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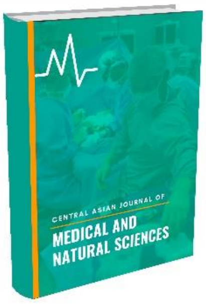

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ECOLOGICAL-GEOCHEMICAL RESEARCH URGUT TOBACCO

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ABSTRACT: The work carried out the results of an ecological and geochemical study of Urgut tobacco. It was found that Urgut tobacco is markedly enriched in Mn, Ni, Zn, Pb, as well as As, Sb and Hg, which is due to the geochemical specificity of the studied area, which belongs to the antimony-mercury geochemical province. Tobacco selectively accumulates Zn, As, Mo, Pb, Li from soil, which have the highest biological absorption coefficients out of 16 studied trace elements. The synergism of the action of Mn, Mo and I2 on the assimilation of B and Li was noted. It was revealed that the leaves of tobacco grown near highways are characterized by an increased content of Zn, Cd and Pb, and the effect of transport emissions spreads to 30 m on both sides of the road. Of the eight types of trace elements (Li, B, Cr, Mn, Cu, Zn, Mo, I) tested against the background of $N_{120}P_{90}K_{60}$, B and Mn turned out to be the most effective both in terms of their effect on biometric indicators of tobacco growth and development, and its yield and commercial grade. The effect of microelements on the yield of raw tobacco and its commercial grade differs in terms of breaking time. Plants experience the maximum need for microelements during the formation of the largest assimilation surface during the formation and maturation of leaves of the middle tiers. The introduction of microfertilizers during this period gives the maximum effect. The amount of a number of trace elements entering the environment with the smoke of Urgut tobacco can, when smoking 100 cigarettes, significantly exceed the daily MPC for indoor air.

KEYWORDS: tobacco, microelement, ecology, geochemistry, digestibility, micronutrient fertilization, synergy, growth, toxic.

INTRODUCTION

The microelement composition of tobacco plants is of interest both from the point of view of its provision with mineral nutrition elements [1,10-16,19], and in connection with the effect on the human body of toxic elements coming from tobacco smoke [8]. The amount of microelements in tobacco fluctuates depending on their content in the soil and in connection with a variety of geochemical conditions, agrotechnical methods, including the use of fertilizers [2-4,18] pesticides and environmental pollution by industrial and transport emissions.

Establishing the trace element composition is of great importance in determining the compliance of raw tobacco with international standards. At the same time, the tobacco plant is also of interest as a convenient object of research in the field of physiology 19, plant biochemistry and occupies a special place in biogeochemical studies 9, being a link in the ecological chain through which chemical elements enter the body a person, bypassing the protective barriers of the digestive tract 8. For agricultural practice. Urgut region is of great importance to establish the types and norms of microelements that provide an increase in yield and improve the quality of raw tobacco.

Taking into account the above, the purpose of this work is to study the content of trace elements in the soil and their entry into tobacco plants in the agroecological conditions of the Urgut region. Studies of the effect of microfertilizers on the yield and assimilation of microelements were carried out with the zoned uromatic tobacco variety Dubek 2898, on a typical irrigated sierozem of the Urgut district of the Samarkand region. Vegetation experiments. The vessels took soil 32 kg each with a gross nitrogen content of 0.082%, phosphorus - 0.2% and potassium -%. Nitrogen, phosphorus and potassium were additionally added to the soil at the rate of 0.1% of the active principle per kg of soil (background) - Trace elements were introduced into the soil according to the guidelines in the form of a solution. Each variant was laid in 4-fold repetition, 6 tobacco plants in one vegetation vessel. Plant samples were taken upon reaching technical maturity (breakage). Small-scale experience. The size of the plot is 2 m2, the repetition rate is 4-fold, the soil is loamy irrigated with typical serozem with nitrogen and phosphorus content as in a small-scale experiment, the thickness of the humus horizon is 35-40 cm. The depth of groundwater is up to 10 m Nitrogen, phosphorus and potassium were additionally added to the soil at the rate of N |, 0P90K60 kg / ha of the active substance. Trace elements were added in the form of salts according to the method. Field experience. The plot area is 200 m^2, the repetition is fourfold, the planting scheme and agricultural technology are adopted in the farm (for the experimental scheme, see Table 1). The selection of plant samples was carried out according to the phases of development when the leaves of each layer reached technical maturity. The variety of leaves and phenological observations were determined according to the method developed by the All-Union Institute of Tobacco and Makhorka (VITIM, 1981). Samples of tobacco leaves to study the content of trace elements entering them with transport emissions were collected along the Samarkand-Urgut road on the territory of the collective farms named after Gorky, Krupskaya and Ilyich. Emission spectral analysis and chemical methods of analysis were used to study the samples 17, 20. Protein nitrogen was determined in the plant - according to Brunstein, carbohydrates according to Bertrand, nicotine - according to Keller at the State Control and Technical Laboratory for Tobacco (Moscow) and the Central Scientific Research Laboratory of the Samarkand Agricultural Institute. Humus in the soil was determined according to Tyurin, total nitrogen according to Kjeldahl, mechanical composition - by the pipette method using the bulk soil mass - by the cylindrical method. The gross boron content in the soil was determined by the carmine method in concentrated sulfuric acid after leaching its soda alloy. Boron was also determined by the same method in plant ash. In parallel, boron in plants was also determined by the spill method using boron-free coals. The mobile boron was extracted by boiling a sample of soil with water in a ratio of 1: 5 for 10 minutes with a photometric determination of boron with a quinalizarin reagent. The results obtained were processed on an IBM PC.

Table 1. Experiment scheme

Options	**Experiments with vegetation, g / vessel**	**Small-scaled, 2m^2**	**Field, kg / ha**
The control - NPK	***5,80***	***3,20***	***16,05***
NPK + H_3BO_3,	***6,00***	***3,43***	***17,15***

NPK + $CuSO_4$ 5 H_2O	*0,56*	*2,47*	*12,35*
NPK + $ZnSO_4 7H_2O$	*1,00*	*2,64*	*13,20*
NPK + $MnSO_4$ $4H_2O$	*4,00*	*4,40*	*22,00*
NPK +Mo	*0,25*	*0,37*	*1,85*
NPK + Li_2SO_4	*0,28*	*1,83*	*9,45*
NPK + KJ	*0,22*	*0,25*	*0,28*
NPK + $Cr_2(SO_4)$,8H,O	*0,56*	*0,98*	*4,90*
Complex of named elements	*1,50*	*2,15*	*10,23*

The soil of the experimental site is relatively poor in carbonates, poor in humus, nitrogen and phosphorus, pVAO potassium is medium-poor. Low mobility was noted for such trace elements as copper, cobalt, nickel, zinc, boron, manganese, and high mobility for molybdenum, selenium, iodine, lithium. The soil of the experimental site contains an insignificant amount of water-soluble salts, which is explained by the deep occurrence of groundwater and the non-salinity of the parent rock. The concentration of copper, zinc, molybdenum and especially arsenic in the studied soils is higher, and manganese, gallium and chromium are lower than their soil clarke, while the figures for nickel, cobalt and vanadium are close to their average content in the soils of the world.

The distribution of trace elements along the soil profile obeys well-defined regularities, in accordance with which elements such as copper, zinc, cobalt, manganese, which are inactive under conditions of alkaline pH and high content of alkaline earth metal compounds in the soil, accumulate in the upper accumulative horizons as a result of the removal of plants by root systems (biogenic accumulation). The situation is similar with arsenic and lead. Another reason for the uneven distribution of trace elements along the soil profile may be the heterogeneity of the parent parent rock, a little modified soil-forming process in the conditions of younger mountain brown soils.

In most fractions of the upper horizons of irrigated typical serozem, the content of the studied microelements is higher than in the lower ones, which is especially noticeable for the silt fraction, which is rich in humus, elements of ash and nitrogen nutrition of plants. The muddy fraction has a large total surface and colloids, on which the processes of sorption and cationic exchange of microelements by clay minerals, hydrous oxides of iron, aluminum and other metals, and organic matter are intensively performed. Based on the classification proposed by Kruglova, Urgut soils should be recognized as deficient in manganese and enriched in copper, zinc and molybdenum.

The content of trace elements in the leaves of tobacco. Oscillation of the microelement composition of leaf ash, depending on the breaking time, is more pronounced for elements (Table 2), the biological function of which is known in plant organisms, as well as for lead and nickel. As for such elements as tin, cobalt and cadmium, their dynamics is less pronounced. This suggests that the entry into the plant of vital elements, the function of which is associated with certain stages of plant growth and development, is subject to the action of regulatory mechanisms, while the elements that do not play a specific biological role in tobacco enter the plant as a result of passive assimilation, the nature of which does not change significantly during its growth and development.

Table 2. Dynamics of microelements in ash of tobacco leaves depending on the time of breaking, mg / kg

Element	**Breakage**				
	I	***II***	***III***	***IV***	***V***
Manganese	**600±18,0**	**600±18,0**	**600±16,50**	**540±14,3**	**570±15,15**
Cobalt	**5,9±0,06**	**6, 6±0,7**	**5, 8±0. 05**	**5,2±0,05**	**5,2±0,05**
Zinc	**210±4,2**	**245±5,60**	**260±5,00**	**280±5,15**	**250±4,60**
Molybdenum	**5,1±0,4**	**6,5±0,5**	**6,0±0,60**	**6,5±0,5**	**4,6±33,3**
Vanadium	**55±0,10**	**42±0,96**	**43±0,86**	**36±0,72**	**33±0,66**
Lithium	**22,2±0,66**	**46±0,92**	**46±0,92**	**38±0,76**	**35,6±1,05**
Chromium	**67±2,00**	**89±2,67**	**81±1,62**	**60±1,20**	**59±1,28**
Gallium	**6,6±0,80**	**5,7±0,6**	**5,2±0,5**	**3,8±0,7**	**2,2±0,54**
Tin	**2,5±0,05**	**2,3±0,03**	**2,2±0,03**	**2,3±0,04**	**2,3±0,05**
Nickel	**29,0±0,058**	**32,0±0,64**	**22,0±0,66**	**16,3±0,48**	**11,6±0,22**
Arsenic	**72,8±2,50**	**68,6±1,38**	**68,6±1,38**	**64,4±1,98**	**64,4±1,98**
Cadmium	**6,8±0,07**	**7,1±0,14**	**7,4±0,21**	**7,4±0,21**	**8,5±0,25**
Lead	**23,0±0,23**	**21,5±0,63**	**23,5±0,48**	**22,0±0,66**	**12,5±0,36**

According to the coefficient of biological absorption (Ax), which is the quotient of dividing the concentration of an element in the plant ash by its content in the soil, tobacco leaves 5 consecutive breaks are arranged in the following row:

Zn>As>Mo>Pb>Li>Cr>B>Cu>Ni>Mn>V>Ga>Co>Sn

It is necessary to note the selective absorption of lithium and especially molybdenum by tobacco, as elements more mobile in conditions of alkaline pH, as well as arsenic and lead. The first of these elements enters the tobacco plant, apparently by similarity to phosphorus, and the second - with a group of bivalent alkaline earth metals.

The proximity to the highway has a definite effect on the microelement composition of tobacco. This is clearly noticeable in relation to zinc, the concentration of which in the tobacco of roadside areas (beginning of the plantation) is 1.6 times higher than at a distance of 50 meters or more (a <5%); and with respect to lead, with which roadside plants are enriched more than twice as compared to the background (a <1%) - The distance from the road does not significantly affect the level of arsenic, copper, manganese and lithium. Attention is also drawn to the fact that the enrichment of plants with lead and especially zinc is most pronounced in the western direction from the highway and to a lesser extent in the eastern direction. This is due to the fact that along the Zerafshan ridge, in the foothills, at the foot of which the tobacco plantations of the Urgut region are located, winds prevail, blowing from east to west and carrying transport emissions to the right side of the road.

Nevertheless, significant differences were found for lead depending on the distance from the highway and in the east direction. Thus, roadside plants are enriched with this element in comparison with plants far from the road by 1 / / times (a <5%). The strip to which the effect of transport emissions extends is relatively small and does not exceed 10 meters in both directions, from which the conclusion suggests itself that tobacco crops should not be closely approached to the highway, but protected by plantings of other crops, such as mulberry.

The arsenic content of Urgut tobacco is 2 times higher than that of standard Kentucky Research Center tobacco. And reflects the geochemical specifics of the studied area / which belongs to the antimony-mercury-arsenic subregion. Lead compounds pollute the natural environment, mainly as a result of transport emissions (Table 3).

The increase in zinc content in roadside tobacco plantings is also associated with road transport. Zinc is also found in lubricating oils. Along with zinc, the composition of car tires and lubricating oils contains the toxic element cadmium, which enters plants together with zinc through the soil. Zinc is a vital element for plants and, in the quantities found, is not dangerous as a pollutant. The situation is different with cadmium. This element accumulates in the body and has carcinogenic properties. According to a number of authors, the increased content of cadmium in the body noted in men is associated with tobacco smoking and the intake of cadmium with tobacco smoke. The cadmium content in the tobacco of the Urgut region is twice as high as in most other regions of tobacco growing.

Table 3. Trace element content in tobacco leaves on the west side of the road (mg / kg dry matter)

Element	*Breakage*			
	I	*II*	*III*	*IV*
As	*5,3±0,5*	*5,0±0,4*	*5,5±0,4*	*5,0±0,5*
Cu	*17,2±1,4*	*16,4±1,9*	*15,1±1,9*	*17,6±1,8*
Mn	*75,8±4,4*	*71,7±5,1*	*78,8±5,1*	*73,4±5,3*
Fe	*1362,6±144,0*	*1161,0±80,0*	*1182,0 ±73,1*	*1067,1±84,1*
Li	*22,3±3,6*	*28,6±2,3*	*30,0±6,2*	*27,3±4,6*
Zn	*48,1±4,1*	*33,0±4,3*	*33,7±4,4*	*29,3±+4,9*
Pb	*3,7±0,4*	*2,4±0,2*	*2,4±0,2*	*1,8±0,2*
Cd	*1,7±0,2*	*1,3±0,2*	*1,2±0,2*	*1,1±0,2*
Ash content,%	*21,5±1,1*	*21,3±1,1*	*21,9±1,1*	*19,4±1,1*

A feature of tobacco culture is the systematic removal of its lower leaves during the growing season of the plant, which significantly reduces the flow of plastic substances to the leaves of the upper tiers and inflorescences. But if the decrease in the intake of proteins and carbohydrates is compensated by the photosynthetic activity of the leaf, then with respect to mineral substances, full compensation is impossible and the leaves of the upper tiers begin to experience mineral starvation, which is aggravated by the fact that they are in the worst conditions of water supply and root nutrition. Partly for this reason, the upper leaves of tobacco are more than 2 times poorer in ash elements compared to the leaves of the lower tiers, and the effect of micronutrient fertilizers is most clearly manifested precisely at the later stages of development of the tobacco plant.

According to the dynamics of their concentration in ash, the trace elements studied by us can be divided into three groups. These are, firstly, the elements, the concentration of which decreases according to breakdowns. These include manganese and elements with little-studied biological function - vanadium, chromium, nickel, gallium. The dynamics of manganese, as can be seen from the data obtained, is weakly expressed in the growing experiment, in the small-plot experiment is characterized by an exponential curve, in which the largest decrease is observed in the leaves of the second break.

Another group of elements changes little in their concentration throughout the experiment. It includes lithium, boron, cobalt, copper, arsenic, molybdenum, tin and lead. Some elements of this group behave differently in vegetation and small-plot experiments. So, in the first, the concentration of copper in the leaves of 4 and 5 breaks is reduced by 20%, in the second it remains at the same level or even increases by 10%. Lead, cobalt, arsenic behave similarly.

The third group includes only one element zinc. Its relative content in ash gradually increases, which indicates the existence of a specific mechanism for its assimilation by the plant. A decrease in the concentration of most elements in the ash of the leaves of the last two breaks gives reason to expect during this period the most favorable reaction of tobacco plants to microfertilizers and, first of all, to the addition of manganese.

The ratio of the content of individual elements to each other is of certain interest. So for copper and zinc, it fluctuates in the range 1: 4 - 1: 6, gradually expanding chunks to breaking. Similarly, the ratio of vanadium to chromium is 1: 1 - 1: 2, also slightly increasing in the leaves of the upper tiers. The ratio of cobalt to nickel is kept strictly in the range of 1: 4. If we compare the ratios of these elements in leaf ash and soil, then we can see that the ratio of copper to zinc in the latter is only 1: 1.6, vanadium to chromium - 0.9: 1 and nickel to copper - 1: 3.3, and the plant so. possesses the ability to selectively accumulate zinc and partly chromium and nickel.

This selectivity is most pronounced for zinc, which actively participates in the processes of nucleic acid metabolism and protein synthesis, intensively proceeding in the forming leaf. Copper, which is involved in the plant in the process of photosynthesis (plastocyanin), respiration (cytochrome oxidase), redox reactions (ascorbate oxidase, superoxide dismutase), is also vital for plants, but it is required in much lower quantities than zinc. There is currently no physiological explanation for the selective accumulation of chromium and nickel.

As you know, the elements of root nutrition have different mobility in the tobacco plant. Takh, phosphorus and potassium are capable of re-utilization and entering the young parts of the plant, and calcium, which forms poorly soluble compounds with organic acids, accumulates in increased amounts in the leaves of the lower layer. We can assume that in terms of their mobility in a tobacco plant, the elements of the first group behave like calcium, and the second and third ones behave like the easily mobile elements phosphorus and potassium. There are known easily mobile complex compounds of boron with carbohydrates, phenols, zinc and copper in the form of coordination compounds with amino acids, which facilitates their re-utilization in plants.

The interaction between microelements in a tobacco plant has a different character in a small-plot experiment than in a vegetation one. First of all, attention is drawn to the synergism of the action of manganese, molybdenum and iodine in relation to boron in tobacco leaves (a <1; 25%, respectively). This synergism is also manifested when a mixture of trace elements is introduced into the soil (a <1%).

There is also a synergism between lithium and copper, noted in the growing experience. At the same time, the previously observed antagonism between lithium, cobalt and nickel is absent. Another interesting observation is the identification of antagonism between copper and zinc, which is often observed in other plants, as well as in the body of animals and is based, apparently, on the competition of both metals for the same mechanism of absorption or transport (and <2%). Antagonism between copper, which has a variable valence, and other chromium and manganese ions similar to it on this basis (a <5%) is also characteristic. Iodine has a positive effect on the assimilation of a number of trace elements - boron, cobalt, copper, gallium and molybdenum (a <5.1, 1 and 5%, respectively).

The increased Li content in tobacco can be considered as a result of the high level of its available form in the soil and good mobility in the plant itself.

Plant growth and development. According to its action on the formation of the leaf surface, microfertilizers can be divided into 2 groups. In the first of them, the largest average leaf area is achieved by the beginning of budding (on the 45th day of counting) and decreases by the beginning of flowering (on the 60th day). It includes lithium, chromium, copper, molybdenum, iodine and a complex of trace elements. The second group includes, along with the control, boron, manganese and zinc, for which the largest average size of the leaf blade is observed at the beginning of flowering. It can be assumed that the effect of microfertilizers referred to above to the first group affects to a greater extent the first stages of leaf development, while boron and manganese stimulate both cell division and their subsequent growth.

As for the variants with copper, lithium, chromium and molybdenum, at the end of the reference period a statistically significant decrease in the increase in the average leaf surface is observed, and for copper and iodine there is a weak negative correlation between the number of leaves and their area, whereas in control and for boron, the correlation coefficient between these two indicators is positive and is, respectively, r = 0.45 and 0.8.

By the beginning of flowering, the largest total surface of tobacco leaves develops in the variants with manganese and boron, and the smallest in the variants with lithium and molybdenum. Apparently, the long-term exposure to these two elements in the doses used, nevertheless, has a certain negative effect on the formation of leaves, which manifests itself, however, only 2 months after the start of the experiments. The effect of iodine, most pronounced on the 45th day of accounting, becomes minimal by the beginning of flowering, and chromium, copper and zinc does not differ from control. The depressing effect of lithium and molybdenum is evidently also manifested in the variant with a complex of trace elements, in which the development of the leaf surface in the last 15 days of observations sharply slows down and amounts to only 2 cm^2 per day per plant.

For all biometric parameters studied in the course of three series of vegetation, small-plot and field experiments, the highest indicators on typical gray soils of the Urgut region were obtained in variants with boron and manganese, which fully justifies the forecast made by E.K. Kruglova about the prospects the use of these elements as microfertilizers for agricultural crops grown on the left bank of the Zerafshan. This refers to the number of leaves, their area, the height of tobacco plants, as well as to such economic indicators as the yield and grade of tobacco, increasing them by 25.0 and 23.5%, respectively (Table 4).

Table 4. Influence of microfertilizers on the yield of tobacco leaves, c / ha

Experience options	*1984*	*1985*	*1986*	*Average for*
NPK- Control	***38,77±0,19***	***36,14±0,11***	***36,7±10,06***	***37,87±0,27***
NPK+Li	***41,81±0,10***	***42,58±0,23***	***49,14±0,26***	***41,81±0,10***
NPK+Cr	***42,56±0,17***	***41,4±10,15***	***47,40±0,11***	***47,6±10,36***
NPK+Mn	***47,86±0,12***	***46,62±0,18***	***47,0 ±0,43***	***47,0 ±0,45***
NPK+Cu	***38,86±0,24***	***37,35±0,17***	***37,50±0,16***	***37,5±0,17***
NPK+Zn	***42,29±0,44***	***40,75±0,18***	***41,41±0,49***	***42,3±0,44***
NPK+Mo	***44,14 ±44,18***	***43,36±0,26***	***43,06±0,49***	***43,5±0,57***
NPK+КомпМЭ	***42,98±0,04***	***41,10±0,12***	***41,42±0,13***	***42,00±0,18***
Ash content,%	***21,5±1,1***	***21,3±1,1***	***21,9±1,1***	***19,4±1,1***

The quality of tobacco differs little according to the options, the fluctuations of the results obtained do not allow us to speak with confidence about the effect of microfertilizers, there is an increased synthesis of nicotine and resinous substances in the version with copper, which is consistent with the observations of D.K. Kalemnov and American authors. An increase in the synthesis of nicotine under the influence of lithium, described by L. Ezdakova in experiments with a sandy culture of tobacco, was not observed when it was planted in the soil.

The composition of the condensate of tobacco smoke is dominated by resins, the content of which ranges from 73-80%, water - 12-18% and nicotine - 8-10%. The highest values of these three condensate components are found in the copper version. In other cases, statistically significant differences with the control were not found.

6-15% of the nicotine present in tobacco passes into the main stream of tobacco smoke, and the rest of the nicotine enters the environment with a side stream of smoke.

According to the degree of transition to tobacco smoke, the studied elements can be conditionally divided into three groups: difficult, medium and highly volatile. The first includes iron, cobalt, lead and nickel, which volatilize by no more than 1/3. The second group of elements whose losses with tobacco smoke do not exceed 2/3 are chromium, manganese, copper and zinc, as well as arsenic, bromine and lanthanum. And finally, the third group includes elements that turn into smoke by 70-100% - silver, cadmium, antimony, selenium and mercury.

The amount of trace elements entering the environment with tobacco smoke during intensive smoking significantly exceeds their average daily maximum permissible concentration (MPC) in the ambient air and in closed rooms can create a certain danger to the health of not only the smoker himself, but also his surroundings.

CONCLUSIONS

1. Urgut tobacco is markedly enriched with manganese, nickel, zinc, lead, as well as arsenic, antimony and mercury, which is due to the geochemical specificity of the studied area, which belongs to the antimony-mercury geochemical province. Tobacco selectively accumulates zinc, arsenic, molybdenum, lead, lithium from the soil, which have the highest biological absorption coefficients out of 16 studied trace elements.

2. The interaction between individual microelements in a tobacco plant in most cases has the character of physiological antagonism, which is explained, apparently, by the existence of common transport systems for elements with close ionic radii or electronegativity, as, for example, in transition metals. The synergism of the action of manganese, molybdenum and iodine on the assimilation of boron and lithium was also noted.
3. Leaves of tobacco grown near highways are characterized by a high content of zinc, cadmium and lead, and the effect of transport emissions extends to 30 m and both sides of the road. In this regard, tobacco plantations should not be close to the highway and must be protected by plantings of other crops.
4. Of the eight types of trace elements (Li, B, Cr, Mn, Cu, Zn, Mo, I) tested against the background of $N_{120}P_{90}K_{60}$, boron and manganese turned out to be the most effective both in terms of their influence on biometric indicators of tobacco growth and development, as well as and on its yield and commercial grade with an economic effect of 7.8 thousand rubles / ha. A slightly lesser effect was obtained from the addition of molybdenum and iodine.
5. The effect of microelements on the yield of raw tobacco and its commercial grade differs in terms of breaking time. Plants experience the maximum need for microelements during the formation of the largest assimilation surface during the formation and maturation of leaves of the middle tiers. The introduction of microfertilizers during this period gives the maximum effect.
6. The amount of a number of trace elements entering the environment with the smoke of Urgut tobacco can, when smoking 100 cigarettes, significantly exceed the daily MPC for indoor air. This is of no small importance for its toxicological assessment, since nickel carbonyl, vanadium, chromium, arsenic, antimony and mercury are considered toxic and potentially carcinogenic substances. Features of biochemical indicators of the quality of tobacco and tobacco smoke must be taken into account when blending Urgut tobacco with other types of raw tobacco.

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