24,0	22,1	18,2
11		24,6	22,0	20,2	17,6
10		22,4	20,0	18,4	16,0
9		20,2	18,0	16,6	14,4
8		17,9	16,0	14,7	12,8

In Table 11 Braude (1972) brought together the three decisive criteria which determine sow productivity namely, time of weaning, number of piglets born per litter and percentage lost during rearing. The output of piglets per sow per year can be similar even though different systems are employed because of the interaction of litter size and reproductive cycle length. Table 11 shows that 20,2 piglets reared per sow per year can result from either (1) weaning at 10 days a litter of nine piglets born (2,8 litters per year) or (2) weaning at thirty-five days a litter of 11 piglets born (2,3 litters per year). The data presented therefore clearly illustrate that maximum gain (in terms of pig numbers) from early weaning is dependent on the number of piglets born and reared and on whether the maximum number of litters per sow per year are attained or not. Under practical farming condi-

tions I feel that a farmer should first be able to produce at least 20 piglets per sow before attempting early weaning where additional skill, technical know-how and more sophisticated equipment is essential.

Early weaning under practical circumstances has been reported on by Green (1972) as illustrated in Table 12.

Table 12

Comparison of 10 to 12 day with 42 day weaning (Green, 1972)

	Conventional weaning 42 days	Early weaning 10–12 days
Farrowings	204	74
Lactation (days)	55	12
Weaning-oestrus (days)	7,5	7,2
Conception rate (%)	87	93
No. born per litter	11,2	10,2
No. reared per litter	9,4	9,4
Litters/year	2,05	2,7
Pigs/sow/year	19	25

The figures presented in Table 12 show that early weaning had no effect on the interval between weaning and the following oestrus, conception rate increased slightly (from 87 to 93%) litter size dropped by one (from 11,2 to 10,2) the number of piglets reared per litter remained the same, more litters were farrowed per annum (2,7 as against 2,05), while the most important factor emerging is the fact that 6 more piglets were reared per sow in one year; an increase of 31%.

Although expensive diets are used in the initial stages when piglets are weaned at a very young age, the total feed costs involved in rearing early-weaned piglets to eight weeks of age are less than the costs involved in weaning piglets at a later stage (Green, 1972).

Table 13

Feed costs of 8 week old pigs in relation to weaning age (Ridgeon, 1971)

Age at weaning (weeks)	Costs/pig (£)
8	4,02
7	3,94
6	3,81
5	3,72
3 – 4	3,81
Early weaning (Beecham)	3,63

Data from Ridgeon (1971), as set out in Table 13, show total feed costs to drop from £ 4,02 per pig when weaned at 8 weeks to £ 3,63 per pig when weaned at 10–12 days of age according to the Beecham system.

The relatively low feed costs per piglet, together with a high productivity of up to 25 piglets per sow per year therefore represent a very successful and highly efficient system. A system which I feel we will most definitely have to impliment in the not too distant future if we want to increase the efficiency of our pigs.

Nutrition

It is essential that we feed our pigs according to their nutritional requirements for a specific predetermined aim.

In pregnancy and lactation the sow must be fed to produce and rear a maximum number of piglets. Research has shown that foetal growth and the number of piglets born are influenced but very little by protein and energy intake during pregnancy. The demands of lactation are, however, considerable and if not met by the diet the maternal reserves are depleted. The most efficient feeding pattern therefore results from a relatively low intake during gestation and a high intake in lactation. In fact, recent research (Elsley & MacPherson, 1972 & Kemm, 1974) has shown that sows can produce large litters on daily intakes in pregnancy of 1 to 1,5 kg of air-dry feed (13,2 to 19,7 MJ metabolisable energy) and only 120 g of protein derived from a diet with a protein content of 12% or less.

As far as the growing pig is concerned, we must produce a pig that will conform to the requirements of the meat trade and to public demand. A pig with a maximum lean content and a minimum amount of fat must therefore be produced. The energy intake of the pig determines to a large extent the amount of fat deposited in the animal body, hence it is important to consider energy intake in relation to body composition, growth rate and the efficiency with which ingested nutrients are utilized. Although rate of growth is enhanced by increasing feed intake and by the use of high density diets, it is clear that the amount of energy that has to be fed to the pig is dependent on the end product required and on the efficiency with which the end product is produced. For maximum lean meat production it is therefore essential that the protein content of the diet, as well as the quality of the proteins fed must be sufficient for allowing the animal to attain its potential for lean growth.

In practice, maximum lean growth of about 450 g per day, depending on the genetic potential of the animal, can be attained by feeding a diet with at least 16% crude protein and not less than 0,8% lysine. Fat deposition is normally curtailed by restricting total feed intake to levels varying between 1,8 and 2,2 kg per day of diets that normally vary substantially in energy concentration. Consequently there is no definite prescribed energy allowance for the growing pig. Hence it is important that

research should be conducted towards quantitating the effect of dietary energy level and concentration on the growth rate, body composition, carcass quality and the utilization of feed nutrients of the growing pig. A well defined end product and an accurate assessment of the nutritional requirements of the growing pig will thus enable us to feed our pigs exact amounts of feed required to produce the predetermined end product. In this way we will in future be able to become more efficient and use our energy resources more effectively.

Other factors influencing efficiency

The intensification of pig farming together with the arrival of larger units compels the pig farmer to keep abreast with the latest technical developments, while management will play a more important rôle as pig units become bigger. Consequently I feel that the South African pig farmer should pay more attention to record-keeping, improve the housing facilities of his pigs and continually update his knowledge so that he can benefit from research findings and in this way become a more efficient producer and at the same time produce a quality product.

In conclusion it is my belief that if we improve the quality of our pigs (by this I mean increased carcass lean content relative to fat content) and if we keep the price of pork products relative to other meats down and also produce more pork with less feed, pig production in South Africa will in future play a significant rôle in the South African meat industry.

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