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THE EFFECT OF DIFFERENT TYPES OF NITROGEN FERTILIZERS ON THE DURATION OF GROWTH PHASES, PLANT DENSITY, AND WINTER SURVIVAL RATE OF WINTER WHEAT

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Annotation: This article presents the results of a study conducted at the educational and experimental farm on the effect of different types of nitrogen fertilizers on the duration of phenological phases, seedling density, and winter survival dynamics of winter wheat.

Keywords: Wheat, nitrogen, mineral fertilizer, ammonium nitrate, ammonium sulfate, ammonium chloride, urea.

Nitrogen is one of the essential nutrients crucial for plant life. It is a key component of amino acids, proteins, nucleic acids, and other vital organic compounds, ensuring proper plant growth and development. Nitrogen deficiency can lead to various growth issues, such as leaf yellowing and stunted growth. Therefore, the role and impact of nitrogen on plant life have been a subject of research for many years. Global studies indicate that nitrogen significantly influences soil fertility and plant nutrition. The amount of nitrogen fertilizers applied to agricultural fields has been increasing annually. According to statistical data, from 2000 to 2023, the global use of nitrogen fertilizers has increased by 30%, positively impacting plant growth [1].

According to many scientists, for wheat seeds to transition from the swelling stage to the germination stage, they must absorb 50-55% moisture relative to their dry mass, taking into account the seed size and soil-climatic conditions. As the moisture content in the grain increases under optimal air temperature, biochemical and physiological processes within the seed begin, activating enzymes that convert organic compounds such as proteins, fats, and carbohydrates into soluble forms. Starch is transformed into a water-soluble state and gradually accumulates in the embryo. Due to moisture, nutrients move from the endosperm to the seed embryo, initiating the growth of the radicle and the initial leaf. The primary root pierces through the seed coat and grows deeper into the soil, while the initial seed leaf emerges in the opposite direction, reaching the soil surface. After some time, the second and third roots form. The sum of effective temperatures required for winter wheat seeds from swelling to emergence should be **120°C**. If the daily temperature is **10°C**, the seeds of sown winter wheat varieties will emerge in **12 days**, whereas at **20°C,** they will emerge in **6 days**. The time required for winter wheat seed emergence varies between **7 to 25 days,** depending on factors such as air temperature, sowing depth and timing, soil moisture, and its physical condition. Scientists have also noted that if these factors are insufficient, delayed germination of sown winter wheat can significantly reduce yield [2,4].

According to scientific research, the rapid and complete germination of winter wheat seeds sown in our country depends on various factors. These include the sowing time and rate, the duration of the growth and development phases of the cultivated variety, the amount of precipitation and soil moisture availability, air temperature and relative humidity, the number and rate of irrigations, the quantity and ratio of applied mineral and organic fertilizers, soil tillage methods and depth, as well as several other factors. [3,5,6].

According to the effect of different nitrogen fertilizers on the developmental phases of winter wheat, the best results were observed in the second variant, where ammonium nitrate fertilizer was applied. In this variant, the period from sowing to maturity lasted **220 days**. This was **4-8 days earlier** compared to the first and fifth variants, where ammonium nitrate and urea were applied in a **1.5:1.0 ratio** and only urea was used, as well as the control variant, where no nitrogen fertilizer was applied.

Winter wheat varieties undergo a dormancy period during the winter season. The winter hardiness of autumn-sown wheat varieties depends on various external environmental factors, particularly on how well the plants are prepared for dormancy and their acclimatization before winter. When winter wheat varieties are provided with optimal temperature and sufficient moisture, they develop well, accumulate an adequate amount of sugar in their tissues, and increase their resistance to winter and early spring low temperatures. The primary cause of seedling damage and high mortality during winter is a sharp drop in air temperature. When temperatures drop too low, ice crystals form between plant tissue cells, compressing the cell protoplasm. If the protoplasm loses its water content, it becomes permeable, leading to frost damage, which causes the leaves to turn yellow. Additionally, seedling suffocation can also result in plant death.

When studying the effect of different nitrogen fertilizer types on the seedling density and winter survival rate of winter wheat, the best results were observed in the second variant, where ammonium nitrate was applied. At the beginning of the growing period, the seedling density in this variant was **472.8 plants/m²,** but after winter, this indicator decreased by **11.4%,** reaching **419.0 plants/m²** by the end of the growing period. Compared to the fifth variant, where ammonium nitrate and urea were applied in a **60%:40%** ratio, this result was **2.7 plants/m² higher;** compared to the first variant, where only urea was applied, it was **6.8 plants/m² higher;** and compared to the control variant, it was **45.0 plants/m² higher**.

The table below presents data on the seedling density and winter survival rate of winter wheat based on the experiment.

The effect of different types of nitrogen fertilizers on the seedling density and winter survival rate of winter wheat.

№	Variant	Seedling Density, plants/m²		Plants Lost During Winter, %	Final Seedling Density, plants/m²
		At the Beginning of the Growing Period	After Winter		
1	Only Urea Applied	470,1	412,3	12,3	412,3
2	Only Ammonium Nitrate	472,8	419,0	11,4	419,0
3	Only Ammonium Chloride	466,2	407,0	12,8	407,0
4	Only Ammonium Sulfate	457,1	395,4	13,5	395,4
5	Ammonium Nitrate 60% + Urea 40%	471,4	416.3	11,7	416.3
6	Urea 60% + Ammonium Nitrate 40%	471,2	414,7	12,5	414,7
7	Ammonium Chloride 20% + Ammonium Nitrate 40% + Urea 40%	468,7	409,7	12,6	409,7
8	Ammonium Sulfate 20% + Ammonium Nitrate 40% + Urea 40%	466,6	401,8	13,9	401,8
9	No Nitrogen Applied	434,8	374,0	14,0	374,0

According to the results of our research conducted in the experimental field of the Andijan Institute of Agriculture and Agrotechnologies, the second variant, where ammonium nitrate produced at the **Farg‘onaazot JSC** plant was applied, showed the highest efficiency among different nitrogen fertilizers. In particular, the vegetation period of the plants lasted **220 days**, which was **14 days earlier** compared to the control variant. The crop experienced **less damage** from winter cold and mortality, and the seedling density was **30.8 plants/m² higher** than in the control variant.

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