

THE ABC'S OF NPK: REFINING YOUR TOMATO FERTILITY PROGRAM

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To get the most out of any vegetable crop, proper planning is important. There is no excuse for a bad soil fertility program in your tomatoes. Unfortunately, time and time again I see fields with poor yields, uneven ripening along with yellow-shouldered and poor tasting fruit. All because they did not take a \$15 preseason soil test and follow through on the recommendations.

For an effective fertilizer program, start with a soil test. Choose a lab that is experienced in running samples and providing recommendations based on the soils, climate, and crop response in your region. In New York, we recommend Agro-One in Ithaca, which uses Cornell's procedures and recommendations. If you use another lab and are happy with the results, stay with it. Do not change labs from year to year as you will likely get different recommendations leading to different results

When sampling, take soil samples down to 6 to 8 inches, using a clean shovel or auger. If you know the field is uniform, you can take 15 to 20 subsamples and combine into one sample, in areas as large as 20 acres. Again, only if you know from past experience the field is uniform. If you do not know the details of a field or if you know some parts contain different soil types (from a soil map), sample those areas separately. I have seen many fields where topsoil is eroded in places and the subsoil begins to emerge, likely changing pH. Look for these abnormalities and sample accordingly.

Once you get your results, it is time to plan your tomato fertility program. Here is what we recommend for total nitrogen and phosphorus in New York, based on soil test results (Table 1).

Table 1. Recommended N, P₂O₅ in pounds per acre for tomatoes grown in New York

Recommended Nitrogen Lb. N/acre	Recommendation (lb. P ₂ O ₅ /acre)				
	Very Low	Low	Medium	High	Very High
100	200	150	100	50	0-20

It is very easy to over apply nitrogen, which can lead to puffy, soft, low quality fruit. Make sure you take credits for any cover crops, manures, compost and soil organic matter (15 to 20 pounds of N per acre for every 1% soil organic matter). Pay strict attention to the phosphorus level. For many vegetable growers, P levels have increased due to over application of high P fertilizers and the use of manures and composts. High P levels have been shown to contribute to problems with ripening. If your soil tests high, a starter solution high in P may be all that is needed.

Although I don't like to say that any nutrient is more important than any other, when it comes to tomatoes, potassium is the key. Lower potassium will result in yellow shoulders and blotchy

ripening (Figure 1). Potassium has an impact on flavor too. Make sure you optimize potassium applications using the recommendations in Table 2.

Table 2. Recommended K₂O in pounds per acre for tomatoes grown in New York

Recommendation (lb. K ₂ O/acre)				
Very Low	Low	Medium	High	Very High
240	180	120	60	0

We recommend that you apply about 30 to 50% of your nutrients when you prepare your beds. Here is where we separate the beginners from the more experienced

growers. I'm assuming that you have plastic mulch, trickle irrigation and the ability to fertigate. You can put the rest of the fertilizer through the trickle, over the course of the season. But to optimize fertility, we recommend that you sample the plants through foliar testing throughout the season.

Figure 1. Yellow shoulder disorder in tomatoes



Pictures - Jerry Brust, IPM Vegetable Specialist, University of Maryland;

As with soil sampling, if you sample incorrectly, the results will not be useful – garbage in means garbage out. Steve Bogash, a tomato specialist with Penn State University, recommends beginning foliar sampling at the onset of flowering and continuing every two weeks until the last of the fruit has sized. You will need to sample the most recently mature leaf, which sounds like it will be difficult to find on a consistent basis. To get the same leaf each time, start at the growing tip and count down 4 to 5 leaves and snap off that leaf – stem and leaf. When we talk about a tomato leaf, we mean the entire including the smaller leaflets and the stem or petiole (Figure 1). Make sure you sample at the same time of the day to maintain consistency. Take a minimum of 15 samples from a field and use plants that are of average size, not too big, not too small. Place in paper bags and keep samples cool until you can send to a lab. You want one with a quick turnaround. Some of our growers have used both Waters Ag Lab (facilities in Georgia, Kentucky and North Carolina) and Agri-Analysis (located in Pennsylvania). The labs will recommend fertilizers based on the results. In general, we expect levels of N, P, K, Ca, and Mg to be around 4%, 1%, 3%, 3% and 1%, respectively.

Figure 1. Tomato “leaf”, containing petioles and leaflets



Something that many growers do not factor into their calculations is the pH of their irrigation water. Optimum pH is 6.2 to 6.5 and water higher or lower than the optimum can reduce availability of applied nutrients. In New York, the water tends to be on the alkaline side of neutral. If you are using water from wells or surface water, the pH can change throughout the season and should be monitored. Water from municipal sources will tend to be more stable. The pH can be adjusted using acids at the time of fertigation.

Finally, let's talk about flavor. My colleague at Rutgers, Soil Fertility Specialist Joe Heckman has looked at this in tomatoes. Dr. Heckman has identified potassium, sulfur and boron as those which may play a key role in developing maximum tomato flavor. And although we don't think of sodium and chloride as having beneficial qualities, they may also play a role. At one time, many of the fertilizers we used contained sodium as a byproduct (Chilean nitrate for example), as well as sulfur and other minor nutrients. As our fertilizers have changed and purer materials are used, nutrients may be low, perhaps at levels that don't cause deficiencies but may modify flavor.

Heckman grew tomatoes and did a one time drench of sea water (he is on the Jersey shore) over the top. He noticed plants appeared stressed with some burning on the foliage that was quickly outgrown. In a blind taste test, people prefered tomatoes that had been treated with the ocean water. Although this sounds odd, it does agree with researchers in Israel who found that treating tomatoes with table salt/sodium chloride resulted in better flavor as observed by taste panels. They hypothesized that “the improved taste under salinity may stem from salinity increased acids and sugars and/or an increase in other flavoring compounds”.

I think there may be something to this. Not that you can create a great tasting tomato from one that has been bred for shipping, but you may be able to maximize the flavor of tomatoes that are already good tasting. Sometimes a little stress may be a good thing!