

## **Guidance Workbook:**

The intention of this section of the booklet is aimed at assisting you in calculating your farms N requirements and production.

Fertilizer plans can be calculated online, however the purpose of this document is to

1. Assist you in calculating how much manure should be applied depending upon the CNR, this will allow you to develop a better understanding of how a Fertilizer Plan is formulated.
2. Give Livestock Breeders allows the farmer to calculate the manure storage facilities required on their farm based on the amount of manure produced on site.
3. This document will also give you a complete explanation of the purpose of a fertiliser plan and how to read one.

### **Workbook 1**

When calculating how much manure is required for a parcel the first figures which must be taken into consideration is the Crop Nutrient Requirements (CNR). Table 4 below indicates the standard figures in regards to agricultural crops.

<b>Crop Type</b>	<b>Yield (t/ha)</b>	<b>Nitrogen Kg N/ha</b>	<b>Phosphorus kg P<sub>2</sub>O<sub>5</sub>/ha</b>	<b>Potassium Kg K<sub>2</sub>O/ha</b>
Carrot	30	90	80	160
Fennel	50	140	80	160
Wheat	5	150	100	100
Barley	5	100	80	80
Oats	4	60	80	60
Maize	10	250	100	120
Sorghum	30	250	100	150
Rape seed	3	100	100	100
Chickpea	2	30	80	80
Broad bean	3	20	80	80
Bean	3	20	80	80
Pea	15	30	80	160
Grass	30	70	100	100
Sulla	15	50	120	120
Potatoes	30	150	120	240
Basil	30	90	50	150
Brussels sprouts	10	110	80	160
Cabbage	30	110	70	160
Chicory	40	130	60	180
Endive	25	90	50	150
Lettuce	30	130	60	180

Leek	30	150	60	180
Parsley	30	80	60	120
Celery	20	160	90	180
Spinach	25	120	50	150
Asparagus	6	90	80	150
Artichoke	30	170	60	180
Broccoli	20	140	90	180
Cauliflower	30	100	70	160
Dill	1	110	80	80
Cucumber	50	180	120	240
Watermelon	50	160	90	180
French bean	30	40	50	100
Eggplant	35	170	80	240
Melon	40	150	100	200
Pepper	40	200	100	300
Tomato	50	130	100	200
Pumpkin	30	130	80	160
Courgettes	26	130	100	200
Garlic	12	150	80	160
Onion	30	120	80	160
Beet	60	160	70	210
Radish	30	40	100	100
Turnip	30	90	80	160
Table grapes	20	180	90	210
Wine grapes	15	110	60	180
Quince	12	90	60	120
Apple	30	130	60	140
Pear	25	160	80	160
Apricot	20	170	70	210
Cherry	20	110	80	80
Almond	10	100	80	80
Peach / Nectarine	30	170	70	210
Plum	20	150	60	180
Orange	25	210	90	210
Lemon	25	200	80	200
Tangerine	25	180	80	180
Grapefruit	30	170	70	160
Olive	3	130	80	160
Fig	10	90	60	120
Pomegranate	10	90	60	120
Strawberry	30	190	100	300
Mulberry	12	120	60	180

Table 5 below indicates the amount of N present in the different types of manure

Livestock	N content in manure	Maximum rate of manure to be applied (tons/ ha)*
Cattle	0.56%	30
Pig (Solid)	0.81%	21
Layer	1.52%	11
Broiler	2.62%	6
Rabbit	0.83%	20
Sheep	0.90%	19

Through the use of Tables 4 and 5 the maximum amount of manure which can be applied/ ha can be determined. Then this figure can adjusted accordingly depending upon the actual size of the parcel (1Ha = 8.9 tumuli).

E.g. In order to explain how to calculate the amount of manure (which varies depending on the livestock manure to be used) to be applied to a specific crop, the following example is being given: If a farmer is cultivating 1Ha of carrots and he/she will be using cattle manure as a fertiliser, he/she can determine the amount of manure required by the crop through the following calculations.

First it must be determined how many kg of nitrogen are present in every tonne of manure. To do this the following formula can be used:

$$\frac{1000\text{kgs}}{100} = 10$$

This figure is then multiplied by the % of N content in manure (refer to Table 5), in the case of cattle this is 0.56% (and then this figure you change according to the manure you will be utilizing).

$$10 \times 0.56\% = 5.6\text{kgs}$$

This determines that in 1 tonne of cattle manure there is 5.6kgs of N.

You then can refer to Table 4, which states that carrots require 90kg/ N/ha. Therefore the CNR is then divided by the N/tonne

$$\frac{90}{5.6} = 16 \text{ tonnes}$$

Therefore it can be determined that if a farmer were to cultivate 1 ha of carrots then he/she must apply 16 tonnes of cattle manure to reach the N requirements. This figure is then taken into consideration in a Fertilizer Plan as it can vary depending upon the soil analysis results.

Workbook 2

This workbook can be used by the Livestock Breeder to calculate the amount of manure produced on site, thus allowing the LB to determine the manure storage facilities required. The information ultimately obtained from this table can also be used by the LB to determine how much manure he has available to sell to land users. To further accord he/she can also calculate the overall N present on the farm at any given time through the use of Table 5 in collaboration with the results obtained in Schedule 1.

Schedule 1: Calculation schedule for manure storage capacity

<b>Animal</b>	<b>Capacity in Days</b>	<b>No of Animals on Farm</b>	<b>Total Volume Manure for Capacity/Head in M<sup>3</sup></b>	<b>Total Volume in M<sup>3</sup> (CxD)</b>	<b>Storage Facility Type</b>
<b>Broilers</b>	15		0.004		Cesspit
	153		0.015		Manure Clamp
<b>Layers</b>					
	15		0.00106		Cesspit
	153		0.01683		Manure Clamp
In Case of Air Drying Pullets	153		0.009792		Manure Clamp
	15		0.00135		Cesspit
	153		0.00918		Manure Clamp
<i>Total</i>	<i>15</i>				<i>Cesspit</i>
<i>Total</i>	<i>153</i>				<i>Manure Clamp</i>
<b>Rabbits</b>	15		0.04875		Cesspit
(Does)	153		0.11		Manure Clamp
<b>Swine</b>					
Lactating	15		0.15		Cesspit
Gestating	15		0.045		Cesspit
Replacement	15		0.045		Cesspit
Boars	15		0.045		Cesspit
Fatteners/ Weaners	15		0.06		Cesspit
<i>Total</i>	<i>15</i>				<i>Cesspit</i>
Lactating	153		1.16		Manure Clamp
Gestating	153		0.07		Manure Clamp
Replacement	153		0.07		Manure Clamp
Boars	153		0.07		Manure Clamp
Fatteners/Weaners	153		0.07		Manure Clamp
<i>Total</i>	<i>153</i>				<i>Manure Clamp</i>

<b>Ovines and Caprines</b>	15		0.03		Cesspit
	153		0.26		Manure Clamp
<b>Cattle</b>					
Lactating + Dry	153		7.36		Manure Clamp
Lactating Only	15		0.9		Cesspit
lactating + Dry with Bedding	153		8		Manure Clamp
In Case of Separator	15		1.5		Cesspit
	153		1.84		Manure Clamp
Heifers 1-2 Years					
Heifers 1-2 Years + Bulls + Sire	15		0.12		Cesspit
	153		2.88		Manure Clamp
With Bedding	153		3.18		Manure Clamp
In Case of Separator	15		0.29		Cesspit
	153		0.76		Manure Clamp
Heifers 0-1 Years					
Calves	15		0.18		Cesspit
	153		1.12		Manure Clamp
With Bedding	153		1.24		Manure Clamp
In Case of Separator	15		0.26		Cesspit
	153		0.28		Manure Clamp
<i>Total</i>	<i>15</i>				<i>Cesspit</i>
<i>Total</i>	<i>153</i>				<i>Manure Clamp</i>

A livestock breeder can determine the amount of storage space required through the basic mathematical equations supplied in schedule 1. Swine will be used as an example therefore a copy of the section of the schedule concerning swine has been inserted below. Keep in consideration that all areas in red have been added, simply to demonstrate how to work out the table.

<b>Swine</b>		<b>Number of Livestock (Column 1)</b>		<b>(Column 2)</b>	<b>(Column 3)</b>	<b>(Column 4)</b>
Lactating	15	40	X	0.15	6	Cesspit
Gestating	15	20	X	0.045	0.9	Cesspit
Replacement	15	3	X	0.045	0.135	Cesspit
Boars	15	5	X	0.045	0.225	Cesspit
Fatteners/ Weaners	15	350	X	0.06	21	Cesspit
<i>Total</i>	<i>15</i>				<i>28.26</i>	<i>Cesspit</i>
Lactating	153	40	X	1.16	46.4	Manure Clamp
Gestating	153	20	X	0.07	1.4	Manure Clamp
Replacement	153	3	X	0.07	0.21	Manure Clamp
Boars	153	5	X	0.07	0.35	Manure Clamp

Fatteners/Weaners	153	350	X	0.07	24.5	Manure Clamp
<i>Total</i>	153				72.86	<i>Manure Clamp</i>

The first task the LB must do is insert the number of livestock he/she has in Column 1 in relation to the age, gender and breeding cycle (lactating/ gestating). It is necessary to enter the correct figures as the amount of manure varies depending upon the aforementioned factors.

After entering the data into Column 1, these figures must then be multiplied by the data in Column 2, and the result inserted into Column 3.

Column 4 specifies the type of storage facilities these calculations apply to. Therefore all results in relation to (i.e.) cesspits in Column 3 are then added up and the answer is inserted into the total for cesspits. Thus it can be determined that a farm with this population of swine will require a cesspit capable of storing 28.26 M<sup>3</sup> of waste for a period of 15 days.

The same scenario then applies to Manure Clamps, whereby a storage space of 72.86 M<sup>3</sup> is required in this case.

Workbook 3:

The areas which are indicated in blue are the areas the farmer is expected to supply the information for. The NPK values will be obtained through soil analysis and the farmer will then pass this data on to the competent individual compiling the fertilizer plan.

The information indicated in red will then be calculated and the input will be provided by the individual compiling the FP. The amount of manure and inorganic fertiliser which the farmer must apply to accommodate the CNR (of the crop specified at the initial stage of the FP) in collaboration with soil analysis, is indicated at the end of the fertiliser plan in green.

Schedule 2: Example of a Fertilizer Plan

**FERTILISER PLAN TEMPLATE**

**Name:**

**I.D.**

**Address:**


**Crop Type**

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**Expected Yield (t/ha)**

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**Soil Test Data mg/l**

<b>N</b>	<b>P</b>	<b>K</b>

		Amount	Plant nutrients		
			N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O
Plant nutrient requirement kg/ha	<i>area of field</i>		<i>value</i>	<i>value</i>	<i>value</i>
Plant nutrients requirement in the given area (kg)			<i>value</i>	<i>value</i>	<i>value</i>
Nutrient levels in soil					
Nutrients to be applied from irrigation water					
Nutrients to be applied as fertiliser			<i>value</i>	<i>value</i>	<i>value</i>
Type of manure to be applied and the nutrient content in 1 tonne	<i>type of manure</i>		<i>value</i>	<i>value</i>	<i>value</i>
Maximum amount of allowable Nitrogen in livestock manure that can be applied in the given area					
Maximum Rate of manure (tonnes)		<i>quantity of manure</i>			
Amount of manure required in a given area to satisfy the plant requirements, containing the given nutrients (tonnes)		<i>quantity of manure</i>	<i>value</i>	<i>value</i>	<i>value</i>
Amount of nutrients to be applied from fertilisers			<i>value</i>	<i>value</i>	<i>value</i>
Amount of N fertiliser	<i>fertiliser type</i>	<i>value</i>			
Amount of P fertiliser	<i>fertiliser type</i>	<i>value</i>			
Amount of K fertiliser	<i>fertiliser type</i>	<i>value</i>			

Prepared by:

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Signature

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Date