nutrient stewardship

4R Planning Templates

A Guide to Developing 4R Plans

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Introduction

The 4R Nutrient Stewardship framework helps organize nutrient management decisions by focusing on what's important; applying nutrients using the Right Source @ the Right Rate, Right Time and Right Place®. It is about using fertilizer and other nutrient sources more effectively and efficiently. For growers this translates into getting more value for every dollar spent on nutrient management and reducing negative off-farm impacts at the same time.

Including 4R in a whole-farm sustainability plan maintains economically resilient farms, helps to sustain vibrant rural communities, and contributes to national and global food security[1].

The core of successful on-farm implementation is developing a 4R Nutrient Management Plan. One of the key principles of 4R Nutrient Stewardship is site-specific management where nutrient management practices are optimized to match the requirements of the crop and manage environmental risks at the individual field or sub-field level. The result is a series of practices suited to local conditions. These BMPs need to be regionally specific, consistent with global 4R principles, and supported by scientific studies that are relevant to the local cropping systems. Guidance on regionally appropriate suites of 4R practices, reviewed and vetted by a panel of expert practicing and research agronomists, is available on the Fertilizer Canada website. Farmers and their agronomic advisors can use their local knowledge and experience to select BMPs from the guidance document and fine-tune them for the individual farm.[2]

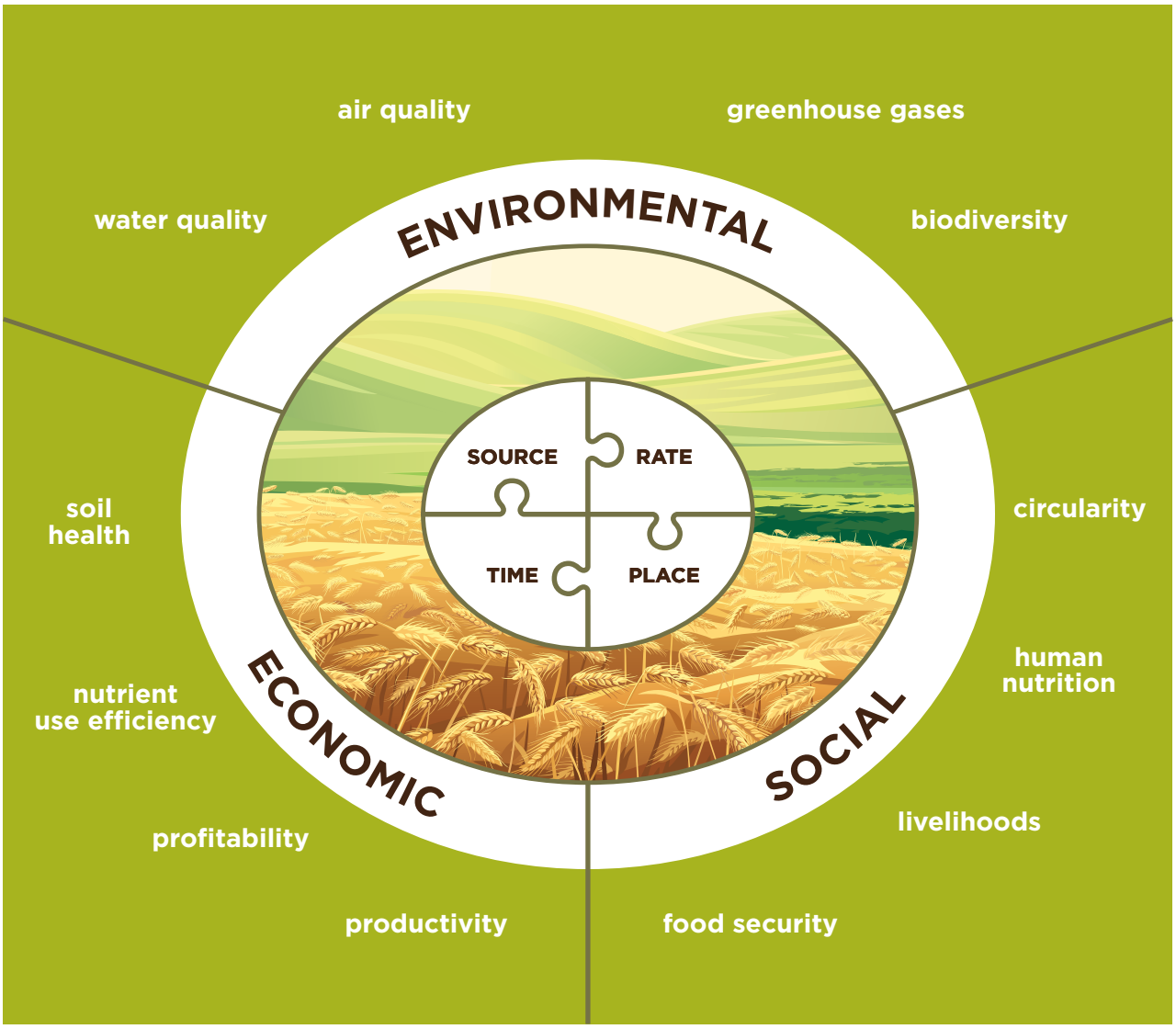
Source, rate, time and place are not independent; rather they form a highly interrelated system. Implementation needs to consider the impact a decision on one R has on the other three. Because the 4Rs are integrated they can work together synergistically. The right source, rate, time, and place choice depends on the specific situation (crop, soil, topography, equipment, nutrient source availability, etc.). Crop production rarely occurs under ideal conditions. A 4R Plan may require short-term adjustments through the growing season to deal with contingencies such as adverse weather. In many cases, the required adjustment can be accomplished through shifts to alternative BMPs that may be at a lower level than the planned practice. Achieving a specific level of 4R practice (basic, intermediate, advanced) may not be possible every year. 4R Planning also recognizes that some contingencies may require the short-term use of practices that may not be considered BMPs in order to deal with logistical and other disruptions.

There are a few things that distinguish 4R practices from regular nutrient applications. The first is that the 4Rs are a comprehensive

1 For further background on 4R adoption see *Furthering 4R Nutrient Stewardship* https://sprpn.org/wp-content/uploads/2022/01/IB03_English.pdf

2 See *4R Consistent Practices for Annual Broadacre Canadian Crops* for guidance on regionally appropriate BMPs.

Figure 1. Potential Goal Areas to Consider in 4R Planning.



Performance indicators reflect the social, economic and environmental aspects of the performance of the plant-soil-climate system. Their selection and priority depend on stakeholder values.

approach to sustainable nutrient management. The 4R approach doesn't focus solely on the economic returns, or the environmental impacts, or the social ramifications of nutrient use in isolation. The aim is to optimize nutrient management decisions and achieve a balanced set of economic, social and environmental goals (Figure 1). These sustainability goals are set by the farmer for the farm enterprise with the assistance as required from farm advisors and recognizing the priorities of external stakeholders. Part of the process is to link nutrient management and cropping system performance to sustainability goals in a measurable and traceable way. The use of key performance indicators or KPIs to measure progress follows the 4R principle of adaptive management and continuous improvement (Figure 1). In the environmental and social components, some performance measures may be beyond the scope of the individual farm with measures of progress performed using aggregated data at the regional or national level.

The 4R Plan Fit-for-Purpose

Developing a 4R Nutrient Stewardship Plan is not a one-time exercise, but an ongoing process that plays an integral role in the yearly crop planning cycle.A 4R Plan evolves over time as opportunities arise to integrate new technologies, products, and concepts into the cropping system on the farm.

The necessary components in a 4R Plan include information on source, rate, time, and place for each nutrient application at the field or sub-field level. Other necessary elements include crop type, location or field identifier, and outcome measurements including crop yield and quality. Depending on the goals of the farmer, calculated outcomes may include more complex metrics such as post-harvest nutrient balance, fertilizer use efficiency, return on investment (ROI) on fertilizer, and reductions in GHG emissions.

The complexity of the 4R Plan may vary depending on the end use (Figure 2). On the farm, the aim of 4R planning is to move towards more sustainable nutrient management. While a relatively minimal 4R Plan may be a good place to start, keep in mind future needs as verification of sustainable nutrient management practices is increasingly required by third parties including farm customers in the downstream supply chain.

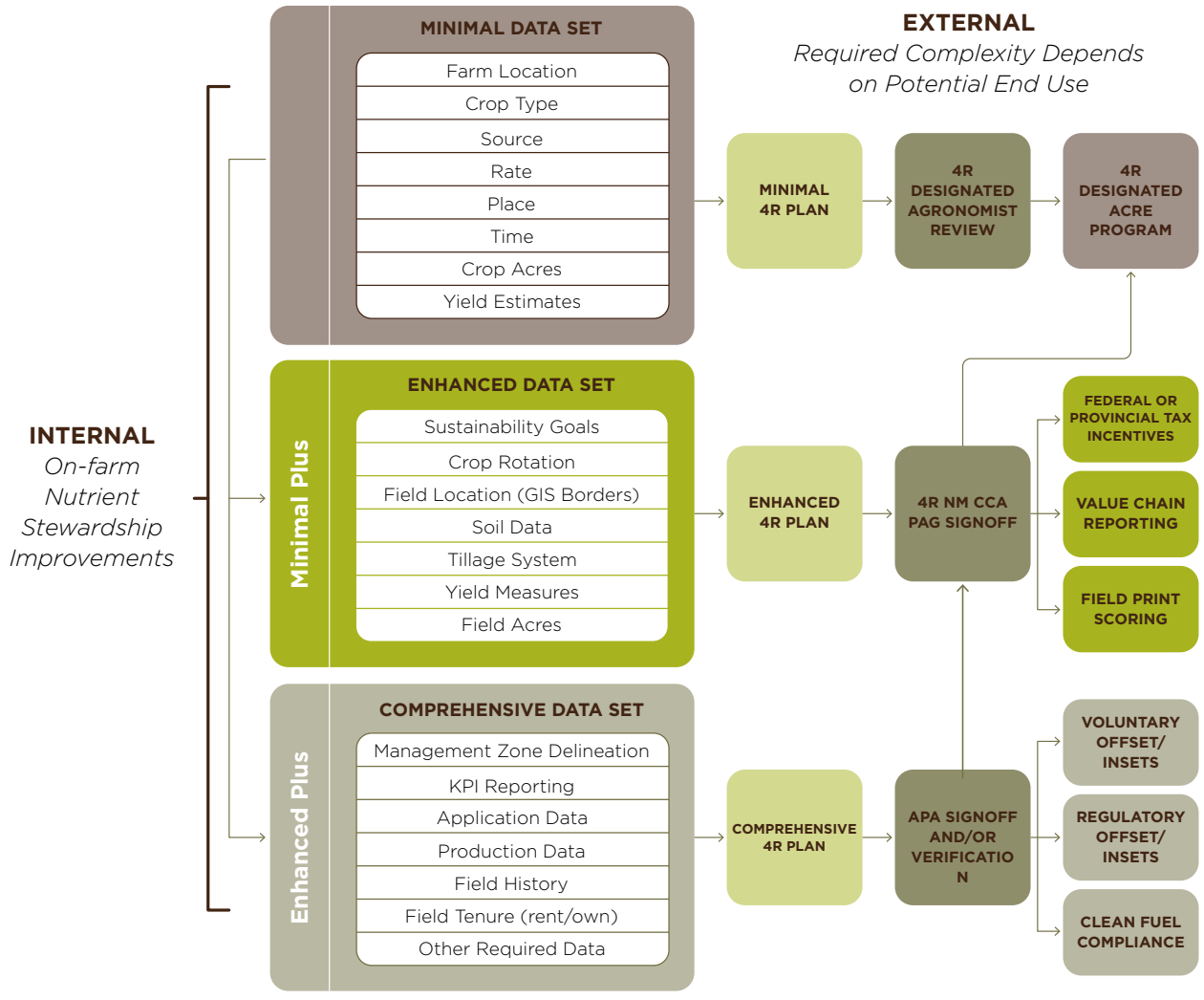
An important consideration is the reliability of the data collected. For some programs such as the *4R Designated Acre Program*, farmer attestation reviewed by the 4R Designated Agronomist is acceptable. More complex plans developed for market access and/or regulatory requirements generally require measurements supported by objective evidence rather than attestations. Measurements such as yield may need to meet specific criteria for accuracy, and acceptable proof that BMPs were followed may be set within a formal protocol. End user requirements may include auditing, for example, 4R Plans required under a GHG offsetting or insetting projects, may be audited using ISO Standards to meet a reasonable level of assurance.

The purpose of this document is to outline the planning process and provide information (including templates) that can be used to develop appropriate 4R planning tools for farmers and agronomists engaged in making nutrient management decisions. The farm and the upstream and downstream members of the supply chain are increasingly reliant on digital information. While these templates are in a sense, traditional documents and can be used as such, they are also conceptual and intended as a guide to individuals and organizations that want to build 4R planning into their own digital management systems.

Considerations when moving to a digital environment include:

1. Eliminate as much manual data entry as possible. Data that is only entered once and/or pulled from other sources is preferable to repetitive manual data entry.
2. Consider who the farmer may need to share the data with (crop advisors, insurance brokers, customers, aggregation platforms etc.) and how it would be accessed and/or transferred (API, CSV, Excel spreadsheet etc.)
3. Build in consistency in terminology by using techniques such as drop-down menus or check lists.

Figure 2. Data Sources to Consider in 4R Planning and Reporting.[1]

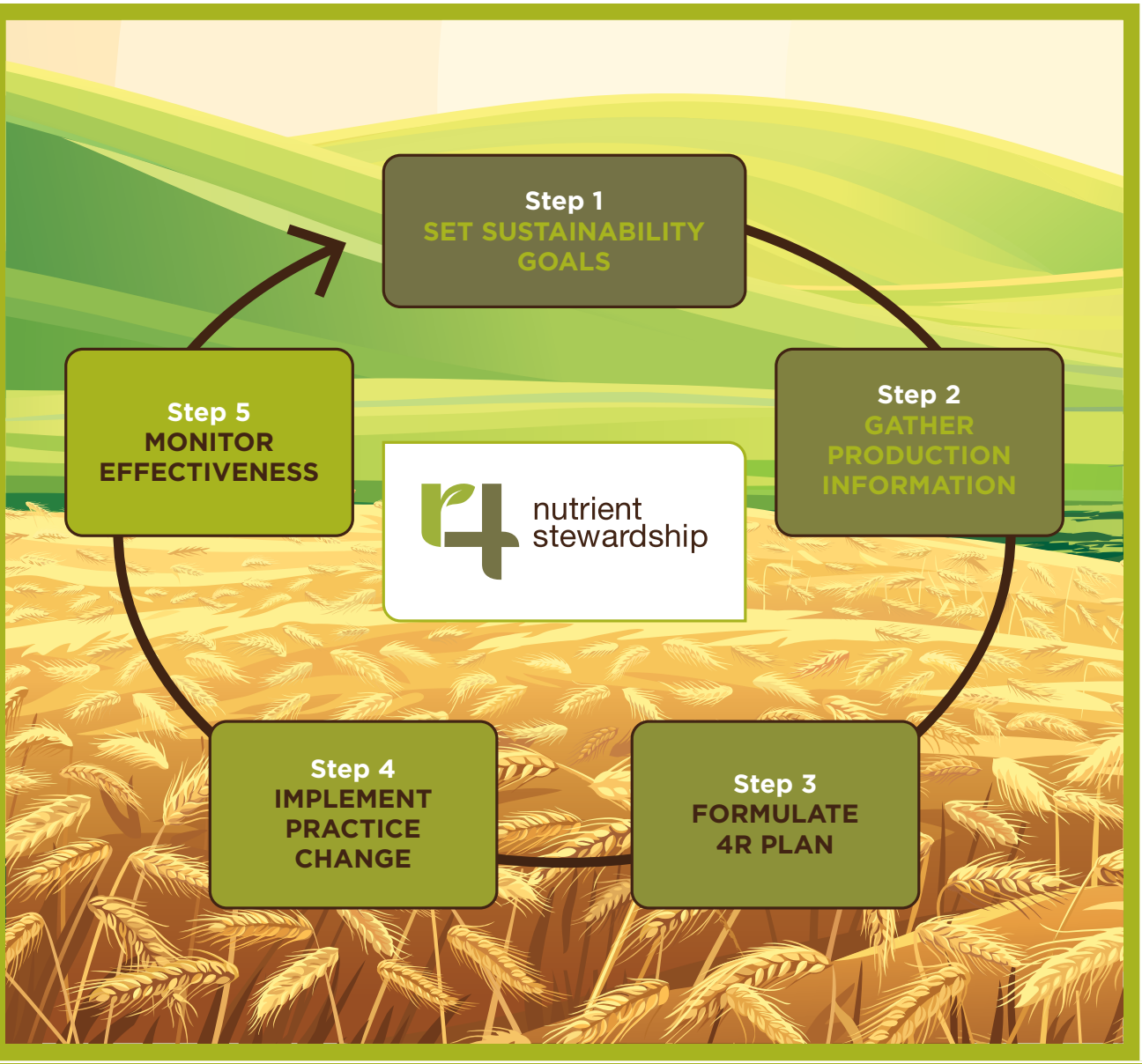


[1] Data sets shown may not include all data required for specific end uses. When developing data collection refer directly to reporting requirements set out by third party end users.

4R Plans and Planning

4R Plans are living documents that set goals, track progress towards those goals, and make adjustment based on measurable results through a continuous improvement cycle (Figure 3).

Figure 3. Adaptive Management in the 4R Planning Cycle.



Farm Information

Information that identifies the farm the location and the overall scope of the operation (Table 1).

Table 1. Typical Farm Information Elements.

ENTERPRISE NAME & ADDRESS: *(Farm or Business Name)*	The legal and/or operating name of the farm. This is particularly important when using the 4R Plan as part of an ecosystem services or market access protocol.
FARMER CONTACT INFORMATION: *(Name, Phone, & Email)*	This should include the person who makes the nutrient management decisions on the farm.
ENTERPRISE DESCRIPTION: *(farm location, number of fields, total acres, crop rotations, livestock)*	A general description of the farm operation. This may become more complex in offset and/or inset programs where ownership of the land may be tied to the right to sell or transfer credits.
ADVISOR CONTACT INFORMATION: *(Name, Company, Phone, Email & Professional Credentials)*	The advisor that assisted with 4R Plan development and/or signed off on the plan when sign-off is required. Information should include professional designation identifiers such as CCA or PAg membership number, 4R Designated Agronomist identifier and APA credentials as required.

Sustainability Goals & Indicators

The 4R approach is goal driven. Goals can be set in each of the three sustainability areas and performance indicators that would indicate progress towards those goals can be reported. Focus on goals with outcomes that have a clear cause and effect relationship to nutrient management. Keep in mind that many worthwhile sustainability goals may not have a direct link to nutrient management practices and may be better included within an overall farm sustainability plan. The 4R Plan can be nested within an overall plan if desired.

Economic and environmental goals and meaningful performance indicators can be set at the individual farm level. Social goals and accompanying performance indicators may require aggregation of data at a regional or national scale to be meaningful. The individual farm may support these larger efforts through data sharing and in turn receive information such as benchmark comparisons of farm or crop performance within a peer group. When setting goals, ensure that systems are in place to collect the data needed to complete the performance indicator. To start performance indicators are best based on data that is easily obtainable. Performance indicators measurable at the farm level include productivity, profitability, nutrient use efficiency, and soil health (Table 2). Since many useful performance indicators can be expressed per unit of production, collecting accurate yield data on a field or subfield basis is key.

Table 2. Examples of Performance Indicators Measurable at the Farm Level[1]

METRIC	SAMPLE INDICATORS	COMMENTS
PRODUCTIVITY, defined in terms of marketable product.	**Yield** *(tonne crop/ha)*	Measuring yield at the field or subfield level helps quantify difference in productivity. Methods can include yard or in-field weigh scales, grain cart scales, bin measurements all of which can be used to calibrate combine yield sensors and/or allow post-harvest adjustment of yield maps.
	Land Use Efficiency *(ha/tonne crop)*	The inverse of yield quantifies land as an input of production. Low values indicate efficient land use. LUE is typically used as part of the "footprint" of production. Useful in comparing among fields or subfield areas or across crop types. Regionally aggregated data can provide benchmarks for comparison.
QUALITY	**Crop Quality** *(grade or desired attribute concentration)*	Quality attributes vary by crop type. While genetics and environment are major determinants of crop quality, nutrient management also plays an important role. Setting and achieving a quality target may increase crop price and/or be necessary for market access. Quality and yield are the main driver of gross revenue on a per acre basis and higher revenue impacts benefit cost ratios and ROI.
PROFITABILITY, difference between revenue and expenses.	**Benefit Cost Ratio** *($ crop/$ Nutrient)*	Explicit measures such as ROI on fertilizer dollars spent requires some measure of yield without fertilizer. Simpler benefit cost measures can be used to compare relative economic performance among fields, crops, years and against regional or national benchmarks.
NUTRIENT USE EFFICIENCY can be tracked as the ratio of outputs to inputs or as a surplus or deficit.	**Partial Factor** *(Productivity = Yield/Unit Fertilizer N)*	Compare relative performance among fields, crops, years and against regional or national benchmarks.
	Partial Nutrient (*Balance = Nutrient Content Harvested Crop/ Nutrients Applied)*	Compare relative performance at the subfield, whole field or whole farm level. <1 in nutrient deficient systems >1 in nutrient surplus systems Slightly less than 1 to 1 tends to maintain fertility for conserved nutrients like P and K.

Table 2. Examples of Performance Indicators Measurable at the Farm Level[1]

METRIC	SAMPLE INDICATORS	COMMENTS
SOIL HEALTH fertility and/ or biological and physical characteristics that support productivity.	**Soil test levels**	Soil tests are valuable for nutrients retained in the soil, particularly P and K. Soil tests provide context for interpretation of partial nutrient balance (PNB). Where soil tests indicate suboptimal levels, PNB >1 is appropriate, and where levels are above optimal, PNB<1 may be appropriate.
	Soil pH	The acid/base balance in soil can profoundly affect both the form and availability of nutrients in soil. Soil pH in poorly buffered soils can decline in response to applied ammonium-based fertilizers. Tracking soil pH supports decisions to apply lime, correcting soil pH and supplying soil nutrients calcium and magnesium.
	Organic Carbon *(DSOC = SOCti – SOCt0)*	Crop residues are the main feedstock for building SOC and residue quantities are directly influenced by nutrient management. SOC changes slowly (3 to 10 years for detectable change) and requires careful sampling (typically of benchmarks within fields) to track changes. See Soil Organic Carbon Soil Health Institute. Note that protocols used to quantify carbon offsets or insets may specify particular methods.

[1]Examples of goals including environmental and social goals relating to the possible metrics shown above and additional indicators and measures can be found in Appendix C.

Field Information

The management unit within a 4R Plan is the field. Create a field plan for each field and update when/if any changes occur (Table 3).

Table 3. Examples of Field Level Information within a 4R Plan.[1]

DATA	COMMENTS
FIELD NAME / NUMBER	Year to year consistency in field naming facilitates tracking field performance over time. Changes in field borders as well as amalgamation or splitting of fields over time should be noted.
FIELD LOCATION	Legal land description and/or latitude and longitude of field centroid and/or analog or digital field borders.

Table 3. Examples of Field Level Information within a 4R Plan.[1]	
DATA	**COMMENTS**
FIELD AREA	Cropped area of field or parcel. Uncropped areas of field or parcel such as woodlots, wetlands, grassed water ways may be required for certain ecosystem service applications.
SUBFIELD MANAGEMENT ZONES	Description and map identifying subfields within the field that may be managed differently with respect to source, rate, time and place.
LANDSCAPE TOPOGRAPHY AND SOIL DRAINAGE CHARACTERISTICS	This can range from qualitative descriptions to georeferenced information such as a digital elevation model (DEM) mapped using GIS software.
SOIL CHARACTERISTICS	Include quantitative analysis or semi-quantitative estimates of soil characteristics such as soil organic matter, texture, pH, salinity (EC), cation exchange capacity etc. (see Table 4)
ROTATION HISTORY	3-5 years rotation history is usually sufficient to capture the rotation noting recent manure applications, annual legume crops, annual or perennial forages, and cover crops. Ecosystem service applications may have specific guidance on rotation history.
PREVIOUS CROP	The type of crop in the most recent growing season can influence nutrient management decisions in the coming year. For example, nitrogen fertilizer rates may be adjusted downward when seeding into annual legume stubble.
CROP TO BE SEEDED	Part of the annual planning cycle for nutrient management.

[1] Note the frequency, reliability, precision, and accuracy should be fit for purpose. Meeting first the nutrient managers needs for on-farm planning of current operations and future improvements, and secondly but also important the needs of off-farm sustainability partners. The latter may include farm customers, regulators, ecosystem service aggregators etc. within the value chain.

Table 4. Soil Analysis Data

ATTRIBUTE	PRIORITY	FREQUENCY	PURPOSE	DEPTH	REGION
Soil Characteristics					
PH	high	≥ 4 y	DS	0-6 in	all
ELECTRICAL CONDUCTIVITY (EC)	high	≥ 4 y	DS	0-6, 6-24 in	WC
CATION EXCHANGE (CEC)	med	≥ 4 y	DS	0-6 in	all
SOIL ORGANIC MATTER	high	5-10 y	DS	0-6, 0-12 in	all
SOIL ORGANIC CARBON	#	5-10 y	BL, PR	0-6, 0-12 in	all
SOIL TEXTURE	med	BL	BL	0-6 in	all
Nutrient Analysis					
MINERAL N (NH4+ AND NO3-)	*	annual	DS, PR	0-6, 6-24 in	all
P~	high	≥ 4 y	DS, PR~	0-6 in	all
K	high	≥ 4 y	DS	0-6 in	all
S	L		DS	0-6, 6-24 in	all
MG	high	4 y	DS	0-6 in	all
ZN	high	4 y	DS	0-6 in	all
MN	high	4 y	DS	0-6 in	all
CA	L		DS	0-6 in	all
FE	L		DS	0-6 in	all
CU	*		DS	0-6 in	WC, muck soils
B	L		DS	0-6 in	all
MO	L		DS	0-6 in	all
CL	*		DS	0-6, 6-24 in	WC

Legend: DS = decision support; PR = performance reporting; BL = baseline; * = high where needed for DS;
= where soil carbon protocol is in effect; L = less useful soil test information
~soil test P may be useful for performance reporting in the context of a P loss assessment tool

Complete the field description before any 4R practices are put in place. Soil attributes (Table 4) characterized through soil testing may be useful for both on-farm decision support and for performance reporting. Soil characteristics and the soil test levels of many nutrients change slowly, and analysis need not be repeated annually for all parameters. However, baseline measurements before implementation of a 4R Plan, including soil nutrient analysis, is important in tracking changes over time. Keep record of your soil test results and track trends to see if your practices are changing soil characteristics and nutrient availability. Soil test methods vary by region and laboratory. Consistency in methods, including in sampling depths, is required for accurate trend analysis. The usefulness of the soil nitrate test varies by region tending to be more useful in establishing fertilizer N rates in drier regions where nitrate tends to persist. The nitrate test may serve several other functions including as a performance measure where it is relevant to N losses impacting surface or groundwater quality or increased risk of denitrification and as an indicator of post-harvest residual N attributable to reduced crop uptake or over fertilization.

Practices – Assessment for 4R Consistency

While all nutrient application requires source, rate, time, place decisions there are certain practices that are not consistent with 4R principles. During 4R plan development, any practices that do not meet 4R criteria need to be identified. These off-side practices should be noted in the plan and become the highest priority for practice change. A practice that qualifies as a BMP in one region may not qualify in another, based on differences in cropping systems, climate, and in some cases regulations. Some examples of are shown below (Table 5).

Guidance on regionally appropriate 4R BMPs for different cropping systems have been developed through consensus with leading Canadian agronomists and environmental scientists and are available through the Fertilizer Canada website. *4R Consistent Practices for Annual Broadacre Canadian Crops*

Table 5. Examples of Practices Inconsistent with 4R Principles.[1]

RIGHT	PRACTICE
SOURCE	Fall Application of UAN. Not inoculating legume crops in fields that haven't previously grown that crop.
RATE	Same rate of nutrient in all fields regardless of soil supply and yield potential differences.
TIME	Fall Application of primary N sources before soil has cooled in drier regions. Fall application of primary N sources in humid regions.
PLACE	Application on snow or frozen ground.

[1] Consult *4R Consistent Practices for Annual Broadacre Canadian Crops* on Fertilizer Canada website for complete list of practices that do not qualify as 4R BMPs.

4R Nutrient Recommendations

Complete a 4R Nutrient Application plan for each field based on most recent soil samples and assessment of soil supply from processes such as nitrogen mineralization, previous manure applications, and other internal cropping system sources. Also consider factors such as soil moisture at seeding, fertilizer costs, and equipment capacity. When using soil test values to develop rate recommendation make sure the soil test method has been calibrated to crop response. There are at least five different soil test P methods used in Canada which would give a different value if applied to the same soil sample. For example, using the P rate guidelines developed for an Olsen test on a soil test P value obtained with the Mehlich extractant would result in under application of P.

Table 6. Example of 4R Nutrient Application Recommendation Field Level

FIELD ID	HOME FIELD (NW-18-13-12-W4)			
NUTRIENT	RIGHT SOURCE	RIGHT RATE	RIGHT TIME	RIGHT PLACE
NITROGEN	Urea/MAP/AS	100 lb N/ac	Spring at Seeding[1]	NPKS Mid-row Band
PHOSPHORUS	MAP	20 lb P_2O_5/ac		
POTASSIUM	KCL	20 lb K_2O/ac		
SULPHUR	AS	15 lb S/ac		
MICROS:	Not Required	NA	NA	NA

[1] Record actual date nutrients applied following completion of field operation.

If custom blends are used record sources used in the blend and the blend application rate.

Table 7. Example of Record Keeping for Custom Blend.[1]

	N	P	K	S	N-P_2O_5-K_2O-S	APPLICATION RATE
CANOLA BLEND	Urea (46-0-0)	MAP (11-52-0)	KCl (0-0-60)	AS (21-0-24)	(32-6-6-5)	314 lb acre

[1]Information in Table 7 would be combined with Table 6 for complete record of fertilizer use by field.

Record your manure (or other organic sources) analysis and application practices (Table 8). Update when necessary and track forward to ensure residuals are considered in subsequent crop years. Manure and other organic nutrient sources such as municipal solid waste compost or municipal biosolids from sewage are regulated provincially. Follow the appropriate provincial regulations for source, rate, time, and place when applying organic sources derived from animal, human, or industrial waste. Several provinces have agronomic manure management guides designed to complement the regulatory framework. [3]

3 *Alberta Nutrient Management Planning Guide* for example is a comprehensive guide to manure management.

Table 8. Example 4R Nutrient Application Recommendation – Organic Sources[1]

RIGHT SOURCE	RIGHT RATE	RIGHT TIME	RIGHT PLACE
SOLID BEEF MANURE	Application Rate 10.5 t/acre Available Nutrients[2] 70 lb N/acre 35 lb P2O5/acre 150 lb K2O/acre	Late Fall after soil has cooled to less than 10°C.	Broadcast and incorporated within 24 hours to a minimum depth of 2 inches.
	Residual Nutrients 70 lb N/acre 15 lb P2O/acre 0 lb K2O/acre		

[1] Only a portion of the total N and P in manure are available in the year of application.

[2] Availability of residual nutrients should be factored into nutrient management decisions in subsequent years.

Nutrient Balance Summary

Based on best available information perform a nutrient balance calculation for macronutrients (Table 9). Nutrient balance can be performed when the fertilizer recommendation is made using target yields and then updated after harvest using actual yields.

Table 9. Example Nutrient Balance Summary for Canola Crop.[1,2]

YIELD	50 BU/AC (2.8 T/HA)			
NUTRIENT	**N**	**P2O5**	**K2O**	S
A-TOTAL APPLIED	100 lb N/ac	20	20	15
B-ESTIMATED UPTAKE	@2.38 lb N/bu 119 lb N/acre	@0.90 lb P2O5/ bu 45 lb P2O5/acre	@2.93 lb K2O / bu 146 lb K2O /acre	@0.86 lb S/bu 43 lb S/acre

Table 9. Example Nutrient Balance Summary for Canola Crop.[1,2]				
YIELD	**50 BU/AC (2.8 T/HA)**			
NUTRIENT	**N**	**P2O5**	**K2O**	S
C-ESTIMATED REMOVAL	@1.68 lb N/bu 94 lb N/acre	@0.67 lb P2O5/ bu 34 lb P2O5/acre	@0.35 lb K2O / bu 18 lb K2O /acre	@0.19 lb S/bu 10 lb S/acre
ESTIMATED SURPLUS/ DEFICIT A-C	6 lb N/acre	-14 lb P2O5/acre	2 lb K2O /acre	5 lb S/acre

[1] Uptake and removals for canola based on survey completed by U of S 2020-22 *Canola Uptake and Removal*. For other Western Canadian crops, see *Prairie Nutrient Calculator*. For background and uptake values consult Fran Walley et al. 2023 *Revising the crop nutrient uptake and removal guidelines for Western Canada*.

[2] Note that uptake and removal values may vary by region, consult regional sources for appropriate values. OMAFAA Publication 611 Soil Fertility Handbook provides tables relevant for Ontario. For Quebec, it's CRAAQ Guide de référence en fertilisation, 2e édition *https://www.craaq.qc.ca/Publications-du-CRAAQ/guide-de-reference-en-fertilisation-2e-edition-et-nouveau-chapitre-10/p/PSOL0101-C01*. Atlantic Canada typically uses the same information as Ontario.

Performance Indicator Tracking

Performance indicators may include nutrient use efficiency, nutrient balances, crop yield, ROI on fertilizer dollars spent etc. Performance indicators should relate back to the sustainability goals and measures. Chart indicators over time to show trends in Performance Indicators.

Table 10. Example Nitrogen Performance Indicator Trends Farm Level Canola				
INDICATOR	**2024**	**2025**	**2026**	**2027**
AVG YIELD (bu/acre)	50	52	56	57
AVG N RATE (lb N/acre)	100	110	100	100
PRIMARY N SOURCE	Urea	Urea	DI Urea	DI Urea
AVG PARTIAL FACTOR PRODUCTIVITY NITROGEN (bu/lb N applied)	0.50	0.47	0.56	0.57

Opportunities for Improvement

At the end of each cropping cycle and following assessment of the performance indicators look for opportunities for improvement. Recognizing that adoption of some more advanced BMPs (for example, variable rate or section control) may require a longer planning period than an annual crop cycle to implement.

Table 11. Example of Opportunity for Improvement

4R	OPPORTUNITY TO IMPROVE BMPS 2025 ASSESSMENT
SOURCE	Switch to Double Inhibitor Urea.
RATE	Reduce rates by 5-10% to account for higher efficiency. Adjust by field when recommendation varies from average by more than 10 lb N/acre.
TIME	Maintain all N at seeding.
PLACE	Maintain midrow band placement at 2-3 inches.
See Table 10 for 2024, 2025 example of assessment.	

Appendices

Appendix A – Sample 4R Plan Template at Farm Level - Fertilizer Dealership or Independent Agronomist.

Appendix B – 4R Plan Template Developed for NERP Use Alberta.

Appendix C – Additional Examples Sustainability Goals and Measures.

Appendix A – Example 4R Plan Template at Farm Level

The 4R template in Appendix A is an example of a format developed for use by a retailer or independent agronomist. This provides elements necessary for tracking progress as well as the information required for reporting under the 4R Designation Program.

NITROGEN

Farm Name:	Contact:	Date:

RATE

HOW IS THE FARMER MAKING THE RATE DECISION (check all that apply)

_ Based on current soil test (within 3 yrs)
_ Based on yield history and previous rate
_ Credits nutrient from crop residues and/or manure
_ Uses Var. Rate Recommendation
_ Based on Provincial Rate Guidelines

Notes: e.g. soil condition, temperature, crop type, rates applied

SOURCE

Check All that Apply:

_ Urea
_ ESN
_ Ammonia
_ UAN
_ Ammonium Sulfate
_ Other N sources (e.g. Manure) _____
_ Nitrification inhibitor _____
_ Urease inhibitor _____

TIME AND PLACEMENT

Fill in table below with check mark, product name or rate

Timing x Placement	Fall	Fall, Cool Soil *temp. <10 C*	Spring pre-seeding	Spring at seeding	Post seeding or in crop
BROADCAST					
BROADCAST & INCORP.					
BAND					
SEEDROW					

Manage risk of loss or immobilization of N by adjusting Rate or Source

Notes (e.g. Time, Resource or Equipment Management constraints):

Other considerations

_ Setback from waterways or drainage features
_ Complies with local nutrient management regulations
_ Manure management plan follows local regulations

SULPHUR

Farm Name:	Contact:	Date:

RATE

HOW IS THE FARMER MAKING THE RATE DECISION (check all that apply)

_ Based on current soil test (within 3 yrs)
_ Based on yield history and previous rate
_ Uses Var. Rate Recommendation
_ Based on Provincial Rate Guidelines

Notes: e.g. tillage system, forages rotation

SOURCE

Check All that Apply:

_ Ammonium Sulphate
_ Elemental S
_ Combined sulphur sulphate products (eg.MES-15)
_ ATS 15-0-0-20
_ 16-20-0-14
_ Other _____

TIME AND PLACEMENT

Fill in table below with check mark, product name or rate

Timing x Placement	Fall	Spring pre-seeding	Spring at seeding	Post seeding
BROADCAST				
BROADCAST & INCORP.				
BAND				
SEEDROW				

Notes (e.g. Time, Resource or Equipment Management constraints):

POTASSIUM

Farm Name:	Contact:	Date:

RATE

RATE (check all that apply)

_ Based on current soil test (within 3 yrs)
_ Based on yield history and previous rate
_ Based on Provincial Rate Guidelines
_ Build, maintain or drawdown of soil level
_ Chloride benefit

Notes: e.g. tillage system, forages rotation

SOURCE

Check All that Apply:

_ Potassium Chloride 0-0-60
_ Potassium Sulfate
_ Liquid (analysis) _____
_ Other sources _____

TIME AND PLACEMENT

Fill in table below with check mark, product name or rate

Timing x Placement	Fall	Spring pre-seeding	Spring at seeding	Post seeding
BROADCAST				
BROADCAST & INCORP.				
BAND				
SEEDROW				

Manage for root interception, soil interactions and low mobility.

Notes (e.g. Time, Resource or Equipment Management constraints):

CONTINUOUS IMPROVEMENT

Farm Name:	Contact:	Date:

MEASURING PROGRESS AND MAKING IMPROVEMENTS:
Identify 1 to 2 goals for improvement and measures that can be tracked on the farm.

In addition to profitability, consider environmental goals like soil health, and water quality, and social issues like time and labor management on the farm or local community concerns.

These examples are general. Effective goals and measures are farm specific.

Crop production goals

- Improve nutrient use efficiency (nutrient applied/unit of crop produced)
- Optimize land use efficiency (with yield mapping and profitability mapping)
- Crop quality improvements

Soil Management goals

- Balanced soil fertility
- Erosion management
- Tillage System

Water Management goals

- Reduce run-off
- Increase infiltration
- Improve drainage

Farm management goals

- Field mapping
- Equipment utilization
- Time management
- Energy use
- Production Records system
- Habitat management

Appendix B – 4R Plan Template Developed for NERP Use Alberta

The sample 4R Plan was originally developed for use with Alberta's NERP Protocol. Useful as a resource document in formatting 4R Plan templates. Will be updated following revisions to the nitrous oxide reduction protocol developed for use in the voluntary market and scheduled for release in early 2026.

https://fertilizercanada.ca/wp-content/uploads/2016/01/Alberta.pdf

Appendix C – Example Sustainability Goals and Measures

SUSTAINABILITY LINK	GOAL AREA	GOALS	KEY PERFORMANCE INDICATORS
Economic			
PRODUCTIVITY, PROFITABILITY EFFICIENCY	Efficiency	Improve Nitrogen Use Efficiency	Estimate Partial Factor Productivity
			PFP = Yield/(Unit Fertilizer N + manure N + other N input)
		Reduce N surplus	N balance: Total N inputs – N removed by harvest
	Profitability	Estimate ROI on fertilizer at field level	Calculate Benefit Cost Ratio (BCR) at individual field level.
			BCR = Crop Value/Nutrient Cost (include any change in costs from BMP adoption)
Environmental			
AIR QUALITY WATER QUALITY SOIL QUALITY BIODIVERSITY	GHG Emissions	Reduce N2O emissions through Source, Rate, Time, and Place optimization.	Estimate and track N2O emissions using *OMAFRA Greenhouse_Gas_Site*, 4R Climate Smart methodology or other regionally appropriate nitrous oxide estimation tools.
			DN2O = N2Oproject - N2Obaseline
	Water Quality	Reduce Phosphorus Losses	P timing and placement
			P balance
	Soil Health	Move soil fertility toward optimum levels	Soil test P and K
			P and K balances (total inputs – removed by harvest)
	Air Quality	Minimize ammonia loss	Estimate ammonia loss as a function of source, rate, timing and placement of N sources using appropriate calculators or direct measurement approaches such as Dosi-Tubes.
	Biodiversity	Maintain and/or increase on farm habitat. Note:	Assess profitability of low yielding marginal areas and remove from cropping system where technically and logistically feasible.
			Increase in on-farm habitat over 5 years as measured through permanent cover acres.
Social			
COMMUNITY FOOD SECURITY ADVOCACY	Community	Provide Ecosystem Services	Participate in nitrous oxide reduction program by applying NERP BMPs.
			Provide nitrous oxide reduction based on carbon credits to voluntary market.
	Food Security	Sustainably Intensify Production on Farm by optimizing nutrient management and other aspects of cropping system management.	Participate in sustainability platform and use regional benchmarks to track performance.
			Track improvements using Field to Market Canada's Field Print Calculator
	Advocacy	Increase society's awareness of how farmers in the _____ Watershed are responsible stewards of the land.	Join local Water Stewardship Group.
			Participate in Water Stewardship Projects in your area.