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Zap the Sap for Precise Fertigation

Using petiole sap testing can help growers determine if and when fertilization is needed

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Vegetable growers -- especially those who use drip irrigation -- now have a handy tool to help them manage nitrogen (N) and potassium (K) fertilizer. *American Vegetable Grower* columnist George Hochmuth, vegetable Extension Specialist at the University of Florida, says plant petiole sap-testing is a technique growers and consultants can use themselves on a weekly basis to make sure crops are getting the proper amounts of these two important nutrients. Results are immediate, so there is no delay in waiting for a laboratory analysis.

Several sap-testing kits are available in the \$100 to \$300 range (see Table 1 on Page 2). The quick-test kits measure nitrate-nitrogen, not total N. Some kits read out in nitrates and some in nitrate-nitrogen. Most calibration tables are in nitrate-nitrogen values. For kits that read out in nitrates (NO₃), the reading must be divided by

4.43 to find the nitrate-nitrogen value, which can then be compared to chart values. Potassium levels are usually read directly as parts per million (ppm) K.

Sample During Daytime. Take samples between 9 AM and 4 PM for the most consistent results. Keep in mind that similar temperature and weather conditions will also help with consistent readings.

Petiole Selection Important. Select petioles (leaf stems) of the most-recently matured leaves -- that is, those leaves that have reached maximum size and have changed from a light-green to a dark-green color. Use the fleshy petiole of the leaf. Hochmuth says that in most crops, the petiole is easy to identify. In tomato, which has a compound leaf, the petiole is the whole leaf stem with all the tiny leaflets stripped off. The tomato leaf petiole is about 8 inches long. Pepper leaf petioles, on the other hand, are only about 1 inch long. "Although 3 or 4 petioles may produce a sufficient amount of sap for testing, additional plants must be sampled to ensure that the sample is representative of the field or area being tested," Hochmuth says. "About 20 leaves are enough to adequately represent a 5- to 10-acre field if it is a uniform field."

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Chop and Mix Sample. After gathering the petioles, chop and mix them, and use a sub-sample of the chopped pieces for the testing sample. Hochmuth suggests using a garlic or lemon press to squeeze the sap from the sample. Other materials needed include a sampling knife, scissors, paper towels, distilled water, a chopping knife and board, and testing kits. (There are separate kits to measure N and K.)

Measure Sample Quickly. While research in Florida has shown that fresh, whole petioles can be stored on ice for up to 8 hours or frozen overnight without appreciable changes in their sap concentrations, measurement of the pressed sap nutrient content must be made within 1 to 2 minutes of pressing. Otherwise, nitrate readings could change when the sap is exposed to air.

Although the calibration scale (see Table 2) has been developed for crops grown under Florida conditions, Hochmuth says research has shown that the values will probably work in other production areas as well. The basic technique is to compare readings you get with your test kit to the ranges listed on the table. "If your reading falls within the range, no change is needed," Hochmuth says. "If the values you find are above those listed, you may need to reduce the amount of N or K. If below the range, either you're not applying enough fertilizer, or possibly it has leached from sandy soils."

Heed Advice and Experiences. He suggests that growers outside of Florida use the table as a starting point or guideline, and refer to their local county Extension office for help in adapting the numbers to local conditions. He also says experience should be taken into account. "If you are growing on heavier soils out West, you may get a high K reading even if you haven't added any K to the soil," he says. "Experience will tell you the higher number reflects what's already in the soil, and doesn't necessarily indicate that you need to make a change in your fertilization program."

Sample Once a Week. Hochmuth suggests that growers or their consultants conduct petiole sap-testings a minimum of once a week during the growing season. "Sap concentrations of N and K can change rapidly, and if you don't test frequently, you will miss those changes," he says. "Petiole sap-testing can give you some quick answers, and it is reasonably inexpensive. But nothing is foolproof. You still have to use your head."

Table 1. Testing Kit Options

There are several companies offering sap testing kits. Here is a sampling:

Merckoquant test strips are available from *EM Science*, P. O. Box 5018, Cherry Hill, NJ 08034-0395.

To use, dip a test strip into the petiole sap and allow the strip color to develop for 60 seconds. Compare the developed color to a chart which comes with the kit to determine the approximate nitrate concentration.

A reflectometer is also available for use with the test strips to facilitate nitrate determinations. Often, fresh sap must be diluted (one part fresh sap to 19 parts distilled water) to achieve a reading within the range of the calibrated color scale.

The HACH colorimeter and ion-specific electrodes are available from *HACH Co.*, P. O. Box 389, Loveland, CO 80539.

Place diluted sap in two viewing tubes (supplied with the kit). Place one tube in its slot in a hand-held comparator. Empty the contents of one reagent-powder container into the second viewing tube and shake for one minute. After mixing, place the second viewing tube in its slot in the comparator. Rotate the color disk on the comparator until the color on the wheel matches the color in the tube with the reagent. The resulting nitrate-N concentration can be read from the comparator.

Cardy ion-specific meters are available from *Spectrum Technologies*, 12010 South Aero Drive, Plainfield, IL 60544.

Kits include hand-held electrodes for nitrate and K as well as a hydraulic sap press. Place a crop of fresh sap in a continuous film over the electrodes, and read the resulting ion concentration from the digital nitrate or K meter. Diluted sap may be needed to keep the determinations within the calibrated range.

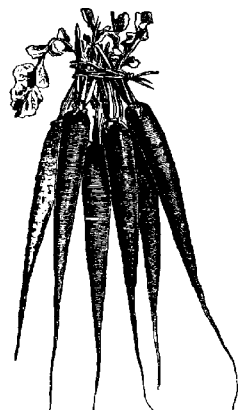
Hochmuth says the sap testing kits are scientific tools and require careful handling. "The kits and chemicals should be stored in a protected place within the proper temperature ranges specified by the manufacturer," he says. "Kits should not be stored in a pick-up truck or at the pump house between uses."

Table 2. Know Your Nitrogen Level

CROP	CROP DEVELOPMENT STAGE	FRESH PETIOLE SAP CONCENTRATION (PPM)	
		NO ₃ -N	K
BROCCOLI & COLLARD	SIX-LEAF STAGE	800-1000	NR ¹
	ONE WEEK PRIOR TO FIRST HARVEST	500-800	
	FIRST HARVEST	300-500	
CUCUMBER	FIRST BLOSSOM	800-1000	NR
	FRUITS 3 INCHES LONG	600-800	
	FIRST HARVEST	400-600	
EGGPLANT	FIRST FRUIT (2 INCHES LONG)	1200-1600	4500-5000
	FIRST HARVEST	1000-1200	4000-4500
	MID HARVEST	800-1000	3500-4000
MUSKMELON	FIRST BLOSSOM	1000-1200	NR
	FRUITS 2 INCHES LONG	800-1000	
	FIRST HARVEST	700-800	
PEPPER	FIRST FLOWER BUDS	1400-1600	3200-3500
	FIRST OPEN FLOWERS	1400-1600	3000-3200
	FRUITS HALF GROWN	1200-1400	3000-3200
	FIRST HARVEST	800-1000	2400-3000
	SECOND HARVEST	500-800	2000-2400
POTATO	PLANTS 8 INCHES TALL	1200-1400	4500-5000
	FIRST OPEN FLOWERS	1000-1400	4500-5000
	50% OF FLOWERS OPEN	1000-1200	4000-4500
	100% OF FLOWERS OPEN	900-1200	3500-4000
	TOPS FALLING OVER	600-900	2500-3000
SQUASH	FIRST BLOSSOM	900-1000	NR
	FIRST HARVEST	800-900	
TOMATO (FIELD)	FIRST BUDS	1000-1200	3500-4000
	FIRST OPEN FLOWERS	600-800	3500-4000
	FRUITS 1 INCH IN DIAMETER	400-600	3000-3500
	FRUITS 2 INCHES IN DIAMETER	400-600	3000-3500
	FIRST HARVEST	300-400	2500-3000
	SECOND HARVEST	200-400	2000-2500
WATERMELON	VINES 6 INCHES LONG	1200-1500	4000-5000
	FRUITS 2 INCHES LONG	1000-1200	4000-5000
	FRUITS HALF MATURE	800-1000	3500-4000
	AT FIRST HARVEST	600-800	3000-3500

¹NR -- No recommended ranges have been developed.

Editor's Note: These guidelines are for production in Florida. Check with your local Extension agent to determine guidelines in your area.



TEXAS PRODUCE CONVENTION & TRADE SHOW
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Specialty Potatoes

Russian Banana, Rose Finn Apple, All Blue, Granola. They're not names traditionally associated with the vegetable Americans love to mash, bake, and fry. But these specialty potatoes are catching on with growers in the Western U.S. who are reaping a premium price from consumers in search of a better-tasting potato. The trend is booming in California and Washington, where specialty varieties have gained in popularity the past 10 years.

WESTERN STATES LEAD THE WAY

"Specialty growing really started with the small, organic farmers as part of their direct-marketing effort to fancy restaurants or farm markets," says Ron Voss, Extension vegetable specialist at the University of California-Davis. "But as that industry has grown, and as more people have tasted the difference that exists among potatoes, I think more people are actually looking for them." Increased demand has boosted the number of specialty growers in California from 15 or 20 a decade ago, to 100 to 200 today, Voss estimates. In Washington in 1987, none of the state's 30 potato shippers offered specialty varieties, according to Erik Sorensen, area Extension agent at Washington State University-Pasco. But in 1992, that number jumped to nine, he says.

SPECIALTY POTATOES: HERE TO STAY

Both growers and Extension agents agree that specialty potatoes will continue to rise in popularity, and consumers' tastes will dictate. "I'm sure that a great many inexperienced American potato eaters -- who like potatoes but have never tasted really good ones -- will get pretty worked up about it when they do," Condon predicts.

GETTING STARTED

The biggest hurdle for any grower who wants to start growing specialty varieties is locating quality seed in

large amounts, according to Voss. Currently, only a few seed companies offer specialty varieties on a limited basis, he says, adding that seed growers must have enough volume to make their expense worthwhile. Seed for Russian Bananas and Rose fingerlings can top \$2 per pound, according to Brait, who says less expensive varieties sell for anywhere from 50 or 60 cents per pound to \$1.50 per pound. "Each year it gets harder and harder for us to find seed, because more and more people are growing these varieties," Brait says. "Yellow Finn doubled in price this year."

For large commercial potato growers, adding specialty potatoes to their crop may not always be practical. "Tonnage, disease resistance, and storage are the three criteria that have driven potato breeding in the American market for the past 100 years," Condon says. "If you breed for taste, that's what you get; you don't get some of those other things. I would say that any commercial grower who thinks he's going to be able to raise Red Golds and sell them at a near-commercial price, instead of at a premium price, is going to go broke." However, Sorensen claims that Washington specialty varieties aren't just for the small grower anymore. Now that the market for the specialty types has been established, he says many large-scale growers are raising Yukon Golds, a specialty variety that is becoming more mainstream, along with traditional russets. "These specialty potatoes are, in some cases, easier to grow than the standard variety," he says. "Some of them are more disease-resistant."

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