

## USAGE, HISTORY, SYSTEMATICS AND COMMON MORPHOLOGY OF RICE

<sup>1</sup>Khudaykulov Jonibek Bozarovich, <sup>2</sup>Baxtiyorov Sherzod Farxod ugli

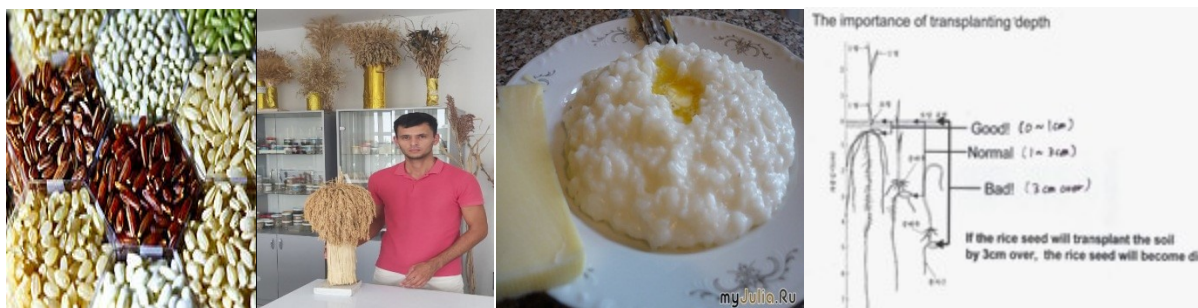
<sup>1</sup>Professor, Tashkent state agrarian university

<sup>2</sup>Master's student, Tashkent state agrarian university

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**Abstract.** Rice is the oldest cultivated plant. Its introduction into crop dates back to the Neolithic. According to scientists, rice crop could first have arisen in India, Indochina and China or, at the same time, in all parts of South and Southeast Asia. Rice starch is used in the textile, perfumery, and medical industry. Straw rice is used for feeding animals. The article discusses the usage, history and main features of rice.

**Keywords:** rice, crop, cereal, digestibility, high blood pressure.



**Usage.** This is a valuable cereal crop, which ranks second in the world after wheat in the area of sowing and gross grain production. Rice groats is distinguished by good digestibility and nutritional value, contains on average 7.18% protein, 0.26% fat and carbohydrates 79.36%, and many different vitamins. Rice decoction is widely used for therapeutic purposes. Rice diet is good for high blood pressure. Rice starch is used in the textile, perfumery, and medical industry. Straw rice is used for feeding animals, 1 kg of straw contains 22 g of raw protein and 0.24 f.u. In addition, rice straw is widely used as a roof for the production of clothing, rope, shoes, bags, paper and compost. In the straw of rice there is 1% protein, 0.55 fat, 30% carbohydrates. Rice straw is used as a fertilizer, since one ton of straw contains 8 kg of nitrogen, 1 kg of phosphorus and 12 kg of potassium.

Rice grain is widely consumed in Asia: 104 kg per capita in Japan, 120 kg – in China, 98 kg – in Pakistan, 66 kg – in India, – 2.5 kg in the United States and 1.1 kg – in England. A kilogram of rice contains about 4000 calories.

When processing rice for cereals, on average, 48% of cereals, 16% of broken grains, 13% of bran, 3% of flour and 20% of florets are obtained. Upon receipt of the grain, the grain is ground, which causes a change in the quality of the grain. As grinding increases, the protein content decreases from 8.44 to 7.75%, fat from 1.82 to 0.53%, ash from 1.29 to 0.64%, and fiber from 0.35 to 0.18% (9).

**History.** Rice is the oldest cultivated plant. Its introduction into crop dates back to the Neolithic. According to scientists, rice crop could first have arisen in India, Indochina and China or, at the same time, in all parts of South and Southeast Asia. In India, wild forms of rice were

found. According to historical and archaeological excavations, the birthplace of rice is probably the peninsula of Hindustan, where large thickets of wild rice were found.

Linguistic sources do not provide accurate information about the origin of rice, but it is possible to judge from them about the foci of crop. In Chinese, it is called "oulizz", which means "good grain for food", some ethnic groups called "rishi", "richi", and "arishi". From this root came the names of the crop among European nations: riso – in Italian, rice – in English, reis – in German, riz – in French. Different nations call it Arruz – in Egyptian, Aryz – in Persian, shaly – in Uzbek, and Tajik. There are many names for this crop in Indochina.

In Central Asia, the ancient areas of rice cultivation are Uzbekistan and Tajikistan. In the first millennium BC, irrigated agriculture already existed in these areas. At that time, rice was sown in the Fergana Valley. In the south of Russia, rice appeared in 1927 in the Astrakhan region.

Rice is the most widespread crop after wheat, and according to FAO data for 2013, data on planted area, yield and gross grain production are shown in Table 1.

<b>Rice production – 2019</b>	
<b>Country</b>	<b>Millions of <u>tonnes</u></b>
 <a href="#"><u>China</u></a>	211.4
 <a href="#"><u>India</u></a>	177.6
 <a href="#"><u>Indonesia</u></a>	54.6
 <a href="#"><u>Bangladesh</u></a>	54.6
 <a href="#"><u>Vietnam</u></a>	43.4
 <a href="#"><u>Thailand</u></a>	28.3
 <a href="#"><u>Myanmar</u></a>	26.3
 <a href="#"><u>Philippines</u></a>	18.8
 <a href="#"><u>Pakistan</u></a>	11.1
 <a href="#"><u>Brazil</u></a>	10.4
<b>World</b>	<b>755.5</b>

**Systematics.** Rice belongs to the family of *Poaceae*, subfamily – *Oryzaceae*, genus – *Oryza*, first described in 1735 by C. Linnaeus (Zaurov). The complete classification is done by a botanist R.Yu.Rozhenits. The genus includes 19 species. Only two of them are cultivated in crop – *O.Sativa* L, *O.Glaberrima* Steud.

**Cultivated rice.** Annual spring plant is cultivated in tropical, subtropical and temperate zones of the world.

Stems are erect or cranked-curved, up to 3-8 mm thick, 0.3-3 m high, strongly tilted, sometimes branching, up to 8 stem nodes, bare, hollow inside, green; nodes are green, sometimes

with an anthocyanin stain; leaf vaginas are open, smooth, ciliate ears, covering stem, leaves are lanceolate-linear, bare or haired, finely serrated at edges, leaves are green, yellow-green, and dark-green. The tongue is filmy, triangular in shape, cut at the top.

Inflorescence panicle is 10 - 40 cm long with a ribbed axis. Axis is bare, ribbed. The branches of the first order panicles sit 1–4 together. Spikelets are single-flowered, bisexual, erect, short-pointed, or awnless. Glumes are short, shorter than flowering florets. Flower florets are large, cover the grain. Stamens are well developed, there are 6 of them with oblong anthers. There are 2 pillars with two feathery stigmas. Fruit consists of grains, compressed from the sides. Grain's length is from 4 to 12 mm, width is 1.9-3.1 mm, from white-cream to red-brown. Diploid – the number of chromosomes is 24.

**Classification of cultural species.** The species is divided into two subspecies: short grain – *brevis* with a grain length of up to 4 mm and common – *communis* with a grain length of 5-10 mm and more. Ordinary rice, in turn, is divided into two periods (or branches): Sino-Japanese – *sino-japonica* and Indian – *indica*. The *sino-japonica* subspecies often has a powdery grain, and the ratio of length to width of the kernel is 1.4:1 or 2.5:1 to 2.9: 1. There are forms without spines or with long rough spines. Flower florets are downy. Leaf blades are narrow, green. The topmost plate departs from the straw almost at a right angle. The *indica* subspecies have thin, long kernels, often vitreous, with a ratio of length to width of the kernel 3:1, 5:1 and more. Often awnless or have tender short spines. Leaves and floral florets slightly haired. The leaf blades are wide, the top leaf departs from the straw at an acute angle.

**Table 2.**

**Characteristics of rice subspecies**

Traits	Indian	Chinese-Japanese
Leaves	Wide, light green	Narrow, dark green
Grain	Elongated, sometimes flat	Short, rounded
Tillering	Strong	Medium
Stem	Tall	Low
Hairs on flowering florets	Thin and short	Thick and long
Shattering	Strong	Weak
Plant tissue	Soft	Tough
Photoperiod responsiveness	Different	Different

These subspecies are divided into varieties according to the following characteristics: the curvature of the tops of flowering florets, the length of spikelet florets, sponginess, coloring of flowering florets and spines, color of the fruit, staining of the endosperm.

#### **Features of morphology**

Rice – *Oryza sativa L.* – spring herbaceous plant. With the germination of the grain, the embryonic roots and the stem start to grow. In the tillering stage, secondary, or nodal roots are formed from the tillering node. Adventitious roots are formed a lot – up to 30 - 40 and more. The maximum number of roots is observed in the phase of sweeping and reaches 200 - 300 roots. The formation of the roots is significantly affected by the water regime. The bulk of the roots has a length of 30 - 40 cm, but rare reaches up to 1 m. The bulk of the roots are located in a layer of 20 - 25 cm, and in young plants – in a layer of 10 cm. As the rice develops, it acquires the properties

of aquatic plants. The main and adventitious roots have airy tissues of aerenchyma. Thanks to them, the required concentration of oxygen is maintained in rice plants.

The stem of rice is straw, round, hollow, and there is a parenchyma in the lower internodes. Stems are erect, 80–130 cm high. In floating rice, the length of the stems is 4–5 m. The stem is bare, green, sometimes purple and red. The number of nodes on the stem is from 10 to 20. At the base of the stem there are more nodes. In nodes there is aerenchyma. The stem diameter varies in height, and the thinnest stem is in the upper internodes, which ends with a panicle. The strength of the stem from lodging depends on the thickness of the walls of the straw. Stem resistance to lodging is a valuable economic feature. Usually rice varieties with strong straw and with a low stem are resistant to lodging.

Rice bushes well. Side stems emerge from the tillering node. The number of fruit-bearing shoots can reach up to 50. The shape of rice bushes is compact (shoots deviate from the main stem by 20°); weakly developed when deviated by 30°; medium swinging with a deviation of 40°; strongly expanding with a deviation above 40°, it can be up to 60°. In wild forms of rice, shoots sometimes creep.

**The leaves** of rice are simple, linear. The first leaf of a germinated seed is called an awl. The second leaf erupts from the crack of the coleoptile. Starting from the third leaf, real leaves develop, consisting of the vagina, uvula, ears and plate.

The vagina of the leaf grows from the node and covers the stem, the outside is bare, smooth, can be painted at the base in purple or red. Leaf plate is narrow, long. In an adult plant, the length of the leaf blade is up to 20 - 25 cm, width is 1.5 - 2 cm. The leaves are usually green, but there are purple and red leaves. Lamina is rarely haired. The number of leaves is always equal to the number of nodes. In Uzbekistan, the varieties usually have leaves on the stem 3 - 5. The formation of leaves occurs before the stage of sweeping. A panicle appears from the upper vagina. The tongue is a scaly film of triangular shape, split from top to bottom. The size of the tongue is 1-1.5 cm. The tongue is located at the site of the transition of the vagina into the leaf plate. The ears are part of the leaf blade. They are located on the sides at the base of the leaves. The ears cover the stalk on both sides and hold the leaf blade. Ears and tongues are better developed in the lower leaves.

**Rice inflorescence – panicle.** It develops at the last interstice of the stem. A panicle consists of a main axis, which is divided by nodes. 2 - 3 lateral branches of the first order depart from the nodes, and second order from them. Spikelets on short legs sit on the side branches. On the basis of the combination of the panicle axis flexibility and its compactness, several types of panicle can be distinguished: the panicle is a straight compact, straight spreading, compact, erect, strongly bent compact, strongly bent leaned. Elements of the panicle structure: the length of the panicle, the number of nodes on the main axis, the distance between nodes, the number of axes of the 1st and 2nd order per node of the main axis, the length of the axes of the 1st order, the number of spikelets on the main axis and on the axes 1 second, and in rare cases, and third order. Each element of the structure of the panicle is subject to significant changes. Usually, the average length of the panicle is 20–25 cm, and the number of spikelets is from 80 to 300 pieces. The length of the panicle and the number of spikelets, besides the varietal characteristics, are also influenced by the growing conditions. Spikelets are always single-flowered, strongly compressed from the sides. The spikelet length is 4–12 mm. The mass of 1000 spikelets (seeds) in cultivated varieties in Uzbekistan is usually 27–32 g. There are two spikelet florets, they are located on both sides of the spikelet. Usually, the length of spikelet floret is 1/3 the length of the spikelet. Spikelet also has

two floral florets. The surface of the florets is rough, smooth, haired to varying degrees, ribbed, straw yellow, red, brown, dark purple, almost black. The color of the spines coincides with the color of flowering florets. The ratio of spikelet and flowering florets to the weight of the spikelet is called filminess. Filming depends on the variety. The varieties of Uzbekistan have an average filming of 17-20%.

Rice flower is bisexual, ovary with two feathery stigmas and six stamens. Stamens have a filament and anthers. When flowering, the staminate filament is extended to 1-2 cm. When ripe, the anthers burst and pollen spills out. The color of the anther is yellow, red, sometimes dark purple. In each anther there are up to 1000 pollens. Ovary is single-seeded, sessile, and single-nest. Stigmas are of the same color with the stem.

**Fruit - grain**, covered with flowering florets, they do not grow together with the fruit. The shape of the grains is round, short, thin, and long. Grain length is from 4 to 12 mm, width is 1.2-3.5 mm. The surface of the grain repeats the surface of flowering florets, may be ribbed, smooth, etc. The color of the kernel is yellow-brown, red, rarely black. The seed consists of the embryo, endosperm and integument. The endosperm contains nutrients that are used by the plant at the beginning of development. The endosperm has an aleurone layer in the peripheral part. Proteins, vitamins accumulate in the aleurone layer. The endosperm has a glassy and powdery consistency. The endosperm cells are filled with starch and therefore the rice groat have a whitish tinge.

The endosperm is covered with a seed and fruit coat. The fruit shell is shiny, yellow. The fruit coat is the pericarp, developing from the ovary. The germ is located at the base of the grain, has a shield, buds of the primary leaf, stem and rootlet. When the seed germinates, the flap converts the insoluble endosperm nutrients into soluble, due to enzymatic processes, and supplies the embryo with nutrients.

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