



Processing Carrot Research Program



Varietal Evaluation and Adaptation

- ❖ Thirty four slicer and ten dicer varieties were evaluated in Great Village, NS. Slicers were sown at 33 seeds/ft and dicers at 16 seeds/ft. The highest yielding slicer variety was Tempo with nearly 9t/ha more than the standard variety, Oranza. Also, Tempo had the most recoverable roots which resulted in greater gross return per hectare than all other varieties. Nikita recorded the lowest slicer yield.
- ❖ The highest yielding dicer line was SVR717013 at approximately 23t/ha more than the standard variety, RCC. Calgary reported the lowest yields. Recovery of >11/2 roots was the greatest with Cascade.

Resource Optimization

P and K Interactions

- ❖ There was no interaction between P and K for carrots. Application of P and K fertilizers did not enhance yield or quality.
- ❖ Carrots did not respond to P application at any level both in low or medium P soils.

Nitrogen Modeling

- ❖ In a greenhouse trial, a N,P,K fertilizer treatment of 100 ppm produced the largest roots, with largest girth, and the most 2" to 3" roots. Treatments above 200 ppm N,P,K had smaller roots and were susceptible to diseases.
- ❖ Field trials held in Glenholme, Great Village, and Highland Village showed similar gross yield, grade, and root girth for all N treatments. This correlated with tissue N and K levels and not P, Ca, and Mg.

Nutrient auditing

- ❖ A validation trial to study the advantage of fertilizer in a carrot-grain-forage rotation was conducted. The fertilized plot showed a significant enhancement in gross yield and girth compared to non-fertilized plots.

Sulphur Nutrition

- ❖ A sulphur survey was conducted in 14 fields across NS by taking soil samples at 0-6" and 6-12". King's county fields were lower in S than Colchester County fields.
- ❖ A S trial was conducted in Medford with Oranza. Treatments consisted of 0, 20, 40, and 80 kg/ha S. There was no significant effect of S application on gross yield or quality.

Irrigation

- ❖ Field experiments were conducted in 2001 and 2002 at Sheffield Mills Farms in Kentville, NS. In 2001 treatments consisted of 0, 20,30, 40, 50, and 60 Cbar soil moisture tension. The optimal moisture was found to be -30 – 40 cbar. Maintaining soil moisture above -60 cbars enhanced carrot yields by nearly 2 folds. Based on 2001 results the soil moisture for the 2002 trials were maintained at -60 cbar throughout the season and the irrigation was given at different plant growth stages. A control of no irrigation was also used. Plots irrigated at 10-12 weeks showed significantly higher yields. To keep soil moisture at -60 Car in 2002 required 5 irrigation events. Also, waiting until late season to irrigate decreased yield and quality.

Effect of Crop Competition on Yield, Photosynthesis, Soil moisture, and Nutrient depletion

- ❖ Carochoice and RCC were seeded at various rates to determine the effect of intraplant competition on plant growth, root yield, and recovery. RCC was sown at 9, 12, 14, 16 and 18 seeds/ft. Carochoice was sown at 16, 22, 26, 33, and 36 seeds/ft. Plant stands for both RCC and Carochoice were lower than expected. Leaf fresh weight, root girth, and root length were greater with lower stands of RCC and Carochoice. 18 plants/ft was optimal for Carochoice yields and 9 plants/ft was optimal for RCC yields.
- ❖ Carrot photosynthesis modeled. Increase in PAR increased Pn and WUE. Optimal Pn was observed to be at 700-800 $\mu\text{mole m}^{-2} \text{s}^{-1}$ PAR
- ❖ Increasing CO₂ concentration from 350 to 1050 increased Pn (52%) and WUE (47%).

Germination Synchronization and Stand Establishment

- ❖ Critical soil temperature for optimal germination was 20-25 degree C.
- ❖ Germination was inhibited at temperatures below 10 degrees.
- ❖ Salicylates and GA3 promoted germination at a low temperature of 5°C
- ❖ Optimal soil moisture for emergence was 40% FC. Seedling emergence was totally inhibited at a moisture content of 20%FC.
- ❖ Ambiol and glycinebetaine were equally effective in enhancing germination at 25% FC
- ❖ Both in a single row field trial and commercial scale field trial were conducted GB plots had significantly more stand than the untreated control. However, there was no significant enhancement in yield or recovery for all treatments. The commercial scale trial showed that Ambiol, GB, and water-treated plots had a significantly higher stand but yield was unaffected. Plants may compensate independently depending on the stand.

Stress Physiology and Acclimation

Stress Physiology

- ❖ Soil moisture below -33 cbars reduced growth, Pn, Cs, WUE and damaged membranes. Carrot seedlings accumulated a Quaternary Ammonium Compound, glycinebetaine (GB). Reapplying GB protected plants and reversed membrane damage.

Effect of Antitranspirants

- ❖ Several antitranspirants were screened for their effectiveness in reducing stomatal conductance (Cs). Amongst all, Wilt-pruf, an analogue of ABA, glycinebetain (GB) were the most effective in reducing Cs.
- ❖ Two seasons of field trials were conducted in 2001 and 2002. Treatments consisted of GB, Water, untreated, COOCH3, and Wilt-Pruf. The effects of antitranspirants were masked by naturally induced antitranspirants. Thus, no conclusions could be drawn in 2002 for transpiration or stomatal conductance.

Effect of Foliar Application of GB

- ❖ Two seasons of field trials were conducted in 2001 and 2002 to study the effects of GB on transpiratory water loss and soil moisture depletion. GB decreased root girth significantly compared to the control. Application of GB had no significant effect on yield and recovery. No conclusions could be made for transpiration and stomatal conductance.

Bulking Physiology

- ❖ Among several PGRs screened, ethrel and polyamines triggered bulking *in vivo*.
- ❖ To study the effects of Ethrel and polyamines in bulking in RCC. Ethrel 10 ppm + Spermine 0.1 ppm were sprayed at 2 and 4 weeks after emergence onto carrots. The results showed that Ethrel + Spermine treatment significantly enhanced yield over the control.

Physiological Disorders

Varietal Sensitivity to Greenshoulders

- ❖ Thirty four varieties were evaluated in Great Village, NS for their sensitivity to greenshoulders (GS). It was found that the plant canopy volume does not modulate GS. Exposing hypocotyls to light during the early seedling emergence triggered GS.

Effect of Hilling

- ❖ Treatments consisted of hilling at 20-25, 45-50, and 60-70 days after emergence and all possible combinations of the treatments. The intensity of greening was determined by a chlorophyll index (CI). Hilling twice at 20-25 and 45-50 days had the greatest reduction in GS.

Effect of Plant Population Density

- ❖ There were no significant differences in GS with various seeding rates with RCC and Carochoice.

Maturity, Yield and Quality Modeling

- ❖ The objective of this study was to understand the maturity dynamics of slicer and dicer varieties as influenced by environmental parameters and to establish correlation and develop maturity and root quality models. It was found that cumulative rainfall, cumulative degree days, cumulative solar radiation, and cumulative high temperature for all varieties showed significant correlation with yield. One or many of these parameters can be used for modeling maturity and plan harvesting.

Pest and Disease Forecasting – CIPRA

- ❖ To develop a pest monitoring and forecasting system based on real time weather information for Nova Scotia's processing carrot industry. Field trials were conducted in 2001 and 2002 in Colchester Co., NS. Treatments consisted of fungicide applied as per the growers schedule, no fungicide application, and fungicide applied as recommended by CIPRA. CIPRA software forecasted 13-14 periods of blight infection but actual field counts were minimal. Weather data also suggested field conditions were ideal for infection to occur. There were no significant differences between treatments for leaf development. Plots sprayed as per grower schedules had significantly higher yields than the other 2 treatments except in Debert. CIPRA model is being recalibrated.

EEES Carrot Based Cropping Systems

- ❖ To study the effects of preceding crops in rotation on carrot development, yield, quality, soil physio-chemical changes, weed distribution, and the occurrence of pests and diseases. In 2002 spring wheat, annual rye grass, timothy grass, and dicer carrots were seeded in plots. In 2003, all plots were seeded as dicer carrots. A duplicate trail was set up adjacent to the first and the same crops were seeded as in 2002. The trial will be completed in 3 consecutive years.

