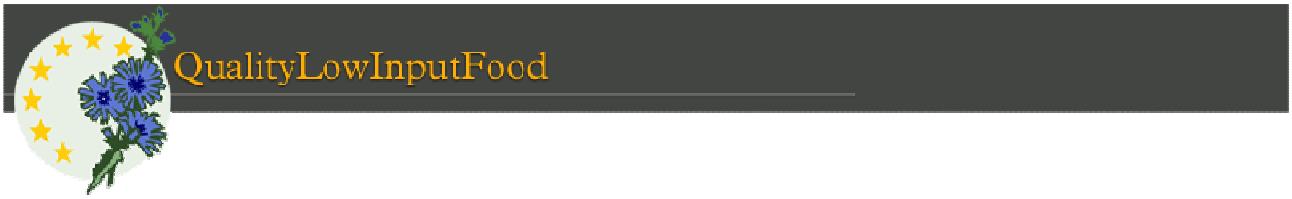

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QualityLowInputFood

Improving quality and safety and reduction of cost in the European organic and 'low input' supply food chains

Integrated Project (IP)

Food Quality and Safety

Deliverable 1 Effect of rooting area and drinker in the outdoor run on behaviour and Ascaris infection of organic pigs

WP4.1.1.3 Effect of run management and design on helminth infections of pigs

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Effect of rooting area and drinker in the outdoor run on behaviour and Ascaris infection of organic pigs

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***Abstract* – Hygiene is often a problem on the outdoor runs of growing organic pigs. Manure and urine are mainly excreted outside, but spread all over the run. Reducing the dirty surface may improve well being, reduce ammonia emission, improve hygiene and reduce labour and parasite infections. The presence of a rooting area and of a drinker on the outdoor run were tested in a 2x2 factorial design. The pens with the rooting areas had a higher number of pigs on the outdoor run than the pens without a rooting area (1.6 vs 1.2 pigs). This was caused by more pigs in area 2 and 3. At higher temperatures there were more pigs outside, except in the rooting area: this was popular at all temperatures.**
A rooting area resulted in a cleaner outdoor area, however in some cases the rooting area became a dunging area. An extra outdoor drinker leads to a cleaner area around the drinker, but to a dirtier indoor area. No difference in Ascaris infection was found between the four treatment combinations.

INTRODUCTION

All organic pigs should have the disposal of an outdoor run. This consists of a partly roofed concrete run. Only sows should have additional pasture. In the concrete run at maximum half of the floor is slatted floor. In this situation it is inevitable that part of the manure and urine will be excreted on the solid floor. This results in extra cleaning labour, ammonia emission and infection burden. To minimise fouling of the solid floor direction of the excretory behaviour is important. Experience with directing excretory behaviour on the outdoor run is scarce, where for the indoor pen more information is available (Hacker et al, 1994; Fraser, 1985; Aarnink, 1996). Pen design, equipment and climate control effect excretory behaviour. So far outdoor runs for growing finishing pigs are often bare without any materials or fibres. Additional material can stimulate species-specific behaviour and subsequently animal well-being and direction of excretory behaviour. At the moment knowledge about the design of outdoor runs to promote concentrated dunging behaviour is lacking
The aim of the project is to stimulate natural behaviour to improve animal well being and direction of excretory behaviour to reduce ammonia emission, cleaning labour and parasitic infection.

MATERIAL AND METHODS

The experiment was carried out in the organic finishing unit of the research farm in Raalte (NL) from September 2003 until March 2005. In total 4 batches were followed in a room with 2 rows of 4 pens for 14 pigs each. One row was on the West and one on the East side of the building. The pens consisted of an indoor area with a creep and 2 feeders and an outdoor area which was roofed for 75%. Water was available in a bowl on the side partition above the slatted floor. Each pen measured a width of 4.57 m and a depth of 4.65 m indoors and 3.20 m outdoors. This means 1.4 m² indoor and 1.0 m² outdoor for every pig. The indoor pens had a 16 cm raised slatted floor of 1.60 m deep near the side wall and a slatted floor of 1.60 m deep on the outer side of the outdoor run. All solid concrete floors have a slope of 1-2% towards the slatted floor. The pigs in each pen received a daily amount of approximately 0.5 kg of chopped straw on the solid floor every day. All pen partitions, except on the outer side of the pen, were solid to prevent pens effecting each other.
The upper 2 m of the side wall consists of a fabric with 50% openings and a manually controlled curtain. An open ridge served as the main air outlet. A creep of 1.75 deep and 3.00 m deep and transparent PVC flaps provided the required microclimate for the animals. No heating system was available in this finishing room.

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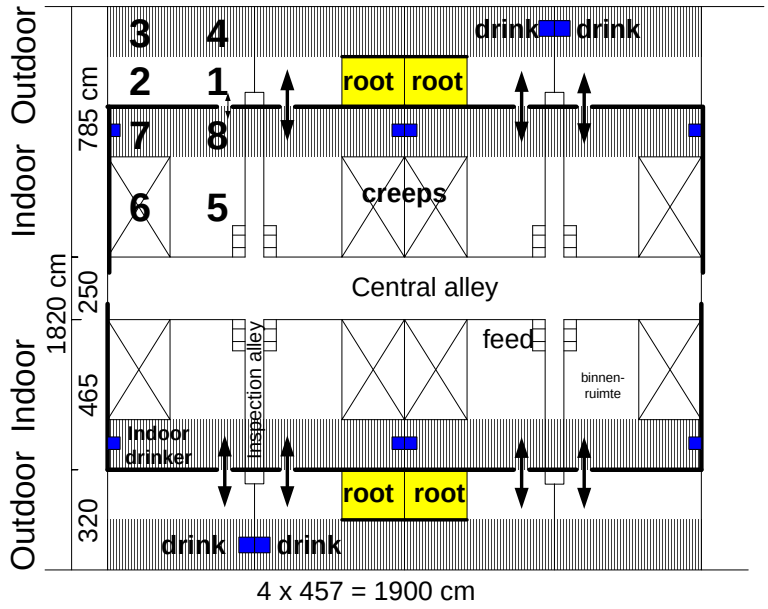

Figure 1. Layout of the room (8 pens indoor and outdoor, area codes in upper left pen)

The piglets (Large White x (Large White x Dutch Landrace)) entered the room at 25 kg (10-11 weeks) and were ready for slaughter at 110 kg (27 weeks). The animals were kept according to the EU regulations for organic pigs (EU, 1999). A group was a mixture of gilts and barrows.

Treatments
A 2x2 factorial design was used to test the effect of the presences of both a rooting area and a drinking bowl in the outdoor run, resulting in 4 treatment combinations.
"Root" - In half of the outdoor runs a rooting area was available with daily fresh chopped lucerne hay. Dirty material was removed on a daily basis if necessary. The rooting area (1.60x2.00 m) was placed on the solid floor of the outdoor run with a 0.90 m high solid partition on the side of the slatted floor and a low barrier of 0.26 m high as entrance.
"Drink"- In half of the outdoor runs with and without rooting area an extra drinking bowl was installed on the slatted floor. The distribution of the treatments is presented in Fig. 1.
Parasite infection
In batch 1 and 2, ca. 160,000 infective eggs of *Ascaris suum* were spread over the faeces deposited against the wall of the outdoor run. In batch 3 and 4, 6 pigs were separated and fed with pellets on which 60,000 infective eggs of *A. suum* were spread.

Observations
Video images are stored every 15 minutes and analysed during daylight periods on Monday, Wednesday and Friday in week 4, 9 and 14 (27,519 observations). Every pen had its own camera hanging 4 m high above the centre of each outdoor run. The outdoor run was divided in 4 quadrants (Fig. 1) and the presence of pigs in each of the four quadrants was counted. Behaviour was not recorded in the indoor part of the pen. The number of present animals per quadrant was log transformed and analysed using log transformation of REML Variance Components Analysis in GenStat 6.1 (Lawes Agricultural Trust, 2002).

Pen fouling was registered twice a week on a scale of 0 (clean) to 5 (very dirty). The outdoor as well as the indoor area were divided in quadrants resulting in 8 scores per pen (Fig. 1). Fouling score was analysed using REML Variance Components Analysis in GenStat 6.1 (Lawes Agricultural Trust, 2002). The results are analysed separately for the first, second and third month in the finishing pen. The model used was FoulingScore = constant + quadrant + root + drink + temperature-out + interactions.
Indoor and outdoor temperatures were registered by the climate computer (Fancom).
Before and during the stay in the pen, pigs were regularly sampled for faecal egg counts. After slaughter, condemnation figures were registered.

RESULTS

In table 1 the mean number of pigs per area are presented per treatment combination.

Table 1 Presence of pigs on the outdoor run, area codes are in upper left pen of figure 1

	root		noroot	
	drink	nodrink	drink	nodrink
Area 1	0.50	0.41	0.53	0.51
Area 2	0.55[a]	0.75[a]	0.25[b]	0.34[c]
Area 3	0.19[ab]	0.27[a]	0.13[b]	0.17[ab]
Area 4	0.27	0.20	0.26	0.19
Tot. animals outside	1.51[a]	1.62[a]	1.18[b]	1.21[b]

[a]Means with a different superscript indicate a significant difference (P<0.05)

Area 2 has more pigs if there is a rooting area. Area 3 (slatted) has more pigs in "root-nodrink" than in "noroot-drink". In total the rooting areas attract more pigs to the outdoor run.

Figure 2 shows the distribution of the presence over the day of the pens with and without a rooting area. It once more shows the attractiveness of the rooting area, but also the late afternoon/early evening as most preferred time of the day to be outside.

According to the statistical analysis the presence of pigs is in all areas significantly effected by temperature: the higher the temperature, the more pigs. But when there is a rooting area pigs there is no relationship with temperature for area 2. This means that the rooting area is also attractive at lower temperatures.

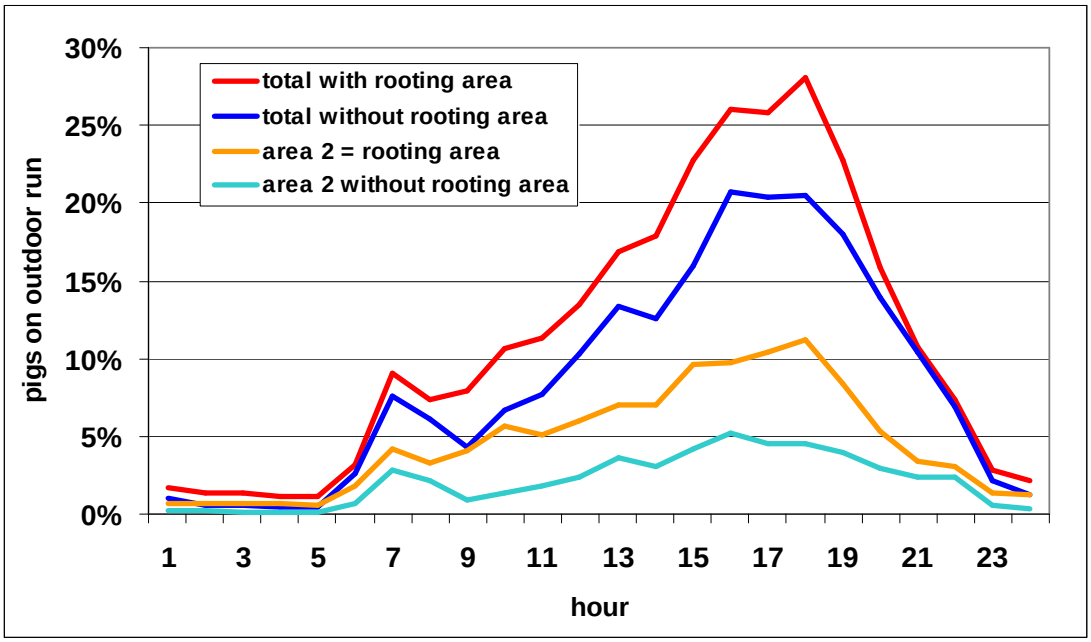

Figure 2. Pattern of presence over the day for the total outdoor run and for area 2 (position of rooting area) in the pens with and without rooting area.

Tables 2 and 3 show the pen fouling scores of the outdoor and the indoor areas.

Table 2 Pen fouling score on the outdoor run, area codes are in upper left pen of figure 1

	root		noroot	
	drink	nodrink	drink	nodrink
Area 1	1.96	2.28	2.22	2.29
Area 2	1.24[a]	0.60[b]	2.51[c]	2.75[c]
Area 3	3.45	3.19	3.55	3.28
Area 4	1.95[a]	3.13[b]	2.29[a]	3.25[b]
Tot. fouling score	2.15	2.25	2.62	2.89

[a]Means with a different superscript indicate a significant difference (P<0.05)

Table 3. Pen fouling score in the indoor pen.

	root		noroot	
	drink	nodrink	drink	nodrink
Area 5	0.32	0.24	0.23	0.09
Area 6	0.04	0.02	0.12	0.07
Area 7	2.52[a]	0.70[b]	2.20[a]	0.75[b]
Area 8	0.98	1.24	1.81	0.95
Tot. fouling score	0.96	0.54	1.08	0.46

[a]Means with a different superscript indicate a significant difference (P<0.05)

The outdoor area is cleaner with a rooting area, but occasionally the rooting area becomes a "toilet". Indoor area 7 (slatted, near indoor drinker) was dirtier in the presence of an outdoor drinker. The animals do not use the indoor drinker if there is outdoor drinker available.

The faecal egg counts didn't show any significant differences between the treatments. The high score in "noroot-nodrink" was mainly caused by an exceptional high score in one pen (see table I in the Appendix).
Half of the livers were condemned at the slaughterhouse because of white spots. Again there was no effect of the treatments.

Table 4. Faecal egg counts (Ascaris) and liver condemnation per treatment

	root		noroot	
	drink	nodrink	drink	nodrink
Faecal egg count (EPG* x 1000)	4.6	2.9	4.9	8.9
Condemned livers (%)	49%	41%	47%	50%

* EPG=Eggs per Gram faeces just before slaughter

CONCLUSIONS

A rooting area attracts more pigs to the outdoor run and leads to a cleaner outdoor run.
An extra outdoor drinker leads to a cleaner area around the drinker, but a dirtier indoor area.
Infections with *A. suum* are easily established and can be transferred from infected pigs to *A. suum*-free pigs. No influence of the treatment combinations could be demonstrated on egg output or liver condemnation figures.

ACKNOWLEDGEMENT

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Appendix: Individual pen scores for EPG and liver condemnation

Table I. Mean EPG (eggs per gram faeces) before slaughter

	Batch 1	Batch 2	Batch 3
Pen 1 (NN)	25,600	8,800	1,900
Pen 2 (RN)	10,100	1,500	1,100
Pen 3 (RD)	5,500	5,900	750
Pen 4 (ND)	3,600	10,500	1,400
Pen 5 (NN)	8,100	7,100	1,600
Pen 6 (RN)	1,800	750	2,000
Pen 7 (RD)	9,100	4,700	1,800
Pen 8 (ND)	5,600	7,200	900

NN= noroot, nodrink RN= root, no drink
RD= root +drink ND= noroot, drink

Table II. Liver condemnation figures

	Batch 1	Batch 2	Batch 3	Batch 4
Pen 1 (NN)	7/14	3/13	8/14	12/14
Pen 2 (RN)	5/14	1/13	12/14	4/14
Pen 3 (RD)	5/14	1/13	10/14	6/14
Pen 4 (ND)	3/14	3/13	6/14	8/14
Pen 5 (NN)	3/14	4/13	8/14	10/14
Pen 6 (RN)	3/14	0/13	9/14	11/14
Pen 7 (RD)	7/14	3/13	11/14	11/14
Pen 8 (ND)	5/14	3/13	13/14	11/13