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# Effect of Gestation Gain on Lactation Performance and Return to Estrus of First Parity Sows

G.W. Libal
*South Dakota State University*

D.N. Peters
*South Dakota State University*

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G. W. Libal[1], C. R. Hamilton, and D. N. Peters
Department of Animal and Range Sciences

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One of the most costly problems in the swine industry is the high turnover rate of sows in the herd. Failure to consume adequate feed and excess weight loss during lactation has been associated with subsequent reproduction problems. Research has proven that high gestation feeding levels and excessive gestation gain results in low lactation feed intake and excessive sow weight loss during lactation. Sows completing their first parity and sows from extremely productive lines have been identified as those most likely to be lost from the operation because of failure to conceive after weaning. Recommended gestation feeding levels often result in much larger gestation weight gain relative to body weight for first parity sows than mature sows. This might partially explain the high culling rate of sows after their first parity. The research reported herein was designed to determine the effect of gestation gain for first parity sows on farrowing performance, lactation feed intake, change in sow weight, and backfat during lactation and the interval from weaning to estrus.

(Key Words: First parity sow, Gestation gain, Lactation feed intake, Sow weight change.)

### Experimental Procedure

Eight-month old, Large White x Landrace F1 gilts were assigned to one of three gestation feeding regimes as they were bred. Assignment to treatment was based on breeding date, weight, and boar to which she was bred (Hampshire x Duroc F1). Treatments consisted of energy levels that were calculated to provide for 45 kg of gestation gain (NORMAL), 32.5 kg of gestation gain (MEDIUM), or 20 kg of gestation gain (LOW).

The treatments consisted of three feeding regimens that included a standard level of a nutrient-fortified diet that nutrient-fortified diet that supplied all the daily nutrients required of a pregnant gilt and additional levels of ground corn to supply additional energy. The composition of the standard diet fed at 1.2 kg per day to each sow is shown in Table 1.

The gestation treatments were:

- NORMAL – 1.2 kg of a fortified diet plus .6 kg ground corn
- MEDIUM – 1.2 kg of a fortified diet plus .4 kg ground corn
- LOW – 1.2 kg of a fortified diet plus .2 kg ground corn.

The feeding levels were for gilts housed in a thermoneutral environment. Gilts were fed once daily and housed in gestation crates over slatted floors in a naturally ventilated gestation barn. As the environment changed by seasons and weather patterns, the level of corn included was increased by .2 kg when the temperature dropped below 10°C and decreased by .2 kg when the temperature rose above 27°C for more than 24 hours.

Gilts were weighed, ultrasonically measured for last rib and average backfat thickness, and placed in farrowing crates on day 110 of gestation. Sows and pigs were weighed within 12 hours after farrowing, at 7 days, 14 days, and 21 days post-farrowing, and at weaning which was between 21 and 28 days after farrowing. Sows were allowed ad .libitum consumption of a standard lactation diet (Table 1) from farrowing to weaning. Feed was weighed into the feeder twice daily and weekly feed consumption was calculated for each sow. At weaning, sows were measured for backfat by ultrasound to calculate fat change during lactation. Within the time period of normal breeding schedules, days to return to estrus after weaning were obtained.

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TABLE 1. COMPOSITION OF GESTATION AND LACTATION DIETS, %

| Ingredient | Gestation[a] | Lactation[b] |
|---|---|---|
| Ground corn | 57.51 | 76.57 |
| Soybean meal, 44% | 36.54 | 19.22 |
| Dicalcium Phosphate | 3.52 | 2.49 |
| Limestone | 1.05 | .72 |
| White salt | .88 | .50 |
| Vitamin-TM premix | .50[c] | .50[d] |
| | 100.0 | 100.0 |
| Crude protein, % | | |
| Calculated | 21.0 | 15.4 |
| Analyzed | 20.7 | 15.4 |

[a]Fed at 1.2 kg per day.
[b]Fed ad libitum.
[c]Provided per kg of complete gestation diet: 148 mg Zn, 110 mg Fe, 11 mg Cu, 37 mg Mn, 259 :g I, 440 :g Se, 34 IU vitamin E, 6.93 mg riboflavin, 46.2 mg niacin, 35:g vitamin $B_{12}$, 4.62 mg vitamin $K_3$, 27.7 mg pantothenic acid, 874 mg choline, 7390 IU vitamin A, and 739 IU vitamin $D_3$.
[d]Provided per kg of complete lactation diet: 100 mg Zn, 75 mg Fe, 7.5 mg Cu, 25 mg Mn, 159 :g I, 300 :g Se, 33 IU vitamin E, 6.6 mg riboflavin, 44 mg niacin, 30 :g Se, 33 IU vitamin E, 6.6 mg riboflavin, 44 mg niacin, 30 :g vitamin $B_{12}$, 4.4 mg vitamin $K_3$, 26.6 mg pantothenic acid, 545 mg choline, 5480 IU vitamin A, and 548 IU vitamin $D_3$.

A total of 120 gilts were bred and allotted to treatments as they were brought into the herd for their first parity. The experiment was analyzed as a randomized block design with nine blocks of sows and three treatments. The sow and her litter were considered the experimental unit.

## Results

Of the 120 gilts that were allotted to the three feeding regimens at breeding, 83 sows successfully completed lactation with data collected. Table 2 presents a summary of the weight changes of sows associated with the three feeding levels. As anticipated, weights of sows at day 110 of gestation and post-farrowing reflected (P<.001) the feeding level during gestation. Total gain for sows receiving the NORMAL feeding level was higher (P<.001, 36.6 kg) than for sows of the MEDIUM (28.0 kg) and LOW (24.3 kg) feeding levels but not as high as anticipated (45 kg). The gain by sows receiving MEDIUM and LOW were higher than expected. Net gestation gain (post-farrowing weight minus breeding weight) followed the same pattern and ranged from 23.7 kg to 12.5 kg for the highest and lowest feeding levels, respectively. It was anticipated that the net gain would be 25 kg for the group fed NORMAL and 0 kg for the group fed LOW. The sows receiving LOW were much heavier than expected.

Table 3 summarizes sow weights at various stages of lactation that averaged just over 24 days in length for each treatment group. Sow weights differed by gestation treatment at 7 days (P<.001) and at 14 days, 21 days, and weaning (P<.01). The differences in weights that existed post-farrowing due to gestation feeding levels were maintained during lactation. Sow weight change during lactation was not different (P>.10) among sows that had received different gestation feeding levels. Compared to sow weights post-farrowing, sow weights at 21 days of lactation were slightly heavier and sow weights at weaning were similar to weights for the same sows post-farrowing regardless of gestation feeding level.

Table 4 summarizes feed intake on a weekly basis and for the 21-day and total lactation periods. No differences (P>.10) in feed intake among sows that had received different feeding levels during gestation were observed for any portion of the lactation period. Week 1 feed consumption averaged just less than 5 kg/day and week 3 feed consumption was over 6.5 kg/day. Average daily feed consumption for lactation was over 5.9 kg for all sows regardless of gestation treatment and was above the level normally expected for first parity sows. These high levels of feed intake would account for the lack of change in first parity sow weight during lactation.

Last rib backfat, average backfat, and backfat change for first parity sows is summarized by gestation feeding level in Table 5. Backfat measurements at 110 days of gestation were affected by gestation feeding levels (P<.05) and were reflective of the gestation weight gain. Last rib backfat was 2.1 mm greater for sows receiving NORMAL compared to those receiving LOW. Average

TABLE 2. FIRST PARITY SOW WEIGHTS AND WEIGHT CHANGES FOR GESTATION RELATED TO GESTATION FEEDING REGIMENS

| Item | Gestation feeding levels NORMAL | MEDIUM | LOW | SD | P |
|---|---|---|---|---|---|
| No. of sows bred | 41 | 41 | 38 | | |
| No. of sows farrowing | 31 | 26 | 26 | | |
| Sow weight, kg | | | | | |
| Breeding | 126.0 | 129.6 | 125.6 | 10.1 | ns |
| 110 days | 163.6 | 158.1 | 151.3 | 12.4 | *** |
| Post-farrowing | 150.7 | 144.7 | 139.4 | 10.0 | *** |
| Gestation weight gain, kg[a] | 36.6 | 28.0 | 24.3 | 9.3 | *** |
| Net gestation weight gain, kg[b] | 23.7 | 14.4 | 12.5 | 8.0 | *** |

ns P>.10
*** P<.001
[a]Breeding weight – 110-day weight.
[b]Breeding weight – post-farrowing weight.

TABLE 3. FIRST PARITY SOW WEIGHTS AND WEIGHT CHANGES FOR LACTATION RELATED TO GESTATION FEEDING REGIMENS

| Item | Gestation feeding levels NORMAL | MEDIUM | LOW | SD | P |
|---|---|---|---|---|---|
| Sow weight, kg | | | | | |
| Post-farrowing | 150.7 | 144.7 | 139.4 | 10.0 | *** |
| Day 7 | 154.9 | 148.9 | 142.8 | 10.3 | *** |
| Day 14 | 152.9 | 147.4 | 141.6 | 11.0 | ** |
| Day 21 | 151.4 | 147.3 | 141.1 | 11.0 | ** |
| Weaning | 150.5 | 146.3 | 139.3 | 11.3 | ** |
| Sow weight change, kg | | | | | |
| To 21 days | .7 | 2.6 | .8 | 9.6 | ns |
| Lactation | -.6 | 1.2 | -.4 | 10.2 | ns |
| Lactation length, days | 24.3 | 24.5 | 24.3 | 2.1 | ns |

ns P>.10.
** P<.01.
*** P<.001.

TABLE 4. FIRST PARITY SOW FEED INTAKE DURING LACTATION RELATED TO GESTATION FEEDING REGIMENS

| Item | Gestation feeding levels NORMAL | MEDIUM | LOW | SD | P |
|---|---|---|---|---|---|
| Feed intake, kg | | | | | |
| Week 1 | 34.0 | 35.2 | 31.7 | 5.9 | ns |
| Week 2 | 40.7 | 39.7 | 41.2 | 7.0 | ns |
| Week 3 | 46.3 | 45.2 | 45.5 | 7.2 | ns |
| 21 days | 121.0 | 120.0 | 119.1 | 16.9 | ns |
| Lactation | 146.3 | 143.5 | 143.3 | 21.1 | ns |
| Lactation length, days | 24.3 | 24.5 | 24.3 | 2.1 | ns |

ns P>.10.

TABLE 5. FIRST PARITY SOW BACKFAT AND BACKFAT CHANGES DURING LACTATION RELATED TO GESTATION FEEDING REGIMENS

| Item | Gestation feeding levels | | | SD | P |
|---|---|---|---|---|---|
| | NORMAL | MEDIUM | LOW | | |
| Last rib backfat, mm | | | | | |
| 110 days | 13.8 | 12.7 | 11.7 | 2.6 | * |
| Weaning | 12.2 | 11.0 | 10.6 | 2.6 | ns |
| Change | -1.6 | -1.7 | -1.1 | 1.9 | ns |
| Average backfat, mm | | | | | |
| 110 days | 17.8 | 16.5 | 15.6 | 2.7 | * |
| Weaning | 15.8 | 15.3 | 14.3 | 3.1 | ns |
| Change | -2.0 | -1.2 | -1.3 | 2.5 | ns |

ns P>.10
* P<.05.

backfat was greater than last rib backfat for all sows and the spread between the average backfat for sows receiving NORMAL and LOW was 2.2 mm. No differences in backfat loss (P>.10) were observed due to gestation treatment. However, each group of sows lost some backfat during gestation whether measured as last rib or average backfat. Variation associated with backfat levels within a treatment group remained the same (last rib) or increased (average) over lactation and the difference in mean backfat among groups narrowed. As a result, backfat levels for sows among the treatment groups were not statistically different at weaning.

Sow farrowing performance and litter performance during lactation is shown in Table 6. Numerically, first parity sows fed the LOW energy during gestation farrowed more live pigs than the other groups. However, no statistical difference (P>.10) in number of live pigs born was observed due to gestation treatment. Litter weights at birth were similar (P>.10) among treatment groups. Litter size was adjusted by cross fostering to about 10 pigs per litter (9.92 for the NORMAL group). Lactation performance was based on the adjusted litters. Litter size at weaning was not different (P>.10) among treatment groups. Pig survival rate averaged about 90% for all litters. Weights of adjusted litters were similar across gestation treatment (P>.10) at birth, 21 days, and at weaning. Litter weights at weaning were within the range expected of first parity sows that have the genetic potential for high milk production.

Return to estrus information related to gestation feeding levels is shown in Table 7. Estrus detection was accomplished only during a specified breeding window that was generally from weaning to 10 to 16 days post-weaning. This accounts for the relatively small percentage of sows detected in estrus. Most sows were detected in estrus and rebred during subsequent breeding windows. No difference (P>.10) in time to return to estrus after weaning was observed due to gestation treatment among those detected in estrus during the breeding window. Days to return to estrus for those sows were between 6.6 and 6.9.

Reduction of gestation feeding levels of first parity sows below those recommended had no advantage for any criteria evaluated. However, reduction of feeding levels to provide roughly 50% of the net gestation gain (LOW) of the NORMAL group of sows produced no negative effects. Farrowing performance, lactation performance, and return to estrus were similar among all sow groups.

TABLE 6. FIRST PARITY SOW LITTER SIZE AND LITTER PERFORMANCE DURING LACTATION RELATED TO GESTATION FEEDING REGIMENS

| Item | Gestation feeding levels | | | SD | P |
|---|---|---|---|---|---|
| | NORMAL | MEDIUM | LOW | | |
| Farrowing performance | | | | | |
| Pigs born alive | 9.46 | 9.64 | 10.45 | 2.7 | ns |
| Litter weight, kg | 12.95 | 12.43 | 13.04 | 3.6 | ns |
| Lactation performance | | | | | |
| Litter size | | | | | |
| Adjusted birth | 9.92 | 10.60 | 10.75 | 2.1 | ns |
| Weaned | 9.30 | 9.29 | 9.62 | 2.0 | ns |
| Litter weight, kg | | | | | |
| Adjusted birth | 13.56 | 13.81 | 13.63 | 2.8 | ns |
| 21 days | 51.82 | 50.24 | 54.71 | 10.4 | ns |
| Weaning | 58.35 | 54.71 | 57.29 | 11.2 | ns |

ns P>.10.

TABLE 7. FIRST PARITY SOW RATE AND TIME OF RETURN TO ESTRUS AFTER WEANING RELATED TO GESTATION FEEDING REGIMENS[a]

| Item | Gestation feeding levels | | | SD | P |
|---|---|---|---|---|---|
| | NORMAL | MEDIUM | LOW | | |
| No. of sows | 31 | 26 | 26 | | |
| Detected in estrus | | | | | |
| Number | 24 | 15 | 17 | | |
| Days | 6.6 | 6.9 | 6.9 | 2.3 | ns |

[a]Sows were observed for estrus for 10 to 16 days post-weaning during normal breeding period.
ns P>.10.


Summary

Eight-month old replacement gilts (120) were assigned by breeding date, weight, and boar to which they were mated to one of three gestation feeding regimes as they were bred. Treatments consisted of energy levels that were expected to provide for 45 kg of gestation gain (NORMAL), 32.5 kg of gestation gain (MEDIUM), or 20 kg of gestation gain (LOW). Each treatment consisted of a standard level of a complete diet and an additional level of ground corn to supply additional energy. Sows were allowed ad libitum consumption of a standard lactation diet from farrowing to weaning. Of the 120 gilts that were allotted to the three feeding regimens at breeding, 83 successfully completed lactation with data collected.

Weights of sows at day 110 of gestation and post-farrowing reflected the feeding level during gestation. However, total gain for sows receiving the NORMAL feeding level was not as high as anticipated. Net gestation gain (post-farrowing weight minus breeding weight) followed the same pattern and ranged from 23.7 kg to 12.5 kg for the highest and lowest feeding levels, respectively. Sow weights differed by gestation treatment at 7 days and at 14 days, 21 days after parturition, and weaning. Sow weight change during lactation was not different among sows that had received different gestation feeding levels and, thus, sow weights at weaning were a function of different weights at farrowing.

Backfat measurements at 110 days of gestation were affected by gestation feeding levels and were reflective of the gestation weight gain. No differences in backfat loss during lactation were observed due to gestation treatment.

No differences in feed intake among sows that had received different feeding levels during

gestation were observed for any portion of the lactation period. Average daily feed consumption for lactation was over 5.9 kg regardless of gestation treatment, above the level normally expected for first parity sows.

Litter size did not change from birth to weaning due to gestation feeding regimen. Pig survival rate averaged about 90% for all litters. Weights of adjusted litters were similar across gestation treatment at birth, 21 days, and weaning. Litter weights at weaning were within the range expected of first parity sows that have the genetic potential for high milk production.

No difference in time to return to estrus after weaning was observed due to gestation treatment among those detected in estrus during the breeding window. Days to return to estrus for those sows were between 6.6 and 6.9.

No advantage for any criteria measured were found for reducing first parity sow gestation gain below that normally recommended (45 kg). However, no negative effect of lowering gestation gain to well below the recommended level (24 kg) was observed as well.

## Implications

The results of this study do not support the hypothesis that reducing gestation energy intake of first parity sows below levels, which will produce, recommended gestation gain will improve lactation performance, lactation feed intake and return to estrus. However, the performance of sows that were fed for gestation gain well below the recommended level was very good. This would suggest that the level of gestation gain for the first parity sow is not critical as long as it is not excessive. Because of the documented problems of excessive feeding levels during gestation, this research would also suggest that when choosing a standard feeding level for a group of first parity sows which may differ in their energy requirements because of body weight, genetic makeup, or housing conditions it might be better to err to the side of lower gestation energy intake and thus lower gestation gain.