

## BARLEY DISEASES AND THE IMPORTANCE OF THEIR STUDY

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**Abstract.** *In our republic, barley is the main fodder crop grown on irrigated and dry lands, and barley is also widely used in the food industry. One of the important issues is to take full advantage of the biological capabilities of barley and do a lot of work to fight against early ripening, salt, drought, heat, cold, lying down, and diseases. However, in the following years, it was found that the yield of barley in irrigated lands does not exceed 25-30 s/ha per hectare, and in dry areas it does not exceed 12-15 s/ha. The main reason for this is the diseases caused by fungi found in barley. These diseases include: scald, leaf rust, stem rust, barley grass stripe rust, powdery mildew, common root rot, crown rot, speckled leaf blotch, net blotch, spot blotch, covered smut, crown rot. Developing a scientific basis for reducing the damage caused by these diseases by studying them is of great theoretical and practical importance in obtaining a high-quality and high yield from barley.*

**Keywords:** *barley, plant, productivity, disease, pathogen, fungi, dry land, irrigated land, scald, rust, blotch, rot, root, leaf, stem.*

Introduction. Barley is a valuable crop, it is a food – food, cereal and fodder – hay crop, and it is a good raw material for the beer industry due to its low protein content in its grain. Barley is an ancient crop, distributed in most parts of the world and cultivated from the 12th to the 10th millennium BC to the present day. Barley is widely cultivated in Central Asian countries, including Uzbekistan. Barley is the fastest growing grain crop. Barley is a heat-resistant plant that improves air dryness. The grain contains 13% water, 2% protein, 64.6% carbohydrates, 5.5% fiber, 2.1% fat, 2.8% ash. 1 kg of barley grain is equal to 1.2 nutritional units. In the dryland farming region, spring barley is grown, and in irrigated lands, high-yielding autumn barley, which can enjoy autumn-winter and green moisture well, is grown. It ripens very early before the onset of dry heat (late March - June). It yields up to 50 s per hectare in irrigated areas. Naturally, high productivity is achieved if high-quality seeds are used in strict compliance with the correct selection, placement and agrotechnics of grain crops. On the contrary, if poor-quality seeds are used for planting by improper selection of varieties, it is possible to lose 30-40% of the yield and even higher. Therefore, according to the decision of the Cabinet of Ministers of the Republic of Uzbekistan dated September 8, 2020 No. 546 on measures for the cultivation of grain in 2021, 185 thousand 795 hectares of dryland areas of the Republic are fertile for the harvest of 2021, high quality indicators are set for the forecast indicators of placement of high-quality autumn grain crops by varieties [1,2,6,8].

The conducted scientific research, experiments of advanced farms show that there are opportunities to increase productivity by 50-60 s/ha in irrigated areas, and productivity by 25-30 s/ha and even more in dry areas. However, in the following years, it was found that the yield of barley in irrigated lands does not exceed 25-30 s/ha per hectare, and in dry areas it does not exceed

12-15 s/ha. The fact that the quality of the cultivated grain is often suitable for fodder shows that beer and food products (barley groats, etc.) do not fully meet the requirements of the production industry [4,10].

To use all the opportunities available in grain production to increase grain productivity and quality, first of all, high-yielding varieties, to study their biological characteristics, to have a correct relationship with them, to achieve positive results creation of primary resources is one of the urgent issues [5].

But when any good variety is planted from high-yielding seeds with high planting quality and in the process of seed propagation, if all agrotechnical rules are followed correctly, free from diseases and insects, it will never lose its genetic characteristics, potential productivity opportunities [4,9].

Barley plant is mainly affected by scald, leaf rust, stem rust, barley grass stripe rust, powdery mildew, common root rot, crown rot, speckled leaf blotch, net blotch, spot blotch, covered smut, crown rot. Pathogens that cause these diseases seriously affect productivity and product quality. Developing a scientific basis for reducing the damage caused by these diseases by studying them is of great theoretical and practical importance in obtaining a high-quality and high yield from barley.

Research results. It is important to study every disease of barley. As a result of the research, the fungal diseases of barley, the causative agents of these diseases, the symptoms of the disease, the spread of the disease, the sources of infection and control measures were briefly studied (Table 1)[7].

*Table 1*

*General information about barley diseases*

№	Disease	Causative agent	Symptoms	Occurrence	Decrease in productivity in %	Control
1.	Scald	<i>Rhynchosporium secalis</i>	Large (1 cm), oval stems with light green water on the leaf plate. They turn pale brown and form a darker border. In severe attacks, the wounds accumulate and lose their distinctive shape and color.	The disease is spread by rain splash and dew, early sown crops	10-20 % to 45%	Stubble cleanliness and varietal resistance will aid control. Seed and foliar fungicides
2.	Powdery mildew	<i>Blumaria graminis f.sp.hordei</i>	White powdery spores on upper leaf surfaces, underside of	Favoured by high humidity and temperature of	10-15% to 40%	Resistant varieties, seed and foliar fungicides

			leaves turn yellow to brown	15–22°C. Worse in high-fertility paddocks and early sown crops		
3.	Leaf rust	<i>Puccinia hordei</i>	Small circular orange pustules on upper leaf surface	Moist conditions with temperatures in the range 15–22°C	20% to 50%	Resistant varieties and control volunteer barley and barley grass over summer-autumn
4.	Stem rust	<i>Puccinia graminis</i>	Large red-brown pustules. Rupture of leaf and stem surface	Infection requires temperatures in the 15–30°C range and moist conditions	15% to 40%	Resistant varieties and control volunteer wheat, triticale and barley over summer-autumn
5.	Barley grass stripe rust	<i>Puccinia striiformis</i>	Yellow powdery pustules in stripes on the leaves	Can develop throughout the growing season	25% to 30%	Avoid susceptible varieties
6.	Net blotch	<i>Pyrenophora teres f.teres</i>	Small brown spots that develop into dark brown streaks on leaf blades that have net like appearance	Spores can be produced for >2 years on stubble. Moist condition, temperatures in the 15–25°C range	5% to 20%	Resistant varieties, crop rotation and stubble management

7.	Spot blotch	<i>Pyrenophora teres f.masculata</i>	Dark brown spots to 10 mm, with yellow margins	Infection from stubble especially in wet autumn conditions.	5% to 20%	Manage barley stubble and control barley grass. Avoid very susceptible varieties. Foliar fungicides.
8.	Speckled leaf blotch	<i>Septoria passerinii</i>	Light brown elongated spots surrounded by yellow tissue with the margins of the leaf often dried. Eventually, lines of very small black structures called pycnidia form in the brown tissue of the lesion.	The pathogen overwinters in infected residue and is mainly dispersed over short distances by rain-splashed pycnidiospores	15% to 50%	Resistant varieties, apply fungicides, rotate with other crops, destroy infected barley residue.
9.	Covered smut	<i>Ustilago segetum var.hordei</i>	Dark, compacted heads, grain replaced by smut balls	Spores germinate in infected grain when temperatures are 14–25°C	5% to 25%	Resistant varieties, seed treatments
10.	Common root rot	<i>Cochliobolus sativus</i>	Brown discoloration of roots, subcrown internode and crown. Plant stunting, brown spots on leaves and reduced tillers	Scattered through crop	10% to 50%	Crop rotation

11.	Crown rot	<i>Fusarium pseudograminae</i>	‘Whiteheads’ or deadheads most obvious after flowering, pink discoloration under leaf sheaths	Most common on heavy or poorly drained soils. Favoured by moist, humid conditions with temperatures 15–30°C	15% to 40%	Crop rotation, stubble removal, cultivation
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One of the main diseases found in barley is scald. As can be seen from the data in the table, barley scald is caused by the fungus *Rhynchosporium secalis* and is common barley crops in most seasons. Its severity varies between crops and seasons, but in general, it is more prevalent in high-rainfall areas. Field experiments have estimated grain yield losses due to scald to be 10–20% in susceptible varieties, and individual losses as high as 45% have been recorded. The first symptoms are large (1sm), pale green watery oval lesions on the leaf blade. These turn pale brown and develop a darker margin. In severe attacks lesions become crowded and lose their characteristic shape and colour. Often the first lesions appear near the base of the leaf (water running down the leaf tends to deposit spores in this position). The lesions then develop and can lead to total loss of the leaf. The leaf sheaths and ear can also become infected (Picture 1).



**Picture 1. Symptoms of scald of barley.**

One of the most common diseases found in barley is rust. There are three different rusts that can infect barley. Each varies in importance depending on variety susceptibility, seasonal conditions and control strategies in place.

Leaf rust, caused by *Puccinia hordei*, is common in high rainfall areas and is present in other areas during wet seasons. Losses of up to 20% are possible during favourable seasons.

Stem rust, caused by *Puccinia graminis*, is uncommon but can cause severe crop losses of up to 40% during wet and warm seasons.

Barley stripe rust, caused by *Puccinia striiformis* sp. *hordei* is an exotic disease that can potentially cause severe infection and losses of up to 30% (Picture 2)[6].



**Picture 2. Symptoms of barley rust diseases. A) Leaf rust symptoms on barley leaf; B) Stem rust symptoms on barley; C) Barley grass stripe rust symptoms on barley.**

One of the most common diseases found in barley is powdery mildew. Powdery mildew can only grow on green plants. It survives the harvest period on late tillers, releasing spores that are spread by the wind to infect the new crop. Favourable factors for powdery mildew include warm (12° to 20°C) and humid (but not raining) weather, and wind aids its spread. Temperatures above 25°C will check disease spread. Rapidly growing, thick crops provided with high levels of nitrogen are most vulnerable, particularly in susceptible varieties. White fluffy pustules appear on the leaves, the stem and on the ear. The pustule can easily be rubbed off and the tissue is discoloured brown underneath. With time the pustule itself turns brown and black spore cases called picnidia can be seen embedded in the fungus (Picture 3).



**Picture 3. A barley plant infected with powdery mildew.**

Another common disease of barley is net blotch. There are two forms of net blotch present on Earth. The net form of net blotch, caused by the fungus *Pyrenophora teres* f. *teres*, is currently less common in southeastern regions because the majority of barley varieties are resistant, but it can be more damaging. The spot form of net blotch, caused by *Pyrenophora teres* f. *maculata*, is more common, due to the widespread cultivation of susceptible varieties, especially in Victoria, Australia where recent surveys have estimated it to be present in >95% of crops. However, losses to spot form of net blotch are minimal in most cases (Picture 4).



**Picture 4. A barley plant infected with net blotch.**

Another common disease of barley is crown rot. Crown rot is caused predominantly by the fungus *Fusarium pseudograminearum*. It survives from one season to the next in the stubble remains of infected plants and grassy hosts. The disease is more common on heavy clay soils. Infection is favoured by high soil moisture in the 2 months after planting. Drought stress during elongation and flowering will lead to the production of ‘deadheads’ or ‘whiteheads’ in the crop. These heads contain pinched seed or no seed at all. The disease may be managed through planting partially resistant varieties, inter-row sowing or crop rotation. If the disease is severe, rotation to a non-susceptible crop for at least 2 years, and preferably 3 years, is recommended (Picture 5).



**Picture 5. Symptoms of barley crown rot.**

Diseases develop mainly as a result of various factors. Such factors include: excessive moisture, dry and warm weather, insufficient or unstable soil moisture, excessive use of nitrogen fertilizers, crops with grain weeds blockage – infection reservoirs, late planting of crops. Measures to combat these diseases are also different, i.e. crop rotation, seed processing before planting, planting resistant varieties, weed control, and activities during the growing season and after harvesting. In the fight against the disease, at first, measures to reduce the main source of infection of the disease, to limit and slow down the development of the disease during the growing season of the plant, are of great importance. In the implementation of these measures, along with organizational economic and agrotechnical measures, the use of biological and chemical control measures is of high importance. In this regard, it is necessary to study the norms, methods and terms of use of drugs.

### **Conclusion**

In conclusion, barley is an important crop in agriculture, and improving effective control measures against pathogens that harm its productivity is one of the urgent issues. Barley plant is mainly affected by scald, leaf rust, stem rust, barley grass stripe rust, powdery mildew, common root rot, crown rot, speckled leaf blotch, net blotch, spot blotch, covered smut, crown rot.

Pathogens that cause these diseases seriously affect productivity and product quality. Developing a scientific basis for reducing the damage caused by these diseases by studying them is of great theoretical and practical importance in obtaining a high-quality and high yield from barley. To combat these diseases, crop rotation, seed processing before planting, planting resistant varieties, weed control and activity during the growing season and after harvesting are important.

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