LED Grow Light Spectrum Selection Guide

1. Core Spectrum Band Definitions

Band Name	Wavelength Peak	Primary Function
UV	315–400 nm	Anthocyanin/polyphenol synthesis; stress resistance
Blue	440–470 nm	Chlorophyll synthesis; stomatal regulation; morphogenesis
Green	500–560 nm	Deep-layer photosynthesis; canopy penetration; visual comfort
Red	630–670 nm	Peak photosynthetic efficiency; drives carbon assimilation
Far-Red	700–760 nm	Elongation effect; flowering regulation; shade avoidance

2. Spectrum Ratio Selection Table

Category	Crop Name	Blue 450nm	Green 530nm	Red 660nm	Far-Red 730nm	UV 380nm	Color Temp	PPFD μmol/m²/s	Photoperiod h/day	Application Scenario
1 Leafy Vegetables										
Leafy Vegetables	Lettuce / Spinach / Celery / Pak Choi / Crown Daisy	15–20%	10–12%	60–70%	2–5%	0–2%	3500–4500 K	100–300	12–16	General leafy vegetable production
Leafy Vegetables	Chives / Coriander / Shepherd's Purse / Amaranth / Perilla	15–20%	10–12%	60–70%	2–5%	0–2%	3500–4500 K	150–350	12–16	Aromatic leafy vegetables
2 Fruit Vegetables										
Fruit Vegetables	Tomato / Cucumber / Eggplant / Bell Pepper / Chili	15–20%	8–12%	55–60%	8–12%	2–4%	2700–3500 K	400–800	14–18	Year-round greenhouse fruit vegetables
Fruit Vegetables	Watermelon / Melon / Pumpkin / Bitter Gourd / Sponge Gourd	15–18%	8–10%	55–62%	8–12%	2–3%	2700–3500 K	450–800	12–16	Melons and gourds
Fruit Vegetables	Potato	15–20%	8–10%	58–65%	5–8%	0–2%	3000–4000 K	300–600	12–16	Tuber crops
3 Berries										
Berries	Strawberry / Blueberry / Raspberry / Blackberry	15–20%	8–12%	55–65%	5–10%	1–3%	3000–4000 K	350–600	12–18	Elevated strawberry / blueberry greenhouse
Berries	Grape / Kiwifruit / Goji Berry	12–18%	8–12%	55–65%	8–12%	1–3%	2700–3500 K	400–700	12–16	Climbing berry vines
4–5 Ornamental Flowers										
Ornamental	Rose / Mini Rose /	20–30%	10–15%	45–55%	5–10%	3–5%	4000–	200–500	12–16	Cut rose / greenhouse

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Flowers	Carnations / Lily / Tulip						5000 K			flowers
Ornamental Flowers	Chrysanthemum / Gerbera / Daisy / Eustoma / Gypsophila	20–30%	10–15%	45–55%	5–10%	3–5%	4000–5500 K	250–500	14–18	Short-day flowering plants
Ornamental Flowers	Phalaenopsis / Oncidium / Cymbidium / Dendrobium	25–35%	8–12%	40–50%	5–10%	2–4%	4500–6000 K	200–400	10–14	Orchids (low-light species)
6 Fruit Tree Seedlings										
Fruit Tree Seedlings	Citrus / Apple / Pear / Peach / Cherry	25–30%	8–12%	50–58%	3–5%	1–2%	4500–6000 K	200–400	12–16	Deciduous fruit tree nursery
Fruit Tree Seedlings	Mango / Lychee / Longan / Loquat / Persimmon	25–30%	8–12%	50–58%	3–5%	1–2%	4500–6000 K	250–450	12–16	Tropical / subtropical fruit seedlings
7 Succulents										
Succulents	Crassulaceae / Echeveria / Sempervivum / Crassula	20–30%	10–15%	40–50%	5–15%	2–5%	5000–7000 K	150–300	8–14	Crassulaceae (high light)
Succulents	Cactaceae / Hylocereus / Globe Cactus / Columnar Cactus	20–30%	8–12%	40–55%	5–15%	2–5%	5500–7500 K	200–400	8–16	Desert succulents
Succulents	Haworthia / Crystal Radish / Haworthiopsis / Window Plant	15–25%	10–15%	35–50%	5–15%	1–3%	5000–6500 K	100–250	8–12	Haworthia (low light)
8 Animal Husbandry										
Animal Husbandry	Broiler / Layer / Chick	5–10%	10–15%	5–10%	0–5%	0%	3000–4500 K	20–80	16–23	Poultry farming (low blue)
Animal Husbandry	Duck / Muscovy Duck / Goose / Quail	5–10%	10–15%	5–10%	0–5%	0%	3000–4500 K	20–80	16–22	Poultry
Animal Husbandry	Piglet / Fattening Pig	3–8%	5–10%	3–8%	0–5%	0%	3500–5000 K	30–100	16–20	Livestock (minimize blue)
9 Aquaculture										
Aquaculture	Freshwater Fish / Bass / Tilapia / Mandarin Fish / Eel	10–20%	10–15%	8–15%	5–10%	0%	4000–6000 K	50–150	12–18	Freshwater fish farming
Aquaculture	Marine Fish / Grouper / Yellow Croaker / Snapper	10–20%	10–15%	8–15%	5–10%	0%	4000–6000 K	60–200	12–18	Marine fish farming

Category	Crop Name	Blue 450nm	Green 530nm	Red 660nm	Far-Red 730nm	UV 380nm	Color Temp	PPFD μmol/m²/s	Photoperiod h/day	Application Scenario
Aquaculture	Microalgae / Spirulina / Chlorella / Haematococcus	25–35%	15–20%	30–40%	2–5%	0–2%	5000–6500 K	200–500	12–20	Algae culture (blue-dominant)
10–15 Legumes & Cash Crops										
Legumes & Cash Crops	Cowpea / Green Bean / Edamame / Kidney Bean / Lima Bean	15–22%	10–14%	52–60%	5–10%	1–3%	3500–4500 K	250–500	12–16	Vegetable legumes
Legumes & Cash Crops	Soybean	15–20%	10–14%	55–62%	5–10%	1–3%	3500–4500 K	300–600	12–16	Soybean field / greenhouse
Legumes & Cash Crops	Maize / Sweet Corn / Waxy Corn	12–18%	10–14%	55–65%	5–10%	1–3%	3000–4500 K	400–800	12–16	Maize seedling / growth
Legumes & Cash Crops	Cotton (Gossypium spp.)	12–18%	10–14%	55–65%	5–10%	1–3%	3000–4500 K	400–800	12–16	Cotton field supplemental lighting
Legumes & Cash Crops	Tobacco (Nicotiana tabacum)	15–22%	10–14%	52–62%	5–8%	2–4%	3500–4500 K	300–600	12–18	Tobacco seedling / field
11 Seed Germination										
Seed Treatment	Vegetable Seeds (General)	20–30%	10–15%	45–55%	3–8%	1–2%	5000–6500 K	100–200	0–48h	Germination chamber (sprouting)
Seed Treatment	Legume Seeds	15–25%	10–15%	50–60%	3–8%	1–2%	4500–6000 K	150–300	0–72h	Legume seed germination
Seed Treatment	Flower Seeds	20–35%	8–12%	40–55%	3–8%	2–4%	5500–7000 K	100–250	0–96h	Flower seed germination
12 Commercial Forestry										
Commercial Forestry	Tea (Camellia sinensis)	20–28%	10–15%	45–55%	3–8%	2–5%	4000–5500 K	200–500	12–16	Tea garden (enhances catechins)
Commercial Forestry	Mulberry	18–25%	10–14%	50–58%	3–8%	1–3%	4000–5500 K	200–450	12–16	Sericulture
Commercial Forestry	Rubber Tree Seedlings	20–28%	10–14%	48–58%	3–5%	1–2%	4500–6000 K	250–500	12–16	Commercial tree nursery
16–17 Cereal Crops										
Cereal Crops	Wheat (Triticum spp.)	12–18%	10–14%	58–68%	5–10%	1–2%	3000–4500 K	400–800	12–18	Wheat greenhouse / field supplemental
Cereal Crops	Rice (Oryza sativa)	12–18%	10–14%	58–68%	5–10%	1–2%	3000–4500 K	400–900	12–18	Rice seedling / field
Cereal Crops	Barley / Oats / Buckwheat / Job's Tears	12–18%	10–14%	58–68%	5–10%	1–2%	3000–4500 K	400–800	12–16	Other cereals
Ext. Hydroponics										

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Hydroponics	Hydroponic Lettuce / Hydroponic Basil / Hydroponic Spinach / Arugula	18–25%	10–14%	55–62%	3–8%	1–3%	4000–5500 K	200–400	14–18	Hydroponic leafy greens
Hydroponics	Hydroponic Tomato / Hydroponic Strawberry / Hydroponic Cucumber	15–22%	8–12%	55–62%	5–10%	1–3%	3500–5000 K	400–700	14–18	Hydroponic fruit vegetables
Ext. Medicinal Plants										
Medicinal Plants	Ginseng / American Ginseng	15–25%	10–14%	50–60%	3–8%	2–5%	4000–5500 K	200–450	12–16	Ginseng (shaded forest light)
Medicinal Plants	Dendrobium officinale / Dendrobium / Noble Dendrobium	18–28%	10–15%	45–58%	5–10%	2–5%	4000–6000 K	150–400	10–14	Dendrobium orchids (epiphytic)
Medicinal Plants	Honeysuckle / Isatis / Mugwort / Astragalus	15–22%	10–14%	52–62%	3–8%	2–4%	4000–5500 K	250–500	12–16	Traditional Chinese medicinal herbs
Ext. Industrial Hemp										
Industrial Hemp	Industrial Hemp / CBD Hemp	10–15%	8–12%	60–70%	8–15%	1–3%	2700–3500 K	400–1000	12–18	Industrial hemp (red-far-red preference)
Ext. Forage & Turf										
Forage & Turf	Alfalfa / Ryegrass / Timothy Grass	15–22%	10–14%	52–62%	3–8%	1–2%	3500–5000 K	300–600	12–18	Forage crop production
Forage & Turf	Turfgrass / Tall Fescue / Bluegrass / Bermudagrass / Zoysia	15–22%	10–14%	52–62%	3–8%	1–2%	3500–5000 K	200–500	8–14	Golf course / turf
Ext. Sugarcane & Sugar Crops										
Sugarcane	Sugarcane / Sugar Beet	10–15%	8–12%	62–72%	5–12%	1–2%	2700–3500 K	500–1000	12–16	High-light, red-far-red preference
Ext. Climbing & Vine Fruits										
Climbing Fruits	Hami Melon / Cantaloupe / Dragon Fruit / Passion Fruit / Kiwifruit	12–18%	8–12%	58–68%	8–12%	1–3%	2700–3500 K	450–800	12–16	Climbing vine fruits

3. Full Spectrum Color Temperature Reference

Color Temp Range	Light Appearance	Recommended Application
2700–3000 K	Warm Yellow-White	Fruit/veg maturation, sugarcane, cotton, hemp
3000–3500 K	Warm White	Veg growth stage, cereals, cash crops
3500–4500 K	Neutral White	Leafy greens, legumes, tea, forage
4500–5000 K	Cool White	Flowers, fruit seedlings, medicinal plants
5000–6500 K	Cool White-Blue	Seedlings, seed germination, succulents, algae
6500–7500 K	Daylight Blue-White	Cacti, mushroom primodia induction

4. Selection Guidelines & Notes

• Prioritize tri-channel (red/blue/white) adjustable or full-spectrum + far-red quad-channel fixtures for dynamic adjustment by growth stage

• Spectrum ratios are reference ranges; adjust per fixture brand, mounting height, and planting density

• PPFD values are target top-canopy references, affected by fixture wattage and mounting density

• For animal husbandry, keep blue light minimal (≤10%); excess blue may cause stress reactions

• For aquaculture, moderate blue; excessive blue can suppress fish melatonin and impair growth

• For major cereals (wheat/rice), rely primarily on natural field light; this table applies to greenhouse / seedling stages

• For new or non-standard crops, conduct small-scale tests for 2–4 weeks before full-scale deployment