RICE GROWTH AND DEVELOPMENT

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Abstract. *Germination and emergence of seedlings, tillering and stem elongation, flowering. Flowering, organogenesis, relationship with environmental factors such as relationship with soil, nutrients, water, heat of rice (Oryza L) were described in this thesis.*

Keywords: *rice, oryza, seed, germination, emergence, environmental factors, condition, tillering, stem, elongation, flowering, nutrients, relationship with water heat, factors, influencing, yield.*

Germination and emergence of seedlings. In rice crop, to obtain uniform and sufficiently full shoots is the most important among all other crop management practices. Seeds for germination absorb 23 - 28% of water by weight of seeds, during this period they do not need oxygen, the endosperm develops due to anaerobic respiration. With deep embedding of seeds (4–5 cm), anaerobic respiration is enhanced, which leads to the death of the seeds.

Seeds germinate at a temperature of 10 - 46°C, at low temperatures the embryo decays, the optimum temperature of germination is 34°C. Some forms of rice do not germinate during initial flooding with water. Scientists have established good germination of large seeds in anaerobic conditions.

Rice seeds germination in the wet fields

It takes 7-15 days from seed germination to emergence of seedlings, depending on the air temperature, soil moisture, and germination energy. In the seedling phase, up to 3-4 leaves are formed, this coincides with the beginning of the tillering stage, which takes place under aerobic conditions. During the period of germination, a rapid growth of the root system occurs, air cells (passages) appear in the roots, which provide the plant with oxygen. Shoots flooded with water up to 15 cm easily overcome the layer of water and go outside.

Tillering and stem elongation. At a temperature of 20 - 30°C shoots rowth quickly, this is greatly facilitated by mineral fertilizers applied during this period. Under these conditions, axillary buds grow, which leads to tillering. Tillering starts at 3–4 leaves and lasts until 8–9 leaves form when the stem elongation phase begins. In the tillering stage, a crucial moment of rice development takes place, the duration of the growing season depends on it. With 8 - 9 leaves, the

stem elongation begins, in this phase the panicle and its parts develop. The beginning of the stem elongation phase depends on the ripeness of the variety, in the early maturing varieties it begins with the formation of 5-6 leaves, and in the late maturing with 8 - 9 leaves.

Flowering. In rice, flowering coincides with heading. If heading occurs in the first half of the day, then flowering – in the second, and if heading occurs in the second half of the day, then flowering – on another day. Flowering depends on the temperature of the day. The optimum temperature for flowering is about 30°C, the minimum 15 - 20°C, and maximum - 50°C. Flowering begins at the top, but within the panicle the first spikelet flowers earlier. In general, the order of flowering is often violated. Panicle flowers 5 - 8 days. The greatest number of flowered spikelets is observed on the 2nd - 3rd day. For optimum flowering, the air humidity should be 70 - 80%. Rice does not flower at very low humidity (40%). One flower flowers an average of one hour. This process is delayed in cloudy weather.

Reproductive phase. The process of formation and ripening of the grain takes place in several stages, during which the grain is formed, the germ, the endosperm develops, the grain is filled with nutrients, the amount of water decreases. This period is divided into three ripening periods: dairy, waxy and full maturity phases. When milky maturity grain grows in length and width, the content resembles milk. 11-12 days pass from the moment of pollination to milky maturity, during this period the water content of the grain is 70%. When waxy ripeness, the grain acquires a powdery consistency and is cut with a fingernail, the water content in this period is up to 35%, this phase lasts up to 20 days. It takes up to 5-7 days from wax to full maturity, and the whole period of maturation lasts 30 - 40 days depending on environmental conditions. Under adverse weather conditions, the development of the lower spikelets is delayed. Rice varieties on the growing season are divided into the following groups.

Table 1. Rice maturity groups

Groups	Days to heading	Days to maturity	The sum of average temperatures during the growing season, °C
Very early maturity	45-50	90-100	2000-2200
Early maturity	51-55	101-110	2200-2300
Medium maturity	56-65	111-120	2300-2500
Late maturity	76-100	125-140	2600-2700

Organogenesis. Rice has 11 stages. The 1st stage – the cone of growth is not yet differentiated, 3 first leaves are laid in the embryo, the outer leaf is the coleoptile and the next leaf is without the plate, the 3rd leaf is the germ layer with the plate. This stage coincides with the germination and the beginning of the emergence of shoots.

The 2nd stage – the embryo stem is differentiated and the leaf vagina is laid, the leaf formation ends and the adventitious roots are formed. This stage takes place between sprouting and tillering.

The 3rd stage – cone of growth is differentiated. Panicle segments appear, axes of the first nodes are laid, the longer this stage, the more productive the panicle. This stage takes place in the tillering stage.

The 4th stage – sprigs of the 1st, 2nd, and subsequent nodes grow, spike nodes are laid and individual spikelets are isolated. By the end of the stage, the panicle reaches 1 cm. This stage corresponds to the end of tillering.

The 5th stage – spikelets differentiate with the formation of spikelet and flowering florets, lodicules, generative organs – the stamen and pistil are developed. This stage takes place at the end of stem elongation phase.

The 6th stage – the formation of generative tissues in the anthers and the pistil, the embryonic sac; ovule and pollen grains are formed. This phase continues in stem elongation phase.

The 7th stage – growth in length of all axes of the inflorescence, florets, spines and straws occurs. All flower organs are enlarged several times. This stage begins at the end of stem elongation phase.

The 8th stage – flowering, pollination and insemination.

The 9th stage – proembryo is formed, the embryo and the germ of the endosperm develops. Seed embryonic development occurs.

The 10th stage – endosperm is formed, in which starch grains, aleurone layer are formed.

The 11th stage – full ripening of the seed, the passage of milky, waxy and full maturity phases. The endosperm and the embryo lose water.

Environmental conditions can speed up or slow down the passage of all stages of development.

Relationship with environmental factors

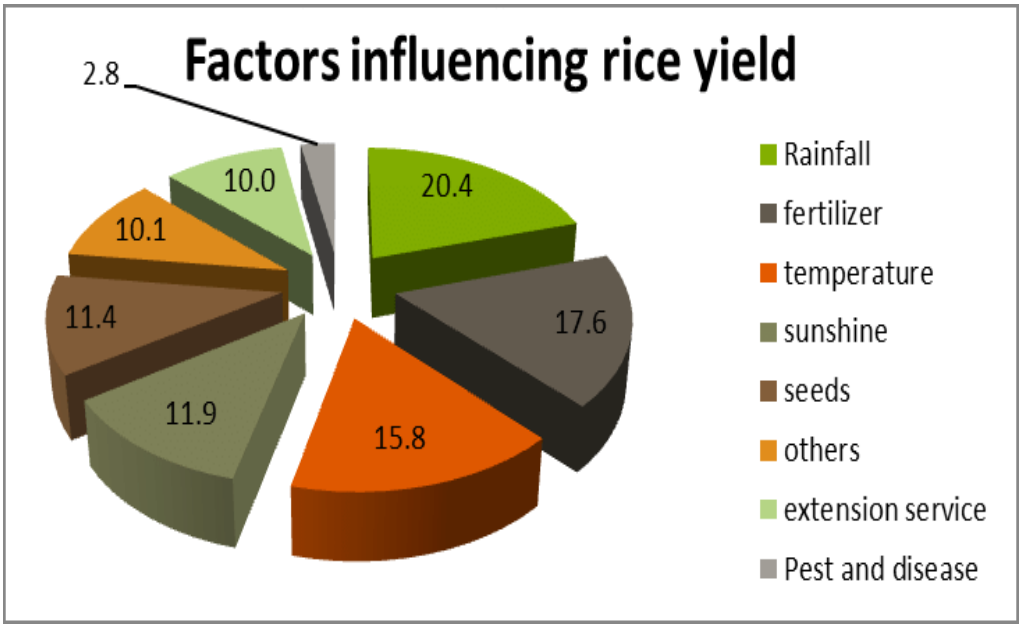
The need for water. Rice differs from other cereals in its ability to grow and develop in water. Without abundance of water, rice does not produce high yields. The rice is hygrophyte, it grows on flooded soils, but the need for water differs in phases of development. Rice does not require a layer of water during seed germination and from wax to full maturity. Water is necessary for seed germination, but the water layer in the soil allows the development of only a embryonic bud, and the roots do not develop, therefore, after pecking the seeds until the emergence of seedlings (1st real leaf), water is discharged from the fields. After the emergence of seedlings, the water layer is again set at 15–20 cm. During the period of tillering for better development of the root system and lateral branches, the water layer is reduced to complete absorption, but not drying. At this time, fertilizers are applied, after which a layer of water is set 10-15 cm before the beginning of waxy maturity. The water layer creates favorable conditions for the thermal regime of the rice field, smoothes daily fluctuations in air temperature, has a leaching effect on saline soils, suppresses weeds, saves the soil from erosion, and allows long-term rice cultivation in the same field.

Reaction to heat. Rice makes high demands on heat. For the development of rice, the temperature of water in various phases of development is of great importance. The minimum water temperature for seed germination is 10 - 14°C, but at this temperature the seeds germinate within 12 -15 days. At 20 - 25°C seeds germinate for 5 - 7 days. Low temperature adversely affects the development of plants in all phases, especially in the flowering phase. The optimum water temperature for rice is 30–33°C. Temperatures above 40°C violate flowering and insemination. According to scientists, rice flower in July took 3 days, in August – 4, September – 5-6, October – 7 days.

The constant flow of water in checks reduces the temperature of the water and thereby contributes to an increase in rice yield.

It has been established that a decrease in water temperature to 20–22° during the development of an embryonic panicle by deeper flooding or flow of water contributes to an increase in the number of twigs of the panicle.

In the process of evolution, “dry field” varieties appeared, but so far their yields are low, and there are very few such varieties.

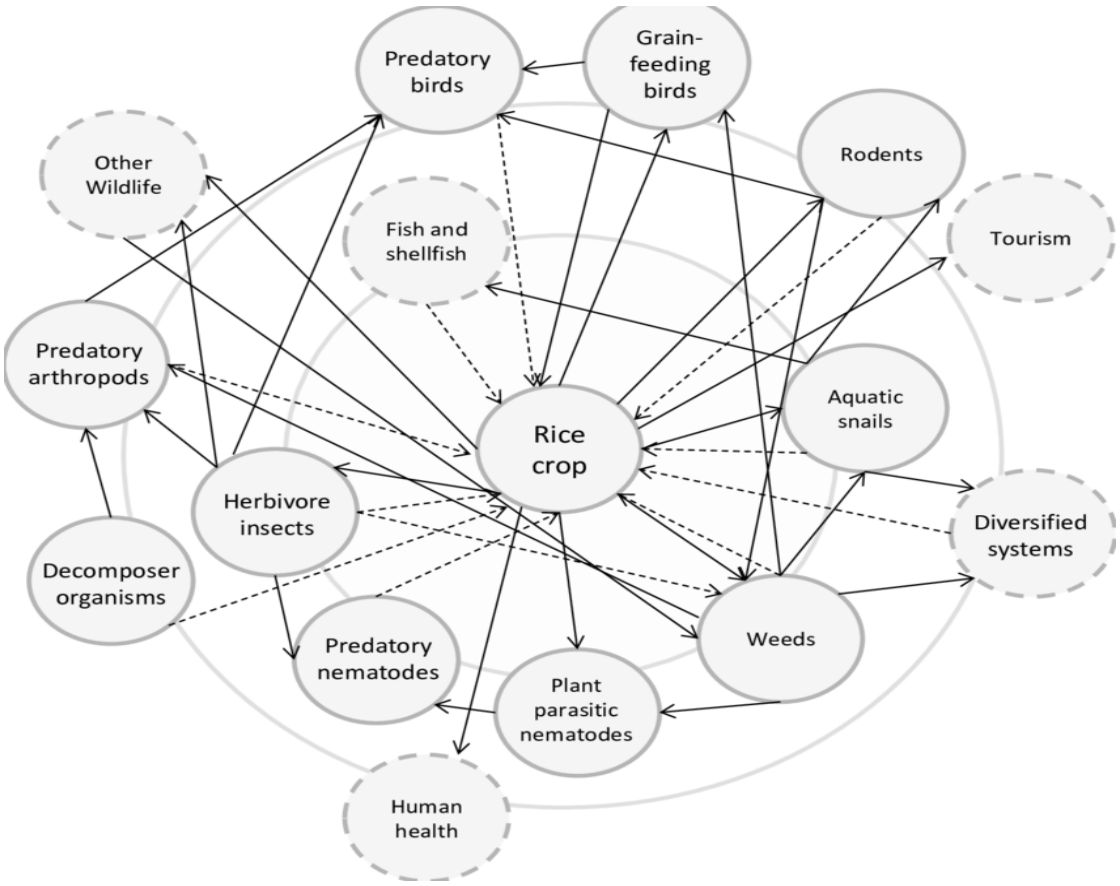


Reaction to the light. When forming the rice crop, the duration of solar illumination is of great importance. Planting a short day, many varieties require an 11-12 hours day. Rice varieties cultivated in Uzbekistan are well developed in 9 - 12 hours of light. For example, in India, the “aman” varieties are sown, which are sown in June, they are harvested at the end of the monsoon period, when the daily light is greatly reduced, it ripens in November and December, when it is dry. But at the same time there are varieties not very responsive to the length of the day. Long daylight hours without affecting the heading, contributes to the powerful development of the vegetative mass.

The photosynthetic activity of crops in rice is higher than that of other cereals. The maximum concentration of chlorophyll occurs during the transition from a vegetative to a generative state. The smallest assimilation activity in rice occurs in the flowering and milky maturity phases. The maximum intensity of photosynthesis is observed during the tillering period and when the grain is poured. Different leaves provide carbon to various plant organs. For example, the 7th leaf provides the root, the 9th provides the growth point and only partially the root. In the dry period, rice produces more yield than in the rainy period.

Relations between different components in the rice ecosystem indicating the complexity of the system. Components located closer to the rice crop include permanent residents in the crop. Components located away from the crop are often occasional visitors to the crop that occur in the rice-production landscape. Circles with dashed outlines represent economic activities that interact with rice production. Solid arrows indicate resource flows or benefits (in the direction of the arrow) to or from the rice crop; dashed arrows are indirect benefits to the rice crop.

For the length of light, the most sensitive varieties grown in countries lying between 32-35° n.l. and 25° s.l. For breathing, rice varieties require less oxygen than other cereals. Under field conditions, rice constantly requires oxygen throughout the growing season, except for the period of seed germination. Under anaerobic conditions, the growth of coleoptile can last 20-25 days. Without oxygen access, the leaves and spine do not develop. Sprouts flooded with water can overcome a layer of water up to 25 cm.



Factors influencing rice yield

Relationship with the soil. Rice is not demanding on soils; it can be cultivated on marsh, meadow, peat-gley, saline, and sodic soils. The most favorable are the alluvial soils of river valleys, which are heavy and clayey with a sufficient content of organic matter. The ratio of rice to salinization is different. Young plants die at an initial salt content of 2–3% sodium chloride — more than 3%, and sodium carbonate, more than 0.1% of the dry weight of the soil. The reaction of the soil pH 5.6-6.5 is the most favorable (9).

Nutrients demands. If there is not enough nitrogen, the rice does not tiller well, the panicle is smaller and the graininess is low. Nitrogen is required a lot from the seedling stage to the emergence. The lack of phosphorus causes a violation of metabolic physiological processes, the leaves become narrower. Of all the food elements, rice most of all makes potassium out of the soil. A lot of potassium is required from the tillering stage to flowering. Formation of 1 ton of rice grain requires on average 20-24 kg of nitrogen, phosphorus – 8-13 kg, potassium – 25-32 kg. In addition, rice requires small amounts of sulfur, iron, calcium, zinc, copper, molybdenum, and manganese.

Diseases and pests. Rice is damaged by pyriculariasis, fusarium, gelmintosporioz, and alternariosis. These diseases sometimes cause crop loss of up to 40%. Shoots are thinned due to diseases, and leaves turn yellow, rot, or curl and dry. Gelmintosporioz affects rice in all phases of development. Of insects, great harm is caused by the shield, estery, barley miner, rice mosquito, coastal fly, and rice liquor. The gravel damages the germinating seeds and the root system of the seedlings, the ester affects the immature roots of rice, the barley miner affects the crops of rice with deep flooding. Rice mosquito damages rice seedlings in the presence of a constant layer of water. Cereal aphid infects rice during the period of tillering, and stem elongation. The leaves turn yellow and dry.

The varieties are Avangard, Alanga, Gulzar, Gulzhakhon, Jaikhun, Ilgor, Istikbol, Istiklol, Iskandar, Lazurniy, Mustaqillik, Nukus-2, Nukus-70, UzROS-7-13, and Sanam.

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