4 nutrient stewardship

DECISION-MAKING GUIDE
POTASSIUM

The 4R Nutrient Stewardship Framework provides a comprehensive approach of managing plant nutrients to increase food production while improving the ecological integrity of farms. When correct decisions are made regarding the 4R's (using the right nutrient source, at the right rate, at the right time, and in the right place) there are many benefits, including better crop growth, decreased nutrient leakage to the environment, and the protection of natural areas and wildlife.

Implementing 4R principles is challenging because there is no single set of correct practices that can be universally adopted. Each farmer and crop adviser makes decisions best suited to local conditions and crops—adjusting practices for each field and soil, production targets, weather conditions, economic objectives, environmental concerns, and regulations—to meet the overall goals. Because local conditions determine the appropriate 4R practices, nutrient management decisions are best made at a local level, rather than with centralized regulations.

Potassium (K) is an essential plant nutrient that is commonly lacking in many fields. An insufficient K supply in the soil frequently limits crop growth and quality. When there is a shortage of adequate K or when soil conditions limit its uptake by roots, plants rapidly become stressed. A K shortage quickly leads to disruption of normal growth processes, leaving the plant stunted and susceptible to attack by insects and disease.

Potassium fertilizer (frequently referred to as potash) is easier to manage compared with many other plant nutrients. It is always present in soil and in plants as the K^+ cation, without complex chemical and microbial reactions. There are no undesired effects on air or water resulting from K fertilization.

Potassium is found in the minerals of most soils, but its rate of release to plant roots is often not fast enough to keep pace with the demand of rapidly growing crops. The addition of K fertilizer supplements the natural soil supply and minimizes the risk of a K deficit that will limit crop yields.

The principles of 4R Nutrient Stewardship provide a scientific basis for farmers to make fertilizer management decisions to achieve their production goals in an environmentally acceptable manner that meet social objectives.

Provide a balance of essential plant nutrients, considering the use of all available nutrient sources. *Plant roots only take up nutrients in a soluble form and they must be present when the plant needs them. Potassium fertilizer sources should be selected based on their chemical and physical properties, and the crop nutrient requirement.*

Examples of Right Source

- The nutrient value of K in all potash fertilizers is identical. However, the other nutrients that accompany the K are also very important for plant nutrition.
- There are a number of soils that contain insufficient chloride, sulfate, or magnesium to meet plant requirements. A potash fertilizer source with these accompanying nutrients should be selected to meet specific crop needs.
- Certain crops have sensitivity to individual nutrient salts. For example, almonds are sensitive to chloride, so a sulfate-based potash fertilizer may be most appropriate. Wheat often responds favorably to applications of chloride in many environments.
- Many K sources are applied as a solid fertilizer, while fluid forms of potash fit better into some agricultural operations, depending on the local conditions.

IPNI International Plant Nutrition Institute
3500 Parkway Lane, Suite 550
Peachtree Corners, GA 30092-2844
USA | www.ipni.net | Ref # 16023

Add fertilizer based on the soil nutrient supply and the plant demand. *Application rates should be adjusted based on regular soil testing to account for the existing nutrient supply. Realistic predictions of crop performance and yield can be used to estimate crop requirements and nutrient removal. Potash application rates will also account for fertilizer use efficiency.*

Examples of Right Rate

- High-yielding crops remove large amounts of K during harvest. For example, a high-yielding potato crop will remove over 600 lb K/A. When K is continually withdrawn during crop harvest, a nutrient replacement plan is needed to avoid exhausting the soil reserves.
- Adjust K fertilizer application rates based on soil testing, which will assess the current supply in each field and predict the future K-supplying capacity.
- Sample plant tissue during the growing season to verify that plants have adequate K for healthy growth. If the tissue K concentrations are low, it may be feasible to apply additional fertilizer to minimize loss of yield or quality.

Decisions on the time of potash application should account for the nutrient demands of the crop, the soil nutrient supply, potential losses, and the ability to get application equipment into the field. *In general, it is preferable to add fertilizer as close to the time of plant uptake as possible. However for K fertilizer, application may precede crop uptake by months because the risk of loss to the environment is low.*

Examples of Right Time

- Understand the time of peak K demand by crops and then apply fertilizer in advance of that time to minimize any yield-robbing nutrient shortage.
- Potassium movement in soil is relatively slow and the risks of adverse environmental impacts are minimal. It is sometimes desirable to apply sufficient K in a single application to meet the needs of two years of crops.
- Potash is most frequently applied near the time of planting. On sandy, coarse-textured soils, it is sometimes necessary to make additional applications during the growing season.

Plant nutrients need to be in a soluble form before roots can acquire them. *Potassium fertilizers are generally soluble, but they do not move far in the soil before the K is held on charged sites of clay minerals. Fertilizer K can be applied to the soil surface and then incorporated by rainfall, irrigation, or tillage, or it can be added in concentrated zones beneath the surface to maximize plant recovery. The concept of "right place" also refers to applying fertilizer only in field zones where crops will positively respond to nutrient additions. In consistently low-yielding areas, it may be useful to reduce fertilizer applications to match crop needs, avoiding the risks of inefficiency and economic loss.*

Examples of Right Place

- Place K fertilizer near the crop root zone or where it can move into the root zone based on root development and architecture. There are advantages to both broadcast and banded applications of potash. Local conditions and farmer goals dictate which fertilizer placement is preferable.
- Adjust K fertilizer application rates for field zones based on soil conditions, soil testing, and potential crop productivity.
- Avoid placing large amounts of K fertilizer in close proximity to newly planted seeds to avoid salt damage. Application of K fertilizer in the root zone is an effective way to enhance uptake, but seedlings may be initially sensitive to a single large dose.