



# **Quantifying shade environments and light requirements for turfgrasses**

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**It has been estimated that 25% of all turfgrasses are experiencing shade stress**



Sources of shade include trees, buildings, stadiums, clouds, and mountains

## How much light do we have? = Daily light integral

- The total photosynthetically active radiation (PAR) that the plant receives over 1 day
- Measurement units:
  - mol / m<sup>2</sup> / day







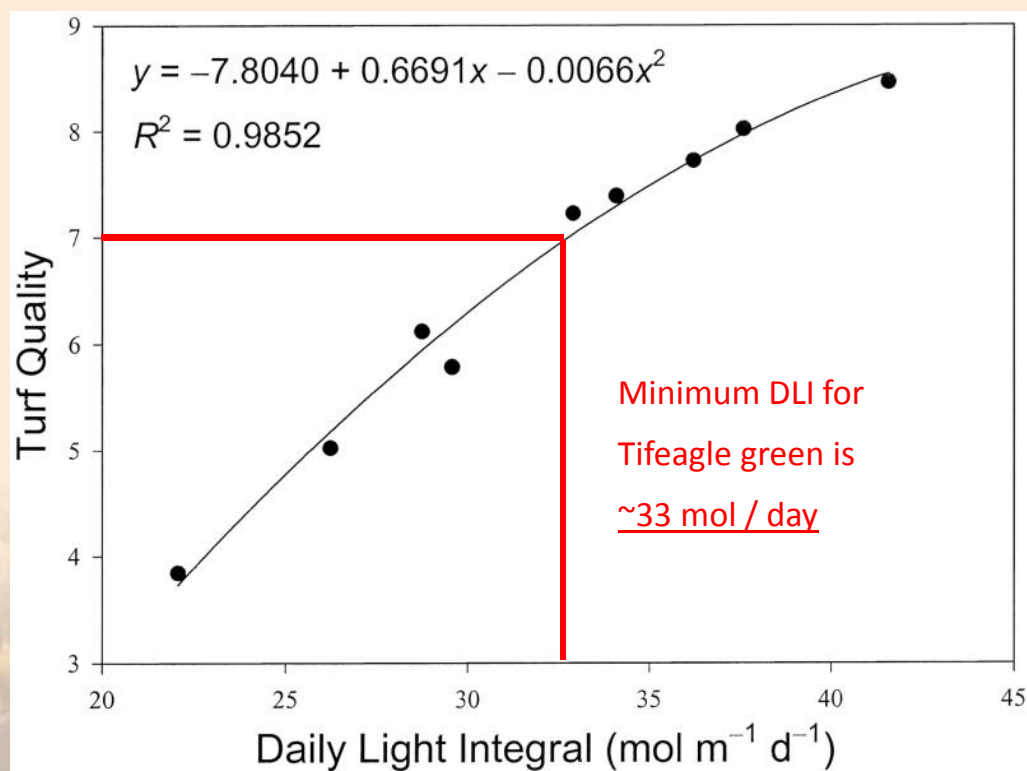
# The core idea...

If we can measure the DLI at a site (say a putting green) and the research tells us what the minimum light requirement (in DLI) for a grass should be, then we can make more informed decisions...



# DLI and turf quality of a Tifeagle green

— Bunnell and McCarty, Clemson



**SAN DIEGO 2019**  
CONNECT. **DISCOVER.** ELEVATE.



golf industry show

**GCSAA EDUCATION CONFERENCE**

**Shade system being used at  
the UofA**





0% shade – 43.3 mol PAR / day

30% shade – 28.1 mol PAR / day

Overseeded and non-overseeded bermudagrass  
at a mowing height of 1 inch (2.5 cm)

overseeded

non-overseeded

overseeded

non-overseeded

60% shade – 15.9 mol PAR / day

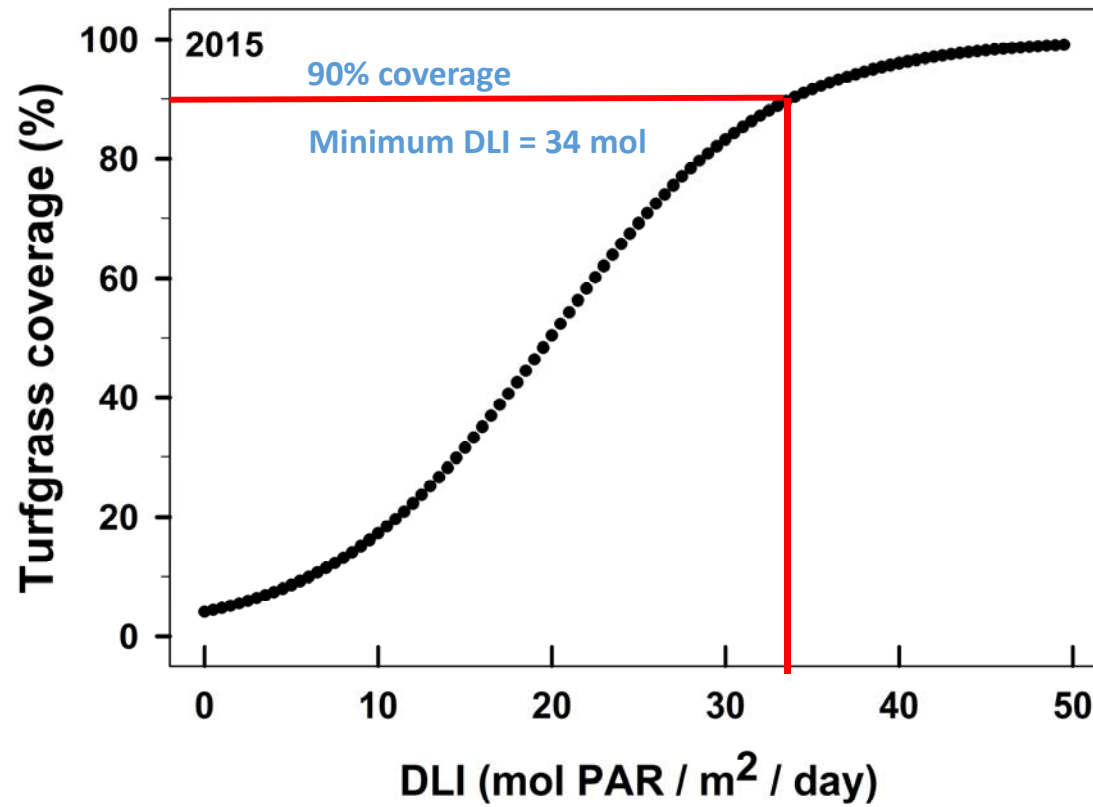
90% shade – 3.5 mol PAR / day

overseeded

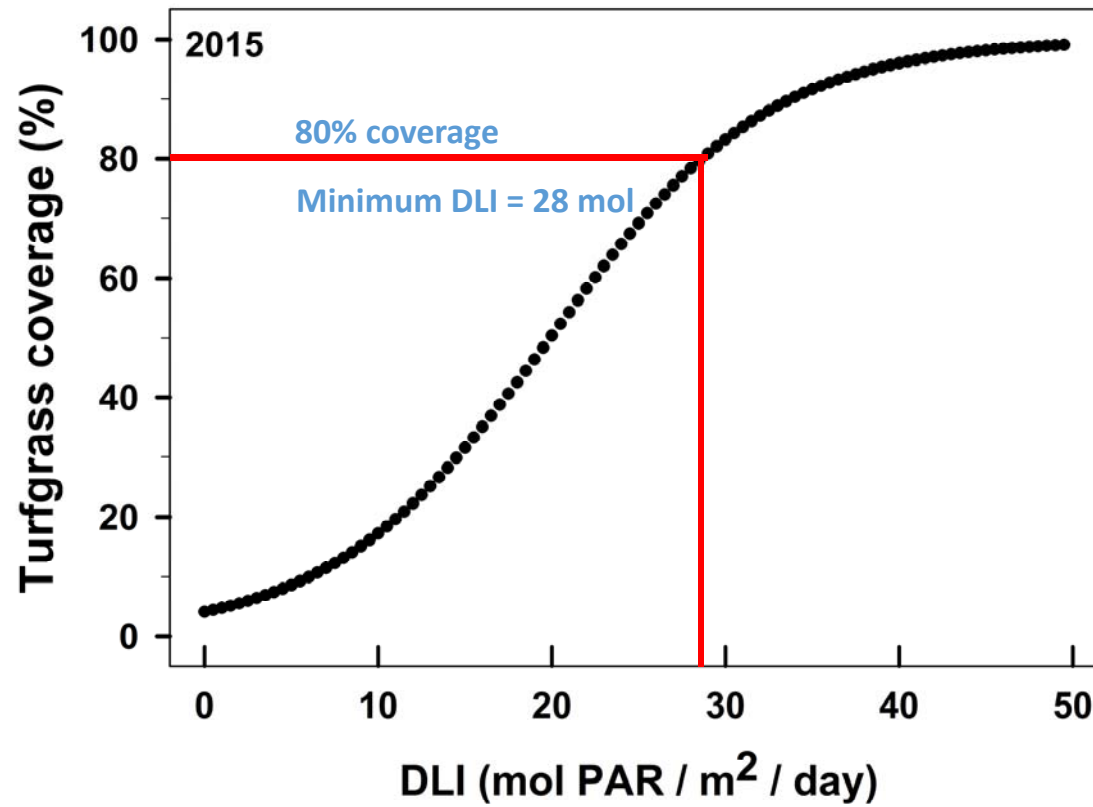
non-overseeded

overseeded

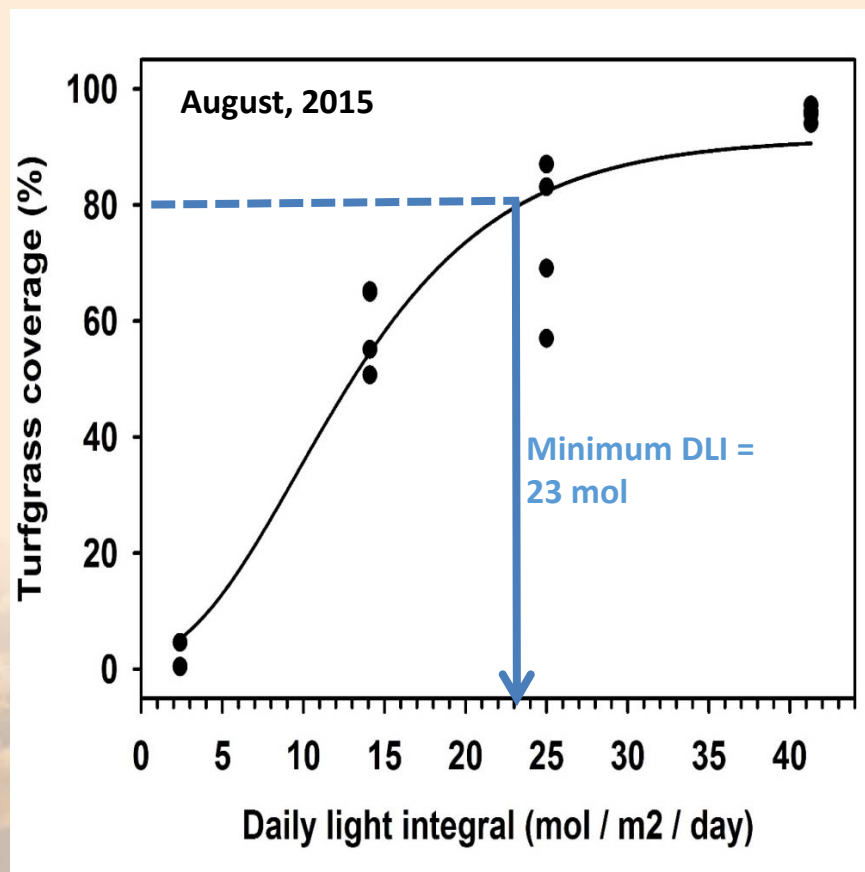
non-overseeded







## Overseeded bermudagrass (perennial ryegrass) coverage, as affected by DLI





# Creeping bentgrass at a mowing height of 0.125 inch (3 mm)

Full Sun  
DLI = 45.6 mol / m<sup>2</sup> / day

70% afternoon shade  
DLI = 28.4 mol / m<sup>2</sup> / day



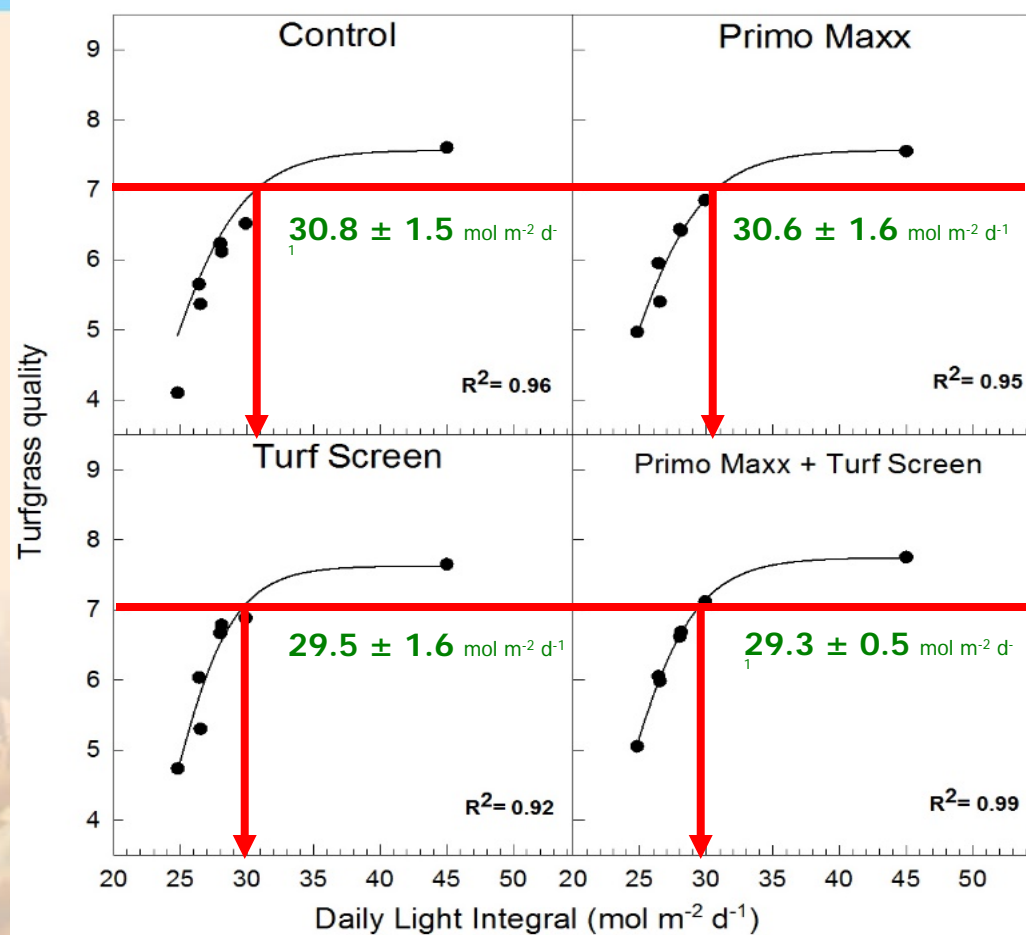
80% afternoon shade  
DLI = 26.5 mol / m<sup>2</sup> / day



90% afternoon shade  
DLI = 24.9 mol / m<sup>2</sup> / day



## Minimum DLI – Creeping bentgrass





- Tools are available to quantify light on your golf course
- We are beginning to have a better understanding of minimal light requirements of different grasses
- Data gives you a better chance to **make an agronomic argument**

**Minimum DLI  
requirements of  
various grasses and  
mowing heights**

Species	Rough	Fairway	Greens
	----- minimum DLI -----		
	<i>(mol / m<sup>2</sup> / day)</i>		
Bermudagrass	18-23	28	32+
Perennial ryegrass	10	14	
Creeping bentgrass			30
Zoysiagrass	11		