ANNUAL PERFORMANCE REPORT 2019

- **TITLE:** Optimizing Nutrient Delivery for Modern Cultivars of Greenhouse-grown Potted Chrysanthemums: Sub-irrigation and Drip-irrigation Systems

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- **INSTITUTION:** University of Guelph

Hypothesis

- Nutrient use efficiency of modern cultivars greenhouse-grown potted chrysanthemums can be improved by reducing nutrient supply during vegetative growth, in combination with an interrupted supply during reproductive growth, without sacrificing plant yield & quality

Current Project Objective

- Optimize the delivery of the remaining macronutrients (calcium and magnesium), as well as the micronutrients, to sub-irrigated and drip-irrigated potted chrysanthemums.

Year 1 Objective

April, 2018 – March 31, 2019 - Optimize the delivery of calcium and magnesium during vegetative growth of sub-irrigated potted chrysanthemums over 2 growing seasons in a research greenhouse

Optimizing Ca or Mg Delivery in a Research Greenhouse

1 2 3 4 5 6

Stage of Bloom Development

- No symptoms of Ca/Mg deficiency were evident across treatments

- No negative effects of Ca/Mg treatments on plant/flower quality , bloom development

Stephens et al. 2019 unpublished

Tissue Ca Levels are Acceptable, even with Low Ca, during Vegetative Growth

Cultivar	Supplied Ca (ppm)	Expt. 1		Expt. 2	
		Tissue Ca (% M)	Plant DM (g)	Tissue Ca (% DM)	Plant DM (g)
Milton Dark Pink	68	1.35 a	6.37 a	1.19 a	5.07 a
	135	1.12 b	5.65 a	1.35 a	5.03 a
	270	0.96 c	5.96 a	1.70 b	4.80 a
Williamsburg Purple	68	1.16 a	6.38 a	0.78 a	6.16 a
	125	0.97 b	6.16 a	0.95 b	6.48 a
	270	0.83 c	5.83 a	1.18 c	6.76 a

Tissue Mg Levels are Acceptable, even with Low Mg during Vegetative Growth

Cultivar	Supplied Mg (ppm)	Expt. 1		Expt. 2	
		Tissue Mg (% DM)	Plant DM (g)	Tissue Mg (% DM)	Plant Mg (g)
Milton Dark Pink	9	0.62 b	2.85 a	-	-
	18	0.64 ab	3.10 a	-	-
	36	0.70 a	2.77 a	-	-
Williamsburg Purple	9	0.38 b	2.66 a	-	-
	18	0.37 b	2.77 a	-	-
	36	0.42 a	2.67 a	-	-

Validating Macronutrient Delivery in a Commercial Greenhouse

- Commercial greenhouse w/ high (natural) light
- Pinched plants grown in 4-in pots containing peat/perlite mix (uncharged) using sub-irrigation
- Randomized design, 4 cultivars and 100 plants/cv/treatment
- 3 treatments (with full micronutrients): optimized macronutrient s over crop cycle; optimized macronutrients interrupted at inflorescence emergence; 50% optimized macronutrients interrupted
- Commercial harvest (~50% flowers opened)
- Visual symptoms, plant characteristics, plant yield, tissue analysis with development

Year 2 Objective

- **Apr 1, 2019 – March 31, 2020 -** Optimize the delivery of zinc and copper during vegetative growth of sub-irrigated potted chrysanthemums over 2 growing seasons in the research greenhouse

Year 3 Objective

- **Apr 1, 2020 – Mar 31, 2021 -** Optimize the delivery of iron and manganese during vegetative growth of sub-irrigated potted chrysanthemums over 2 growing seasons in a research greenhouse

Year 4 Objective

- **April 01, 2021 – March 31, 2022) -** Optimize the delivery of boron and molybdenum during vegetative growth of sub-irrigated potted chrysanthemums over 2 growing seasons in a research greenhouse

Experimental Design for Micronutrient Studies

- Research greenhouse w/ high or low natural light
- Pinched plants of 2 modern cultivars grown in 4-in pots containing peat/perlite mix (uncharged) using sub-irrigation
- Optimized macronutrient regimen
- Balanced split-plot with micronutrient treatment as main plot & cv. as sub-plot; main plots - RCBD of 4 blocks arranged on 2 benches, with border rows
- 3 interrupted treatments: 100% (industry standard), 50% & 25%, resulting in 25% and 12.5% , respectively, over crop cycle
- Visual symptoms, plant characteristics & foliar analysis of tissue nutrient (pooled) at inflorescence emergence

Year 5 Objective

- **Apr 1, 2022 – Dec 31, 2022 -** Confirm whether the optimized nutrient delivery system established for sub-irrigated potted chrysanthemums in the research greenhouse is applicable to both sub-irrigated and drip-irrigated chrysanthemums over 1 growing season (i.e., spring/summer) in a commercial greenhouse setting

Experimental Design

- Commercial greenhouse w/ high (natural) light
- Pinched plants grown in 6-in pots containing peat/perlite mix (uncharged) using sub-irrigation or drip-irrigation
- Randomized design, 4 cultivars, 100 plants/cv/treatment
- 3 treatments: optimized nutrients over crop cycle; optimized nutrients interrupted; 50% optimized nutrients interrupted
- Commercial harvest
- Visual symptoms, plant characteristics, plant yield, foliar analysis with development

Highlights

- Optimized low N, P, S, K, Ca & Mg delivery during vegetative growth, followed by the elimination of supply during reproductive growth, markedly improves the use efficiency of these nutrients in sub-irrigated chrysanthemums

- Overall N, P, S, K, Ca & Mg delivery can be reduced by 75-87.5% over the crop cycle, compared to industry standards, without sacrificing plant & flower quality

- Future research will optimize the delivery of micronutrients

Industry Expectations

- New knowledge related to timing & supply of fertilizer to sub-irrigated & drip-irrigated chrysanthemums
- Improved delivery nutrient strategy will reduce nutrient usage, volume of nutrient-rich feedwater that must be treated &/or discharged, & environmental risk
- Other floricultural crops

Knowledge & Technology Transfer

- Sutton, W.J. (presenter), Bozzo, G.G., MacDonald, W.N., Carlow, C., Shelp, B.J. 2018. Optimizing sulphur delivery in subirrigated chrysanthemums. Canadian Society of Horticultural Science Annual Meeting, Niagara Falls, Canada
- Shelp, B.J. (presenter), Sutton, W.J., Schenck, L., Aalbers, J. 2018. Assessing a novel nutrient delivery strategy for commercial production of subirrigated chrysanthemums. Canadian Society of Horticultural Science Annual Meeting, Niagara Falls, Canada.
- Shelp, B.J., Sutton, W.J., MacDonald, W.N. 2018 Moving towards low-input floricultural operations. Greenhouse Canada magazine (December): 16-20.
- Sutton, W.J., Bozzo, G.G., Carlow, C., MacDonald, W.N., Shelp, B.J. Strategic timing and rate of sulphur fertilization improves sulphur use efficiency in sub-irrigated greenhouse-grown chrysanthemums, Can. J. Plant Sci (revised MS submitted)
- Sutton, W.J., Shelp, B.J Managing sulphur nutrition of sub-irrigated greenhouse-grown chrysanthemum. Greenhouse Canada magazine (to be submitted May, 2019)
- Shelp, B.J., Sutton, W.J., Flaherty, E.J. Towards low-input production of subirrigated chrysanthemums: Phosphorus uptake and remobilization using a novel delivery strategy (to be submitted to Hort Res in May 2019)