

Light Interception and Canopy Coverage of Lettuce and Radish Grown under Different Wavelengths of Red Light-Emitting Diodes (LEDs)

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Salad-Type Crop Production During Space Missions

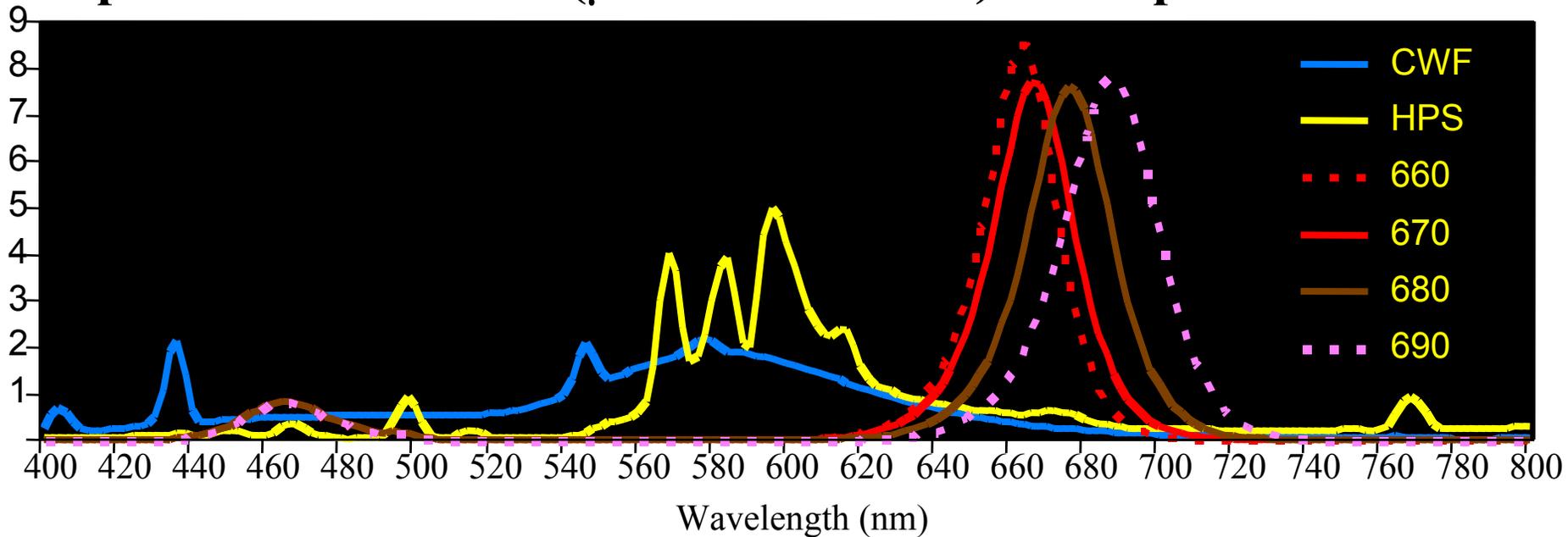
- **Low growth habit with defined shape**
- **Adaptable to confined controlled environment cultivation**
- **Short life cycle allows multiple harvests in defined time periods**
- **Simple post-harvest processing**
- **Fresh vegetable source with supplemental minerals, vitamins, and fiber**
- **Psychological well-being for crew**

Light-Emitting Diodes (LEDs)

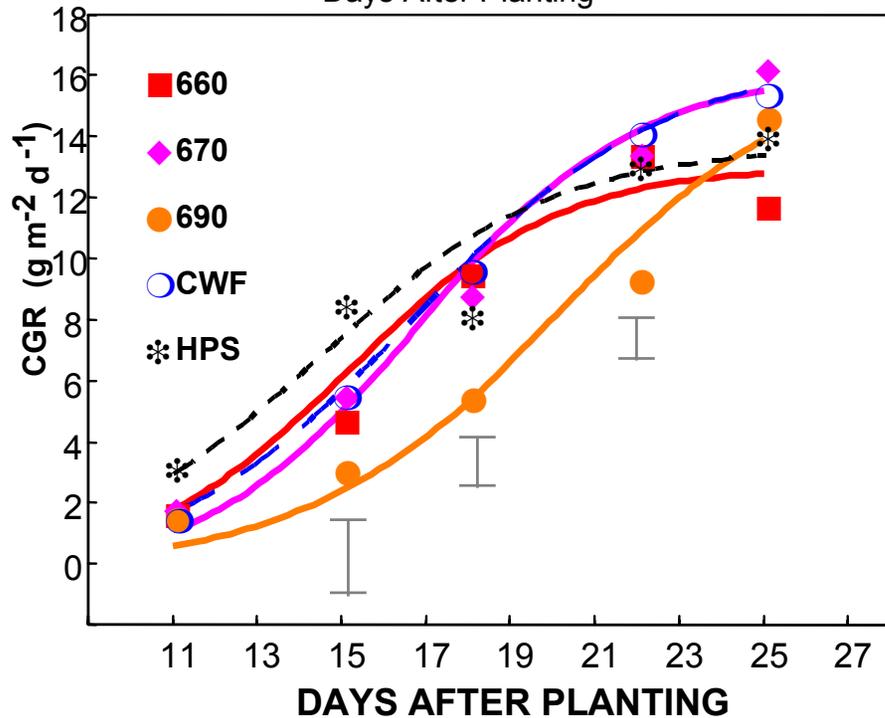
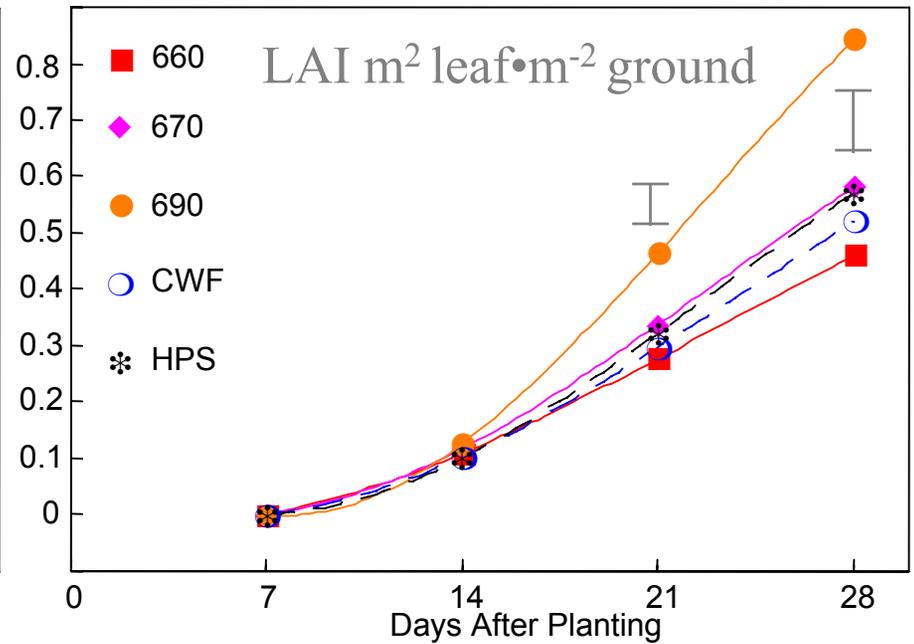
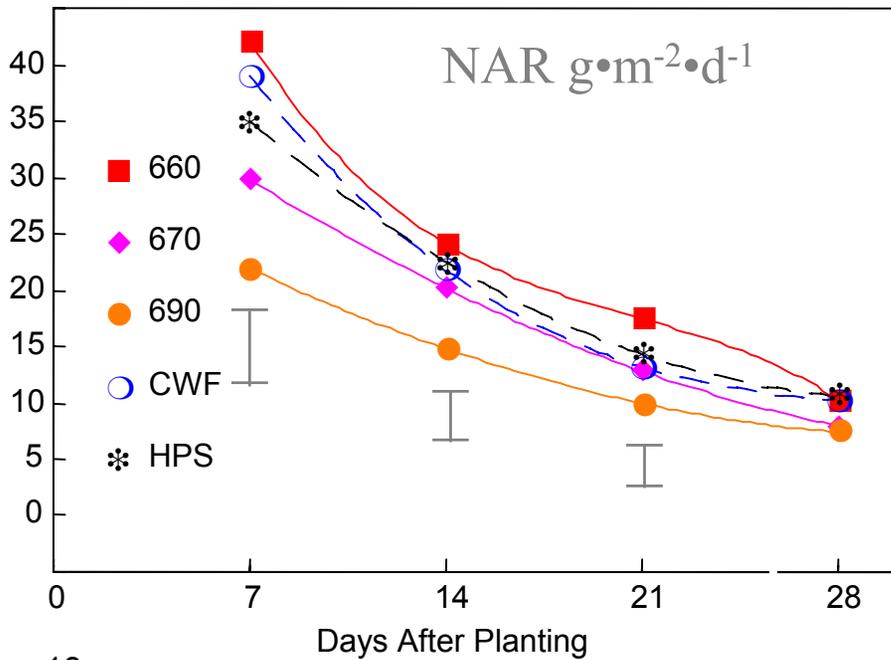
- **Small mass and volume**
- **Limited thermal radiation projection to plant canopy**
- **Plants safely grown in close proximity to arrays**
- **Particularly suited for space transit vehicles**



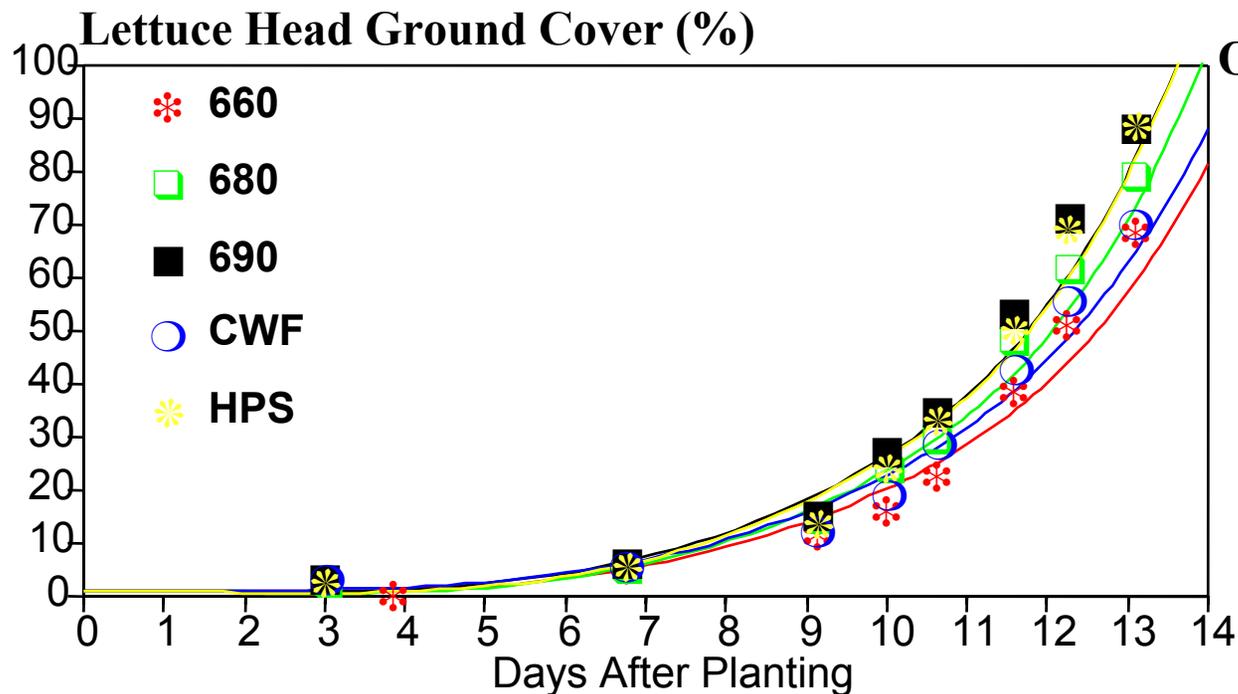
Spectral Photon Flux ($\mu\text{mol m}^{-2} \text{s}^{-1} \text{nm}^{-1}$) of lamps tested



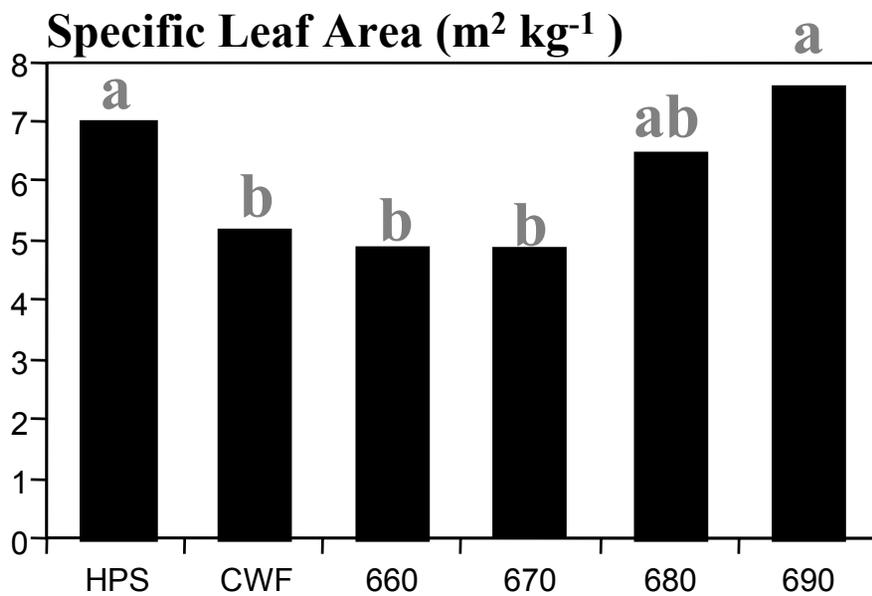
CHARACTERISTIC	Broad-Spectrum		Light-emitting diodes (nm)			
	CWF	HPS	660	670	680	690
Photon Flux(300-1100nm)	272	401	251	253	264	296
PPF (400-700 nm)	250	250	250	250	253	249
YPF	218	229	225	221	212	196
Blue	54	16	22	22	22	21
Red	66	106	227	227	230	228
Far-Red	4	15	1	2	7	30
PSS	0.84	0.85	0.88	0.87	0.84	0.76



Leaf area index (LAI), net assimilation rates (NAR), and crop growth rates (CGR) of “Cherry Belle” radish plants over 28 day crop cycles in the presence of LED, CWF, or HPS lighting. Bars indicate least significant difference at $\alpha=0.05$.



Overhead Digital Photography



Different letters above bars indicate significant difference based on ANOVA and Tukey's HSD mean procedure test ($P < 0.05$)

CONCLUSIONS

- **Tests to date confirm that LED lighting technology is a plausible alternative to conventional (HPS, CWF) plant lighting sources**
- **Far-red radiation was observed to promote a higher LAI**
- **In certain cases, yield promotion in salad crops was a function of more efficient light interception**