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RESEARCH ARTICLE

EFFECT AND INFLUENCE OF A PHYSIOLOGICALLY ACTIVE SUBSTANCE ON THE GROWTH AND QUALITY OF RICE YIELD

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ABSTRACT

Rice productivity is low in Congo. The objective was to study the effect of a growth stimulant when sowing the Nerica 6 variety, their influence on yield and product quality. The emistime was used as a growth regulator during the development cycle with different doses (10 ml/t, 30ml/t, 1ml/ha, 5ml/ha). The control seeds were soaked in water, the treatments were repeated three times. The application of an active physiological substance was evaluated on the growth parameters of the plants, the results show that in an emistime contribution of 10 ml/t favors the intense growth of the stems. Plant growth regulator treatments promote an increase in chlorophyll content and an increase in the number of ears.

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INTRODUCTION

Rice, Oryza sativa L. (Poaceae) is among the cereals grown in the world for nutrition. Rice occupies one of the first places both in relation to the sowing area and in relation to the harvest. It is cultivated worldwide over an area of nearly 145 million ha (FAOSTAT, 2012). One of the avenues for increasing the effectiveness of rice cultivation in Loudima over the next few years is the use of technology which advocates the rejection of chemical weed control techniques and the compulsory use of varieties with high resistance against crop enemies in the growth phase. The qualities of sowing a culture are determined in the first place by its biology. For the growth of the crop, it is necessary to create the growing conditions more conducive to its development and obtaining a large harvest (Narcissov V.P., 1976). Water, heat, oxygen, the needs of which vary in certain phases of growth and development, are necessary for the growth and development of rice. The growth processes in the seed begin at a temperature of 10 to 12^0 c, but the optimum temperature for growth is between 24 and 28^o c. At near-optimal temperatures, shoots appear between the 5th and 7th day after sowing. When germination takes place in land submerged by water, the coleoptile is the first to grow. It elongates until it appears on the surface, after which the roots develop. Shoots develop best between 24 and 28^0 C for 10 to 15 days. The development of rice cultivation technology in Africa was initiated by many scientists (Kalinine, 1987. Joutchenko, 2001).

However, the cultivation of rice in the crop rotation system with tillage techniques, the correct use of organic and mineral fertilizers, timely sowing, the use of a rational water regime, the fight against weeds and pests do not guarantee a high and high-quality grain harvest. According to AA Joutchenko, the state of agriculture in Africa and the world is characterized not only by a constant trend of an exponential increase in irreparable energy costs for each additional unit of production, but also by an increasing risk of pollution. World and destruction of the natural environment, the strong dependence of the magnitude (30-80%) and quality of yield on abiotic and biological constraints (Joutchenko, 2001). It is the action of abiotic and biotic stresses which is the main cause of the significant differences between the potential and realized yields of cultivated rice varieties.

MATERIAL AND METHODS

The plant material consisted of rice grains of variety (Nerica 6). The seeds of the variety (Nerica 6) are brown in color. Nerica: New Rice for Africa, is the result of crossing an old, very resistant African variety and a high-yielding Asian variety. It is a rice cultivar developed by Monty of the Africa Rice Center to improve rice cultivation in West Africa. This Nerica 6 variety is grown a lot in Loudima. Nerica is a rice that can grow just about anywhere. In the Congo, rice can be produced like maize.

NERICA 6

Analysis of soil samples shows that the soils in this area are low acid and neutral. The pH values of low acid and neutral soils are between 5.5 and 7.5 (Baize, 2000). The C/N ratio, the sum of exchangeable bases and the cation exchange capacity are high. The Ca/Mg and Mg/K ratios are within the standards. Soils in this area are low in nitrogen and rich in Ca^{2+} and Mg^{2+}. The soils of Loudima being clay-sandy soils and the effect of burning could explain these results. The work of Nzila (1992) on the soils that have been burnt in the Niari valley have proven the interest of this technique for soil fertilization.

Growth regulator used: Emistime was used as a growth regulator in this study. The regulator was used during the rice development cycle with different doses:

- Contrôle,
- Emistime 10 ml/t
- Emistime 30 ml/t
- Emistime 1 ml/ha
- Emistime 5 ml/ha.

Implementation of the test, regulator and experimental device: The test was carried out for 5 months, the months of November-December-January-February-March over a period of two years. Regarding the field experience, sowing was carried out on a 3 m x 1 m board with spacing of 20 cm x 20 cm. The seeds were deposited at the rate of 3 seeds per pocket in order to have a density of 225 seeds sown per bed. This board was sterilized with hot water at a rate of 10 liters per m2 then covered with a black tarpaulin for 3 days in order to eliminate pathogenic germs. In the field were sown the seeds of a variety of rice (Nerica 6), soaked beforehand for two hours in the solution of emistime at different doses (10 ml/t, 30 ml/t, 1 ml/ha,5ml/ha).The control seeds were soaked in water, the experiment according to the growth regulator study of different doses on the formation of the structural elements of the crop, the productivity of rice and the quality of seed was made of lysimeter concrete (the dimension was 3 x 1m and the depth was 0.6m). Salts and we put the earth (ballast) of 10 cm, then we rammed. Then we put three layers of soil (10 cm), cleaned of root remains and we sieved with the mesh size of 20 x 20 cm. The lysimeters filled with earth taken from the rice fields. Rice sowing is done in rows, the distance between rows is 15 cm, the depth of seed sealing is 1.5-2 cm, and the standard of seed sowing is 250 kg/hectare. We made the distribution (planting) of the plants in the germination phase for all the variants of the experiment in order to form the optimal density (250-300 plants per m^2). During the experiment, the following observations and determinations were made: daily growth of plants, recording of plant development phases, dates of appearance of each new leaf, photosynthetic surface, root growth, chlorophyll content. The emistime treatments favor the intense growth of the stems.

RESULTS

The main and initial factors of the external environment on the growth and development of seedlings which have a high variability, are generally considered to be temperature, humidity and light. However, for rice cultivation, temperature is of great importance, it varies considerably over time and is a key factor for survival. As shown in Figure 1, the temperature dynamics over the years of study were characterized by a sharp increase and decrease relative to the annual average, forming various conditions for the passage of growth phases of rice plants. Thus, in 2020 there were favorable conditions for the placement and laying of generative organs, which had a positive effect on the rate of productive bush and an increase innumber of grains at maturity. In 2021, the conditions were less favorable for the Nerica 6 rice variety. This led to a decrease in the grain mass of the main panicle and the plant as a whole. Air temperature results during the growing season vary significantly with application rates (Figure 1). These results reveal that an increase in the mass of grains of the main panicle in 2020 compared to 2021. However in 2021, a decrease in the mass of grains of the main panicle was observed in July.

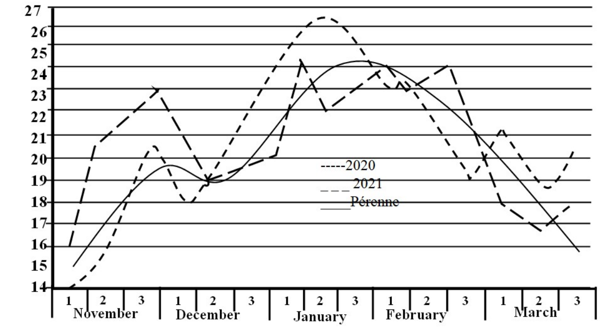

Figure 1. Air temperature during rice growing season

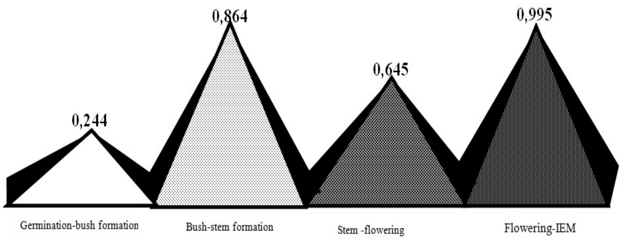

Figure 2. Photosynthetic potential of rice plants of the Nerica 6 variety, in millions of m2. Day/ha

It is known that stress, acting on the biological system, affects the subsequent response of the system. In this case, the resistance of plants to dysfunctional factors is manifested, divided into active and passive. O. A. Zauralov attributes to passive stability the resting state of plants, and to active - their ability to maintain normal metabolism and active growth under stressful conditions (Sauralov O.A., 2000). The characteristic of active resistance may be the ability of plants to accumulate primary assimilations in the process of photosynthesis. The unfavorable environmental factors that developed in 2021 negatively affected the photosynthetic activity of the leaf apparatus during the flowering period, as evidenced by the values of the photosynthetic potential (Figure 2). One of the ways to increase the resistance of plants to stress factors and to bring the yield achieved in these climatic conditions of the soil closer to the potential is the use of plant growth regulators. The effectiveness of using growth regulators in rice cultivation is mentioned by many researchers (CheoudjenA.Kh, Sinyagovsky V.I., 2002; Aliev D.A, 1974). However, the emergence every year of a large number of new growth regulators with an unexplored spectrum of their action necessitates a more detailed study of their regulatory role in rice ontogenesis.

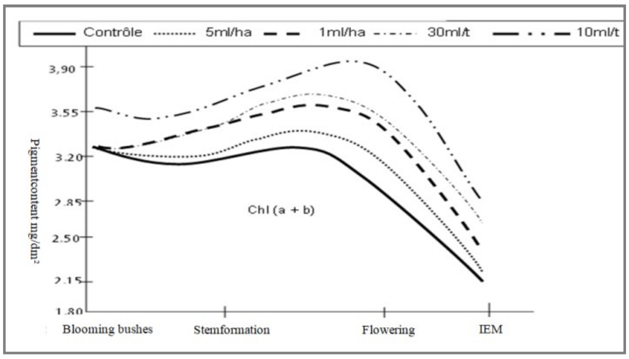

Figure 3. Evolution of chlorophyll a and b content in rice leaves according to different methods of application of emistime

In the lysimetric and field experiments located at the Loudima rice growing site, we studied the effect of different doses and methods of using the emistime drug on the growth, development and yield of rice plants. The results of the studies showed a significant increase in rice grain yield (up to 45% in the lysimetric experiment and up to 9% in the field).

As we know, the value of the harvest strongly depends on the functioning of the photosynthetic apparatus and the amount of assimilates accumulated in the process of photosynthesis. One of the most important indicators with which the value of the crop is most closely correlated is the photosynthetic potential (PP), which determines the completeness of the dynamics of formation and the degree of perfection of sowing (Aliev DA, 1974). The effect of emistime on the PP of rice plants was manifested in maintaining it at a high level throughout the vegetation. Thus, during the growing season, the excess control was 21.0-42.4% (depending on the dose and method of treatment). Another indicator of the functioning of the photosynthetic apparatus is the content of plastid pigments, which, as accents of solar energy, characterize the photosynthetic productivity of the plant (Figure 3). Figure 3 shows that the total chlorophyll a and b content of control plants in the casing phase decreased. This is probably due to the inability of the plants to provide them with an assimilation surface during the period of intensive growth. In treated plants, this decrease was practically not observed, which indicates a high intensity of photosynthesis during this period.

DISCUSSION

The action of the growth regulator (emistime) was evaluated on the growth and production of the rice variety on different treatments. The emistime treatments favor the intense growth of the stems. The work of Voroviob (2003) and Erigine (1981) showed the role of the growth stimulant in increasing rice production and plant growth. Our growth regulator investigations showed that the addition of emistime improved not only the production of the rice variety, but also the process of photosynthesis. This proves the determining role of emistime in the formation of ears, hence its contribution to the improvement of rice yield. This response of the rice variety to the supply of emistime would be due to the importance of the growth regulator in plant metabolism. The productivity of rice plants depends on their genotypes and external factors. In a complex chain of correlations of physiological and biochemical processes taking place in the plant, to each of them belongs a certain role in the formation of the harvest.

The rapid growth of the main stem observed at the level of the emistime treatment (10 ml/t, 30 ml/t, 1 ml/ha, 5 ml/ha) and the control at two months after sowing is explained by the fact that this period coincides with the delay flowering during which the rate of photosynthesis would be high in order to be able to satisfy the needs of the plant in elaborated substances necessary at the time of floral initiation (Moore P.H and Ginosa H, 1983).

CONCLUSION

As you can see from the above data, using growth regulators it is possible to optimize many processes of the vital activity of rice. Having the ability to enhance the realization of the potential possibilities of plants, they actively influence productivity. Therefore, by using growth regulators of different orientations, it is possible to modify the donor-acceptor relationships of plants in order to obtain a high and high-quality harvest of rice grains. Treatment with growth regulators favored an increase in chlorophyll content. It should be remembered that growth regulators do not replace the elements of rice cultivation technology, but only constitute an effective and complementary approach to intensive technology that contributes to the emergence of the agricultural system to a completely new stage of development.

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