



Processing Carrot Research Program

Summary of Research highlights

- **VARIETAL ADAPTATION**

- Among all the recent varieties tested Tempo has consistently yielded more than the standard variety, Oranza with high recoverable roots. Cascade, a dicer variety, has, on average, ranked #1 with the highest yield and recovery over the past 5 years.

- **CARROT NUTRITION**

Phosphorus (P) and Potassium (K) interaction and requirements

- There has been found to be no interaction between P and K for carrots. Application of P and K fertilizers at any level did not enhance yield or quality.
- Carrots did not respond to P application at any level in soils with low to medium P availability.

N,P, K Requirements

- In a greenhouse trial, a N,P,K fertilizer treatment of 100 ppm produced roots with the largest girth, and the most 2” to 3” roots. Treatments above 200 ppm N,P,K had smaller roots and were susceptible to diseases.

N Requirements

- Field trials held in Glenholme, Great Village, and Highland Village, N.S. showed similar gross yield, grade, and root girth for all N treatments.

Rotation and Fertilizer Requirements

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

Sulphur Nutrition

- A sulphur survey was conducted in 14 fields across N.S. Soil samples were taken at 0-6” and 6-12” at both time of sowing and at harvest. King’s county fields were lower in S than Colchester County fields.
- A sulphur application trial was conducted in Medford, King’s County, N.S. in 2002, as well as in Berwick, King’s County and Great Village, Colchester County in 2003. 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 AND WATER REQUIREMENT**
 - Field experiments were conducted in 2001 and 2002 at Sheffield Farms in Sheffield Mills, King's County, N.S. In 2001, treatments consisted of maintaining soil moisture at 0, -20, -30, -40, -50, and -60 cbars soil moisture tension. The optimal moisture was found to be -30 to -40 cbars. Maintaining soil moisture above -60 cbars enhanced carrot yields by nearly 2 folds. Based on 2001 results the soil moisture for the 2002 trials was maintained at -60 cbars 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. Waiting until late season to irrigate decreased yield and quality.

- **CROP COMPETITION AND YIELD AND QUALITY MODELING**
 - 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.

- **RESOURCE OPTIMIZATION AND MODELING**
 - Carrot photosynthesis was modeled. An increase in PAR increased Net Photosynthesis (Pn) and Water Use Efficiency (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%).
 - Critical soil temperature for optimal germination is 20-25°C.
 - Germination is inhibited at temperatures below 10°C.
 - Salicylates and Gibberellic Acid (GA₃) promoted germination at 5°C.
 - Optimal soil moisture for emergence was measured at 40% field capacity (FC). Seedling emergence was totally inhibited at a moisture content of 20% FC.
 - Ambiol and glycinebetaine (GB) were equally effective in enhancing emergence at 25% FC.
 - Both a single row field trial and commercial scale field trial were conducted. GB plots had a significantly higher plant stand than the untreated control, however, there was no significant enhancement in yield or recovery by one treatment. The commercial scale field trial showed that Ambiol, GB, and water-treated plots had a significantly higher stand but yield was unaffected.

- **STRESS PHYSIOLOGY**
 - Soil moisture below -33 cbars reduced plant growth, Net Photosynthesis (Pn), Stomatal Conductance (Cs), Water Use Efficiency (WUE) and damaged cell membranes. Carrot seedlings exposed to drought

accumulated Quaternary Ammonium Compound, glycinebetaine (GB) in their tissues. Preconditioning seeds with GB protected plants and impeded membrane damage.

- Several antitranspirants were screened for their effectiveness in reducing Cs. Amongst all, Wilt-pruf, an analogue of ABA and GB were the most effective in reducing Cs.
- 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.
- 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 Plant Growth Regulators (PGRs) screened, ethrel and polyamines triggered bulking in vivo. To study the effects of Ethrel and polyamines 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 significantly enhanced yield over the control.

- **PHYSIOLOGICAL DISORDERS**

- 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.
- Trials were conducted to determine the effect of hilling on reducing GS. 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.
- There were no significant differences in GS occurrence at various seeding rates in either RCC or 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 CALIBRATION**
 - 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 at several sites in 2001, 2002, and 2003 in Colchester Co., N.S. Treatments consisted of fungicide applied as per the grower’s schedule, no fungicide application, and fungicide applied as recommended by CIPRA. CIPRA software forecasted 13-14 periods of blight infection in the 2001 season 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 in 2001. Plots sprayed as per grower schedules had significantly higher yields than the other 2 treatments except in one location. CIPRA model is being recalibrated.
- **EEES CARROT BASED CROPPING SYSTEMS**
 - The objective is 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 15 x 40 M plots. In 2003, all plots were seeded to 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.

For more information, please contact:

Dr. R. Lada PhD (*Adelaide*), P.Ag.,
 Research Professor and Chair,
 Processing Carrot Research Program
 Nova Scotia Agricultural College
 Truro, Nova Scotia, B2N 5H3
 Tel: (902) 893 2309
 Fax: (902) 897 9762
 Email: rlada@nsac.ns.ca

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