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Four weeks of 36 h/12 h Photoperiod Can Promote Increases in *Cannabis Sativa* Floral Biomass and Yield Efficiency

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Photoperiodic plants utilize seasonal changes in their 24-h circadian rhythm to regulate flowering. Most indoor grown *Cannabis sativa* cultivars are 'short day' plants that require regular intervals of uninterrupted darkness to promote robust flowering responses. In commercial indoor *Cannabis sativa* cultivation, flowering is typically promoted by transitioning from short to long nights (from $\leq$8 h nights to a 12 h day /12 h night photoperiod). (12H). Under regular, sufficiently long uninterrupted periods of darkness, cannabis rapidly develops visible flowers in meristematic regions; normally within two weeks. While this photoperiod protocol is highly efficacious in most indoor grown cannabis cultivars, recent research has shown that shorter nights (e.g., 13/11 h) still promotes robust flowering responses in some cultivars while increasing both vegetative and floral biomass to levels much higher than simply the increases in daily light integral. Building on this, we hypothesized that a 36/12 h (36H) photoperiod – essentially a 48-h cycle but still including a 12-h dark period with no implications for daily cultivator activities – could promote flowering and increase yield through increased light exposure. Two photoperiodic cultivars, 'Bubba' (BU) and 'Planet of the Grapes' (PG), were grown in an indoor environment under 12H and 36H photoperiod treatments. There was no photoperiod treatment effects on circadian measurements of photosynthetic rate and stomatal conductance in weeks 1 and 3. Under 12H, both cultivars initiated flowering after $\approx$10 days. Under 36H, flowering in BU was delayed by $\approx$6 days whereas PG did not initiate flowering during the first 27 days, despite experiencing more uninterrupted dark periods than the 12H plants had when meristematic flowering was first observed. At this time, while all remaining plants were exposed to 12H until they reached commercial floral maturity both cultivars in 36H had approximately double the aerial biomass of 12H treatment, despite a total light integral (TLI) that was only 1.5 times that of 12H. Only five days after switching to 12H, PG plants from 36H treatment had visible meristematic flowers, indicating that the weaker flowering signal in the 36H treatment was still perceived by BU, priming it for rapid flowering after switching to 12H. While the time to commercial maturity was longer in 36H plants, they produced substantially greater vegetative and inflorescence biomass in both cultivars compared with 12H, resulting in 1.2 times (BU) and 1.7 times (PG) higher floral yield efficiency when normalized to TLI. These findings highlight the potential of non-24-h photoperiodic cycles as viable cultivation strategies for maximizing yield in photoperiodic cannabis, thereby enhancing overall light use efficiency.

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