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**THE EFFECT OF INDIGOFERA (INDIGOFERA TINCTORIA L.) CROP
PLANTING DATES AND IRRIGATION REGIME ON SOIL WATER PERMEABILITY**

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Abstract: *The article discusses scientific facts on the influence of indigofera (Indigofera tinctoria L.) crop planting dates and irrigation regime on the permeability of light gray soils in the Kashkadarya region (Karshi district).*

INTRODUCTION

Soil fertility preservation and efficient water resources utilization are among the urgent problems in modern agriculture. Global climate change, water deficit, and soil degradation make it necessary to improve soil agro-technical properties. Soil water permeability is one of the most important properties that determine plant growth and development. It regulates the balance of water and air in the soil. It is also one of the most important properties that affect crop yield. Recently, legume and green manure crops have attracted considerable interest due to their positive role in improving soil fertility. Among such crops, indigofera (*Indigofera tinctoria* L.) is considered to be one of the most valuable. It improves soil fertility, fixes nitrogen in the soil, has a strong root system, and improves soil structure. It increases the permeability of the soil to water. The effect of indigofera on the physical properties of the soil depends on the crop planting dates and irrigation regime. It is scientifically and practically important to study the influence of different crop planting dates and irrigation regime on the permeability of *indigofera tinctoria* L.

Literature Review. Soil water permeability refers to how easily the soil can move and hold water. Soil water permeability is an extremely important factor in watering crops during farming. It is an important crop-growing factor and depends mainly on the texture, humus, slope, and other natural properties of the soil (Rijov, 1952) [1]. Many scientists have conducted extensive research into the issue of water permeability in different crops at different times. For example, A.S. Bolkunov and X.S. Romanov (1970) investigated the issue of water permeability in relation to the crop rotation system of alfalfa [2]. Sh.N. Nurmatov (1981) and A.M. Dehqonov (2007) investigated soils that wash away easily during irrigation, while A.A. Iminov (2006) researched repeated crops and norms of planting winter wheat [3; 4; 5].

Research Findings. This study revealed that soil water permeability not only depends on crop planting dates but is directly affected by optimal irrigation regimes applied during the vegetation period. This means that soil water permeability depends on the combination of optimal crop planting dates and irrigation regimes applied during the vegetation period.

However, soil water permeability decreases when there is excess irrigation. Scientific studies were carried out from 2023 to 2025 under the conditions of light gray soils in the Kashkadarya region to study the effect of crop planting dates and irrigation regimes applied to *Indigofera tinctoria* L. on soil water permeability. According to the experimental data (Table 1), it can be stated that soil water permeability under the effect of crop planting dates and irrigation regimes applied to *Indigofera tinctoria* L. is influenced to some extent, but the effect of these factors may vary.

At the end of the growing period of the plant, in the variants where the planting date was 20-25 April, the soil water permeability over a period of 6 hours was studied in 2023, 2024, and 2025, respectively, within the range of 570-653; 610-690; 550-630 m³/ha. Of these variants, the most optimal results were obtained in the seventh variant, where irrigation was carried out at 60-70-60% of LFMC, with soil water permeability being equal to 653; 690; 630 m³/ha, respectively. Thus, the next place was occupied by the variants where the planting date was 10-15 April.

Table 1

Effect of planting dates and irrigation regimes on soil water permeability, m³/ha (2023–2025)

Var. No	Planting dates	Pre-irrigation soil moisture relative to CHDNS, %	Observation time, hour																										
			2023 y.			2024 y.			2025 y.			2023 y.			2024 y.			2025 y.			2023 y.			2024 y.			2025 y.		
			1 hour	2 hours	3 hours	4 hours	5 hours	6 hours	Total during 6 hours	Average per 1 hour, m ³ /ha	2023 y.	2024 y.	2025 y.	2023 y.	2024 y.	2025 y.	2023 y.	2024 y.	2025 y.	2023 y.	2024 y.	2025 y.	2023 y.	2024 y.	2025 y.				
At the beginning of the vegetation period			308	316	304	175	185	171	101	110	97	58	68	53	48	57	44	35	44	31	725	780	700	121,0	130,0	117,0			
At the end of the vegetation period																													
1	01.05.04	60-70-60	267	273	282	146	152	140	88	95	83	45	51	39	39	46	34	27	33	22	612	650	580	102,0	108	96,6			
2		70-70-60	242	249	241	132	138	130	81	88	76	38	44	35	33	41	27	24	30	21	550	590	530	91,6	98,3	88,3			
3		75-80-70	225	231	230	124	129	120	73	78	71	35	40	30	30	35	25	22	27	19	510	540	495	85,0	90,0	82,5			
4	10-15.04	60-70-60	270	277	268	149	158	145	90	98	85	47	56	43	41	49	37	28	37	24	625	673	600	104,1	113,0	100,0			
5		70-70-60	249	257	242	136	145	134	84	92	80	41	50	37	36	44	32	34	42	25	580	630	550	96,6	105,0	91,6			
6		75-80-70	230	237	235	130	137	130	78	84	74	40	47	31	35	41	28	27	34	22	540	580	520	90,0	96,6	86,6			
7	20-25.04	60-70-60	274	279	270	154	162	150	93	99	90	51	58	47	46	52	42	35	40	31	653	690	630	106,8	115,0	105,0			
8		70-70-60	256	261	254	143	149	140	91	96	89	46	54	43	41	46	39	38	44	35	615	650	600	102,5	108,0	100,0			
9		75-80-70	238	244	240	134	141	133	82	89	81	45	52	36	38	44	32	33	40	28	570	610	550	95,0	102,0	91,6			

Here, the indicators were slightly lower than those in the variants where the planting date was 20-25 April, with soil water permeability being equal to 625; 675; 600 m³/ha, respectively.

In the variants where *Indigofera tinctoria* L. was planted at different dates, it was established that an increase in irrigation regimes has an adverse effect on soil water permeability. Thus, in the fifth variant, where irrigation was carried out at 70-70-60% of LFMC, the soil water permeability over a period of 6 hours was equal to 580; 630; 550 m³/ha, respectively. In the variant where irrigation was carried out at 75-80-70% of LFMC, the soil water permeability was equal to 540; 580; 520 m³/ha.

In the first, second, and third variants, where *Indigofera tinctoria* L. was sown on 01-05.04, soil water permeability was minimal among all the variants and equaled 510-612; 540-650; 495-580 m³/ha, respectively. The differences were 25-40 m³/ha compared to the

variants where *Indigofera tinctoria* L. was sown on 10-15.04 and 41-70 m³/ha compared to the variants where *Indigofera tinctoria* L. was sown on 20-25.04.

In conclusion, it may be stated that during the cultivation of *Indigofera tinctoria* L., with different dates for sowing and irrigation norms applied, by the end of the vegetation period, there was a significant reduction in soil water permeability compared to its values at the beginning of the vegetation period (725; 780; 700 m³/ha). Therefore, according to the analysis of the research results, the deterioration of soil water permeability may be related to the increased irrigation norms for *Indigofera tinctoria* L.

Conclusion. The research results have shown that soil water permeability directly depends not only on the dates for sowing *Indigofera tinctoria* L., but also on the optimal irrigation norms during its vegetation period. In particular, soil water permeability was maximal when *Indigofera tinctoria* L. was sown on 20-25 April and irrigation norms were 60-70-60% of LFMC.

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