Hollow Stem in Cauliflower

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Keywords: Hollow stem, rate of growth, Boron, *Brassica oleracea* var. *botrytis*

Abstract

The occurrence of, sometimes large, cavities in the stem of cauliflower formed a serious quality problem for Dutch cauliflower growers in recent years. The cause of the problem under the local conditions was not clear. In field experiments, the application of boron and variation in the growth rate of the crop, were studied for effects on the occurrence and degree of seriousness of hollow stem. Broadcast application of boron at 1 and 2 kg per hectare at planting had no effect on the percentage of affected plants nor on the length of the cavities. There was no causal relation between the boron content of the stem at harvest and the occurrence or the length of the cavities. However, a positive relation between the average growth rate of the stem and the percentage of affected plants was observed.

INTRODUCTION

The occurrence of hollow stems in cauliflower (*Brassica oleracea* var. *botrytis*) forms a serious quality problem for Dutch cauliflower growers. The presence of cavities in the stem results in quality declassification, or worse, in the occurrence of bacterial rot in the stem, resulting in complete loss of the plant. The presence of a cavity is sometimes accompanied by a curd consisting of two closely connected parts, making the curd unmarketable. Soil boron deficiency has been reported as a cause of the hollow stem disorder in cauliflower (Maier, 1951; Batal et al., 1997). Also conditions stimulating an increase in plant size have been reported to increase the number of plants with a stem cavity (Scaife and Wurr, 1990). The cause of the hollow stem disorder under the local conditions was not obvious. Therefore, in three field experiments the single and combined effects of application of boron and creating conditions for rapid growth, were studied for effects on the occurrence and the degree of seriousness of hollow stem.

MATERIALS AND METHODS

General

Three experiments were conducted during the summer of 1999 in growers fields in "De Streek" region, the major Dutch cauliflower growing area in the North Western part of the Netherlands, on sandy clay to clay soils with a pH-KCl ranging from 7.4 to 7.5. Shortly after soil preparation for planting, modular raised transplants of the cultivar ‘Fremont’ were machine planted by the growers at a planting distance of 0.75 m between rows and 0.50 m in the row. Fertilizer application, pest, disease and weed control were conducted by the growers according to commercial practice. The boron content of the soil was 3.1, 4.4 and 3.0 mg/kg (soil layer 0-30 cm, dry weight basis) for Experiments 1, 2 and 3 respectively.

Experimental Procedures

The experiments were established in a randomized complete block design with nine treatments in three replicates. Treatments were the application of boron at rates of 1 and 2 kg per hectare in the form of Borax (11.3 % B). Variation in growth rate between plants was achieved through varying the planting distance in the row, creating variation in plant density. By removing plants and by planting additional plants in the row, distances of 1, 0.50 and 0.25 m between plants in the row were made. Each level of boron

application was repeated at each level of plant density, resulting in nine treatments. Net plot size was 3.75 x 3.5 m. At harvest 15 plants in each plot were cut longitudinally and evaluated for the presence of a cavity. The length of the cavity and total plant length were measured. Fresh weight, dry weight and boron content of curds, leaves and stems of three of these plants was determined. Statistical analysis was done through analysis of variance with the Genstat 5 programme (Genstat 5 Committee, 1993).

RESULTS

Application of Boron

The application of boron had no effect on the percentage of plants with a stem cavity nor on the relative lenght of the cavity (data not shown). There was no obvious causal relation between the percentage plants with a hollow stem in the three experiments and the boron concentration of the stem (Figure 1).

Planting Distance

The planting distance in the row had a large effect on the percentage of plants with a hollow stem (Table 1). The average percentage of plants with a hollow stem varied between experiments. Nevertheless, the increase in number of plants with a hollow stem with an increase in the distance between plants in the row, was significant in each experiment. Similarly, the relative length of the stem cavity of the cauliflower plants in each experiment significantly increased with an increase in planting distance in the row (Table 2). The percentage of plants with a hollow stem in the three experiments was positively related to the average growth rate of the stem in gram fresh weight per day during the crop growth period (Figure 2).

DISCUSSSION

The boron content of the soils in the experiments proved to be considerably above the required minimum level. The boron content of soils is considered good at levels above 0.35 mg B per kg soil (Van Dijk, 1999). Application of 1 and 2 kg boron per hectare had no effect on the percentage of cauliflower plants with a hollow stem nor on the seriousness of the defect. However, creating conditions for rapid growth of individual plants, by increasing the planting distance in the row, increased both the percentage of plants with a hollow stem and the relative length of the cavity. The percentage of plants with a hollow stem appeared to be positively related to the average growth rate of the stem during the experiment. In conclusion, boron deficiency plays no role in the cause of the hollow stem disorder under the local conditions and that the occurrence and degree of seriousness of stem cavities is related to the growth rate of the stem. Conditions likely to increase the growth rate of the crop are likely to increase the incidence of the hollow stem disorder.

Literature Cited

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Tables

Table 1. The effect of the planting distance in the row on the percentage of plants with a hollow stem.

Experiment	Planting distance in the row (cm)			LSD	Significance
	25	50	100	(α = 0.05)	
1	37	84	96	11	p<0.001
2	59	93	98	10	p<0.001
3	7	36	67	15	p<0.001

Table 2. The effect of the planting distance in the row on the length of the cavity as a percentage of total plant length.

Experiment	Planting distance in the row (cm)			LSD	Significance
	25	50	100	(α = 0.05)	
1	9	17	29	5	p<0.001
2	14	20	35	4	p<0.001
3	6	11	15	5	p=0.011

Figures

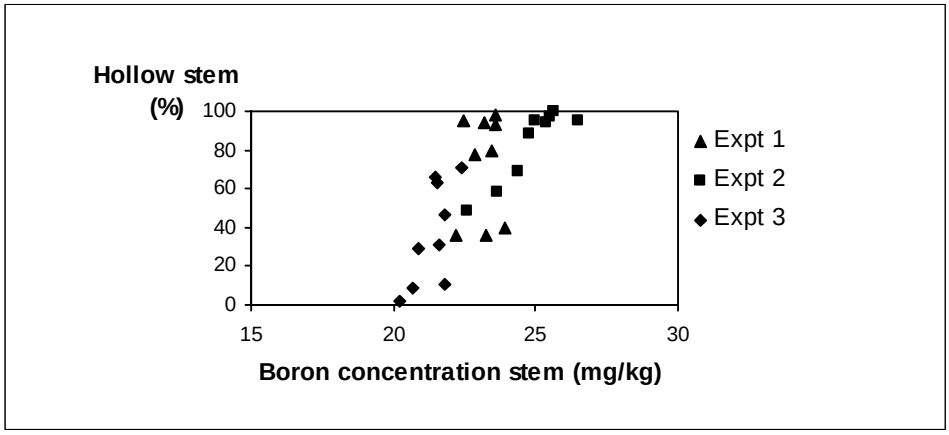

Fig. 1. The relation between the percentage plants with a hollow stem and the Boron concentration of the stem.

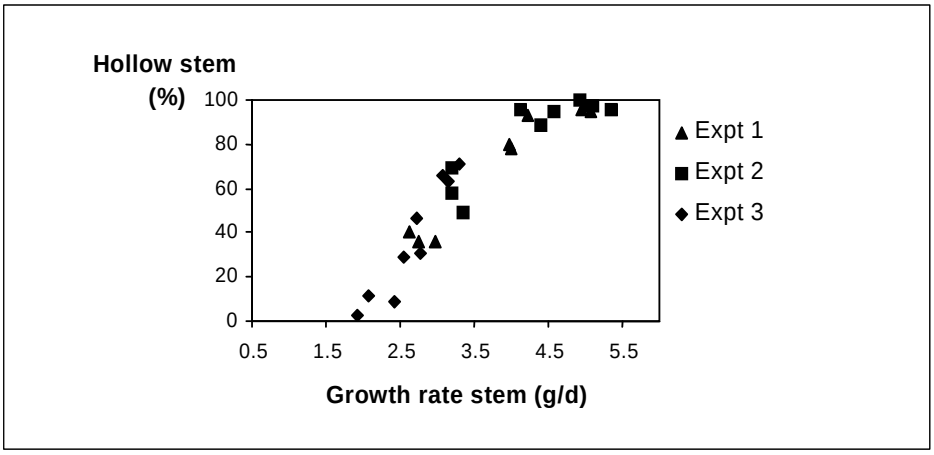

Fig. 2. The relation between the percentage plants with a hollow stem and the average growth rate of the stem in gram fresh weight per day.