Project title: Enhancing the Quality and Shelf Life of Lettuce

Project Number: FI 2013-0015

Final Report

Project Leader: Kim Best, Prospect Agri-Services

Project Coordinator: Dr. Raj Lada, Dalhousie Faculty of Agriculture

Date of Submission: March 1, 2016

Enhancing the Quality and Shelf Life of Lettuce
FI 2013-0015

Kim Best, Project Leader

ABSTRACT

A number foliar and furrow nutrient applications were used in this trial to investigate practices that could enhance the quality and shelf life of Romaine lettuce grown in Cape Breton, Nova Scotia. Soil and foliar nutrient applications were used on successive plantings over two growing seasons. It was observed in the field that plants in plots with the soil applications of BioMax grew more quickly than the plants in the other treatments and the untreated control. This is reflected in the yield data where these treatments commonly produced among the heaviest head weights. Storage samples of the full sized packed heads and Romaine hearts were evaluated weekly. No clear trends on the effect of the treatments on shelf life have been identified to date. Although, some treatments had better shelf life than others, it was not consistent for both the head sizes and packing systems.

Project Objective: The objective of this trial was to identify nutrient applications that maintain or improve yield, improve post-harvest quality and enhance shelf life of whole lettuce heads.

Materials and methods: Nine plantings of Romaine lettuce were set over the 2014 and 2015 growing seasons, with plots planted at 12" in-row spacing to develop full-size Romaine heads and plots planted at 6" in-row spacing to emulate Romaine heart production. Soil applied nutrients were placed in the transplant hole with the 4-6 week old lettuce plant and foliar treatments were applied every week to 2 weeks after planting to harvest. Harvest was conducted at mature size for the specific markets, with yield and quality data collected. Samples were placed in a commercial lettuce storage following the grower's packing practices for each market and evaluated over 5-6 weeks post harvest. Full size Romaine lettuce heads were packed unwrapped in waxed cardboard cartons. Romaine hearts were packed, 3 heads per commercial heart bag and placed in un-waxed cardboard cartons. All of the packaging used in the trial was designed for commercial lettuce packing and storage and provided by the cooperator.

Results and discussion: Soil nutrient applications of BioMax and Symbex were observed to enhance the color and size of the plants compared to other treatments, particularly shortly after transplanting. The harvested data did indicate heavier head weight from the BioMax treatments in 2015 and both the BioMax and Symbex treatments in 2014 compared to other treatments including the untreated control. Any difference in head quality at harvest was less obvious as all treatments were the same cultivar within the plantings. However, samples from Vigor-Cal-Boron and Vigor-Cal-Boron with Moly treatments exhibited significant evidence of fertilizer burn in 2015. This was not the case in 2014, however, examination of the data indicated a higher incidence of tipburn on these treatments which may or may not have been slight fertilizer burn. Samples from all plots were placed in storage for a number of weeks post-harvest. Four Romaine heart bags with 3 heads per bag were stored for each plot. At evaluation, if one heart had breakdown and was determined to be unmarketable, the whole bag of 3 heads was discarded. If they remained marketable, they were returned to the bag and placed back in storage. All of the

full sized heads harvested were placed in waxed cardboard cartons. Heads that showed signs of breakdown were discarded. The shelf life data is represented in percent of bags or heads retained as marketable and returned to storage for up to 6 weeks in 2014 and 5 weeks in 2015 post-harvest. In 2014, marketable samples of Romaine hearts treated with Orcal were retained for up to 5 weeks post-harvest, however, only 14% of the full size heads were marketable after only 3 weeks. The Vigor-Cal-Boron and the BioMax treated full sized heads resulted in 42% of the samples retained 3 weeks post-harvest. In 2015, overall shelf-life was less than in 2014. This can be attributed in part to few samples from Vigor-Cal-Boron and Vigor-Cal-Boron with Moly being stored or having any shelf life due to fertilizer burn. Samples from the BioMax and the untreated control plots were the best treatments in both head sizes. Orcal seemed to have some benefit. No clear trends were identified as to which of the treatments best enhanced shelf life. As this trial is repeated over seasons, more data will be available to analyze.

Conclusion and Summary: Multiple plantings of Romaine lettuce were established on a commercial lettuce farm in Cape Breton, Nova Scotia. Plots were planted at 12" in-row spacing to produce full size, single heads and 6" in-row spacing for Romaine heart production. Over two seasons, harvest yield and quality were consistently high using BioMax and Symbex soil treatments. Samples of all treatments were placed in commercial storage for weekly post-harvest evaluations until all the crop was discarded. Data was not consistent over the two seasons evaluated. Although, some treatments had better shelf life than others, it was not consistent for both the head sizes and packing systems. This trial will continue in 2016.

Executive Summary: Horticulture Nova Scotia conducted a trial where a number foliar and furrow nutrient applications were used to investigate practices that could enhance the quality and shelf life of Romaine lettuce grown in Cape Breton. Soil and foliar nutrient applications were used on successive plantings over two growing seasons. It was observed in the field that plants in plots where the soil applications of BioMax and Symbex were used, grew more quickly than the plants in the other treatments and the control. This is reflected in the yield data where these treatments produced the heaviest head weights. Storage samples were evaluated weekly. No clear trends on the effect of the treatments on shelf life have been identified to date. Although, some treatments had better shelf life than others, it was not consistent for both the head sizes and packing systems.

Acknowledgements: Thanks are extended to the following trial cooperators Joe King, Eyking Brothers Farm , Dr. Raj Lada, Dalhousie Faculty of Agriculture and; Prospect Agri-Services staff.

Table 1. 12" Spacing - Lettuce yield and quality, 2015

				Attribute Ratings[z]						
Fertilizer Treatment	Marketable Head weight (g)	Polar diameter (cm)	Equator diameter (cm)	Appear-ance	Exterior Color	Rib Size	Size Uniform	Overall Quality	Tipburn Severity Rating	% heads with Tipburn
Biomax	548	27	9	4	4	3	4	4	5	3
Control	535	26	10	4	4	3	4	4	5	0
Nutrical	508	26	10	4	4	3	3	4	5	0
Symbex	503	26	9	4	4	3	4	4	5	0
VCB	439	27	8	3	4	4	4	3	4	17
VCB & Moly	425	27	9	3	4	3	3	3	4	17
Orcal	404	26	9	4	4	3	3	4	5	5
Grand Mean	**480.3**	**26.4**	**9.2**	**3.6**	**3.7**	**3.3**	**3.5**	**3.6**	**4.7**	**5.9**

[z] Ratings of 1 - 5 with 5 = most desirable and 3 = average; Tipburn severity of 5 = no tipburn, 4 = a trace, 3 = unmarketable

Table 2. 6" Spacing - Lettuce yield and quality, 2015

				Attribute Ratings[z]						
Fertilizer Treatment	Marketable Head weight (g)	Polar diameter (cm)	Equator diameter (cm)	Appear-ance	Exterior Color	Rib Size	Size Uniform	Overall Quality	Tipburn Severity Rating	% heads with Tipburn
VCB	391	24	7	3	4	3	3	3	3	29
Control	365	25	8	4	4	4	3	4	5	3
Biomax	361	26	8	4	4	3	4	4	5	22
Symbex	345	25	8	4	4	3	3	4	5	8
Orcal	340	25	8	4	4	4	4	4	5	13
Nutrical	312	25	8	4	4	3	3	3	5	4
VCB & Moly	300	24	7	3	4	4	3	3	4	25
Grand Mean	**344.9**	**24.7**	**7.6**	**3.4**	**3.8**	**3.3**	**3.2**	**3.3**	**4.4**	**14.9**

[z] Ratings of 1 - 5 with 5 = most desirable and 3 = average; Tipburn severity of 5 = no tipburn, 4 = a trace, 3 = unmarketable

Table 3. Shelf life % heads suitable to retain in storage post harvest, 2015. 12" spaced plots packed as single heads in waxed cardboard cartons.

Fertilizer Treatment	% retained after 1 week	% retained after 2 weeks	% retained after 3 weeks	% retained after 4 weeks	% retained after 5 weeks
Biomax	93	45	18	0	0
Control	75	42	17	0	0
Nutrical	86	46	14	0	0
Symbex	83	48	10	0	0
VCB	33	21	0	0	0
VCB & Moly	33	17	0	0	0
Orcal	84	59	13	4	0
Grand Mean	**69.7**	**39.5**	**10.1**	**0.5**	**0.0**

0 indicates that there were no samples returned to storage

Table 4. Shelf life - % bags of 3 heads suitable to retain post harvest, 2015. 6" spaced plots packed as Romaine hearts, 3 per poly bag, packed in unwaxed cardboard cartons.

Fertilizer Treatment	% retained after 1 week	% retained after 2 weeks	% retained after 3 weeks	% retained after 4 weeks	% retained after 5 weeks
VCB	0	0	0	0	0
Control	65	40	15	0	0
Biomax	51	33	17	0	0
Symbex	6	43	8	0	0
Orcal	75	33	8	0	0
Nutrical	92	54	4	0	0
VCB & Moly	0	0	0	0	0
Grand Mean	**49.4**	**29.1**	**7.5**	**0.0**	**0.0**

0 indicates that there were no samples returned to storage

Table 5. 12" Spacing - Lettuce yield and quality, 2014

				Attribute Ratings[z]						
Fertilizer Treatment	Marketable Head weight (g)	Polar diameter (cm)	Equator diameter (cm)	Appear-ance	Exterior Color	Rib Size	Size Uniform	Overall Quality	Tipburn Severity Rating	% heads with Tipburn
Bio Max	474	24	10	4	4	4	4	4	4	25
Symbex	472	24	9	4	4	3	3	4	4	34
Orcal	457	23	9	4	4	3	3	4	4	17
Nutrical	426	23	9	4	4	4	4	4	4	10
Control	412	23	9	3	4	3	3	3	5	38
VCB	408	22	9	3	4	3	3	3	4	40
VCB & Moly	401	24	9	4	4	3	3	3	4	41
Grand Mean	**435.6**	**23.4**	**9.4**	**3.5**	**3.7**	**3.2**	**3.2**	**3.4**	**4.3**	**29.1**

[z] Ratings of 1 - 5 with 5 = most desirable and 3 = average; Tipburn severity of 5 = no tipburn, 4 = a trace, 3 = unmarketable

Table 6. 6" Spacing - Lettuce yield and quality, 2014

				Attribute Ratings[z]						
Fertilizer Treatment	Marketable Head weight (g)	Polar diameter (cm)	Equator diameter (cm)	Appear-ance	Exterior Color	Rib Size	Size Uniform	Overall Quality	Tipburn Severity Rating	% heads with Tipburn
Bio Max	324	24	7	3	4	4	3	3	4	24
Symbex	314	25	7	4	4	4	3	4	4	31
Orcal	309	24	7	3	4	4	4	3	4	41
Nutrical	305	24	7	3	4	3	3	3	4	13
Control	300	24	7	3	4	3	3	3	4	24
VCB	287	24	7	4	4	3	3	3	4	48
VCB & Moly	286	23	7	3	4	3	4	3	4	18
Grand Mean	**303.4**	**24**	**7.2**	**3**	**3.7**	**3.4**	**3.3**	**3.2**	**4.1**	**28.3**

[z] Ratings of 1 - 5 with 5 = most desirable and 3 = average; Tipburn severity of 5 = no tipburn, 4 = a trace, 3 = unmarketable

Table 7. Shelf life % heads suitable to retain in storage post harvest, 2014. 12" spaced plots packed as single heads in waxed cardboard cartons.

Fertilizer Treatment	% retained after 1 week	% retained after 2 weeks	% retained after 3 weeks	% retained after 4 weeks	% retained after 5 weeks	% retained after 6 weeks
Bio Max	99	70	42	0	0	0
Control	100	68	37	12	0	0
Nutrical	100	54	25	0	0	0
Orcal	100	71	14	0	0	0
Symbex	94	54	12	0	0	0
VCB	96	82	42	0	0	0
VCB & Moly	91	77	37	0	0	0
Grand Mean	**97**	**68**	**29.8**	**1.7**	**0**	**0**

0 indicates that there were no samples returned to storage

Table 8. Shelf life - % bags of 3 heads suitable to retain post harvest, 2014. 6" spaced plots packed as Romaine hearts, 3 per poly bag, packed in unwaxed cardboard cartons.

Fertilizer Treatment	% retained after 1 week	% retained after 2 weeks	% retained after 3 weeks	% retained after 4 weeks	% retained after 5 weeks	% retained after 6 weeks
Bio Max	100	61	29	0	0	0
Control	88	75	25	0	0	0
Nutrical	88	62	19	3	0	0
Orcal	100	59	25	13	13	0
Symbex	88	78	44	0	0	0
VCB	71	57	29	7	0	0
VCB & Moly	96	82	57	0	0	0
Grand Mean	**90**	**90**	**32.4**	**3.3**	**1.8**	**0**

0 indicates that there were no samples returned to storage