PHOTOPERIODIC REACTION AND RELATIONSHIP WITH ENVIRONMENTAL FACTORS OF BARLEY

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Abstract. *Photoperiodic reaction and relationship with environmental factors: such as relationship with soil, nutrients, water, heat of barley were described in this thesis.*
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Photoperiodic reaction. The duration of the cultivation of barley is led to the formation of different genotypes in relationship with environmental factors, including day and night length. There are various data on this indicator. The presence of genotypes that are not sensitive to the length of the day makes it possible to adapt to environmental conditions.

Knowledge of the reaction of varieties on the photoperiod allows you to choose the right time for planting and avoid adverse weather conditions. With a decrease in the length of the day, development is accelerated, the degree of tillering, the number of leaves, the area of leaves, and the graininess of the ear increases. These indicators depend on the mode of illumination, intensity, quality of light. Knowing these factors one can control the development of plants and increase productivity. Barley is a long day plant, but there are biotypes that are not sensitive to the length of the day, which will speed up the creation of early maturing varieties. Optimization of cultivation conditions requires the creation of varieties with a wide range of responses to the most important environmental factors. Varieties with a weak or neutral reaction to the photoperiod are more flexible and can be grown in any zone.

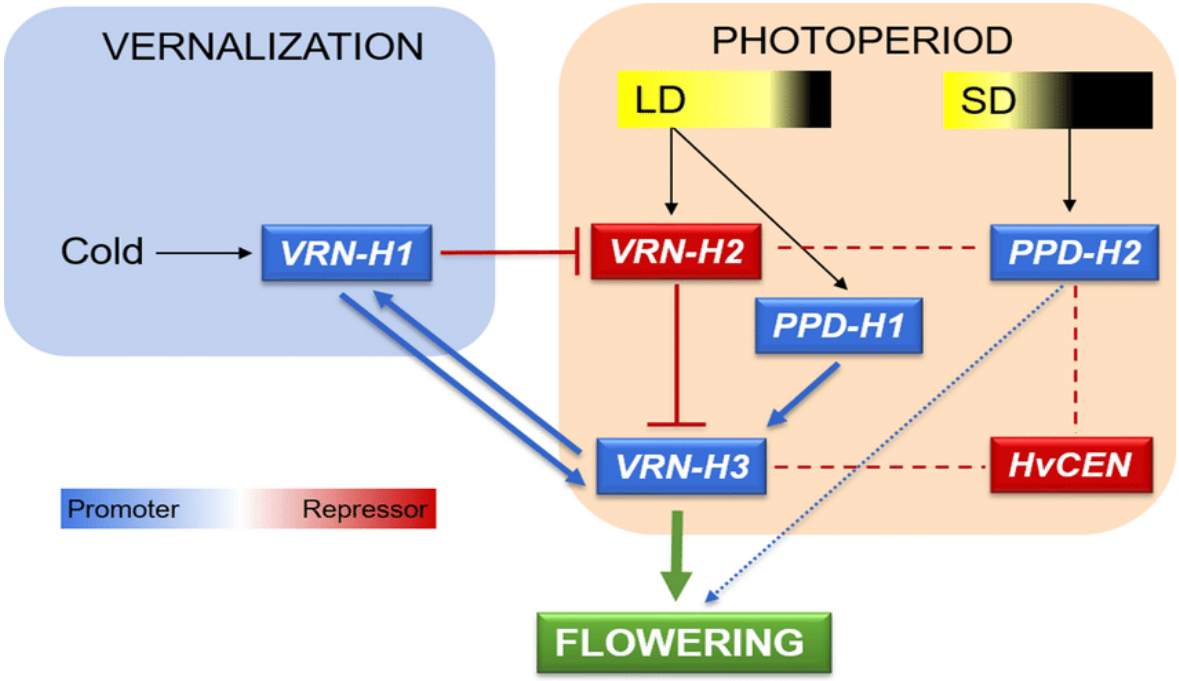
Winter and spring form. In historical terms, winter and spring forms were established under the influence of external conditions, and natural and artificial selection. Wild species of barley had winter and spring forms, therefore it is natural to enter into the crop of various forms of barley. Cultivated barley is divided into winter, facultative and spring ones. Winter crops and facultative forms are sown in autumn, and go into the tillering stage in winter. Spring forms are dominated in the world. They can be sown in autumn in areas with warm winters. Facultative forms are cultivated mainly in winter sowing and less in spring as in spring sowing provide low yields.

The genetic nature of winter and spring forms was studied by Japanese scientists, who identified three spring genes: one recessive (sh) and two dominant (Sh2 and Sh3).

Barley is not winter survival and is a low-resistant crop due to its biological characteristics, and therefore the distribution area of barley is less than wheat areas. Barley in the winter period dies from freezing, damping off of plants, soaking, plant bulging, and ice crust. In Central Asia, barley often dies from the drying of the soil and the lack of winter survival. In different zones, the causes of the death of a crop are different; they are caused by environmental factors and the characteristics of varieties. The most vulnerable organs are the tillering node. Damage to the tillering node is equal to the death of the plant.

In order to increase winter hardiness in autumn, barley is hardened, the concentration of cell sap increases, and the sugar content of cell sap increases. The varieties with high winter hardiness have high sugar content (more than 10%). Changing the temperature of the day and night contributes to good hardening. During the hardening period, plastic substances accumulate, plant growth decreases, and the dry matter content increases.

Winter hardiness is associated with the development of plants. If, before the transition to winter, the plants have passed the tillering phase, then they overwinter poorly, since the differentiation of the ear begins.



Flowering time control in barley: main genes, environmental cues and regulatory pathways. Reproductive transition in barley is regulated by genetic networks that respond to extended periods of low temperature (vernalization, blue frame) and day length (photoperiod, orange frame). Genes depicted in blue promote flowering, whereas genes depicted in red act as repressors. Blue and green arrows indicate induction. Red lines with blunt ends indicate repression. Antagonistic relationships between genes reported in the literature are represented as dashed red lines. PPD-H2 connection with flowering is represented as a dashed blue line because it induces spikelet initiation but not floral development (Mulki et al. 2018). LD long days, SD short days

Frost resistance. In the spring after the beginning of the growing season, there are often recurrent frosts, which cause great harm if the plants are not resistant to frost. This is observed in spring barley. Depending on the phase of development, the resistance of plants to frost is different. The most vulnerable phase is when the first leaf has not left the vagina.

Resistance to drought. Usually, when cultivated in a rainfed cereals, barley crops dominated by 40% (4 times in Africa) before wheat. Under irrigated conditions, wheat crops are 3 times more than barley. Drought-resistant forms of barley are cultivated in Uzbekistan.

The nature of drought tolerance is not well understood. In the physiological aspect, drought resistance is a protective reaction of plants from dehydration. In biochemical terms, protein and

nucleic acid metabolism is disturbed in drought tolerance. In drought-resistant varieties, the protein content is reduced.

When assessing drought tolerance, the length of the growing season, the interphase periods matter. Earliness avoids periods of drought. Therefore, it is very important to create varieties of early maturing. Drought tolerance is often associated with heat resistance. The latter also depends on the phase of development. Critical period in relationship with drought is going to the tube – earing, and to heat – from earing to milky maturity.

Pollen is very sensitive to drought and heat, which, under these conditions, loses the ability to normally pollinate, and the ear is sterile, reaching 15 - 35%.

To create drought-resistant varieties during hybridization, drought-resistant forms with valuable breeding traits are attracted.

Responsiveness to irrigation. Barley is drought-resistant crop, and it is used mainly on rainfed and a little on watering.

In Uzbekistan, it is sown mainly on rainfed conditions. On irrigated lands, it is used as a second, intermediate and cover crop for alfalfa. Bare barley is grown everywhere only in irrigation. Irrigation of barley when combined with a high background gives large increases in yield. Watering contributes to good plant growth, increases the number of leaves, leaf surface, tillering, the number of grains per spike, but longevity increases as well. On irrigated conditions, there is a direct correlation between productive tillers and yield, which is not case for rainfed conditions.

Studying various ecotypes of barley, scientists identified 3 groups of varieties in relationship with drought:

1. The group with high biological flexibility – resistant to drought and responsive to irrigation.

2. The group of irrigated agriculture, which gives high yields in irrigation and is not resistant to drought.

3. The group of rainfed agriculture, which is resistant to drought and weak response to irrigation.

Irrigation has a positive effect on the technological properties of the grain, slightly reduces the protein content, which improves the brewing properties. On irrigation in Uzbekistan, grain yields can reach 9-10 t / ha. However, the focus of attention in these conditions should be the danger of disease and reproducibility, which is necessary when selecting intensive plastic varieties.

Salt tolerance. Barley is highly resistant to soil salinity. Increased salinity leads to an overload of plant organs with salts, changes the nutrition and water regime, and, in general, reduces the overall productivity of plants. On saline soils shoots appear later, the growing season is shortened due to the inhibition of all growth processes. In such conditions, it is important to study the response of varieties to salinization. The reaction of varieties to salinization is manifested in the early stages of development. To assess the salt tolerance of plants, you can use the salt tolerance index. The salt tolerance index is the ratio of the number of seedlings in salt solutions to the number of seedlings in distilled water. It uses sodium chloride. Lower salt tolerance during autumn sowing was noted. Scientists have identified a variety of forms of barley tolerant to salt, which opens up prospects for the creation of salt-resistant high-yielding varieties.

Relationship with environmental factors.

Relationship with soil. Barley is close to wheat soil related parameters, but it can be cultivated on various types of soil. However, acidic, dry, peaty and sandy soils are of little use.

Barley is very sensitive to the soil pH. The optimal pH is 6–7. At pH 3.5, barley does not sprout. Scientists are investigating the tolerance of the global gene pool to aluminum, as this is an indicator of the resistance of varieties to the acidic reaction of the soil. Barley tolerance to aluminum is a genetic trait.

Relationship with nutrients. Among grain crops, barley consumes nutrients very early, to the stem elongation phase, barley consumes 2/3 of potassium and almost 46% of phosphorus, in flowering phase it consumes 85% of nutrients.

In order to compile a fertilizer system, it is necessary to take into account the removal of nutrients by the crop, the availability of nutrients to the soil, and know the nutrient absorption coefficients of the soil and fertilizers by barley crop. On average, 1 c. grain and the corresponding associated products consumed nitrogen 1-1.5 kg, phosphorus – 0.6 -1 kg, potassium – 0.4 kg. Nitrogen fertilizers in moderate doses increase the yield and the amount of protein slightly – 0.3 - 0.6%, which is very important for brewing barley. To improve the quality of malting barley, it is important to apply phosphate and potash fertilizers.

Relationship with water. Barley is drought-resistant crop, and the greatest amount of water is required in the phase of stem elongation and earing. The lack of water during this period dramatically reduces the yield, which is observed on the rainfed areas of Uzbekistan. The lack of water during maturity period leads to the grain weakness, as the outflow important substances into the grain stops.

Relationship with heat. Seeds begin to germinate at a temperature of 1–2°C, but the optimum is 15–20°C. The sum of effective temperatures for the germination phase is 100°C. Seedlings can withstand frosts of 3 - 4°C, while the leaves are damaged, but the tillering node is not damaged. The anthers die at -1°C, the embryo – at -1.5–4°C of frost. Grain at humidity of 16% withstands very low temperatures and maintains germination. Barley is demanding heat from the earing phase to maturity.

Diseases and pests. Diseases and pests affect barley. Barley diseases are as follows: smut (damages the ear), smut (damages the ear), black smut (damages the ear), dwarf rust (hurts the leaves) and stem rust (damages stems), helminthosporium (leaves are damaged), strip helminthosporium (damages leaves from the seedling stage to maturity), root rot, cercosporella (rotting stem base), powdery mildew, rhynchosporia, septoriosis; viral and bacterial diseases – streaky mosaic, yellow dwarfism, basal bacteriosis, striped bacteriosis, brown bacteriosis, patchy bacteriosis. Pests – Swedish fly (damages the generative and vegetative organs), nematode, pyavitsa, thrips, mining fly, Hessian fly, grass moth, bread sawfly, bird-cherry aphid, striped flea bread, green-eyed.

In variety improvement, it is necessary to pay attention to diseases and pests resistant varieties. It is advisable to take into account resource saving technologies including to produce environmentally friendly products at developing cultivation practices, in order to fight against diseases and pests.

Varieties. Winter barley varieties – Abu Gofur, Adir, Dobrynya, Ikhtiyor, Kondrat, Novosadski-525; Spring barley varieties – Vodka.

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