"SOW NUTRITION"

by

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The paper is based on an investigation into the nutrition of the breeding sow under conditions applicable to those dairying districts of New Zealand where permanent pasture is the only crop grown. Judging by the appearance of sows frequently seen in dairying districts the owners are under the impression that sows are equipped with stomata and symbiotic bacteria.

The prolificacy of the sow is such that she is producing all the time with only a short period after weaning during which condition may be regained and reserves built up. Hammond has shown that the number of ova shed for fertilisation is considerably in excess of the number of piglets born alive: Atrophy being though perhaps due to a recessive genetic factor as in the rabbit. The recessive factor is said to act by way of a lack of some secretion in the blood of the mother and not by way of the genetic composition of the embryos. Why this should have a selective influence if the genetic composition of the embryos or the supply of nutrients is to them not involved, is not clear.

It is quite common, however, for a sow which as a high fecundity to "come to light" with a small litter, while Mc Kenzie has shown that sows which are well fed over the early part of the pregnancy period have larger litters than those which are poorly fed. Since foetal atrophy in sows is common and to a considerable degree in the early stages of pregnancy, it is considered that nutrition could also have an important influence on the survival of the foetuses, in that the mother must first satisfy her needs for survival in order to reproduce.

It is conceivable that if the supply of nutrients to the sow is poor the supply to the foetuses will be cut down to the point where some foetuses must die, and this effect would be a progressive one commencing at fertilisation and extending to the foetuses as the pregnancy period progressed.

The influence of nutrition could also make its effect felt in the latter stages of pregnancy when the foetuses are growing rapidly. This effect would be seen in two ways: (1) how the pigs were born, i.e., alive or dead, and (2) the liveweight and vigour at birth.

Another factor influenced by nutrition is the sow's ability to suckle the young, and reflected in the growth curve of the young pigs from birth to three weeks. In addition, while sterility in the pig is not a problem like that of the cow, it is not uncommon for sows in very poor condition to return to the boar repeatedly or not to come on heat. Here again nutrition has an important effect.

Finally, pasture forms a greater part of the sow's diet in New Zealand than it does in most countries and there are periods, particularly the winter months, when pasture growth is insufficient for the sow's needs. Much work has been done in America on the nutrition of the sow. That may also be said about most of the research that is being carried on in New Zealand and the value of this kind of work lies in the fact that it has been done on the New Zealand farmers' own doorstep.

EXPERIMENTAL MATERIAL:

To examine the possible ffect of nutrition on the factors briefly mentioned, twenty sows in four groups of five were placed on trial at the weaning of their maiden litter. Prior to weaning all received the same treatment.

Four treatments were imposed as follows:-

Group 1: Pasture throughout the pregnancy period from weaning to farrowing.

Group 2: Pasture from weaning until six weeks before farrowing when concentrates were fed until farrowing.

Group 3: Concentrates for six weeks after weaning, then pasture only until six weeks before farrowing when concentrates were again fed. During the first gestation this group was fed throughout the pregnancy period. This was altered to the first and last six weeks as the sows were becoming unduly fat and clumsy.

Group 4: Concentrates for six weeks after weaning followed by pasture only until farrowing.

Concentrates were fed at the rate of 5 lbs. per sow per day. A standard ration consisting of a mixture of meat meal, maize meal and pollard was fed throughout. During the eight weeks' suckling period the same standard ration was fed at the rate of 6 lbs. per sow per day, plus 1 lb. per day for each piglet being suckled.

The treatment imposed on Group L was considered to be the lowest plane of nutrition that could be imposed under New Zealand conditions of permanent pasture. (From pasture consumption trials with sows it has been found that even on good pasture the sow only consumes enough pasture for maintenance and, generally speaking, she maintains whatever condition she has when the litter is weaned.

The paddocks used for the sows were grazed in the ordinary way by the dairy herds of the Research Station.

The treatment given to Group 2 is similar to that carried out on many dairy farms where the sow is brought in to the farrowing pen and fed a little meal or milk for a few weeks before farrowing, it being recognised somewhat grudgingly that the sow heavy in pig does need a little extra food at that time.

Group 3 were on a plane of nutrition which gave a quick regain of condition lost during suckling and also a rising condition during the latter stages of pregnancy when the litter in utero are growing most rapidly.

The treatment compared on Group 4 gave a quick regain of condition lost during suckling and kept the sows in a rising condition during the early stages of pregnancy or if they returned to the boar.

The four treatments are considered to give a basis for comparison for examining the effect of feeding over the early and latter stages of the gestation period.

Statistical treatment of the results of the first three farrowings has been carried out by Mr. Paton and Mrs. Sorrell. Statistical treatment of the results obtained with the reversed treatments has not yet been carried out owing to the delayed performance of the Group 3 sows when changed from the highest to the lowest plane of nutrition. The reason

for the delay will be made clear in considering the behaviour of the groups on their respective treatments.

INFLUENCE OF NUTRITION ON LITTER NUMBERS:

Results of the first three farrowings for all sows farrowed:-

(1) Mean number per litter:

Group	Alive Birth	Alive 3 Weeks	Alive 8 Weeks
1	7.91	6.58	6.50
2	7.11	6.49	6.35
3	8.80	7.68	7.83
4	9.53	8.73	8.53

Statistical treatment of the data showed "no significant" difference for litter numbers at birth, but a "significant" difference at 3 and 8 weeks. The main difference at 3 and 8 weeks was due to that of Group 4 but Groups 3 and 4 combined also showed a "highly significant" difference at 3 weeks and a "significant" difference at 8 weeks.

(2) MORTALITY IN THE GROUPS DURING THE SUCKLING PERIOD:

It was found that deaths from all causes during the suckling period was not significant between the groups, but "accident", i.e., pigs overlain caused rather more deaths in Groups 3 and 4 than in Groups 1 and 2.

Total number of foetuses and number born dead for all sows farrowed the first 3 farrowings:

Group 1		Group 2		Group 3		Group 4.	
Foetuses	Dead	Foetuses	Dead	Foetuses	Dead	Foet.	Dead
3	0	2	1	6	7	2	7

Foetuses were considered to be those piglets which had died some considerable time before parturition. They varied from mummified objects of 2/3% in length and weighing 40/50 grms. to objects weighing up to 4-500 grms. The largest, showing by their lack of hair, sunken eyes and general appearance, that they had been dead some considerable time.

Piglets described as dead at birth were those which were delivered dead but from their appearance and weight had obviously been alive until parturition commenced or shortly before. In my opinion, deaths at birth are mainly due to the breaking of the umbilical cord of the piglet while in utero followed by suffocation through delayed expulsion. In support of this it is not uncommon to have piglets delivered in which the heart is still beating faintly and on rare occasions one is able to resuscitate a piglet.

(4) THE INFLUENCE OF NUTRITION ON BIRTH WEIGHT:

Mean weight per piglet for all sows which farrowed:-

	Group 1	Group 2	Group 3	Group 4.
Mean weight (lbs.)	2.24	2.71	2.84	2.39

Statistical treatment showed that the birth weight of piglets of Groups 2 and 3 in which the sows received concentrates for six weeks before farrowing were heavier than piglets from sows of Groups 1 and 4 which did not, the difference was "highly significant."

(4) THE INFLUENCE OF NUTRITION ON THE MILKING QUALITIES OF THE SOW:

The ability of the sow to milk is influenced by her condition at farrowing. Well-conditioned sows that are well fed prior to farrowing, like well-fed cows, produce better than poor ones and this is reflected in the growth rate of the litter. The following table shows the liveweight increase from birth to 3 weeks, for all sows farrowed:-

Group No.		Increase Birth - 3 weeks (lbs.)
1	...	6.94
2	...	9.43
3	...	10.09
4	...	7.41

Analysis of the variation in liveweight increase from birth to 3 weeks due to nutrition, showed that: (1) there was no significant difference between Groups 1 and 4; (2) there was a "highly significant" difference between Groups 1 and 4 compared with Groups 2 and 3; (3) there was a "significant" difference between Groups 2 and 3.

The highly significant differences are obtained where a comparison is made between litters of sows that were fed prior to farrowing, with those which were not fed. The significant difference between Groups 2 and 3 is interpreted as being due to the superior feeding of Group 3 which was fed after weaning as well as before farrowing.

It can, therefore, be stated in general terms that sows fed on pasture and supplementary ration of concentrates for six weeks prior to farrowing produce piglets heavier at birth than sows which are not fed and the piglets from sows fed before farrowing make better progress and are heavier at 3 weeks of age than piglets from sows which have not been fed. Well-fed sows, due to farrow, give a better indication than poor sows of when the event is to take place.

The mammary glands swell and milk can be expressed to a considerable degree. Poor sows show little mammary development and milk cannot be expressed to the same extent.

(5) INFLUENCE OF NUTRITION ON THE LIVEWEIGHT INCREASE OF PIGLETS FROM BIRTH TO EIGHT WEEKS:

A good plane of nutrition prior to farrowing produces higher birth weights, better milk production by the sows and higher litter weights at three weeks. Such litters are ready to take advantage of creep feeding from three weeks onwards, resulting in heavier litters at weaning (8 weeks.)

The mean increase in weight from birth to eight weeks for the respective groups showed a similar trend to that for birth to three weeks, with one exception. There emerged a "highly significant" difference between the mean liveweights of Groups 1 and 4 at eight weeks which did not occur at three weeks. The difference appears to be mainly due to initial differences in birth weights, since when allowance for birth weight was made in the analysis of variance the sum of the squares is increased almost to that attributable to the comparison between the Groups receiving additional feeding before farrowing compared with those which did not. This is shown in the following table:-

Feeding Group compared	Degrees of Freedom	Unadjusted Mean Square	Adjusted Mean Square
1 with 4	1	5,695,18	7,724,71
2 with 3	1	1,474,30	475,46
1 & 4 with 2 & 3	1	34,785,95	8,061,87

The increase in weight from birth to 8 weeks upon which the foregoing results are based was as follows:-

Group No.		Mean Increase Birth 8 weeks (lbs.)
1	..	36.11
2	..	38.59
3	..	40.38
4	..	33.09

THE EFFECT OF NUTRITION ON THE OERTRUS CYCLE AND BREEDING EFFICIENCY OF THE SOWS UNDER THE 4 PLANES OF NUTRITION:

The incidence of temporary sterility of the type encountered in the dairy cow is also found in the sow, but complete cessation of the oertrus cycle was also encountered with sows of Groups 1 and 2, i.e., the sows which were not fed after weaning. This was most noticeable after reversing the treatments, i.e., when sows which had been on the highest plane of nutrition were changed to the lowest plane. The latter will be dealt with in the summary of the results obtained after the reversal of the treatments.

During the first three farrowings no trouble was experienced with the sows of Groups 3 and 4, i.e. those fed after weaning. In the other two groups, one sow of Group 1 went out to pasture in November, she came on heat but did not hold. After three months this sow was fed up to 10 lbs. of meal a day and brought back to high condition - she did not come in season, however, until she had been fed for three months, during which time she put on about 130 lbs. liveweight. The sow was mated and produced a litter of 15. At weaning she was again in low condition and was placed on pasture for 12 months and did not come in season. She was again placed on a high plane of nutrition and regained condition, was then mated and again produced a litter of 15. At this time the treatments were reversed and this sow was elevated to the best plane of nutrition and came in season normally each time after weaning.

Two sows in Group 2 also delayed coming on heat, after weaning. One sow was quiescent for three months after weaning her first experimental litter and three months after her recent litter. The other sow was mated and apparently settled. She was brought in for six weeks' feeding before farrowing and came in season a few days after feeding commenced. Whether a poor plane of nutrition had caused this sow not to hold to the first service and to become quiescent or whether the litter was reabsorbed at a later date is not known.

TOTAL PRODUCTION OVER THE FIRST THREE FARROWINGS:

While the mean number per litter at birth was not significantly different for any Group, there was a very real difference in the total number of piglets born per Group, due, of course, to the sows of Groups 1 and 2 which gave trouble and had to receive special treatment to bring them back to breeding condition. This prevented the statistical use of litter data from these sows for the subsequent litter, especially in the case of the sow in Group 1. From the practical point of view it resulted in a loss of litter numbers in a given time and caused the sows to farrow at an unfavourable season. The point is emphasised by the total number born alive and weaned by each four Groups:

(6)

Group	Born Alive	Weaned
1	96	78
2	94	84
3	129	125
4	143	130

In order to eliminate any carry-over effect of previous treatment, the first farrowing after the change over has been eliminated from each Group and the following results are for the subsequent three farrowings:-

(7) Mean size of litter:

Group	BIRTH		3 WEEKS		8 WEEKS	
	Reversed	Original	Reversed	Original	Reversed	Original
1	9.0	7.91	7.06	6.58	6.8	6.50
2	6.33	7.11	4.60	6.49	4.53	6.35
3	7.55	8.80	5.33	7.68	5.33	7.83
4	8.33	9.53	6.86	8.73	6.80	8.53

With the exception of Group 2 the results are in agreement with those of the first farrowing and there has been an improvement in mean litter numbers with an improvement in feeding and vice versa. Group 2 are disappointing in that with the change from last six weeks' feeding to first six weeks there has not been an improvement in numbers born alive.

Group 3, in particular, showed a marked reaction to the alteration from a good to poor plane of nutrition. While on the good plane of feeding there was no trouble with any of them returning to the boar. There was no trouble at the first mating after the reversed treatments and this was to be expected since the sows were in good condition. After the first litter three of the five sows gave trouble. One sow did not come on heat and had to be fed for two months before returning to normal. At farrowing she became cannibalistic. At weaning she was again placed on pasture and did not come on heat in two months. Was then fed for six weeks, came on heat and was settled without trouble.

The history of the two other sows was similar, but during the anoestrus period they were both given an injection of Pituitrin to which neither responded. Both came in season after a short period of feeding and were mated without further trouble.

This caused considerable loss of time and little data from this Group and the relative production in total litter numbers for all groups on their original and reversed treatments may be seen in the following table:-

(8) TOTAL LITTER NUMBERS:

Group	BORNE ALIVE		WEANED	
	Reversed	Original	Reversed	Original
1	135	96	102	78
2	95	94	68	84
3	68	129	48	125
4	125	143	102	130

FOETUSES AND NUMBERS BORN DEAD:

Group 1				Group 2				Group 3				Group 4			
Foetuses		Dead		Foetuses		Dead		Foetuses		Dead		F.		D	
Rev.	Orig.	Rev.	Orig.	Rev.	Orig.	Rev.	Orig.	Rev.	Orig.	R.	O.	R.	O.	R.	O.
3	3	9	0	1	2	6	1	5	6	13	7	3	2	7	7

(9) BIRTH WEIGHTS:

GROUP 1		GROUP 2		GROUP 3		GROUP 4	
Rev.	Orig.	Rev.	Orig.	Rev.	Orig.	Rev.	Orig.
2.40	2.24	2.63	2.71	2.22	2.84	2.69	2.39

The birth weights show a similar trend to that obtained with the original treatments, i.e., with better feeding for six weeks prior to farrowing there is an increase in the birth weight. Conversely with a poor plane of nutrition. This is particularly so for Group 3.

(10) THE INFLUENCE OF NUTRITION ON THE MILKING QUALITIES OF THE SOW:

WEIGHT INCREASE. BIRTH - 3 WEEKS (LBS).

Group No.	Reversed.	Original.
1	9.16	6.94
2	8.43	9.43
3	8.56	10.09
4	8.65	7.41

Here again the influence of nutrition prior to farrowing persists. Statistical treatment of the liveweight increase for farrowings before the reversed treatments showed, however, that the heaviest pigs at birth were heaviest at three weeks of age, but the differences tended to fade out at eight weeks when differences at birth were allowed for.

(11) LIVEWEIGHT INCREASE. BIRTH - 8 WEEKS (lbs.)

Group No.	Reversed.	Original.
1	35.16	36.11
2	34.86	38.59
3	34.17	40.38
4	32.80	33.09

In conclusion, it may be said with a degree of assurance that the results obtained indicated where the nutrition of the sow in New Zealand may be improved. The disposal of sows by farmers for the reason that they will not breed is common and few farmers are prepared to feed their sows at the rate of 5-10 lbs. of meal or gallons of milk a day for 2-3 months and bring them back to good breeding condition. The results also offer an explanation for the trouble some farmers encounter when they purchase in-pig sows that are in good condition and are no trouble at the next mating but which are in poor condition and give trouble after weaning the second litter.