

Ecological Estimation of the Soil Useful for Vegetables in the Guba-Khachmaz Area of Azerbaijan

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Abstract

Ecological estimation from soil condition is one of the most important question of modern soil science. In the present article we are studying characteristics of soil ecological conditions and some types of soil in Kuba-Khachmaz zone. The ecological estimation of the soil under vegetables of studied territory was conducted on the base of own researches and data of literary sources. Assessment of the soils - their fertility, which can be expressed equitable and sustainable features characterizing the soil's ability to meet the needs of plants in mineral nutrition and water. Soil fertility is determined by their water and heat, gas and nutrient regime, and the composition and reaction of the soil solution, i.e, dynamic factors, depending on the climate and many other conditions [14]. In connection with unequal requirements of different crops to environmental conditions, primarily to soil, the task is to identify the qualitative assessment to quantify the differences between the soils in fertility in the natural, agricultural zone, with comparable levels of farming [11]. For the vegeculture powerful development in Azerbaijan there are exceptionally favourable soil-climatic conditions. We have been given the characteristics of individual soil types and subtypes are suitable for growing vegetables. Ecological assessment was carried out using private rating scales for individual soil characteristics. According to our researches, it was found that the meadow-brown soils are best for growing vegetables (85s.). While grey-brown soils are estimated 73 scores.

Keywords

Soil Fertility, Soil Valuation, Ecological Estimation, Vegetables

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1. An Urgency of the Problem

A problem of the ecological appraisal from soils condition and monitoring is one of the most important problems of the present practical soil science. It includes in a large spectrum of problems among which in the potential and actual fertility appraisal, usefulness of the soils for the agricultural plants growing, definition of the levels in their pollution by chemical combinations, analyses of the technological peculiarities [15].

At present, being a component of the natural – anthropogenic complex, the soil tests not only an anthropogenic loafing but

also an influence of the ecological factors, essentially effecting on soil-forming process proceeding, soil organisms vitality, the agricultural plants growth and development i.e. an ecological assessment of soils condition resulting in a complex appraisal of the biological-soil, geomorphological, geochemical, geophysical and other factors and parameters in its situation, and also their changes under an influence of the anthropogenic loading, is at a present period of the actual problem [7].

The vegeculture is one of the most difficult branches in agriculture. Besides many different cultures are used in vegeculture with the sharply different requirements for agrotechnics conditions, vegetable cultures are grown in open

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ground and greenhouses, for the local needs and transportation on a long-distance.

So for ex. the vegetable production in the Guba-Khachmaz zone is directed to the provision with the raw-material of the tinned industry, but a geographical proximity in this zone to the industrial centre – Baku and Sumgait – stimulates the vegetable development with the purpose of the population supply in these cities with the fresh vegetables.

In this connection an ecological appraisal of the soils good for vegetable in the Guba-Khachmaz zone was performed with the calculation of this region soil-climatic parameters.

2. Object and Method of the Researches

Our researches were carried out in the soils good for vegetable in Guba-Khachmaz. Conducting the ecological appraisal of the different types in the soils good for vegetable from the Guba-Khachmaz zone is based on methodical recommendations by D.I.Bulgakov [2], G.Sh.Mammadov [8,10], S.Z.Mammadova [12] and other methods [6].

3. Analysis and Discussion

Geographical situation, peculiarities of the relief and geomorphology.

The Guba-Khachmaz natural zone is situated at the end of north-eastern Azerbaijan. In north-west it borders on Dagistan from south and south-west joins Absheron and Shamakhy-Ismailli climatic-economic region. The zone total area is 804.7000. 374,5 000 hectares are used in agriculture. The territories where the agriculture develops, mainly, occupy the low mountains foothill and eastern accumulative plain [1].

The Guba-Khachmaz lowland is conceived to be a large plain placing from the side range slopes to north-east, with two stages: Guba-Gusar inclined plain, directly adjoining the side ranges slope foot and the Caspian shore lowland from Sumgait river mouth to the Samur river mouth. Guba-Gusar inclined plain begins with the narrow region and extends in the direction from alluvial lowland plain. The plain width to Samur reaches – 30-35 km. A relief of the foothill band-sweep in the inclined plain is wavy, here and there is hilly. Here gardening (horticulture), vegetable develop. A system of the Great Caucasus in limits of Azerbaijan consists of the period precipitation rock deposits, at Yura, chalk and fourth period. An age and type of soil cover is connected with the geological structure age and character and period [4].

The dominating rocks in the west part of the eastern slope from the Guba-Khachmaz territory are: low chalk lime and

blocky conglomerate at upper Yura, the side range main rocks, dark-coloured gleyey shale of Low Yura. The soil-forming rocks in the low part of the territory (low-land) are the third and ancient Caspian deposit. The soil-forming rocks in the low part of the territory (low-land) are the third and ancient Caspian deposit. The capacious pebble thickness is soil-forming rock in the Gusar inclined plain. A power of the plain gravel layers reaches 8-10 m and more, decreases till 3-4 m in the accumulative plain. Besides gravel as soil-forming rocks of the inclined plain the loessial-gley and loams, pale-yellow and yellowish – pale yellow colors are widely represented. A power of loessial rocks vibrates from 8-10 to 20 metre. The eastern end of the lowland is conceived of the ancient Caspian deposits with the solonchic-gleyey rocks[13].

4. Climatic Conditions

On climate, a foothill zone of the north-eastern part in the Great Caucasus is belonged to moderate – warm arid steppe. Here the winter is warm and mild with the unstable or little-stable snowy cover, the summer is warm and dry where middle monthly temperature of the summer months on stations is 20,6-24,5° C.

But middle yearly temperature of the weather vibrates from 9,4 to 12,5° C. A positive temperature is higher than 10°C at foothill vibrates in limits of 3600-4000°C. For growing of the most agricultural plants such quantity of the temperature sums are wholly enough.

The middle yearly quantity of the rainfalls in limits of the given territory vibrates from 342 mm (Khachmaz) to 549 mm (Gusar). The least quantity of the precipitations is observed in Gilgilchay (308mm) [5]. A significant number of the rainfalls falls at the spring-summer period, an enough quantity of the moisture is provided for agricultural plants. However in the Lowland regions of the semi-desert zone the precipitations don't generally provide getting of the increased crops. Hence, here the moisture deficit should be compensated by an artificial irrigation.

A main factor promoting over the plant cover formation is a place a relative humidity. A middle yearly relative moisture vibrates in limits of 39-88%. Difference of the relative moisture distribution can be explained by geographical location, large area of the evaporating locality.

I.e. all the indicating elements of the climate, changes which are conditioned by relief form, degree and exposition, their differences under soil-forming conditions influence on soil cover forming character.

Plant cover in the Great Caucasus region is extremely rich and various. A.A.Grossgeim [3] distinguishes seven large

plant regions: forests, deserts and semi-deserts, saline vegetation, mountainous forestless formation, subalpine-alpine vegetation, sandy vegetation, water and riverside vegetation. The forestry vegetation occupies a significant area from the Caspian sea-shore (lower forest of the Guba-Khachmaz zone), on the river valley, covers the side range northern slopes. The Tugay forests extend in the lowland regions on the Caspian seaside from Khachmaz till Samurchay. The bushy vegetation on the north-eastern slope in comparison with the forest occupies a less area and spreads unequally. Some bushes (juniper, rhododendron) have a zonal character, create special vegetative community and influence on lithosphere. The grassy vegetation plays an essential role in the soil-forming process. The steppe community in an region of the Great Caucasus occupy a zone between semi-desert and forestry zones and are relatively expressed in the Guba-Gusar inclined plain.

Soil cover. The Guba-Khachmaz zone is one of the large agricultural regions in the republic. The soils from this zone are mainly used in the gardening, vegeticultural, grain economy, viticulture and stock-breeding. The arable soils occupy 12,2% of the total area or 26,8% from the agricultural lands area. These soils are mainly used under vegetable and grain cultures. They form a little area in Khachmaz (40,0% of the total area) and Gusar (28,3%) regions. The arable soils accordingly form 11,7% and 20,0% in Guba and Khachmaz.

The territory soil spreading is in a strict connection with a law of the vertical zonality. The following soils are distinguished in the investigative territory: mountain-meadow, mountain-meadow chernozem-like, mountain-forestry brown, mountain-brown after forestry, grey-brown, meadow-serozem and alluvial meadow. In agriculture mountain-brown, grey-brown, meadow-brown, meadow serozem and alluvial – meadow soils are mainly used.

Mountain –brown soils extend in the different parts of the territory, at a height of 500-700 m above sea. These soils are mainly powerful and middle powerful and eroded to a different degree. They are characterized by an increase of the humus horizon power, well expressed grainy-nut-like structure. The soils are rich in and their distribution on a profile is enough gradual, but the content vibrates in limits of 0,80-5,5%. The nitrogen content forms 0,08-0,30%, phosphorus – 0,20-0,35%. A sum of the exchangeable bases is sufficiently high – 25-40 mg.ekv. per 100g of soil. In a composition of the absorbing complex there is much exchangeable calcium and magnesium. The soils are poor in absorbing Na. The pH quantity of water suspension indicates a reaction alkaline character. The mechanical composition of the mountain-brown soils is gleyey, heavy and middle loamy.

Grey-brown soils occupy an insignificant area and extend in

the territory different parts. On the relief conditions the grey - brown soils occupy a part of the plain, foothill and low mountains. The soil-forming rocks are served by delluvial carbonate and alluvial-lime gleys and loams. The humus content, total nitrogen and phosphorus in these soils are lower in comparison with the brown soils on profile. A little powerful differences of these soils are poor in nutrient. In a profile of grey-brown soils a clear differentiation of carbonates content between the separate stratum with their regular increase is observed from depth.

The grey-brown soils are distinguished by an exchange high capacity, vibrating approximately 25-55 mg.ekv. per 100 g of soils. The environment reaction in these soils possesses an alkaline character.

Meadow-brown soils are formed on the areas of the increased subsoil and surface moisture in the zone of brown soils. They are characterized by an available of well expressed humus horizon, profile merging and also carbonates availability on the low stratum. The humus content on the upper horizon, profile merging, and also carbonates availability on the low stratum. The humus content on the upper stratum vibrates in limits of 2,0-4,5%, phosphorus – 0,100-0,250%. The meadow-brown soils are saturated with the bases. A sum of the exchangeable bases is 20-35 mg.ekv. per 100 g of soils. The carbonate soils, their content hesitates in limits of 8,0-18,2%. The mechanical content is mainly gleyey and heavy-loamy. Among these soils there are weak solonetz-like types [1].

Alluvial-meadow soils extend on the river terraces and along the increase of the revers and their flows are conceived younger soils with the meadow soil-forming signs. They are formed on the alluvial deposits of the light mechanical content.

A humus quantity on upper stratum of the alluvial-meadow soils hesitate in limits of 1,4-3,7%. A content of total nitrogen and phosphorus on the upper parts of the humus horizon is significant. Their content accordingly vibrates in limits of 0,09-0,18% and 0,16-0,23%. The mechanical content in these soils is loamy and sandy loam. Carbonates quantity is high and 1,2-14,5% here. The exchangeable bases sum vibrates in the large limits from 2,5 to 20,6 mg.ekv. per 100 g of soils. Natrium, that creates solonetz-like in these soils, is found in a composition of the exchangeable bases.

I.e. taking into account of the relief peculiarity, the favourable climatical conditions, we should comment that the soils in the plain territory of Guba-Khachmaz zone allow to grow fruit, vegetable and other agricultural plans on a scale of the commodity output.

On the basis of the soil cover investigations in the studied

territory, we distinguish – four types of soils good for vegetable cultures growing: mountain-brown, grey-brown, meadow-brown and alluvial-meadow soils.

For it the soils evaluation in the investigating territory was performed. As is known the main criteria are humus supply, elements of mineral nutrition and sums of the absorbed bases under soil evaluation.

Soil bonitet – is a good integral quantitative indication defining real quality of some or other soils for effective plant growing [9].

Then taking the particular scales of the soils appraisal on separate signs, taking into account the main climatical indications, the ecological scores were calculated for mountain-brown, grey-brown, meadow-brown and alluvial-meadow soils. The obtained results are reflected on the table.

For the main ecological factors which essential influence on

agricultural production are a relief and climate. We used such indices as locality height, a quantity of the falling precipitations and a sum of the temperature above 10°C for the appraisal conduction. From the soil indications an indications of pH, calcareous, physical gley, a quantity of the water-resistant aggregates were applied by us.

As is obvious from the table, the mountain-brown soils on locality height above sea (500-700m) obtained 70 scores. However, here 100 scores were got on precipitations (549 mm), the vegetable cultures need for moisture obtaining. On diagnostical signs the mountain-brown soils got 80 scores. On other physic-chemical indices, such as water-resistant aggregates quantity, physical gley content of these soils obtained 79 scores, their calcareous is valued by 63 scores, while getting 97 scores over pH, so the vegetable cultures grow well in the neutral soils. An ecological score for these soils froms 81 scores (Table).

Table Estimation of ecological condition of the soils good for vegetable in Guba-Khachmaz zone.

Names of the soils	Height, m	Rainfalls, Mm	$\sum t > 10^{\circ}C$	Bonitetmark	CaCO ₃ , %	pH	<0,01, MM	>0,25, MM	Ecological mark
Mountain-brown	500-70070	549100	2200-360080	80	4,463	7,297	52,880	63,279	81
Grey-brown	200-50090	45082	2200-400080	69	6,897	7,682	57,073	54,068	73
Meadow-brown	200-50090	45082	4285100	94	4,564	7,010 0	58,571	59,274	85
Alluvial-meadow	0 – 200100	34262	3600-4000 90	83	3,854	7,494	50,882	56,270	80

It is seen from the table that the grey-brown soils on bonitet scores got 69 scores, however an ecological score somewhat increased and formed 73 scores. It is explained by that on height of the locality 90 scores were obtained, on a quantity of the precipitations 90 scores were also obtained and 97 scores on calcareous.

The meadow –brown soils got the most ecological score 85 scores. Though the bonitet scores for these soils formed 94 scores. Calcareous influences on ecological score decrease - 64 scores physical clay content 71-scores, a quantity of water-resistant aggregates-74 scores, while getting 100 scores on ph.

The alluvial –meadow soils on locality height above sea level got 100 scores. On temperature sum above 10° C, 90 scores was obtained. Such heat providing in here is high enough, that makes a condition for the vegetable cultures development. On a quantity of the falling precipitations 62 scores were got here. It is connected with that the vegetable cultures are in need for moisture. Consequently, the frequent irrigations are required.

5. Conclusions

1. The present soil-ecological conditions in the Guba-

Khachmaz zone in connection with the vegetable cultures growing are investigated. A feature of the separate soil types and subtypes and their fitness for the vegetable cultures was given.

2. A qualitative assessment of soil of the Guba-Khachmaz area was performed. The diagnostic indicators for evaluation conducting were selected reserves of humus, nitrogen, phosphorus and sum of the absorbing bases. The meadow-brown dark soil (94 scores) was selected as a model.
3. On the basis of the particular investigations, data of the fund materials and literature sources, an ecological appraisal of the soils good for vegetable in the investigated territory was created with the utilization of the particular scales of the soils value on the separate signs. It is established that for vegetable growing, the meadow-brown soils are the best (85 scores). But the grey-brown soils got the least scores (73 scores).

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