Soybean fruit development and set at the node level under combined photoperiod and radiation environments

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Introduction

Long days during soybean post-flowering increase seed number. Yield formation processes are generally described in terms of resource availability. Thus, the photoperiodic effect on seed number has been previously associated to a prolonged radiation offer because long days prolong the crop's cycle. However, evidences of important intra-nodal processes independent of resource availability suggest that photoperiodic effects at the node level might also contribute to yield formation. This work aims to describe photoperiodic effects on pod development and set at the node level, different from radiation effects.

Materials and Methods

Two field experiments were conducted in Buenos Aires, Argentina, with an indeterminate soybean cultivar of maturity group V under a factorial combination of radiation levels (full or shaded 35%) and photoperiod extension regimes (natural, artificially extended +1.5 or +3 h) imposed from flowering to maturity.

Flowering, pod elongation and establishment were registered, 3 times per week, at nodes located on a basal, central or apical position of the main stems, on three plants per plot. Transverse sections of pods and seeds were observed with an optical microscope. The pod *lag* phase was determined as the phase between opened flower and pod 2 cm long. Pod fill initiation was determined when seeds reached 3 mm (~R5[†]). All phase durations were corrected by temperature and expressed in thermal days (td)[§].

Results

Long days delayed the development of individual flowers into seed filling pods, delaying the initiation of pod elongation without changing pod elongation rate. The embryo development matched the external pod development, irrespective of the pod's chronological age. Flowering was prolonged under long days because active seed filling was delayed on primary racemes (dominant positions). More flowers opened on lateral racemes because the flowering period was extended. Long days increased pods per node on the main stems, by increasing pods on lateral racemes (usually dominated positions) at some main stem nodes.

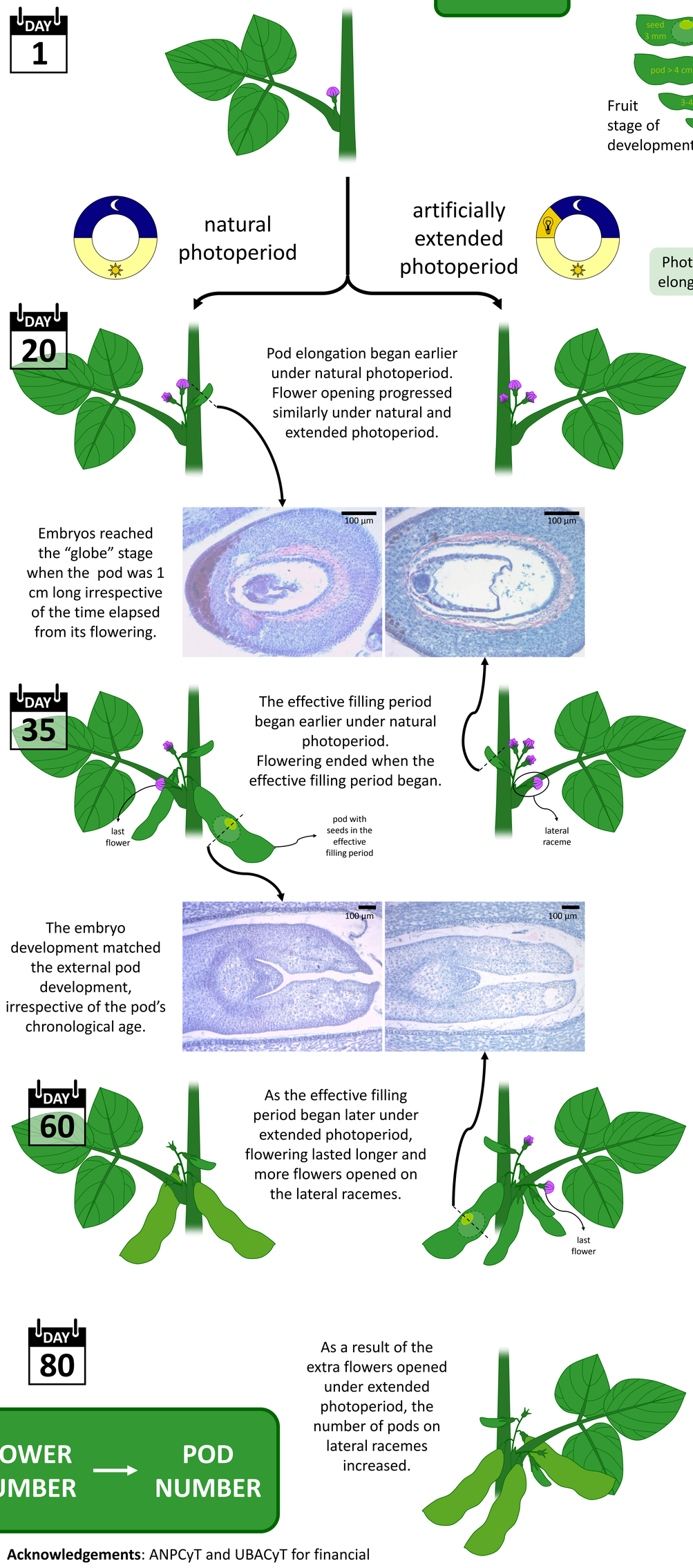
Conclusion

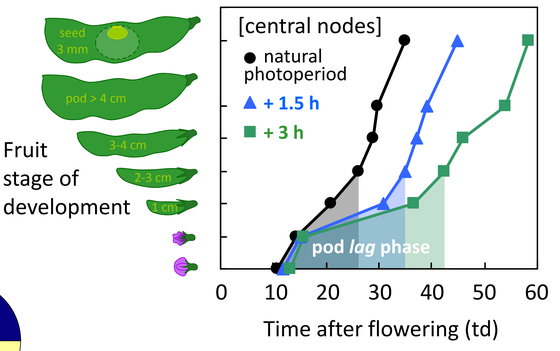
Our results suggest that long days during post-flowering enhance pods per node relieving the competition between pods of different hierarchy. As long days postpone the elongation and active growth of the dominant pods, flowering extends and more pods establish at usually dominated positions. This proposed physiological mechanism is also present under reduced radiation conditions and could be introduced as a favorable trait in breeding programs.

FLOWER OPENING → **POD *LAG* PHASE** → **POD FILL START** → **FLOWERING END** → **FLOWER NUMBER** → **POD NUMBER**

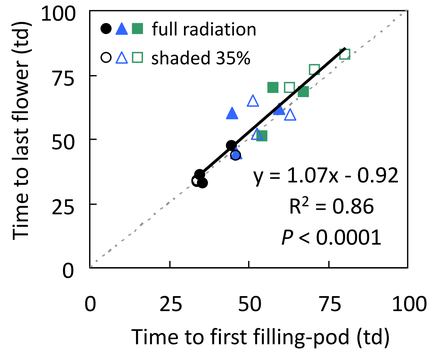
† Fehr WR, Caviness CE. 1977. Iowa State University Special Report 80: 1–12.
§ Piper EL, Boote KJ, Jones JW, Grimm SS. 1996. Crop Science 36: 1606–1614.

Results

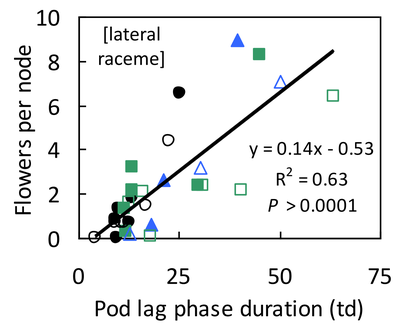




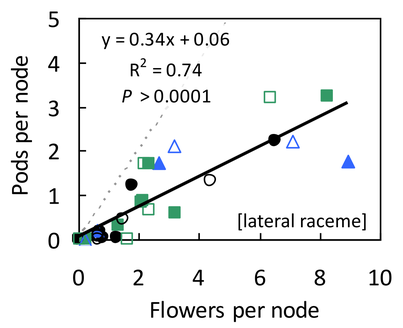
Photoperiod extension delayed the onset of pod elongation without changing pod elongation rate.



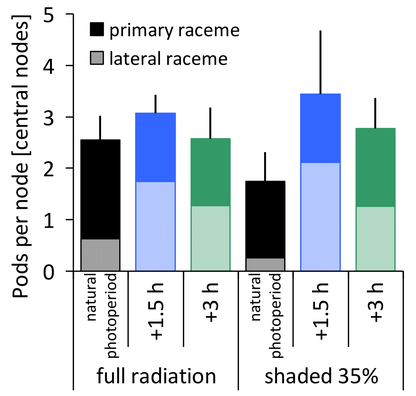
At the node level, flowering ended when the effective filling period began.



More flowers opened on lateral racemes when the *lag* phase was prolonged.



Pod number on lateral racemes was related to the number of opened flowers.



Photoperiod extension increased the number of pods on lateral racemes.

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