



4R NUTRIENT STEWARDSHIP BASICS

Teacher Resource for 4R Case Study Lesson One: An Introduction to 4R Nutrient Stewardship





THE HABER–BOSCH PROCESS

- Discovered by Fritz Haber
- Solved a huge challenge that limited crop yields in the early 1900's
- Paved the way to make cheap commercial production of nitrogen and phosphorous fertilizers possible



THE SUSTAINABILITY CHALLENGE

- Global population will increase to 9.6 billion by 2050
- Dramatic growth of middle class
- More food from existing land



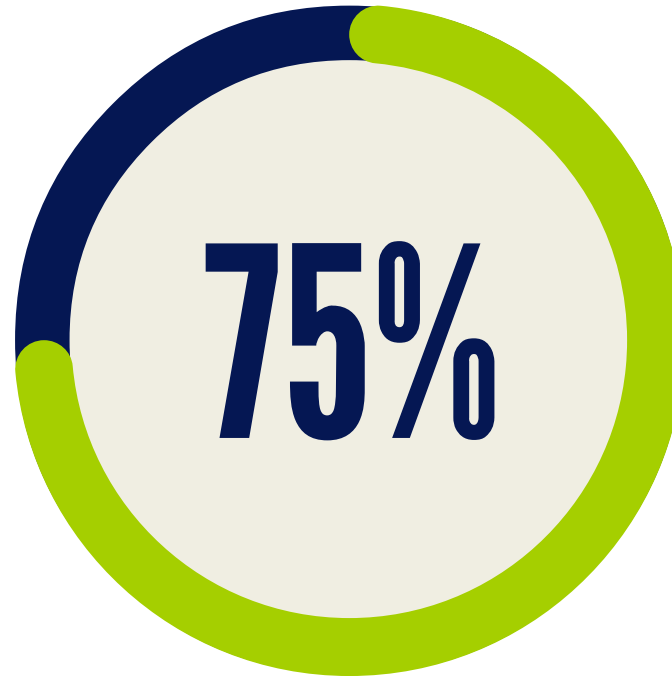
How do we sustainably feed 9.6 billion people?

- 4R Nutrient Stewardship will play a key role in meeting the sustainability challenge.



FOOD SECURITY AND SUSTAINABLE AGRICULTURE

- Food production must be increased by 70 per cent by 2050 to feed the growing population



- 4R Nutrient Stewardship allows farmers to increase food production on less land in a sustainable manner





nutrient stewardship

4R Nutrient Stewardship can **help** grow crops sustainably

The 4Rs work to increase production/profitability for farmers while ensuring the future of the agricultural industry

RIGHT



SOURCE

RIGHT



RATE

RIGHT



TIME

RIGHT



PLACE

SUSTAINABILITY GOALS

Environmental

- Sustain or improve soil quality
- Maintain nutrient levels within natural ecosystem
- Preserve wildlife habitat

Economic

- Produce revenues to sustain farm operation
- Preserve quality of life
- Make the most of dollars spent on fertilizer

Social

- Produce nutritious, abundant, affordable food
- Help meet global food needs
- Provide ongoing employment opportunities in agriculture



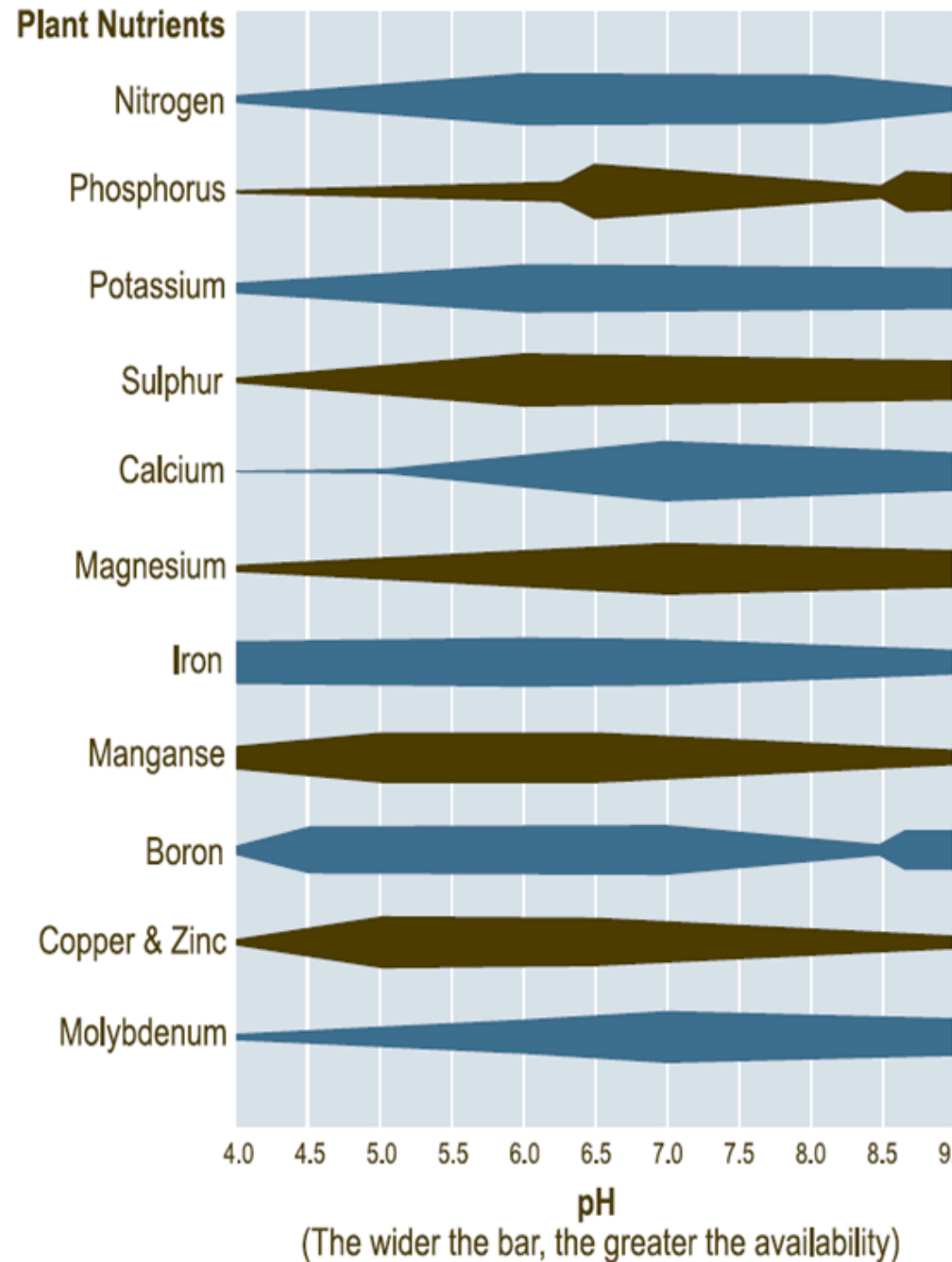
NUTRIENTS AND CROP NEEDS

- Plants require 17 different nutrients to grow
 - Three essentials: C, H, O
- Macronutrients: N, P, K, Ca, Mg, S
- Micronutrients: Cu, Cl, B, Fe, Mn, Mo, Ni, Zn
- Liebig's Law of Minimum



NUTRIENT UPTAKE AND LOSS

- Weather
- Soil - physical and chemical properties
- Best management practices of the 4R framework



RIGHT SOURCE, RIGHT RATE, RIGHT TIME, RIGHT PLACE

- **Right Source** - What is the best source to obtain balanced fertilization?
- **Right Rate** - How much fertilizer to apply in typical Canadian conditions?
- **Right Time** – What is the optimum time to apply nutrients under local conditions?
- **Right Place** – What is the best place to put the nutrients under local conditions?





4R STRATEGIES FOR LIMITING PHOSPHORUS LOSSES

- **Right Source** - What is the best source to obtain balanced fertilization?
- **Right Rate** - How much fertilizer to apply in typical Canadian conditions?
- **Right Time** – What is the optimum time to apply nutrients under local conditions?
- **Right Place** – What is the best place to put the nutrients under local conditions?



PUTTING TOGETHER P FERTILIZER

<p>Right Source P:</p> <p>Highly available and easy to control (phosphate ion H_2PO_4 and HPO_4^{2-}).</p>	<p>Right Rate of P:</p> <p>To match crop requirements.</p>	<p>Right Time of P:</p> <p>Timed to coincide with period of greatest demand and /or lowest risk of environmental loss.</p>	<p>Right Place of P:</p> <p>Where it is easily accessible when required.</p>	<p>Land Management:</p> <p>Grow high yielding/high input crops on productive land.</p>
<p>Granular or liquid ammonium phosphate fertilizers both convert rapidly to phosphate ions.</p>	<p>Based on soil test recommendations and fertility guidelines.</p>	<p>Apply in spring at or near time of seeding to meet early growth demands of young plants.</p>	<p>In soil near or with the seed depending on crop sensitivity or placed in a side band.</p>	<p>Adjust P fertilization practices for any limitations related to growing conditions and land capability.</p>



4Rs USE ADAPTIVE MANAGEMENT

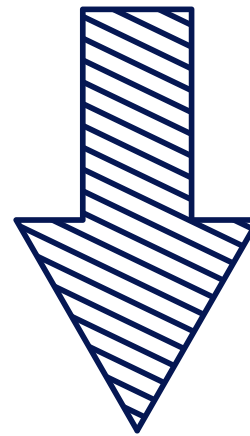
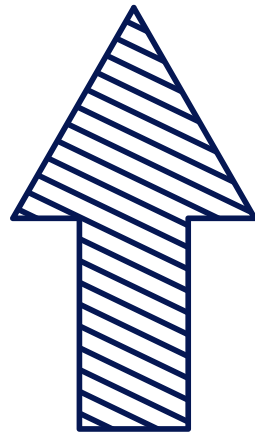
- Goal setting
- Assessing production information
- Formulating a plan
- Implementing practice change
- Monitor effectiveness



WHY USE 4R NUTRIENT STEWARDSHIP PLANNING?

- Farmers already implement various forms of sustainable agriculture & 4R Nutrient
- Stewardship provides a framework to improve their operations through:

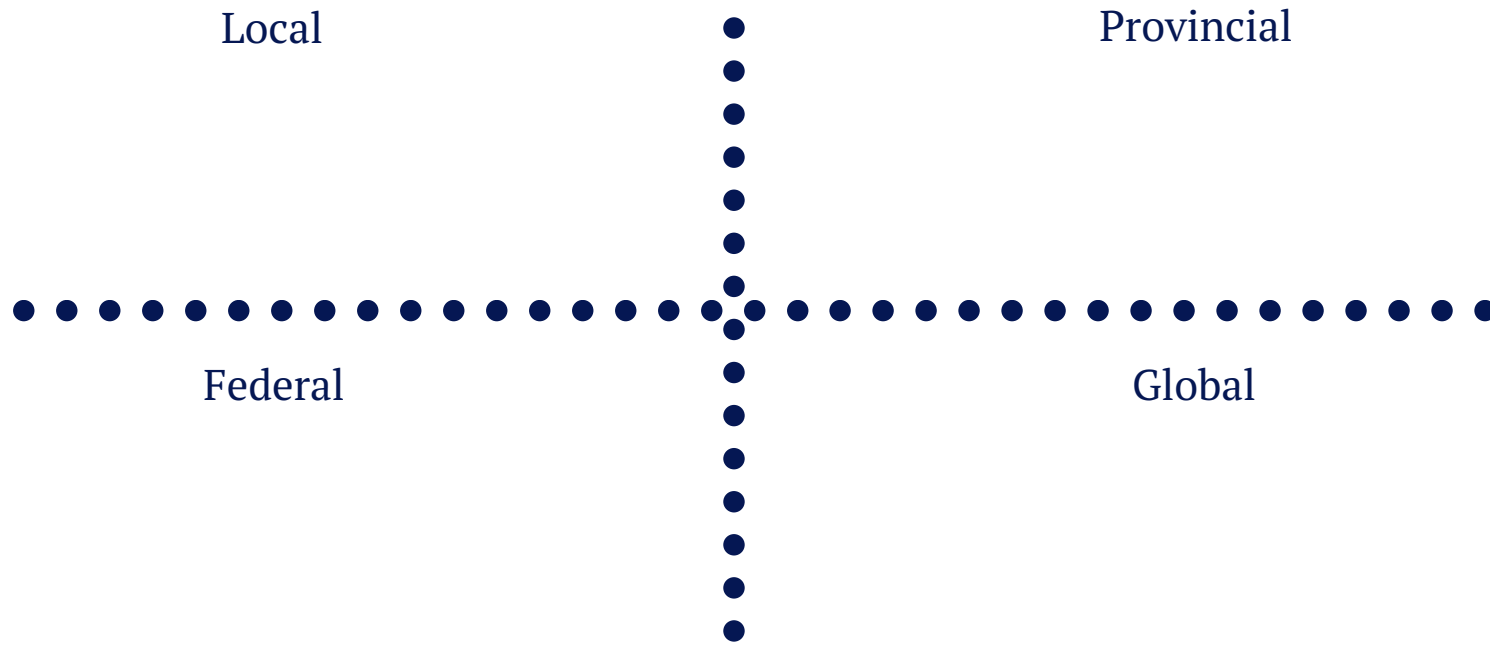
- Increased nutrient management, NUE, and revenue



- Decreased environmental risk as nutrient loss is reduced



CHALLENGES TO FEEDING THE WORLD



THANK YOU

For more information, visit nutrientsforlife.ca

