# THE CHANGING OF PHOSPHATE REGIME OF SOILS WITH CARBON-MAGNESIA SALTING UNDER THE INFLUENCE OF NEW COMPLEX FERTILIZERS AT COTTON CULTIVATION

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## ABSTRACT

In condition of meadow ground Zarafshan oasis studied influence phosphorus containing fertilizers NPhF, NCPhF on phosphate mode of these ground are installed utilization ratio of phosphorus from fertilizers. The installed коррелятивные to dependencies between rate of the fertilizers and available forms of phosphorus of ground, capacity of the contents available phosphate, growing and development of the plants of the cotton plant sort "Omad" and "Akdariya-6". Will installed optimum rate of the contributing (175 kgs/ha $P_2O_5$) phosphorus containing fertilizers in condition of meadow ground Zarafshan oasis.

**Keywords:** Phosphate, carbonates, Kizil-Kum phosphorites, NPhF (nitric-phosphoric fertilizers), NCPhF (nitro-calcium phosphate fertilizers).

## INTRODUCTION

It's well known, that conditions of phosphate nourishing of cotton-plant on the soils with carbon-magnesium salting, when the content of carbonate in the soil is higher than 10 %, and in separate cases it reaches 45 %, and the share of carbonates of magnesium exceeds 20-30 % from these total amounts depends on the degree of availability of phosphorus in the content of phosphorus containing fertilizers [1, 2, 3, 10, 11, 12, 13, 14].

It is proved by numerous researches, conducted on the given soils the surplus of carbonate considerably reduces the

availability of phosphoric fertilizers for plants, and here it must be marked, that the deficiency of phosphorus mostly displayed at high norms of nitric and potassic fertilizers. The long-standing permanent experiments on studying the effectiveness of fertilizers in cotton-alfalfa crop rotation and at monoculture, conducted at the chair of agrochemistry of (2001-2022) show, that on the soils with large content of carbonates the chemical absorption of available phosphorus increases at the absence of introduction of organic fertilizers, at monoculture and one-sided introduction of only phosphoric fertilizers [4, 5, 13, 15].

The availability of phosphorus out of fertilizers, and their fixing in the soil is mostly determined by the form of phosphoric fertilizers, the content of water-soluable and citrate-soluable phosphates as well as methods and terms of introduction of fertilizers.

It is ascertained by research, that the form of fertilizers, methods of their introduction not only influence on the coefficient of application of phosphoric fertilizers, but also influence on the coefficient of application of phosphorus from the soil and change the fractional composition of phosphorus in the soil.

It is ascertained by the separate laboratory and vegetational experiments the dependence of assimilation of phosphoric fertilizers by plants (cotton-plant, corn, potatoes, wheat) from the content of carbonates and bicarbonates of calcium and magnesium in the soil [1, 3, 9, 10, 14].

At present the chemical industry of Uzbekistan produces phosphoric and complex fertilizers and phosphorites of Kizilkum deposit which serve as a raw material.

There phosphorites differ with rather low content of $P_2O_5$ and in this connection there is conducted their dressing up to 18-20 % and it is considerably lower, than in the composition of phosphorites of Kara-Tau. The reserves of Jeroy-Cardara deposit of Kizil-Kum phosphorites are elaborated on the base of large investments of Navoi mining-metallurgical plant and reserves of phosphorites valued up to 303,6 mln t of ore or 57,7 mln t of $P_2O_5$. For extending of application of phosphorites of Jeroy – Sardara deposit and increasing the quality of raw materials for chemical industry in 2006 there were begun on dressing natural phosphorites. The complex scheme allowed to get 400000 t of washed and burned concentrate and 200000 t of washed dry concentrate. In the future it is planned to obtain up to 800000 t of dressed concentrate [6 - 8].

The chemical plants of Samarkand, Navoi and Fergana produce a number of complex fertilizers of nitrophoses,

superphoses, nitroammophoses type on the base of phosphorites, which are distributed under the names NPhF (nitric-phosphoric fertilizers), CPh (calcium phosphate), CAPh (calcium ammo-phosphate), NCPhF (nitro-calcium phosphate fertilizers), PhSLS (phosphoric suspense liquid saltetre).

These fertilizers, by the content of phosphorus, nitrogen, the degree of availability of these elements for plants and also the content of other elements and ballast considerably differ from traditional ammophose, nitrophoses, nitroammophoses and carboammophoses, at present in agriculture of Uzbekistan the managing of phosphate regime of the soil is very important in connection with considerable lowering of the coefficient of the returning of carrying out this element. In this connection the special role belongs to the searching of ways of raising the effectiveness of introduced fertilizers. We conducted laboratory and field experiments on the study of influence of separate new complex fertilizers on the soils with carbon-magnesium salting on the growth, development and yield-capacity of cotton-plant, change of phosphate regime of the soil and availability of phosphoric fertilizers during different periods of plant vegetation.

## MATERIALS AND METHODS

The experiments were conducted between Akdarya and Karadarya rivers (Miancal), which are the tributaries of the Zarafshan river. Under these conditions there was studied the content of mobile (available under conditions of carbonate soils) phosphates in the soil, the changing of fractional composition of soil phosphates.

There was studied the influence of fertilizers on the growth, development and yield-capacity of cotton-plant, determined the parameters of optimum conditions of phosphoric feeding, which ensure better conditions of feeding and raising the coefficient of application of phosphoric fertilizers.

The experimental plot is situated on the meadow soils with the content of humus 1,3 %, total nitrogen 0,1 %, gross phosphorus 0,16 %, potassium 2,42 %. Before conducting the experiment – N-$NH_4$ – 22,4 mg/kg, N-$NO_3$ – 15,4 mg/kg, $P_2O_5$ – 20,8 mg/kg, $K_2O$ – 320 mg/kg. in the arable layer of the soil the total content of carbonates is 18,7 %, and among them carbonates of calcium – 14,1 %, the capacity of absorbtion of cations 14,2 mg equivalent per 100 g of soil and out of them 10,3 mg equivalent $Ca^{2+}$ and 3,3 mg equivalent $Mg^{2+}$.

During field experiments there were 11 variants. The experiment was carried out in fourfold repeatedness; the length of

the plot is 30 m, width – 7,2 m, the square – 216 $m^2$ the record square of the plot comprises 108 $m^2$.

Variants are located in the systematic order in one layer. During the experiment there were used mineral fertilizers such as: ammonia saltpetre ($NH_4NO_3$-34,6 % N), chloride potassium (KCl–60 % $K_2O$), ammophose ($NH_4H_2PO_4$ – 11-12 % N, 46 % $P_2O_5$), nitric-phosphoric fertilizers (NPhF - 10 % N, 10 % $P_2O_5$), nitro-calcium phosphate fertilizers (NCPhF - 6 % N, 16 % $P_2O_5$).

In soil sample analysis's are organized on the following methods: Humus - on Tyurin; The general nitrogen, phosphorus and potassium on Malicev-Gricenko; The nitrate nitrogen on Grandvald- Lie; ammonium nitrogen with reagent Nessler with the following determination on KFK-2; movable phosphorus and exchange potassium on method B.P.Machigin with the following determinations $K_2O$ on fiery photometer; pH - an potentiometer; the factious composition of phosphorus on method Chang-Djhekson, in variant Aksinazi Ginsburg; organic phosphorus on method Meta; the amount absorbed катионов by method Shmuk; factor capacity and intensities of phosphorus by methods R.Scofield and S.Olsen.

## RESULTS AND ANALYSIS

During our experiments the introduction of phosphoric fertilizers on the base of phosphorites of Kizilkum ensured some increase of the content of mineral phosphates in the soil, mainly water and citrate soluable ones. At the same time there has taken place the changing of absolute content of different fractions of phosphoric compounds. The greatest changes have taken place in the content of water soluable phosphates, and in addition, it happened proportionally to the increasing of the norms of phosphoric fertilizers (picture 1).

The less change has taken place in thrice-replaced phosphates of calcium. Comparatively stable on the soils of neutral and feeble alkaline and especially with high content of carbonates, phosphates of aluminium and iron in significantly increased at the application of NPhF (nitric-phosphoric fertilizers).

At application of nitrocalciumphosphate fertilizers (NCPhF) on the contrary there is marked the reduction of the content of fraction of aluminium – iron – phosphates apparently it is connected with pH of given fertilizers.

It should be marked that at introduction of NCPhF - nitrocalciumphosphate fertilizers the content of one and two replaced orthophosphates of calcium in the soil has increased. The application of both complex fertilizers (NPhF and NCPhF) contributes to some increase of

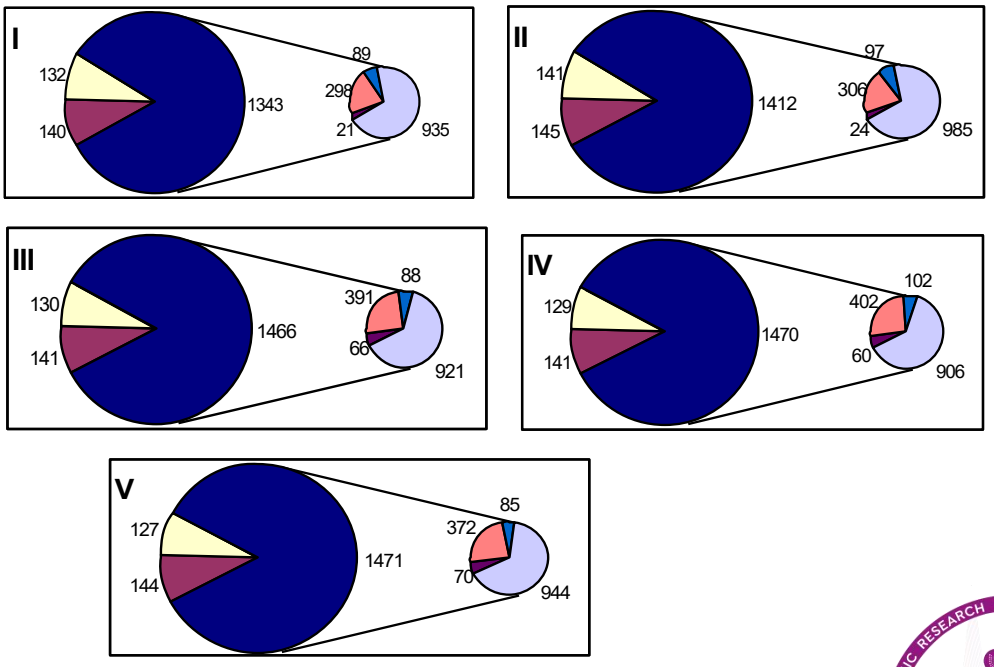
available phosphates in the soil. This difference is marked in comparison with variants, where there was used ammonia and a part of phosphates of which mostly moved to less available compounds. In our opinion it is connected with more active chemical absorbtion of carbonates calcium and magnesium of phosphates from the composition of ammophose.

In the variant with application of NCPhF there marked the improvement in supplying the plants with phosphorus in comparison with application of NPhF. In variants, where there were used 175 kg/ha of $P_2O_5$ in the forms of ammophose the content of monocalceum phosphate comprised 66 mg/kg, which is 6 mg/kg more than the application of nitrogen phosphorus fertilizer and is on the level of application of NCPhF.

It should be marked, that with the increasing the norm of introduction of phosphorus in the form of NPhF there is also observed the increase of the content of monocalceum phosphates up to 55 mg/kg, at introduction of 125 kg/ha of $P_2O_5$ and up to 64 mg/kg, at introduction of 200 kg/ha of $P_2O_5$. At the same norms of $P_2O_5$, in variants, where there was used NCPhF, the content of monocalceum phosphates was considerably higher.

As a whole it can be marked the considerable increasing of mono and dicalceum of phosphates at introduction of both new fertilizers.

At the same time at introduction NPhF there was marked insignificant increase of aluminium and iron phosphates and at introduction of NCPhF-more significant increase of the content of dicalceum of phosphates (picture 1).



I. The control without fertilizers, II $N_{250}K_{125}$ – Background, III Background + Pam 175,

IV Background + Pnphf 175, V Background + Pncphf 175

Organic phosphorus, Unsoluable remains, Mineral phosphorus,

In that: $Ca_I$ – P, Aℓ – P, Fe – P, $Ca_{II}$ – P.

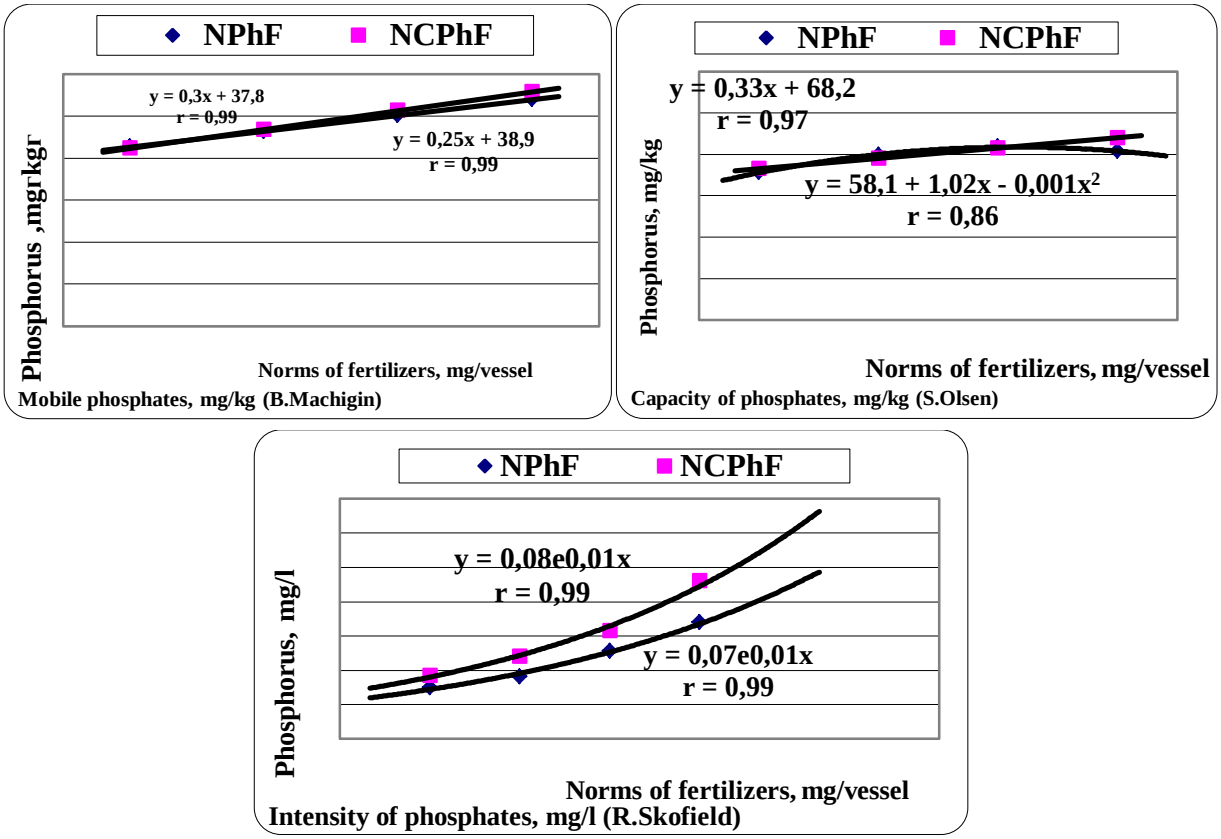
**Picture 1. Fractional composition of phosphates.**

The study of correlation dependence of the content of phosphorus by method of (B.Machigin) showed that there exists the direct dependence on the norm of fertilizers y= ax+b in the equation of regression of both types of fertilizers, and the coefficient of correlation comprises r=0,99, which proves the dependence of the content of mobile phosphorus not only on the norm, but on the type of fertilizer.

The study of the influence of fertilizers on the content and capacity of phosphates by method of S.Olsen, at introduction of NPhF and NCPhF showed that the absorbtion of phosphorus from these fertilizers considerally differ.

The curve of dependence of the capacity of content and capacity of phosphates at introduction of NPhFcorrespond the equation of regression according to formula $y=58,1+1,02X-0,01X^2$, and coefficient of correlation r=0,86, which is statistically proved by proportional increasing capacity with the increasing of the norm of fertilizers. The dependence of available phosphates on the carbonate soil at changing of the norm of introduction NCPhF corresponds to the equation of regression y=0,33X+68,2 and the coefficient of correlation r=0,97, and there is the capacity of available phosphates at introduction of NCPhF is higher than at NPhF, which indicates the absorbtion of phosphates of NCPhF mostly changeably (picture 2).

During laboratory researcher there was studied the intensity of transition into soil solution of phosphates introduced in composition of fertilizers of NPhF and NCPhF by method of R.Scofield. Every vessel with 1 kg capacity was filled with 15-60 mg/kg of $P_2O_5$. In 120 days after the beginning of composting of different types of fertilizers it was ascertained that the line of regressing of transferring phosphates to the soil solution from the fertilizer NPhF $y=0,07e^{0,01X}$, and NCPhF $y=0,08e^{0,01X}$. The coefficient of correlation of fertilizers comprised r=0,99 (picture 2).




**Picture 2. The dependence of mobile phosphorus, capacity of phosphates and intensity of phosphorus and changing the norm of phosphoric fertilizers.**

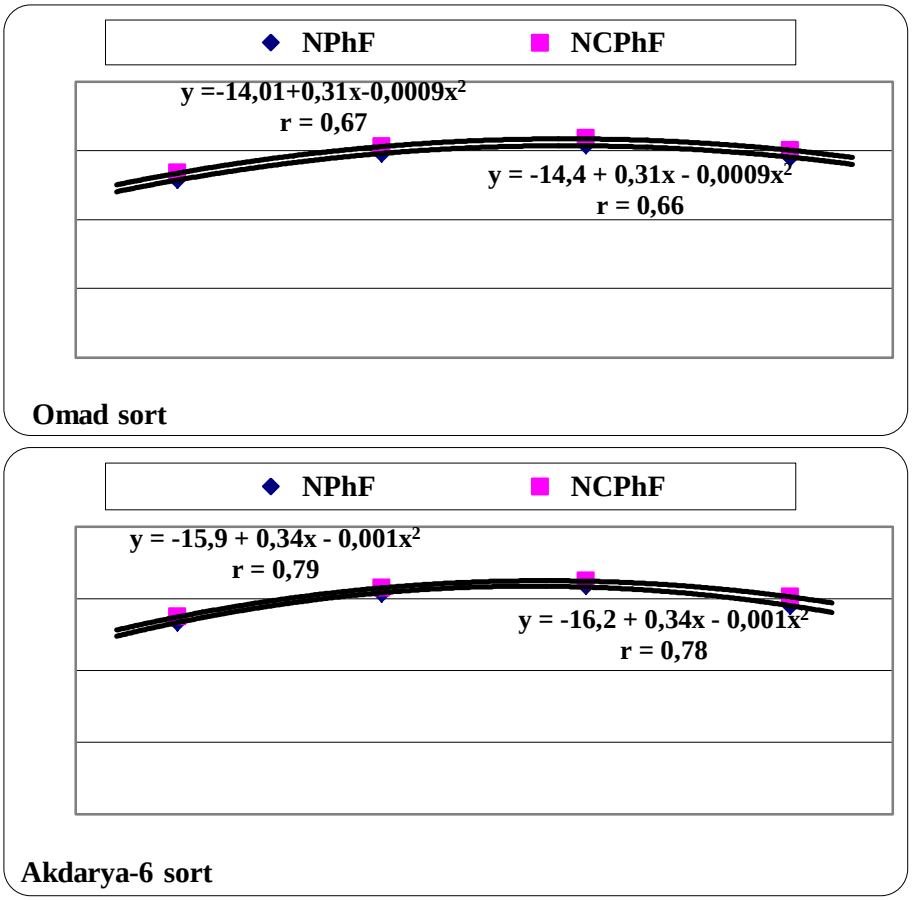
During field experiments on the meadow carbonate soils of the valley of the Zarafshan river and inter river of Miyankal the coefficient of application of phosphoric fertilizers fluctuated from 10,8 % to 13,3 % at cultivation of cotton – plant of Omad sort. In variant of introduction of 175 kg/ha of $P_2O_5$ in the form of ammophose, but at introduction of NCPhF and NPhF in the same norm of $P_2O_5$, it comprised 13,2 %.

While increasing the norm of phosphoric fertilizers the dependence of coefficient of application of phosphorus from fertilizers on the norm of fertilizers was determined by the equation of regression $y= b_1X+b_2X^2$. There was ascertained, that before the norm of fertilizers 175 kg/ha of $P_2O_5$, the coefficient of application of phosphorus was the highest, but the further increase has led to the reduction of application of phosphoric fertilizers for plants.

The study of the dependence of application of phosphoric fertilizers by cotton-plant of Omad sort at introduction of NPhF has shown, that the correlation coefficient comprised r=0,66 and NCPhF r=0,67.

In the experiments with Akdarya-6 sort the correlation coefficient at introduction of NPhF comprised r=0,78 and NCPhF

r=0,79, that is the dependence on the norm of coefficient of application of phosphorus from fertilizers of Akdarya-6 sort is higher than that of Omad sort (picture 3).



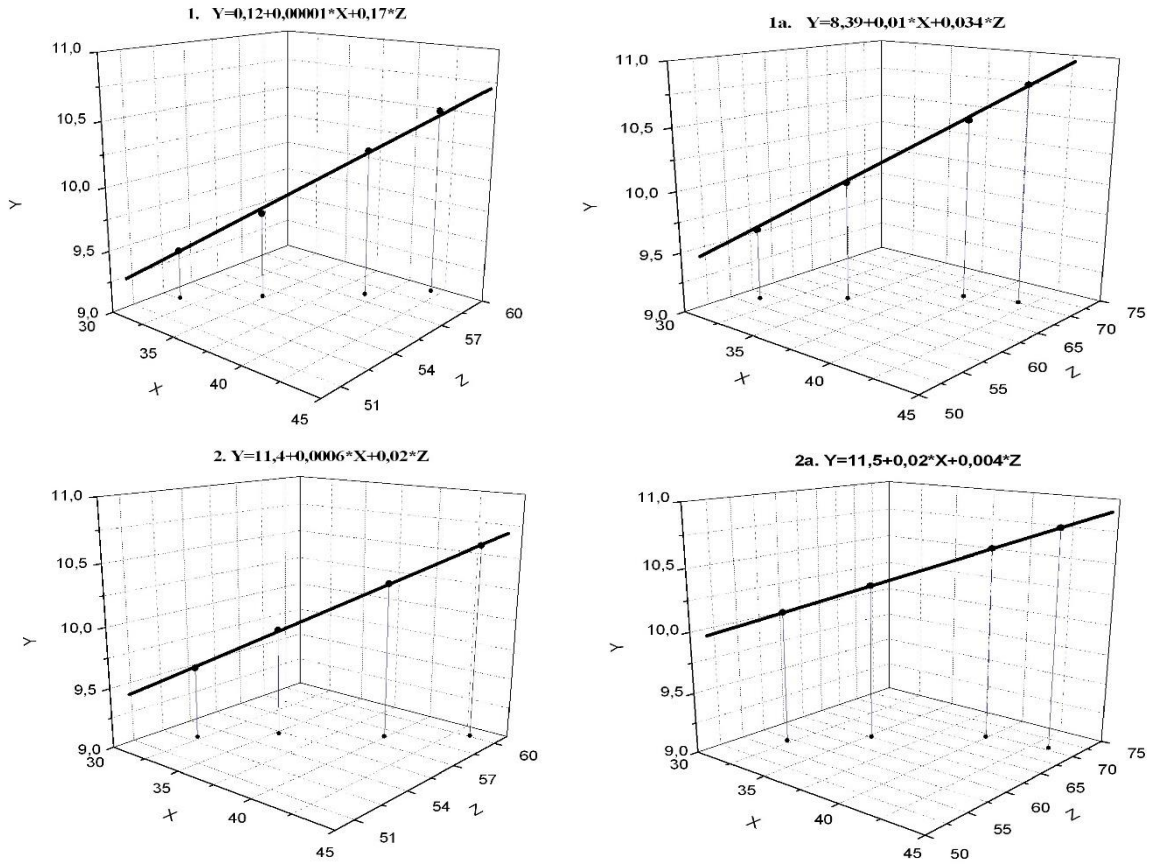

**Picture 3. The dependence of application of phosphoric fertilizers of cotton-plant Omad sort and Akdarya-6 sort on the norm of phosphorus.**

The study of the dependence on the norm of fertilizers and the content of available $P_2O_5$ for plants in the soil during blossoming (X), formation of fruit branches (Z) and height of the main stem (Y) is shown in the equation of regression $Y=a+b_1X+b_2Z$. The coefficient of correlation of Omad sort at changing the norm of introduction $P_2O_5$ in the form NPhF $r_{XY(Z)}=0,95$; $r_{XZ(Y)}=0,97$; $r_{YZ(X)}=0,99$, and NCPhF $r_{XY(Z)}=0,94$; $r_{XZ(Y)}=0,95$; $r_{YZ(X)}=0,99$. At the sort of Akdarya-6 $r_{XY(Z)}=0,83$; $r_{XZ(Y)}=0,97$; $r_{YZ(X)}=0,69$ and $r_{XY(Z)}=0,94$; $r_{XZ(Y)}=0,70$; $r_{YZ(X)}=0,85$ (picture 4).

## CONCLUSION

On the base of conducted laboratory and field experiments with sort of cotton-plant Omad and Akdarya-6 on meadow soils, subjected to carbonate-magnesium salting there can be made a

conclusion that introduction of NPhF and NCPhF in the norm 175 kg/ha $P_2O_5$ ensures the most optimal phosphate regime and allows getting the highest yield of good quality.




**Picture 4. The dependence of the growth and development of plants on the norm of phosphorus in the form NPhF and NCPhF. 1-NPhF. 2-NCPhF, sort Omad. 1a-NPhF. 2a-NCPhF, sort Akdarya-6.**

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