

Fertilizing Crops in High Tunnels

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Farm Bureau Bio-Ag Symposium

October 12, 2010

Introduction

Properly fertilizing crops in high tunnels or hoop houses is important to maximize yields and profits of high value crops such as tomatoes. Providing nutrients to the crop through the drip irrigation system on a daily or weekly basis is one means of meeting the nutrient needs of the crop. Since the crop nutrient needs change as the crop matures, the amount of nutrient applied at any particular time should be appropriate for the crop growth stage.

Preplant Fertility

Managing soil fertility is more than simply adding plant nutrients to the soil for uptake by crops. Good fertility practices include additions of organic matter to soil to improve soil quality characteristics such as water holding capacity, soil condition (tilth/friability), microbial activity, and infiltration rate.

Addition and incorporation of one to two inches of an organic amendment such as compost builds soil quality. Though soil amendments like compost contain nutrients, those nutrients are only slowly available to crops. Thus, most soil amendments should not be considered to be fertilizers.

Another opportunity for improving soil quality is use of cover crops. Legume cover crops are commonly used both to build soil quality and as organic fertilizers; in particular by organic growers. Cover crop residues are a good source of readily available plant nutrients. However, unless the plastic cover is removed from the high tunnel during the growth of the cover crop, some means of irrigation must be provided.

Animal manures are also good sources of both nutrients and organic matter. However, an addition of one to two inches would most likely oversupply nutrients. Application rates of manure should be based on the nutrient content of the material and the nutrient needs of the crop. The nutrient content can be determined by sending a waste sample to the North Carolina Department of Agriculture and Consumer Sciences (NCDA) Agronomic Division (<http://www.ncagr.gov/agronomi/index.htm>) Waste Analysis Laboratory. For a small fee, the laboratory will determine the nutrient content and make an application rate recommendation for the crop to be grown. It is important to take precautions so that produce is not contaminated by potential human pathogens contained in manures. For vegetable operations, manure should be applied to and incorporated in the soil at least 120 days before the crop is harvested.

As a practical matter, in most high tunnel operations, crops are growing in the tunnel most of the year, so there would never be a 120 day buffer period between any manure application and the harvest of the next crop. Manure that is sufficiently composted can be applied without any restrictions related to "days before harvest." Sufficient composting

for farmers using windrow composting systems is defined as “achieving consistent temperatures in the windrow of 130 degrees F for 15 days while turning the windrow five times during that period.

In both organic and conventional high tunnel production systems, fertilizers are added to soil before the crop is started. Generally, only a portion of the nutrients “required” for full production are provided “pre-plant,” and the remainder are supplied as either a sidedressing alongside each row of plants or in drip irrigation water supplied to the crop. The general exception to this practice is the application of phosphate (P_2O_5) fertilizers, which are almost always applied before the crop is planted. There are multiple sources of information available that provide recommendations for both pre-plant and sidedress application rates for various crops. See the publication “Southeastern 2009 Vegetable Crop Handbook” for more information on rates (<http://www.aces.edu/pubs/docs/A/ANR-1344/ANR-1344.pdf?PHPSESSID=3d67bc17c06d3bbb0e6bfd8492a2345a>).

A “best management practice” is to supply pre-plant nutrients based on soil test results. Soil levels for major nutrients can be determined at no charge by sending a soil sample to the NCDA Soil Testing Laboratory. Test results will indicate how much lime and fertilizer to apply to soil (per 1000 square feet). See the Agronomic Division web site for details on the soil test (<http://www.ncagr.com/agronomi/sthome.htm>). “Understanding the Index System” (<http://www.ncagr.com/agronomi/stindex.htm>) provides additional information about understanding the soil report.

Some organic growers apply the entire nutrient requirement for the crop before the crop is planted, but, generally, this practice does not result in the most efficient use of nutrients. Often, many organic crops managed this way suffer from nutrient deficiencies. Sidedressing with organic fertilizers such as feather meal (approximately 12% nitrogen or N) or Sul-Po-Mag (20% potash or K_2O) is a practical alternative to organic growers who want to “split” fertilizer applications.

Calculating fertilizer application rates

Every fertilizer has a “guaranteed plant analysis”. The analysis is the three numbers printed on the fertilizer bag that are separated by dashes. These three numbers represent the percentages of N, phosphate (P_2O_5) and K_2O , respectively, in the fertilizer material. Thus, a 50 pound bag of 10-10-10, is composed of 10% N, 10% P_2O_5 , and 10% K_2O , and contains five pounds of each of these nutrients (10% of 50 pounds equals five pounds).

To determine the amount of fertilizer to apply that will meet the recommended “preplant” or “sidedress” nutrient application rate, divide the recommended amount of nutrient by the percent of the nutrient in the fertilizer bag (expressed as a decimal). For example, to determine the amount of triple superphosphate (0-46-0) to apply to supply 50 lbs of P_2O_5 per acre, divide 50 by 0.46. The amount of triple superphosphate to apply equals 109 lbs per acre (this equals 2.5 lbs/1000 sq.ft.). Likewise, the amount of Sul-Po-Mag (0-0-20) fertilizer needed to supply 100 lbs of K_2O per acre is 100 divided by 0.20 or 500 lbs per acre (this equals 11.5 lbs/1000 sq.ft.).

Fertilizing the Crop Through the Drip Irrigation System (Fertigation)

The major nutrients usually delivered through the drip irrigation system are N, K₂O and calcium (Ca). Vegetables have a high demand for these nutrients as fruit is produced. Although there are many fertilizers to choose from, two fertilizers commonly used to deliver these nutrients in appropriate amounts are calcium nitrate (CaNO₃) and potassium nitrate (KNO₃). These two fertilizers are typically purchased as “horticultural grade” products, because these formulations tend to dissolve relatively easily in water; i.e. they are highly “soluble.”

A variety of soluble organic fertilizer products are available in the marketplace; however, finding these materials locally can be a challenge. An option for growers is to purchase them online. Typically, organic fertilizers that can be applied through drip irrigation systems are expensive. However, given the high value of crops typically grown in high tunnel systems, that investment may be small compared to the price an organic crop commands in the locally-direct marketplace. Soluble organic fertilizers have relatively low percentages of nutrients in the fertilizer; for example, many organic growers would use fish emulsion (5-1-2) to fertigate crops. Shipping costs can be substantial for large operations requiring large quantities of product.

Soluble fertilizers are mixed in recommended proportions to deliver the appropriate amount of fertilizer to the crop relative to the stage of growth of the crop. The following table demonstrates how the nutrient requirements of a tomato crop change over the course of the production season.

Days After Planting	N requirement (lbs/acre/day)	K requirement (lbs/acre/day)	
		High Soil K	Low Soil K
0-14	0.5	0.5	0.5
5-28	0.7	0.7	1.4
29-42	1.0	1.0	2.0
43-56	1.5	1.5	3.0
55-77	2.2	2.2	4.4
78-98	2.5	2.5	5.0

Mixed in the correct proportions, CaNO₃ and KNO₃ can be injected into drip irrigation systems to supply crop nutrient needs at the stages of growth identified in the table above. Note that calcium (Ca) will also be supplied. In crops such as tomatoes and peppers, calcium supplements are important for the prevention of blossom end rot, a common disorder that occurs when plants are deficient in calcium. Growers typically inject fertilizer into lines on a daily basis, but weekly fertigation is also commonplace.

The table above describes the amount of nutrient required, not the amount of fertilizer required. The tables included with this document describe the amount of CaNO₃ and

KNO₃ fertilizer that are required to supply the correct amounts of N and K₂O for a particular crop at a particular growth stage. The tables also describe the amount of water required to fully dissolve CaNO₃ and KNO₃ materials (warm water speeds the process). Once dissolved in water, the fertilizer can then be injected into the drip system as water is pumped out to the high tunnel.

A common practice is to prepare enough fertilizer to supply the crop for a week. In this case a tank large enough (at a minimum) to hold the water needed to fully dissolve the fertilizer is used. After the fertilizer is mixed with the water, the tank is “topped off”. One seventh of the tank is injected daily for a week. For example, with a 50 gallon tank (or barrel), a little over seven gallons would be injected into the drip system on a daily basis with the irrigation water (50 gallons divided by 7 days equals 7.14 gallons per day).

Since injectors may vary with respect to rates of injection, this simplifies any calculation about how long to keep the injector working. However, since most “irrigation runs” are one to two hours in length, fertilizer must be injected fast enough to get required amounts in the system within this time frame. The drip system should run for five to ten minutes after the injector is turned off, in order to purge the drip lines of nutrient. Fertilizer left in the lines can encourage the growth of algae in the system, resulting in the clogging of lines and emitters.

Tables are included that provide fertigation tables for organic tomatoes and squash. These fertilizers have been chosen randomly from materials listed by the Organic Materials Review Institute (OMRI). They have been chosen to provide examples and do not represent an endorsement or recommendation for use. The primary reasons for their choice in the organic fertigation examples are their relatively good solubility and their relatively high nutrient content. Growers may choose other fertilizers and calculate the appropriate amounts of those fertilizers to use to meet crop nutrient requirements.

Crop Tissue Analysis

The recommended rates of fertilizers that are described in the tables should be considered as general guidelines. Soils vary in their nutrient content and in the availability of those nutrients. Adjustments to the recommendations should be based on the nutrient status of the plants at any particular growth stage. The nutrient status of plants can be determined through “plant analysis.” Typically, leaf samples randomly chosen from the “most recently mature leaves” on a set number of plants are gathered and delivered to the NCDA Plant Analysis Laboratory (for details on this program see <http://www.ncagr.gov/agronomi/pwshome.htm>). For a small fee, a laboratory report describing the nutrient content of those leaves will allow growers to adjust the fertigation program to address either deficiencies or <http://www.ncagr.gov/agronomi/pwshome.htm> over-application of nutrients. High value crops should be tested for tissue nutrient content on a regular basis.

Fertigation Chart for Tomato (High Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	0.23	0.11	0.59	0.28	1.17	0.57	2.35	1.14
fertilizer needed 15-28 days after planting	0.33	0.16	0.82	0.40	1.64	0.80	3.29	1.59
fertilizer needed 29-42 days after planting	0.47	0.23	1.17	0.57	2.35	1.14	4.70	2.27
fertilizer needed 43-56 days after planting	0.70	0.34	1.76	0.85	3.52	1.70	7.05	3.41
fertilizer needed 57-77 days after planting	1.03	0.50	2.58	1.25	5.17	2.50	10.33	5.00
fertilizer needed 78-98 days after planting	1.17	0.57	2.94	1.42	5.87	2.84	11.74	5.68
Water Required to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.13		0.33		0.66		1.33	
water needed 15-28 days after planting	0.2		0.5		0.9		1.9	
water needed 29-42 days after planting	0.3		0.7		1.3		2.7	
water needed 43-56 days after planting	0.4		1.0		2.0		4.0	
water needed 57-77 days after planting	0.6		1.5		2.9		5.8	
water needed 78-98 days after planting	0.7		1.7		3.3		6.6	
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.6	0.8	4.1	2.0	8.2	4.0	16.4	8.0
fertilizer needed 15-28 days after planting	2.3	1.1	5.8	2.8	11.5	5.6	23.0	11.1
fertilizer needed 29-42 days after planting	3.3	1.6	8.2	4.0	16.4	8.0	32.9	15.9
fertilizer needed 43-56 days after planting	4.9	2.4	12.3	6.0	24.7	11.9	49.3	23.9
fertilizer needed 57-77 days after planting	7.2	3.5	18.1	8.8	36.2	17.5	72.3	35.0
fertilizer needed 78-98 days after planting	8.2	4.0	20.5	9.9	41.1	19.9	82.2	39.8
Weekly Water to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.93		2.32		4.65		9.30	
water needed 15-28 days after planting	1.3		3.3		6.5		13.0	
water needed 29-42 days after planting	1.9		4.6		9.3		18.6	
water needed 43-56 days after planting	2.8		7.0		13.9		27.9	
water needed 57-77 days after planting	4.1		10.2		20.5		40.9	
water needed 78-98 days after planting	4.6		11.6		23.2		46.5	

Fertigation Chart for Tomato (Low Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	0.23	0.11	0.59	0.28	1.17	0.57	2.35	1.14
fertilizer needed 15-28 days after planting	0.19	0.32	0.48	0.80	0.95	1.59	1.91	3.18
fertilizer needed 29-42 days after planting	0.27	0.45	0.68	1.14	1.36	2.27	2.73	4.55
fertilizer needed 43-56 days after planting	0.41	0.68	1.02	1.70	2.05	3.41	4.09	6.82
fertilizer needed 57-77 days after planting	0.60	1.00	1.50	2.50	3.00	5.00	6.00	10.00
fertilizer needed 78-98 days after planting	0.68	1.14	1.70	2.84	3.41	5.68	6.82	11.36
Water Required to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.13		0.33		0.66		1.33	
water needed 15-28 days after planting	0.3		0.8		1.6		3.2	
water needed 29-42 days after planting	0.5		1.1		2.3		4.5	
water needed 43-56 days after planting	0.7		1.7		3.4		6.8	
water needed 57-77 days after planting	1.0		2.5		5.0		10.0	
water needed 78-98 days after planting	1.1		2.8		5.7		11.3	
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.6	0.8	4.1	2.0	8.2	4.0	16.4	8.0
fertilizer needed 15-28 days after planting	1.3	2.2	3.3	5.6	6.7	11.1	13.4	22.3
fertilizer needed 29-42 days after planting	1.9	3.2	4.8	8.0	9.5	15.9	19.1	31.8
fertilizer needed 43-56 days after planting	2.9	4.8	7.2	11.9	14.3	23.9	28.6	47.7
fertilizer needed 57-77 days after planting	4.2	7.0	10.5	17.5	21.0	35.0	42.0	70.0
fertilizer needed 78-98 days after planting	4.8	8.0	11.9	19.9	23.9	39.8	47.7	79.5
Weekly Water to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.93		2.32		4.65		9.30	
water needed 15-28 days after planting	2.2		5.5		11.1		22.2	
water needed 29-42 days after planting	3.2		7.9		15.9		31.7	
water needed 43-56 days after planting	4.8		11.9		23.8		47.6	
water needed 57-77 days after planting	7.0		17.4		34.9		69.8	
water needed 78-98 days after planting	7.9		19.8		39.6		79.3	

Fertigation Chart for Squash (High Soil K Index)

	0.1 acre			0.25 acre			0.5 acre			1.0 acre		
	CaNO ₃	KNO ₃	KNO ₃	CaNO ₃	KNO ₃	KNO ₃	CaNO ₃	KNO ₃	KNO ₃	CaNO ₃	KNO ₃	KNO ₃
Daily Fertilizer Requirement (lbs)	0.47	0.23	1.17	0.57	2.35	1.14	4.70	2.27	1.14	4.70	2.27	2.27
fertilizer needed 0-7 days after planting	0.70	0.34	1.76	0.85	3.52	1.70	7.05	3.41	1.70	7.05	3.41	3.41
fertilizer needed 8-21 days after planting	0.94	0.45	2.35	1.14	4.70	2.27	9.39	4.55	2.27	9.39	4.55	4.55
fertilizer needed 22-63 days after planting												
Water Required to Dissolve Fertilizer (gal)	0.1 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre
water needed 0-7 days after planting	0.27	0.66	1.33	2.66	0.66	1.33	2.66	0.66	1.33	2.66	0.66	1.33
water needed 8-21 days after planting	0.4	1.0	2.0	4.0	1.0	2.0	4.0	1.0	2.0	4.0	1.0	2.0
water needed 22-63 days after planting	0.5	1.3	2.7	5.3	1.3	2.7	5.3	1.3	2.7	5.3	1.3	2.7
Weekly Fertilizer Requirement (lbs)	0.1 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre
CaNO ₃	3.3	8.2	16.4	32.9	8.2	16.4	32.9	8.2	16.4	32.9	8.2	16.4
KNO ₃	4.9	2.4	12.3	6.0	24.7	11.9	49.3	23.9	11.9	49.3	23.9	23.9
fertilizer needed 0-7 days after planting	6.6	3.2	16.4	8.0	32.9	15.9	65.8	31.8	15.9	65.8	31.8	31.8
fertilizer needed 8-21 days after planting												
fertilizer needed 22-63 days after planting												
Weekly Water to Dissolve Fertilizer (gal)	0.1 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre	1.0 acre	0.25 acre	0.5 acre
water needed 0-7 days after planting	1.86	4.65	9.30	18.59	4.65	9.30	18.59	4.65	9.30	18.59	4.65	9.30
water needed 8-21 days after planting	2.8	7.0	13.9	27.9	7.0	13.9	27.9	7.0	13.9	27.9	7.0	13.9
water needed 22-63 days after planting	3.7	9.3	18.6	37.2	9.3	18.6	37.2	9.3	18.6	37.2	9.3	18.6

Fertigation Chart for Squash (Low Soil K Index)

	0.1 acre			0.25 acre			0.5 acre			1.0 acre		
	CaNO ₃	KNO ₃	KNO ₃	CaNO ₃	KNO ₃	KNO ₃	CaNO ₃	KNO ₃	KNO ₃	CaNO ₃	KNO ₃	KNO ₃
Daily Fertilizer Requirement (lbs)												
fertilizer needed 0-14 days after planting	0.25	0.41	0.61	1.02	1.02	1.23	2.05	2.05	2.45	2.45	4.09	4.09
fertilizer needed 15-28 days after planting	0.35	0.59	0.89	1.48	1.48	1.77	2.95	2.95	3.55	3.55	5.91	5.91
fertilizer needed 29-63 days after planting	0.41	0.68	1.02	1.70	1.70	2.05	3.41	3.41	4.09	4.09	6.82	6.82
Water Required to Dissolve Fertilizer (gal)												
water needed 0-14 days after planting	0.1	0.41	1.02	0.25	1.02	2.04	0.5	2.04	4.08	1.0	4.08	4.08
water needed 15-28 days after planting	0.6	0.6	1.5	1.5	1.5	2.9	5.9	2.9	5.9	5.9	5.9	5.9
water needed 29-63 days after planting	0.7	0.7	1.7	1.7	1.7	3.4	6.8	3.4	6.8	6.8	6.8	6.8
Weekly Fertilizer Requirement (lbs)												
fertilizer needed 0-14 days after planting	1.7	2.9	4.3	7.2	7.2	8.6	14.3	14.3	17.2	17.2	28.6	28.6
fertilizer needed 15-28 days after planting	2.5	4.1	6.2	10.3	10.3	12.4	20.7	20.7	24.8	24.8	41.4	41.4
fertilizer needed 29-63 days after planting	2.9	4.8	7.2	11.9	11.9	14.3	23.9	23.9	28.6	28.6	47.7	47.7
Weekly Water to Dissolve Fertilizer (gal)												
water needed 0-14 days after planting	2.85	2.85	7.13	0.25	7.13	14.27	0.5	14.27	28.53	1.0	28.53	28.53
water needed 15-28 days after planting	4.1	4.1	10.3	10.3	10.3	20.6	41.2	20.6	41.2	41.2	41.2	41.2
water needed 29-63 days after planting	4.8	4.8	11.9	11.9	11.9	23.8	47.6	23.8	47.6	47.6	47.6	47.6

Organic Fertiligation Chart for Tomato (High Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Fish	KMag	Fish	KMag	Fish	KMag	Fish	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.00	0.14	2.50	0.34	5.00	0.68	10.00	1.36
fertilizer needed 15-28 days after planting	1.40	0.19	3.50	0.48	7.00	0.95	14.00	1.91
fertilizer needed 29-42 days after planting	2.00	0.27	5.00	0.68	10.00	1.36	20.00	2.73
fertilizer needed 43-56 days after planting	3.00	0.41	7.50	1.02	15.00	2.05	30.00	4.09
fertilizer needed 57-77 days after planting	4.40	0.60	11.00	1.50	22.00	3.00	44.00	6.00
fertilizer needed 78-98 days after planting	5.00	0.68	12.50	1.70	25.00	3.41	50.00	6.82

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Fish	KMag	Fish	KMag	Fish	KMag	Fish	KMag
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	7.0	1.0	17.5	2.4	35.0	4.8	70.0	9.5
fertilizer needed 15-28 days after planting	9.8	1.3	24.5	3.3	49.0	6.7	98.0	13.4
fertilizer needed 29-42 days after planting	14.0	1.9	35.0	4.8	70.0	9.5	140.0	19.1
fertilizer needed 43-56 days after planting	21.0	2.9	52.5	7.2	105.0	14.3	210.0	28.6
fertilizer needed 57-77 days after planting	30.8	4.2	77.0	10.5	154.0	21.0	308.0	42.0
fertilizer needed 78-98 days after planting	35.0	4.8	87.5	11.9	175.0	23.9	350.0	47.7

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	0.83	0.19	2.08	0.47	4.17	0.95	8.33	1.89
fertilizer needed 15-28 days after planting	1.17	0.27	2.92	0.66	5.83	1.33	11.67	2.65
fertilizer needed 29-42 days after planting	1.67	0.38	4.17	0.95	8.33	1.89	16.67	3.79
fertilizer needed 43-56 days after planting	2.50	0.57	6.25	1.42	12.50	2.84	25.00	5.68
fertilizer needed 57-77 days after planting	3.67	0.83	9.17	2.08	18.33	4.17	36.67	8.33
fertilizer needed 78-98 days after planting	4.17	0.95	10.42	2.37	20.83	4.73	41.67	9.47

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	5.8	1.3	14.6	3.3	29.2	6.6	58.3	13.3
fertilizer needed 15-28 days after planting	8.2	1.9	20.4	4.6	40.8	9.3	81.7	18.6
fertilizer needed 29-42 days after planting	11.7	2.7	29.2	6.6	58.3	13.3	116.7	26.5
fertilizer needed 43-56 days after planting	17.5	4.0	43.8	9.9	87.5	19.9	175.0	39.8
fertilizer needed 57-77 days after planting	25.7	5.8	64.2	14.6	128.3	29.2	256.7	58.3
fertilizer needed 78-98 days after planting	29.2	6.6	72.9	16.6	145.8	33.1	291.7	66.3

Organic Fertiligation Chart for Tomato (Low Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Fish	KMag	Fish	KMag	Fish	KMag	Fish	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.00	0.14	2.50	0.34	5.00	0.68	10.00	1.36
fertilizer needed 15-28 days after planting	1.40	0.51	3.50	1.27	7.00	2.55	14.00	5.09
fertilizer needed 29-42 days after planting	2.00	0.73	5.00	1.82	10.00	3.64	20.00	7.27
fertilizer needed 43-56 days after planting	3.00	1.09	7.50	2.73	15.00	5.45	30.00	10.91
fertilizer needed 57-77 days after planting	4.40	1.60	11.00	4.00	22.00	8.00	44.00	16.00
fertilizer needed 78-98 days after planting	5.00	1.82	12.50	4.55	25.00	9.09	50.00	18.18

Weekly Fertilizer Requirement (lbs)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Fish	KMag	Fish	KMag	Fish	KMag	Fish	KMag
fertilizer needed 0-14 days after planting	7.0	1.0	17.5	2.4	35.0	4.8	70.0	9.5
fertilizer needed 15-28 days after planting	9.8	3.6	24.5	8.9	49.0	17.8	98.0	35.6
fertilizer needed 29-42 days after planting	14.0	5.1	35.0	12.7	70.0	25.5	140.0	50.9
fertilizer needed 43-56 days after planting	21.0	7.6	52.5	19.1	105.0	38.2	210.0	76.4
fertilizer needed 57-77 days after planting	30.8	11.2	77.0	28.0	154.0	56.0	308.0	112.0
fertilizer needed 78-98 days after planting	35.0	12.7	87.5	31.8	175.0	63.6	350.0	127.3

Daily Fertilizer Requirement (lbs)

	0.1 acre			0.25 acre			0.5 acre			1.0 acre		
	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag
fertilizer needed 0-14 days after planting	0.08	0.19	0.21	0.47	0.42	0.95	0.83	1.89	1.17	2.92	1.17	5.83
fertilizer needed 15-28 days after planting	0.12	0.58	0.29	1.46	0.58	2.92	1.17	5.83	1.67	8.33	2.50	12.50
fertilizer needed 29-42 days after planting	0.17	0.83	0.42	2.08	0.83	4.17	1.67	8.33	1.83	9.17	3.67	18.33
fertilizer needed 43-56 days after planting	0.25	1.25	0.63	3.13	1.25	6.25	2.50	12.50	2.08	10.42	4.17	20.83
fertilizer needed 57-77 days after planting	0.37	1.83	0.92	4.58	1.83	9.17	3.67	18.33	2.08	10.42	4.17	20.83
fertilizer needed 78-98 days after planting	0.42	2.08	1.04	5.21	2.08	10.42	4.17	20.83				

Weekly Fertilizer Requirement (lbs)

	0.1 acre			0.25 acre			0.5 acre			1.0 acre		
	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag
fertilizer needed 0-14 days after planting	0.6	1.3	1.5	3.3	2.9	6.6	5.8	13.3	4.1	20.4	8.2	40.8
fertilizer needed 15-28 days after planting	0.8	4.1	2.0	10.2	4.1	20.4	8.2	40.8	5.8	29.2	11.7	58.3
fertilizer needed 29-42 days after planting	1.2	5.8	2.9	14.6	5.8	29.2	11.7	58.3	8.8	43.8	17.5	87.5
fertilizer needed 43-56 days after planting	1.8	8.8	4.4	21.9	8.8	43.8	17.5	87.5	6.4	32.1	12.8	64.2
fertilizer needed 57-77 days after planting	2.6	12.8	6.4	32.1	12.8	64.2	25.7	128.3	7.3	36.5	14.6	72.9
fertilizer needed 78-98 days after planting	2.9	14.6	7.3	36.5	14.6	72.9	29.2	145.8				

Organic Fertiligation Chart for Squash (High Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Fish	KMag	Fish	KMag	Fish	KMag	Fish	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-7 days after planting	2.00	0.27	5.00	0.68	10.00	1.36	20.00	2.73
fertilizer needed 8-21 days after planting	3.00	0.41	7.50	1.02	15.00	2.05	30.00	4.09
fertilizer needed 22-63 days after planting	4.00	0.55	10.00	1.36	20.00	2.73	40.00	5.45
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-7 days after planting	14.0	1.9	35.0	4.8	70.0	9.5	140.0	19.1
fertilizer needed 8-21 days after planting	21.0	2.9	52.5	7.2	105.0	14.3	210.0	28.6
fertilizer needed 22-63 days after planting	28.0	3.8	70.0	9.5	140.0	19.1	280.0	38.2

Fish is calculated on 5-1-2.

KMag is calculated on on K-Mag Crystals 0-0-22 (OMRI approved and available Peaceful Valley Farm Supply www.groworganic.com).

Peaceful Valley also has Phytamin 6-1-1, which may be less expensive than fish.

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-7 days after planting	1.67	0.38	4.17	0.95	8.33	1.89	16.67	3.79
fertilizer needed 8-21 days after planting	2.50	0.57	6.25	1.42	12.50	2.84	25.00	5.68
fertilizer needed 22-63 days after planting	3.33	0.76	8.33	1.89	16.67	3.79	33.33	7.58
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-7 days after planting	11.7	2.7	29.2	6.6	58.3	13.3	116.7	26.5
fertilizer needed 8-21 days after planting	17.5	4.0	43.8	9.9	87.5	19.9	175.0	39.8
fertilizer needed 22-63 days after planting	23.3	5.3	58.3	13.3	116.7	26.5	233.3	53.0

Organic Fertiligation Chart for Squash (Low Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Fish	KMag	Fish	KMag	Fish	KMag	Fish	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.80	0.65	4.50	1.64	9.00	3.27	18.00	6.55
fertilizer needed 15-28 days after planting	2.60	0.95	6.50	2.36	13.00	4.73	26.00	9.45
fertilizer needed 29-63 days after planting	3.00	1.09	7.50	2.73	15.00	5.45	30.00	10.91
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	12.6	4.6	31.5	11.5	63.0	22.9	126.0	45.8
fertilizer needed 15-28 days after planting	18.2	6.6	45.5	16.5	91.0	33.1	182.0	66.2
fertilizer needed 29-63 days after planting	21.0	7.6	52.5	19.1	105.0	38.2	210.0	76.4

Fish is calculated on 5-1-2.

KMag is calculated on on K-Mag Crystals 0-0-22 (OMRI approved and available Peaceful Valley Farm Supply www.groworganic.com)

Peaceful Valley also has Phytamin 6-1-1, which may be less expensive than fish.

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag	Phytamin	KMag
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.50	0.75	3.75	1.88	7.50	3.75	15.00	7.50
fertilizer needed 15-28 days after planting	2.17	1.08	5.42	2.71	10.83	5.42	21.67	10.83
fertilizer needed 29-63 days after planting	2.50	1.25	6.25	3.13	12.50	6.25	25.00	12.50
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	10.5	5.3	26.3	13.1	52.5	26.3	105.0	52.5
fertilizer needed 15-28 days after planting	15.2	7.6	37.9	19.0	75.8	37.9	151.7	75.8
fertilizer needed 29-63 days after planting	17.5	8.8	43.8	21.9	87.5	43.8	175.0	87.5

Fertigation Chart for Pepper (Low Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	0.23	0.11	0.59	0.28	1.17	0.57	2.35	1.14
fertilizer needed 15-28 days after planting	0.19	0.32	0.48	0.80	0.95	1.59	1.91	3.18
fertilizer needed 29-42 days after planting	0.27	0.45	0.68	1.14	1.36	2.27	2.73	4.55
fertilizer needed 43-56 days after planting	0.41	0.68	1.02	1.70	2.05	3.41	4.09	6.82
fertilizer needed 57-98 days after planting	0.49	0.82	1.23	2.05	2.45	4.09	4.91	8.18
Water Required to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.13		0.33		0.66		1.33	
water needed 15-28 days after planting	0.3		0.8		1.6		3.2	
water needed 29-42 days after planting	0.5		1.1		2.3		4.5	
water needed 43-56 days after planting	0.7		1.7		3.4		6.8	
water needed 57-98 days after planting	0.8		2.0		4.1		8.2	
Weekly Fertilizer Requirement (lbs)								
	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃
fertilizer needed 0-14 days after planting	1.6	0.8	4.1	2.0	8.2	4.0	16.4	8.0
fertilizer needed 15-28 days after planting	1.3	2.2	3.3	5.6	6.7	11.1	13.4	22.3
fertilizer needed 29-42 days after planting	1.9	3.2	4.8	8.0	9.5	15.9	19.1	31.8
fertilizer needed 43-56 days after planting	2.9	4.8	7.2	11.9	14.3	23.9	28.6	47.7
fertilizer needed 57-98 days after planting	3.4	5.7	8.6	14.3	17.2	28.6	34.4	57.3
Weekly Water to Dissolve Fertilizer (gal)								
	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃
water needed 0-14 days after planting	0.93		2.32		4.65		9.30	
water needed 15-28 days after planting	2.2		5.5		11.1		22.2	
water needed 29-42 days after planting	3.2		7.9		15.9		31.7	
water needed 43-56 days after planting	4.8		11.9		23.8		47.6	
water needed 57-98 days after planting	5.7		14.3		28.5		57.1	

Fertigation Chart for Pepper (High Soil K Index)

	0.1 acre		0.25 acre		0.5 acre		1.0 acre	
	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃	CaNO ₃	KNO ₃
Daily Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	0.23	0.11	0.59	0.28	1.17	0.57	2.35	1.14
fertilizer needed 15-28 days after planting	0.33	0.16	0.82	0.40	1.64	0.80	3.29	1.59
fertilizer needed 29-42 days after planting	0.47	0.23	1.17	0.57	2.35	1.14	4.70	2.27
fertilizer needed 43-56 days after planting	0.70	0.34	1.76	0.85	3.52	1.70	7.05	3.41
fertilizer needed 57-98 days after planting	0.85	0.41	2.11	1.02	4.23	2.05	8.45	4.09
Water Required to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.13		0.33		0.66		1.33	
water needed 15-28 days after planting	0.2		0.5		0.9		1.9	
water needed 29-42 days after planting	0.3		0.7		1.3		2.7	
water needed 43-56 days after planting	0.4		1.0		2.0		4.0	
water needed 57-98 days after planting	0.5		1.2		2.4		4.8	
Weekly Fertilizer Requirement (lbs)								
fertilizer needed 0-14 days after planting	1.6	0.8	4.1	2.0	8.2	4.0	16.4	8.0
fertilizer needed 15-28 days after planting	2.3	1.1	5.8	2.8	11.5	5.6	23.0	11.1
fertilizer needed 29-42 days after planting	3.3	1.6	8.2	4.0	16.4	8.0	32.9	15.9
fertilizer needed 43-56 days after planting	4.9	2.4	12.3	6.0	24.7	11.9	49.3	23.9
fertilizer needed 57-98 days after planting	5.9	2.9	14.8	7.2	29.6	14.3	59.2	28.6
Weekly Water to Dissolve Fertilizer (gal)								
water needed 0-14 days after planting	0.93		2.32		4.65		9.30	
water needed 15-28 days after planting	1.3		3.3		6.5		13.0	
water needed 29-42 days after planting	1.9		4.6		9.3		18.6	
water needed 43-56 days after planting	2.8		7.0		13.9		27.9	
water needed 57-98 days after planting	3.3		8.4		16.7		33.5	