LandWISE

LandWISE Nutrient Budget Templates: Applications

About

LandWISE Nutrient Budget Templates for nitrogen and phosphorous provide a convenient method to compare crop nutrient requirements and nutrient application plans and to assess associated risks.

The Nutrient Budget Templates are minimal-cost, simple mass-balance approximations intended to inform management decisions and support ongoing improvement. Using best available industry recommendations or otherwise justified inputs, they can be used to document and demonstrate Good or Best Nutrient Management Practice.

Pre-planting the LandWISE Nutrient Budget Templates can be used to develop or validate fertiliser plans and indicate anticipated post-crop field nutrient status. Post-harvest they can be used to assess the fate of nutrients given actual events.

Because the basis of nutrient management for nitrogen and phosphorous is different, separate Templates are designed for each.

Applications

The LandWISE Nutrient Budget Templates are useful elements of Farm Environment Plans and as documentation of Good Agricultural Practice. They support a systematic and justified determination of need for application of additional nutrients, and the selection of fertilisers and rates for those nutrients to be applied. They show projected surpluses that may follow production and harvesting of a crop and enable implementation of suitable management strategies based on relative risk.

There is no established rule guiding the frequency with which nutrient budgets should be completed. A Fertiliser Plan should be determined for each scenario. When crop type, expected yield, crop residue nutrient levels, or soil test values vary, new budgets should be created. Good practice includes a post-crop assessment to review the results of prior management decisions.

Nitrogen Nutrient Budget Template

The Nitrogen Template seeks to balance inputs and outputs of Nitrogen, including accounting for changes in soil and crop residue pools. The first stage in the process (Step 2) is creation of a Fertiliser Plan pre-planting.

- Part 1 of the Nitrogen Template draws together soil test results, plant residue levels and industry best practice crop nutrient requirements to compare available nitrogen with justified crop requirements.
    - The default inputs are drawn from laboratory soil test results, anticipated crop yields, recommendations in "*Nutrient Management Guidelines for Vegetable Crops in New Zealand*" (Reid and Morton, 2019) and an assessment of crop residues in the paddock. The result will show if addition of additional nitrogen is justified based on industry guidelines.
- Part 2 of the Nitrogen Template tabulates and calculates the amount of nitrogen in planned fertiliser, compost or manure applications. This enables a matching combination of inputs to be determined, or a provided recommendation to be checked.
- Part 3 calculates a Planned Nitrogen Balance by comparing extra Nitrogen required with planned nitrogen inputs. It may show a budgeted Nitrogen Surplus or Deficit.

If the required and planned amounts balance (zero result), it signifies that just enough Nitrogen will be applied to finish the projected crop. If there is a surplus, planned additions can be reduced to minimise

excess nitrate in the soil. If there is a deficit, planned additions can be increased to ensure the crop will meet yield and quality targets.

The second stage of the Nitrogen Template (Step 3) is a Post-Harvest Assessment once actual events are known.

- Part 1 assesses the amount of Nitrogen in exported crop, and the change in Nitrogen stored in crop residues and the soil pool pre- and post-crop.
- Part 2 tabulates and calculates the amount of Nitrogen that was actually applied to the crop.
- Part 3 calculates the Actual Nitrogen Balance by comparing the total Nitrogen applied and removed and the changes in the crop residue and soil pools.

A balance (zero result) shows all the additions and removals are accounted for. A significant loss shows the fate of all Nitrogen is not explained. It could indicate a loss of Nitrogen either by volatilisation, denitrification, fixation or by leaching.

Phosphorous Nutrient Budget Template

The Phosphorous Template seeks to ensure an adequate but not excessive amount of available Phosphorous is available for the most demanding crop in an annual rotation. As with Nitrogen, the first stage (Step 2) is preparation of a Fertiliser Plan.

- Part 1 of the Phosphorous Template draws together soil test results, plant residue levels and industry best practice crop nutrient requirements to compare available nitrogen with justified crop requirements. The default inputs are drawn from laboratory soil test results, anticipated crop yields, and recommendations in "*Nutrient Management Guidelines for Vegetable Crops in New Zealand*" (Reid and Morton, 2019). The result will show if additional Phosphorus is justified.
- Part 2 of the Phosphorous Template tabulates and calculates the amount of Phosphorous in planned fertiliser, compost or manure applications. This enables a matching combination of inputs to be determined, or a provided recommendation to be checked.
- Part 3 calculates a Planned Phosphorous Balance by comparing extra Phosphorous required with extra Phosphorous planned. It may show a budgeted Phosphorous Surplus or Deficit. If the required and planned amounts balance (zero result), it signifies that soil Available Phosphorous level will be unchanged.
- Part 4 calculates the percentage of applied Phosphorous that is expected to be removed as harvested produce. If the Available Soil Phosphate level is above the recommended optimum for the most demanding crop in the planned rotation, the soil Phosphate can be "mined" and only a fraction of the crop removed Phosphorous need be applied. If the Available Soil Phosphate level is below the recommended optimum for the most demanding crop in the planned rotation, an amount of Phosphorous greater than crop removal should be applied to raise the level.

The second stage of the Phosphorus Template (Step 3) is a Post-Harvest Assessment once actual events are known.

- Part 1 tabulates and calculates the amount of Phosphorus that was actually applied to the crop.
- Part 2 assesses the amount of Phosphorus that is exported in crop removed from the field.
- Part 3 calculates the Actual Phosphorus Balance by comparing the total Phosphorus applied and removed. The Phosphorus Balance is divided by a soil type factor to calculate the likely change in soil test Olsen P to 15cm over time.

A significant deficit will be represented by a decrease in soil fertility. A surplus will indicate an increasing soil fertility. Over the long term, a grower should aim to achieve a balanced phosphorus balance based on the crop rotations agronomic optimum fertility requirements.

Nutrient Budget - Nitrogen

LandWISE INCORPORATED

Date: / /

Step 1 - Paddock Info

Admin

Grower/Agronomist Name:

Trading Name:

Paddock

Paddock Name:

Area (ha):

Crop

Planted: / /

Planned Harvest: / /

Step 2 - Fertiliser Plan

Expected Yield: t/ha

Soil N: kg N/ha

N Quick Test ☐
Lab Test Available N ☐
Min-N ☐

Depth (cm): _____

Nitrogen Recommended: kg N/ha

Fertiliser Planned

Base Fert	0% %N	×	kg/ha	=	0.0 kg N/ha
Starter Fert	0% %N	×	kg/ha	=	0.0 kg N/ha
Sidedress 1	0% %N	×	kg/ha	=	0.0 kg N/ha
Sidedress 2	0% %N	×	kg/ha	=	0.0 kg N/ha
Sidedress 3	0% %N	×	kg/ha	=	0.0 kg N/ha

+ + + + = 0.0 kg N/ha

Planned Fertiliser Nitrogen: 0.0 kg N/ha

0.0 kg N/ha

\+ Previous Crop Residue Supply: kg N/ha

− 0.0 kg N/ha

=

Planned Nitrogen Balance: 0.0 kg N/ha

Positive = N Surplus
Negative = N Deficit

Notes

Step 3 - Post Harvest Assessment

Actual Yield: t/ha × N in Yield: kg N/t = Actual Yield N Exported: 0.00 kg N/ha

Measured ☐ Estimate ☐ (Actual Yield) Measured ☐ Estimate ☐ (N in Yield)

\+

Residue at Harvest: kg N/ha − Previous Crop Residue Supply: kg N/ha = Crop R sidue Balance: 0.0 kg N/ha

Lab Estimate ☐ (Residue at Harvest) Lab Estimate ☐ (Previous Crop Residue Supply)

\+

Soil N (Post-Harvest): kg N/ha − Soil N (Planting): kg N/ha = Soil N Balance: 0.0 kg N/ha

Lab Test Available N ☐
Lab Test Min-N ☐
N Quick Test ☐
Depth (cm): _____

− 0.0 kg N/ha

=

Actual Nitrogen Balance: 0.0 kg N/ha

Positive = N Gain
Negative = N Loss

Crop Harvested: / /

Actual Fertiliser Applied

Base Fert	0% %N	×	kg/ha	=	0.0 kg N/ha
Starter Fert	0% %N	×	kg/ha	=	0.0 kg N/ha
Sidedress 1	0% %N	×	kg/ha	=	0.0 kg N/ha
Sidedress 2	0% %N	×	kg/ha	=	0.0 kg N/ha
Sidedress 3	0% %N	×	kg/ha	=	0.0 kg N/ha

+ + + + = 0.0 kg N/ha

0.0 kg N/ha

Notes

Sustainable Farming Fund · Ballance agri-nutrients · horizons regional council · LandWISE INCORPORATED · Gisborne District Council · Potatoes New Zealand

Nutrient Budget - Phosphorus

LandWISE INCORPORATED

Date: / /

Step 1 - Paddock Info

Admin

Grower/Agronomist Name:

Trading Name:

Paddock

Paddock Name:

Area (ha):

Crop

Planted: / /

Soil Type:

Planned Harvest: / /

Step 2 - Fertiliser Plan

Expected Yield: t/ha

Available Soil P: mg/L

Depth (cm)

Olsen P

Phosphorus Recommended: kg P/ha

Fertiliser Applied

	%P/100		kg/ha	=	kg P/ha
Base Fert		×		=	
Starter Fert		×		=	
Sidedress 1		×		=	
Sidedress 2		×		=	
Sidedress 3		×		=	

\+ \+ \+ \+ =

kg P/ha

− kg P/ha

= kg P/ha

÷ **Crop Removal**

Expected Yield: t/ha × P in Yield: kg P/t = kg P/ha

× 100

= **% of Crop Removal**: %

P Surplus/Deficit: kg P/ha

If Available Soil P is **above optimum**, use only a fraction (less than 100%) of your crop's P removal or maintenance rate to **'mine' soil P**

If Available Soil P is **below optimum**, apply more P in Fertiliser than your crop's P removal (more than 100%) to **raise soil P levels** through "capital application"

Step 3 - Post Harvest Assessment

Crop Harvested: / /

Actual Fertiliser Applied

	%P/100		kg/ha	=	kg P/ha
Base Fert		×		=	
Starter Fert		×		=	
Sidedress 1		×		=	
Sidedress 2		×		=	
Sidedress 3		×		=	

\+ \+ \+ \+ =

kg P/ha

− P Exported in Yield: kg P/ha

= kg P/ha

Actual Yield: t/ha × P in Yield: kg P/t = kg P/ha

Measured / Estimate

Measured / Estimate

Actual P Surplus/Deficit: kg P/ha

÷ Rate Required to inc. by 1 unit: kg P/ha

Soil Rate of Change

Allophanic & Granular (VOLCANIC)	25 kg P/ha
Recent (SANDS) OR Peat (ORGANIC)	13 kg P/ha
Sedimentary (RECENT & BROWN)	10 kg P/ha

= **Phosphorus Change (Olsen P Change)**: units

*If **positive** number, then Olsen P will **increase***

*If **negative** number, then Olsen P will **decrease***

Sustainable Farming Fund · Ballance agri-nutrients · horizons regional council · LandWISE INCORPORATED · Gisborne District Council · Potatoes NEW ZEALAND