DLI (Daily Light Integral)

How much light do my plants need?

LED Smart Inc., December 2022

DLI stands for Daily Light Integral, is the total amount of photosynthetic light (PAR) delivered to a plant over a 24-hour period.

The amount of light a plant receives during the measured time period is important for proper growth and optimal photosynthesis.

How much light depends on each plant type and the growth stage. DLI and quality of light can factor into all aspects of a plant's physical characteristics, including rooting, branch length, budding, flowering, etc.

DLI is calculated using the formula of the accumulated PAR over one square meter in a 24-hour period, expressed as mol m^{-2} d^{-1}.

The total amount of light needed by any plant depends on several factors: growth stage,

$$DLI = \frac{PPFD \times (3600 \times Hours)}{1{,}000{,}000}$$

PPFD

HOURS	1	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
1	0.0036	0.36	0.54	0.72	0.9	1.08	1.26	1.44	1.62	1.8	1.98	2.16	2.34	2.52	2.7	2.88	3.06	3.24	3.42	3.6
2	0.0072	0.72	1.08	1.44	1.8	2.16	2.52	2.88	3.24	3.6	3.96	4.32	4.68	5.04	5.4	5.76	6.12	6.48	6.84	7.2
3	0.0108	1.08	1.62	2.16	2.7	3.24	3.78	4.32	4.86	5.4	5.94	6.48	7.02	7.56	8.1	8.64	9.18	9.72	10.26	10.8
4	0.0144	1.44	2.16	2.88	3.6	4.32	5.04	5.76	6.48	7.2	7.92	8.64	9.36	10.08	10.8	11.52	12.24	12.96	13.68	14.4
5	0.018	1.8	2.7	3.6	4.5	5.4	6.3	7.2	8.1	9	9.9	10.8	11.7	12.6	13.5	14.4	15.3	16.2	17.1	18
6	0.0216	2.16	3.24	4.32	5.4	6.48	7.56	8.64	9.72	10.8	11.88	12.96	14.04	15.12	16.2	17.28	18.36	19.44	20.52	21.6
7	0.0252	2.52	3.78	5.04	6.3	7.56	8.82	10.08	11.34	12.6	13.86	15.12	16.38	17.64	18.9	20.16	21.42	22.68	23.94	25.2
8	0.0288	2.88	4.32	5.76	7.2	8.64	10.08	11.52	12.96	14.4	15.84	17.28	18.72	20.16	21.6	23.04	24.48	25.92	27.36	28.8
9	0.0324	3.24	4.86	6.48	8.1	9.72	11.34	12.96	14.58	16.2	17.82	19.44	21.06	22.68	24.3	25.92	27.54	29.16	30.78	32.4
10	0.036	3.6	5.4	7.2	9	10.8	12.6	14.4	16.2	18	19.8	21.6	23.4	25.2	27	28.8	30.6	32.4	34.2	36
11	0.0396	3.96	5.94	7.92	9.9	11.88	13.86	15.84	17.82	19.8	21.78	23.76	25.74	27.72	29.7	31.68	33.66	35.64	37.62	39.6
12	0.0432	4.32	6.48	8.64	10.8	12.96	15.12	17.28	19.44	21.6	23.76	25.92	28.08	30.24	32.4	34.56	36.72	38.88	41.04	43.2
13	0.0468	4.68	7.02	9.36	11.7	14.04	16.38	18.72	21.06	23.4	25.74	28.08	30.42	32.76	35.1	37.44	39.78	42.12	44.46	46.8
14	0.0504	5.04	7.56	10.08	12.6	15.12	17.64	20.16	22.68	25.2	27.72	30.24	32.76	35.28	37.8	40.32	42.84	45.36	47.88	50.4
15	0.054	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	27	29.7	32.4	35.1	37.8	40.5	43.2	45.9	48.6	51.3	54
16	0.0576	5.76	8.64	11.52	14.4	17.28	20.16	23.04	25.92	28.8	31.68	34.56	37.44	40.32	43.2	46.08	48.96	51.84	54.72	57.6
17	0.0612	6.12	9.18	12.24	15.3	18.36	21.42	24.48	27.54	30.6	33.66	36.72	39.78	42.84	45.9	48.96	52.02	55.08	58.14	61.2
18	0.0648	6.48	9.72	12.96	16.2	19.44	22.68	25.92	29.16	32.4	35.64	38.88	42.12	45.36	48.6	51.84	55.08	58.32	61.56	64.8
19	0.0684	6.84	10.26	13.68	17.1	20.52	23.94	27.36	30.78	34.2	37.62	41.04	44.46	47.88	51.3	54.72	58.14	61.56	64.98	68.4
20	0.072	7.2	10.8	14.4	18	21.6	25.2	28.8	32.4	36	39.6	43.2	46.8	50.4	54	57.6	61.2	64.8	68.4	72
21	0.0756	7.56	11.34	15.12	18.9	22.68	26.46	30.24	34.02	37.8	41.58	45.36	49.14	52.92	56.7	60.48	64.26	68.04	71.82	75.6
22	0.0792	7.92	11.88	15.84	19.8	23.76	27.72	31.68	35.64	39.6	43.56	47.52	51.48	55.44	59.4	63.36	67.32	71.28	75.24	79.2
23	0.0828	8.28	12.42	16.56	20.7	24.84	28.98	33.12	37.26	41.4	45.54	49.68	53.82	57.96	62.1	66.24	70.38	74.52	78.66	82.8
24	0.0864	8.64	12.96	17.28	21.6	25.92	30.24	34.56	38.88	43.2	47.52	51.84	56.16	60.48	64.8	69.12	73.44	77.76	82.08	86.4

0-5 | 5-10 | 10-15 | 15-20 | 20-25 | 25-30 | 30-35 | 35-40 | 40>

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temperature, water, humidity, and other factors. However, many researchers[1] have developed some ideal ranges that are applicable to most plant types.

The following is a compilation of data from various experts regarding the amount of DLI required by differing plant types at various stages of growth.

Growers should consider delivering this minimum DLI to their plants.

Understanding just how much light your crop requires at each growth stage could save you money. How? Using controlled LED lighting, within your operation, you can deliver the right amount of light at the opportune time.

Supplemental or primary lighting with LED technology allows the grower to control the timing and delivery of light to their crops. Additional light may increase yield and growth; thus the grower can determine their potential increased harvest with the cost of extra lighting. Growers should push their crops to their maximum yield potential.

With the development of dimmable and color ratio controlled lighting through the GROW3 system, the grower can consider scheduling and light levels adjustment to match the minimum required DLI levels for their plants. In addition, the GROW3 system allows the grower to adjust the levels and color of delivered light throughout each growth stage, saving energy. Want to know more? Ask us how.

CROP	DLI
Vegetative cuttings (Liners) - early	4-6
Violets, orchids, ferns	4-6
Seedlings/cuttings	6-8
Potted Bulbs	6-15
Vegetative cuttings (Liners) - late	6-10
Seedlings (Plugs) - early	6-10
Shade plants (Annuals and Perennials)	6-10
Foliage plants	6-10
Stock plants (for cuttings)	10-20
Cannabis (Cloning)	10-16
Seedlings (plugs) - late	10-15
Small herbs	10-12
Annual bedding plants	10+
Leafy greens and herbs	12+
Potted Flowering Plants	12+
Shrubs	12+
Lettuce (Head)	14-16
Cut flowers	15+
Fruiting vegetables	15+
Cucumber	20-30
Capsicum (Peppers)	20-30
Eggplant	20-30
Tomatoes	22-30
Cannabis (Acclimation to Flowering)	25-38
Cannabis (Vegetative/Bulking)	25-46
Cannabis (Full Bloom)	41-51

This data also only refers to all light within the 400-700nm range. While DLI (mol m^{-2} d^{-1}) is the total amount of light delivered, the correct color of light is still needed by each plant, at each growth stage. See article regarding "Defining the Color of Light" and "What is light?" in this series.

[1] *Erik Runkle, DLI 'Requirements', GPN, May 2019 (https://gpnmag.com/article/dli-requirements/) and Dr. Lynnette Morgan, Massey University, NZ*

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