

CUCUMBER

Optimization of the CO₂ level (E.M. Nederhoff and J.A.M. Uffelen) Annual Report, 1986. Naaldwijk, The Netherlands

In the first half of 1986 an experiment was carried out with cucumber, in which the principle of optimization of the CO₂ concentration was tested. As a basis for the optimization the glasshouse climate computer carries out simulation calculations in order to estimate both the production and the costs of CO₂-supply with different CO₂ levels. The level indicated as economic optimum is passed on as setpoint to the actual CO₂ control programme.

The experiment was conducted in a Venlo-house with cucumber cv. 'Lucinde'. The planting date was 14 January. CO₂ enrichment started on 29 January. The first picking was on 27 February and the experiment was terminated on 9 June. Pure CO₂ was applied from a tank. There were 6 treatments in duplicate: in 2 treatments CO₂ enrichment took place on the basis of the optimization programme, and in 2 other treatments by comparison continuous CO₂ levels were maintained of 300 and 500 ppm, respectively. The difference between the 2 optimization treatments was the parameter for the cost price of CO₂. In the treatment 'opt-25' this was set at Df1 0.25 per kg CO₂ and in 'opt-55' at Df1 0.55/kg.

Of the 4 treatments production and CO₂ consumption were compared. The yield until 1 April was highest with 'opt-25'. This is explainable because also the CO₂ consumption and consequently the average CO₂ level was highest. After 1 April the CO₂ consumption increased very strongly in the treatment with continuous 500 ppm. On the other hand, in the optimization treatments CO₂ was applied selectively (more ventilation resulted in a lower CO₂ setpoint). The cu-

mulative results on 9 June pointed out that in the 'opt-25' treatment only half the amount of CO₂ of the 500 ppm treatment was consumed (51%), whereas the cumulative production figures were virtually equal. The production rate of the last period (May-June) was even greater with 'opt-25' than with 500 ppm. The results with 'opt-55' were slightly less favourable. Due to the higher value for the cost price parameter, CO₂ was applied more sparingly, especially in May and June when there was frequent ventilation. The reduced enrichment manifested itself in the lower cumulative CO₂ consumption (26% of the consumption in the 500 ppm treatment) and the lower production (89% of the production in the 500 ppm treatment).

From this first test of the optimization programme the conclusion was drawn that it is possible to realise a high production increasing effect by means of selective enrichment at relatively low application costs. The explanation is that with the aid of the optimization programme enrichment can be carried out at moments when the crop uses the CO₂ offered most effectively (with much light) and when the costs are relatively low (with little air exchange).

In the remaining 2 treatments the effect was studied of pulsating CO₂ application. These treatments consisted of 8 minutes CO₂ enrichment until 500 ppm per 90 and per 180 minutes, respectively. It appeared that in these treatments the yield increased very little and that this way of enrichment does not offer perspectives. These findings confirm the results of an experiment carried out in 1985 in an autumn crop of sweet pepper (see Annual Report 1985, p. 59).