Nitrogen on the farm: Pupil sheet

Slurry (a mixture of faeces, urine and water) is produced in large quantities on livestock farms. Used wisely it is a valuable source of nutrients, especially nitrogen. Wrongly applied however, it can cause pollution as excess nitrates are leached into the ground water and rivers. The toxic gas ammonia is also released from slurry and manure heaps. So how do you get the right balance? Farmers can use software to predict what will happen when they apply a given amount of slurry, depending on how they apply it and what the weather is doing. Below are some examples which were produced using a program called MANNER, which was developed by ADAS.

Here are three scenarios:

- Scenario 1: The tank is full, so they need to empty it quickly, even though it's January. They apply it a rate of 90 m^3/ha, on a field of grass. They use a splashplate spreader, and it rains heavily later that day.
- Scenario 2: They invest in a bigger tank, so they can wait till the end of March, then apply it to grass at 90 m3/ha, again using a splashplate spreader. This time the weather is dry, and it's also very windy.
- Scenario 3: They keep it until mid-April, and this time they split the application into two 45 m^3/ha applications to reduce the risk of runoff from the slurry. They apply the first application in mid-April following the first cut of silage, and the second in late May following the second cut. They apply it using a bandspreader which applies the slurry direct to the soil. There is no wind on either application day, and there is light rain following the first slurry application

To see what happens to the N in the slurry, you can enter the amount and application method, together with a postcode and data about soil type and weather into the computer. Here are the results:

Table 1 The fate of applied nitrogen, in kg/ha

	Scenario 1	**Scenario 2**	**Scenario 3**	
Slurry applied			1st application	2nd application
Estimated total N content (A)	234	234	117	117
Losses				
Nitrate leaching	47	0	0	0
Ammonium volatilization	8	45	5	18
Denitrification (N_2O and N_2)	8	5	4	3
Total N losses				
% N lost				
Available for crop				
This crop	46	59	46	36
Next crop, this year	8	8	4	0
Total N taken up (B)				
Nitrogen efficiency				
B/A x 100%				

1. Calculate the total amount of N lost for each scenario, and enter it in the table. Then calculate the percentage of N that is lost and put that in the row below. Finally, calculate the total N uptake and efficiency of each method in the bottom rows.

2. Which method results in the highest N loss through leaching of nitrates, and why?

3. Which method results it the highest N loss through volatilization of ammonia, and why?

4. Which method is the best and how did you decide?

Cost savings

Slurry is also rich in potassium and phosphorus, as well as nitrogen and other nutrients. Nitrogen, phosphorus and potassium, often referred to as NPK, are the main nutrients that farmers apply to their fields. So using slurry wisely doesn't just keep our rivers and air clean, it also saves money. But how much?

It depends how the slurry is applied. For scenario 3, it looks like this:

Table 2: Cost savings for scenario 3

Nutrient	**Slurry analysis in kg/tonne**	**Amount available to the crop in kg/ha**	**Value in p/kg**	**Saving to farmer in £/h (nearest £)**
Total N	2.6	85 [49 + 36]	90	
P2O5 - phosphate	1.2	108	80	
K2O	3.2	288	60	
			Total saving:	

Complete the table to show how much the slurry is worth to the farmer.

You can also do this with the other two scenarios, using the total available N from the first table, and keeping P and K the same.