Potassium Fertilizers.

Comparing fertilizers can be quite challenging under the best of conditions, that being said, let's dive in!

Some key pieces of information must be discovered before we can make a recommendation about a potassium fertilizer application.

Before we go the distance lets look at what we know about potassium.

Potassium facts;

Function of potassium in the plant is crucial to enzymatic reactions, protein regulation, osmotic regulation of the cation/anion balance, stomate regulation, nutrient transport, solute movement into & out of cells. Potassium is highly mobile in plants, important in plant cell elongation. Potassium is important to phloem transport of sugar throughout the plant.

99% of soil potassium is non-exchangeable; it is part of the mineral matrix of the soil (mica, feldspar, etc.). Potassium is released by weathering, & microbial processes, temperature & moisture will have an effect on this process, and it releases by diffusion. This potassium can't be measured in a soil test by chemical extraction laboratories.

Exchangeable potassium can be measured in the soil test. A chemical extraction (acid solution) is required to separate the ions from the soil colloid.

Extractable potassium (soluble, ionic) is a very small fraction of the solution. After all, isn't that what is our focus is? Plants don't eat they drink.

Main issues with potassium fertilizers are;

1. Solubility of the applied material.
2. Reactivity of the applied material.
3. What is the residual effect of the applied material.

Potassium fertilizers commercially available;

Potassium chloride, (KCL 0-0-60) also known as MOP or muriate of potash. Muriate of potash will usually be the most inexpensive option; it does come with chloride baggage (a distinct disadvantage in many crops). K_2O % 63.0, Soluble at 20^{o} C to a 16% solution under laboratory conditions. 84% quickly becomes an insoluble salt in the soil. As potassium chloride breaks down 37% is chloride, which to many crops is detrimental. Also of note is the salt index of MOP, 116. Sodium nitrate is 100 on the salt index scale.

Potassium sulfate (K_2SO_4) 0-0-50 also known as sulfate of potash. Good source of potassium in soils that have sulfate sulfur deficits. K_2O content % 54, Soluble at 20^{o}C to a 5 % solution under laboratory conditions. 95% quickly becomes insoluble in soil as a salt. As potassium sulfate breaks down we are left with sulfate sulfur residue. When soils are deplete of sulfate sulfur this application is beneficial. However many agricultural soils are not deficient and so we run into excess sulfate sulfur problems. Salt index of 46.

Potassium nitrate (KNO_3) 13-0-45 is an excellent source of both potassium & nitrogen. Widely used as component of water soluble fertilizer products. Not an inexpensive potassium option. K_2O content 46.0 %
Soluble at 20^{o}C to an 11% solution under laboratory conditions. When nitrogen is required this application is beneficial.

Potassium carbonate (K_2CO_3) 0-0-60 very soluble in water. When used as a component of a complete nutrient solution this could be a very cost effective option. K_2O content 60% molecular weight 138.2 Soluble at 20^{o}C to a 98% solution under laboratory conditions. In solution we are left with K & CO_2 both are very beneficial to plants.

Potassium thiosulfate ($K_2S_2O_3$) 0-0-25 could be a good option in some circumstances. Soluble at 20°C to a 25% solution. This material carries a high E.C. and care must be taken not to over apply and cause phytotoxic results.

Potassium magnesium sulfate (K_2SO_4-$2MgSO_4$) 0-0-22 11Mg 22S This fertilizer is a double salt of magnesium & potassium sulfate. Effective where K & Mg nutrition is required, combined with sulfate. Soluble at 20°C to a 5% solution under laboratory conditions. Good soil source of potassium & magnesium. Again the issue is the 95% that is not quickly soluble & sulfate baggage.

H-85 (KOH + C) 0-0-15 all plant available potassium and soluble carbon.

diKap (K_2HPO_4 + CHNO) 0-31-52 Soluble at room temperature 100%. Di-potassium phosphate reacted with carbon to form a compound. Leaves no residual salt in the soil. Very efficient form of phosphorus and potassium. Will not react with soil.

A couple of issues to address,

The issue of residue is only applicable to products that require high rates of application for efficacy. If you could apply potassium chloride or potassium sulfate at the rate of 5 pounds per acre to get a plant response, then the sulfate/salt issue would be a moot one. To get any efficacy out of those materials the rates must be 20-50 times more than that. There is the problem.

In terms of p.p.m. solubility we must remember, a soil with 20 p.p.m. soluble potassium you have only 2-3 pounds of actual soluble potassium, depending on the C.E.C. of the soil. If we want a plant response we need to increase soluble potassium by 20%. We can get this response by adding ½ pound of soluble potassium. From my perspective a 2 pound application of diKap per acre will have just over 1 pound of 100% soluble potassium.

To view this from a different perspective,

K mag is soluble at 5%. It is 22% potassium. If you do the math for a 100 pound application, this is equal to just over 1 pound of actual soluble potassium that will quickly be available to the plant, this is equal to a diKap application of 2 pounds per acre, without the salt residues.

Recommendation concepts,

We will need to look at some concepts to understand the efficiency of potassium applications.

1. Soil chemistry,
2. reserve K,
3. water: air (soil structure),
4. yield goals,
5. root health,
6. timing & frequency
7. and finally input quality must all be reviewed.

With Respect,

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