

1. Introduction

The increasingly intensified rearing of livestock resulted in decreased life cycle production of sows worldwide limited only to 3-4 farrowing and the sorting rate exceeds the acceptable values reaching 45-50 % or even 60 % annually. It is well known that satisfying production results can only be achieved by high productivity, duly mature and healthy sow stocks with good maternal behavior. These terms are to be realized by keeping the breeding sows in stall with outrun where the good effects of sunlight and fresh air are came true, however free movements of animals are limited.

In conjunction consumer demands are growing for pork deriving from healthier and natural production systems, pressing forward the development of more natural technologies as an alternative for conventional systems. Moreover these new social constraints affect the legislation of the European Union, which resulted stricter directives of animal and environmental protection.

These three poles – finding alternatives for conventional systems, varying market demands, animal and environmental protection- justify the investigation of the natural rearing techniques of brood-stocks that of the grassland based rearing of gilts is an old-new method.

Our aim was to provide fundamental data for the grassland based production results and behavioral patterns of a modern breed (Hungarian Large white x Hungarian Landrace) compared to the same parameters obtained in conventional systems. During the experiment, which was initiated with 2x28 sows we defined the production and breeding indices and monitored the behavioral patterns, the grassland usage and the condition of ryegrass pastures.

2. Methods of the experiments

The experiments detailed in the thesis were set up at a conventional pig farm located at the southeastern part of Hungary in Bekes County during 2000-2003. Ryegrass grassland was established on the one and a half hectare fallow area of the pig farm. During the experiments 2x28 Hungarian Large white x Hungarian Landrace gilts were reared in both grassland based and conventional systems. The experiments on grassland were carried out on three previously formed pastures that were used in different levels till the day of data recordings. The location of the facilities at the pig farm, the experimental set-up or the descriptions of rearing technology and farm routines are detailed in the *Materials and Methods* chapter of the thesis.

The data obtained during the experiments are detailed in Table 1.

1. table

Fields of gathering data

| Fields of data | pastured | closed |
|---|----------|--------|
| | group | |
| <i>Production results</i> | | |
| Voluntary feed intake | x | x |
| Change in weight | x | x |
| Av. daily weight gain | x | x |
| Data of first and successful inseminations, this time the age and weight of gilts | x | x |
| Long of first farrowing | x | x |
| At farrowing: piglets number and ind. weight at 1., 21. days, and at weaning | x | x |
| Number of live and still-bored piglets | x | x |
| Rate and reasons of piglets mortality | x | x |
| Sorting out of sows | x | x |
| Number of back-to-oestrus | x | x |
| <i>Ethological observations</i> | | |
| Social rank | x | |
| Daily activity | x | x |
| Behavior of sow before farrowing | x | x |
| Behavior of sow during of farrowing | x | |
| Maternal behavior | x | |
| <i>Grassland-measurements</i> | x | |
| Establishment | x | |
| State of development of perennial ryegrass | x | |
| Ingredients of species | x | |
| Using of pasture | x | |
| Chemical composition | x | |

3. The principal results and conclusions of the experiments

The results of the experiments on the comparison of free range and conventional rearing of gilts just as the three farrowings and piglet rearing show that the voluntary feed intake of gilts kept on grassland was 7,3 % higher compared to the ones in conventional system. This outcome of the experiments namely the higher feed intake of free-range pigs is verified by the results of BARBARI et al (1997) and WHITTMORE (1998). They suggest, that it could be elucidated by two main reasons: on the one hand the gilts do not eat the feed spread out on the ground around the feeder, which in turn is a feed-loss, and on the other hand the free range gilts are more active than those kept in the conventional system. The higher energy requirement of the greater activity might be the reason for the higher feed intake of free-range gilts. For the same reason the free-range group had a poorer growth during this period of the experiments compared to the ones in the conventional closed system. However, the rearing of brood-stock should not be aimed at rapid growth and high bodyweight, therefore this index is not of primary importance.

As the piglets are the only product of the sows the age of gilts at the first brood period is very important for the breeders or farmers. We found that the free-range gilts were 28,5 days younger in average at the time of the first insemination than those reared in the closed system. This difference is longer than an oestrus cycle hence it has a very high practical importance. With this object two months later we treated the gilts in the conventional system that were not in oestrus with PG 600 hormone injection. We found that the free-range gilts not only were earlier in oestrus but it was more intensive and expressed than that of those in the conventional system. This phenomenon could be related to positive effect of the outdoor conditions as it is confirmed in the studies of KIRKWOOD et al. (1981) and LEVIS (2003).

During the two and a half years of our experiment we were able to evaluate the results of three farrowings and piglet rearing. The results are detailed in Table 2.

2. table

Comparison of three farrowings (in % of B group)

| | av. livebored | | 21. day | | weaning | |
|------------------|---------------|----------------------|---------------|----------------------|---------------|----------------------|
| | nr.piglet/sow | weight of piglet/sow | nr.piglet/sow | weight of piglet/sow | nr.piglet/sow | weight of piglet/sow |
| First farrowing | | | | | | |
| A ₁ | 108,4 | 100 | 107,9 | 112,5 | 109,3 | 124,4 |
| A ₂ | 93,7 | 100 | 92,1 | 100 | 94,2 | 97,7 |
| B | n=9,5 (100%) | 1,5=100% | n=8,9 (100%) | 5,6=100% | n=8,6 (100%) | 8,6=100% |
| Second farrowing | | | | | | |
| A ₁ | 115,4 | 106,7 | 121,1 | 89,6 | 116,1 | 97,9 |
| A ₂ | 105,8 | 113,3 | 106,3 | 95,5 | 106,5 | 95,7 |
| B | n=10,4 (100%) | 1,5=100% | n=9,5 (100%) | 6,7=100% | n=9,3 (100%) | 9,4=100% |
| Third farrowing | | | | | | |
| A ₁ | 116,8 | 100 | 118,7 | 90,9 | 118,7 | 90,4 |
| A ₂ | 101,2 | 115,4 | 107,7 | 100 | 107,7 | 95,7 |
| B | n=10,1 (100%) | 1,3=100% | n=9,1 (100%) | 6,6=100% | n=9,1 (100%) | 9,4=100% |

A₁- at grassland reared and farrowed sows; A₂ – at grassland reared, but in closed farrowed sows; B – in closed system reared and farrowed sows

During the first two occasions some sows farrowed in individual huts at pasture. The sows in this group had a better farrowing and rearing performance in both litter number and weight at the first litter than that of those farrowed in the conventional system. Compared to the results obtained in the conventional system the weaning weight was 2,1 kg higher on the average in the group of sows that farrowed on the grassland. The mean number of piglets per litter was 9,4 and 8,6 (piglets/litter) on the grassland and in the conventional system, respectively. Expressing these values as litter weight it is clearly seen that the grassland farrowed sows overdo the ones farrowed in the conventional system by 26,6 kilograms.

During the time of the second and third litters or piglet rearing the sows farrowed on the grassland kept their advantage in number of piglets per litter or weaning. The average weight of piglets was similar in both systems. Compared to the data obtained in the conventional system the weaned litter weight of the sows farrowed on the grassland was 11,9 and 6,3 kilograms higher at the second and third litter, respectively. The growth of the piglets could have been positively affected by the excellent milk production of the sows or the fresh air and the greater activity of the piglets, which might have improved their appetite. As an other possible explanation of the good growth we observed that the piglets not only consumed their own rations, but

also occasionally “steal” some food from their mothers trough or had themselves nursed at other sows. As against the opinion of LARSEN and KONGSTED (1999) or HÖTZEL et al. (2004). Our results in farrowing and piglet rearing performance at the grassland groups were higher compared to that of those in the conventional system

Investigating the reasons of piglets mortality we can clearly verify those references (SVENDSEN et al. 1986; CARAZZOLO et al, 1999), where the crushing was pointed out as the main underlying cause. Infection was found to be the main reason of mortality in the conventional system. In our experiment during each farrowing period the highest rate of piglet mortality was found in the group of sows kept in the conventional system (Table 3.).

3. table

Piglets mortality till weaning

| Treatments | first farrowing | | | second farrowing | | | third farrowing | | |
|--------------|------------------|----------------|-----|------------------|------------------|------|------------------|------------------|-----|
| | A ₁ * | A ₂ | B | A ₁ * | A ₂ * | B | A ₁ * | A ₂ * | B |
| mortality, % | 8,7 | 8,9 | 9,5 | 10,0 | 10,0 | 10,6 | 8,5 | 4,9 | 9,9 |

* P<0,01

No still-bored piglets occurred in the case of the grassland-farrowed sows that verify the hypothesis that the grassland based rearing improved the physical condition of sows.

The leg lesions and reproductive problems were found to be the main reasons of sorting-out (rejection) in the closed system, while only lesions affected the grassland kept stocks. As it is mentioned above the active oestral behavior of gilts was observed later on sows as well, therefore less sows had to be sorted out through lack of oestrus. After the weaning more sows could have been inseminated again on the grassland than in the conventional system. It is suggested, that the rearing conditions have positive effects on later stages of life cycle of sows. The sows seemingly hold the advantages gained as gilts therefore becoming better in both physical condition and resistance. This statement is fortified by the fact that at the end of the experiment after the third weaning 46,5 % and 25 % of the sows remained in the grassland based and in the conventionally kept groups, respectively.

The behavioral patterns of the free-range swine are exciting and practically important observations. During our investigations we found that even in the grassland based rearing technology the social/priority rank evolves. However, our results are against the widespread hypothesis and the references in this issue. We found that not the older and/or larger gilts were the dominant individuals in the group, but the more active, younger and slighter gilts were superior. The results of our survey confirm the view of

the references in this object as the free-range swine spend larger part of the day actively than those in closed systems. This rearing technology has the advantage that all the inherent behavioral patterns of the species/breed can be expressed, which contributes to the assurance of animal welfare. The greater activity can be the explanation for higher feed intake and poorer growth as well as the better physical condition and constitution. The third part of our ethological observations focused on the farrowing and piglet-rearing behavior on grassland and in farrowing huts. We found that even this modern breed was able to prepare its nest one or two days prior to farrowing, and was able to farrow successfully without assistance. The sows fed and looked after their piglets carefully as it is proved by their before mentioned piglet rearing performance.

We found similar results such as ours about the area usage of swine in different references, while ERIKSEN and KRISTENSEN (2001) notify that the uneven area usage of swine can bring on environmental loading effects. We had the same observations such as the intensively used 25-30 % of the area became devastated, the plantation disappeared and wallows were created. After one and a half month of intensive usage monocotyledonous and dicotyledonous weed species appeared on the pure ryegrass grassland.

In conclusion we can state that according to the result of our experiments the free-range rearing technology of swine could be a reasonable alternative for conventional, closed technology. We can make the conclusion as well that further scientific work is needed to refine some points of this technology and to develop an economically feasible (a size of at least 150-200 sows) modern, complete technology for successful pig farming.

The thesis includes a technological proposal for the establishment of a grassland based farm with 25-30 sows.

4. New and novel results of the thesis

In our experiment it has been proven, that grassland-based pig production system allows of the better maximizing the genetically fixed capacity of sows. This simple technology can decrease the keeping costs.

On the grounds of our work we draw up the following new and novel results.

Production results:

- In Hungarian circumstances, using Hungarian Large white x Hungarian Landrace gilts, we determined, the pasture-reared gilts were inseminated with 28,5 days earlier and more successful, than closed-reared group (85,7 and 61,1%). Performance of three farrowings was much better in pasture-based group, than closed kept sows.
- In Hungarian circumstances 53,5 % of outdoor reared and kept sows and 75% of indoor reared and kept sows were sorting out till the end of experiment

Ethological observations:

- Among gilts at pasture also strong priority order evolved. The more active, younger gilts gained ascendancy over less active and older gilts.
- At pasture the gilts were more active than closed-kept group.
- The nest building of sow before farrowing is emphatic, which farrowed on pasture, in individual hut. But this movement can be noticed also in the closed system.

Grassland-measurements:

- In Hungarian circumstances, on established perennial ryegrass pasture, the pigs have not used equally the pasture (25-30% as resting and excretion place).

5. Publications in topic of thesis

Posters and lectures:

ALEXY, M.- GUNDEL, J. - NAGY, G. (2001): Sertés szabadtartásunk története. Irodalmi áttekintés. A gyepek szerepe az állattartásban. Debreceni Gyepgazdálkodási Napok 18. Természetes állattartás 6., Debrecen, 137-141.p.

ALEXY, M. – GUNDEL, J. – NAGY, G.(2002): Tenyészsertések szabadtartása. XXIX. Óvári Tudományos Napok, Agrártermelés-életminőség, Állattudományi Szekció, 22.p.

ALEXY, M. – GUNDEL, J. - NAGY G. (2002): Szabadtartásban nevelt süldők termékenyülési eredménye. Gyepgazdálkodási Tanácskozás. Magyar Tudományos Akadémia.

ALEXY, M. – GUNDEL, J. – NAGY, G. (2002): Sertés szabadtartási kísérletünk néhány termelési eredménye. Tavasz Szél Doktoranduszi Konferencia. Debrecen

ALEXY, M. – GUNDEL, J. – NAGY, G. (2003): Termelési eredmények kocák szabadtartásában. Tavasz szél Doktoranduszok Országos Szövetségének Tudományos konferenciája, Sopron 5-9.p.

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ALEXY, M. - GUNDEL, J. - NAGY, G. (2002): Tenyészsüldők felnevelése szabadtartásban. 2. Nemzetközi Sertésenyésztési Tanácskozás, Debrecen, 373-379.p.

ALEXY, M. - GUNDEL, J. - NAGY, G. (2002): Tenézszerterek szabadtartásának lehetősége. EU Konform mezőgazdaság és élelmiszerbiztonság Szakmai Konferencia, Alkalmazott K+F szekció. Debrecen, 46-51.p.

ALEXY, M. – NAGY, G. – GUNDEL, J. (2003): Grassland in a pig production system. Optimal Forage Systems for Animal Production and the Environment. Proc. of the 12th Symposium of the European Grassland Federation. Pleven, Bulgaria, 279-282.p.

ALEXY, M. - GUNDEL, J. – NAGY, G. (2003): Outdoor rearing of gilts. Proc. of 54th Annual EAAP Meeting, Rome, Italy. 379.p.

ALEXY, M. – NAGY, G. – GUNDEL, J. (2004): Pig production responses to a grassland based outdoor system. European Grassland Conference, Switzerland, 2004. 06. 21-24. megjelenés alatt.

Scientific articles:

ALEXY, M. – GUNDEL, J. - NAGY, G. (2002): Tenézszerterek szabadtartásának lehetősége Magyarországon. Debreceni Agrártudományi Közlemények 9. 9-11.p.

ALEXY, M. – NAGY, G. – GUNDEL, J.(2003): A süldőnevelés eredményei szabadtartásban. Debreceni Agrártudományi Közlemények 10. 8-11.p.

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ALEXY, M. – GUNDEL, J. – NAGY, G. (2004). Süldők viselkedése szabadtartásban. Debreceni Agrártudományi Közlemények 11. megjelenésre elfogadva.

Professional articles:

ALEXY, M. – GUNDEL, J. – NAGY, G. (2002): Tenézsüldők felnevelése szabadban – állati jóllét. A sertés, 7/1, 38-45.p.

ALEXY, M. – GUNDEL, J. – NAGY, G. (2002): Februári fiaztatás egyedi kunyhókban. A sertés, 7/2. 24-27.p.

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NAGY, G. – ALEXY, M. – SZENDI, R. (2003): A sertések legeltetésének fontosabb gyepgazdálkodási kihívásai. EU konform Mezőgazdaság és Élelmiszerbiztonság. Nemzetközi Tudományos Konferencia. Gödöllő, 322-330.p.