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Some features of using photomorphogenesis for soybeans (*Glycine max* L. Merr.) under accelerated vegetation conditions (speed breeding)

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Motivation and aim: To identify lines that fully realize their biological potential under different lighting conditions, thereby selecting the optimal material for selection.

Materials and methods: When conducting research on the effect of different day lengths and spectral composition of light, two dozen soybean genotypes were selected, which, according to maturity groups, belonged to early, mid-early and mid-late, and according to the growth type – to determinate and indeterminate groups. Two options for the duration of daylight were studied – 8 hours and 22 hours, due to which it was possible to track the degree of sensitivity of each group of varieties to the length of daylight and its effect on the development of the studied plants. During the experiment, the optimal temperature (+25 °C) and air humidity (60%) were maintained in the climatic chambers, regular fertilizing of plants was carried out taking into account the needs for the growth stages.

Results: Photoperiodism is one of the main factors affecting the development of plants, including soybeans. Photosensitive soybean varieties respond to changes in daylight hours, which affects flowering time, plant height and, ultimately, yield. Non-photosensitive varieties, on the contrary, demonstrate resistance to photoperiod changes, which makes them promising for cultivation in regions with variable climatic conditions.

Observation revealed that most of the studied lines exhibit pronounced photoperiodism: under short daylight hours, the transition to the generative phase occurs 26 days after sowing, which is 20–22 days earlier than under long day conditions (47 days). Some varieties were insensitive to daylight hours, and their flowering occurred on the 28th day after sowing regardless of the photoperiod, which opens up opportunities for their use in regions with variable climatic conditions. Short daylight accelerated the onset of the main phenological phases: flowering, emergence of ovaries, filling of beans and seeds occurred earlier. The vegetation period for early-ripening varieties in the short-day group was 85 days, and for late-ripening ones – 94 days, due to the reduction of periods between phenophases. Under long-day conditions, an increase in plant height and an extended vegetation period of up to 110 days were observed. During the experiment, it was found that with a 22-hour photoperiod, the height of indeterminate varieties reached 170 cm, while for determinate varieties it was 70 cm. With an 8-hour daylight, the maximum height of indeterminate varieties did not exceed 130 cm, and for determinate varieties – 50 cm. Differences were found between plant height and internode length under different photoperiods, while the number of internodes was the same. The maximum number of beans formed under long day was 52 pcs., and under short day – 37 pcs. Using digital phenotyping to evaluate and differentiate soybean plants grown under different day lengths showed that under long photoperiod it is possible to obtain a broader differentiation of lines, both time series and at single time points, using clustering.

Conclusions: Varieties with different sensitivity to photoperiod were identified. The results of the study show that long days not only contribute to an increase in plant height, but also affect the duration of their vegetation. These patterns open up new opportunities for breeding and agronomic practice, allowing the selection of soybean varieties that are better adapted to the conditions of a particular region and are able to provide an optimal yield even under conditions of limited time for harvesting.

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