Fresh grass clover intake and energy metabolism in organic sows fed a control or a low protein compound feed in winter and summer

M. Eskildsen\*, U. Krogh, A. G. Kongsted, and P. K. Theil

**Abstract**

A control and a low dietary protein strategy was tested in 47 organic 1st and 2nd parity sows in winter and summer under Danish weather conditions. Sows on the low protein strategy ingested more fresh grass clover than the control group in summer (2.60 kg/d vs. 2.29 kg/d; P = 0.007). The mean SID lysine intake from grass clover amounted to 21 g/d in gestation, which is well above the daily SID lysine requirement throughout pregnancy. There were no differences between the two dietary regimens on sow productivity, body composition, locomotive activity or blood- and urine metabolites (data not shown; P>0.05) in both seasons.

The daily intake of protein- and amino acid exceeded the requirements during pregnancy, also when sows were fed the low protein compound feed, but the low protein diet supplied insufficient SID lysine during lactation, which compromised the milk production. Sows lost 794 g/d of body fat in the period from d5 to d40 in lactation and the energy requirement amounted to 120 MJ ME/d at peak lactation. In conclusion, sows with access to pasture can be fed lower protein during gestation and also in lactation during summer.

**Introduction**

Organic sows in pasture systems spend extra energy on thermoregulation, a prolonged lactation period and they have the opportunity for increased locomotory activity as compared to conventional sows. These aspects increase the energy requirements of outdoor sows, whilst their protein (and hence lysine) requirement most likely is comparable on a daily basis (Close and Poornan, 1993; Jakobsen and Hermansen, 2001). However, organic sows are often supplied more feed with greater protein but lower lysine concentration as indoor sows, hence they ingest considerably more protein per day as compared with indoor sows. Excess dietary protein reduces feed efficiency and increases the N-excretion to the environment. Hence, the protein-to-energy ratio formulated for indoor pigs is most likely not optimal for organic sows.

We hypothesized, that grass intake in summer and silage intake in winter would allow a reduction of the protein content in the compound feed by 13% without compromising sow productivity.

**Materials and methods**

Forty-seven lactating LY sows were randomly assigned into low protein (12.8% of DM) or control (14.7% of DM) diets. Two periods (winter or summer) were tested. The two diets were adjusted to be iso-energetic and were of 100% organic origin. To meet the extra demand for thermoregulation and locomotory activity, the energy allowance from both treatments was increased by adding 10% and 15% extra during summer and winter, respectively, as compared with the recommended feeding curves for indoor sows (Danish Pig Research Centre).

During summer, sows were fed 4.2 kg in early gestation until d81 and 4.8 kg/d until farrowing. Lactating sows were fed 4.7 kg/d on 1-3 days in milk (DIM), from 4-14 DIM, the feed allowance increased by 0.5 kg/d, reaching a plateau of 11.1 kg/d from 14 DIM until weaning at 47 DIM. On top of that, sows had ad libitum access to clover grass sward in the summer period and grass silage in winter (November 1st to April 15th). All sows and piglets were individually weighed, backfat scanned and milk-, blood-, and urine- samples were collected from the sow in mid and late gestation (d60 and d100) and early, peak and late lactation (d 5, 20, and 40 DIM). Body pools of fat and protein were estimated using deuterium dilution technique. HElocomotory activity was measured using GPS trackers and total heat production was estimated from the pulse measured with a heart rate monitor.

**Results**

There were no difference in liveborn, birthweight or daily gain of the piglets in the two dietary groups (table 1). Season was confounded with parity, as sows were 1st parity in winter and 2nd parity in summer and productivity was generally higher in 2nd parity sows.

Table 1. Reproductive performance in 1st and 2nd parity sows fed 100% organic diets differing in proportion of protein winter and summer

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Season** | | |  | **Dietary Protein** | | |  | **P-values** | |
|  | **Winter** | **Summer** | **SEM** |  | **Control** | **Low** | **SEM** |  | **Season** | **Protein** |
| Liveborn | 13.5b | 16.8a | 0.5 |  | 15.1 | 15.2 | 0.49 |  | 0.005 | 0.83 |
| Still born | 2.10 | 2.17 | 0.64 |  | 2.59 | 1.69 | 0.64 |  | 0.93 | 0.37 |
| Birthweight, g. | 1320b | 1509a | 30.2 |  | 1413 | 1416 | 30.8 |  | 0.007 | 0.95 |
| Piglet weaning weight, kg | 14.6 | 16.1 | 1.07 |  | 15.5 | 15.2 | 1.07 |  | 0.36 | 0.86 |
| Weaned piglets/litter | 10.9b | 12.6a | 0.29 |  | 11.7 | 11.9 | 0.3 |  | 0.009 | 0.65 |

Protein strategy did not affect sow live weight, body pools or energy used on locomotive activity. Sows on the low protein strategy ingested 31 g/d more of DM from grass clover, than the control fed sows (p=0.05) (table 2)

Table 2. Grass clover intake (only summer), live weight measurements, body pools, heat production and locomotive activity in 1st and 2nd parity sows fed iso-energetic organic diets differing in proportion of protein winter and summer at different reproductive stages (parturition = d 0).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Reproductive stage | | | | | |  | Dietary protein | | |  | P-values | |
|  | -55 | -15 | 5 | 20 | 40 | SEM |  | Control | Low | SEM |  | Stage | Protein |
| Sow weight, kg | 238c | 273a | 255b | 232c | 218d | 2.89 |  | 243 | 243 | 2.85 |  | <0.001 | 0.85 |
| Back fat, mm. | 17.5b | 20.1a | 20.2a | 16.3b | 13.4c | 0.78 |  | 17.3 | 17.7 | 0.87 |  | <0.001 | 0.79 |
| Protein pool, kg/sow | 41.5b | 45.8a | 42b | 40.1bc | 39.3c | 0.58 |  | 42.2 | 41.3 | 0.48 |  | <0.001 | 0.32 |
| Fat pool, kg/sow | 41.4b | 60.4a | 57.8a | 37.4bc | 30.oc | 3.05 |  | 45.3 | 45.5 | 3.49 |  | <0.001 | 0.95 |
| Heat production |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Distance, Km | 2.46a | 1.88b | 0.70d | 1.48c | 1.7bc | 0.16 |  | 1.73 | 1.56 | 0.19 |  | <0.001 | 0.56 |
| ME locomotive, MJ/d | 4.83a | 3.9b | 1.4d | 2.62c | 2.96c | 0.28 |  | 3.21 | 3.07 | 0.26 |  | <0.001 | 0.74 |
| Grass clover intake in summer, Kg/d | 2.45b | 2.44b | 1.55c | 3.16a | 2.62b | 0.13 |  | 2.29b | 2.60a | 0.78 |  | <0.001 | 0.007 |
| Grass clover intake in summer, g DM/d | 428b | 409b | 225c | 574a | 472b | 0.02 |  | 403 | 440 | 0.01 |  | <0.001 | 0.04 |
| SID lysine intake from grass clover, g/d | 21.2b | 20.9b | 14.7c | 26.9a | 19.7b | 1.20 |  | 20.0 | 21.4 | 0.72 |  | <0.001 | 0.18 |
| Total ME requirement, MJ/d | 27.5c | 31.2c | 94.2b | 120.3a | 91b | 2.01 |  | 72.3 | 70.3 | 1.37 |  | <0.001 | 0.62 |