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The Effect of Organic Matter and Mineral Fertilizers on the Growth, Development, and Yield of Winter Wheat Plants in Irrigated Serozem - Meadow Soil Subjected to Leaching

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Annotation: This article shows that as the level of leaching in plain area soils increased as a result of flooding, the amount of humus and nutrients in the soil decreased accordingly. To restore soil fertility, organic and mineral fertilizers were applied to irrigated serozem-meadow soils washed away by floods. The soil properties, as a result of restoring fertility in a short time, are described, indicating the winter wheat crop. As a result, it was determined that in the soil samples taken at the high index after the end of the winter wheat vegetation of the field experimental area, i.e., when zoohumus was applied, the humus content in the 0-30, 30-50 cm layers changed by 0.639-0.822%, mobile phosphorus by 29.3-61.5 mg/kg, and exchangeable potassium by 271-379 mg/kg.

Keywords: Irrigated serozem meadow soils, soils with varying degrees of leaching, arable and sub-arable layers, soil restoration.

Introduction. In determining the current state of soils in the world, it is important to prevent negative phenomena such as dehumification, erosion, salinization, and loss of biodiversity**.** Research is being conducted to develop scientifically based criteria for assessing the humus status of eroded soils and new agrotechnology for effective methods of restoring soil fertility lost as a result of flood processes. For this purpose, it is necessary to implement agrotechnical measures using various methods to restore the fertility of the soils of the area severely damaged by this disaster. On May 1, 2020 year a natural disaster occurred in the Syrdarya region, causing damage to a certain part of the "Sardoba Reservoir" dam in the Sardoba district of the region. As a result, water overflowed from the dam, causing serious damage to several settlements, residential areas, social facilities, and irrigated agricultural lands, including cotton, grain, melons, and other crops, in the Sardoba, Okoltin, and Mirzaabad districts of the region.

Study Area and Methods. Research Field experiments were continued on serozem-meadow soils consisting of proluvial-alluvial, lake-alluvial deposits, irrigated by the Jettisoy and Sardoba deposits in the Bek cluster farm area of the Mirzachol massif of the Mirzaabad district of the Syrdarya region. The groundwater table is at a depth of 2.5-3.0 meters, and the field experiment consisted of seven variants with three rotations. During the cotton-winter wheat sowing process, the following sequence of work was carried out:

Experience system.

1. N_{180} P_{126} K_{90} (Background)- Control ratio $N_{1,0}$ $P_{0.7}$ $K_{0.5}$
2. Background + 200 ml/ha Bioenergy –M biopreparation
3. Background + Biohumus 10 t/ha
4. Background + Zoohumus 10 t/ha
5. Background + Manure 20 t/ha
6. Background + organic mineral fertilizers (OMF) 15 t/ha
7. Background + organic mineral fertilizers (OMF) 10 t/ha

1- experimental design.

1st replicate							2st replicate							3st replicate						
1	2	3	4	5	6	7	1	2	3	4	5	6	7	1	2	3	4	5	6	7

The experiment was conducted in a systematic (ordered) manner with 3 replications (scheme 1). The length of the experimental area is 20 meters, the width of each plot is 91.2 meters (6 rows, of which 4 are considered, 2 are protective rows; row spacing is 0.76 cm). The area of one plot is 91.2 m2 or 0.0912 hectares. The total area of the experiment is 1915.2 m2 or 0.1915 hectares. Methods of conducting field experiments [2]. General chemical analyses of the soil were carried out according to generally accepted methods based on the instructions of E.V. Arinushkina [3].

Research results and their analysis. In the recommendations of the American scientist Jason-Clark for the management of soil and soil fertility restoration after flooding, nitrogen in water-saturated soils is converted into gaseous forms during the denitrification process and is released into the atmosphere. As a result of the current flooding, the population of microorganisms decreases. During flooding, it is possible to observe the accumulation of various amounts of erosion sediment residues in the fields. If a large amount of residues or sediments have accumulated, then deeper plowing is required [4].

In agricultural lands flooded by the tsunami in Miyagi Prefecture, Japan, it was observed that soil salinity increased, fertility and physical siltiness decreased, and some areas were collected and transported. In addition, when comparing soil data before the tsunami flood, differences in soil properties were found. In order to restore soil fertility in flooded areas, phytoremediation was used to change the C:N ratio. In agriculture, cheap, salinity-reducing cotton waste, ash, charcoal, and halophyte plants were recommended for salt removal and harmlessness[5; p-39-48., 6; p- 19-24].

Decree of the President of the Republic of Uzbekistan No. F-5569 dated May 1, 2020, was adopted [1]. A field experiment was conducted to improve the eco-reclamation state of irrigated lands after the Sardoba reservoir flood, namely, to quickly change the soil nutrients in three different places when growing oilseed and fodder crops on saline soil. It was determined that the humus in the old soil plow layer under the muddy sediments formed under the influence of the flood was washed out by 0.032-0.102%, nitrogen by 2.7-9.9 mg/kg, and mobile phosphorus by 5.1-5.3 mg/kg. In addition, soil samples were taken at different depths before and after plowing, chiseling, and harrowing the flooded area. By comparing the amount of fractions in the mechanical composition of the studied soil, it was observed that the amount of physical clay was mixed [7; 71-74-p., 8; 40-42-p., 9; 36-39-p.].

When comparing the mechanical composition of soils washed to various degrees before and after the flood, physical clay and silt particles (0.5-10 and 0.4-7 percent) decreased, while coarse sand (0.4-12 percent) increased, while in areas where the soil was washed and accumulated, physical clay and silt particles (2 and 0.5 percent) increased, while coarse sand decreased, and on this basis an improved classification was developed. When comparing the amount of nutrients with the initial data of the field experiment, in the field experiment on soil fertility restoration, the average humus content in the 0-30 cm layer in options 3 and 4 was 0.099-0.168%, total phosphorus 0.027-0.036%, total potassium 0.111-0.149%, causing the amount of nutrients that plants can absorb to move from average to high, from high to very high [10; 45-p., 11; 49-56-p.]. Despite the different properties and characteristics of cultivated plants, they prefer favorable soil conditions, that is, soils rich in organic matter. In order to obtain the desired yield from winter wheat varieties suitable for soil and climatic conditions, it is necessary to solve such an urgent and responsible task as the introduction into production of organic and mineral fertilizers, among a number of agrotechnical measures.

In order to restore the fertility of soils that were weakly washed out as a result of flooding, N_{180} P_{126} K_{90} (Background) - a control mineral fertilizer was applied to irrigated meadow soils, with an NPK ratio of 1.0:0.7:0.5, and in addition to the control, various amounts of various zoohumus, biohumus, organic mineral fertilizers (OMF), black cattle manure and biopreparation were applied to the following variants. In field-experimental studies, the elite generation of Alekseevich variety of winter wheat was sown. In this case, 7 field-experimental variants were carried out, consisting of 3 rotations.

In the field experiment conducted before planting, the amount of humus, total nitrogen, phosphorus, potassium, mobile phosphorus and exchangeable potassium was determined in laboratory conditions. Table 2.

Table 2. Average agrochemical analysis of irrigated serozem-meaddow soil in the experimental field.

№ options.	Depth, cm.	25.02.2022			06.04.2022.			08.05.2022		
		Hunuss %	Mobile phosphorus mg/kg	Exchangeable potassium mg/kg	Hunuss %	Mobile phosphorus mg/kg	Exchangeable potassium mg/kg	Humus %	Mobile phosphorus mg/kg	Exchangeable potassium mg/kg
1	0-30	0,629	21,9	218	0,630	22,4	220	0,631	22,7	221
	30-50	0,449	16,1	189	0,451	18,1	192	0,451	16,3	190
2	0-30	0,653	28,3	245	0,657	28,8	261	0,662	29,4	251
	30-50	0,554	10,6	229	0,559	13,6	235	0,563	13,6	231
3	0-30	0,699	34,9	303	0,715	49,8	330	0,721	46,7	328
	30-50	0,585	18,7	237	0,595	21,5	242	0,613	19,4	251
4	0-30	0,748	42,4	316	0,789	59,1	368	0,822	61,5	379
	30-50	0,59	21,3	220	0,625	25,4	268	0,639	29,3	271

5	0-30	0,652	41,6	293	0,671	43,2	318	0,678	48,5	311
	30-50	0,535	20,8	227	0,539	21,2	235	0,548	23,2	238
6	0-30	0,664	36,3	280	0,659	39,9	299	0,686	41,2	298
	30-50	0,623	25,8	208	0,635	26,1	221	0,639	29,1	223
7	0-30	0,601	32,3	274	0,604	35,2	279	0,605	35,3	284
	30-50	0,568	20,8	201	0,571	21,6	212	0,577	22,2	208

On October 15, 2021, the elite generation of the Alekseevich variety of winter wheat was planted in the field experiment. According to the results obtained during the vegetation period of the winter wheat plant (February 25, 2022); in the 0-30 cm and 30-50 cm layers of the background control variant 1, the average humus content was 0.449-0.629%, very low, low, mobile phosphorus was 16.1-21.9 mg/kg low, exchangeable potassium was 189-218 mg/kg low, medium group (Table 2).

The lowest indicators compared to the control were observed in the 2nd and 7th variants, which had an average humus content of 0.554-0.653 and 0.568-0.601%, mobile phosphorus in the 2nd variant 10.6-28.3 and 7th variant 20.8-32.3 mg/kg, and exchangeable potassium in the 229-245 and 201-274 mg/kg.

It was determined that the average humus content of options 3 and 4, which had a high indicator compared to the control, was 0.585-0.699% and 0.590-0.748% low, mobile phosphorus in options 4 and 5 was 21.3-42.4 and 20.8-41.6 mg/kg low, and exchangeable potassium in options 3 and 4 was 237-303 and 220-316 mg/kg medium, respectively.

According to the research results (06.0.2022), the average humus content in the background control variant 1 returns is 0.451-0.630%, which is very low, a low indicator: mobile phosphorus is 18.1-22.4 mg/kg, low indicator, exchangeable potassium is 192-220 mg/kg, low, belongs to the average group. It was determined that the 3rd and 4th variant returns, which had a high indicator compared to the control, had an average humus content of 0.595-0.715% and a low indicator of 0.625-0.789%, mobile phosphorus of 21.5-49.8 and 25.4-59.1 mg/kg, low, high, exchangeable potassium of 242-330 and 268-368 mg/kg, medium, high.

In the results obtained (08.05.2022), the average of the returns of options 3 and 4 is the best, the humus content is 0.613-0.721% and 0.639-0.822%, low, mobile phosphorus is 19.4-46.7 and 29.3-61.5 mg/kg, low, high, exchangeable potassium is 251-328 and 271-379 mg/kg, medium, high. It was found that as a result of plant adaptation, some variants decreased compared to previous phases.

Phenological observations were conducted on the growth and development of winter wheat plants in the washed-out soil of the second year of the study. In it, yield calculations and a number of related works were carried out in field studies during the stages of winter wheat gathering, tillering, heading and ripening. In the period of plant tube formation (06.0.4.2022) in the control-1 variant, where only mineral fertilizers were applied, the average number of clumps per 1 m2 was 235, the average plant height was 35.7 cm, and the total number of plant stems was 270.4. In variants 3 and 4, where biohumus and zoohumus were applied at 10 t/ha, the number of clumps per 1 m2 was 28-75 more than the control variant, the average number of plant stems was 56.8-66.8 more than the control variant, and the average plant height was 5.1 cm higher than the control variant (Table 3).

Table-3. Phenological observations of winter wheat plants experimentally grown on flooded irrigated serozem- meaddow soils. (2022- year)

№. options, return	6 aprel			8 may				8 june			
	1 m² herbal collection	Total number of plant stems, 1m²/piece	Plant height per 1 m², cm.	Total plant, number of stems, 1m²/unit	1 m² plant height	1 m² of plant with spikelets	Spike length per 1 m² plant, cm	1 m² plant stem height	1 m²: length of the plant spike	1 m²: Total plant stem number, pcs.	1 m²: Number of productive plant stems, pcs.
1-I	199	292,0	35,0	411,0	48,8	389	5,1	58,8	6,7	478,3	358
1-II	258	285,2	35,3	409,1	45,0	349	5,2	55,0	6,5	487,8	352
1-III	247	234,4	36,8	351,2	32,6	311	5,4	42,6	6,4	442,5	324
Avarege	**235**	**270,4**	**35.7**	**390,4**	**42,1**	**350**	**5,2**	**52,1**	**6,5**	**469,5**	**345**
2-I	235	371,2	34,4	496,8	50,0	466	7,1	60,9	8,1	618,2	468
2-II	240	230,4	37.2	485,6	49,6	485	6,8	60,6	8,5	665,2	500
2-III	235	277,2	42.3	465,8	47,0	461	6,1	58,9	7,2	651,2	496
Avarege	**237**	**292,8**	**38.0**	**482,7**	**48,9**	**471**	**6,6**	**60,1**	**7,9**	**644,9**	**488**
3-I	295	386,4	38,0	579,6	55.6	580	7,2	65.6	7,8	780,2	585
3-II	247	298,8	39,2	488,2	52.2	518	7,3	62.2	8,3	730,9	520
3-III	247	296,0	39.2	594,0	52.4	526	7,5	62.4	8,9	759,9	551
Avarege	**263**	**327,2**	**38.8**	**553,9**	**53,4**	**541**	**7,3**	**63,4**	**8.3**	**757,0**	**552**
4-I	319	321,2	40,8	581,8	56,9	610	7,2	66,9	7,9	779,1	586
4-II	340	340,0	38,2	501,0	56,3	460	8,1	66,3	9,1	780,2	569
4-III	271	350,4	42,6	534,6	51,1	480	7,1	64,1	8,9	791,2	582
Avarege	**310**	**337,2**	**40.5**	**539,1**	**54,7**	**517**	**7,5**	**65,8**	**8,6**	**783,5**	**579**
5-I	295	309,2	35,9	493,8	50,3	532	7,9	65,9	8,4	722,2	536
5-II	252	344,0	42,3	576,0	49,2	498	7,2	63,8	8,2	681,1	509
5-III	232	329,2	44,2	543,8	47,6	496	8,0	53,8	8,7	696,1	506
Avarege	**260**	**327,6**	**40.8**	**537,9**	**49,0**	**509**	**7,7**	**62,0**	**8,4**	**699,8**	**517**
6-I	216	312,0	39,0	528,0	50,1	392	7,8	65,0	8,8	698,0	499
6-II	264	330,0	40,8	552,0	53,0	480	7,1	64,0	7,9	689,0	489
6-III	288	330,0	40,6	528,0	52,0	640	7,0	62,0	7,9	725,0	542
Avarege	**256**	**324,0**	**40,1**	**536,0**	**51,7**	**504**	**7,3**	**63,7**	**8,2**	**704,0**	**510**
7-I	276	330,0	38,4	570,0	49,0	456	7,6	63,0	8,6	668,0	488
7-II	204	324,0	42,2	510,0	54,0	459	6,9	61,0	7,9	679,0	502
7-III	288	306,0	39,8	480,0	51,0	499	7,0	64,0	8,0	638,0	481
Avarege	**256**	**320,0**	**40,1**	**520,0**	**51,3**	**471**	**7,2**	**62,7**	**8,2**	**661,7**	**490**

Table-4. A winter wheat crop experimented on flooded irrigated grassland soils. (2022- year)

№. options, return	Options name	Plant indicators per 1 m²					Stem length	Spike length	Weight of 1000 grains of wheat, gr	Productivity	
		Number of productive stems	plant collection	Stem weight, gr	Ear weight, gr	Total weight, gr				In 1 m², gr.	c/ha
1-I	N_{180} P_{126} K_{90} Background-Controol	358	199	480	1026	1506	52,1	6,7	40,0	450	45,0
1-II		352	258	492	1044	1536	48,5	6,5	41,0	450	45,0
1-III		324	247	504	864	1368	42,6	6,4	38,0	455	45,5
Avarege		**345**	**235**	**492**	**978**	**1470**	**47,7**	**6,5**	**39,6**	**451,6**	**45,2**
2-I	Background- 200m l/ha Bioenergy –M biopreparation	468	235	588	1254	1842	52,8	8,1	41,0	500	50,0
2-II		500	240	516	1296	1812	52,1	8,5	41,0	490	49,0
2-III		496	235	540	1260	1800	51,7	7,2	39,0	500	50,0
Avarege		**488**	**237**	**548**	**1270**	**1818**	**52,2**	**7,9**	**40,3**	**497**	**49,7**
3-I	Background- Biohumus 10 t/ha	585	295	612	1566	2178	57,8	7,8	42,0	585	58,5
3-II		520	247	624	1122	1746	53,9	8,3	42,0	565	56,5
3-III		551	247	588	1344	1932	53,5	8,9	41,0	570	57,0
Avarege		**552**	**263**	**608**	**1344**	**1952**	**55,1**	**8.3**	**41,6**	**573**	**57,3**
4-I	Background- Zoohumus 10t/ha	586	319	624	1500	2124	59,0	7,9	42,0	685	68,5
4-II		569	340	672	1428	2100	59,0	9,1	42,0	680	68,0
4-III		582	271	648	1260	1908	53,2	8,9	41,0	675	67,5
Avarege		**579**	**310**	**648**	**1396**	**2044**	**57,1**	**8,6**	**41,6**	**680**	**68,0**
5-I	Background- Manure 20 t/ha	536	295	696	1416	2112	60,3	8,4	42,0	570	57,0
5-II		509	252	708	1290	1998	58,2	8,2	38,0	568	56,8
5-III		506	232	672	1380	2052	51,6	8,7	42,0	569	56,9
Avarege		**517**	**260**	**692**	**1362**	**2054**	**56,7**	**8,4**	**40,6**	**569**	**56,9**
6-I	Background- OMF 15 t/ha	499	216	660	1296	1956	56,3	8,8	42,0	550	55,0
6-II		489	264	648	1272	1920	57,0	7,9	41,0	550	55,0
6-III		542	288	648	1236	1884	52,0	7,9	39,0	540	54,0
Avarege		**510**	**256**	**652**	**1268**	**1920**	**55,1**	**8,2**	**40,7**	**547**	**54,7**
7-I	Background- OMF 10 t/ha	488	276	648	1248	1896	51,7	8,6	40,0	510	51,0
7-II		502	204	516	1272	1788	52,0	7,9	40,0	520	52,0
7-III		481	288	624	1248	1872	55,0	8,0	42,0	520	52,0
Avarege		**490**	**256**	**596**	**1256**	**1852**	**52,9**	**8,2**	**40,7**	**517**	**51,7**

In addition, according to the data of the plants (08.05.2022), in the control variant 1, where mineral fertilizers were applied during the earing phase, the total number of plant stems per 1 m2 was on average 390.4, the average plant height was 42.1 cm, the number of ears was 350, and the ear length was 5.2 cm. In variants 3 and 4, where 10 t/ha of biohumus and zoohumus were applied, the total number of plant stems per 1 m2 was 163.5-148.7 more on average than in the control variant, the plant height was 11.3-12.6 cm higher, and the number of spikes was 191-167 more, while in variants 5 and 4, where 20 t/ha of manure and 10 t/ha of zoohumus were applied, the spike length was 2.5-2.3 cm higher than in the control variant.

During the full ripening period (08.06.2022), in the control variant 1, where mineral fertilizers were applied, the total number of plant stems per 1 m2 was on average 469.5, the number of productive plant stems was 345, the average plant height was 52.1 cm, and the spike length was 6.5 cm. In variants 3 and 4, where biohumus and zoohumus were applied at 10 t/ha, the total number of plant stems per 1 m2 was on average 287.5-314 more than the control variant, the plant height was 11.3-13.7 cm higher, and the spike length was 1.8-2.1 cm higher (Table 3).

In the experimental field, in the Control 1 variant, the average number of balls per 1 m2 of area was 235, the weight of the stalk was 492 g, the weight of the ear was 978 g, the total weight was 1470 g, the average weight of 1000 grains of wheat was 39.6 g, and the yield was 45.16 c/ha. In variants 3 and 4 of the experiment, where 10 t/ha of biohumus and zoohumus were used, the number of bushes was on average 263 and 310, 1000 grains of wheat weighed on average 41.6 grams, 10 t/ha of zoohumus and 20 t/ha of manure, the weight of the stalk was 648 and 692 grams, the weight of the spike was 1396 and 1362 grams, the total weight was 2044 and 2054 grams, and the yield was 68.0 and 56.9 c/ha (Table 4).

The highest yield was obtained in options 3 and 4, with an average yield of 57.3-68.0 s/ha. Compared to the control option, option 2 yielded 4.54 s/ha, option 3 12.14 s/ha, option 4 22.84 s/ha, option 5 11.74 s/ha, option 6 9.54 s/ha, and option 7 6.54 s/ha. A single-factor method of mathematical processing was developed for the effect on the yield of winter wheat carried out in irrigated meadow soils. In it, NSR05= 1.06 s/ha was determined for the yield of winter wheat.

A one-factor mathematical treatment method was developed for the effect on winter wheat yield under irrigated serozem-meaddow soils. It was determined that NSR05= 1.06 s/ha for winter wheat yield.

Conclusion. The results of a field experiment aimed at restoring the fertility of soils washed away by natural disasters show that, compared to the control, the processes of nutrient elements and phenological monitoring of winter wheat plants during the vegetation period, as well as wheat yield, were determined in option 2, where the Bioenergy-M biopreparation was used. The highest values were observed in the options where biohumus and zoohumus were used.

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