



# Viability of broad-spectrum LED as a substitute for HPS in greenhouse tomato

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## Background and aim

Supplementary light in greenhouses is used during winter months to allow for year-round production or quality improvement. Currently High Pressure Sodium (HPS) lamps are the standard supplementary light source. Our aim is to evaluate broad spectrum white LED as supplementary light in greenhouse tomato.



**Figure 1.** Tomato plants under broad spectrum white LED, two months after transplanting.

## Materials & Methods

**Light recipes:** (1) HPS, (2) Broad spectrum white LED, and (3) Broad spectrum white LED with far red.

**Cultivars:** 'Merlice' (truss tomato) and 'Tomagino' (cherry tomato)

**Duration:** 5 months in high-wire Venlo greenhouse.

**Temperatures:** One °C higher for half of light recipe (2) and all of (3).

## Results - Merlice

- Stem length reduced by 14% under White LED compared to HPS (n.s.)
- Number of leaves 5% reduced under White LED compared to HPS (n.s.)
- Replacing part of R with FR increases stem length by 7% (n.s.)
- No significant difference in yield between HPS and White LED, even with temperature compensation.
- Yield increased by 11% when replacing part of R with FR (n.s.)



**Figure 2.** Merlice grown under broad spectrum white LED with supplemental far red + 1°C, two months after transplanting.

**Table 1.** Results of cv. 'Merlice' after 20 weeks of cultivation. Means followed by a different letter within a cultivar are significantly different according to Fisher's protected LSD test (P=0.10).

Treatment	Stem length (m)	Leaves per plant	Fruit FW (kg/m <sup>2</sup> )	Fruits per m <sup>2</sup>
HPS	6.1 a	71 a	13.9 a	104
White LED	5.2 a	67 a	13.7 a	98
White LED + 1°C	5.3 a	67 a	14.0 a	106
White LED + FR + 1°C	5.6 a	70 a	15.6 a	108

## Results - Tomagino

- Stem length reduced by 12% under White LED compared to HPS (n.s.)
- Replacing part of R with FR increases stem length by 5% (n.s.)
- Stem length increases mainly due to internode length increases.
- White LED + 1°C resulted in 11% yield increase compared to HPS (n.s.)
- No significant effect of FR on yield observed.



**Figure 3.** Tomagino under broad spectrum white LED + 1°C, two months after transplanting.

**Table 2.** Results of cv. 'Tomagino' after 20 weeks of cultivation. Means followed by a different letter within a cultivar are significantly different according to Fisher's protected LSD test (P=0.10).

Treatment	Stem length (m)	Leaves per plant	Fruit FW (kg/m <sup>2</sup> )	Fruits per m <sup>2</sup>
HPS	6.3 c	84 a	8.9 a	730
White LED	5.6 a	80 a	9.2 ab	710
White LED + 1°C	5.8 ab	80 a	9.9 c	776
White LED + FR + 1°C	6.1 bc	81 a	9.8 bc	784

## Discussion

Shorter internode length in White LED compared to HPS may be the result of lack of blue in HPS lamp. The slight reduction in number of leaves under White LED may be the result of lower apex temperature. However, yield was not reduced under White LED.

The yield increase from the red to far red replacement is found to be in agreement with Kalaitzoglou et al. (2019), who report a positive effect of far red on tomato yield.

## Conclusions

Tomatoes can be grown well under supplementary broadband white LED with a tendency for a higher yield compared to conventional HPS supplementary light.

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