Soil and Plant Nutrient Relationships in Processing Carrots

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Introduction

Carrot (*Daucus carota* L. var *sativus*) production in Nova Scotia is both challenging and unique. Carrots are grown under cool temperatures, rainfed conditions and in mineral soils usually of low fertility. Growers must rely on fertilizer inputs which can result in high costs and environmental problems. There is no solidly-based, local fertilizer recommendation for carrots despite the fact that soil tests are currently the method employed by growers to evaluate the needs of their crop.

In a production system, it is essential, to understand the relationship between external nutrient concentration and tissue nutrient concentration since tissue nutrient concentration drives physiological and biochemical processes of the plant. In order to optimize growth and development of the plant, it is essential that the relationship between soil and tissue nutrient concentration and yield and quality be understood. This information can then be used to calibrate soil tests and to optimize soil nutrient status, yield and quality.

Little or no information is available for carrots on either the critical plant tissue(s) or the optimal tissue nutrient concentrations at various growth stages. This research will provide another means for growers to determine the fertility requirements of their crop.

Objectives

1. To identify the critical tissue(s) at different growth stages that correlates with the soil
2. To establish a relationship between critical tissue(s) and soil nutrient concentration
3. To define the relationships among tissue and soil nutrient concentrations and yield and quality through the development of yield and quality optimization models

Methods

A greenhouse trial is ongoing using dicer carrots, variety Red Core Chantenay (RCC). RCC was seeded in sand with a gravity fed drip irrigation system. Nine fertility treatments consisting of a complete 20-20-20 plus micronutrients fertilizer at 0, 50, 100, 150, 200, 250, 300, 350, and 400 ppm equivalent of N, P, and K were used. Soil and plant tissue samples were taken at 4 and 9 weeks and a final harvest at 13 weeks.

Figure 1: Overview of greenhouse setup

Figure 2: Treatment 6 pot with carrots at 9 weeks

Each individual leaf, individual petiole, and root were separated for all carrot plants for extraction analysis to determine all essential element levels. Height, root length, number of leaves, and fresh and dry weights were taken at each harvest. During the final harvest appraisal yield and quality measurements were also taken including physiological disorders and grades. Physiological disorders include green shoulder, forking, splitting, aster yellows, and insect damage. Carrot grades range from culls which are less than 3/4",fancy from ¾" to 11/2", premium from 11/2" to 2" and oversize greater than 2".

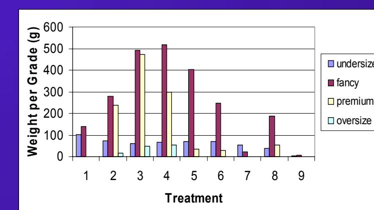
Results and Discussion

Visual assessment of carrots roots from replications 1 and 2 suggest treatment 3 (100 ppm) produced the largest roots. Treatments 5 to 9 are smaller in size and were susceptible to disease. Treatment 9 in replication 1 was lost to insect damage and *Rhizoctonia*. As well, treatment 7 in the same replication was severely diseased.

Figure 3: Greenhouse replication 1 carrots

Figure 4: Greenhouse replication 2 carrots

Girth, as measured near the top of the carrot, was smallest for treatments 1, 7, and 9. Treatment 3 had the largest girth compared to all other treatments. Treatment 3 also produced the most premium grade carrots compared to all other treatments. All treatments had a small percentage of culls and oversize carrots. Treatment 4 had the most fancy grade carrots followed closely by treatment 3.



Graph 2: Weight of each grade (g) for treatments 1 to 9

Treatments 6, 7, and 8 had smaller root lengths and leaf lengths compared to treatments 3 and 4 which were similar. The number of leaves was similar for all treatments.

Conclusion

Preliminary results suggest 0 and 50 ppm treatments did not provide enough fertilizer to obtain maximum growth while plants receiving above 300ppm were found to be more susceptible to disease. The treatment with 100 ppm N, P, and K is optimal, producing the highest yields and quality.

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