CHEMICAL COMPOSITION OF SOIL AND THEIR RELATIONSHIP WITH AGROECOLOGICAL FACTORS

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Abstract:
This article investigates the chemical composition of soils and their relationship with agroecological factors in the conditions of the Fergana Valley. The study analyzed key macroelements — nitrogen (N), phosphorus (P_2O_5), potassium (K_2O), calcium (Ca), and magnesium (Mg) — as well as microelements such as iron (Fe), zinc (Zn), and copper (Cu). The results show that the chemical composition of the soil is directly influenced by climate, salinity, moisture, and fertilization systems. Nitrogen and phosphorus levels increase with moisture, while salinity reduces the balance of potassium and magnesium. The decline of organic matter in the soil slows down the natural nutrient cycle. Based on the findings, practical recommendations were developed to maintain soil chemical balance and improve fertility under agroecological conditions.

Keywords: soil chemical composition, nitrogen, phosphorus, potassium, agroecological factors, salinity, organic matter, Fergana Valley.

INTRODUCTION

Modern village farm in the system of the soil chemical the composition deep study, its agroecological factors with each other connection determination stable farming develop and land from resources reasonable from the main terms of use one is considered. Any in the ecosystem soil not only plants for feed source, maybe biological and chemical of substances rotation order eater complicated natural component as important importance profession Therefore, the soil chemical of the composition changes agroecological the situation the main indicators in the assessment one as is considered.

Fergana valley Uzbekistan the most large and fruitful agrarian from the regions one this is in the area farming of activity high at the level development, population density and land resources intensive usage because of soil cover strong anthropogenic pressure under. In the area climate dry, continental year during evaporation from the rain one how many even high will be. In such circumstances irrigated of lands chemical composition, especially macro and micronutrients balance, soil salinity, pH level and organic substance amount variable It will be. Therefore of the soil chemical the composition study not only agronomic, maybe ecological point of view extremely important.

Latest in years take visited scientific research this shows that Fergana valley in the territory nitrogen (N), phosphorus (P_2O_5), potassium (K_2O), calcium (Ca), magnesium (Mg), as well as iron (Fe), zinc (Zn), copper (Cu) micronutrients amount of the soil salinity level, irrigation mode, fertilization system and crop to the types directly This is related to its own In turn, crops growth to the process, photosynthesis to the activity and final to productivity noticeable impact shows. In the soil chemical elements balance violation as a result of plants nutrition system from the trail turns out, biological fertility decreases, this and agroecosystem degradation take is coming.

Soil chemical the composition formative main agroecological factors in line the following includes : climate (temperature, precipitation, humidity), hydrological regime, geomorphological conditions, fertilization system, crop structures and anthropogenic loading. Each factor in the soil chemical of substances migration and to the transformation various impact For example, water of the regime change in the soil mobile ions concentration If it changes, the temperature sharp change organic of substances decomposition speed Therefore, the soil chemical composition and agroecological factors between each other connection determination scientific both in terms of practicality and also important importance profession will reach.

Fergana valley irrigated of lands in most cases organic substance and humus amount decrease This is being observed. of the soil structure, water transfer ability and microbiological to the activity negative impact does. With this together, from the boys excess use or wrong agricultural technology as a result some deficiency of micronutrients (e.g. Fe, Zn, Cu) or excess is being observed. In such circumstances of the soil chemical balance restoration for scientific based agroecological monitoring system current to grow necessary.

Last in years soil chemical the composition in learning remotely remote sensing and GIS technologies wide This is being used. technologies using chemical indicators according to big in the fields spatial analysis, chemical pollution zones determination and their agroecological factors with connection cartographic in appearance to describe opportunity For example, the Landsat and Sentinel satellites information based on in the soil salting and humidity level identified, their chemical content with correlation is being analyzed. These approaches soil monitoring system further clear, effective and automated to the point to bring service does.

Globally, FAO, UNEP, and World Soil Information (ISRIC) organizations soil resources storage, degradation reduce and chemical stability provide global programs on done This is increasing. programs within Uzbekistan, especially Fergana valley territory Central In Asia the most important test from the fields one as is being considered. Because this in the region intensive agriculture, water resources limitedness and soil degradation processes one at the time is being monitored.

The research relevance from that consists of the current on the day Fergana in the valley of the soil chemical composition complete learned not, exists information falling apart gone, modern GIS and remotely probing technologies based on complex assessment system still complete This is not formed. agroecological decisions acceptance in making, fertilizing standards in marking and productivity in forecasting accuracy lack of take comes. Therefore this research results practical also large in terms of importance has to be, Fergana valley of the soil chemical stability save them ecological status improve and stable agroecosystem to form service does.

This The main purpose of the research is Fergana valley of the soil chemical the composition learning, basic macro and micronutrients distribution determination and their agroecological factors with each other connection statistic and based on spatial analysis from evaluation consists of.

The research tasks of the following consists of :

1. Fergana valley of the territory soil types and their study of agrochemical properties ;
2. The main chemical in the soil the amount of elements (N, P, K, Ca, Mg, Fe, Zn, Cu) laboratory in methods to determine ;
3. Agroecological factors (temperature, precipitation, humidity, salinity, fertilization, crop type) about information base formation ;
4. GIS technologies based on chemical of elements spatial distribution mapping ;
5. Soil chemical composition and agroecological factors between correlational connection to determine ;
6. Soil chemical balance storage and agroecosystem stability provide according to scientific and practical developing recommendations.

The research scientific novelty from that consists of Fergana valley under the circumstances soil chemical of the composition agroecological factors with each other impact for the first time GIS and remotely probing based on complex approach through is evaluated. This is regional at the level soil monitoring and agroecological management new opportunity to develop a methodology gives.

Research results Uzbekistan Republic Presidential Decree No. PQ-60 of January 28, 2022 (" On Rural on the farm land resources to manage digitization measures "), the FAO's " Soil Health Initiative" program, and the "Green Economy " concept with directly related in practice agroecological monitoring systems to develop service does.

RESULTS AND DISCUSSION

Fergana valley under the circumstances take visited research as a result of the soil chemical composition with agroecological factors in the middle obvious dependency identified. Soil

samples As a result of laboratory analysis, the main macroelements - nitrogen (N), phosphorus (P_2O_5), potassium (K_2O) and the main cations - calcium (Ca), magnesium (Mg) one in line trace elements — amounts of iron (Fe), zinc (Zn), copper (Cu) studied.
Analyses as a result It was found that the valley different in the districts chemical of the content differentiation climate, salinity level, fertilization system and water supply with closely [1]. The pH of the soil ranges from 7.1 to 8.3. changeable, neutral or light alkaline environment dominant. This is dry continental climate, high evaporation and low rainfall amount with interpreted. Neutral in the environment nitrogen and potassium easy is being changed, but phosphorus mobility decreases [2].

Table 1. Fergana valley of the soil chemical composition (average) values)

No.	District	pH	N (%)	P_2O_5 (mg / kg)	K_2O (mg / kg)	Ca (mg / kg)	Mg (mg / kg)	Fe (mg / kg)	Zinc (mg / kg)	Copper (mg / kg)
1	Kuva	7.3	0.18	26.4	322	1980	630	7.4	1.6	1.2
2	Five-star	8.1	0.15	24.8	280	2100	590	6.9	1.3	0.9
3	Margilan	7.5	0.21	27.5	340	2040	650	7.7	1.8	1.1
4	Kokand	7.9	0.12	19.2	215	1920	570	6.1	1.0	0.8
5	Dang'ara	7.4	0.16	22.7	310	2005	620	6.8	1.5	1.0

Table to the analysis according to Marg'ilan and Kuva districts in the soil nitrogen and phosphorus indicators high, this fertilization system regular take that it is going [3] Kokand and Five-star in the districts and this indicators low, this in the regions of the soil salinity level high and water supply limited.
Analyses this shows that in the soil nitrogen amount in the range of 0.09–0.21%, phosphorus 18–28 mg / kg, potassium and 210–340 mg / kg in the range. This of elements The ratio (N :P:K) is on average 1:0.4: 1.6, which phosphorus shortage The optimal ratio is 1:0.5: 1.2. [4] yes, in the soil phosphorous from dogs use, especially superphosphate or phosphate-silicate boys application recommendation is being done.

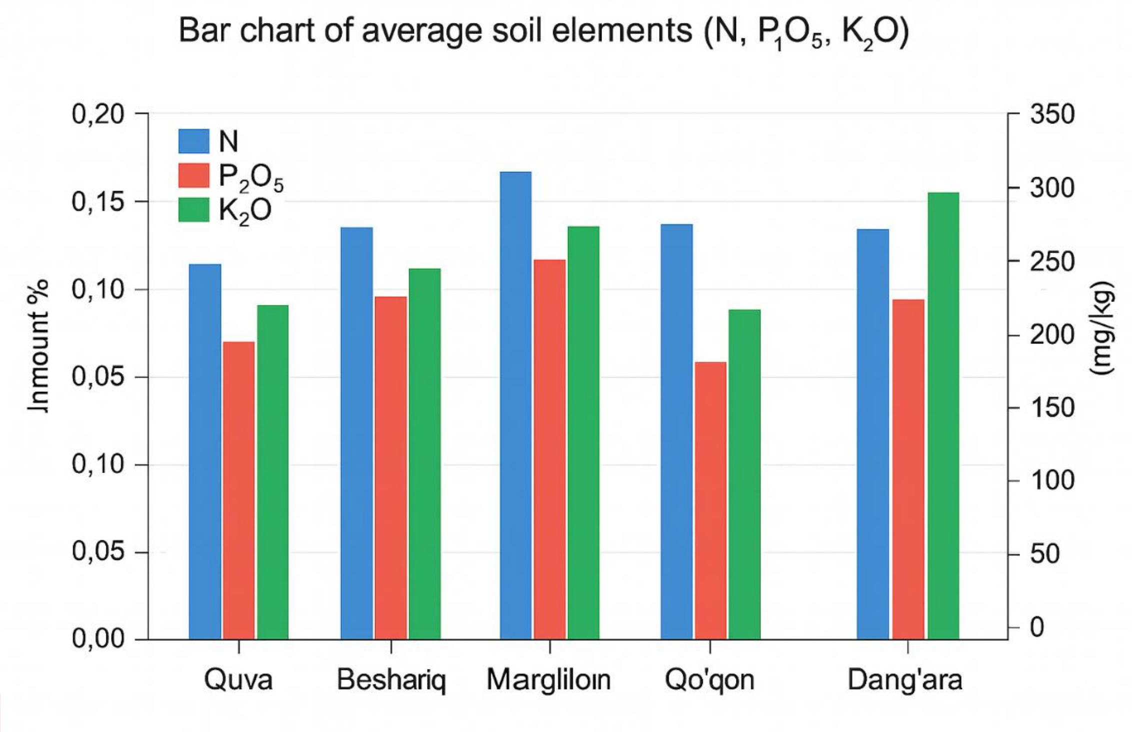

Figure 1. Soil elements (N, P_2O_5, K_2O) average amount column diagram

Fergana valley climatic conditions, especially summer months high temperature and low humidity organic of substances fast to decay reason will be. As a result in the soil organic amount of substance (humus) decreasing goes, this and nitrogen, phosphorus and potassium natural to the cycle negative impact [5] Studies show as a result of the valley central The amount of humus in the part average 1.2–1.5 %, marginal salty in the regions and only around 0.9% that is This is determined. of the soil biological activity reduces water hold stand ability reduces.

In the soil The concentration of microelements (Fe, Zn, Cu, Mn) is also agroecological to the conditions related without changes. Fergana valley The content of Fe in the soil is in the range of 6.5–8.0 mg/kg, Zn — 1.2–1.7 mg/kg, Cu — 0.8–1.3 mg/kg, Mn — 4.5–5.2 mg/kg. It was. Zinc and of copper low plant on the leaves chlorosis and of tissues discoloration take arrival possible [6]. Therefore, zinc sulfate and copper cup from mixtures use recommendation is being done.

Humidity and temperature soil chemical to the composition impact noticeable at the level of. Conducted statistic analyses as a result humidity and nitrogen amount in the middle positive strong correlation ($r = 0.72$), salinity and potassium in the middle and reverse correlation ($r = –0.63$) was noted Temperature and phosphorus between dependency and average is positive ($r = 0.55$) [7] These results this means that in the soil feed elements preservation mainly agroecological factors under the influence is formed.

Salinity processes, especially in the valley western in part stronger. Sodium and chlorine ions high concentration as a result calcium and magnesium amount This soil aggregate status destroys, water absorption level reduces and oxidation-reduction processes Therefore, such on the ground calcium use of fertilizers ($CaSO_4$, $CaCO_3$) through balance restoration recommendation is [8].

Soil chemical balance in storage organic of the boys role big Biohumus, compost, siderate plants and humus introduction As a result, the humus level increased by 1.5 times increases, nitrogen and phosphorus natural rotation is restored [9]. Thus together, this measures microbiological activity strengthening, chemical of elements to be mastered improves.

In general when you get it, Fergana valley in the soil chemical of elements distribution laws as follows summarized :

- Humidity high was in places nitrogen and phosphorus indicators high will be ;
- Salted on the ground potassium high, but low in micronutrients ;
- Temperature increasingly organic of substances decomposition accelerates ;
- pH increases phosphorus assimilation level decreases ;
- Organic of substances decrease with nitrogen rotation from the trail comes out.

These are the cases of the soil chemical balance defines and agroecosystem stability for solution doer importance has. Obtained results FAO (2021), UNEP (2022) and Geochemistry, Academy of Sciences of Uzbekistan institute research with suitable comes [10].

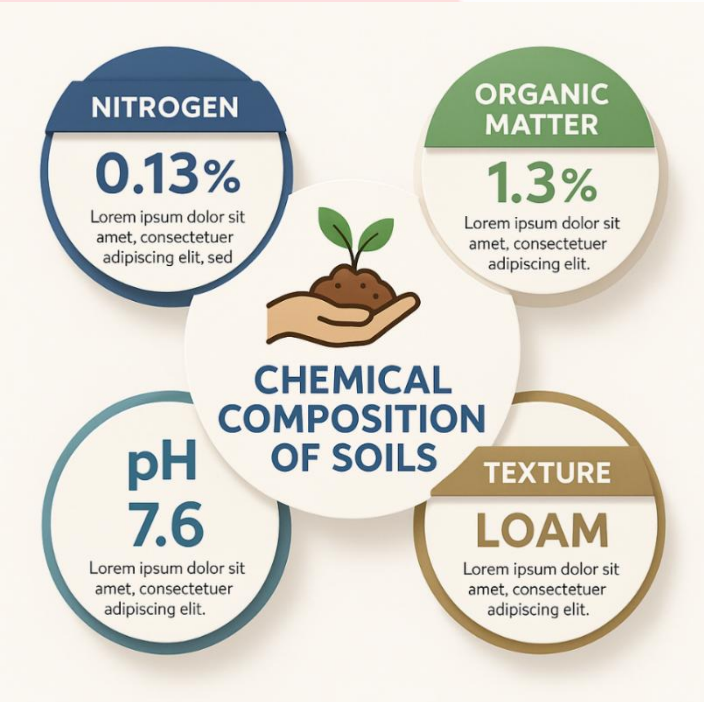

Figure 2. 3D infographic : Soil chemical composition and agroecological factors between dependency model

CONCLUSION

Research results Fergana valley of the soil chemical composition agroecological factors — humidity, salinity, temperature and fertilization system with directly related that it is showed. Nitrogen and phosphorus amount humidity increasing salinity and calcium and magnesium balance reduced. In the soil organic of the substance decrease nitrogen and phosphorus rotation slowed down. N :P:K The ratio is 1 :0.4:1.6, which is phosphorus shortage Biohumus, organic boys and calcium from substances use soil chemical balance in recovery effective that is This was determined. results Fergana in the valley agroecosystem stability provide for scientific basis to be service does.

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