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Gurbanov E.A., Gaziyeva P.Ch.

ESTIMATION AND REGIONALIZATION OF POTENTIAL RISKINESS OF THE IRRIGATIVE EROSION IN THE KUR-ARAZ LOWLAND

Azerbaijan University of Architecture and Construction, Department of Geomatic, AZ 1073, Baku, A.Sultanova str. 11, Azerbaijan
e-mail: eldar_qurbanov_54@mail.ru

Abstract. It was determined that the irrigative erosion developed in the arable areas under complex relief condition in the sloping plain and foothill regions of the Azerbaijan Republic. It is important to define a potential riskiness of erosion with the purpose of preparing of the fight measures against irrigation erosion and to characterize the factors which created it in these zones. We defined durability of soils against erosion and their water absorption ability and characterized a surface sloping of the soils for it. The potential riskiness of the soil irrigative erosion is divided into 5 degrees: weak risky, mean risky, strong risky, very strong risky and catastrophic risky. The riskiness was estimated by a quantity of the soil which is possible to be leached.

During the surface irrigation the soil water-absortion ability and durability against erosion must be taken into account while preparing technology against erosion.

Key words: irrigation erosion, erosion potential riskiness, riskiness degree, durability against erosion, regionalization.

INTRODUCTION

The erosion researches show that it is very difficult to prevent from soil leaching of soils on practical side. Therefore at first a potential riskiness of the zone must be estimated and regionalizated while the measures are prepared against erosion in the irrigative soils. A quantity of the soil which is possible to be leached must be assumed as a basis in the valuation. While applying a definite irrigative technics the leaching soil quantity characterizes a potential riskiness. While preparing measures against erosion these parameters the leaching soil mass limit must be taken into cosideration. At first the degrees of the erosion potential riskiness in the soils should be defined and mapped. The soil-protective irrigation techology must be worked according to each riskiness degree. The additional measures should be applied for increase of the water expenditure quantity (value). The measures must be taken for increasing of soil durability against erosion. In surface irrigation the transverse furrows must be used and beforehand fertiling methods should be applied.

OBJECTS AND METHODS

There are some methods for estimation of the potential riskiness of the soil erosion. (M.S.Kuznetsov [1], L.W.Gatto [2]) R.Morgan [3].

We have used of M.S.Kuznetsov's [4] methods in order to evaluate and district a potential riskiness of the irrigative erosion development According to general of these methods the potential riskiness of the irrigative erosion depends on soil durability against erosion, irrigation technics or water surface, surface inclination, a quantity of the water-durable aggregates [5] (Khamdanov Kh, 1975) We have learnt and evaluated water-durability of the soils against erosion by M.S.Kuznetsov's bottom leaching rate [6].

We have calculated a quantity of the possiple leaching by the following formula because a quantity of the leaching soil exactly characterizes erosion potential riskiness.

$$Q = \frac{1}{a}\left[\frac{i \cdot r}{V_{\Delta y}\frac{d}{10}}\right]\cdot\frac{100}{l} \qquad (1)$$

Q - a quantity of the leaching soil, t/h, a-inter-row distance, by m, *i*-inclination, *r*- water expenditure for furrows, by l/s, $V_{\Delta y}$ - bottom leaching rate of the stream, by-m/sec, *r*-mean diametre of water- durable aggregates by-mm, *l* - length, by-m.

We have learnt a bottom, leaching rate by M.S. Kuznetsov's method [7] and planned ıt accordıng to M.P. Babayev and E.A. Gurbanov's suggestions [8].

The bottom leaching rate of the stream has been calculated by the following formula [9].

$$V_{\Delta y} = 1.55\sqrt{\frac{g}{r_0 n'}(r - r_0)(1 - \frac{P}{100})m/s} \quad (2)$$

d-mean diametre of water-durable aggregates;mm; g-free fall accelaration; cm; r,r_0-corresponding and water special weight; gr/$sm^2.c^2$; P-soil porosity; %, n/-coefficient that characterizes a flow (n/=1.46).

The quantity of the water-durable soil aggregates has been defined by N.Savinov's method and a mean size has been calculated by the following formula.

$$\overline{d} = \frac{d_1P_1 + d_2P_2 + \ldots + d_nP_n}{100} \quad (3)$$

Here $d_1,d_2,\ldots.d_n$ is a mean diametre of the water-durable aggregates for fraction: mm, $P_1,P_2\ldots.P_n$ is a quantity of the water-durable aggregate fraction by a percentage.

The valley sloping has been characterized by general received methods. The investigations have been carried out in the Kur-Araz valley, mainly Garabagh, Mil, Shirvan, Mugan and South-Eastern Shirvan plains.

RESULTS AND DISCUSSION

According to the consequences of the research the durability of grey-brown (Cypsisols),meodow-grey (Gley is Calsisols), grey (Calsisols) soils against erosion-a bottom leaching rate of the flow is 0.043 m/s, grey-brown(Kastonozems)-0.054 m/sec, steppe mountain-brown (Haplic Kastonozems) soils are 0.092 m/s (Table 1).

Table 1 – Durability of the soil soft sowing layer against erosion

Soil	Mean diametre of water-durable aggregates,mm	Bottom leaching rate of the flow, m/sec
Cypsisols, Gleyis Calsisols, Calsisols	0.27	0.043
Calci Kastonozems	0.32	0.043
Kastonozems	0.34	0.054
Haplic Kastonozems	1.16	0.092

The mean diametre of the waterdurable aggregates is 0.27 mm in grey-brown (Cypsisols), Meadow-grey (Glayis Calsisols) and grey (Calsisols) soils, 0.32 mm in bright grey-brown (Calci Kastonozems) soils, 0.34 mm in chestnut (Kastonozems) soils, 1.16 mm in steppe mountain brown soils (Haplic Kastonozems).

The surface sloping of the irrigative soils in the valley have been classified as the following: 1) without sloping-less than 0.0015, mean sloping-0.0005;

2) weak sloping-0.0015-0.0025, mean sloping-0.002; 3) mean sloping-0.0025-0.0075; mean sloping -0.005; 4) great sloping-0.0075-0.015, mean sloping-0.015; 5) very large sloping-0.015-0.025; mean sloping-0.02; 6) mean sloping hill-side 0.025-0.055; mean sloping -0.04,very sloping hill-side 0.055-0.10, vertical slope>0.10 (Table 2). A character of the zone according to the sloping is shown on Table 2. Till 50 % of the Lowland zone is without sloping. The soils of the Salyan plain, North Mugan, one part of the Mil and Shirvan plains.

Table 2 - Classification of the inclination of the Kur-Araz Lowland irrigative soil

Value of the surface inclination	Sloping	Surface character	Characters of the irrigative soil surface sloping
Without sloping	<0.0015	Very smooth	Irrigation is conducted by a burning method, debris materials are collected.
Sloping	0.0015-0.0025	Smooth	Irrigation is conducted by a burning method. Debris material accumulating occurs.
Mean	0.0025-0.0075	Weak sloping	It is useful for irrigation with furrow and zones, but when inclination is 0.004, erosion process development begins in great water expenses.
Large	0.075-0.015	Weaker sloping	There must be measures against irrigation erosion in all methods of the irrigation.
Very large	0.015-0.025	Sloping	It is unfit for irrigation, riskiness of soils against erosion in irrigation.Weak water expenses are applied.
Mean sloping hill-side	0.025-0.055	Sloping foothill	Irrigation erosion with the zones in irrigation is very risky. Very large soil mass is leached by furrows in irrigation, therefore contour irrigation and special measures are fulfilled.
Very sloping hill-side	0.055-0.10	Very sloping foothill hill-side	Very large soil leaching occurs in irrigation. Irrigation tecnics must be applied against erosion, short furrows and contour irrigation must be used.
Vertical hill-side	>0.10	Vertical smooth hill-side	It is unfit for irrigation. Erosion process is very risky, ravine, hollow valleys. Artificial rains, drop and other methods are used in the irrigation.

Bank-side of the river of Kur concern here. The soils that having weak surface sloping are in North Mugan, Sabirabad and Saatli, Salyan, on the shores of the Caspean Sea (Neftchala), Mil plain (Imişli, Agjabedi), Barda and Yevlakh in the Garabagh plain, Ujar in the Shirvan plain, Kurdamir and Agdash.

The soils having mean sloping surface spread around Azizbayov canal of Shouth Mugan, accumulative terrace of the Kur river in south-east Shirvan, debris cone of the Araz river in Mil, around head Mil Canal, Hajigabul region of Shirvan, Goychay, Kurdamir districts, around upper Shirvan.

The soils having very large and large sloping surface are between Azizbayov canal and state border of Iran Islamic republic in South Mugan, Bolgarchay debris cone, a great part of South-east Shirvan, Araz debris cone in the Mil plain, Yevlakh district in the Garabag plain, Shirvan plain, Girdiman, Agsu, Goychay and Turyanchay cone of the Left bank of the Shirvan Canal.

Irrigation erosion potential riskiness is defined paying attention to the surface sloping, water-penetrating ability of the irrigative soils and durability against erosion. Erosion riskiness is estimated according to [10] N.K. Shikula, A.G. Rojkov and P.S. Tregubov's (1973). Leaching intensity scale (Table 3).

Table 3 – Estimation of the zone erosion riskiness for leaching soil quantity

Erosion riskiness value of the zone	Leaching soil quantity	
	t/h in year	mm/year
There is not erosion riskiness	Leaching rate falls behind soil forming rate	
Weak risky	Less than 6	Less than 0.5
Mean risky	6-12	0.5-1.0
Strong risky	12-24	1.0-2.0
Very strong risky	24-60	2.0-5.0
Catastrophic risky	More than 60	More than 5.0

In order to define a quantity of the leaching soil G.M.Huseynov [11] (1969), E.A.Gurbanov's [12] (2010) irrigation technics is used (Table 4). During irrigation paying attention to leaching soil quantity the zone is divided into the following potential riskiness regions in order to prepare fight measures against irrgation erosion.

Table 4 – Estimation of the potential riskiness of irrigation erosion (leaching soil quantity, t/h)

A quantity of water-absorption ability	Mean sloping of irrigative area					
	0.1	0.04	0.02	0.01	0.005	0.002
	Riskiness degree					
	catastrophic	Very strong	Strong	Mean	Weak	Safe
Strong	–	24.5	15.6	10.4	4.8	–
High	–	26.5	18.3	14.8	5.6	–
Mean	–	30.6	20.1	16.9	6.8	1.6
Low	–	48.4	26.8	–	9.3	2.4

1. Potential safe soils-more than half of the Lowland are concerned irrigation erosion, they surround weak sloping and non-sloping zones. The grey, grey-meadow and grey-brown soils possessing water-absorption ability to a different degree including, the leaching soil quantity isn't more than 2.5t/h-year. It is necessary to use traditional irrigation technology in the same zones. Potential safe soils surround North Mugan, Salyan plains, Wholly Shirvan, arround the Kur in Mil and Garabagh.

2. Weak potential risky soils consolidate soil areas possessing different water-absorption ability and mean sloping of less than 0.005 and sloping of 0.005 strong and high water-absorption ability. Leaching soil quantity in year isn't more than 6 for a hectare. Such soils surround around the Araz river valley of North Mugan, the areas of the left bank of the Azizbayov Canal, automobile inter-high-way of Baki-Gazakh with Garasu marsh in the Shirvan plain, irrigative soils around Upper Garabagh Canal. The leaching soil mass quantity is 6-12 t/h in mean potential risky soils against irrigation erosion.

3. The soils which possess mean and low water-absorption ability and their sloping is 0.005 and possess high water-absorption ability, sloping of 0.005-0.01 include in mean risky zones. The same soils concern right river zone of the Azizbayov Canal in south Mugan, irrigative zones of the Araz river debris cone in Mil. They surround Yevlakh district in Garabagh, Goychay and Agdash regions in Shirvan. The soil-water protective irrigation technology is demanded to be used during irrigation.

4. The leaching soil quantity is 12-24 t from hectare in the strong potential risky zones of the irrigation erosion. The soils possessing high and mean water-absorption ability with the sloping of 0.01 and strong, high and mean water-absorption ability of 0.02 concern potential risky soils. Though such soils don't surround a large zone they spread in the river debris cone of the Shirvan plains, ancient cone of the Araz river in Mil, in the zones between Azizbayov Canal of South Mugan state border of Iran Islamic Republic. It is important to fulfil additional soil-protective measures with the irrigation technics against erosion in the strong potential dangerous soils.

5. The leaching soil quantity changes by 24-60 t from hectare in a year in the areas where irrigative erosion is very strong potential risky. The soils possessing waterabsorption ability and sloping of 0.02 and different waterabsorption ability, sloping of 0.04 belong to such risky areas. Very strong potential risky soils surround Bolgarchay cone, South-east of Shirvan, sloping areas in which Shirvan plain joins the Great Caucasus, Agsu, Girdman, Goychay and Turyanchay debris cone, including Araz ancient terraces and cone of the Mil plain, Gargarchay, Tartar and Injachay cone and small areas.

6. The catastrophic risky soils of irrigation erosion aren't observed in the Kur - Araz Lowland during the research. The yearly leaching must be more than 60 h. in such soils.

It is possible to leach the soils in this quantity in the separate zones different times. It is necessary to use additionally contour irrigation with the irrigation technics and technology against erosion, measures which rise durability against erosion, progressive irrigation methods (drop, aerozol and etc) in the very strong and catastrophic potential risky soils of irrigation erosion.

CONCLUSION

It was defined during the research that the bottom leaching rate, soil water-absorption ability and applied irrigative technics characterize potential riskiness of irrigation erosion inclination, durability of soils against erosion.

The weak risky leaching is 6 t/h, mean risky is 6-12; strong risky is 12-24; very strong risky is 24-60; catastrophic risky is more than 60 depending on the

risky degree the soil-protecting irrigative techniques must be prepared and applied for every soil type.

The advanced irrigative methods are recommended in the areas having very strong and catastrophic risky degree, using of drop and aerosol irrigation is necessary depending on character of the agricultural plants.

Different measure preparations are taken into account for each of five separate risky districts. The irrigation must be conducted on the previous basis in the safe soils. The water expenditure must be regulated and leaching shouldn't be more than 2.5 t/h-year in the weak risky soils. The soil protective irrigative technology application is recommended in the mean risky soils. The additional measures system must be prepared in strong , very strong and catastrophic risky soils, and used of progressive irrigation technics in drop and aerosol irrigations.

It was determined during the carried out investigations that the main reasons of degradation in the soils of the lowland of Kur-Araz were rain erosion, irrigation erosion, deflation, irrigation and intensive use of the pastures.

The rain erosion happens on bare and inclined slopes and it is a cause for degradation of the pasture soils. At first complex measures must be fulfilled against it. A development of the irrigation erosion exposes the soils to the most intensive degradation in the soils where the irrigation inclination is 0.003-0.005 and higher than it.

Degradation happens by increase of the quantities of inclination and water expenditure, an expense of humus, nitrogen and other biogenic elements which belong to washout soil and its structure. Running the danger of degradation of these areas was studied very exactly.

Grazing turned into the main reason of degradation in the pastures. The intensive grazing intensifies erosion and deflation and degradation in the soils.

It was know that a level of the development of degradation in the lowland of Kur-Araz required fulfillment of the fight against it.

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ТҮЙІН

Гурбанов Э.А., Газиева П.Ч.

КУР-АРАЗ ОЙПАТЫНЫҢ ИРРИГАЦИЯЛЫҚ ТОПЫРАҚ ЭРОЗИЯСЫНЫҢ ПОТЕНЦИАЛДЫ ҚАУПІН БАҒАЛАУ МЕН АУДАНДАСТЫРУ

Әзірбайжан Архитектура және Құрылыс Университеті,

AZ 1073, Баку қ., А.Султанова көш. 11, Әзірбайжан,

e-mail: eldar_qurbanov_54@mail.ru

Әзірбайжан Республикасының жыртылған жерлер зонасындағы жазық және таулы аудандарының беткейлерінде ирригациялық эрозия күрделі жер бедері жағдайында дамитыны анықталды. Ирригациялық эрозиямен күресу шараларын ұйымдастыру және оның пайда болуына ықпал еткен факторларды сипаттау мақсатында эрозияның пайда болуының ықтимал қауіптерін анықтау маңызды болып табылады. Біз топырақтардың эрозияға қауіптілігі мен олардың су-абсорбциялық қабілетін анықтап, топырақ беткейінің жайпақтылығын сипаттадық. Топырақтың ирригациялық эрозиясының ықтимал қаупінің 5 деңгейі бар: әлсіз қауіп, орташа қауіп, күшті қауіп, өте күштіқауіп және апаттық қауіп. Қауіп сілтісіздендіруге ұшырау мүмкіндігі бар топырақ мөлшеріне байланысты бағаланды.

Ирригация кезінде топырақтың суды абсорбциялау қабілетіне және эрозияға қарсы технологияларды дайындау барысындағы эрозияға тұрақтылығын есепка алу қажет.

Түйінді сөздер: ирригациялық эррозия, ирригация ықтималдылығының қаупі, қауіп деңгейі, эрозияға тұрақтылығы, аудандастыру.

РЕЗЮМЕ

Гурбанов Э.А., Газиева П.Ч.

ОЦЕНКА И РАЙОНИРОВАНИЕ ПОТЕНЦИАЛЬНОГО РИСКА ИРРИГАЦИОННОЙ ЭРОЗИИ ПОЧВ В КУР-АРАЗСКОЙ НИЗМЕННОСТИ

Азербайджанский Университет Архитектуры и Строительства, кафедра геоматики, AZ 1073, г. Баку, А.Султанова 11, Азербайджан,

e-mail: eldar_qurbanov_54@mail.ru

Было установлено, что ирригационная эрозия развивается в пахотных зонах в условиях сложного рельефа на склонах равнинных и предгорных районов Азербайджанской Республики. Важно определить потенциальный риск возникновения эрозии с целью подготовки мер по борьбе с ирригационной эрозией и охарактеризовать факторы, способствовавшие ее возникновению. Мы определили устойчивость почв к эрозии и их водоабсорбирующую способность и охарактеризовали пологость поверхности почв. Потенциальный риск ирригационной эрозии почв делится на 5 степеней: слабый риск, средний риск, сильный риск, очень сильный риск и катастрофический риск. Риск оценивался по количеству почвы, которая может быть подвержена выщелачиванию.

Во время ирригации следует учитывать способность почвы абсорбировать воду и устойчивость к эрозии при подготовке противоэрозийных технологий.

Ключевые слова: ирригационная эрозия, риск ирригационного потенциала, степень риска, устойчивость к эрозии, регионализация.