2. Brooks, A. N. 1954. The sting nematode, **Belonolaimus gracilis** Steiner. Proc. Soil Sci. Soc. Fla. 14: 157-158.
3. Brown, J. G. 1968. Root knot in Arizona. Bull. Ariz. Agr. Exp. Sta. 212, 40 pp.
4. Christie, J. R. and V. G. Perry. 1951. A root disease of plants caused by a nematode of the genus **Trichodorus.** Science, N. Y. 113: 491-493.
5. Christie, J. R. and V. G. Perry. 1951. Removing nematodes from soil. Proc. Helm. Soc., Washington. 18: 106-108.
6. Colbran, R. C. 1958. Studies of plant and soil nematodes. 2. Queensland host records of root-knot nematodes (**Meloidogyne** species). Qd. J. Agric. Sci. 15: 101-136.
7. Holderman, Q. L. and T. W. Graham. 1953. The effect of different plant species on the population trends of the sting nematode. Plant Dis. Reptr. 37: 497-500.
8. Linde, W. J. Van Der. 1956. The **Meloidogyne** problem in South Africa. Nematologica 1: 177-183.
9. Linde, W. J. Van Der, et al. 1959. Host-parasite relationships of South African root-knot eelworms (**Meloidogyne** spp.). Sci. Bull. Dep. Agri. Tech. Serv., Un. S. Afr. 385, 1-16.
10. Minz, G. 1958. Root-knot nematodes, **Meloidogyne** spp., in Israel. Spec. Bull. Agric. Res. Stn Rehovot 12, 10 pp.
11. Overman, A. J. 1964. Annual Report: Florida Agricultural Experiment Station, p. 300.
12. Overman, A. J. 1958. Effectiveness of various soil fumigants in commercial production of chrysanthemums. Proc. Fla. State Hort. Soc. 71: 394-400.
13. Overman, A. J. 1968. Use of repeat applications of soil fumigants as they affect commercial chrysanthemum production. Proc. Fla. State Hort. Soc. 81: 432-436.
14. Rohde, R. A. and W. R. Jenkins. 1957. Host range of a species of **Trichodorus** and its host parasite relationships on tomato. Phytopathology 47: 295-298.

EFFECTS OF ACCUMULATION OF EXCESS PHOTOSYNTHATE IN CHRYSANTHEMUM LEAVES[1]

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Abstract

The accumulation of excess photosynthate (carbohydrates) in chrysanthemum leaves may apparently be induced by a variety of causes such as the removal of the photosynthate "sink" to which carbohydrates are normally translocated, or by an excess of photosynthetic activity over export due to climatic or cultural factors. The symptoms include thickening, downward rolling of margins, chlorotic mottling, bronzing, and actual necrosis of small leaf areas. The symptoms at certain stages closely resemble those of magnesium deficiency. The effects of light intensity, cultural practices and chrysanthemum varieties are related to the contents of sugars and starch which in turn, when present in excess amounts, apparently cause the symptoms described.

Introduction

The lower leaves of chrysanthemum plants growing in commercial plantings frequently are observed to have a physiological disorder characterized by a thickening and downward rolling of the margins of the leaves. In intermediate stages the leaves affected have a chlorotic mottling closely resembling a magnesium deficiency. The disorder described occurs uniformly, however, with high levels of magnesium fertilization. As the disorder progresses further, there is a pronounced bronzing of the formerly chlorotic areas which is later followed by necrosis, blackening and destruction of the affected tissue. The disorder has an etiology similar to that of physiological leaf roll of tomatoes (4). Conditions that favor an accumulation of photosynthate also favor the appearance of the described physiological disorder. Disbudding and pruning increase the incidence and severity of the disorder. Varieties which are capable of rapid growth are less susceptible. Full exposure to sunlight greatly increases the disorder.

The effects of light on the photosynthetic activity, flower and leaf quality and photosynthate production have been previously reported for Bluechip and Iceberg cut-flowers (3, 5).

The present research was undertaken to explore the possibility that the described disorder of lower leaves of chrysanthemum plants may be ascribed to the adverse effects of the accumulation of excess carbohydrates. A further objective was to obtain quantitative information on the physiological responses of two varieties of chrysanthemum to varied degrees of solar illumination.

Materials and Methods

'Bluechip' and 'Iceberg' cultivars of *Chrysanthemum morifolium* Ram. were grown in the spring season, from February to the end of May,

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under four degrees of shading, namely 0 (full sunlight), 25, 50 and 75 percent. Duplicate plots were grown in each of the duplicate saran cloth houses that had been covered with plastic screen material of the desired shading quality. Normal cultural procedures were followed, with weekly pesticide spray applications and bi-weekly applications of 8-8-8 mixed fertilizer at the rate of 500 lbs/a.

Chlorophyll was determined by the method of Aron (1). Photosynthetic capacity was determined in conventional Warburg manometry using a 0.2% Pardee's carbon dioxide buffer (2), a temperature of 32°C and 1250 ft C illumination. Sugars were separated with unidimensional paper chromatography, developed with P-anisidine and amounts determined according to the areas of spots. Starch was separated from sugars, hydrolyzed with concentrated sulfuric acid and determined as glucose spectrophotometrically with anthrone reagent.

Results

The effects of varied light intensity on plant characteristics are presented in Table 1. Increasing shade resulted in larger lower leaves, less dry weight per unit area but increasing chlorophyll content. Photosynthetic capacity tended to increase on the basis of fresh weight of leaf disks, going from 0 to 75% shade, however, the response appeared non-linear because of a high rate of photosynthesis resulting from the 25% shade treatment. Plant height generally increased as a result of shading. Flower yield appeared to be greatest with 25% shade and was reduced by 75% shade in comparison with the other treatments.

Glucose and starch contents of leaves were reduced by shade, especially by the highest percentage of shade, 75% (Table 2). Total carbohydrates in leaves generally decreased with increasing shade. Carbohydrate contents of flowers decreased with increasing shade; *Iceberg was* affected in this manner to a greater degree than Bluechip. Sucrose content of Bluechip flowers was reduced more by shading than were the other carbohydrates. In Iceberg flowers, only the starch content was reduced.

The lower leaves of Bluechip were more susceptible to thickening, downward rolling of margins, yellowing, bronzing and ultimately to the development of necrotic spots than were the lower leaves of Iceberg. The effect of high light intensity on Iceberg was limited to thickening, yellowing and a downward roll of leaf margins. The occurrence of these physiological disorders was greatest in the 0% shade and somewhat less in the 25% shade cloth houses. Fifty and 75% shade prevented the development of the syndrome.

Discussion

The effects of shade on plant growth habits of Bluechip and Iceberg chrysanthemums were characteristic of the effects expected by commercial growers and horticulturists, namely, that a light degree of shading was beneficial in terms of flower quality and yield. The exact degree of shade that is most desirable will depend, however, on cultural practices, varieties and season. The experiment described was carried out in the spring season. Observations made during this experiment, together with the data reported indicate that 25% shade was the best degree of shading under the experimental conditions employed.

The fact that Iceberg is less susceptible to the downward leaf roll, discoloration and breakdown of lower leaves than Bluechip is probably related to the characteristically faster growth rate of Iceberg which can result in greater utilization of photosynthate manufactured in the lower leaves. The data reported, together with observations described in the introduction, lend strength to a hypothesis that the characteristic

Table 1. Effect of shade on plant characteristics of Bluechip (BC) and Iceberg (IB) chrysanthemums

Shade %	Mean area, cm^2, lower leaves			Dry wt lower leaves g/cm^2			Leaf chlorophyll mg/100 mg fresh weight			Photosynthesis[1]			Plant height, cm			Yield of flowers, lbs/18 stems		
	BC	IB	Av	BC	IB	Av	BC	IB	Av	BC	IB	Av	BC	IB	Av	BC	IB	Av
0	24.7	24.1	24.4	.72	.54	.63	.13	.11	.12	111	94	103	31.4	29.2	30.3	2.6	3.8	3.2
25	26.1	28.1	27.1	.68	.51	.60	.14	.15	.15	154	126	140	32.3	32.4	32.4	2.6	4.1	3.4
50	26.1	39.0	32.6	.54	.42	.48	.16	.16	.16	121	106	114	34.8	33.5	34.2	2.6	3.9	3.3
75	26.3	35.8	31.1	.50	.42	.46	.17	.18	.18	158	135	147	34.5	36.2	35.4	2.3	3.1	2.7
LSD, .05						.07			.02						2.0			0.3

[1]Photosynthetic capacity, ul O_2 evolved/100 mg/hr

Table 2. Effect of shade on carbohydrate contents[1] of leaves and flowers of Bluechip (BC) and Iceberg (IB) chrysanthemums.

Shade	Fructose		Av	Glucose		Av	Sucrose		Av	Starch		Av	Total		Av
%	BC	IB		BC	IB		BC	IB		BC	IB		BC	IB	
LEAVES															
0	.12	.12	.12	.14	.13	.14	.24	.16	.20	.15	.11	.13	.65	.52	.59
25	.09	.11	.10	.13	.12	.13	.17	.18	.18	.19	.12	.16	.58	.53	.56
50	.10	.10	.10	.11	.11	.11	.18	.14	.16	.07	.01	.04	.46	.36	.41
75	.08	.11	.10	.00	.00	.00	.12	.14	.13	.02	.03	.03	.22	.28	.25
LSD, .05						.02			.05			.06			.10
FLOWERS															
0	.22	.21	.22	.21	.20	.21	.08	.03	.06	.33	.33	.33	.84	.77	.81
25	.18	.16	.17	.18	.18	.18	.02	.02	.02	.40	.30	.35	.78	.66	.72
50	.18	.17	.18	.17	.15	.16	.02	.02	.02	.29	.24	.27	.66	.58	.62
75	.16	.19	.18	.16	.18	.17	.01	.03	.02	.31	.10	.21	.64	.50	.57
LSD, .05						.03			.02			.06			.11

[1]Percent of fresh weight. Leaves sampled April 11, flowers sampled May 23.

physiological disorder of lower leaves of chrysanthemums, as described, is caused by an accumulation of photosynthate (carbohydrates) to levels that are in some manner physiologically damaging to the lower leaves of the plants.

LITERATURE CITED

1. Arnon, D. I. 1949. Copper ensymes in isolated chloroplasts. Polyphenoloxidase in **Beta vulgaris**. Plant Physiol. 24: 1-15.

2. Umbreit, W. S., R. H. Burriss and J. F. Stauffer. 1964. Manometric techniques. 305 pp. Burgess Publishing Company, Minneapolis, Minn.

3. Woltz, S. S. 1965. Photosynthesis in chrysanthemum cut-flowers. Proc. Fla. State Hort. Soc. 78: 415-417.

4. Woltz, S. S. 1968. Influence of light intensity and photosynthate export from leaves on physiological leaf roll of tomato. Proc. Fla. State Hort. Soc. 81: 208-211.

5. Woltz, S. S. and W. E. Waters. 1967. Effects of storage lighting and temperature on metabolism and keeping quality of **Chrysanthemum morifolium** cut-flowers relative to nitrogen fertilization. Proc. Amer. Soc. Hort. Sci. 91: 633-644.

MARKET NEWS REPORTS FOR FLORISTS' PRODUCTS: CHANGE AND CHALLENGE

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Abstract

Market news reports relating to the transportation of Florida floricultural products were initiated in 1959. Eight years later, in 1967, a feasibility study was started to determine procedures for implementing a large scale market news reporting service for the nation's floricultural products. Regular market news reports were begun in San Francisco, Chicago and Dallas. In addition, the program in Florida was expanded to include price information and to extend the coverage on destination areas.

Although shipping point price data are collected and disseminated, a serious lack is a more thorough reporting of price data on consignment sales to terminal markets. Nevertheless, the cur-