

Phosphorus Management for Vegetable Production in Florida¹

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Introduction

Phosphorus (P) is an important nutrient for plant growth and economical vegetable production in Florida. A deficiency of P leads to reduced plant growth and reduced yields, and in extreme cases, the plant fails to grow much beyond the seedling stage. Although P shortage can severely limit vegetable growth, severe P deficiency is rarely observed in commercial vegetable fields in Florida because P has built up in many agricultural soils, and vegetable growers typically apply P to most vegetable crops each season, irrespective of the soil test results.

P has generally been thought of as immobile in most agricultural soils, including those in Florida. P mobility is a function of the type of soil and the chemistry of the soil, being somewhat mobile in very coarse, acidic soils with low concentrations of iron, aluminum, and calcium. There are situations where these types of soils exist in Florida; one such soil was researched by Rhue et al. (1987). P is relatively immobile in most commercial vegetable soils in Florida because of the presence of large quantities of calcium and iron which precipitate P, reducing the P

leaching potential. In many of these soils, P has been built up to great concentrations and crop response to added P fertilizers on these soils is unlikely (Hochmuth et al., 1993). There are however reports of crop responses to small amounts of P added as starter fertilizer on soils with high P and calcium concentrations, such as some shallow Histosols in southern Florida (Hochmuth et al., 1994; 1996).

Soil Testing for P

Since P is typically immobile in most Florida soils, it is amenable to soil testing programs. The University of Florida employs the Mehlich-1 extractant for determining soil-test P concentrations for mineral soils. The calibration of the Mehlich-1 soil test is presented in Table 1 and the P fertilizer recommendations for vegetables grown on mineral soils in Florida are presented in Table 2. The University of Florida employs water as the extractant to determine soil-test P levels for organic (Histosol) soils. The P recommendations for vegetables grown on organic soils are presented in Table 3. These Florida fertilizer recommendations are based on many years of field research with most vegetable

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crops. The research with P has been reviewed, for several vegetable crops, by Hochmuth and Cordasco (2000a-k). More detail on the P fertilization recommendations are presented in Circular 1152 "IFAS Standardized Fertilization Recommendations for Vegetable Crops" by Hochmuth and Hanlon (2000b), available on the web at <http://edis.ifas.ufl.edu/CV002>.

P Application

When required for crop production, P fertilizers can be supplied from several sources, including triple- or single-superphosphates, various ammonium phosphates, potassium phosphates, or phosphoric acid. Most research dealing with comparisons of sources for effects on crop production, on most soils, documents negligible differences among the sources for their ability to supply P to the crop. Liquid or dry forms of P fertilizers have performed similarly for crop production.

On soils where P is not likely to be mobile, the P fertilizers should be placed in the root zone. Typically P should be banded near the root of the transplant or near the germinating seed. Work with vegetables grown on the Histosols of the Everglades Agricultural Area (EAA) showed that banding reduced the P fertilizer needs by up to 50% with some crops (Sanchez et al., 1990; 1991). The research with fertilization of vegetables produced on Histosols in the EAA was reviewed by Hochmuth et al. (1994; 1996). In most production situations with mineral soils, P can be banded near the seed or plant or incorporated in the bed area prior to planting. This latter method would be the choice for polyethylene mulch culture systems. Where crops are established in cool soils, small amounts of P (so-called starter P) can be applied with the seed, seedpiece, or transplant (Hochmuth, 2000) to hasten early plant development. Supplemental or sidedress applications of P are usually not needed during the season when careful attention is given to the P fertilizer needs of the crop before or at planting. Rarely will P be needed in a nutrient solution being injected into a drip irrigation system.

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Table 1. Mehlich-1 soil test indices and interpretations for vegetable crops grown on mineral soils in Florida.

Element	Very Low	Low	Medium	High	Very High
	Mehlich-1 index (ppm)				
P	<10	10-15	16-30	31-60	>60
K	<20	20-35	36-60	61-125	>125
Mg		<15	15-30	>30	
Ca	<50	50-100	101-300	301-500	>500

Adapted from Hochmuth and Hanlon, 2000b.

Table 2. Phosphorus fertilizer recommendations for vegetable crops grown on mineral soils in Florida.

Crop	Mehlich-1 soil-test index values and interpretations				
	<10 Very Low	10-15 Low	16-30 Medium	31-60 High	>60 Very High
	P recommendation (lbs. P ₂ O ₅ /acre)				
Beans	120	100	80	0	0
Broccoli	150	120	100	0	0
Cabbage	150	120	100	0	0
Carrot	150	120	100	0	0
Celery	200	150	100	0	0
Cucumber	120	100	80	0	0
Eggplant	150	120	100	0	0
Endive, escarole	150	120	100	0	0
Lettuce (head, leaf)	150	120	100	0	0
Muskmelon	150	120	100	0	0
Mustard, kale	150	120	100	0	0
Okra	150	120	100	0	0
Onion (bulb)	150	120	100	0	0
Onion (bunch)	120	100	80	0	0
Parsley	150	120	100	0	0
Pepper	150	120	100	0	0
Potato	120	120	60	0	0
Radish	120	100	80	0	0
Spinach	120	100	80	0	0
Squashes	120	100	80	0	0
Strawberry	150	120	100	0	0
Sweet Corn	150	120	100	0	0
Sweet Potato	120	100	80	0	0
Tomato	150	120	100	0	0
Watermelon	150	120	100	0	0

Adapted from Hochmuth and Hanlon (2000b).

Table 3. Phosphorus fertilizer recommendations for vegetable crops grown on organic (Histosol) soils in Florida.

Crop	Soil-test index values with the water soil extraction (P)								
	3	6	9	12	15	18	21	24	> 27
	P recommendation (lbs. P ₂ O ₅ /acre)								
Celery	260	200	140	80	20	0	0	0	0
Endive	200	175	150	125	100	75	50	25	0
Escarole	200	175	150	125	100	75	50	25	0
Lettuce (Head)	200	175	150	125	100	75	50	25	0
Radish	100	40	0	0	0	0	0	0	0
Romaine	200	175	150	125	100	75	50	25	0
Sweet Corn	160	120	80	40	0	0	0	0	0

Adapted from Hochmuth et al. (1994; 1996).