

## NRCS Fertility Guidelines for Irrigated Specialty Crops on Coarse Textured Soils

Specialty crops such as vegetable crops and corn crops such as popcorn, sweet corn, and seed corn are frequently grown on irrigated, sandy soils in Illinois. Coarse textured soils are desired for the production of specialty crops due to good internal drainage and increased trafficability, but require the availability of irrigation. Nutritional requirements of specialty crops differ from agronomic crops grown on the finer textured soils in Illinois. Coarse textured soils low in organic matter release little nitrogen to the growing crop. Most of the nitrogen needs to be supplied by fertilizer. Nitrogen from annual legumes such as green beans, peas, and soybeans is negligible in sandy soils; therefore, nitrogen “credits” to the fertilizer budget for the next crop is not recommended. Additionally, fertilizer applications on sandy, irrigated soils must be done in such a manner to minimize leaching to ensure yield, quality, and minimize movement of nitrates to groundwater. The guidelines that follow should be used for nutrient management planning by clients participating in NRCS assisted programs in Illinois.

### **GREEN BEANS**

**Nitrogen:** A total of maximum of 100 lbs. N/acre applied in minimum of 3 applications (starter, 3 weeks after planting, pre-bud) can be made. More frequent applications may be desired if fertigation is used to apply the fertilizer. Nitrogen credits from perennial legume crops such as red clover or alfalfa will be considered in the nitrogen budget.

**Phosphorus:** Build to the recommended soil test levels according to the Illinois Agronomy Handbook. Where soil tests are between 51 and 70 lbs. P/acre, apply 70 lbs.  $P_2O_5$ /acre. No more than 35 lbs.  $P_2O_5$ /acre applied as starter where soil P tests are above 60, 65, and 70 for high, medium, and low P-supplying soils respectively.

**Potassium:** Build to the recommended soil test levels according to the Illinois Agronomy Handbook. Follow the guidelines in Table 2, Fertilizer Guide for Commercial Vegetable Growers, Circular 1185 for specific recommendations.

### **PEAS**

**Nitrogen:** A total of maximum of 100 lbs. N/acre applied in minimum of 3 applications (starter, 3 weeks after planting, pre-bud) can be made. More frequent applications may be desired if fertigation is used to apply the fertilizer. Nitrogen credits from perennial legume crops such as red clover or alfalfa will be considered in the nitrogen budget.

**Phosphorus:** Build to the recommended soil test levels according to the Illinois Agronomy Handbook. Where soil tests are between 51 and 70 lbs. P/acre, apply 70 lbs.  $P_2O_5$ /acre. No more than 35 lbs.  $P_2O_5$ /acre applied as starter where soil P tests are above 60, 65, and 70 for high, medium, and low P-supplying soils respectively.

**Potassium:** Build to the recommended soil test levels according to the Illinois Agronomy Handbook. Follow the guidelines in Table 2, Fertilizer Guide for Commercial Vegetable Growers, Circular 1185 for specific recommendations.

## **POPCORN, SWEET CORN, SEED CORN**

**Nitrogen:** A total of maximum of 180 lbs. N/acre applied in minimum of 3 applications (starter, 3 weeks after planting, pre-bud) can be made. More frequent applications may be desired if fertigation is used to apply the fertilizer. Nitrogen credits from perennial legume crops such as red clover or alfalfa will be considered in the nitrogen budget.

**Phosphorus:** Maintenance phosphorus will not be applied at rates exceeding the maintenance rate for 180 bushel field corn. No maintenance phosphorus will be applied where soil P tests are greater than 70 lbs. P/acre. No more than 35 lbs. P<sub>2</sub>O<sub>5</sub>/ acre applied as starter where soil P tests are above 60, 65, and 70 for high, medium, and low P-supplying soils respectively

### **Potassium:**

Since there is little or no build-up of K in sandy soils, use 1.5 times the maintenance rate.

## **N-P-K Fertilizer Requirements and Recommendations in Pumpkins and Related Crops**

**Adapted from J.M. Swiader**

### **1. Nitrogen fertilization recommendations**

Due to the various physio-chemical transformations and mobility of N in most soils, chemical tests for plant-available soil N can be highly inaccurate and misleading. Subsequently, fertility recommendations for N in pumpkins are not based on soil N tests, but rather are based primarily on crop yield potential, with adjustments made for soil organic matter content. In Table 1, N fertilizer recommendations are for a crop yield potential of 15-25 tons/acre, a relatively high but achievable yield level.

**Table 1. Nitrogen fertilizer recommendations in pumpkins (and related crops).<sup>2</sup>**

<b>soil organic matter content (%)</b>			
<b>&lt; 2</b>	<b>2-9.9</b>	<b>10-20</b>	<b>&gt;20</b>
<b>(lbs N/acre)</b>			
<b>100</b>	<b>80</b>	<b>60</b>	<b>30</b>

<sup>2</sup>for a yield goal of 15-25 tons/acre

On sandy soils, and other soils with less than 2% organic matter, the common practice is to split the N application, with 1/2 the N applied pre-plant, and 1/2 side-dressed when vines run.

For each ton of solid dairy or cattle manure applied, N recommendations can be reduced 3-4 lbs/acre. If liquid sources of dairy or cattle manure are used, subtract 10 lbs N/acre for each 1000 gallons/acre of material applied. However, in no case should amounts of manure in excess of N fertilizer requirements be applied.

**2. Phosphorus (P) and potassium (K) fertilization recommendations P and K soil test levels.**

As regards P and K fertility requirements, pumpkins and winter squashes are classified as demand-level '5' crops, which means they have a relatively high demand for P and K. Unlike N, however, P and K fertilizer recommendations are based on the levels of plant-available nutrient in the soil. Optimum soil test levels of exchangeable P and K for pumpkins are shown in Table 2.

**Table 2. Optimum soil test levels for P and K in pumpkins and related crops.**

soil type	soil P1 (lbs/acre)	soil K
loam, silt, clay	60-75	250-350
sands	60-75	200-300

**P and K fertilizer recommendations.** When P and K soil tests are in the optimum range, P and K fertilizer recommendations are set to a rate approximately equal to the amount removed in the harvested part (pumpkin fruit) of the crop. This is known as the 'maintenance' level and is roughly equal to 10 lbs P/acre and 105 lbs K/acre. Based on these totals, and converting P and K to their respective oxide equivalents (and increasing the P requirement 50% to account for fixation by soil particles), the fertilizer maintenance requirement (FMR\*) for P and K in pumpkins for a yield goal of 20-25 tons fruit/acre calculates out to approximately 125 lbs K<sub>2</sub>O/acre and 50 lbs P<sub>2</sub>O<sub>5</sub>/acre.

**When soil test results are below the optimum range.** Additional P and K are added in with the maintenance P and K level. Conversely, when soil test results are above the optimum range, P and K fertilizer recommendations are reduced to approximately 1/4 to 1/2 the maintenance levels. These calculations are factored in to the P and K fertilizer recommendations in Tables 3 and 4, respectively. The recommendations in each table are based on a fruit-yield potential of 20-25 tons/acre, for plant population densities of 1,850-4,500 plants/acre. Note; soil test results are expressed in lbs/acre, while fertilizer recommendations are given as P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O equivalents.

**Table 3. Phosphorus fertilizer requirements (P<sub>2</sub>O<sub>5</sub>) in pumpkins for various levels of soil P fertility**

P1 soil test (lbs P/ac)	expected yield level		
	maximum (lbs P <sub>2</sub> O <sub>5</sub> /ac)	95%	90%
100	0	-	-
90	30	-	-
80	60	0	-
70	90	20	-
60	120	50	0
50	150	80	30
40	180	110	60
30	210	140	90
20	240	170	120
10	270	200	150

P 'maintenance' level (~ 50 lbs P<sub>2</sub>O<sub>5</sub>/acre)

**Table 4. Potassium fertilizer requirements (K<sub>2</sub>O) in pumpkins for various levels of soil K fertility**

K soil test (lbs K/ac)	expected yield level		
	maximum (lbs K <sub>2</sub> O/ac)	95%	90%
400	60	-	-
300	150	60	-
280	160	70	10
260	180	90	30
240	200	120	40
220	210	130	60
200	230	150	80
180	250	170	90
160	260	180	110
140	280	200	130
120	300	220	140
100	310	230	160
80	330	250	180
60	350	270	190
40	360	280	210

**K 'maintenance' level (~ 125 lbs K<sub>2</sub>O/acre)**

## References

Borboom, C.M., Bundy, L. G., Bussan, A.J., Colquhoun, J.B., Cullen, E.M., Delahaut, K.A., Kelling, K.A., Mahr, D.L., Stevenson, W.R., Wyman, J.A. 2006. Commercial Vegetable Production in Wisconsin A3422. University of Wisconsin Extension. <http://cecommerce.uwex.edu/pdfs/A3422.PDF>

Commercial Vegetable Guides. Oregon State University.  
<http://oregonstate.edu/Dept/NWREC/vegindex.html>

Garber, J.M. and Swiader, J.M. Fertilizer Guide for Commercial Vegetable Growers. October 1985. University of Illinois at Champaign-Urbana. Cooperative Extension Service Circular 1185.  
[http://efotg.nrcs.usda.gov/references/public/IL/FertilizerGuide\\_Circular1185.pdf](http://efotg.nrcs.usda.gov/references/public/IL/FertilizerGuide_Circular1185.pdf)

Rosen, C.J., and Eliason, R., Nutrient Management for Commercial Fruit and Vegetable Crops. 2006. University of Minnesota Extension Service.  
<http://www.extension.umn.edu/distribution/cropsystems/DC5886.html>

Wolkowski, R.P., Kelling, K.A., and Bundy, L.G., Nitrogen Management on Sandy Soils A3634. University of Wisconsin, Madison. <http://s142412519.onlinehome.us/uw/pdfs/A3634.PDF>

Ziegler, K.E., Ashman, R.B., White, G.M., Wysong, D.S., rev. Hanna, M.A., Nielsen, R.L., Zuber, M.S. Popcorn Production and Marketing, National Corn Handbook NCH-5, Current Report 2104. Oklahoma Cooperative Extension Service. <http://pss.okstate.edu/publications/cornsorgsudan/CR-2104web.pdf>