Is your effluent nitrogen application rate sustainable?

A case study from the APL "Environmental Training Package for Piggery Managers"

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Do you know how much nitrogen you are applying when you irrigate effluent? What about the amount removed by the plants grown on the effluent irrigation area? Regulatory agencies in most states require a match between the mass of nitrogen applied as irrigated effluent and the mass removed by crop harvest (or livestock grazing) plus an allowance for ammonia volatilisation.

This case study provides the steps for determining an appropriate effluent irrigation rate using the expected crop nitrogen removal rate. It is the second in a series modified from the APL "Environmental Training Package for Piggery Managers". Participants at workshops for the training package work through a series of case studies each highlighting problems and dilemma's faced by the fictional Farmer MacDonald.

Background Information

The three pieces of information needed to determine the appropriate effluent irrigation rate are:

- The concentration of total nitrogen and ammonia nitrogen in the effluent for irrigation
- The nitrogen concentration of the crop being grown
- The expected yield of the crop being grown.

The nitrogen and ammonia-nitrogen concentrations of the effluent should be determined prior to the main effluent irrigation period. Effluent should be analysed just prior to irrigation since the nutrient concentration may vary widely depending on the rainfall pattern. For the purpose of this case study, we will assume that the effluent contains 1000 mg/L of nitrogen, of which 800 mg/L is in the ammonia form. Regulatory agencies usually accept that up to 40% of total nitrogen (in this case 400 mg/L) or up to 50% of ammonia nitrogen (in this case 400 mg/L) will be lost by volatilisation under spray irrigation. Volatilisation occurs when nitrogen is converted to a gaseous form and is transferred to the atmosphere. In this instance, the effective nitrogen concentration of the effluent applied is 600 mg/L (i.e. 1000 mg/L less 4000 mg/L of volatilisation).

The nitrogen content of crops can be obtained from animal nutrition references or by analysing the grain. The concentration data supplied will usually be in the "dry matter" form. The nitrogen concentration of cereal grains is typically 1.6-2.6%, which equates to a protein content of 10-16% (dry matter basis). For the purpose of this case study, we will assume that the nitrogen content of the crop grown is 2%.

The expected yield of crops can be estimated by past experience or by consulting an agronomist. If the nitrogen concentration of the crop is in the dry matter form, the dry matter yield of the crop should be used to calculate the mass of nitrogen removed by the crop. The dry matter content of grains is typically about 88%, so each tonne of

grain contains about 880 kg of dry matter and 120 kg of water. If a harvested grain yield of 3 t/ha is expected, the dry matter yield will be 2.64 t/ha (i.e. 3 t * 88%).

Calculating the Mass of Nitrogen Removed by Crops

The nitrogen removal rate of crops is equal to the dry matter yield of the crop (2.64 t/ha) multiplied by the nitrogen concentration of the crop (2%). In this case, the nitrogen removal rate is 0.053 t/ha or 53 kg/ha/yr. This is also the target nitrogen application rate.

Calculating the Effluent Application Rate

If we wish to apply 53 kg/ha/yr of nitrogen, how much effluent must be applied? After accounting for volatilisation losses, the effective nitrogen concentration of the effluent is 600 mg/L, which is equivalent to 600 kg/ML. If we divide 53 kg/ha/yr by 600 kg/ML, we find that the required application rate is 0.088 ML/ha/yr. This is equal to 88 KL/ha/yr, 88,000 L/ha/yr or 8.8 mm/yr.

Environmental Training Package Valuable for Industry

Mr Ean Pollard participated at an "Environmental Training Package" workshop held in Young. According to Ean, everyone involved in the industry should attend this course.

The package addresses issues that are relevant to piggeries of all sizes. Looking at the sample farm (Farmer MacDonald's farm) allows an objective look at some of the problems that could face our industry and allows us, as producers, to look at our own farm from a different perspective. It also gives producers an idea of what is expected of our industry from an environmental view-point.

This case study is the second of a series condensed from the APL "Environmental Training Package for Piggery Managers". Participants at these workshops work through a series of case studies each highlighting the dilemma's faced by the fictional Farmer MacDonald.

The Environmental Training Package for Piggery Managers is now being presented as a series of workshops throughout Australia. Your group may be eligible for APL funding assistance. For more information, please contact the National Co-ordinator, Robyn Tucker, on 03 – 5381 0709 or 0419 – 787 137.

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