Salicylic acid effects on economic production of pumpkin and tomatoes

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OBJECTIVES:

Iron (Fe) is one of the important micronutrients essential for plant growth. Due to its oxidation-reduction properties, Fe plays a critical role in various physiological and biochemical pathways in plants such as DNA synthesis, respiration, and photosynthesis processes. Moreover, Fe serves as a critical component of several vital enzymes that carry out electron and oxygen transport functions, facilitate chemical transitions, regulate protein stability, and is thus required for a wide range of biological functions.

An imbalance between the soil Fe availability and its demand by the plant are the primary causes of widespread Fe deficiency among different vegetable crops. While abundant in most soils, the ionic activity of Fe (solubility) is low as it often forms insoluble Fe compounds in soil. While the chelate Fe is better than conventional mixed Fe fertilizers; but at pH above 6, almost 50% of the chelate Fe becomes unavailable to plants.

Nanotechnology is increasingly adapted in agriculture, aiming to reduce the use of reactive chemicals, minimize nutrient losses, and increase economic yields by precision nutrient management practices. Our preliminary greenhouse studies have shown that Fe nanotechnology is far more effective in supplying Fe to plants, compared to the commonly used Fe fertilizers/chemicals. Substituting nano Fe fertilizer for conventional and chelate Fe fertilizations is expected to increase Fe availability to plants in a controlled way to increase the growth, yield, and quality of vegetable crops. Despite all these potential advantages, the use of nano-Fe in the agricultural sector is still relatively limited. The objective of the research was to determine the effects of different rates of nano-Fe fertilization on the growth, yield and quality of fresh market tomatoes compared to chelate Fe fertilization and disseminate the science-based knowledge and production economics to the farmers and educators.

MATERIALS and METHODS:

This trial evaluated four different rates of salicylic acid, applied via drip irrigation to tomato and pumpkins. Tomato cultivar H3402 was seeded into 50 cell plug trays containing Metro Mix 360 soilless media on April 23, 2019. 100 lbs. actual 19-19-19 was applied to field prior to laying plastic. Plastic rows were 5' apart with tomato plants being spaced 1.5' apart in row. Tomato transplants was planted onto raised beds using a waterwheel transplanter on June 12th. 100 lbs. actual 19-19-19 was applied to the field prior to seeding of pumpkins. JPN 62009 pumpkins were seeded to the field on June 4th, rows were 10' apart with seeds planted 3' apart in row. This study was conducted at the Ohio State University (OSU) South Centers/Piketon Research & Extension Center at Piketon, Ohio (lat. 39.07° N, long. 83.01° W), elevation 578 feet. The experimental soil is designated as a DoA—Doles silt loam, with 0–3% slopes. It is a deep, nearly level and somewhat poorly drained soil. Typically, the soil surface is a brown, friable silt loam about 20 cm deep and beneath this the subsoil is about 18.5 m. Fungicides were applied following recommendations from the Midwest Vegetable Production Guide for Commercial Growers (ID-56).

Table 1. Yields from salicylic acid treatments tomato.

Treatment	*Marketable lbs. per Plant*	*Marketable lbs. per Acre*	*Average Fruit Weight (oz.)*	*Soluble Solids*

.01 Molar Solution	9.535 A	55378 A	0.1275 A	5.8833 A
.02 Molar Solution	7.764 A	45091 A	0.149 A	6.0333 A
.04 Molar Solution	7.565 A	43935 A	0.13525 A	5.9667 A
Control	6.631 A	38511 A	0.1295 A	5.8667 A
.005 Molar Solution	6.26 A	36358 A	0.12625 A	6.0333 A

**Values with the same letter are not significantly different.*

Table 2. Tomato Total Chlorophyll.

Treatment	*Chlorophyll*
0.01	62.935 A
0.04	61.88 AB
0.02	56.42 BC
Control	55.44 BC
0.005	51.16 C

**Values with the same letter are not significantly different.*

Table 3. Tomato Total Chlorophyll by Date.

Date	*Chlorophyll*
9/12/2019	68.145 A
7/12/2019	58.135 B
7/26/2019	56.05 B
8/23/2019	52.795 B
8/9/2019	52.71 B

**Values with the same letter are not significantly different.*

Table 4. Yields from salicylic acid treatments pumpkin.

Treatment	*Marketable lbs. per Plant*	*Marketable lbs. per Acre*	*Marketable Fruit per Acre*	*Average Fruit Weight (lbs.)*
.005 Molar Solution	20.193 A	29321 A	14157 A	8.6959 A
Control	19.252 A	27954 A	12342 A	9.2037 A
.02 Molar Solution	16.752 A	24324 A	12705 A	8.65 A
.01 Molar Solution	16.408 A	23824 A	10890 A	8.3137 A
.04 Molar Solution	16.07 A	23334 A	10527 A	8.3523 A

**Values with the same letter are not significantly different.*

Table 5. Pumpkin Total Chlorophyll.

Treatment	*Chlorophyll*
Control	43.27 A
0.02	37.21 B
0.01	36.925 B
0.04	35.96 B

0.005	35.665 B

**Values with the same letter are not significantly different.*

Table 6.Pumpkin Total Chlorophyll by Date.

Date	*Chlorophyll*
7/12/19	46.055 A
7/26/19	44.115 AB
8/23/19	40.505 BC
8/9/19	38.485 C
9/6/19	19.87 D

**Values with the same letter are not significantly different.*

RESULTS:

Overall plant and fruit quality was good in both the tomatoes and pumpkin trials. Salicylic acid treatments were applied on 7/12/19 and 7/26/19. All treatments was applied via the drip irrigation. Both tomatoes and pumpkins were harvested on 9/19/19. There was no statistical difference between any of the treatments in this year's study. Tomato pounds per plant ranged from a high of 9.53 lbs. to a low of 6.26 lbs. per plant. Marketable pounds per acre ranged from 55,378 lbs. to 36,358 lbs. per acre. The .01 molar solution produced both the highest pounds per plant and pounds per acre. The control which was just standard production methods without any salicylic acid treatment produced 6.63 pounds per plant and 38,511 pounds per acre. The lowest yielding treatment was the .005 molar solution. The largest fruit size was produced by the .02 molar solution. The soluble solids ranged from a high of 6.03 to a low of 5.88. Pumpkin marketable pounds per plant ranged from a high of 20.19 to a low of 16.07 pounds per plant. Marketable pounds per acre ranged from 29,321 to 23,334 pounds. The marketable fruit per acre had a high of 14,157 fruit to a low of 10,527 fruit per acre. The .005 molar solution treatment was the best preforming treatment in the pumpkins with the control treatment preforming the second best. The average fruit weight ranged from 9.2 pounds to a low of 8.31 pounds.