



UNDERSTANDING OUR ENVIRONMENT:

Seasonal Daily Light Integrals Across and Along Indiana

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Light provides the energy for photosynthesis that drives plant growth. The total amount of light available for photosynthesis in a day is called the daily light integral, or DLI. It is measured in mol/m²/day. The optimal level varies: for low-light plants such as ferns 4 mol/m²/day is enough; for transplants of vegetables 10-12 mol/m²/day is acceptable but more light will lead to faster growth; and for greenhouse production 15-17 mol/m²/day

is recommended for lettuce and 20-30 or more mol/m²/day for tomatoes.

Solar DLI varies over the year and around the state because day length changes, the angle of the sun above the horizon changes, and weather conditions, such as clouds or haze, change. Knowing about this variation can help growers manage crop schedules and environment in structures like high tunnels and greenhouses, and

Monthly average DLI in Indiana

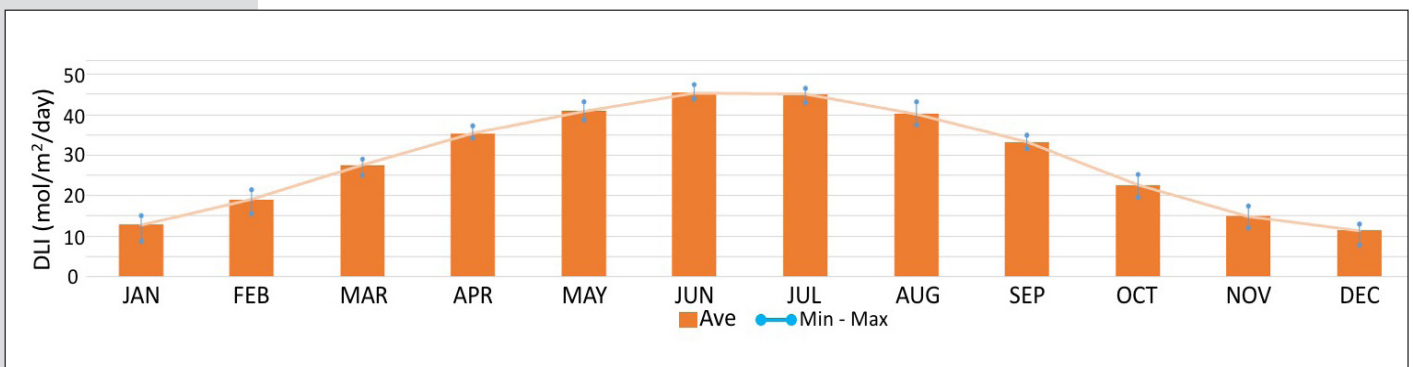


Figure 1. Monthly average DLI in Indiana. Lines at top of bars illustrate the range of monthly average values around Indiana. For example, in January the location in Indiana with the highest DLI averaged 15, the location with the lowest DLI averaged 7, and across the entire state the average was 13.¹

understand observed differences in crop growth and development.

The graph (Fig. 1) and maps (Fig. 2) show DLI for outdoors, estimated from models of solar radiation over the period 1998-2012¹. DLI inside a high tunnel or greenhouse would be about 50% to 90% of outside, depending on the greenhouse covering and amount of shading within the structure. Under row covers in a high tunnel, DLI would be 50% or less of outside.

Additional Resources

Commercial Greenhouse Production: Measuring Daily Light Integral in a Greenhouse. HO-238-W. https://mdc.itap.purdue.edu/item.asp?Item_Number=HO-238-W

Managing the Environment in High Tunnels for Cool Season Vegetable Production. HO-297-W. https://mdc.itap.purdue.edu/item.asp?Item_Number=HO-297-W

¹ Logan and Faust provided the data for the figures. Details of their methods are available in Faust, J. E. and J. Logan. 2018. Daily light integral: a research review and high-resolution maps of the United States. *HortScience* 53:1250-1257. The maps are derived from 1271 gridded points each representing a square about 0.6 mile on a side. The DLI for each point is based on a satellite radiation model and converted to DLI using the factor $0.007265 \text{ mol/m}^2/\text{day} = 1 \text{ watt-hour/m}^2/\text{day}$. This conversion of solar radiation measured in units of energy (watts) to units of DLI (photons) doesn't take into account variations in intensity of the wavelengths of solar radiation that occur during the year, and so is an estimate of DLI. You can see maps for the entire country at <https://myutk.maps.arcgis.com/apps/MapSeries/index.html?appid=d91ba9eb487d43f3a82161a1247853b6>.

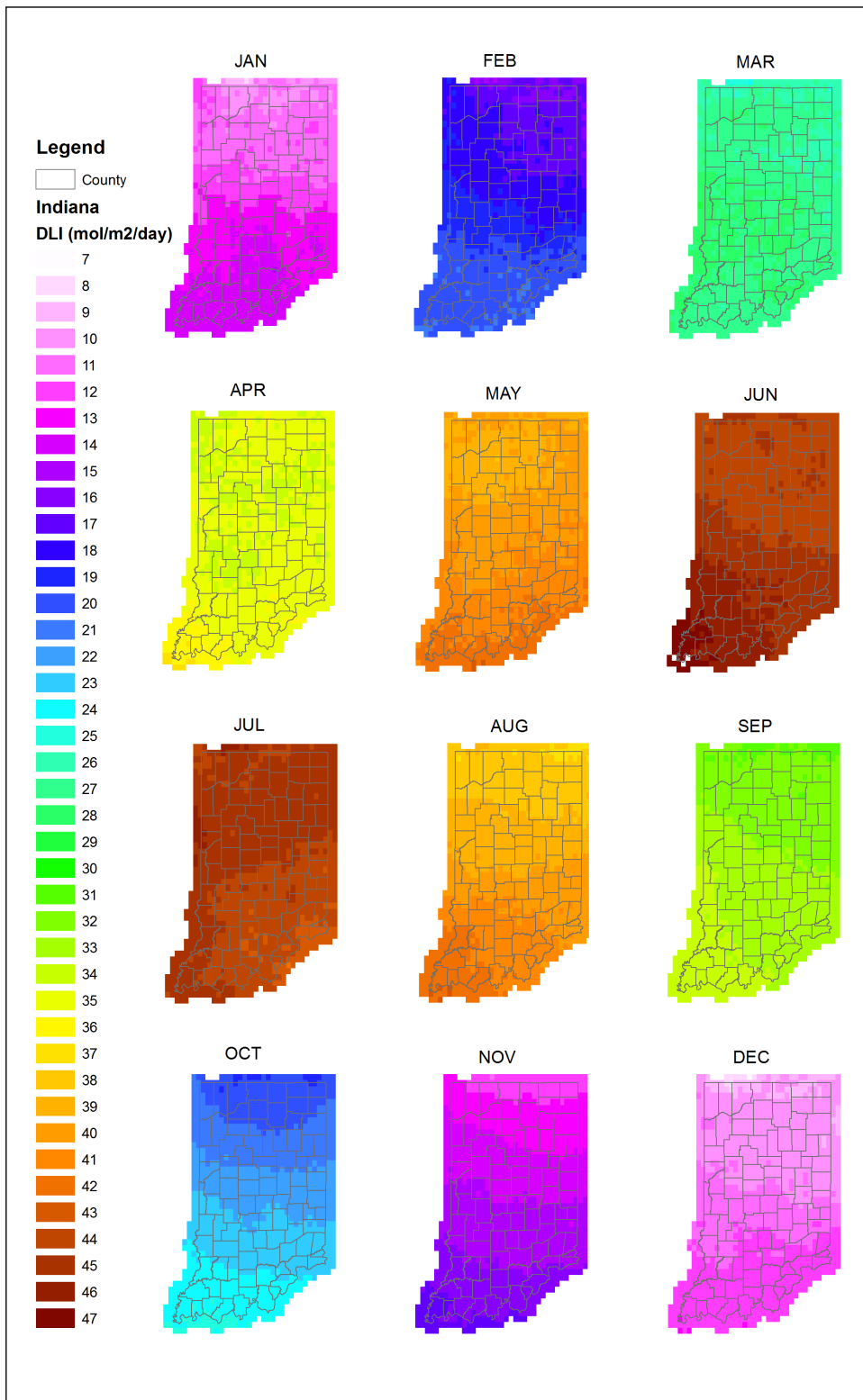


Figure 2. Average monthly outdoor solar DLI along and across the state of Indiana.