



Analysis of Organic Fertilizers for Use in Vegetable Transplant Production

Robert Hadad and Robert G. Anderson, Department of Horticulture

Introduction

Many farmers have an interest in using organic fertilizers for vegetable transplant production. There are no general recommendations for using organic fertilizers, because historically, organic fertilizers are generally insoluble in water, and nutrients are slowly available. Because of their insolubility, organic fertilizers have not been applied with the use of injectors in a typical greenhouse transplant production system. This project was initiated to determine the uniformity of the analysis of organic fertilizers and to determine if a conductivity meter could be used to approximate fertilizer rates in the same way that this meter is used for inorganic fertilizers.

Materials and Methods

Five organic fertilizers were selected based on their advertised solubility in water and their use by growers. These products were purchased from Peaceful Valley Farm Supply, P.O. Box 2209, Grass Valley CA 95945, (916) 272-4769 and are listed below.

Inorganic fertilizers are generally simple to use, because it is easy to determine the fertilizer concentration with the use of a conductivity meter. Standard tables have been published by the fertilizer companies to demonstrate that the relationship between conductivity, mS, and nitrate nitrogen, ppm, in a fertilizer solution is linear. The use of a conductivity meter makes it is easy to mix a fertilizer solution and determine the nitrate nitrogen concentration before applying it to the plants.

Organic fertilizers have been difficult to apply at a specific rate because the amounts of nutrients per unit of fertilizer solution were not known. In order to determine amounts of the selected fertilizers that should be used for transplants, mixtures of the fertilizers were analyzed. The fertilizers were mixed at $\frac{1}{2}$, 1, $2\frac{1}{2}$, and 5 times the manufacturer's recommended



A mixture of vegetable and flower plants were successfully grown with the selected organic fertilizers. Plants were in containers placed on a capillary mat that was on top of a piece of polystyrene board floating on water, with the fabric draped into the water to wick the nutrient solution to the plants.

rates in one gallon of water. The mixtures were allowed to stabilize for 2 hours. A sub sample of 1 pint of fertilizer water was removed and refrigerated to stop metabolic activity. These samples were analyzed by the UK Regulatory Services Soil Testing Lab.

Results and Discussion

The organic fertilizers were successful for plant production. Plants grown on the “raft” subirrigation system appeared normal.

Vegetable transplants would typically be grown with 50 to 70 ppm nitrate nitrogen of an inorganic fertilizer in a subirrigation system. The following amounts of these selected organic fertilizers could be used based on the standardized water analyses reported here:

- Algamin would be used at 4 to 5 Tbs per gallon,
- Bat guano at 1.5 to 2 Tbs per gallon,
- Fish emulsion at 4 to 5 Tbs per gallon,
- Maxicrop at 3/4 to 1 tsp per gallon,
- Mermaid’s Fish Powder at 2 to 4 Tbs per gallon.

Based on the standards for inorganic fertilizers, the analyses demonstrated that there would be advantages and disadvantages to the use of these organic fertilizers.

- Algamin is a good source of potassium, calcium, and magnesium, but is low in phosphorus. Additionally, the pH is somewhat high for growing plants in growing media.
- Bat guano has high concentrations of nutrients that are released when mixed with water. Potassium levels are fine for this fertilizer, while calcium and magnesium levels are low. Phosphorus concentrations are quite high—this would be a disadvantage, because plant height is controlled better at low P levels. The biggest problem with bat guano is the low pH, which could be a significant problem for the use of this fertilizer.
- Fish emulsion has low concentrations of nitrate nitrogen in comparison to relatively high rates of phosphorus and potassium. Calcium and magnesium levels are moderate for a liquid fertilizer solution. The pH of the solution is relatively high but stable even at higher fertilizer rates.
- Maxicrop analyses produced results like the similar material Algamin, with high potassium and low phosphorus. Calcium and magnesium were at moderate levels. The pH was relatively high as was the alkalinity, which would prevent easy pH changes.
- Mermaid’s fish powder has moderate levels of phosphorus and potassium as well as low but uniform levels of calcium and magnesium. The pH remains at a somewhat high level, and the alkalinity is so high that the pH could not easily be reduced for plant production.

The knowledge of the efficacy of inorganic fertilizers is based on years of testing and experience. The efficacy of organic fertilizers for plant growth in greenhouse systems will require a significant amount of time because there is little knowledge of how the organic nutrients become available to plant roots and how specific mixtures of organic fertilizers can be adapted for good plant nutrition.

Table 2. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of Algamin organic fertilizer in one gallon of water.

Fertilizer Name Algamin (liquid)
 Guaranteed Analysis **0.2-0.0-0.4** - 0.2% water-soluble organic nitrogen
 Origin Extract of processed seaweed from Norway, *Ascophyllum nodulosum*
 Manufacturer Peaceful Valley Farm Supply, P.O. Box 2209 Grass Valley CA 95945
 Recommended Rate 2 Tbs/gal

	Number of Tablespoons per gallon of water			
	1 (½x rate)	2 (1x rate)	5 (2½x rate)	10 (5x rate)
pH	6.78	6.68	6.28	5.62
Conductivity (mS)	0.45	0.63	1.08	1.95
Alkalinity (ppm)	33	47	43	52
Nitrate-Nitrogen (ppm)	17	25	80	111
Phosphorus (ppm)	1	1	2	4
Potassium (ppm)	16	27	56	133
Calcium (ppm)	25	31	38	62
Magnesium (ppm)	29	42	76	143
Zinc (ppm)	0.1	0.1	0.1	0.3
Copper (ppm)	0	0	0	0
Iron (ppm)	0	0.1	0.3	0.8

Table 3. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of bat guano organic fertilizer in one gallon of water.

Fertilizer Name Bat Guano
 Guaranteed Analysis **10-3-1** - 5.0% water-soluble organic nitrogen, 5.0% water-insoluble organic nitrogen
 Origin Dried bat manure from dry caves in South America
 Manufacturer Down to Earth Distributors, Inc, Eugene, OR 97401
 Recommended Rate 4 Tbs/gal

	Number of Tablespoons per gallon of water			
	1 (½x rate)	2 (1x rate)	5 (2½x rate)	10 (5x rate)
pH	4.14	3.51	3.16	2.96
Conductivity (mS)	0.52	0.9	1.8	3.5
Alkalinity (ppm)	0	0	0	0
Nitrate-Nitrogen (ppm)	64	128	247	520
Phosphorus (ppm)	19	50	85	210
Potassium (ppm)	25	62	127	305
Calcium (ppm)	33	34	37	47
Magnesium (ppm)	9	10	14	22
Zinc (ppm)	0.3	0.5	1	2.1
Copper (ppm)	0	0	0	0
Iron (ppm)	0	0.1	0.4	0.9

Table 4. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of fish emulsion organic fertilizer in one gallon of water.

Fertilizer Name GreenAll Fish Emulsion (liquid)
 Guaranteed Analysis **5-2-2** - 0.4% ammoniacal nitrogen, 3.6% water-soluble organic nitrogen,
 1.0% water-insoluble organic nitrogen
 Origin Liquid concentration of fish scraps.
 Manufacturer E.B. Stone & Sons, Inc. Suisun CA 94585
 Recommended Rate 2 Tbs/gal

	Number of Tablespoons per gallon of water			
	1 (½x rate)	2 (1x rate)	5 (2½x rate)	10 (5x rate)
pH	7.33	7.34	7.46	7.37
Conductivity (mS)	0.54	0.68	1.1	1.8
Alkalinity (ppm)	76	80	146	236
Nitrate-Nitrogen (ppm)	12	32	68	110
Phosphorus (ppm)	68	122	191	462
Potassium (ppm)	66	147	240	593
Calcium (ppm)	34	33	35	39
Magnesium (ppm)	13	15	20	25
Zinc (ppm)	0	0	0	0.2
Copper (ppm)	0	0	0	0.1
Iron (ppm)	0	0	0	0.1

Table 5. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of Maxicrop organic fertilizer in one gallon of water.

Fertilizer Name Ohrstrom's Garden Maxicrop (powder)
 Guaranteed Analysis **1.0-0.0-4.0** - 1.0% water-soluble nitrogen
 Origin Extract of processed seaweed from Norway, *Ascophyllum nodulosum*.
 Manufacturer Maxicrop USA, Inc. P.O. Box 964 Arlington Heights IL 60006
 Recommended Rate 1 tsp/gal

	Number of Tablespoons per gallon of water			
	1 (½x rate)	2 (1x rate)	5 (2½x rate)	10 (5x rate)
pH	7.63	7.33	7.21	6.89
Conductivity (mS)	0.56	0.75	1.6	2.1
Alkalinity (ppm)	123	150	265	350
Nitrate-Nitrogen (ppm)	32	69	176	370
Phosphorus (ppm)	0	0	1	1
Potassium (ppm)	113	150	500	714
Calcium (ppm)	28	25	33	35
Magnesium (ppm)	12	9	17	20
Zinc (ppm)	0.2	0	0.2	0.3
Copper (ppm)	0	0	0	0
Iron (ppm)	0	0	0.1	0.7

Table 6. Analysis of nutrients from water samples mixed with ½, 1, 2½, and 5 times recommended rate of Mermaid's Fish Powder organic fertilizer in one gallon of water.

Fertilizer Name Mermaid's Fish Powder
 Guaranteed Analysis **12-0.25-1** - 2.0% ammoniacal nitrogen, 6.0% other water-soluble nitrogen, 4.0% water-insoluble nitrogen
 Origin Dried fish protein digest
 Manufacturer Integrated Fertility Management, Inc. 333 Ohme Gardens Rd. Wenatchee WA 98801
 Recommended Rate 2 Tbs/gal

	Number of Tablespoons per gallon of water			
	1 (½x rate)	2 (1x rate)	5 (2½x rate)	10 (5x rate)
pH	6.82	6.57	6.52	6.41
Conductivity (mS)	0.35	0.49	1.0	1.1
Alkalinity (ppm)	95	165	463	529
Nitrate-Nitrogen (ppm)	14	40	91	170
Phosphorus (ppm)	6	11	20	38
Potassium (ppm)	15	30	66	97
Calcium (ppm)	27	26	21	20
Magnesium (ppm)	10	10	11	11
Zinc (ppm)	0	0	0	0
Copper (ppm)	0	0	0	0
Iron (ppm)	0	0	0	0

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