THE IMPORTANCE OF SOIL SUPPLY WITH PHOSPHORUS AND DIFFERENT FORMS OF NITROGEN FERTILIZERS IN INCREASING THE EFFICIENCY OF ENERGY EXCHANGE OF THE LEAVES OF THE ARTICHOKE PRICKLY

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ABSTRACT

As a result of the studies carried out, it was found that the development of the artichoke prickly is in direct and inverse correlation with certain phases of plant development, with a change in the respiratory systems. For example, the developmental phases of 3-4 true leaves and seed maturation in artichoke prickly and respiration are in direct correlation with the pentose phosphate cycle, and in the phases of budding, flowering and seed maturation, respiration is in direct correlation with the glycolytic cycle. Productivity during photosynthesis and the glycolytic respiration cycle is in direct relationship, and in inverse relationship with the pentose phosphate cycle. The experimental results also indicate that there are positive interactions between the uncoupling of the oxidation and phosphorylation process, the activity and efficiency of respiration.The above interactions, in particular correlations, can be used as criteria for studying the productivity (leaf biomass) of artichoke prickly, as well as increasing the biosynthesis of biologically active substances (rutin, lutelin, etc.).

KEYWORDS: *Oxidation, Phosphorylation, Nitrogen Fertilizers, Photosynthetic Productivity, Rutin, Luteolin, Glycolytic, Pentose Phosphate, Biosynthesis, Biomass.*

INTRODUCTION

It is known that nitrogen fertilizers have the most significant effect on plant productivity among mineral fertilizers. With the use of a stable nitrogen isotope ^{15}N, it was found that on a typical gray soil, cotton uses fertilizer nitrogen not by 60-70%, as previously thought, but by 40-42%

(Ryzhov S.N., Pirakhunov T.P., Tashkuziev M.M. ., Aliev A.T., 1979; Khodzhiev T., Bairov A., 1992).

The main reason for the incomplete use of nitrogen fertilizers by plants is gaseous and other types of losses resulting from denitrification and leaching of nitrates into groundwater, such losses reach 40-45 percent and more.

The development of methods for the effective use of nitrogen fertilizers for plants, including prickly artichoke, is of not only scientific, but also practical importance, since it provides high yields and improved quality of the studied plants, as well as reducing the level of environmental pollution.

The transformation of fertilizer nitrogen in irrigated typical sierozem and gravelly sierozem, as well as its use by plants, depending on the nitrogen nutrition regime, has been insufficiently studied (Abzalov A.A., 2009; Ki m L.M., 1988; Pirakhunov T.P., Mannanova R. N., Zakirova D., 1988).

This paper highlights the development phases, exploration of minerals and nitrogen fertilizers at a certain stage, as well as the change in the respiratory system during the growth period. For example, from 3-4 phases of true leaves to the period of active growth and development, the intensity of respiration and glycolytic cycle, respiration productivity increases, but the period of the pentose phosphate cycle is reduced. By the end of the growing season, the opposite indicators of the above-mentioned aspects are observed.

Objective: It is known that the process of respiration in plant cells is considered the basis of energy activity. In this regard, we set a goal to study the effect of various forms of nitrogen fertilizers in conditions of different phosphorus supply on the respiration chemistry of artichoke prickly.

Methods of research: the sowing of artichoke prickly seeds was carried out at the experimental site of Tashkent pharmaceutical institute on March 5, 2019 according to the scheme 90x40x1. In the experiments, ammonium sulfate – 150, phosphorus P_2O_5 – 110 and potassium 75 kg/g in the form of K_2O were used. Watering is carried out according to the 4-6-2 scheme.

RESULTS AND DISCUSSION

The result of the research found that, despite the sufficiency of soil with phosphorus in varying degrees and use of nitrogenous fertilizers in all variants the maximum point of breathing process is the most active period of development of plants in the phase of budding and flowering (table. 1).

When considering the impact of different standards of soil sufficiency with phosphorus on the process of respiration, it should be noted that the more phosphorus, the more respiration occurs.

The sufficiency of phosphorus in the soil should be medium, since its high content does not lead to an increase in the intensity of respiration. To provide phosphorus to the soil, 200 kg is enough, at 300 kg it does not provide economic efficiency, otherwise the cost of artichoke raw materials increases.

When looking at the table in detail, it can be found that the value of the respiration rate is also associated with the forms of nitrogen fertilizers. For example, the effect of urea on the respiration rate of artichokes starting from 3-4 true leaves and in the remaining periods of development is greater compared to the use of ammonium nitrate fertilizer.

TABLE 1.THE EFFECT OF DIFFERENT NITROGEN FERTILIZERS AND THE SUFFICIENCY OF PHOSPHORUS IN THE SOIL ON THE RESPIRATION PROCESS OF ARTICHOKE PRICKLY (O_2 G/H OF RAW MASS) FIELD EXPERIMENTS

Level of phosphorus supply	Forms Of nitrogen fertilizers	Phases of growth and development				
		3-4 real leaves	budding	flowering	fruiting	Ripening of seeds
Low	NH_4NO_3	580	644	821	785	632
Low	$CO(NH_2)_2$	550	678	849	806	647
Average	NH_4NO_3	630	715	883	867	685
Average	$CO(NH_2)_2$	580	742	910	844	702
Average	NH_4Cl	530	686	812	792	648
Average	KNO_3	575	734	846	810	665
High	NH_4NO_3	650	739	912	878	714
High	$CO_4(NH_2)_2$	610	752	946	908	742

However, at the beginning of plant development – in the phase of 3-4 true leaves, the effect of ammonium nitrate on the respiration process is much higher than that of urea.

The same thing was observed with high and medium sufficiency of phosphorus in the soil.

From this we can conclude that in the initial stage of artichoke development – in the phase of 3-4 real leaves, the plant is relatively better at absorbing ammonium nitrate than urea. So, in the initial stage of artichoke development in the phase of 3-4 real leaves, it is better to use nitrogen in the form of ammonium nitrate, and in the future – urea. Nitrogen in the form of ammonium chloride is ineffective in breathing.

The nitrogen in the potassium nitrate is more effective in the respiration process than ammonium chloride. However, it is impossible to draw a conclusion about the energy of respiration, the state of the chemistry of respiration, the consumption of the substrate, or other factors, only by the results of the intensity of plants respiration. Therefore, it is necessary to determine other indicators of respiration, for example, the determination of the respiratory coefficient.

During respiration, the substrate is oxidized due to the absorbed oxygen and carbon dioxide is released into the external environment. Usually, in many cases, carbohydrates are consumed as a substrate of respiration. In this case, the ratio of the volume of carbon dioxide released to the volume of oxygen absorbed during the respiration of plants is 1. Even if the plant is provided with a large volume of oxygen, this indicator remains equal to 1. If the substrate of the plant respiration is protein, fat, or other similar substances, then the respiration coefficient will be less than 1 or may be more than 1 if more oxidized compounds are consumed [7,8].

The results of the experiments showed that in all phases of artichoke development from the phase of 3-4 true leaves, the respiration coefficient increased, and at the end of the growing season this coefficient decreased (Table 2).

The following data may be the cause of this phenomenon:

1. During periods of active growth and development of plant tissue, plants consume a lot of oxygen.

2. The consumption of a large number of substrates as they grow and develop, primarily carbohydrates, leads to increased oxidative processes, which in turn causes the absorption of more oxygen.

During respiration, proteins and fats are oxidized and converted into carbohydrates. The resulting carbohydrates are consumed during respiration.

TABLE 2.INFLUENCE ON THE RESPIRATION RATE OF ARTICHOKE (μL O_2 G/H) OF SOIL SUFFICIENCY WITH PHOSPHORUS AND NITROGEN FERTILIZERS

Level of phosphorus supply kg/ha	Forms of nitrogen fertilizers	Phases of growth and development				
		3-4 real leaves	budding	flowering	fruiting	Ripening of seeds
100	NH_4NO_3	1.0	1.3	1.5	1.4	1.2
100	$CO(NH_2)_2$	1.2	1.2	1.4	1.3	1.2
200	NH_4NO_3	0.9	1.2	1.3	1.3	1.1
200	$CO(NH_2)_2$	1.0	1.3	1.3	1.2	1.0
200	NH_4Cl	1.0	1.4	1.5	1.5	1.3
200	KNO_3	1.1	1.3	1.4	1.4	1.2
300	NH_4NO_3	0.8	1.2	1.3	1.2	1.1
300	$CO(NH_2)_2$	1.0	1.1	1.2	1.2	1.0

Some researchers note that as plants grow and develop, organic acids accumulate in the cells, which increases the release of CO_2 from plants. Apparently in this regard, during the period of active growth of the artichoke, the respiration coefficient increases.

Comparison of the data showed that by providing soil with phosphorus at low level, the ratio of respiration is higher than the supply of soil phosphorus in the medium and high levels, so weak provision of soil phosphorus leads to a reduction in the number of carbohydrate as a substrate for respiration and, in this regard, increased consumption of organic acids in plants, this increases the consumption of oxygen and release of carbon dioxide.

In the phase of 3-4 true leaves, the use of NH_4NO_3 in comparison with urea gives a lower value of the respiration coefficient, and in the period of active growth, on the contrary, the respiration coefficient increases. Therefore, NH_4NO_3 in the 3-4 phase of the real leaves increases the formation of carbohydrates than in the assimilation of urea. Hence, it can be concluded that during the active growth of plants, urea is absorbed better and more carbohydrates are formed than when NH_4NO_3 is absorbed.

During the period of active growth, the respiration coefficient under the influence of NH_4NO_3 increases.

With an increase in the supply of phosphorus, the respiration coefficient becomes less, because at a large and medium level of phosphorus supply to the soil, a lot of carbohydrates are formed, because of this, the value of the respiration coefficient decreases.

The change of the respiratory systems. It is necessary to emphasize the fact that the pentose phosphate cycle and glycolysis cannot be considered independent processes when changing the respiration substrate. They are similar in many ways, and some compounds such as fructose-6-phosphate, fructose-1.6 diphosphate, and triose phosphates can be formed in both cycles.

In addition, the enzymes of the type of aldolase, triazolothiadiazoles, hexoseaminidase are found in both the ways of breathing. With the help of labeled sugar atoms in experiments, they were found as oxidation products of substrates that pass from one respiratory system to another. Despite this, sugar oxidation is important for both respiratory pathways.

Some researchers have concluded from the results of experiments: the glycolytic respiratory system is a source of ATP, i.e., as a source of providing plant cells with energy.

Recently, the biological role of the pentose phosphate cycle in metabolism is considered to be the accumulation of reduced NADP.

Thus, when considering the respiratory pathways, the glycolytic pathway can be considered a source of ATP formation, and the pentose phosphate cycle can be considered a source of reduced NADP-H_2 formation.

The glycolytic and pentose phosphate pathways are involved in the respiration process. Therefore, it is not accidental to detect with the help of toxic substances the share of the pentose phosphate pathway in the process of respiration. These toxic substances are sodium fluoride (NaF), the monoiodoacetate, malonate and others (Table 3**)**.

As it is known, in plant tissues, the infiltration of sodium fluoride should be carried out in a very short time. Then the mechanism of action of sodium fluoride is as follows: fluoride with low dissociated phosphate binds Mg^{2+} and forms a complex: $(Mg^{2+})(F_2)(HPO_4)$.

This complex binds to activated magnesium enzymes and blocks them. Therefore, the effect of fluoride depends on the distribution of phosphorus in plant cells.

TABLE 3.INFLUENCE OF SOIL SUFFICIENCY LEVELS WITH DIFFERENT FORMS OF NITROGEN FERTILIZERS AND PHOSPHORUS ON THE SHARE OF THE PENTOSE PHOSPHATE CYCLE IN THE RESPIRATION PROCESS (AS A PERCENTAGE OF THE TOTAL RESPIRATION INTENSITY)
FIELD EXPERIMENTS

Level of phosphorus supply	Forms of nitrogen fertilizers	Phases of growth and development				
		3-4 true leaves	budding	flowering	fruiting	Ripening of seeds
100	NH_4NO_3	36,6	32,8	29,5	33,4	37,8
100	$CO(NH_2)_2$	39,8	31,2	27,4	30,8	35,4
200	NH_4NO_3	32,5	29,1	26,5	27,9	34,2
200	$CO(NH_2)_2$	33,6	28,6	24,7	26,9	32,1
200	NH_4Cl	35,9	30,8	27,5	29,8	33,6
200	KNO_3	33,0	30,5	26,8	27,4	32,6
300	NH_4NO_3	31,4	28,1	25,2	26,0	32,1
300	$CO(NH_2)_2$	32,7	26,8	23,4	24,9	31,4

Ca^{2+} in this complex displaces Mg^{2+} and inhibits fluorides, since the ratio of the glycolytic cycle and the pentose phosphate cycle in the process of general respiration is very important. We have set the task to study these factors.

Blocking the process of respiration of the enolase enzyme, the ratio of glycolysis in the process of general respiration NaF 2*10 2 was determined, the solution was introduced into intact artichoke cells by vacuum infiltration. After an hour of vacuum filtration, the respiratory rate was measured by the monometric method using the Warburg apparatus. In the Warburg apparatus, the water temperature was maintained at $+30^0$C throughout the experiment.

In the control variant, distilled water was injected into the intact cells instead of the NaF solution. The experiments were carried out in 4-fold repetition. The results of the experiments show that the plant in the periods from the phase of 3-4 true leaves to the period of active growth in the process of general respiration, the proportion of the glycolytic cycle increased (Table 6), and the proportion of the pentose phosphate cycle (Table 3) decreased. This indicates that part of the reactions of the pentose phosphate cycle in the process of respiration has passed to the glycolytic cycle.

From the point of view of researchers (Table 3), the pentose phosphate cycle in the process of respiration is ineffective compared to the glycolytic cycle. An increase in the glycolytic cycle and a decrease in the proportion of the pentose phosphate cycle indicates that during this period in the process of respiration, energy efficiency increases.

It should be noted that in our studies there was a tendency – the higher the phosphorus supply, the more the share of the glycolytic cycle increases and the share of the pentose phosphate cycle decreases. But during the transition from the average sufficiency of phosphorus to the high, a decrease in the efficiency of respiration was observed. In this regard, from an economic point of view, it is better to provide the soil with phosphorus at an average level, since providing phosphorus at a high level is not economical.

TABLE 4.THE INFLUENCE OF THE LEVELS OF SOIL SUFFICIENCY WITH DIFFERENT FORMS OF NITROGEN FERTILIZERS AND PHOSPHORUS DURING THE PENTOSE PHOSPHATE CYCLE ON THE VALUE OF RESPIRATION (AS A PERCENTAGE TO THE INTENSITY RATIO OF TOTAL RESPIRATION) FIELD EXPERIMENTS

Level of phosphorus supply	Forms of nitrogen fertilizers	Phases of growth and development				
		3-4 true leaves	budding	flowering	fruiting	ripening of seeds
100	NH_4NO_3	63,4	67,2	70,5	66,6	62,2
100	$CO(NH_2)_2$	60,4	68,8	72,6	69,2	64,6
200	NH_4NO_3	67,5	67,5	73,5	72,1	65,8
200	$CO(NH_2)_2$	66,4	66,4	75,3	73,1	67,9
200	NH_4Cl	64,11	69,2	72,5	70,2	66,4
200	KNO_3	67,0	69,5	73,2	72,6	64,4
300	NH_4NO_3	68,6	71,9	74,8	74,0	67,9
300	$CO(NH_2)_2$	67,3	73,2	76,6	75,1	68,6

Observations have revealed that regardless of the level of phosphorus, under the influence of NH_4NO_3 in the stage of 3-4 true leaves the effectiveness of pentose phosphate cycle is more than at the urea, and in all other phases of growth and development, on the contrary, under the influence of urea the efficiency of pentose phosphate cycle is less.

Thus, in the phase of 3-4 true leaves, the effect of NH_4NO_3 on respiration productivity is stronger, and in the remaining periods of plant development, the effect of urea is greater. So, it is advisable to fertilize with ammonium nitrate in the phase of 3-4 real leaves, and in the other phases of development - with urea. From the point of view of energy, the most inefficient among nitrogen fertilizers is ammonium chloride. Accordingly, to achieve the goal, it is necessary to use ammonium nitrate in the development phase of 3-4 real artichoke leaves with an average level of phosphorus supply, and in the remaining periods of development, it is better to fertilize with urea.

The effectiveness of breathing. We know that the main task of the breathing process is to provide energy for the metabolic reaction. According to the researchers, the released energy as a result of the oxidation of respiration products with oxygen is re-accumulated in the composition of nucleotides and other compounds. Among these structures, the most important is ATP.

The most important properties of ATP and similar compounds are the ability to combine with the products of respiration under different altered conditions.

TABLE 5.THE OPTIMAL CONCENTRATION OF 2,4 DNP (DINITROPHENOL) FOR THE DISSOCIATION REACTIONS OF OXIDATION AND PHOSPHORYLATION FIELD EXPERIMENTS

Phosphorus supply level, kg/ha	Forms of nitrogen fertilizers	Periods of growth and development				
		3-4 true leaves	budding	flowering	fruiting	ripening of seeds
100	NH_4NO_3	1,5	1,75	2,00	2,00	1,50
100	$CO(NH_2)_2$	1,25	2,00	2,25	2,00	1,75
200	NH_4NO_3	1,75	2,00	2,25	2,25	1,50
200	$CO(NH_2)_2$	1,50	2,25	2,50	2,25	1,75
200	NH_4Cl	1,50	1,75	2,00	1,75	1,25
200	KNO_3	1,75	2,00	2,25	2,00	1,75
300	NH_4NO_3	1,75	2,25	2,50	2,25	1,50
300	$CO(NH_2)_2$	1,50	2,25	2,50	2,00	1,75

It should be noted that the formation of macroergic bonds (this is a chemical compound between phosphorus and oxygen atoms) occurs as part of the ATP structure during energy storage.

Due to the fact that ATP has the property of a high rate of cleavage, when participating in the reactions, phosphate groups can easily break off. The main task of respiration is to provide ATP by converting chemical energy into ATP energy.

We know that oxygen and phosphorus are necessary for the normal course of the respiratory process. Oxygen electrons, acting as an acceptor, participate in the oxidation of respiratory products, and phosphorus participates in the formation of ATP molecules.

It should be noted that regardless of the intensity of gas exchange during breathing, it is impossible to draw a conclusion about the energy, that is, about the amount of ATP formed. You can judge the energy of the breathing process by the P/O indicator. More often, this indicator indicates how much phosphate residues were absorbed in the composition of organic substances due to the consumption of one mole of oxygen. In other cases, toxic compounds are used to break down the respiratory substrates.

It should be noted that under the influence of toxic compounds, the products of respiration are broken down. When toxic compounds are introduced into intact cells to break down and separate substances, the interaction between respiration and the phosphorylation process is disrupted. In such cases, the phosphorylation process is very slow or stops, but the respiration process continues.

It is known that first in animals, and then in plants, it was proved that DNP has the property of slowing down the processes that depend on the energy released during respiration. Splitting toxic substances under the influence of DNP stop the processes of formation of substances in cells, and the cleavage of phosphoric macroergic compounds is observed. In particular, some phosphorylation reactions were stopped. In many cases of collecting information about the respiration of plants and in their interpretation, experimental data were used, given as a percentage of the effect of toxic substances on the maximum stimulation of the intensity of respiration or on the slowing down of the intensity of respiration.

TABLE 6.EFFICIENCY OF DISSOCIATION OF OXIDATION AND PHOSPHORYLATION REACTIONS IN ARTICHOKE (INCREASED RESPIRATION PROCESS) (AS A PERCENTAGE TO CONTROL)

Phosphorus supply level	Forms of nitrogen fertilizers	Phases of growth and development				
		3-4 true leaves	budding	flowering	fruiting	ripening of seeds
100	NH_4NO_3	12	24	31	27	15
100	$CO(NH_2)_2$	10	29	36	32	16
200	NH_4NO_3	18	30	48	42	22
200	$CO(NH_2)_2$	14	35	54	46	24
200	NH_4Cl	10	26	39	35	18
200	KNO_3	16	31	44	39	19
300	NH_4NO_3	22	34	51	43	24
300	$CO(NH_2)_2$	18	38	56	48	26

Some researchers (8) believe that inhibitory analysis can be used to judge the energy productivity of the studied objects. In this regard, it is proposed to use the method of inhibitory analysis in identifying the energy productivity of respiration. The above-mentioned authors believe that it is possible to identify quantitative data on the energy of respiration, if you enter the coefficient of separation of the processes of oxidation and phosphorylation in the study of the process of respiration.

In our studies, the toxic substance 2,4 DNP was used (Tables 4 and 5) to separate the oxidation and phosphorylation reactions. To do this, as an experimental option, cut branches were taken and placed in solutions with different concentrations of 2,4 DNP, for comparison with experimental data, the control was placed in water. In this regard, during the experiment, the properties of the toxic substance used to separate the oxidation and phosphorylation reactions were determined, taking into account the physiological state of the plant, and the optimal concentration of the toxic substance was chosen before each experiment. The toxic substance (2,4 DNP) was introduced by vacuum infiltration into intact artichoke cells.

In this solution, the plant cells were infiltrated for an hour and then the amount of gas exchange during the respiration of the plant was determined. The amount of gas exchange during respiration (at a bath water temperature of +30^{0}C) in the plant cells was determined by the Warburg apparatus.

As a result of the experiments, it was found out that in all variants from the phase of 3-4 real leaves to the period of active growth and development of plants, an increase in the concentration of DNP, used to separate oxidation and phosphorylation, was observed, and at the end of the growing season this indicator decreased.

TABLE 7.PHOTOSYNTHETIC PRODUCTIVITY (G/M^2 DAY)

Phosphorus supply level kg / ha	Forms of nitrogen fertilizers	Phases of growth and development				
		3-4 true leaves	budding	flowering	fruiting	ripening of seeds
100	NH_4NO_3	1,84	3,14	5,74	5,38	2,18
100	$CO(NH_2)_2$	1,71	3,55	6,12	5,49	2,34
200	NH_4NO_3	2,18	3,67	6,18	5,84	2,44
200	$CO(NH_2)_2$	2,04	3,92	6,74	6,08	2,74
200	NH_4Cl	2,02	3,38	5,91	5,68	2,32
200	KNO_3	2,01	3,59	6,07	5,77	2,38
300	NH_4NO_3	2,24	3,81	6,25	5,92	2,51
300	$CO(NH_2)_2$	2,16	4,01	6,57	5,98	2,49

As the activity of physiological and biochemical processes in plants increased, 2,4 DNP with a higher concentration had to be used to separate the oxidation and phosphorylation reactions. In other words, as the activity of growth processes in the plant increases, the conjugation of oxidation reactions with phosphorylation increases.

According to the results of the experiments, the degree of conjugation of the oxidation and phosphorylation reactions is affected by the level of soil sufficiency with phosphorus and various forms of nitrogen fertilizers. For example, in the phase 3-4 of real leaves, the value of this indicator when using ammonium nitrate was higher than when using urea.

In the other phases of development, the value of this indicator was higher under the influence of urea compared to ammonium nitrate.

It follows that the degree of conjugation of oxidation with phosphorylation is in direct proportion to the activity of physiological and biochemical reactions. This means that the concentration of the toxic substance (2,4 DNP) used to separate the processes of oxidation and phosphorylation is an indicator showing the activity of physiological and biochemical processes. This pattern was also observed when phosphorus was sufficient at medium and high levels.

Thus, in the phase of plant development of 3-4 real leaves, it is advisable to use ammonium nitrate, and in other cases urea. It should also be noted that when providing phosphorus to the soil at a high level, there is no proportionality between the amount of phosphorus supply and the increase in the concentration of toxic substances under the influence of all forms of nitrogen fertilizers. Therefore, from the point of view of economy, it is advisable to fertilize the soil with an average level of phosphorus sufficiency.

TABLE 8.INTENSITY AND PRODUCTIVITY OF RESPIRATION (PER RAW WEIGHT, μL O^2 /G/H)

Phosphorus supply level, kg / ha	Forms of nitrogen fertilizers	Phases of growth and development									
		3-4 true leaves		budding		flowering		fruiting		ripening of seeds	
		Breathing intensity	Respiratory productivity	Breathing intensity	Respiratory productivity	Breathing intensity	Respiratory productivity	Breathing intensity	Respiratory productivity	Breathing intensity	Respiratory productivity
100	NH_4NO_3	580	371,2	644	457,2	821	632,2	785	565,2	632	372,9
100	$CO(NH_2)_2$	550	330,0	678	508,2	849	704,2	806	604,5	647	401,1
200	NH_4NO_3	630	434,7	715	536,2	883	724,1	867	684,9	685	431,5
200	$CO(NH_2)_2$	580	377,0	742	593,6	910	782,6	894	724,1	702	456,3
200	NH_4Cl	530	349,8	686	487,1	812	633,4	792	586,1	648	388,8
200	KNO_3	575	402,5	734	543,2	846	676,8	810	623,7	665	412,3
300	NH_4NO_3	650	685,0	739	569,0	912	757,0	878	711,2	714	457,0
300	$CO(NH_2)_2$	610	620,9	752	609,1	946	832,5	908	753,6	742	482,3

In our studies, the concentrations of toxic substances used to separate the oxidation reactions with phosphorylation were ascertained (Table 6). It is easy to see from the data in this table a direct proportionality between the percentages of the separation of oxidation and phosphorylation reactions and the concentration of toxic substances. The mean concentrations of toxic substances (2,4 DNP) is used when uncoupling of oxidation and phosphorylation can be used as physiological and biochemical indicators in determining the effectiveness of the above reactions.

It should be noted that there are direct relationships between the efficiency of conjugation of oxidation and phosphorylation reactions with the productivity of photosynthesis (Table 7), with the intensity and productivity of respiration (Table 4 and 8).

CONCLUSIONS

As a result of the conducted experiments on the separation of oxidation and phosphorylation reactions, the concentrations of the used toxic substance can be used as a value of the reflecting activity of physiological and biological processes.

A direct proportionality was observed between the efficiency of the oxidation and phosphorylation reactions and the productivity of photosynthesis and the oxidation and reduction processes.

From the phase of 3-4 true leaves to the periods of active growth and development, the respiration rate, respiration coefficient, glycolytic cycle, respiration productivity increase, but the value of the pentose phosphate cycle decreases. At the end of the growing season, the opposite picture of the above is observed.

In the phase of 3-4 real leaves, despite the degree of phosphorus intensity and respiration rate, its productivity and energy under the influence of urea is higher, and in the middle of the growing season, on the contrary, under the influence of ammonium sulfate, an increase in these parameters is found.

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