GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 12, Issue 9 September (2024)

# THE EFFECT OF MINERAL FERTILIZER RATES ON THE GROWTH PERIOD OF RICE VARIETIES

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## ABSTRACT

In this article, scientific research on the effect of nitrogen fertilizer rates on late-season rice varieties during the growing season was carried out. scientific research works were conducted in two regions of the Republic, nitrogen fertilizers were applied at the rate of 150 kg, 180 kg and 210 kg per hectare, and it was found that the growth period increases as the rate of nitrogen fertilizers increases.

**Keyword:** Rice, plant, variety, kilogram, rate, nitrogen, fertilizer, hectare, day, period.

## INTRODUCTION

The roots and leaves play a significant role in the exchange of substances between the plant and its life processes. Roots absorb water and minerals, while leaves are specialized for capturing light energy and carbon dioxide. The productivity of a plant depends on the size of these organs, as well as the nutritional conditions and the quantity and composition of fertilizers used. These factors significantly influence the intensity of photosynthesis, root system development, and physiological activity. The function of roots in mineral nutrition is one of the most thoroughly studied aspects of rice physiology. Their morphological and anatomical structure, respiration, and enzymatic activity have been explored in considerable detail.

Rice is a nitrogen-demanding crop. The importance of nitrogen for rice is well known: it is the main component of all proteins and many non-protein substances without exception, and therefore, it actively participates in the formation of the plant organism. The production of 1 ton of rice grain, along with the corresponding amount of straw, requires approximately 28 kg of nitrogen.

The majority of mineral nitrogen is represented by fixed ammonium, with its maximum amount found in the N120P80K60 variant and the minimum in the control group. When only mineral fertilizers are used, the high level of fixation is undoubtedly related not only to the total dose of nitrogen applied to the soil but also to the form of its compounds. The amide nitrogen in urea is converted to ammonium after rice fields are flooded and becomes fixed within the crystal lattice of soil minerals. However, such fixation of $NH4^+$ ions should not lead to negative consequences, as this process is reversible, and fixed ammonium participates in rice nutrition.

Among mineral forms, ammonium and nitrates occupy the second and third positions interchangeably in terms of representation. They serve as the primary sources of nitrogen for rice nutrition, and their quantities remain at similar levels during the post-harvest period, particularly increasing when mineral fertilizers are applied alongside manure. The share of nitrites is small; although their amount doubles from 0.1 to 0.2 mg/kg after fertilizer application, this level does not correspond to the presence of other compounds and does not play a significant role in the soil's nitrogen regime.

After water drainage and rice harvesting, as soil aeration improves and oxidation processes become dominant again, nitrate levels increase significantly while ammonium levels decrease. However, the initial levels of both forms, as determined before planting, are not restored. At the same time, in meadow-chernozem soil, nitrate content is considerably lower than in alluvial-meadow soil, except in cases where manure is applied.

The application of mineral fertilizers alone or in combination with manure prevents the decline of soil potential fertility by increasing total nitrogen reserves, including its easily hydrolyzable, organic, and non-hydrolyzable forms, compared to unfertilized variants. Mineral and organic fertilizers contribute to improving effective fertility and positively affect the composition of mobile mineral nitrogen compounds. The dynamics of these compounds indicate a more favorable nutrition regime at all growth stages, especially when applying N90P60K45 + manure. However, the fertilizer doses used in the experiment do not compensate for the loss of mineral nitrogen compounds through runoff and filtration water, nor for the nitrogen removed with the harvested rice crop.

## RESEARCH METHODS

In scientific research, field experiments, calculations, and observations were carried out based on the "Methodological Guide of the State Commission for Testing Agricultural Crop Varieties" and "Methods for Conducting Field Experiments" (PSUEAITI). The soil samples taken from the experimental fields before sowing were analyzed using the following methods: humus content by I.V. Tyurin, total nitrogen and phosphorus by I.M. Malseva and L.N. Gritsenko, potassium by Smit, mobile phosphorus by B.P. Machigin, and exchangeable potassium by P.V. Protasov.

In this research, the effect of nitrogen fertilizer rates on the growth period of rice varieties was studied. When all varieties were sown at a rate of 5 million viable seeds per hectare in the third decade of April, seed germination occurred within 8-12 days. The late-maturing control variety UzROS7/13 reached the seedling stage in 35-37 days, the tillering stage in 56-60 days, the panicle initiation stage in 92-96 days, the panicle emergence-flowering stage in 104-112 days, and full maturity in 135-141 days.

Compared to the control variety, the Mustaqillik variety in the FON-R120K150 variant was delayed by one day in the seedling and tillering stages. However, it reached the stem elongation stage 4 days earlier, the panicle emergence-flowering stage 2 days earlier, and full maturity 3 days earlier.

Nitrogen is one of the essential nutrients for plants. It is a component of all simple and complex proteins, nucleic acids, chlorophyll, phosphatides, alkaloids, vitamins, and enzymes. The sources of nitrogen for plant nutrition are ammonium (NH4) and nitrate (NO3) salts. Nitrogen produced through ammonification and nitrification does not accumulate in the soil; most of it is absorbed by plants and microorganisms, while some returns to organic form. The nitrogen content in the soil can be increased by applying organic and mineral fertilizers and by planting leguminous crops. Nitrogen fertilizers are obtained through the synthesis of ammonia.

Phosphorus in plants occurs in both mineral and organic forms. In its mineral state, phosphorus is present as calcium, magnesium, and potassium salts of orthophosphoric acid, but its quantity is very low. Since phosphorus plays a crucial role in carbohydrate metabolism, phosphorus fertilizers positively influence sugar accumulation in sugar beets and starch accumulation in potato tubers. Phosphorus is also essential for nitrogen metabolism in plants. Phosphorus fertilizers are obtained from apatites and phosphorites. In addition to phosphate minerals, phosphorites contain various impurities such as sesquioxides, sand, and clay. Therefore, raw materials undergo enrichment before phosphorus fertilizers are produced.

In our research, we focused on determining the effects of mineral fertilizers on the growth phases and vegetation period of rice varieties. Data on the duration of growth phases and the impact of mineral fertilizers on the vegetation period of the "UzROS-7/13" variety are presented in Table 1.

As seen from the data, different rates of mineral fertilizers significantly affect the duration of growth phases and the overall vegetation period of rice. While there are no drastic differences in the duration of growth phases between rice varieties, an increase in fertilizer rates leads to observable variations in their duration.

In our experiments, the control variety "UzROS-7/13" in the FON-R120K150 variant reached the seedling stage 35 days after sowing, the tillering stage at 56 days, the stem elongation stage at 92 days, the panicle emergence and flowering stage at 104 days, and full maturity at 135 days. In the variant with 150 kg of nitrogen fertilizer, the respective phases occurred at 33, 52, 91, 107, and 137 days; with 180 kg of nitrogen at 36, 55, 93, 109, and 138 days; and with 210 kg of nitrogen at 37, 60, 96, 112, and 141 days.

In the late-maturing rice variety Mustaqillik, the difference in the transition to growth phases in the FON-R120K150 variant compared to the control variety was observed. The seedling and tillering stages were delayed by 1 day, but the stem elongation and panicle emergence-flowering stages occurred 2-4 days earlier, while the maturity stage was reached 3 days earlier. In the variant with 150 kg of nitrogen fertilizer, the respective phases occurred at 34, 50, 85, 104, and 134 days; with 180 kg of nitrogen at 37, 52, 90, 107, and 136 days; and with 210 kg of nitrogen at 38, 64, 93, 110, and 138 days.

The effect of nitrogen fertilizer rates on the development of the Tarona rice variety was studied, and in the FON-R120K150 variant, the growth stages were 35, 56, 86, 102, and 129 days, respectively. Compared to the control, the stem elongation and panicle emergence-flowering, as well as the maturity stages, differed by 2-4 days. In the variant with 150 kg of nitrogen fertilizer, the respective stages occurred at 32, 53, 83, 103, and 131 days; with 180 kg of nitrogen at 35, 56, 87, 105, and 133 days; and with 210 kg of nitrogen at 37, 61, 90, 106, and 135 days.

The effect of nitrogen fertilizer rates on the development of the Lazurniy rice variety was studied, and in the FON-R120K150 variant, the growth stages were 34, 54, 87, 100, and 128 days, respectively. Compared to the control, the stem elongation and panicle emergence-flowering, as well as the maturity stages, differed by 2-7 days. In the variant with 150 kg of nitrogen fertilizer, the respective stages occurred at 31, 52, 85, 102, and 130 days; with 180 kg of nitrogen at 34, 57, 87, 103, and 132 days; and with 210 kg of nitrogen at 35, 58, 90, 105, and 134 days.

During the research years, the differences in the growth periods of rice varieties were observed to be based on the biological characteristics of the varieties. The latest maturing variety, UzROS 7/13, showed the effect of different nitrogen fertilizer rates on its growth period, and it was found to mature 6 days later than the control variant.

1st Table The effect of mineral fertilizer rates on the growth period of rice varieties (During the 2017/2019 years in the conditions of Tashkent region)

| Rice varieties | Nitrogen fertilizer rates | development stages | | | | |
|---|---|---|---|---|---|---|
| | | Germination | Tillering | Stem elongation | Panicle emergence and flowering | Maturation (or Ripening) |
| UzROS7/13 | No fertilizer control | 33 | 53 | 85 | 99 | 128 |
| | $P_{120}K_{150}$ (fon) | 35 | 56 | 88 | 102 | 131 |
| | Fon+$N_{150}$ | 33 | 52 | 91 | 107 | 137 |
| | Fon+$N_{180}$ | 36 | 55 | 93 | 109 | 138 |
| | Fon+$N_{210}$ | 37 | 60 | 96 | 112 | 141 |
| Mustaqillik | no fertilizer($N_0P_0K_0$) | 35 | 53 | 85 | 99 | 126 |
| | FON-$P_{120}K_{150}$ | 36 | 55 | 88 | 102 | 129 |
| | N-150 | 34 | 50 | 85 | 104 | 134 |
| | N-180 | 37 | 52 | 90 | 107 | 136 |
| | N-210 | 38 | 64 | 93 | 110 | 138 |
| Tarona | no fertilizer ($N_0P_0K_0$) | 34 | 54 | 83 | 98 | 124 |
| | FON-$P_{120}K_{150}$ | 35 | 56 | 86 | 99 | 126 |
| | N-150 | 32 | 53 | 83 | 101 | 129 |
| | N-180 | 35 | 56 | 87 | 105 | 133 |
| | N-210 | 37 | 61 | 90 | 106 | 135 |
| Lazurnыy | no fertilizer ($N_0P_0K_0$) | 33 | 52 | 84 | 97 | 123 |
| | FON-$P_{120}K_{150}$ | 34 | 54 | 87 | 100 | 126 |
| | N-150 | 31 | 52 | 85 | 102 | 130 |
| | N-180 | 34 | 57 | 87 | 103 | 132 |
| | N-210 | 35 | 58 | 90 | 105 | 134 |

## CONCLUSION

The results of the study showed that increasing the nitrogen fertilizer rates led to an increase in the vegetation period of the plants, with maturation being 6-10 days later compared to the control variants. In the typical gray soils of Tashkent region, it is recommended to use nitrogen at 150 kg, phosphorus at 120 kg, and potassium at 150 kg for the late-maturing rice varieties.

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