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Timeline, Number of Irrigations, Water Application Rate and Irrigation Rate of Winter Wheat

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Abstract: Depending on the given moisture regime for winter wheat, meteorological conditions of the year, the number of irrigations, water application rate and irrigation rate changed as follows (Tables 1, 2).

Keywords: meadow soils, winter wheat variety, water-physical properties of the soil, irrigation regime, irrigation technique, total water consumption, saline regime, pre-irrigation moisture, the lowest water/moisture content, grain quality, leaching irrigation.

In experiment 1, the number of irrigations in 2017-2019, according to the variants of the experiment, ranged from 1 to 3, the size of water application rates from 530 to 1100 m³/ha and irrigation rates from 1100 to 2000 m³/ha.

In var.1, where Sanzar-8 variety of winter wheat was irrigated at a pre-irrigation soil moisture content of 60% LMC, 1 water application was carried out at a rate of 900-1100 m³/ha.

In var. 2, where pre-irrigation soil moisture was maintained at the level of 70-70-60% LMC, 2 water applications were carried out with a rate of 700-800 m³/ha and an irrigation rate of 1400-1600 m³/ha.

In var. 3, where Sanzar-8 variety of winter wheat was irrigated at a pre-irrigation moisture regime of 80-80-60% LMC, it was required to carry out 3 irrigations with a water application rate of 527-620 m³/ha and an irrigation rate of 1800-2000 m³/ha.

Irrigation scheme in var. 1. 0-1-0, in var. 2. 1-1-0, in var. 3. 1-2-0. To maintain the pre-irrigation soil moisture for the Polovchanka variety at the level of 60% LMC (var. 4), it was necessary to carry out 1 irrigation with a water application rate of 900-1100 m³/ha and an irrigation rate of 900-1100 m³/ha.

In var. 5, where the pre-irrigation soil moisture was at the level of 70-70-60% LMC in the calculated layers 0-50 cm before heading and 0-70 cm before ripening, 2 irrigations were given with water application rates of 700-800 m³/ha and irrigation rates of 1500-1600 m³/ha. Maintenance of pre-irrigation soil moisture at the level of 80-80-60% of LMC (var. 6) required 3 irrigations according to the scheme 1-2-0 with water application rates of 500-600 m³/ha and irrigation rate of 1700-1900 m³/ha.

In experiment 2 (winter wheat irrigation technique), in 2020-2021, in accordance with the specified soil moisture at the level of 80-80-60% LMC, 3 irrigations were given according to the 1-2-0 scheme. The lowest irrigation rate (1200-1300 m³/ha) was in var. 3, where counter irrigation was carried out. The largest number of irrigations was carried out in var. 1, where irrigation was carried out by check flooding.

Table 1. Timeline and norms of winter wheat irrigation.

No. var.	Soil moisture, % LMC	Indicators	Water application			Irrigation rate, m ³ /ha
			1	2	3	
Sanzar-8 variety 2017						
1	60-60-60	Irrigation timeline	24.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	981			981
2	70-70-60	Irrigation timeline	2.0.0.5	10.06		
		Inter-irrigation period, days		20		
		Water application rate, m ³ /ha	776	770		1546
3	80-80-60	Irrigation timeline	5. 05	20.05	7.06	
		Inter-irrigation period, days		15	17	
		Water application rate, m ³ /ha	527	710	585	1822
Polovchanka variety						
4	60-60-60	Irrigation timeline	20.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	970			970
5	70-70-60	Irrigation timeline	15.05	5.06		
		Inter-irrigation period, days		20		
		Water application rate, m ³ /ha	780	810		1590
6	80-80-60	Irrigation timeline	3.05	18.05	5.06	
		Inter-irrigation period, days		15	17	
		Water application rate, m ³ /ha	585	623	596	1804
Sanzar-8 variety 2018						
1	60-60-60	Irrigation timeline	25.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	985			985
2	70-70-60	Irrigation timeline	15.05	3.06		
		Inter-irrigation period, days		18		
		Water application rate, m ³ /ha	747	715		1460
3	80-80-60	Irrigation timeline	1.05	17.05	5.06	
		Inter-irrigation period, days		16	18	
		Water application rate, m ³ /ha	585	623	615	1820
Polovchanka variety						
4	60-60-60	Irrigation timeline	20.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	1100			1100
5	70-70-60	Irrigation timeline	13.05	3.06		
		Inter-irrigation period, days		20		
		Water application rate, m ³ /ha	745	810		1555
6	80-80-60	Irrigation timeline	25.05	12.05	31.05	
		Inter-irrigation period, days		17	18	
		Water application rate, m ³ /ha	580	615	680	1875
Sanzar-8 variety 2019						
1	60-60-60	Irrigation timeline	28.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	985			985
2	70-70-60	Irrigation timeline	12.05	1.06		
		Inter-irrigation period, days		21		

3	80-80-60	Water application rate, m ³ /ha	810	720		1530
		Irrigation timeline	3.05	18.05	5.06	
		Inter-irrigation period, days		15	17	
		Water application rate, m ³ /ha	575	610	580	1765
Polovchanka variety						
4	60-60-60	Irrigation timeline	25.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	1005			1005
5	70-70-60	Irrigation timeline	10.05	30.05		
		Inter-irrigation period, days		20		
		Water application rate, m ³ /ha	810	720		1530
6	80-80-60	Irrigation timeline	1.05	17.05	4.06	
		Inter-irrigation period, days		16	17	
		Water application rate, m ³ /ha	580	610	575	1765

Table 2. Timeline and norms of winter wheat irrigation (average for 2017-2019)

No. var.	Soil moisture, % LMC	Indicators	Water application			Irrigation rate, m ³ /ha
			1	2	3	
Sanzar-8 variety						
1	60-60-60	Irrigation timeline	20-25.05			
		Inter-irrigation period, days		-		
		Water application rate, m ³ /ha	970-1100			970-1100
2	70-70-60	Irrigation timeline	2-15.05			
		Inter-irrigation period, days	20-25			
		Water application rate, m ³ /ha	747-760	715-810		1400-1600
3	80-80-60	Irrigation timeline	25.04-5.05			
		Inter-irrigation period, days		16-18		
		Water application rate, m ³ /ha	527-585	610-620	585-620	1800-2000
Polovchanka variety						
4	60-60-60	Irrigation timeline	20-28.05			
		Inter-irrigation period, days				
		Water application rate, m ³ /ha	985-1100			900-1100
5	70-70-60	Irrigation timeline	3-12.05			
		Inter-irrigation period, days	20-27			
		Water application rate, m ³ /ha	745-810	720-810		1500-1600
	80-80-60	Irrigation timeline	25.04-3.05	12.05-18.05	31.05-5.06	
		Inter-irrigation period, days		15-17	17-18	
		Water application rate, m ³ /ha	570-585	550-610	575-680	1700-1900

Table 3. Timeline and norms of winter wheat irrigation with different water application techniques

No. var.	Soil moisture, % LMC	Watering method	Indicators	Water application			Irrigation rate, m ³ /ha
				1	2	3	
2020							
1	80-80-60	Check flooding	Irrigation timeline	3.05	20.05	5.06	
			Inter-irrigation period, days		17	15	
			Water application rate, m ³ /ha	640	710	685	2035
2	80-80-60	Furrow irrigation	Irrigation timeline	5.05	21.05	8.06	
			Inter-irrigation period, days		16	17	
			Water application rate, m ³ /ha	580	540	527	1647

3	80-80-60	Counter irrigation	Irrigation timeline	1.05	17.05	5.06	
			Inter-irrigation period, days		16	18	
			Water application rate, m ³ /ha	475	500	500	1475
2021							
1	80-80-60	Check flooding	Irrigation timeline	1.05	18.05	3.06	
			Inter-irrigation period, days		17	16	
			Water application rate, m ³ /ha	665	640	720	2025
2	80-80-60	Furrow irrigation	Irrigation timeline	1.05	15.05	1.06	
			Inter-irrigation period, days		14	16	
			Water application rate, m ³ /ha	600	550	490	1640
3	80-80-60	Counter irrigation	Irrigation timeline	1.05	17.05	2.06	
			Inter-irrigation period, days		16	16	
			Water application rate, m ³ /ha	500	510	530	1540

Table 4. Timeline and norms of water application with different technologies for winter wheat irrigation (average for 2020-2021)

No. var.	Soil moisture, % LMC	Watering method	Indicators	Water application			Irrigation rate, m ³ /ha
				1	2	3	
1	80-80-60	Check flooding	Irrigation timeline	1.05	18.05-20.05	3.06-5.06	
			Inter-irrigation period, days		17	20	
			Water application rate, m ³ /ha	640-665	640-710	685-720	2000-2100
2	80-80-60	Furrow irrigation	Irrigation timeline	1.05-5.05	15.05-21.05	1.06-8.06	
			Inter-irrigation period, days		16	17	
			Water application rate, m ³ /ha	580-600	530-550	490-527	1600-1700
3	80-80-60	Counter irrigation	Irrigation timeline	1.05	17.05	2.06-5.05	
			Inter-irrigation period, days		16	15	
			Water application rate, m ³ /ha	475-500	500-510	500-530	1400-1500

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