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APPLYING POTASSIUM FERTILIZERS THROUGH DRIP IRRIGATION SYSTEMS

Potassium, often referred to as potash or by its chemical symbol 'K,' is one of three primary nutrients plants require from the soil for proper growth. The other primary nutrients are nitrogen (N) and phosphorus (P). Potassium is required for many functions, including moving resources for fruit development and tolerating external stresses.

The **nitrogen to potassium ratio** is important because it affects whether a plant continues producing foliage or whether it begins to produce flowers and fruit. For crops that fruit, including tomatoes, peppers, and cucumbers, it is important that the plant's nitrogen levels are not too high. Plants with high nitrogen levels have longer stems and more leaves but fewer fruits. Adding potassium will prevent excess vegetative growth and force the plant to produce more flowers and fruit. Table 1 lists an example of the correct nitrogen:potassium ratios for field tomatoes at different growth stages.

Table 1: Weekly fertilizer recommendations for field tomatoes

Weeks after transplant	Nitrogen (N) (lbs/acre)	Potash (P ₂ O) (lbs/acre)	Nitrogen: Potash ratio
1-2	10.5	17.5	1 : 1.7
3-4	14.0	14.0	1 : 1
5-11	17.5	21.0	1 : 2.0
12	14.0	14.0	1 : 1.2
13	10.5	10.5	1 : 1

Note: An additional 50lbs/acre of nitrogen should be applied pre-plant

'**Fertigation**' is the application of soluble fertilizers through the drip irrigation system. This gives close control over the type and amount of nutrients delivered to the plant. **Fertilizer calendars** tell how much of each nutrient should be administered through the drip system at the different stages of crop development. Table 1 shows an example of how many pounds of nitrogen and potash are needed, weekly, for an acre for field tomatoes.

To deliver the required ratio of nitrogen, phosphorus and potassium, you cannot rely on fertilizers like 20-20-20, because they have a fixed ratio of nutrients that cannot be adjusted. Mixing different fertilizers allows for flexibility.

In addition to stocking a nitrogen-based fertilizer, it is recommended that a fertilizer high in potassium is also available to allow adjustment of the nitrogen to potassium ratio. If these fertilizers are to be used in a fertigation system they should be soluble. Remember, the N:P:K number on fertilizer bags tells you what percent by weight there is of each of the three nutrients. A fertilizer high in potassium has an N:P:K ratio where the last number is higher than the first two numbers (nitrogen and phosphorus). The table below gives potassium fertilizers that are commonly used.

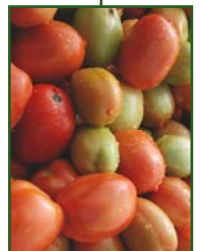


Table 2: Common potassium fertilizers

Fertilizer	N:P:K ratio	Soluble
Potassium chloride	0-0-16	Yes
Potassium nitrate	13-0-46	Yes
Potassium sulfate	0-0-50	Yes
Potassium-magnesium sulfate (KMag)	0-0-22	Yes
Monopotassium phosphate	0-52-34	Yes

In the US Virgin Islands there are few choices for fertilizers high in potassium. At present, we have access to **KMag** (Diamond K) and **Meta-K** (Earth Juice). Both of these fertilizers are organic and soluble. Meta-K has an N:P:K analysis of 0-0-10, while the K-Mag has an analysis of 0-0-22. K-Mag also has the benefit of adding magnesium and sulfur to the soil. Neither of these fertilizers have nitrogen or phosphorus.

To provide recommended nitrogen and potassium amounts in a fertigation program, use a nitrogen fertilizer for the nitrogen requirements and then add a potassium fertilizer to give the right quantities (and ratios) of these two nutrients. The sidebar on the right shows an example of how to calculate the right mix of fertilizers.

For more advice on fertilizer requirements please contact Fintrac, the V.I. Department of Agriculture or the University of the Virgin Islands' Cooperative Extension Service.

Notes:

- Meta-K can be bought at Cruzan Gardens in St. Croix.
- Meta-K needs to be agitated before being sent through the drip system.
- K-Mag can be bought from the Plant Depot, St Thomas in 50lb bags. This fertilizer absorbs water, which may cause it to solidify in storage. While this does not affect the fertilizers viability or ability to dissolve in water, it may take the product longer to dissolve into solution.
- K-Mag does not stay in solution easily and should be stirred just before it is sent through the drip line. Alternatively, this product can be broadcast and worked into the soil before planting (20-50lbs/acre). It can also be applied to the foliage at 1 to 2 lbs per acre.

Calculating Fertilizer Mixes

In Table 2, the recommended amounts of nitrogen and potassium to be applied in the 5th to 11th week are 17.5 lbs/acre of nitrogen and 21 lbs/acre of potassium. If we use 20-20-20 to supply the nitrogen, we need to factor in the fact that only 20% of this fertilizer is nitrogen. To work out how many pounds of 20-20-20 would be needed to provide 17.5 lbs of nitrogen you would do the following calculation:

$$\frac{100}{20} \times 17.5 = 87.5 \text{ lbs of 20-20-20/acre for N requirements}$$

Because 20-20-20 is a complete fertilizer (i.e. one that supplies equal amounts of nitrogen, phosphorus and potassium), 87.5 lbs of the fertilizer also supplies 17.5 lbs of P and K. This does not quite give us enough of the needed potassium (21 lbs). There is a shortfall of 3.5 lbs. To supply this we need to use one of the potassium fertilizers mentioned above. For us in the Virgin Islands, we could use the K-Mag (0-0-22) or the Meta-K (0-0-10).

Below are the calculations needed to find out how much of the potassium fertilizers are needed to give the extra 3.5 lbs.

K-Mag

$$\frac{100}{20} \times 3.5 = 15.9 \text{ lbs/acre to provide the K}$$

Meta-K

$$\frac{100}{10} \times 3.5 = 35 \text{ lbs/acre to provide the K}$$

Because both of these fertilizers are liquid fertilizers we need to convert these weights to volumes using the density of the liquids. Most liquid fertilizers have a density of 10 lbs/gallon. This means that we need 1.6 gallons of K-Mag and 3.5 gallons of Meta-K to give the extra 3.5 lbs of potassium.

From these calculations, the weekly application of:

- 87.5 lb/acre of 20-20-20 and either
- 1.6 gal./acre of K-Mag or
- 3.5 gal./acre of Meta-K

would give us the required amounts nitrogen and potassium for the 5th to 11th week of tomato development. These fertilizers can be mixed together and then sent through the drip irrigation system. The fertilizers should be applied for the duration of the irrigation cycle so that it is evenly spread throughout the root zone. The final 10 minutes of irrigation should be with just water to clean the lines.

