



## FACT SHEET

### SOIL MONITORING FOR ROTATIONAL OUTDOOR PIGGERIES

Rotational outdoor piggeries can sometimes pose a risk to the environment through unsustainable soil nutrient levels and poor land protection measures.

Nutrients are brought into rotational outdoor piggeries as feed. Depending on stocking density and herd composition, nutrients can quickly accumulate in the soil to high levels. Unless the site is actively managed to promote even manure excretion, nutrients will also be unevenly distributed across the paddocks creating nutrient-rich hot-spots. Although the land areas involved may be relatively small there is an increased likelihood of nitrate-nitrogen leaching from these hot-spots during both the pig phase and the cropping phase that follows. There is also a risk of nutrient removal in runoff or as eroded soil. This risk can be reduced by promoting good land protection.

A Nutrient Management Plan (NMP) is a useful tool for planning a suitable stocking density, length of pig phase and cropping rotation for a rotational outdoor piggery. However, it needs to be supported by regular soil monitoring to confirm that nutrients are maintained at levels that pose an acceptable ecological risk.

Ideally collect and analyse soil samples before a pig phase commences. This can help to confirm that the soil has suitable properties for use by pigs (refer to chapter 17 of the National Environmental Guidelines for Piggeries second edition, (2010) revised). It also provides benchmark data for comparison with future analysis results.

Australian research has identified that although nitrogen, phosphorus and potassium build up in the soils of rotational outdoor piggeries, the amounts accumulated are generally not high except when pigs were stocked on an area for more than two years (Rate 2000). Consequently, in most cases it is appropriate to undertake soil sampling and analysis at the end of any two year period that includes a pig phase. For more heavily stocked paddocks, annual soil monitoring is recommended. Collecting samples from areas that are expected to be nutrient-rich (i.e. between the shelters and the feeding area) provides the best guide to environmental risk.

#### Soil sampling with hand auger



Collect one set of composite (bulked) soil samples for each block of paddocks. A block of paddocks is a group of adjacent paddocks used simultaneously to run pigs. For piggeries that operate with a radial paddock system, one radial would constitute a block of paddocks. Similarly, if a piggery uses eight adjacent rectangular paddocks at a time this would constitute a block of paddocks. For each block of paddocks compile a composite soil sample from soil from at least ten holes distributed across the nutrient-rich land areas.

#### Soil sampling with soil rig





Sampling a representative background plot at the same time will provide baseline data for interpreting analysis results. A representative background plot is a 20 m diameter area located on land that has a similar soil type and is physically close to the land being monitored. Sampling the representative background plot at the same time as the pig paddocks provides a basis for comparison when interpreting soil test results. Representative background plots should be on land that has not been used for outdoor pig production, irrigated with effluent or spread with manure, or recently had fertiliser applied. Carefully note the location of the representative background plot so samples can be collected from the same location each time. For each representative background plot, compile samples for each sampling depth from soil from ten holes.

## Example soil profile



For both the block of paddocks and any representative background plot, sampling depths should be in accordance with the conditions of any planning or development consent, approval, permit or licence. If these do not apply, a single composite sample can be compiled for each of the following depth ranges:

- 0 to 0.1 m
- 0.3-0.6 m or 0.3 m to the base of either the root zone or the base of the soil profile (if less than 0.6 m in depth)

- whole soil profile from surface to a depth of 0.6 m or to the base of the root zone or the base of the soil profile.

It is important that soil analysis parameters meet the conditions of any planning or development consent, approval, permit or licence. If this does not apply, use the soil analysis parameters specified in the National Environmental Guidelines for Piggeries:

Parameter	Depth		
	0-0.1 m	0.3-0.6 m (or to base of root zone)	0-0.6 m (or to base of root zone)
pH	✓	✓	-
Electrical conductivity	✓	✓	-
Nitrate-nitrogen	✓	✓	-
Available phosphorus	✓	✓	-
Phosphorus buffer capacity or phosphorus sorption index	-	-	✓
Potassium	✓	✓	-
Organic carbon	✓	-	-
Exchangeable cations and CEC	✓	✓	-

An agronomist or soil scientist can assist in interpreting soil analysis results. Trigger levels for further investigation for some key parameters are given below:

- Salinity (EC) rating of moderate or higher: ECSE exceeding 3.8 dS/m
- Nitrate-nitrogen concentration in the subsoil exceeding:

Sand	1.2 mg NO <sub>3</sub> N/kg
Sandy-loam	1.5 mg NO <sub>3</sub> N/kg
Loam	1.7 mg NO <sub>3</sub> N/kg
Clay-loam	2.0 mg NO <sub>3</sub> N/kg
Medium clay	3.5 mg NO <sub>3</sub> N/kg
Self-mulching clay	4.5 mg NO <sub>3</sub> N/kg

- Available phosphorus for different methods: Colwell P

Clay <30%, pH <7	31 mg P/kg
Clay <30%, pH >7	59 mg P/kg
Clay >30%, pH <7	75 mg P/kg



Clay >30%, pH >7                      85 mg P/kg

*Olsen P exceeding 25 mg P/kg*

*Bray P exceeding 20 mg P/kg*

*BSES P*

<30% clay                                  31 mg P/kg

>30% clay                                  131 mg P/kg

- Exchangeable sodium % (ESP)              6%

Results can be evaluated by comparison with these triggers for further investigation or with the results for a representative background plot.

If the analysis results interpretation confirms that soil nutrients are at suitable levels the area can be used for ongoing or subsequent pig phases. If they do not, take action to reduce soil nutrients to acceptable levels. This will generally involve destocking the land and growing and harvesting plant material from the area.

## References and Further Reading

Australian Pork Ltd 2010 National Environmental Guidelines for Piggeries 2<sup>nd</sup> Edition (revised), Australian Pork Ltd, Deakin.

Rate, AW 2000, Effects of outdoor pig production on nutrient accumulation and movement in soils, Final Report prepared for the Pig Research and Development Corporation, Report no. UWA 28/1119, University of Western Australia, Nedlands, WA.

## Other Fact Sheets in this Series

- Developing a Nutrient Management Plan for a Rotational Outdoor Piggery
- Land and Water Protection Measures for Rotational Outdoor Piggeries
- Promoting More Even Distribution of Manure Nutrients in Rotational Outdoor Piggeries.

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