The main methods of tillage and the influence of the norms of mineral fertilizers on the yield and quality of winter wheat

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Abstract
The article describes the main tillage (softening of the field length and contour method at a depth of 25-28, 32, 35 cm) and mineral fertilizer standards (N240P168K120, N200P140K100, N200P70K50 kg/ha) for the yield and quality of winter wheat in the typical sierozem soils of irrigated erosion region of Samarkand. Under these conditions, in the cultivation of winter wheat mineral fertilizers N200P140K100 in areas where the soil is not washed, N240P168K120 in the case of strong washing, normal stratification, and contour plowing to a depth of 32-35 cm to obtain the highest yield (6.16-6.05 t/ha) and high grain quality (14.3-15.6; grain nature 765-784 g/l).

Key words: irrigation erosion; typical sierozem soils; unwashed; heavily washed; sewage accumulated soils; winter wheat; mineral fertilizers; grain yield; quality

INTRODUCTION

There are 1.964 million hectares of degraded lands in the world today. Including 55.7% due to water erosion, 12.2% due to depletion of nutrients in the soil, salinization, pollution, and 4.2% due to compaction erosion. 6-7 million hectares of land annually are withdrawn from agricultural use. More than 235.9 million hectares of wheat are currently cultivated in over 132 countries worldwide and produced 755.2 million tons of grain. Globally, 1.094 million hectares of arable land are prone to irrigation erosion, and most of this area is in Asia, Africa, and South America, causing damage of up to 400 billion dollars annually. (Abdullaev, 2019; Arabov et al., 2016; Jakbarov & Tangirov, 2017; Kuziev et al., 2016).

In a number of large countries of the world that grow wheat, through the use of resource-efficient agricultural technologies to prevent erosion, maintain and increase soil fertility, as well as the correct choice of the basic methods and depth of soil cultivation, increase yields and quality by saving mineral fertilizers, it is possible to prevent the leaching of nutrients. (Kuziev & Abdurahmonov, 2017; Gafurova et al., 2018; Ibragimov, 2016).

In Uzbekistan, the area under water and irrigation erosion is 1772.3 thousand hectare, or 40% of the total arable land, while in Samarkand region it is 121.9 thousand hectare, and the yield of cotton, wheat, corn and other crops grown on these areas on average, 25-30% less than in uncultivated lands, 30-40% less in some areas, and the quality of crops is very low (Report of the State Committee for Land Resources, Geodesy, Cartography and State Cadastre of Uzbekistan, 2018).

160-200 tons of soil per hectare of typical sierozem soils cultivated due to irrigation erosion, along with 700-800 kg of humus, 100-110 kg of nitrogen, 150-160 kg of phosphorus, 90-210 kg of potassium and many others useful for plants the nutrients are also washed away. As a result, in recent years, in most irrigated and eroded lands, the average yield of winter wheat is 2,0-2,2 t/ha, and the

quality of grain grown often does not fully meet the requirements of the bread industry (Siddikov, 2013; Muminova & Muminov, 2017).

Therefore, the protection of irrigated agricultural areas from water and irrigation erosion requires the correct choice of basic tillage methods, careful consideration of the nutrient requirements of each plot and type of crop, and the effective use of resource-efficient agro-technologies.

MATERIALS AND METHODS

In our experiments in 2016-2018 to determine the effect of basic tillage methods and stratified application of mineral fertilizers on the cultivation of high quality wheat from winter wheat in the conditions of typical gray soils with irrigation erosion, typical sierozem soils of irrigated erosion in Samarkand region, basic tillage methods, depth and mineral fertilizer standards, the "Grom" variety of winter wheat is the object of study.

Field experiments were conducted in the conditions of typical eroded sierozem soils of the farm "Rustambek", Bulungur district of Samarkand region. The slope of the experimental field is 0.004-0.005 m, located in the northern exposure, medium and light sand in mechanical composition, and groundwater at a depth of 14-16 m. In the experimental field, the total area of each plot was 784 m^2 (field length 140 m, of which 52 m was unwashed soil, 58 m was heavily washed and 30 m was washed accumulated soil; width 8 rows x 0.7 = 784 m^2), of which 392 m^2 were taken into account. The number of options is 18, the experiment is 4 repetitions, the options are systematically placed in one tier, and our research is carried out in accordance with the generally accepted methodological guidelines and recommendations in the country.

Agrochemical, agrophysical and microbiological analysis of soils was carried out by the following methods: Humus in the method of I. V. Tyurin, GOST-26213; nitrate nitrogen by ion-selective method, GOST-13496-10; total nitrogen, phosphorus and potassium in one sample by I. M. Maltseva, L. P. Gritsenko method; mobile phosphorus in 1% ammonium carbonate solution by B. P. Machigin method; on the interchangeable potassium flame photometer by the method of P.V. Protasov; carbonates were determined by the Knop method, pH in aqueous absorption using a potentiometer.

The washing of the soil and the accompanying discharge of nutrients into the effluent was detected in the area where the special effluent was collected at the edge of the ridges (2.8x0.5) = 1.4 m^2. The degree of soil washing was measured by the method of H. M. Makhsudov and how much soil was washed; the amount of humus, gross nitrogen, phosphorus, potassium, ammonium and nitrate nitrogen in the water and solid residue in the effluent was determined.

In the first and second ten days of October, seeds of winter wheat variety "Grom" were sown in the experimental field at a depth of 4-5 cm in the SZ seeder at the rate of 5 million seeds per hectare. Mineral fertilizers were applied as follows: 80% of the annual rate of phosphorus fertilizers was applied under plowing; the remaining 20% was applied at the same time as sowing the seeds; the annual rate of potassium was applied under plowing; the annual rate of nitrogen fertilizers was divided into two and applied during the growing season.

Agrochemical and agrophysical analysis of experimental field soils, all phenological observations and biometric measurements in winter wheat were carried out on the basis of methodological manuals "Methods of field experiments" variance was analyzed (Dospexov, 1985).

RESULTS AND DISCUSSION

It is noted that under conditions of typical gray soils subject to irrigation erosion, the effectiveness of the main soil cultivation by contouring, especially their introduction by stratification of the norms of mineral fertilizers in combination with resource-saving technologies, is more effective on the winter wheat yield.

It was observed that in the conditions of typical sierozem soils subject to irrigation erosion, the efficiency of basic contour tillage of winter wheat grain, especially their application by stratification of mineral fertilizer norms in combination with resource-saving technologies is more effective. For example, the yield of winter wheat in the unwashed part of the soil was 55.4-56.5, respectively, of the variants in which the plowing was carried out by

Table 1. Basic tillage methods, depth, and mineral fertilizer standards impact on winter wheat grain yield (average 2016-2018)

№	Experiment options		Winter wheat grain yield, t/ha						
			Soil washing rate				The additional yield obtained is t/ha		
	Tillage methods and depth, cm	NPK norm kg / ha	Unwashed	Strongly washed	Sewage is collected	Average yield	With respect to the method and depth of processing	NPK is relative	Percent
1	Control, plow lengthwise 25-28 см	$N_{200}P_{140}K_{100}$	43,4	40,2	44,8	4,28	-	-	100
2	Control, plow lengthwise 32-35 см	$N_{200}P_{140}K_{100}$	45,3	42,5	46,4	4,47	-	-	100
3	Plow, contour method 25-28 см	Control	18,7	17,4	19,9	1,86	-	-	-
4		$N_{240}P_{168}K_{120}$	55,2	54,6	55,7	5,52	1,24	3,66	129,0
5		$N_{200}P_{140}K_{100}$	52,5	51,3	53,2	5,23	0,95	3,37	122,2
6		$N_{100}P_{70}K_{50}$	44,3	43,2	45,4	4,43	0,15	2,57	103,5
7	Plow, contour method 32-35 см	Control	20,5	19,4	21,6	2,05	-	-	-
8		$N_{240}P_{168}K_{120}$	61,4	60,5	62,3	6,14	1,67	4,09	137,4
9		$N_{200}P_{140}K_{100}$	58,6	57,8	58,5	5,83	1,36	3,78	130,4
10		$N_{100}P_{70}K_{50}$	45,8	44,6	46,2	4,55	0,08	2,50	101,8
11	Chizel, 10-12 см	Control	16,3	14,2	18,8	1,64	-	-	-
12		$N_{240}P_{168}K_{120}$	40,5	38,4	42,5	4,05	-0,23	2,41	-
13		$N_{200}P_{140}K_{100}$	38,7	36,2	40,9	3,86	-0,42	2,22	-
14		$N_{100}P_{70}K_{50}$	35,2	33,3	37,4	3,53	-0,75	1,89	-
15	Chizel, 15-18 см	Control	17,6	16,1	19,5	1,77	-	-	-
16		$N_{240}P_{168}K_{120}$	42,3	40,4	43,6	4,21	-0,07	2,44	-
17		$N_{200}P_{140}K_{100}$	40,8	38,6	42,3	4,05	-0,23	2,28	-
18		$N_{100}P_{70}K_{50}$	37,5	35,7	39,8	3,77	-0,51	2,00	-
	2016 year	LSD_{05}=	3,48	3,49	3,54				
		Sx%=	3,05	3,19	3,00				
	2017 year	LSD_{05}=	3,37	3,21	3,51				
		Sx%=	3,12	3,12	3,16				
	2018 year	LSD_{05}=	3,75	3,51	3,88				
		Sx%=	3,20	3,11	3,21				

the contour method at a depth of 25-28 cm and applied in the norm of mineral fertilizers ($N_{240}P_{168}K_{120}$, $N_{200}P_{140}K_{100}$, $N_{100}P_{70}K_{50}$ kg/ha); 5,26-5,34 and 4,45-4,56 t/ha, or an average of 5,52-4,43 t/ha in three years, 5,53-5,61 in areas with heavily washed soils; 5,24-5,32 and 4,34-4,45 t/ha or 5,46-4,32 t/ha, and in the collected part of the effluent 5,64-5,75, respectively; 5,42-5,51 and 4,52-4,74 t/ha or 5,57-4,54 t/ha, these figures are different from those of plowing carried out at a depth of 32-35 cm in the specified mineral fertilizer standards. 0,63-0,67, respectively, in the unwashed part of the soil; 0,67-0,69 and 0,21-0,19 t/ha or 0,62-0,15 t/ha, 0,56-0,66 when the soil is heavily washed; 0,61-0,62 and 0,22-0,19 t/ha or 0,59-0,14 t/ha and 0,66-0,61 in the collected part of the effluent; 0,53–0,43 and 0,12–0,06 t/ha or 0,66–0,08 t/ha, respectively (Table 1).

Under conditions of typical sierozem soils are prone to irrigation erosion over the years of research (2016, 2017, 2018), under the influence of the methods of tillage, the depth and rates of application of mineral fertilizers, the amount of protein in the grain of winter wheat has changed 12.5-15.2%, 11.8-13.4%, in areas where the soil is not washed; 11.8-15.0%, 11.4-13.1%, in areas where the soil is a strong washed; about 13.1-15.3%, 12.2-13.8% in wastewater collection.

During the years of research, an average of three years in areas of the field where the soil is unwashed, heavily washed out and sewage has accumulated, plowing is carried out by the contour method to a depth of 32-35 cm, mineral fertilizers are applied at the rate of $N_{240}P_{168}K_{120}$ kg/ha or carried out by the method of contour plowing to a depth of 25-28 cm in the unwashed part of the soil protein ingrown grain, respectively 15.2-15.6%.

In our study, the nature of winter wheat grown in the variants of the plowing contour method at a depth of 32-35 cm was higher than in the variant (plowing) carried out at a depth of 25-28 along the length of the plow slope. For example, the grain size in the unwashed part of the control plots was 736 g/l, in the heavily washed part 728 g/l and in the manure collection 748 g/l. 56 and 40 g/l were higher. In these conditions, the nature of winter wheat in the variants treated with chisel at a depth of 10-12 and 15-18 cm, respectively, compared with the plowing carried out by the contour method at a depth of 32-35 cm, respectively 41-33; 45-35; and less than 26–21 g/l.

Thus, due to the stratified application of fertilizers in the cultivation of high-quality grain from winter wheat grown in the conditions of irrigated eroded typical sierozem soils of Samarkand region, it is possible to grow grain in the heavily washed part of the field, as well as in unwashed fields. Increases and ecology, pollution of the environment with mineral fertilizers is prevented.

CONCLUSIONS

It can be noted that in the conditions on typical sierozem soils, exposed to irrigation erosion the main soil cultivation was carried out with a chisel to a depth of 15-18 cm and 32-35 cm with the contour method, when using mineral fertilizers in resource-efficient agricultural technology, it is possible to grow grain 6.16, 6.05 and 6.23 t/ha (protein 14.3-15.6; natural grain 765-784 g/l) and provides a reduction in the difference in the yield of winter wheat cultivated in areas where the soil is heavily washed and unwashed under the influence of erosion.

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