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Change in the Agrochemical Properties of Soils and the Productivity of the Wheel Under the Influence of Electromagnetic Waves

Yuldashev Gulom
Professor of Fergana State University, Fergana, Uzbekistan
Corresponding author email: g.yuldashev@umail.uz

Marupov Azizxon Abbosxonovich
Assistant of Fergana Polytechnic Institute, Fergana, Uzbekistan
Email: a.marupov@ferpi.uz

Abstract---*In recent years, in the world, the anthropogenic impact on the soil, entailing various changes in its properties, is becoming more severe. Especially it is necessary to note the lands located on the boundaries of the protection zones of linear objects. This article studies the agrochemistry of soils that are under zones and linear protection objects and the effect of electric waves on wheat productivity. Overhead power lines have a negative impact on the environment, in particular on its ecological, social, and economic systems due to the high intensity of the electromagnetic field around the lead wires. High-voltage power lines do not significantly affect the content of humus and nutrients.*
Keywords---*agriculture, agrochemical, geographic information systems, power lines, soil*

Introduction

The world pays special attention to the implementation of scientific research on the use of modern geoinformation technologies and remote sensing methods for the study, assessment, and monitoring of lands for agricultural purposes. In view of theory, it seems relevant to study the composition, properties, and monitoring of soils located within the boundaries of protected zones and linear objects using modern geoinformation technologies. For this, it is necessary to note the important role of high-voltage power lines on the properties and productivity of crops (Corwin & Lesch, 2005; McLaughlin & Mineau, 1995).

Uzbekistan contains an open list of zones with special conditions for the use of territories, which are established in order to protect the environment or an object from negative external influences. In relation to them, it is legitimate to use the general term "security zones". In terms of its content, it boils down to prohibitions on the implementation of certain types of activities and to the obligations to fulfill the established ones (Neverova, 2011). At the same time, security zones are located on land plots of many categories and types of permitted use, owned, owned, and used by individuals and legal entities. At the same time, only the total area of land located within the boundaries of protected zones (power lines, gas pipelines, transport, etc.) is about 1/5 of the total land-use area. One of the objectives of the study is an analysis of the agrochemical properties of soils in protective zones of linear objects and the impact on the yield of vegetation (Karhu et al., 2011; Brussaard et al., 2007).

Objectives

The object is soil located on land plots security zones of high-voltage electric lines (power lines), which form electromagnetic waves Fergana and Yazyavan regions (Yuldashev & Marupov, 2019). The climate of the Fergana and Yazyavan regions is suitable for obtaining a high-quality wheat harvest. Winter is mild, sometimes harsh. The average January temperature is -3.2 ℃ (Fergana), the absolute minimum is -25 ℃. The snow cover is short-lived.

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On some winter days, the weather is warm. Hot summer (Thapa & Murayama, 2008; Rehakova et al., 2004). The average July temperature is + 28 °C, the maximum is + 40.4 °C. Average long-term meteorological indicatorsFergana and Yazyavan regions are represented in table-1. The sum of effective temperatures in the regions of Fergana and Yazyavan is 2430 °C, and in Yazyavan it is 2459 °C. The duration of the growing season with temperatures above 11 °C is 223 days. From the given data of the table, it can be seen that the average annual air temperature both in the Fergana region and in the Yazyavan region is not the same and amounts to 15.0-16.2 °C.

Table 1
Average long-term meteorological indicators

Stations	Months												Average annual
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
Temperature, air, ^{0}C													
Fergana region	-2.3	1,2	8.1	16.1	21.2	25.2	26.2	24.4	19.5	13.1	5.4	0.3	13.2
Yazyavan	-2.2	0.9	7.6	15.4	20.5	25.1	25.9	25.1	19.6	12.6	8.5	0.3	13.3
Precipitation, mm													
Fergana region	14	12	18	13	12	8	4	3	2	9	14	12	121
Yazyavan	18	21	29	21	16	10	4	2	3	12	21	18	165
Relative humidity, %													
Fergana region	83	83	72	62	53	46	51	57	62	69	76	83	66.4
Yazyavan	82	81	71	58	53	45	44	52	57	65	76	82	63.8
Soil temperature °C													
Fergana region	-3	1	9	12	26	32	33	30	22	13	4	1	15.0
Yazyavan	-2	1	8	13	27	31	36	34	25	14	5	2	16.2

As for precipitation, there is a big difference between the desert and gray earth zones (Abdullayev & Marupov, 2020; Marupov & Axmedov, 2020). If in Yazyavan there is an average of 121 mm of precipitation, in the Fergana region 165 mm is almost one and a half more. The relative humidity is practically the same at 64%; The soil temperature is also practically the same both in the meadow saz soils of Yazyavan and in the sierozem of Fergana and is 15-16 °C. Newly irrigated meadow soils of the irrigation-saz moistening regime usually occupy well-planned, somewhat lowered territories, and they are formed mostly in the desert zone of central Fergana (Basso et al., 2000; Bastian et al., 2002). The humus content in the arable horizon of these meadow soils ranges from 0.82 to 1.15% (Figure 1).

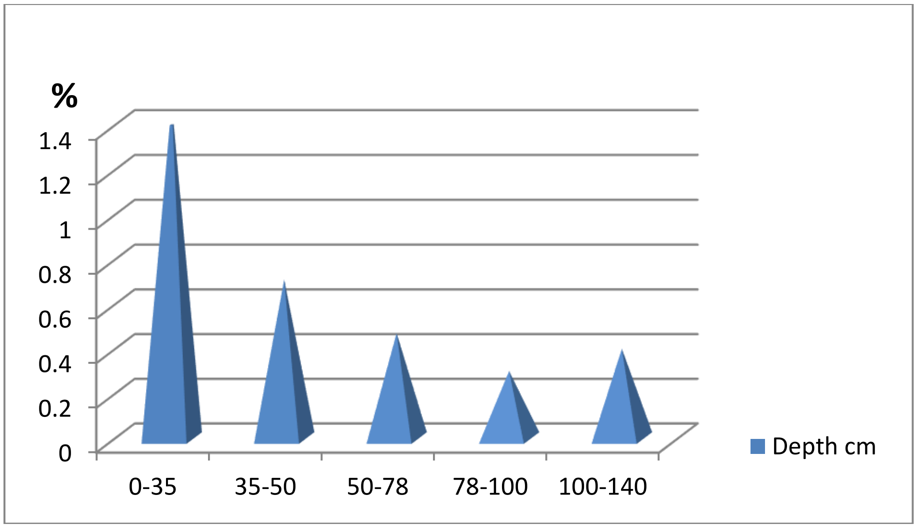

Figure 1. Humus content in the profile of newly irrigated meadow saz soils in Central Fergana (Yazyavan region)

The nitrogen content depends on the amount of humus and ranges from 0.033 to 0.035%. Newly irrigated meadow saz soils are poorly provided with mobile forms of phosphorus. At the same time, fluctuations in its content vary from 13 to 19 mg/kg of soil, which is associated, first of all, with the uneven application of phosphorus fertilizers and the state of the soil. The soils are insufficiently and moderately supplied with mobile forms of potassium (160–321 mg/kg of soil) (Saravanadurai & Manimehalai, 2016; Sadguna et al., 2017).

The object of the study is irrigated typical, light, serezem, piedmont gentle plains, adjacent to the merged fan and upper river terraces, folded loesses, loess-like loams and skeletal-fine earthy proluvium and deluvium on the territory of the Fergana region (Marupov, 2020). Soil: Water-irrigated serozem, typical cultivated, medium-loamy on medium and light loam, with 1-2 m, in places with 0.5-0.8 m, underlain by pebbles, newly irrigated serozem light, weakly cultivated, skeletal-fine earth, with 0.3-0.5 m, less often from 0.1 m underlain by pebbles, etc. (Figure 2)

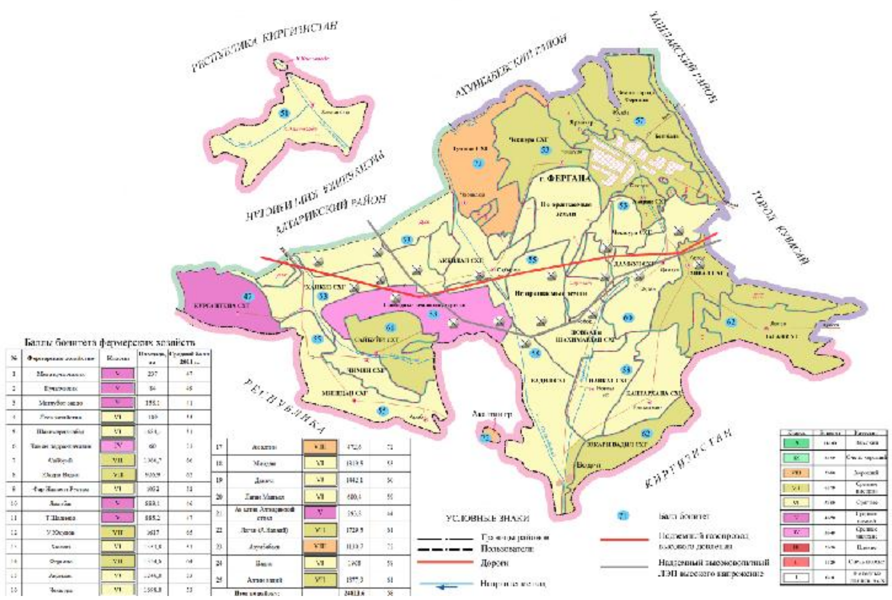

Figure 2. Fergana and Yazyavan regions

On the territory of the Yazyavan region, on flat plains composed of layered alluvial-molten sediments, soils are grown, meadow saz, salted (Figure 3).

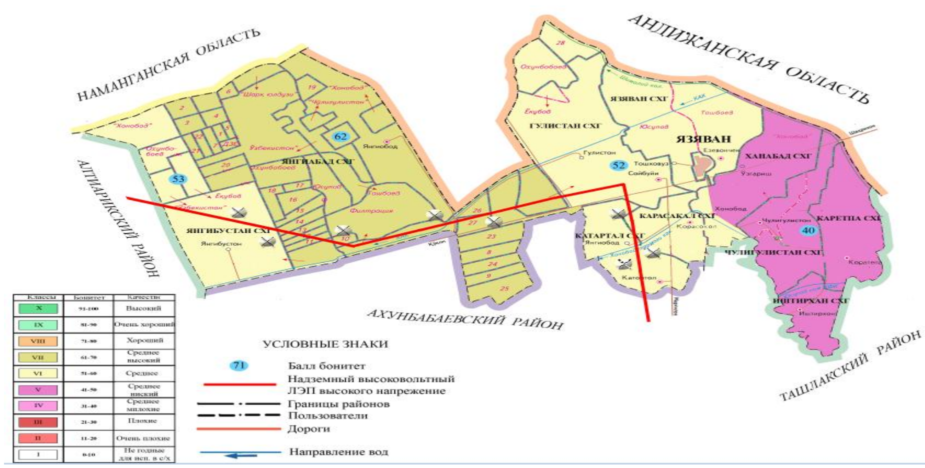

Figure 3. Fergana and Yazyavan regions

Also, in Figures 2-3, the trajectories of the electric transmission line are shown and the sections for sampling soils in the Fergana and Yazyavan regions are marked.

Statistical design

The following analyzes were carried out in the selected soil samples:

a) humus according to the Tyurin method;
b) gross nitrogen and phosphorus, potassium in one sample according to the method of Maltseva, Gritsenko;
c) mobile phosphorus according to Machigin;
d) mobile potassium from 1% ammonium extract according to Protasov;
e) water-soluble salts by the method of water extracts;
f) the mechanical composition of the soil by the pipette method using sodium hexametaphosphate;

Table 2 shows the results of changes in humus content in soils according to Ferganagiprozem and the author. Changes in growth, development, and weight of 1000 wheat seeds under the influence of irrigation with saline waters (Numanovich & Abbosxonovich, 2020).

Table 2
Change in irrigated areas with humus content

No.	Farm	Humus,%				
		up to 1%	1.1-2%	2.1-3%	>3%	Total, ha
1	Meva kchatchilik		thirty	207		237
2	Kchatchilik	36	48			84
3	Matlubot Savdo		158			158
4	Ўrmon khўzhaligi		109			109
5	Shohimardonobod	827	745	113		1685
6	Chimeon parrandachilik	60				60
7	Soibuyi	946	120			1066
8	Yuқori drove *	620	307			927
9	Far Navkent Rustam	452	473	108		1033
10	Yangiboғ *	280	604			884
11	T. Shodieva *		830	56		886
12	U. Yusupov *	550	1067			1617
13	Honқiz *	860	494			1354
14	Farғona	155	870	325	4	1354
15	Oқbilol *	1110	147			1457
16	Chekshura	294	1255	151		1700
17	Oh oltin	238	234			472
18	Mindon *	790	250	279		1319
19	Damkul	688	754			1442
20	Logon Mashal	104	576			680
21	Oқ oltin, Oltiariқ bўlimi	294				294
22	Logon (A. Navoi)	817	890	22		1729
23	Ochunboboev	708	422			1130
24	Drove *	801	1041	126		1968
25	Oltin vodiy *	632	440	306		1378
	Total:	11282	11829	1698	4	24813

* author data, 2020-2021

As can be seen from the table, the area of soils with different humus contents does not change significantly for almost 10 years, small changes are observed in areas with humus contents of 1.1-2%, mainly due to the humus content of up to 1%, which is associated with constant improvements in the state of culture of soils (Marupov et al., 2021). Phenological observations (table-3) showed that the distance from the power line increases the growth and development of wheat.

Table 3
Growth, development of wheat under the influence of electromagnetic waves

Key area number	Distance from power lines, m	Repetition	Plant growth, sm				Weight of 1000 seeds, g.
			Tube-vanie	Koloso-vanie	Milky-wax ripeness	Maturity	
Irrigated typical gray soil (to the left of the power line)							
1	0	1	83.1	95.0	98.5	110.1	43.9
		2	94.6	95.3	98.1	111.3	44.3
		3	80.6	101.0	106.8	110.8	48.4
the average		-	86.1	97.1	101.1	110.7	45.5
2	thirty	1	84.4	100.1	99.5	111.1	44.9
		2	87.3	100.3	99.4	110.3	45.6
		3	83.6	105.1	109.4	115.4	50.1
the average		-	85.1	101.8	102.8	112.3	46.9
3	60	1	90.3	109.6	101.5	115.5	45.5
		2	95.5	105.5	105.4	110.2	45.6
		3	83.3	106.6	108.5	120.4	52.8
the average		-	89.7	107.2	105.1	115.4	48.0
Irrigated typical gray soil (to the right of the power line)							
1a	0	1	83.1	95.0	98.5	110.1	43.9
		2	94.6	95.3	98.1	111.3	44.3
		3	80.5	101.3	106.8	110.8	48.4
the average		-	86.1	97.2	101.1	110.7	45.5
2a	thirty	1	86.6	110.1	115.1	120.5	49.1
		2	91.8	111.4	120.5	119.8	44.8
		3	93.4	98.5	115.6	115.6	47.4
the average		-	90.6	106.7	117.1	118.6	47.1
3a	60	1	91.4	115.6	115.6	121.6	51.1
		2	98.1	111.5	120.4	125.6	46.8
		3	101.6	101.5	120.5	120.6	48.1
the average		-	97.0	109.5	118.8	122.6	48.7

The greatest growth is observed at a distance of 60 m from the power transmission line in the phase of maturity and averages 115.4 seeds (Mamanazarovna & Abbosxonovich, 2021). Changes in the growth and development of wheat led to changes in yields, which are presented in table 4.

Table 4
Change in wheat yield

Key area number	Distance from power lines, m	Repetition	Productivity, ha			
			corn	straw	corn	straw
With the right from the power line, 2019					2020 y.	
		1	45.2	69.0	50.2	73.2
1	0	2	44.8	66.8	49.3	70.2
		3	46.2	68.8	50.8	72.5
the average		-	45.4	68.2	50.1	72.0
		1	48.8	71.3	53.1	76.9
2	thirty	2	47.4	70.5	52.2	74.2
		3	48.3	73.1	53.4	76.9
the average		-	48.2	71.6	52.9	76.0
		1	52.1	72.7	57.2	79.7
3	60	2	51.2	73.5	56.8	77.8
		3	49.8	74.8	58.7	78.5
the average		-	51.03	73,7	57.6	78.7

To the left of the power line, 2019					2020 y.	
		1	45.2	69.0	50.2	73.2
1a	0	2	44.8	66.8	49.3	70.2
		3	46.2	68.8	50.8	72.5
the average		-	45.4	68.2	50.1	72.0
		1	50.8	73.3	54.1	80.6
2a	thirty	2	51.4	72.8	53.7	77.5
		3	50.4	73.8	54.6	80.4
the average		-	50.9	73.3	54.1	79.5
		1	54.1	74.5	60.2	81.9
3a	60	2	52.8	76.1	61.1	79.6
		3	50.5	75.5	59.8	81.9
the average		-	52.5	75.4	60.4	81.1

From which it can be seen that the highest yield corresponds to key areas 3 and 3a, which are located at a distance of 60 m. Both to the left and the right of the power line (Turdaliev et al., 2021).

Results

Overhead power lines have a negative impact on the environment, in particular on its ecological, social, and economic systems due to the high intensity of the electromagnetic field around the lead wires. High-voltage power lines do not significantly affect the content of humus and nutrients (Lagacherie & McBratney, 2006; Soane & Van Ouwerkerk, 1994). Electromagnetic fields of power transmission lines negatively affect the growth, development, and yield of wheat, where directly under the power transmission line (zero physical point) it decreases by 7-10 c / ha.

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