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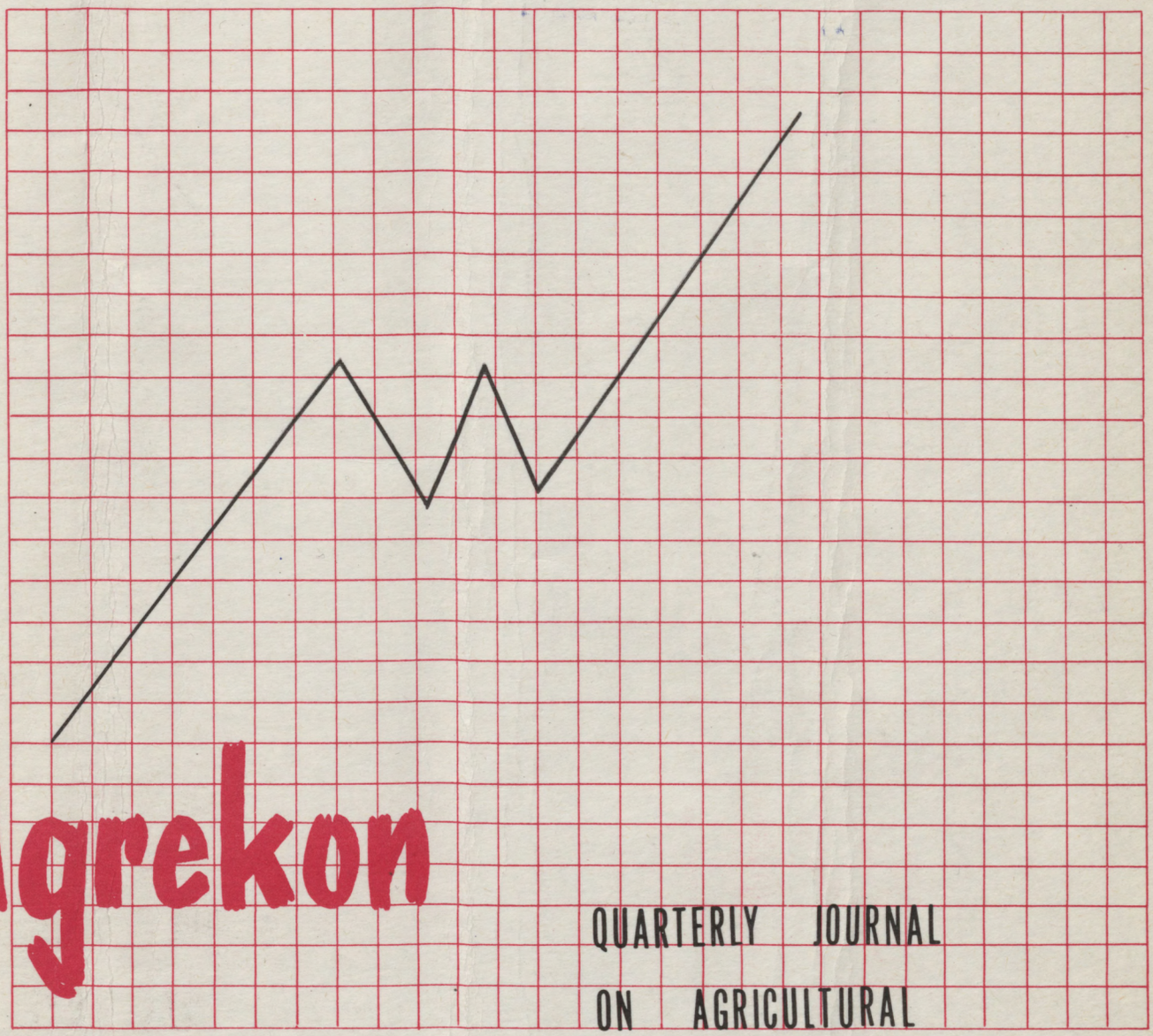

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THE EFFECT OF THE PIGMEAT PRICE CYCLE AND FEED PRICES ON OPTIMAL SCHEDULING IN PIG PRODUCTION*

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1. INTRODUCTION

In an earlier article[1] linear programming was used to schedule pig production and marketing in a well-managed 100-sow unit, given a certain position in the pigmeat price cycle. It was found that differential seasonal fluctuations in prices of different types of pigmeat resulted in an optimal strategy involving deliveries in number of pigs and the ratio between baconers and porkers marketed, varying monthly.

However, pigmeat prices are also subject to cyclical fluctuations with a four-year cycle, and heavier pigs show a sharper cycle than lighter pigs[2].

Seasonal fluctuations in pigmeat prices also differ between the peaks and troughs in the pigmeat price cycle[3].

Feed is the most important single cost item in pig production. With interest not taken into account, feed costs in 1973 amounted to 64%, 29% and 47%, respectively, of total costs in weaner, porker and baconer production in the Pretoria-Witwatersrand area[4]. Feed price levels can therefore potentially have an important effect, not only on profitability of production, but also on the optimum mass at which pigs should be marketed.

In this article the effect of the pigmeat price cycle and feed levels on optimum organisation and profitability in a well-managed 100 sow unit will be discussed.

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2. METHOD

Linear programming was used to investigate the optimum organisation under eight sets of circumstances, four of which were at the peak and four at the trough of the pigmeat price cycle.

For the peak average annual prices for pigmeat were taken at the 1971 level and for the trough at the 1969 level. Seasonal indices were used to determine monthly carcase values. The seasonal indices used were those published by Nel and Groenewald[5]. Solutions were obtained with feed price levels amounting to 90%, 100%, 110% and 120% of the actual price levels in 1969 and 1971.

The model is similar to the one previously reported on[6]. The constraints matrix is identical with that one and will not be dealt with here. Different feed and pigmeat prices result in eight different objective functions. These objective functions are given in the Tables 1(a) and 1(b).

3. EMPIRICAL RESULTS

3.1 General

The IBM company's MPS routine was used to solve the models on the IBM 370 computer at the University of Pretoria. The results appear in Table 2. Where there is no monthly variation figures are not given separately for each month in the Table.

3.2 Profits

The profits given in Table 2 must be adjusted by deducting fixed costs of breeding and replacement animals, including their pens and feed, from the results obtained. These costs appear in Table 3. It was calculated that capital investment per 100 sows (land value included) amounts to R21 646 at the low point of the cycle, compared with R23 162 at the peak of the cycle.

From Table 3 it appears that feed prices and the stage in the pigmeat cycle have an important

effect on the potential profitability of pig production. The differences are further explained in Table 4.

At the peak of the pig price cycle the profit is naturally considerably higher than at the trough.

Increases in feed prices in all cases result in more than proportional drops in profitability. Percentage-wise, these drops are smaller at the peak than at the trough of the cycle, although the drops, measured in absolute terms, assume greater proportions at the peak.

3.3 Mating of sows

Although the model made provision for different numbers of sows to be mated monthly if profitability allowed, results show that the same number of sows must be mated each month; a sow must therefore be mated immediately she comes on heat after the weaning of a farrow.

Profit maximisation therefore also involves maximisation of the number of pigs produced per sow under all price conditions included in the analysis.

3.4 Purchases and utilisation of pen space

The constant rate of mating of sows means that dry sow and farrowing pens can always be fully utilised. A 100 sow unit requires 29 farrowing pens and 98 dry sow pens, consisting of the 74 shown in Table 2 plus those for five breeding boars and for replacement breeding animals.

Different feed/pigmeat price ratios require that different pig combinations be produced and therefore that requirements of feeding pens will differ. Feeding pen requirements vary between 272 (function Z_5) and 132 (functions Z_3, Z_4 and Z_8). At some functions there will be considerable numbers of feeding pens idle during some months.

It may be suggested that these differences in feeding pen space purchases lower the value of the analysis because it is basically applied to one hypothetical farm enterprise. Probability can be applied by means of systems simulation, linked with formal programming, to determine in time the optimum number of feeding pens. However, it is an aspect that must also be linked with the strategy of changes, particularly the growth of the enterprise. This aspect may be regarded as a broad, independent field of study that deserves further research on its own.

The variation in the monthly utilisation of feeding pens is summed up in Table 5.

If only one marketing mass occurs in the optimum plan, as at the 120% feed price level at the low point of the pig price cycle, there is no idle capacity. If more than one marketing mass is produced, idle capacity will be found.

At the higher feed price levels smaller numbers of feeding pens are required because fewer heavier pigs are marketed.

3.5 Labour

One function that was required of the model was to determine how much labour must be employed.

As in the case of feeding pens, there was no idle capacity where only one marketing mass occurred in the optimum plan. The greater the variation in marketing masses, the more idle labour hours there are in total. In the month in which no heavy pigs are marketed there is a relatively greater idleness of labour.

3.6 Feed Rations

Table 6 shows that between the trough (1969) and the peak (1971) of the pigmeat price cycle meat prices increased by more than feed prices. This must be accepted as normal because feed prices in South Africa do not show cyclic fluctuations.

Because feed requirements of sows, boars and young pigs were taken as given and because the optimum plans (Table 2) did not in any case include marketing of pigs under 3 months (weaners or light porkers) sow and boar rations were unchanged, with very small variations in creep and growth rations.

Table 2, however, shows that higher pigmeat prices and lower feed prices are accompanied by considerable increases in optimum finishing rations.

3.7 Marketing masses

In the model provision was made for seven different possible marketing masses in each of the twelve months of the year. The optimum programmes, as given in Table 2, give these particulars in detail. In Table 7 this information is summarised in annual totals.

It appears that in an optimum organisation lower feed prices are coupled with marketing of larger numbers of heavy pigs. Similarly pigs must be marketed heavier at the top of the cycle.

Weaners (18 kg) and the light porkers (45 kg) do not occur in any optimum plans. At the other extremes, sausagers (125 kg) also do not occur at all and the 100 kg baconers are the exceptions.

If feed prices are at a level 20% higher than the basic prices used, feed price levels are high enough to eliminate the differences of effect in meat prices in a discrete distribution. The result is equal average selling masses (and ages) in the optima in such a situation.

3.7.1 18-kg weaners

Although the prices of November and December weaners are relatively high, they never occurred on the optimum plan.

The profitability of these weaners, compared with 45-kg porkers, may be determined by comparing increases in the value of the pig with the feed costs involved. At the 120% feed price level and the trough of the cycle the profitability of the weaner and the 45-kg porker compares as follows:

$$\frac{\triangle \text{ value of pig (December 18 kg - January 45 kg)}}{\triangle \text{ value of feed}} = \frac{\text{R9,72 - R2,84}}{\text{R6,63 - R1,42}} = 1{,}32 > 1$$

At the price situation that is the most favourable for weaners the relative value of weight increase after a 45-kg porker is therefore more than enough to justify the additional cost of feed.

3.7.2 45 kg porkers

This marketing mass also did not occur anywhere in the optimum plans, largely for the same reasons as those for which weaners do not occur in an optimum plan.

3.7.3 60 kg porkers

At the trough of the pig price cycle, when the meat prices were relatively low in comparison with feed prices, this marketing mass occurred in all four feed price variations. For this reason this marketing mass will be recommended particularly for the trough of the cycle - that is to say when the feed prices are high relative to pig prices.

It is largely because of price ratios that the 60 kg porkers (normally super grade) occur in the optimum solutions as against no 45-kg porkers (also normally super grade) and relatively few 70-kg porkers, which would normally be first grade.

Although there are no price differences per kg between 45 kg porkers and 50 kg porkers and although the feed turnover rate deteriorates as far as 45 kg and 60 kg (therefore a lower marginal product between 45 kg and 60 kg), cheaper feed is used to feed a pig from a mass of 45 kg to a mass of 60 kg because at this stage a switch is made to the use of finishing rations. The marginal cost decreases relative to the marginal value product. The higher slaughter percentage with 60 kg porkers than with 45-kg porkers (72% against 70%) also plays a part.

Porkers with a mass of 70 kg obtain lower prices per kg than 60-kg porkers, particularly because of grading.

Feed turnover costs also deteriorate as pigs become older and the result is that only in exceptional cases where seasonal fluctuations in meat prices are the cause is it profitable to market pigs as 70-kg porkers (see Table 2). It therefore appears that competition in a pig farming enterprise consists largely of competition between 60-kg porkers and baconers.

Seasonal fluctuations in meat prices have clear effects on the optimal marketing pattern. In November and in the period January to March porker prices are at a low. During the same period baconer prices are relatively favourable. The consequence is that except when feed prices are high in relation to pigmeat prices, porkers are in a poor competitive position against baconers in these periods. At the peak of the cycle it therefore pays, as shown in Table 2, not to market porkers during these months except if feed prices exceed the base (100) by 20%. The same argument also holds at the trough of the cycle in the two lower feed price categories. In May and August porker prices, on the other hand, compare favourably with baconer prices and during these months and certain other months in the winter the marketing of porkers does have a role to play in the optimum pig farming organisation, depending on meat/feed price ratios. At the peak of the cycle, except at the highest feed price level, porkers have a smaller part to play than at the trough of the cycle.

As soon as feed prices exceed certain marks (10% over the base at the trough of the cycle, and 20% over the base at the peak of the cycle) the cost of feeding pigs to a higher mass than 60 kg becomes very high and it is therefore necessary to concentrate in such a situation only on the production and marketing of 60-kg porkers.

3.7.4 90 kg baconers

It appears from Table 2 that the following situation arises at the peak of the cycle:

Should feed prices drop 10% below the 1971 base, profit is maximised if the producer concentrates entirely on the marketing of 90-kg baconers. With feed prices equal to the 1971 base, production and marketing must still be concentrated largely on these pigs; this would mean that in January, February, March,[7] April, June, July, September and December - eight months of the year - 150 baconers of 90 kg would have to be marketed per 100 sows.

In April, however, relative prices of porkers are so favourable that during this month all porkers in the 60-kg class should be marketed; there would therefore be no marketable 90-kg baconers available in May. The same applies to the 70 kg porkers in July and 90-kg baconers in August. In November prices of 100 kg (mostly second grade) baconers are so favourable that it pays the producer to feed the pigs that reach 90 kg in October for a month longer. The favourable prices obtained by porkers (60 kg) in October make it desirable to market the majority of such pigs in that month, although a limited number (31 per 100 sows) can be profitably carried over to be marketed in November as 90 kg baconers.

If feed prices rise to 10% over the relative 1971 base, the competitive position of baconers is unfavourably influenced. The role of relative changes in seasonal prices now becomes very important. In the months January to April and December, except for a small and probably unpractical break with porkers, 150 baconers of 90 kg should be marketed each month. In November 28 such pigs should be marketed from a 100 sow unit (the rest of the available pigs should be marketed in October as porkers).

When the feed prices reach the 120% level it is not profitable to produce baconers. Porkers should then be concentrated on.

At the trough of the cycle similar economic arguments hold. At low feed prices (90% of the base) 150 baconers of 90 kg per 100 breeding sows should be marketed monthly in seven months (January to March, June, October to December)[8] in order to maximise profit. In April and May also marketing should be concentrated largely on baconers. During the rest of the year, however, price ratios make it preferable to concentrate on porkers.

TABLE 1(a) – Objective functions used in linear programming: Transfer and purchase activities

Activity or Description	Activity no.	Coefficients (cj's) 1969 trough of cycle				1971 peak of cycle			
Objective function number		Z_1	Z_2	Z_3	Z_4	Z_5	Z_6	Z_7	Z_8
Feed price as % of 1969 and 1971 levels		90	100	110	120	90	100	110	120
1. Transfer activities									
Sows mated	X_1 to X_{12}	0	0	0	0	0	0	0	0
Feeding pens: Used	X_{159} to X_{170}	0	0	0	0	0	0	0	0
Idle	X_{171} to X_{182}	0	0	0	0	0	0	0	0
Labour: Used	X_{184} to X_{195}	0	0	0	0	0	0	0	0
Idle	X_{196} to X_{207}	0	0	0	0	0	0	0	0
Dry sow pens: Used	X_{135} to X_{146}	0	0	0	0	0	0	0	0
Idle	X_{147} to X_{158}	0	0	0	0	0	0	0	0
Farrowing pens: Used	X_{13} to X_{24}	0	0	0	0	0	0	0	0
Idle	X_{25} to X_{36}	0	0	0	0	0	0	0	0
2. Purchase activities									
Feed: creep ration	X_{210}	−0,055	−0,061	−0,067	−0,073	−0,062	−0,069	−0,076	−0,083
Growth ration	X_{211}	−0,053	−0,059	−0,065	−0,071	−0,059	−0,066	−0,073	−0,079
Finishing ration	X_{212}	−0,041	−0,045	−0,050	−0,054	−0,045	−0,050	−0,055	−0,060
Sow and boar ration	X_{209}	−0,043	−0,048	−0,053	−0,058	−0,050	−0,054	−0,059	−0,065
Labour hours	X_{208}	−1,632	−1,632	−1,632	−1,632	−2,090	−2,090	−2,090	−2,090
Pens: Farrowing pens	X_{37}	35,040	35,040	35,040	35,040	37,560	37,560	37,560	37,560
Dry sow pens	X_{122}	9,840	9,840	9,840	9,840	10,440	10,440	10,440	10,440
Feeding pens	X_{183}	4,800	4,800	4,800	4,800	5,160	5,160	5,160	5,160

TABLE 1(b) – Objective functions used in linear programming : Marketing activities

Activity	Activity No.	Coefficients Trough of cycle (1969) Z_1 to Z_4 R	Peak of cycle (1971) Z_5 to Z_8 R	Activity	Activity No.	Coefficients Trough of cycle (1969) Z_1 to Z_4 R	Peak of cycle (1971) Z_5 to Z_8 R
18 kg–Jan.	X_{38}	-0,18	0,58	70 kg–July	X_{80}	17,99	24,01
18 kg–Feb.	X_{39}	-0,11	0,78	70 kg–Aug.	X_{81}	16,98	23,39
18 kg–March	X_{40}	-0,09	0,61	70 kg–Sept.	X_{82}	16,98	22,76
18 kg–April	X_{41}	0,08	0,88	70 kg–Oct.	X_{83}	17,02	23,09
18 kg–May	X_{42}	0,36	1,02	70 kg–Nov.	X_{84}	16,70	22,86
18 kg–June	X_{43}	-0,01	1,13	70 kg–Dec.	X_{85}	17,98	23,30
18 kg–July	X_{44}	0,44	1,09	90 kg–Jan.	X_{86}	21,36	28,82
18 kg–Aug.	X_{45}	0,13	1,84	90 kg–Feb.	X_{87}	22,07	29,52
18 kg–Sept.	X_{46}	0,72	1,26	90 kg–March	X_{88}	21,68	28,62
18 kg–Oct.	X_{47}	0,64	1,43	90 kg–April	X_{89}	21,56	28,56
18 kg–Nov.	X_{48}	0,89	2,71	90 kg–May	X_{90}	21,25	27,86
18 kg–Dec.	X_{49}	2,84	5,49	90 kg–June	X_{91}	21,36	28,11
45 kg–Jan.	X_{50}	9,72	13,32	90 kg–July	X_{92}	21,29	28,30
45 kg–Feb.	X_{51}	9,6	13,30	90 kg–Aug.	X_{93}	21,43	28,30
45 kg–March	X_{52}	9,55	13,61	90 kg–Sept.	X_{94}	21,43	28,04
45 kg–April	X_{53}	10,68	14,84	90 kg–Oct.	X_{95}	21,87	27,86
45 kg–May	X_{54}	10,45	14,43	90 kg–Nov.	X_{96}	21,94	29,32
45 kg–June	X_{55}	10,20	14,54	90 kg–Dec.	X_{97}	21,94	29,39
45 kg–July	X_{56}	11,12	14,71	100 kg–Jan.	X_{98}	23,32	29,96
45 kg–Aug.	X_{57}	10,70	14,57	100 kg–Feb.	X_{99}	23,66	30,97
45 kg–Sept.	X_{58}	10,47	14,34	100 kg–March	X_{100}	22,94	29,74
45 kg–Oct.	X_{59}	10,56	14,66	100 kg–April	X_{101}	22,88	30,46
45 kg–Nov.	X_{60}	9,74	14,37	100 kg–May	X_{102}	22,09	28,96
45 kg–Dec.	X_{61}	10,84	14,64	100 kg–June	X_{103}	22,44	29,31
60 kg–Jan.	X_{62}	14,50	19,48	100 kg–July	X_{104}	22,54	29,24
60 kg–Feb.	X_{63}	14,36	19,53	100 kg–Aug.	X_{105}	22,30	29,68
60 kg–March	X_{64}	14,28	19,87	100 kg–Sept.	X_{106}	22,16	29,38
60 kg–April	X_{65}	15,83	21,55	100 kg–Oct.	X_{107}	22,94	29,38
60 kg–May	X_{66}	15,52	20,98	100 kg–Nov.	X_{108}	22,79	31,61
60 kg–June	X_{67}	15,16	21,14	100 kg–Dec.	X_{109}	23,45	30,75
60 kg–July	X_{68}	16,39	21,41	125 kg–Jan.	X_{110}	24,56	32,18
60 kg–Aug.	X_{69}	16,09	21,19	125 kg–Feb.	X_{111}	25,78	34,14
60 kg–Sept.	X_{70}	15,64	20,85	125 kg–March	X_{112}	25,15	32,92
60 kg–Oct.	X_{71}	15,67	21,31	125 kg–April	X_{113}	26,86	36,79
60 kg–Nov.	X_{72}	14,48	21,41	125 kg–May	X_{114}	26,13	33,47
60 kg–Dec.	X_{73}	16,07	21,26	125 kg–June	X_{115}	26,86	34,20
70 kg–Jan.	X_{74}	16,12	21,12	125 kg–July	X_{116}	24,93	33,10
70 kg–Feb.	X_{75}	15,73	20,84	125 kg–Aug.	X_{117}	22,53	31,16
70 kg–March	X_{76}	15,73	21,37	125 kg–Sept.	X_{118}	23,36	29,14
70 kg–April	X_{77}	17,46	23,62	125 kg–Oct.	X_{119}	24,56	31,81
70 kg–May	X_{78}	17,32	23,24	125 kg–Nov.	X_{120}	25,34	33,65
70 kg–June	X_{79}	17,08	23,24	125 kg–Dec.	X_{121}	25,68	32,92

With feed prices equivalent to the 1969 base competition by porkers becomes more serious, although there are certain months when the marketing of baconers should still be predominant in the organisation and other months when 90 kg baconers will still play an important part.

At the two top feed price levels it will not pay a farmer at the trough of the cycle to produce any baconers; greater profits will be realised by concentrating on porkers.

3.7.5 100-kg baconers

Baconers with a live mass of 100 kg normally obtain lower prices than at 90 kg because they are graded lower. Feed turnover rates between masses of 70 and 90 kg are also more favourable than between 90 and 100 kg. The consequence is that it is only profitable under exceptional conditions to feed pigs of a mass of 90 to 100 kg. Such exceptional conditions, as appears from table 2, do occur and arise, as previously mentioned, from seasonal fluctuations in prices. Favourable prices in November do mean that at two of the feed price levels pigs should be fed long enough to be marketed in that month as 100 kg baconers.

3.7.6 125-kg sausagers

Sausagers obtain lower prices per kg than baconers and, in addition, it requires a considerable amount of feed to turn a baconer into a sausager. Such a practice would therefore be profitable only at very low feed prices. The production of sausagers did not appear to be profitable at any of the meat-feed price ratios in this analysis.

4. CONCLUSION

The analysis in this article underlines the necessity for flexibility in the organisation of an intensive type of farm enterprise, particularly if such a farm enterprise, as is the case with pigmeat production, is subject to relatively fast and regular price fluctuations. It is only the manager who maintains a high technical efficiency and at the same time adjusts his organisation to a changing economic environment who can realise big profits.

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6. *Ibid.*
7. The 0,8 porker (approximated to one) that occurred in the solution for February has no practical value. In practice it would be better to feed the single pig for a month longer and market it with the rest as a baconer.
8. The small numbers of porkers in the solution for the months of September and October have no practical significance.

TABLE 2 - Optimum farm plans for a 100 sow unit at different pigmeat and feed price ratios

Objective functions		1969 trough of cycle				1971 peak of cycle			
		Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8
Feed Price Levels (%)		**90**	**100**	**110**	**120**	**90**	**100**	**110**	**120**
Profit figure*		8 814,00	6 381,98	4 031,71	2 084,94	17 823,12	14 709,39	11 730,03	9 363,07
Number of sows mated each month		18,18	18,18	18,18	18,18	18,18	18,18	18,18	18,18
Number % farrowing pens needed		29,09	29,09	29,09	29,09	29,09	29,09	29,09	29,09
Number of farrowing pens idle		-	-	-	-	-	-	-	-
Dry sow pens needed		73,82	73,82	73,82	73,82	73,82	73,82	73,82	73,82
Dry sow pens idle		-	-	-	-	-	-	-	-
Number of sows dry each month		73,82	73,82	73,82	73,82	73,82	73,82	73,82	73,82
Rations									
Sow and boar	(kg)	99 308	99 308	99 308	99 308	99 308	99 308	99 308	99 308
Creep ration	(kg)	12 220	12 182	12 126	12 126	12 240	12 223	12 194	12 126
Growth	(kg)	154 100	154 060	154 042	154 042	154 080	154 115	154 105	154 042
Finishing	(kg)	268 508	213 097	113 305	113 305	316 800	282 782	230 775	113 305
Pig sales									
18 kg Weaners (all months)		-	-	-	-	-	-	-	-
45 kg Porkers (all months)		-	-	-	-	-	-	-	-
60 kg Porkers -									
January		-	34	157,9	157,9	-	-	-	157,9
February		-	90	157,9	157,9	-	0,8	8,1	157,9
March		-	-	157,9	157,9	-	-	-	157,9
April		20,6	157,9	157,9	157,9	-	157,9	157,9	157,9
May		-	89,6	157,9	157,9	-	-	157,9	157,9
June		-	2,3	157,9	157,9	-	-	157,9	157,9
July		157,9	157,9	157,9	157,9	-	-	-	157,9
August		157,9	157,9	157,9	157,9	-	-	157,9	157,9
September		0,7	39,1	157,9	157,9	-	-	-	157,9
October		1,8	79,0	157,9	157,9	-	125,3	128,1	157,9
November		-	-	157,9	157,9	-	-	-	157,9
December		-	157,9	157,9	157,9	-	-	0,4	157,9

Objective functions	1969 trough of cycle				1971 peak of cycle			
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8
Feed Price Levels (%)	**90**	**100**	**110**	**120**	**90**	**100**	**110**	**120**
70 kg Porkers -								
January	-	-	-	-	-	-	-	-
February	-	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-	-
April	-	-	-	-	-	-	-	-
May	7,1	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-	-
July	-	-	-	-	-	154,6	154,6	-
August	-	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-	-
October	-	-	-	-	-	-	-	-
November	-	-	-	-	-	-	-	-
December	154,6	-	-	-	-	-	-	-
90 kg Baconers -								
January	150	-	-	-	150	150	149,6	-
February	150	117,7	-	-	150	150	150	-
March	150	64,5	-	-	150	149,3	142,3	-
April	130,4	150	-	-	150	150	150	-
May	143,1	-	-	-	150	-	-	-
June	150	64,9	-	-	150	150	-	-
July	-	147,8	-	-	150	150	-	-
August	-	-	-	-	150	-	-	-
September	-	-	-	-	150	150	-	-
October	149	112,9	-	-	150	-	-	-
November	148,3	74,9	-	-	150	31	28,3	-
December	150	150	-	-	150	150	150	-
100 kg - All months except November								
November	-	-	-	-	-	150	150	-
125 kg Sausagers -	-	-	-	-	-	-	-	-
Labour								
Labour hours purchased per month	642	610	543	543	644	642	653	543
Labour hours used								
January	569	571	543	543	644	640	650	543
February	637	610	543	543	644	640	653	543
March	642	610	543	543	644	642	653	543
April	642	608	543	543	644	596	612	543
May	638	556	543	543	644	570	538	543
June	642	610	543	543	644	642	538	543
July	595	600	543	543	644	634	571	543
August	528	535	543	543	644	571	529	543
September	569	566	543	543	644	638	571	543
October	637	607	543	543	644	602	601	543
November	637	610	543	543	644	636	637	543
December	631	603	543	543	644	641	644	543
Labour hours idle								
January	73	39	-	-	-	2	3	-
February	5	-	-	-	-	2	-	-
March	-	-	-	-	-	-	-	-
April	-	2	-	-	-	46	41	-
May	4	54	-	-	-	72	115	-
June	-	-	-	-	-	-	115	-
July	47	10	-	-	-	8	82	-
August	114	75	-	-	-	71	124	-
September	73	44	-	-	-	4	82	-
October	5	3	-	-	-	40	52	-
November	5	-	-	-	-	6	16	-
December	11	7	-	-	-	1	9	-
Total labour hours idle per year	**337**	**234**	**-**	**-**	**-**	**252**	**639**	**-**
Feeding pens purchased per month	271	225	132	132	272	272	271	132
Feeding pens used								
January	175	167	132	132	272	271	271	132
February	271	225	132	132	272	272	271	132
March	271	220	132	132	272	272	271	132
April	264	225	132	132	272	224	229	132
May	260	151	132	132	272	177	133	132
June	271	220	132	132	272	272	133	132
July	227	225	132	132	272	263	171	132
August	129	130	132	132	272	177	131	132
September	175	165	132	132	272	272	177	132
October	271	225	132	132	272	234	232	132
November	271	225	132	132	272	272	271	132
December	263	225	132	132	272	270	271	132

Objective functions	1969 trough of cycle					1971 peak of cycle		
	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8
Feed Price Levels (%)	90	100	110	120	90	100	110	120
Feeding pens idle per month								
January	96	58	-	-	-	1	-	-
February	-	-	-	-	-	-	-	-
March	-	5	-	-	-	-	-	-
April	7	-	-	-	-	48	42	-
May	11	74	-	-	-	75	138	-
June	-	5	-	-	-	-	138	-
July	44	-	-	-	-	9	100	-
August	142	95	-	-	-	95	140	-
September	96	60	-	-	-	-	94	-
October	-	-	-	-	-	38	39	-
November	-	-	-	-	-	-	-	-
December	8	-	-	-	-	2	-	-
Idle feeding pen capacity per year	404	297	-	-	-	287	691	-

* Depreciation and interest on breeding pigs not taken into account.

TABLE 3 - Fixed cost and profit for 100 sow units, based on linear programming results

Function-no.	Profit according to L.P. model	Fixed costs of breeding animals	Net profit*	Net profit per R100 of capital**
		R		
Z_1	8 814,00	1 882,32	6 931,68	32,02
Z_2	6 381,98	1 917,12	4 464,86	20,63
Z_3	4 031,71	1 951,92	2 079,79	9,61
Z_4	2 084,94	2 028,48	56,46	0,26
Z_5	17 823,12	2 248,64	15 574,48	67,24
Z_6	14 709,39	2 275,64	12 433,75	53,68
Z_7	11 730,03	2 311,28	9 418,75	40,67
Z_8	9 363,07	2 353,04	7 010,03	30,27

* Does not take into account interest on land and overhead costs.
** Does not take into account land investment.

TABLE 5 - Fluctuation in the monthly utilisation of feeding pens with the optimum plans

Feed price levels	Number of feeding pens needed per month*	Number of feeding pens idle per year	Total width of variation (R)**	Number of months feeding pens fully occupied
Trough of cycle (1969)				
90%	271	404	142	5
100%	225	297	95	6
110%	132	0	0	12
120%	132	0	0	12
Peak of cycle (1971)				
90%	272	0	0	12
100%	272	287	95	5
110%	271	691	140	6
120%	132	0	0	12

* Expressed in terms of a 125 kg sausager's feeding space.
** This shows the difference between greatest and smallest monthly occupation figures for one year.

TABLE 4 - Differences in net profit

Percentage of the actual deflated feed price	Low point of cycle		High point of cycle		Percentage difference between peak and trough (percentage of peak)
	Net profit	Difference as a percentage of preceding figure	Net profit	Difference as a percentage of preceding figure	
%	R	%	R	%	%
90	6 931,68	-	15 574,48	-	55,5
100	4 464,86	35,6	12 433,75	20,2	64,1
110	2 079,79	53,4	9 418,75	24,2	77,9
120	56,46	97,3	7 010,03	25,6	99,2

TABLE 6 - Feed and pigmeat price indices for 1969 and 1971*

	Trough of cycle 1969	Peak of cycle 1971
Index of feed prices with 1969 = 100	100	112,5
Index of pigmeat prices with 1969 = 100	100	128

TABLE 7 - Annual total numbers of pigs marketed at different marketing masses in optimum organisations at different stages of the meat price cycle and different feed price levels

Feed price levels	18 kg weaner	45 kg porker	60 kg porker	70 kg porker	90 kg baconer	100 kg baconer	125 kg sausager	Total number of pigs marketed	Average marketing masses	Total mass of pigmeat (t)
Trough of cycle										
90%	-	-	338,9	161,7	1 320,8	-	-	1 821,4	82,6	150,4
100%	-	-	965,6	-	882,7	-	-	1 848,3	74,3	137,3
110%	-	-	1 894,8	-	-	-	-	1 894,8	60,0	113,7
120%	-	-	1 894,8	-	-	-	-	1 894,8	60,0	113,7
Peak of cycle										
90%	-	-	-	-	1 800	-	-	1 800	90,0	162,0
100%	-	-	284,0	154,6	1 230,3	150	-	1 818,9	84,4	153,5
110%	-	-	767,8	154,6	770,2	150	-	1 842,6	76,6	141,1
120%	-	-	1 894,8	-	-	-	-	1 894,8	60,0	113,7

* Source: Processed from *Abstract of Agricultural Statistics*. Government Printer, Pretoria.