



Detail from the cover illustration for Davy Meijer's PhD thesis *The effects of far-red light on plant-arthropod interactions and the implications for greenhouse tomato cultivation* • Illustration Roos van Dooremal

More red not a bad thing

Plants grow better when more far-red is added to the light. But in principle, the additional growth is at the expense of the energy available for defending the plant against pests. Is that harmful? Not in combination with biological pest control, shows research on tomatoes by PhD candidate Davy Meijer.

Plants respond to the shadow of neighbouring plants by growing faster and making more flowers. This adaptation gives the plant an advantage in the competition for the available sunlight. Plants 'sense' shadow with a special photoreceptor that measures the

'The number of pests increases, but so does the predatory insect population'

More and more growers are exploiting this characteristic by giving plants in greenhouses additional far-red light from LED lamps. Not that you can see that with the naked eye. At 730–800 nanometres, far-red light is outside the visible spectrum, explains PhD candidate Meijer. He investigated what the extra light does to the interaction between insects and tomatoes.

Pests such as the spider mite, greenhouse whitefly and green peach aphid

ratio of red to far-red light. Neighbouring plants reflect far-red, which sets off the shadow avoidance process.

do indeed get a boost when more far-red light is used. Meijer: 'The number of pests increases due to the decline in the defence system. But that increase their food supply in turn sparks growth in the population of predatory insects. They become so numerous they are able to effectively suppress the pests. So biological pest control works well in combination with far-red light.'

Bumblebees

There is no adverse effect either on pollination by bumblebees. On the contrary, show experiments by Meijer. When given a choice, bees prefer to fly to tomatoes growing with extra far-red light. He also discovered why bees do that. The flowers of far-red tomatoes emit a much stronger chemical signal to attract the bees.

'The mix of volatile organic compounds doesn't change, but the total amount produced does,' explains Meijer. 'The stronger signal acts as a kind of neon advert telling the bees this is the place to be.' It's not false advertising either.

'The plant isn't tricking the bees. More far-red light means more flowers, so it's easier to find food.'

Trial setup

The use of far-red light looks like a win-win situation for all parties. The plant grows faster and produces more tomatoes. And those effects are not at the expense of biological pest control or pollination performance. 'Based on my results, I would say: use far-red light. But as a scientist I need to be cautious,' says Meijer.

'These are greenhouse experiments where the bumblebees had a choice,' he says to explain his caution. 'That is not the case in a commercial setting. If you want to demonstrate the overall effect on yields, you'd need a different setup: one greenhouse with far-red light and one without, then compare the yields. But a PhD is only four years.' RK