CARNATION SPLITTING AND TRACE ELEMENTS

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Various workers have indicated that carnation splitting is due to sudden light intensity increases, low temperatures, sudden temperature fluctuation, light intensity variations in relation to night temperatures and factors that might check calyx growth.

Recent work in reference to carnation boron deficiencies and trace elements presented by Campbell (1), Mastalerz (2) and refiewed by Mastalerz (3) indicated low or deficient boron to be associated with an increase in percentage splitting. The amount of boron applied through some trace elements sources was adequate for one year but not adequate for two years if increased splitting were used as a criterion. However, no increased splitting was noted when adequate amount of trace elements were continuously supplied through fortified liquid feeding Table I). The minimum amount of splitting realized was 5% with the fortified liquid fertilizer. This percent of splitting may be considered normal or average for the commercial grower.

It was suggested that if boron deficiency is a factor contribution towards splitting then this factor probably functions at restricted periods. To try and determine this, the production for the various treatments was grouped on a bi-weekly basis for the period of Dec. 1, 1956 to June 5, 1957. Total production and total splits for this period are listed in Table II. Observing the bi-weekly periods from Jan, 14, to March12 statistical analyses show significantly fewer splits for the XL36 and Frit FN 501 (high) treatments over the check for the periods Feb. 13 - Feb. 26 and Feb. 27 - March 12. (Table III). Since all treatments were grown under the same conditions except for the source of trace elements, the indications are that the lack of a trace element or a combination of trace elements contribute towards carnation splitting. Whether or not this is directly attributable to boron alone could be questioned since the treatments contained a combination of trace elements (Table IV).

During 1956 - 1957 carnations grown in the same type soil with low and high calcium levels but not deficient in boron were observed for boron tolerance tests. Boron was applied at the rate of 3 1/2 ounces per 100 gals. of water to cover 400 square feet at the following intervals:-

1. Check - no boron added.
2. 1 boron application 1 month after pinching.
3. 2 boron applications, 1 month after pinching and 5 months later.
4. Boron applications every 2 months starting 1 month after pinching.
5. Boron applications every month starting 1 month after pinching.

As indicated in Table V on a seven month basis neither the average production per square foot nor the percent splits under both low and high calcium levels were significantly effected by boron applications. Since some trace element mixtures seemed to reduce the percent splitting for the periods of Feb. 13 - Feb. 26 and Feb. 27 - March 12 production records from the boron tolerance plots were analyzed for the same periods. Table V shows that for these periods boron applications did not have any significant effect on reducing the average percent splits over the check or no boron plots.

While additional work and evidence are required it would appear from these trends and comparisons that:-

1. The lack of boron may help increase percentage splitting at restricted periods.

2. Applications of trace elements may be instrumental in reducing splitting when they are deficient.

3. Satisfactory or excessive amounts of boron or trace element combinations will not reduce percentage splitting below the normal rate.

4. Factors other from trace elements are involved in carnation splitting.

Literature Cited:-

1. Campbell, F. J. - Trace Element Mixture as a Source of Boron for Carnations. Mass. Flower Growers Assoc. Bul 44, Nov. 1957.

2. Mastalerz, J. W. - Trace Element Mixtures and Growth of Floricultural Crops. Pennsylvania Flower Growers Bul. 73, Feb. 1957

3. Mastalerz, J. W. - Carnations Splitting and Boron Deficiency. Pennsylvania Flower Growers Bulletin 85, Feb. 1958

TABLE I

EFFECT OF TRACE ELEMENT MIXTURES ON THE GROWTH OF CARNATION VARIETIES RED AND WHITE SIM. PLANTED 5/15/55, Waltham, Mass.

TREATMENT	1955-56 *		1956-57	
	FLOWERS PER SQ. FT.	PERCENT SPLITS	FLOWERS PER SQ. FT.	PERCENT SPLITS
1. Check (no boron)	30.4	23.1	9.7	47.9
2. XL-36 (0.04%)	35.3	4.9	28.0	4.1
3. Es-min-el (0.16%) 50 lbs/acre	33.2	23.7	8.7	50.5
4. Es-min-el, 100 lbs/acre	30.8	13.9	14.0	52.1
5. Frit FN501 (2.0%), 50 lbs/acre	32.6	8.7	22.7	21.1
6. Frit FN501, 100 lbs/acre	33.3	4.7	23.2	5.9
7. Frit FN502 (2.8%), 50 lbs/acre	32.8	6.2	22.6	18.4
8. Frit FN502, 100 lbs/acre	31.7	7.4	25.4	14.9

* From Pennsylvania Flower Growers Bulletin 85, February 1958

TABLE II

EFFECT OF BORON TRACE ELEMENT MIXTURES ON CARNATIONS TOTALS - 3 Replications

Treatment	Dec 1-15		Dec 16-29		Dec 30 - 13		Jan 14-28		Jan 29 - 12		Feb 13-26		Feb 27 - 12		Mar 13-26		Mar 27 - 10		Apr 11-24		Apr 24 - 8		May 9-22		May 23 - 5	
	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits	Prod	Splits
Check	1	0	0	0	2	2	12	5	9	8	39	23	31	21	45	19	32	14	9	3	13	8	12	0	7	2
XL 36	8	0	9	0	19	0	42	5	72	8	89	4	97	3	88	2	46	2	36	0	43	0	47	1	20	0
Es-min-el (low)	2	1	1	0	9	4	15	5	21	17	36	19	34	20	39	22	8	3	8	1	6	1	13	3	5	0
Es-min-el (high)	4	0	6	0	6	0	19	12	30	16	44	22	45	37	38	27	29	15	14	5	16	6	15	3	11	2
Frit FN 501 (low)	5	0	9	0	19	3	35	8	50	19	90	10	79	31	77	12	38	10	23	3	34	4	24	0	20	0
Frit FN 501 (high)	12	0	11	0	29	0	47	3	57	7	73	7	70	4	41	5	30	3	39	1	44	0	41	0	17	0
Frit FN 502 (low)	12	0	6	0	18	1	36	11	48	15	73	29	74	14	85	10	44	7	20	2	29	1	30	0	18	0
Frit FN 502 (high)	17	0	20	6	38	3	59	13	65	15	85	16	46	6	62	19	26	2	35	5	38	1	46	3	24	0

TABLE III

EFFECT OF BORON TRACE ELEMENT MIXTURES ON CARNATIONS 1956-1957

(Averages - 3 Replications)

Treatment	Jan 14 - Jan 28			Jan 29 - Feb 12			Feb 13 - Feb 26			Feb 27 - Mar 12		
	Average Production	Av. No. Splits	Av. % Splits	Average Production	Av. No. Splits	Av. % Splits	Average Production	Av. No. Splits	Av. % Splits	Average Production	Av. No. Splits	Av. % Splits
Check	4.0	1.67	29.52	3.0	1.67	38.33	13.0	7.67	71.97	10.33	7.0	46.72
XL 36	13.67	1.67	12.33	23.67	2.67	11.96	30.33	1.33	4.17	32.33	1.0	3.14
Es-min-el (low)	5.0	1.67	23.33	7.0	5.67	87.54	12.0	6.33	35.18	11.33	6.67	70.58
Es-min-el (high)	6.33	4.0	66.66	10.0	5.33	53.7	14.67	7.67	44.74	15.0	12.33	87.85
Frit FN 501 (low)	13.33	2.33	19.93	16.67	5.67	36.29	29.33	7.33	24.72	26.33	9.0	33.77
Frit FN 501 (high)	15.67	1.0	5.26	19.0	2.33	13.62	23.67	2.0	8.02	23.33	1.67	6.87
Frit FN 502 (low)	12.0	3.67	24.44	16.0	5.0	31.8	26.33	9.67	36.49	24.67	4.67	19.83
Frit FN 502 (high)	19.67	4.33	22.10	21.67	5.0	22.62	27.67	5.33	18.55	15.33	2.0	14.42
L.S.D. 5%	8.06	3.67	31.66	7.85	4.11	32.81	11.56	6.78	31.68	12.26	8.01	33.59
1%	11.18	5.09	43.94	10.89	5.71	45.54	16.04	9.42	43.97	17.03	11.12	46.62

TABLE IV

COMPOSITION OF TRACE ELEMENT MIXTURES USED IN EXPERIMENT

COMPOUND	BORON	IRON	PERCENT MANGANESE	COPPER	ZINC	MOLYB-DENUM
Es-min-el	0.16	3.0	9.87	3.81	3.48	-----
XL-36	0.04	0.15	0.18	0.06	0.06	0.009
Frit FN-501	2.0	12.25	4.9	2.0	4.0	0.13
Frit FN-502	2.8	3.9	9.7	2.0	4.0	0.13

TABLE V

EFFECT OF BORON APPLICATIONS ON CARNATIONS

Treatment	Feb 13 - 26 Av. % Splits		Feb 27 - Mar 12 Av. % Splits		7 Month Basis Av. Prod/sq. ft.		% Splits	
	Low Ca	High Ca	Low Ca	High Ca	Low Ca	High Ca	Low Ca	High Ca
1 (Check)	24.78	15.31	24.49	16.24	19.20	17.16	9.53	5.79
2 (Application)	21.62	14.95	25.78	39.04	19.32	18.42	9.26	11.17
3 (2 Applications)	24.75	14.59	35.18	27.78	18.24	17.12	9.64	8.32
4 (Application every 2 months)	13.49	11.53	21.58	22.5	18.14	16.72	5.0	5.74
5 (Applications every month)	9.57	15.26	16.51	25.45	18.56	19.49	5.24	6.9
L.S.D. 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
1%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.