



The Impact of Compost on the Growth of the Yield and Economic Value of Tomato in the Greenhouse

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Abstract:

Tomato has a very important value both in nutrition and economics. Therefore, tomato cultivation is of great importance when considering these two factors.

Kosovo has a tradition and potential for cultivating this vegetable. In Kosovo in open nature, tomato picking begins in late June through September; while in other months it is cultivated in the evening. Nutrient feed targets (ppm) for greenhouse tomatoes in sawdust: Nitrogen 200 ppm, Potassium 300 ppm, Calcium 200 ppm, Phosphorus 55.

This paper deals with the use of 2 kg of root compost, where yields will be satisfactory. Variety Greenhouse 761, average 3.5 kg per plant. Average number of fruit per plant 12, 0. Average grams per fruit 280 gr.

This greenhouse – loving hybrid tomato produces fruit perfect for silicing and generally is ready to harvest about 75 days after seeds germinate.

The use of carbon dioxide (CO₂) supplementation has the potential to increase the yields of a skilled grower who now attains between 55 to 60 kg/m², up to 70 kg/m².

Keywords: Tomato, compost, nutrition, economics, greenhouse.

Preface

Tomatoes have been grown in greenhouses for nearly 100 years. For this reason, there are many techniques for growing tomatoes in a greenhouse and there is more written about greenhouse tomatoes than any other greenhouse crop. Additionally, hydroponics was developed for greenhouse tomato production, so there can be many complicated steps to the production of tomato fruit in a greenhouse. There is no single BEST way to grow greenhouse tomatoes, many ways are successful. An individual grower must experience tomato production, in order to determine the best and most economic techniques in his or her greenhouse. This publication is a general summary of greenhouse tomato practices. It is highly recommended that the reader obtain the publications listed below to get a more thorough view of greenhouse tomato production, hydroponics and the production of other vegetables in the greenhouse (1).

General Aspects of Tomato Production

Light and temperature control -- Tomatoes are a warm season vegetable crop. They grow best under conditions of high light and warm temperatures (summer conditions). Low light in a fall or winter greenhouse, when it is less than 15% of summer light levels, greatly reduces fruit yield when heating costs are highest (Table 1). For this reason, it is difficult to recommend that a greenhouse operator should grow and harvest fruit from December 15 to February 15. Even with the problem of low light and high energy costs, winter greenhouse tomatoes are common in southern Canada and Europe. These greenhouses may use expensive supplementary HID lighting (street lamps) and are able to sell their tomatoes at very high prices because their market is willing to pay a high price for high quality winter tomatoes. If you have a market willing to pay for greenhouse tomatoes, then tomatoes may be a successful crop in your winter greenhouse. (6&7).

Table 1. Relative percentages of heat costs and percent of light, compared to summer months, for fall, winter and spring months.

	September	October	November	December	January	February	March	April	July
heat	0 %	3	15	26	28	18	8	2	0
light	100%	41	32	14	14	27	50	65	100

Based on many years of experience, tomato production is most successful in the spring. Excellent light, moderate heating costs and good prices annually demonstrate this is the best time for greenhouse tomato production. Low winter light and high heating costs create a problem for winter production.



Tomato flower in full bloom, next to a young, green developing fruit.

Tomato plants grow best when the night temperature is maintained at 60-62 F. Temperatures below 60 will prevent normal pollination and fruit development. This is especially true for standard greenhouse varieties, less so for field varieties, so the grower must be sure that thermostats control heaters properly. In warm or hot outdoor conditions, tomatoes in greenhouses must be ventilated to keep temperatures below 95 F. High temperatures not only affect the leaves and fruit, but increased soil temperatures also reduce root growth. (3&4&5&).

Red tomatoes, raw Nutritional value per 100 g (3.5 oz): Energy 74 kJ (18 kcal), Carbohydrates 3.9 g, Sugars 2.6 g, Dietary fiber 1.2 g, Fat 0.2 g, Protein 0.9 g, Vitamins (5%), Vitamin A equiv. 42 µg (4%), beta-carotene 449 µg, lutein zeaxanthin 123 µg, Thiamine (B1) (3%) 0.037 mg, Niacin (B3) (4%) 0.594 mg, Vitamin B6 (6%) 0.08 mg, Vitamin C (17%) 14 mg, Vitamin E (4%) 0.54 mg, Vitamin K (8%) 7.9 µg, Minerals: Magnesium (3%) 11 mg, Manganese (5%) 0.114 mg, Phosphorus (3%) 24 mg, Potassium (5%) 237 mg, Other constituents: Water 94.5 g, Lycopene 2573 µg.

Units: IU-International units, µg = micrograms, mg = milligrams

Percentages are roughly approximated using US recommendations for adults

Source: USDA Nutrient Database (2).

Materials and Method

If you plan to use side wall ventilation, it is best to have the rows of plants run across the greenhouse (perpendicular to the sidewalls) to allow for best air movement. Recognize that roll-up sidewalls are quite energy inefficient and may increase your heating costs dramatically. If you will use fan ventilation with no sidewall ventilation, the rows can be arranged parallel with the greenhouse sidewalls.

Determine the type of structure that you will build to support the tomato crop based on the orientation of the plant rows.

Install the trickle irrigation system, the injector(s) and time clock that it works properly. Obtain a conductivity meter to regularly check the fertilizer concentration (conductivity) of the fertilizer solution used for irrigation. If you plan to use soil or your own formulated soil mix, have this mixture tested before you plan to use it. Tests should be completed 3-6 weeks before plants will be planted to allow enough time to follow recommendations received.

Make sure that the greenhouse and its heating, ventilating and air circulation systems are ready for use.

Be sure the necessary supplies are on hand, e.g., pots, fertilizer, insecticides, fungicides, string, labels, marketing containers and spraying equipment.

Tomato seed should be sown July 5 - July 15 for a fall crop. Growing medium temperature should be maintained at 70 -75 F during germination. Seedlings can be transplanted to pots or cell flats about 2 weeks later. Seedlings will tolerate the high temperatures in summer and may require water twice a day. Apply fertilizer, 50 ppm, about a week after transplanting and again just before the plants will be transplanted into the bags in the greenhouse.

Plant six to eight week old plants into growing media bags August 10-20. Allow 4 sq. ft. of floor space per plant. Use the row spacing most convenient to you. We planted 4 plants in two rows in a standard three cubic foot bag of growing medium. The growing medium bags should be end to end in rows and these rows should be on 4½ to 5 foot centers. Thoroughly water each plant daily until the roots are established in the soil. Summer greenhouse temperatures can cause soil temperatures in the bags to reach 100 F and damage the root system. Consider an external shade for the greenhouse and internal shade over the support structure or an extra layer of black plastic over the growing medium bags to keep the media as cool as possible. Water the plants thoroughly 1-2 times per day. **(3&4&5&)**.

Begin to fertilize the tomato plants immediately after transplanting and continue every day until early December. Use Peters (Scotts-Sierra) Excel CalMag, 15-5-15, to fertilize at 100 ppm for the first two weeks. In September, use 150-175 ppm fertilizer twice per day. As soon as the first fruit form, increase to 200-300 ppm fertilizer with every watering. As the last fruit are ripening in November and December, the fertilizer rate can be reduced to 100 ppm with every watering. Growing medium samples should be taken in early September and early October to be sure the nutritional status is appropriate.

Plants grow rapidly in September producing large leaves and lateral branches. Large individual leaves indicate that the plants are growing normally and a good indicator of the quality of plant care.

The first flowers will appear in mid September. Be sure the first flower clusters are pollinated properly; they are a significant part of the fruit yield for the fall. Do not use pesticides that will kill bees if you use bees for pollination.

Sucker and tie-up the plants weekly to make sure the plants are properly supported. Be extremely observant of the location of lateral branches or suckers. It is easy to mistakenly remove the main stem rather than a sucker. If you remove the main stem, you could cut fruit yields in half. Watch for aphids, whiteflies, beet armyworms and caterpillars of all types in the plant canopy. Do not allow the plants to wilt at any time. Fruit will be damaged if the plants do not get high amounts of water and fertilizer regularly.

Monitor greenhouse temperatures closely. Night temperatures should not fall below 60 F while pollination is occurring. When the first cold days occur in October, allow the greenhouse to stay on the warm side rather than the cool side; tomato plants show cold damage quite easily. Be sure the air circulation system inside the greenhouse is working properly. Cool rainy weather in October and November creates an excellent environment for foliar diseases on tomato.

Harvest ripe fruit every 3-5 days, wash and package appropriately for your market.

Allow the greenhouse to freeze during January to kill all insects and diseases so they will not have an impact on your spring tobacco crop. **(3&4&5&)**.

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Tomatoes product.

Success in greenhouse tomatoes depends completely on fruit yield. Yields of 4-5 pounds per plant are probably break-even for annual costs. However, you should keep good records through the crop, so you can honestly evaluate your costs and returns. One thousand plants in a greenhouse (4000 square feet – 372 m Square meter) can produce approximately 7,000 to 10,000 pounds (one pounds = 0.4536 kg) of fruit from October 15 to January 1 and thus return approximately 3,500.00€ to 5,000.00€ to the greenhouse operator.

Table 2. Tomato fruit yield from four determinate varieties and one indeterminate

Variety (Greenhouse 761)

Tomato Variety	Average pounds per plant	Average number of fruit per plant	Average ounces per fruit
Greenhouse 761	7.8	12.0	10.4

Results and Discussion

The average total weight of fruit harvested from each plant ranged from 6.1 to 7.8 pounds (Table 2), but was quite variable between plants ranging from 4 to 13 pounds per plant. Approximately 11 fruit were harvested from each plant, as an overall average, and the average fruit weighed about 10 ounces = 283.495 gram (1 Ounce = 28.3495 gram). The greenhouse tomato trials compared determinate field tomato varieties with indeterminate garden varieties and indeterminate commercial greenhouse varieties.

The average total weight of fruit harvested from the determinate varieties was quite similar in both years, but fruit size decreased and fruit number per plant increased. The average total weight of fruit and average fruit number per plant was greater but average fruit weight was variable. However, harvest was delayed 1 to 2 weeks on the greenhouse varieties when compared to the determinate varieties. The small fruited varieties performed reasonably well. The determinate varieties grew to a height of 3 to 4 feet (1 foot = 0.3048 m) while the indeterminate varieties, topped after the 6th cluster, grew to 6 feet tall.

Conclusion

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- Begin to fertilize the tomato plants immediately after transplanting and continue every day until early December.
- Plants grow rapidly in September producing large leaves and lateral branches. Large individual leaves indicate that the plants are growing normally and a good indicator of the quality of plant care.

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Literatures:

1. Bob Anderson, Extension Horticulture Specialist, University of Kentucky, Lexington KY 40546.
2. [USDA Nutrient Database](#).
3. American Greenhouse Vegetable Growers Association. P.O. Box 25058, Colorado Springs CO 80936. Annual educational meeting and trade show; Newsletter.
4. Florida Greenhouse Vegetable Production Handbook, Vol. 1, 2, 3. 1991. Publications, IFAS Bldg. 664, Gainesville FL 32611-0011. (About \$20.00).
5. Greenhouse Tomatoes, Lettuce, and Cucumbers 1979. S.H. Wittwer and S. Honma. Michigan State University Press, East Lansing MI 48824. (About \$35.00).
6. <http://www.ces.msstate.edu/~ricks/> — Greenhouse Vegetable Publications at Mississippi State University.
7. <http://www.teleport.com/~tomalex> -- Growing Edge Magazine.