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Effect of relative humidity on fruit set and seed set in pepper (Capsicum annuum L.)

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Summary

With the sweet pepper variety 'Verbeterde Glas' the effect of relative humidity (55, 80 and 95 %) on fruit set and seed set was investigated under controlled conditions. It was found that fruit set is not influenced by the relative humidity, but that seed set increases with increasing humidity. Moreover it appeared that relative humidity affected growth, flower drop, fruit weight, time between pollination and harvest and the gloss of the fruits.

Introduction

Earlier experiments (Cochran, 1932, 1936; Dorland & Went, 1947; Wells, 1967; Hamadeh, 1967; Rylski & Halevy, 1974) have shown that particularly temperature but also light (Auchter & Harley, 1924; Hamadeh, 1967) influence fruit set in pepper. Little is yet known of the effect of the relative humidity (RH). Bashir (1952) states that good fruit set of pepper is associated with a high RH.

To obtain more information on the effect of RH on fruit set and seed set in pepper a tentative experiment was made in the IVT phytotron in 1974. The impression was gained that RH does not influence fruit set but that seed set is promoted by a high RH. In 1976 the experiment was repeated on a larger scale and in a slightly modified form. The results are described in the present paper.

Materials and methods

Seeds of cv. 'Verbeterde Glas' were sown on 6 December 1975. On 5 January 1976 the plants were placed in 12-cm pots and in early February transferred to 10-litre containers. A ready-made potting soil consisting of frozen black peat and clay was used. The plants were raised in a glasshouse at constant 23 °C and about 70 % RH. From 08h00 to 16h00 the plants received additional light from Philips HPL/N mercury vapour lamps, the light intensity was 12 W/m².

On 1 March, when the plants started to flower, 16 plants were placed in each

of three climate rooms with a RH of 55, 80 and 95 %, respectively. The day temperature was 21 °C, the night temperature 16 °C. The daylength was 12 hours, the light intensity at plant height 60 W/m². In the climate rooms the plants were given two dressings of a composite fertilizer NPK 20-5-20 each time at 1.5 g per plant.

From 3 March, all open flowers were pollinated once. Although the pepper is a self-pollinating crop, pollinating was done artificially with a mixture of pollen from other plants from the same treatment. The pollinations were continued until flower drop occurred. Flower drop started on 31 March, 1 April and 16 March for 55 %, 80 % and 95 % RH, respectively.

On 21 April, all plants were moved to a glasshouse for ripening off of the fruits. The fruits were harvested red, weighed individually and the seeds were counted per fruit.

Results

The RH was found to have an effect on plant growth. Table 1 shows the means and their standard deviations for the length of the plants at the beginning and at the end of the experiment and the relative increase in length. It appeared that both on 1 March and 21 April the mean plant length was significantly greater at 95 % RH than at 55 and 80 % RH. The mean relative increase in plant length, also appeared to be significantly higher at 95 % RH than at 55 and 80 %. So growth was strongest at 95 % RH.

The RH was also found to affect flower drop. At 95 % RH flower drop started about fourteen days earlier than at 55 and 80 % RH. As a result the mean number of pollinated flowers per plant was considerably smaller at 95 % than at 55 and

Table 1. Vegetative growth at different humidities.

Relative humidity (%)	Mean plant length (cm) on		Relative increase
	1 March	21 April	
55	29.3 ± 0.4	40.8 ± 0.5	1.39 ± 0.03
80	28.8 ± 0.5	41.0 ± 0.7	1.42 ± 0.02
95	30.7 ± 0.4	46.5 ± 0.8	1.52 ± 0.04

Table 2. Fruiting and seed set at different relative humidities (RH).

	55 % RH	80 % RH	95 % RH
Number of flowers pollinated	196 ± 0.6	195 ± 0.7	81 ± 0.5
Number of flowers set	164 ± 0.7	157 ± 0.7	68 ± 0.5
Fruit set (%)	84 ± 3.7	81 ± 3.6	84 ± 4.3
Mean fruit weight (g)	74 ± 4.0	81 ± 5.0	138 ± 6.7
Mean number of seeds per fruit	78 ± 6.9	100 ± 11.1	182 ± 14.6
Mean number of days from pollination to harvest	72 ± 0.85	72 ± 0.75	69 ± 0.80

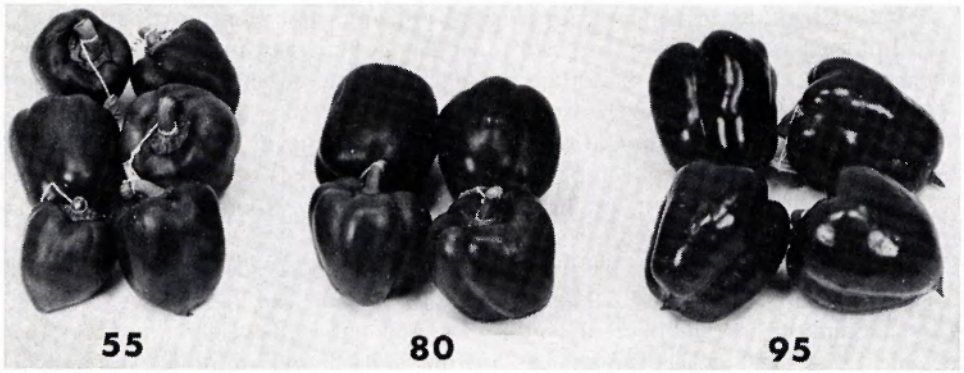

Fig. 1. Effect of RH on the gloss of the fruit.

80 % RH (see Table 2). From Table 2 it appears that there was no effect of RH on the percentage of fruitset, but an increase in RH is a accompanied by a significant increase in the number of seeds.

The mean fruit weight also increased at higher RH. Only the fruit weight at the highest RH appeared to differ significantly from the fruit weights at the other humidities.

Time from pollination to harvest was significantly shorter at 95 than at 55 and 80 % RH.

At the fruit harvest it was found that the fruits were more glossy at higher humidities (Fig. 1).

Discussion

From the literature it appears that air humidity may affect plant growth. With a number of species growth appeared to be stronger at a higher RH, for example with peanut (Fortanier, 1957) cacao (Sale, 1970), cotton (Hoffman et al., 1971), ageratum, petunia and marigold (Krizek et al., 1971), apple (Tromp & Oele, 1972) and lettuce (Tibbits & Bottenberg, 1976). With other plants, such as Red Kidney bean (O'Leary & Knecht, 1971) and pea (Nonnecke et al., 1971) no effect of RH on growth was found. In our experiment on pepper, the RH was shown to have an effect on vegetative growth, which was strongest at the highest RH, although the effect was not very marked.

Previously it was found that a low RH can cause flower drop in pepper (Bashir, 1952). In our experiment it was demonstrated that also a high RH can promote flower drop. Apparently RH has an effect on the number of flowers which can develop into fruits. A similar effect appears to exist in cotton, in which both at extremely low and very high RH the flower buds do not open (Hoffman et al., 1971).

Between 55 and 80 % RH there was no difference in the onset of flower drop, or in vegetative growth. At 95 % RH, however, flower drop started much earlier than at 55 and 80 % RH, but growth also was stronger. This indicates that at a high RH flower drop is promoted by the stronger growth of the plant.

Whether fruit set in pepper will occur or not, does not seem to depend on the RH. But seed set is clearly influenced by the RH and increases with increasing RH. Further research is needed to explain this phenomenon. A better seed set at higher RH was also found in cotton (Hoffman et al., 1971).

A comparison of seed set and fruit set reveals a significant difference in seed set but not in fruit weight between 55 and 80 % RH, whereas between 80 and 95 % RH both seed set and fruit weight differed significantly. Apparently seed set and fruit weight are not correlated.

Consequently the fact that the fruits are heaviest at 95 % RH cannot be ascribed to seed set being best at 95 % RH.

On comparing the number of fruits per plant and fruit weight it appears that between 55 and 80 % RH the number of fruits and fruit weight do not differ significantly. At 95 % RH, however, the number of fruits is considerably smaller but the fruits are much heavier. This indicates that the heavier fruits are due to the number of fruits per plant being much smaller at 95 % RH than at 55 and 80 % RH, so that the fruits could better develop. Thus the heavier fruits at 95 % RH must be the indirect effect of RH on the flower drop.

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