Nutrient Budgeting App: Background & Instructions

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Whether you are an organic producer, transitioning to organic production or a non-organic producer wanting to better understand how legumes in your rotation can help you reduce synthetic nitrogen use, the Nutrient Budgeting App will help you understand the efficiency and flow of nutrients in your fields.

The Nutrient Budgeting App (NBA) will help you calculate whether nutrients are accumulating or being depleted from your fields. It makes it easy for you to add up the nutrients you are adding to your fields (including through N fixation by legumes) and subtract the nutrients that leave your fields to help you plan your crop rotations.

Note: The app is currently designed to be used on a desktop, not mobile devices.

Acknowledgement: The algorithms used in the Nutrient Budgeting App (NBA), as well as general information on the use and interpretation of nutrient budgets, were developed by the Natural Systems Agriculture Lab at the University of Manitoba.

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What Is Nutrient Budgeting?

Creating a nutrient budget will help you evaluate the effect of nutrient management on your field's sustainability and help you assess efficiency and improve resource allocation. The Nutrient Budgeting App was developed to help producers that rely on biological nitrogen fixation to optimize production while decreasing environmental nutrient loss by doing a better job of matching soil nutrients to the needs of the following crops.

Much like a profit and loss statement for a business, a nutrient budget (or balance) provides information about whether nutrients are accumulating or being depleted from a field. A nutrient budget adds up the nutrients that are brought onto the field (including through nitrogen (N) fixation by legumes) and subtracts the nutrients that leave the field, providing the nutrient balance. Nutrient imports and exports are calculated by multiplying the quantity of each material by its nutrient concentration.

Who Should Use the Nutrient Budgeting App?

Whether you are an organic producer, transitioning to organic production or a conventional producer wanting to better understand how legumes in your rotation can help you reduce synthetic nitrogen use, the Nutrient Budgeting App will help you understand the efficiency and flow of nutrients in your fields.

It is a useful tool to account for the N contribution of legumes grown for forage, green manure, or grain (e.g., peas, fababeans). It may be most beneficial to farmers growing legumes at some point in a multi-year rotation, to determine a reasonable yield expectation of a crop following the legume year, based on the legume N contribution, and/or how much additional N would be required to achieve a specific target yield.

The app will also assist farmers in knowing how much phosphorus (P), potassium (K), and sulphur (S) have been exported in harvested crops, and the overall balance of these nutrients based on imports and exports. This can help when choosing the application rate of an input such as manure required to replace the exported nutrients.

What is a Rotation Budget?

A rotation budget is one valuable way to use the Nutrient Budgeting App. **A rotation budget focuses on one field at a time.** All the nutrients added to or removed from the field are quantified for each year of a complete rotation. A rotation budget is useful for assessing the current nutrient balance in a field and also for planning future rotations.

To create meaningful nutrient budgets, we need to accurately quantify the following:

1. **Quantities of all materials entering the field.** The most common import materials include seed, manure, and other soil amendments.
2. **Quantities of all materials leaving the field.** The most common export materials include grain and other cash crops, hay, and straw.
3. **Nutrient concentrations of all the above materials.** Nutrient concentrations of farm products (crops, manure, others) vary widely and samples should be analyzed for each farm. If analyzed samples are not available, estimates from other farms or standard values may be used (See Video 1-Nutrient Sources)
4. **Nitrogen fixation.** The N fixed by legumes can be estimated based on biomass or yield of legume crops and their N concentration, using calculations specific to each crop type.
5. **Field size.** It is useful to know the total nutrient budget for an entire field as well as on a per-acre basis.

Assessment vs. Planning

Rotation budgets can be used either to assess current farm situations and design new ones. New scenarios can involve specific changes to the current system, such as adding manure, or entirely new systems.

QuickStart Guide

In addition to this guide, you can access tutorial videos to help you navigate the Nutrient Budgeting App. These videos are located under the Resources Tab > Instructions and Tutorials, or you can find them directly on the Pivot and Grow website.

Making an Account

To start using the Nutrient Budgeting App, you'll first need to create an account. This allows you to save and revisit your field data, which will be stored anonymously.

Please note that the information collected by the Nutrient Budgeting App may be used in the aggregate for research and statistical analysis. This helps us improve the tool and better meet your needs.

Entering Field Information into the App

Begin by clicking on the **'My Fields' tab** of the Nutrient Budgeting App.

Step 1. Enter a Field

Enter the name of your field and its size in acres.

Step 2. Enter a Year

Enter the year you want to begin your rotation for that field. For example: You may want to start with a past year and work your way up to the present to help you plan for future rotations.

Step 3. Enter Nitrogen Fixation Option

N Fixation: In this section, only include legumes that are nodulated and show signs of effective nitrogen fixation.

Unit Conversion: All inputs must be converted to **pounds, bushels, lbs/acre, or bushels/acre** before entering them into the app. Refer to the instructions in the **Information Collection** section for details.

➢ Green Manures and Underseeded Legumes

1. Select "Green Manure" and click the plus (+) button. Choose either 'Forage legume for green manure' or 'Grain legume for green manure' from the dropdown list. The crop type you select affects the calculation for below-ground nitrogen contributions.
   - **Grain legumes**: Peas, lentils, faba beans, hairy vetch, soybeans, chickling vetch, etc.
   - **Forage legumes:** Includes annual, biennial and perennial small-seeded forage legumes (e.g., alfalfa, clover, sainfoin, sweet clover, crimson clover, etc.)
2. Enter the crop biomass, moisture content*, percent legume in the biomass (by weight) and plant N concentration in the appropriate entry fields.

   **To find the default moisture content value for a crop click on the Nutrient Sources tab and search the Std. Moist. % column for the standard MC of your crop.*

3. Press **Save** when done.

Notes on Entering Mass per Acre or per Field

When entering mass, you have the option to input:

- **Units per Acre** (lbs/acre, bushels/acre), or

- **Total Mass per Field** (lbs or bushels).

If you prefer to enter the **total mass** for the entire field, the app will automatically divide by the field size (in acres, entered during field creation) and convert it into per-acre units.

➢ Hay and Pasture

This section is designed specifically for small-seeded forage legumes. If you're using grain legumes (e.g., peas) as forage, please refer to the "Green Manure" section instead.

To accurately account for nitrogen (N) fixation, you can enter for each crop multiple times to reflect N fixation from each hay cut, grazing event, and/or regrowth separately.

1. Select "Hay/Pasture" and click the plus (+) button.
2. Choose from the dropdown menu: "Hay," "Pasture," or "Unharvested Regrowth."

3. Enter the crop Details.

- Biomass (hay yield or measured/estimated biomass), moisture content, percent legume in the biomass (by weight) and plant N concentration in the appropriate entry fields. **Press Save.**

TIPS

Determining Percent Legume: To obtain accurate legume percentage, you may want to cut, sort, and weigh a sample of standing hay. Even fresh weight provides a reliable estimate, and visual assessments are acceptable as well.

Estimating Regrowth Biomass: Regrowth biomass can be estimated by comparing it to a previous hay yield (e.g., 60% of the 1st cut yield).

Moisture Content Guidelines

- Hay Yields: Generally reported at a moisture content of 15%.
- Pasture Biomass: Usually reported as dry matter yield (0% moisture content). Ensure the moisture content you enter aligns with the biomass value you input.

Using N Concentration

- If only one sample has been analyzed from a field, apply that N concentration across all hay cuts, grazing events, and regrowth for that field. If the N concentration for your legume crop is unknown, use the default value of 2.2%.

➢ Pulses and Soybeans

This section is for legume crops harvested for grain. If a pulse crop was terminated before seed harvest, please use the "Green Manure" section above.

1. Select "Pulse/Soybean" and click the plus (+) button.
2. Choose "Edible Bean," "Other Pulse Crop," or "Soybean" from the dropdown menu.
3. Enter crp details: the crop seed yield (lbs/ac or lbs for the entire field) and moisture content (use 13% as the standard moisture if you don't know the moisture content of your pulse/soybean harvest). **Press Save.**

Step 4. Enter Nutrient Imports

Use this section to record all products brought into the field, including seed. Click the plus (+) button to add an import, then fill in the following information:

- **Item.** Select the product from the dropdown menu. Common items include seed, manure, and crop inputs. The order does not have an impact. If a product is missing from the list, add it on the "Nutrient Sources" tab. Refer to the "Nutrient Sources and Standard Nutrient Coefficients" section below for guidance.
- **Mass.** Enter the quantity applied, specifying your preferred unit (e.g., lbs, lbs/acre, bushels, or bushels/acre).

- **Moisture Content (%).** Enter the moisture content that corresponds with the mass entered.
- If you're unsure of the standard moisture content, refer to the database. **Press Save.**

The App will then calculate the lb/acre of nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) added to the field for each imported product.

Step 5. Enter Nutrient Exports:

In this section, record all products removed from the field. Click the plus (+) button to add an export, then fill in the following information:

- **Item.** Select the exported product from the dropdown menu. Common exports include grain, straw, harvested forages (such as hay or silage), and grazed forage.
- **Mass.** Enter the quantity of each exported item. For grain, record the actual amount removed from the field, including screenings cleaned out later.
- Grazed forage quantity can be estimated by measuring plant biomass before and after grazing or using another suitable method to gauge forage removal by livestock.
- **Moisture Content (%).** Enter the moisture content of the exported grain, hay or other product that corresponds to the mass that you entered for that export.
- If you're unsure of the standard moisture content, refer to the "Nutrient Sources" tab. **Press Save.**

The App will automatically calculate the lb/acre of nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) removed from the field with each exported product.

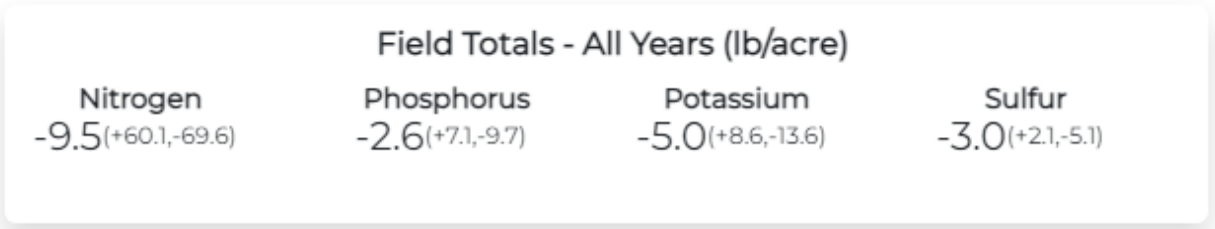
Interpreting Results

Field Totals - All Years (lb/acre)

The Rotation Balance Summary Bar (movable but typically located in the top right corner of your screen—see image on next page) displays the total nutrient flows for the entire crop rotation (all years) of that field.

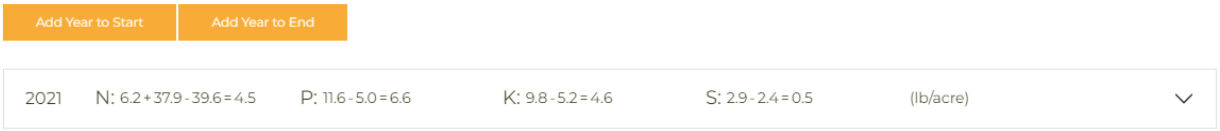
- The bar shows the total nutrient balances for nitrogen (N), phosphorus (P), potassium (K), and sulfur (S) in large, bold numbers, expressed in pounds per acre (lb/ac).
- It also indicates the average nutrient balance based on the number of years in the rotation
- Smaller numbers in brackets next to these bold figures represent the total amounts of each nutrient imported and exported throughout the entire crop rotation.

This overall balance is useful for determining how much of a specific nutrient needs to be added to correct any deficiencies in the rotation. For example, if the total phosphorus (P) deficit over a 6-year rotation is 20 lb/ac, applying manure at a rate of 20 lb P per acre can help restore the P budget to balance.



Annual Nutrient Summaries:

The annual imports, exports and balances for N, P, K and S, expressed on a lb/acre basis, are displayed in a row at the top of each year's data entry section. The year (e.g., 2021) is located on the left side of the row, with an arrow on the right side. lick the arrow to expand or collapse the data entry fields. The collapsed view allows for a quick glance at the annual summaries, while the expanded view provides detailed information for that year. These annual summaries are valuable for comparing different years and fields, as they clearly show when and where nutrient imports and exports occurred.



Ideally, the average yearly balance (per acre) is near zero. However, achieving a perfectly balanced rotation is unlikely. Keep in mind that these budgets are estimates and do not include certain processes: some nutrients are lost to the environment (leaching, volatilization, erosion, or others), and some may be deposited from the atmosphere and/or released from the soil's parent material over time. Nutrients are also released from soil organic matter and, depending on cropping practices, excess nutrients may be used to build up soil organic matter. For these reasons, small surpluses and deficits are not a cause for concern (see Table 1).

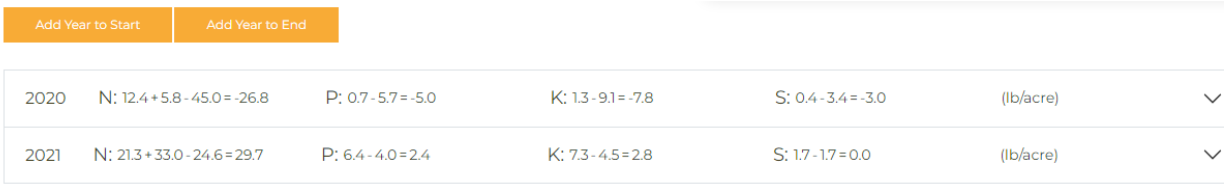
However, if balances – either negative or positive – are large, nutrient management is likely not being optimized. See the Recommendations section below for more details.

Table 1. General guidelines for target values for average annual nutrient balance (lb/ac). Ranges include both positive and negative balances.

Nutrient	Target	Acceptable	Problematic
N	0-10	10-20	>20
P	0-2	2-5	>5
K	0-10	10-20	>20
S	0-2	2-5	>5

Year by Year Balances

To see the year-by-year balances at a glance, click the arrow on the right hand side of each year to see the collapsed view. These balances provide additional details about the role of each crop in determining the final nutrient balance. In most crop rotations, certain years will exhibit significant deficits, while others may show large surpluses. This variability is typical when using green manures and making periodic applications of inputs, such as manure, to manage soil fertility.



This section can be particularly helpful in identifying the reason for a large surplus or deficit over the course of the rotation. For example, an overall K deficit may be traced back to K removal in hay crops or cereal straw. Further insight can be gained by examining the detailed nutrient imports and exports in the data entry sections for the year in question.

Information Collection

Information Required for a Nutrient Budget

Information is required on the type and quantity of products moving onto and off fields. Collect the following information **for each year of an entire rotation on one field**:

Field info:

- Field Name
- Field Size (acres)

Imports – type and amount (per acre or total):

- Seed
- Manure, compost or other soil amendments applied (obtain manufacturer's analysis for any commercial products)
- Yield or biomass of all legume crops (pulses, hay, green manures) for estimating N fixation. Percent legume is required for mixtures.
- Concentrations of N, P, K and S of all products imported to the field. Concentration of N in legumes is required to estimate N fixation.
- The moisture content that corresponds to the nutrient concentrations used. For example, the plant N content of legume biomass will be different at air dry moisture content than it will be at zero percent moisture.

Exports – type and amount (per acre or total):

- Crop yield (grain, hay, greenfeed, etc.)
- Straw removed
- Estimate of grazed forage biomass
- Concentrations of N, P, K and S of all products exported from the field.
- The moisture content that corresponds to the nutrient concentrations used.

Deciding Which Units to Use

For most import and export items the app allows you to choose between four different units of measurement: lbs/acre; lbs; bushels/acre; and bushels. Use the lbs or bushels options if you know the mass for the entire field rather than per acre. If you know the mass of your inputs or exports in different units (e.g. kg; tonnes) you will need to convert the mass to one of the units available in the dropdown lists. The list of nutrient sources in the Nutrient Sources tab shows standard bushel weights of most field crops grown on the prairies. For additional information on how many pounds or kg are in a bushel or tonne of common agricultural crops, here are a couple useful resources:

- Standard Weights per Bushel for Agricultural Commodities-Small Farm Canada (both lbs/bushel and kg/bushel)
- Crop Bushel Weights-Rayglen Commodities (both lbs/bushel and bushels/tonne)

Nutrient concentrations of products (e.g seed, manure, harvested grain, straw, etc.) is also key information used by the Nutrient Budgeting App.

Two Options for Determining Nutrient Concentrations

1) **Collect your own samples for analysis**: Nutrient concentrations for N, P, K and S, based on tests of your own farm products are recommended to generate more accurate results. ***Refer to the Sample Collection and Analysis section below*** for detailed instructions on how to collect representative samples and convert values for use in the App.

2) **Use the Standard Nutrient Coefficient Values in the 'Nutrient Sources' Tab of the Nutrient Budgeting App.** When sample analysis of your own farm products isn't possible, the standard N, P, K, and S values listed in the 'Nutrient Sources' tab provide the default nutrient concentrations, based on available literature. ***Refer to the Nutrient Sources section below*** for detailed instructions on how to read and modify values in the Nutrient Sources tab of the app.

If your own sample analysis values become available later, you can edit the values in the app. See more below and in the tutorial video.

Sample Collection and Analysis

Samples of farm products should be analyzed to obtain actual nutrient concentrations values for each farm. We recommend analyzing samples of all major farm products whenever possible. When analysis of a particular product is not possible, estimates from other farms or the standard nutrient coefficient values in the Nutrient Sources tab of the Nutrient Budgeting App can be used.

Sample collection procedures

Sample collection can be done by farmers themselves. The general procedures are the same as collecting representative samples for any other purpose, such as grain quality.

Choosing which products to analyze:

If it is not possible to analyze all farm products, priority should be given to those that have the biggest influence on nutrient flows for a farm or field. This will vary with each specific situation. For a rotation budget on a particular field, products from other fields on the farm may be analyzed as a proxy for crops grown in past years of the rotation.

In general, products should be selected as follows:

1. Manure – if any manure is applied, a sample should be analyzed, if possible.
2. Crops – analyze samples of the crops (including harvested forages) that will have the greatest impact on the nutrient budget. Choose crops based on the following priorities:
    - Crops with the greatest acreage and/or yield in the current year.
    - Specialty crops for which standard nutrient coefficients (literature values) are not available.

Collecting representative samples:

Samples should be collected in such a way that they accurately represent the whole field or farm. Farmers should use the following guidelines when collecting samples (Table 1).

Table 2. Sampling procedures for grain, hay and manure samples.

Sample type	When to sample	How to collect a representative sample	Final sample size (approx.)	Sample Handling
Grain	When moving grain into or out of the bin	Collect samples from every load. Mix thoroughly and take a subsample.	1 cup	Send sample "as is" (not cleaned).
Hay	After hay is baled	Sample from 15-20 random bales, preferably using a corer. Send the whole sample, unless it is too large.	0.5 lb (250 g)	If subsampling is required, use the quartering method described in the OCES link below.

Manure	During application or from pile as close to application date as possible	Sample from 10-20 loads or points in the manure pile. Mix thoroughly and take a subsample.	1 lb (500 g)	Refrigerate sample. Freeze it if it cannot be sent off within two days.

Sample analysis

Send samples for nutrient analysis at a testing lab. Analysis should include all macronutrients (NPKS) as well as any micronutrients of interest. At many labs, a complete analysis does not cost any more than analyzing for the four macronutrients.

For nutrient budgets, we are interested in the ***total*** nutrient concentration, rather than the level of ***available*** nutrients. Manure N concentration in particular may be reported on an "available N" basis, unless otherwise specified. Ask for a "total N" analysis for manure and compost.

Converting laboratory analysis results:

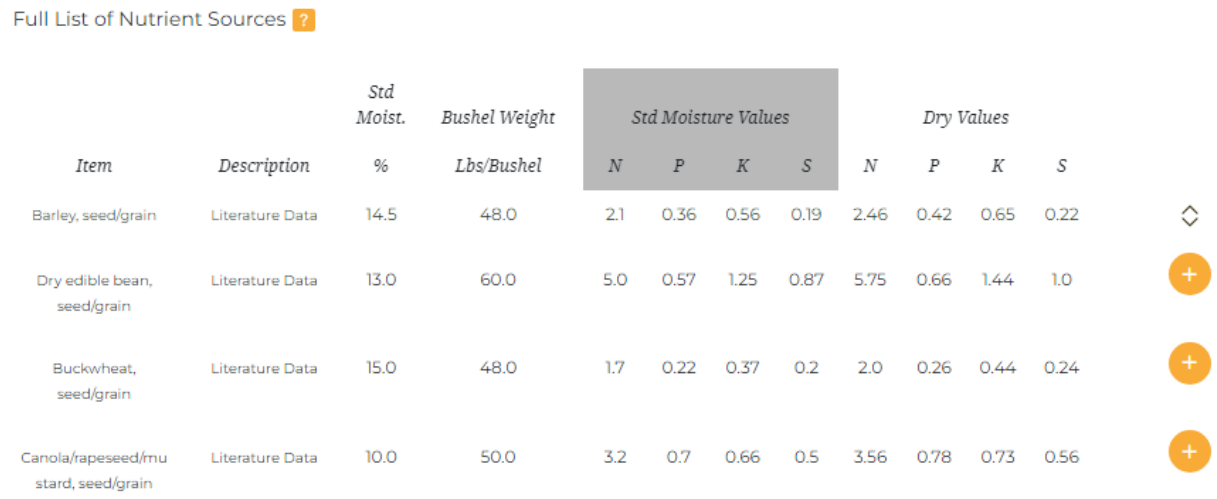
All nutrient coefficients used in the App are expressed as a **percentage** of the specified item. Most labs will report results from N, P, K and S nutrient analysis as a percentage; however, some analyses may be reported in other units, such as lb/ton (manure) or g/kg. If this is the case, you will need to convert these units to a percentage (based on weight) before proceeding with the next step.

It may also be necessary to convert P and K nutrient analyses:

- P may be reported as P_2O_5 (phosphate). To convert P_2O_5 to P, multiply by 0.44.
- K may be reported as K_2O. To convert K_2O to K, multiply by 0.83.

Nutrient Sources: Standard Nutrient Coefficients

When sample analysis of your own farm products isn't possible, the standard values listed in the 'Nutrient Sources' tab can provide a general estimation of nutrient concentrations, based on available literature.


Full List of Nutrient Sources

Item	Description	Std Moist. %	Bushel Weight Lbs/Bushel	Std Moisture Values N	P	K	S	Dry Values N	P	K	S
Barley, seed/grain	Literature Data	14.5	48.0	2.1	0.36	0.56	0.19	2.46	0.42	0.65	0.22
Dry edible bean, seed/grain	Literature Data	13.0	60.0	5.0	0.57	1.25	0.87	5.75	0.66	1.44	1.0
Buckwheat, seed/grain	Literature Data	15.0	48.0	1.7	0.22	0.37	0.2	2.0	0.26	0.44	0.24
Canola/rapeseed/mustard, seed/grain	Literature Data	10.0	50.0	3.2	0.7	0.66	0.5	3.56	0.78	0.73	0.56

The nutrient sources in this tab are commonly added inputs in the form of seeds/grains, hay, grasses, straw and manures, and are listed in alphabetical order by category.

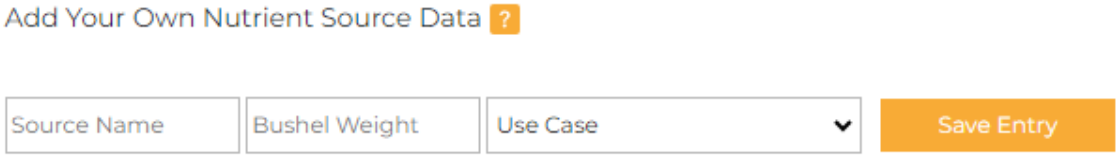
Add Your Own Data for a Listed Nutrient Source

If you have test results from your own nutrient source, you can also add an additional item to any of the listed nutrient sources. Simply press the orange circle + button to the right of the item, then press the orange circle + button next to "Add Additional". You will want to name your own nutrient source to differentiate it from the literature values. Then proceed to enter the values from your test results under the appropriate heading. When done, **press save.**

The next time you go to enter that particular nutrient source into one of your fields in the "My Fields" tab, in the drop down menu you will be able to select from either the literature value or your farm's data value for that particular nutrient source.

Add a New Nutrient Source

If you are importing or exporting a product that is not in the list of nutrient sources you can add it in the Nutrient Sources tab under "Add your Own Nutrient Source Data".



1. Type the name of the new nutrient source in the "**Source Name**" entry box.

2. If it is a grain, type the bushel weight in lbs/bushel in the "**Bushel Weight**" entry box, otherwise leave blank.
3. In the "**Use Case**" entry box, click the down arrow and select how the nutrient source is used.
    a. Select "Import/Seeding" if the nutrient source is only imported (e.g. fertilizer or manure).
    b. Select "Export/Harvest" if the nutrient source is only exported (e.g. hay).
    c. Select "Both" if the nutrient source could be both imported and exported (e.g. grains).
    d. Select "Nitrogen Fixation" if the nutrient source is a legume that fixes nitrogen (e.g. Sweet Clover green manure).
4. Depending on your selection under "Use Case" a new entry box will appear.
    a. If you selected "Import/Seeding", "Export/Harvest", or "Both" the new entry box will be "**Category**", and from the dropdown menu you must select "Crop", "Straw", "Grazed Forage", "Forage" or "Other" to indicate the type of nutrient source.
    b. If you selected "Nitrogen Fixation" for how the nutrient source is used the new entry box will be "**Fixation Type**" and you must select "Green Manure", "Hay/Pasture", or "Pulses/Soybean" as the type of nitrogen fixing crop being entered.
5. Depending on your selection under "Nitrogen Fixation" a new entry box may appear.
    a. If you selected "Green Manure" the new entry box will be "**Green Manure Type**" and you must select either "Grain" if it is a grain legume (e.g. faba beans) being grown as a green manure, or "Forage" if it is a small-seeded forage legume (e.g. clover or alfalfa) being grown as a green manure.
    b. If you selected "Pulses/Soybean" the new entry box will be "**Pulses/Soybean Type**" and you must select "Soybean", "Edible bean", or "Other" as the type of legume being grown as a cash crop for grain harvest.
6. Click "Save Entry" and scroll to the very bottom of the full list of nutrient sources to find your new entry.
7. Press the orange circle + button to the right of the item, then press the orange circle + button next to "Add Additional". Name your item (again), then enter the moisture content (%) and the concentrations (%) of N, P, K and S at that moisture content.
8. Click Save. The new nutrient source will now appear in the dropdown list for that category of nutrient source on the My Fields tab.

Developing Recommendations Based on a Rotation Budget

Theoretically, an overall nutrient balance over a full crop rotation near zero is best. Large surpluses or deficits are a sign that nutrient use is possibly not being optimized.

However, there are many factors that affect the rotation nutrient balance. Sometimes these factors may create results that are counterintuitive and difficult to interpret. In some cases, a field that has

a balance near zero may not have optimal soil fertility and use of nutrients. An extreme example is a field that is fallowed for several years – with no imports or exports, the rotation balance is zero!

Remember that nutrient budgets are just one tool for assessing system health and should be used together with field observations and other tools to gain a more complete understanding of nutrient dynamics on the farm. Using the nutrient budget tool together with soil tests and the green manure bioassay tool can help to clarify the nutrient status of the field.

https://pivotandgrow.com/resources/green-manure-tool-kit/

Also remember that this type of nutrient budget does not provide information about the rate of nutrient release from green manures, terminated forage stands or manure. Nutrient availability to crops can be estimated using other information (analysis of available N, C:N ratios, soil management and others).

Factors that contribute to nutrient deficits (negative balances) in rotation budgets include the following:

- ***Nutrient removal in excess of replacement.*** The most likely cause of a nutrient deficit is crop harvest with little or no nutrient addition.
    - An N deficit may mean that more legumes should be included in the rotation.
    - Deficits of other nutrients (P, K, S) are common on Prairie organic farms and are not necessarily problematic in the near to medium term. However, a long-term plan to replace exported nutrients is required to avoid depleting nutrients to a level that impacts crop growth. The average annual deficit or total rotation deficit can be used to calculate the quantity of soil amendments required to bring the long-term nutrient budget into balance.
- Hay and straw removal can create large K deficits.

Factors that contribute to nutrient surpluses (positive balances) in rotation budgets include the following:

- ***Large application of soil amendments.*** If amendments are applied in excess of crop requirements, a surplus will result. In a rotation budget, it's very common to have large surpluses in individual years due to N fixation by green manures or periodic manure application. However, if surpluses occur in many years, application rates may be too high, or crop yields (nutrient exports) may be too low due to other factors such as weeds (see below).
- ***Poor crop yields due to factors other than nutrients:*** If crop yield is low because of weeds, drought, hail, excess moisture or other non-nutrient factors, nutrient export will be low, even if nutrient levels are good. This may result in an apparent surplus of nutrients in a particular year or even the whole rotation. However, the problem is likely not due to too many nutrients entering the system, but rather other factors limiting yield or harvestability.
- ***Poor crop yields and/or nutrient concentrations due to poor soil fertility.*** Low soil N can also cause crops to have a low N (protein) concentration, which lowers the N output and, paradoxically, may contribute to an N surplus in a rotation budget.

Situations in which nutrient use is not optimized, even though the rotation budget is balanced, include the following:

- ***Poor crop yields:*** A farm with low crop yields will have low nutrient exports. In a situation where few or no nutrients are added, low yields may result in a smaller deficit (i.e. bring a negative nutrient balance closer to zero) than if yields had been good.
- ***Low nutrient concentration in grain or forages:*** If soil is deficient in a particular nutrient, the nutrient levels in the products grown on that soil may be low. Low nutrient concentration means lower nutrient exports, which may result in a smaller deficit than if products had a high nutrient concentration.
- ***Fallow years or unseeded acres.***

Situations in which a nutrient surplus or deficit may be desirable (based on soil testing, the green manure bioassay test and field observations), include the following:

- ***Soil nutrients are low:*** If soil nutrient levels are depleted, importing additional nutrients through N fixation and/or inputs such as manure is recommended. This may result in a rotation operating at a surplus until soil nutrient levels are adequate.
- ***Soil nutrient levels are high:*** Excess nutrients can cause weed problems and can easily become pollutants. If soil nutrient levels are high, it is advisable to reduce inputs and/or take measures to increase yields (i.e. through weed management) and operate a deficit until soil nutrient levels have been lowered somewhat.

Exporting Data

You have two options for exporting your field data, both found under the **Resources tab**:

- Export All Data - PDF
- Export All Data - Excel File

The reports offer two different formats for presenting the results of your nutrient budget. These reports can be used for your own record-keeping. If you are working with an agronomist you may want to send them your nutrient budget information so they can analyze and make recommendations.

These reports present the results of your nutrient budget in two different formats. They can be used for your own record keeping or as a way to share your budget with others. If you're working with an agronomist, you can send them your farm data for analysis to receive recommendations.

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