

INFLUENCE OF CLOVER CULTIVATION ON WATER-PHYSICAL PROPERTIES OF SANDY SOILS

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DOI: 10.47750/pnr.2022.13.S06.495

Abstract

As we know agriculture is very important in every country. In this article was written about clover cultivation on sandy soils. Clover is one of the most water-demanding agricultural crops. Therefore, obtaining a high yield from clover largely depends on the correct determination of the number, duration and rate of irrigation. In our research, we investigated the effect of clover management on soil properties in the newly developed sandy soils of Central Fergana, which are highly susceptible to wind erosion.

Keywords: Clover, Sandy soil, irrigated areas, wind, water resources, agricultural products, population, crop, quality, land.

Introduction

Environmental protection, rational use of land and water resources are important and urgent tasks of today. In this regard, effective use of irrigated lands, which are prone to water and wind erosion, are less productive, have unfavorable properties and characteristics, is of particular importance. Currently, more than 2 million hectares of irrigated areas in the republic are damaged by wind erosion and 722 thousand hectares by water erosion [9]. Under these conditions, the quality and weight of agricultural crops is very low. Also, the area of irrigated land is shrinking due to the fact that relatively fertile lands with good properties and characteristics are being allocated to capital constructions and private estates. However, the demand of the population and industry for agricultural products is growing.

There are 13.8 million hectares of sandy soils and sands (high and low sand dunes) in our republic, of which 500 thousand hectares are used for agricultural production [8]. About 80,000 hectares [3] and more than 75,000 hectares [12] of sand dunes only in the Khorezm oasis are cultivated and cultivated in Central Ferghana. Such lands are less fertile, have unfavorable properties and characteristics, and are susceptible to water and wind erosion. It is desirable to apply and improve the existing measures to combat wind erosion in these areas, and to improve the properties and characteristics of sandy soils, to develop scientifically based agro technical rules for clover care and to implement them in practice.

Materials:

One of the main ways to increase soil fertility, feed and cotton production is to develop and implement scientifically based crop rotation system. Clover is the most effective predecessor for any crop in the crop rotation system. Because clover increases soil fertility, improves its physical, physico-chemical, microbiological, amelioration, nutritional regime and other properties.

E. D. Spratt (1966) found out that the inclusion of clover in crop rotation improves the physico-chemical and biological properties of the soil as a result of his experiments [10]. Since clover remains on the soil surface for three years, it significantly reduces wind erosion. According to the experiments of Q. Mirzajonov (1981), soil flying was not observed under `clover. After three years of clover planted to combat wind erosion, the cotton yield increased by an additional 5.6 centners [5]. Also, clover is crucial in creating a solid fodder base.

In this regard, the President’s Decree № 60 of the President of the Republic of Uzbekistan dated January 28, 2022 "On the development strategy of the new Uzbekistan for 2022-2026" stipulates: "Expanding the livestock feed base and increasing the production volume by 1.5-2 times" [1] in accordance with the decision of the President of the Republic of Uzbekistan dated February 8, 2022 "On measures to further develop animal husbandry and strengthen the animal feed base" President’s Decree № 121 it was decided to plant clover and fodder crops [2].

Clover is one of the most water-demanding agricultural crops. Therefore, obtaining a high yield from clover largely depends on the correct determination of the number, duration and rate of irrigation. K. Isaboev, M. Khasab el - Rasul (1992) in order to obtain a high yield of hay from crop rotation in the conditions of heavy sandy soils of the Chirchik-Ohangaron valley, maintaining soil moisture at 80%, first year clover in 2-2-1 system and second year clover. They recommend irrigating in the 0-2-2-2-0 system at the rate of 500-600 m³/ha [4].

A. Khojasov (1993) recommends irrigating 2- and 3-year clover 6-7 times at the current irrigation rate of 600-700 m³/ha in conditions of medium loam soil [11].

In our research, we investigated the effect of clover management on soil properties in the newly developed sandy soils of Central Fergana, which are highly susceptible to wind erosion.

Methods:

As it is known that clover grows slowly in the first year and produces little hay, it is planted with cover crops. This situation is especially useful in protecting young clover seedlings from the effects of cold and wind erosion. Therefore, in the experiment, clover was planted together with autumn rye.

Table 1 Experience system

Variants	Periods and rates of mineral fertilizer application, kg/hector									
	The first year clover (clover+rye)				The Second year clover		The Third year clover			
	N				P ₂ O ₅	K ₂ O	P ₂ O ₅	K ₂ O	P ₂ O ₅	K ₂ O
	Annual rate	1st feeding	2nd feeding	3rd feeding						
When irrigations are conducted at 85% moisture relative to limited field moisture capacity										
1	-	-	-	-	-	-	-	-	-	-
2	120	60	60	-	120	60	120	60	120	60
3	160	60	60	40	160	80	160	80	160	80
4	200	60	60	80	200	100	200	100	200	100
When irrigations are conducted at 80% moisture relative to limited field moisture capacity										

5	-	-	-	-	-	-	-	-	-	-	-
6	120	60	60	-	120	60	120	60	120	60	
7	160	60	60	40	160	80	160	80	160	80	
8	200	60	60	80	200	100	200	100	200	100	
When irrigations are conducted at 75% moisture relative to limited field moisture capacity											
9	-	-	-	-	-	-	-	-	-	-	-
10	120	60	60	-	120	60	120	60	120	60	
11	160	60	60	40	160	80	160	80	160	80	
12	200	60	60	80	200	100	200	100	200	100	

Since crop rotation of the 1st year was planted together with cover crop - autumn rye, nitrogen fertilizers were used to feed it. In subsequent years, nitrogen is not given. The physical, water-physical property of the soil is the main indicator that determines the nature and direction of all processes occurring in it. The supply of water, nutrients and air to the plant depends on the physical properties of any soil.

Results

During the experiment, the influence of the irrigation method and the rate of mineral fertilizers on the physical and water-physical properties of clover sandy soils was studied. Bulk density is the main indicator of the agrophysical property of the soil. V.K.Pestryakov (1969) noted that the life activity of beneficial microflora, the processes of biological activity, and the nutritional regime, which are directly related to the water-air and thermal regime of the soil, depend on its volume mass [6].

Numerous studies have shown that clover and perennial grasses have significantly reduced bulk soil mass. These crops accumulate a large amount of root residues in the soil during the growing season, and as a result of their decay, the amount of organic matter in the soil increases and its physical properties are improved.

According to the obtained data, sandy soils had a positive effect on the volume mass change when fodder clover was grown, and it was observed to decrease from year to year.

Table 2

Soil layer, SM	Volumetric mass of soil before planting clover, h/sm	Variants											
		1	2	3	4	5	6	7	8	9	10	11	12
		When irrigations are conducted at 85% moisture relative to limited field moisture capacity				When irrigations are conducted at 80% moisture relative to limited field moisture capacity				When irrigations are conducted at 75% moisture relative to limited field moisture capacity			

At the end of the 1st year growing season													
0-30	1,40	1,39	1,38	1,38	1,37	1,39	1,39	1,38	1,38	1,40	1,39	1,39	1,39
30-50	1,45	1,44	1,43	1,43	1,43	1,44	1,44	1,43	1,43	1,45	1,44	1,44	1,44
50-70	1,44	1,44	1,44	1,43	1,43	1,44	1,44	1,43	1,43	1,44	1,43	1,43	1,43
70-100	1,35	1,35	1,35	1,34	1,34	1,35	1,35	1,34	1,34	1,35	1,34	1,34	1,34
0-100	1,41	1,40	1,40	1,39	1,39	1,40	1,40	1,39	1,39	1,41	1,40	1,40	1,40
At the end of the 2nd year growing season													
0-30	1,40	1,38	1,37	1,36	1,35	1,38	1,37	1,36	1,36	1,39	1,38	1,38	1,38
30-50	1,45	1,44	1,43	1,42	1,42	1,43	1,43	1,42	1,42	1,44	1,43	1,43	1,43
50-70	1,44	1,43	1,42	1,41	1,41	1,44	1,43	1,42	1,42	1,44	1,43	1,43	1,43
70-100	1,35	1,34	1,33	1,32	1,32	1,35	1,34	1,33	1,33	1,34	1,34	1,33	1,33
0-100	1,41	1,39	1,38	1,37	1,37	1,40	1,39	1,38	1,38	1,40	1,39	1,39	1,39
At the end of the 3rd year growing season													
0-30	1,40	1,37	1,35	1,34	1,33	1,38	1,37	1,36	1,35	1,39	1,37	1,36	1,36
30-50	1,45	1,43	1,42	1,41	1,40	1,43	1,42	1,41	1,41	1,44	1,43	1,42	1,42
50-70	1,44	1,42	1,41	1,40	1,39	1,43	1,41	1,40	1,40	1,43	1,42	1,42	1,42
70-100	1,35	1,34	1,33	1,32	1,31	1,34	1,33	1,32	1,32	1,33	1,33	1,33	1,33
0-100	1,41	1,39	1,37	1,36	1,35	1,39	1,38	1,37	1,37	1,39	1,38	1,38	1,38

An intensive decrease in soil density occurred in the driving layer (0-30 sm). The main reason for this is the abundance of clover root mass in this layer. As the layer deepened, the change in soil density decreased. Investigations showed that the decrease in soil density depended on soil moisture and the rate of applied mineral fertilizers. For example, when clover was maintained at 85% moisture relative to the limited field moisture capacity, by the end of the experiment, the soil density in a 1-meter layer was 1.37 g/cm³ to 1.35 g/cm³, compared to the initial density (1.41 grams/cm³), depending on the fertilization rate. decreased. A similar relationship was noted when clover was maintained at 80 and 75% humidity relative to the limited soil moisture capacity.

However, in these cases, especially when clover was maintained at 75% moisture relative to the limited field moisture capacity, a decrease in the effectiveness of the applied fertilizers was observed. For example, when irrigation was carried out at 80% relative to the limited field moisture capacity, soil density decreased to 1.38-1.37 g/cm³, depending on the fertilization rate, and to 1.38 g/cm³ at 75% moisture. These indicators are optimal conditions for good growth and development of crops in sandy soils.

Research has shown that newly reclaimed sandy soils have very high water permeability. The ability of sands to retain moisture is low, and the crops grown in them require frequent watering. As a result, some of the used fertilizers are quickly washed away. During the experiments, we observed how the water permeability of sandy soils changed under clover. The obtained results are presented in Table 3.

Table 3. Changes in water permeability of sandy soils under clover according to agrotechnical measures

Experiment variants	Water permeability of sandy soils before the experiment, mm/min	Change in water permeability, mm/min		
		At the end of the 1 st year	At the end of the 2 nd year	At the end of the 3 rd year
When maintained at 85% relative humidity relative to limited soil moisture capacity				
1. N0 P0 K0	4,21	4,20	4,16	4,12
2. N120 P360 K180		4,17	4,13	4,08
3. N160 P480 K240		4,15	4,13	4,08
4. N200 P600 K300		4,12	4,07	4,02
When maintained at 80% relative humidity relative to limited soil moisture capacity				
5. N0 P0 K0	4,21	4,20	4,18	4,15
6. N120 P360 K180		4,18	4,13	4,10
7. N160 P480 K240		4,15	4,11	4,07
8. N200 P600 K300		4,13	4,09	4,04
When maintained at 75% relative humidity relative to limited soil moisture capacity				
9. N0 P0 K0	4,21	4,21	4,19	4,16
10. N120 P360 K180		4,19	4,14	4,09
11. N160 P480 K240		4,17	4,12	4,07
12. N200 P600 K300		4,15	4,10	4,06

The results of the experiment showed that the water permeability of sandy soils is slightly reduced due to the fact that clover leaves a large amount of root and stem residues in the soil, improves the aggregate state of sands (pseudostucture), increases moisture retention as a result of increased porosity. In particular, when clover was maintained at 85% relative to the limited field moisture capacity, water permeability decreased by 0.09-0.19 mm per minute relative to baseline, depending on fertilization rate. Depending on the rate of fertilization, this indicator is 0.06-0.17 and 0.05-0.15 mm/min, respectively, when irrigation is carried out at 80 and 75% relative to the limited field moisture capacity. Therefore, the enrichment of sandy soils with organic residues increases their ability to retain moisture and causes a slight decrease in water permeability. This is a positive situation for sandy soils. Soil moisture is crucial for plant life. Physico-chemical and biochemical processes occurring in the soil (decomposition and synthesis of organic compounds, assimilation of nutrients, activities of microorganisms, etc.) depend on its moisture.

During the studies, it was observed how clover care affects the water capacity of sandy soils. The obtained results are presented in Table 4.

Table 4. Changes in the water capacity of sandy soils under clover according to agrotechnical measures (in the range of 0-100 sm)

Experiment variants	Water capacity of sandy soils before testing, in % relative to absolute weight	Change in water permeability, mm/min		
		At the end of the 1 st year	At the end of the 2 nd year	At the end of the 3 rd year
When maintained at 85% relative humidity relative to limited soil moisture capacity				
1. N0 P0 K0	15,0	15,5	16,0	16,4
2. N120 P360 K180		16,9	17,5	18,0
3. N160 P480 K240		17,5	18,0	18,5
4. N200 P600 K300		17,8	18,4	18,9
When maintained at 80% relative humidity relative to limited soil moisture capacity				
5. N0 P0 K0		15,3	15,8	16,2
6. N120 P360 K180		16,5	17,0	17,6
7. N160 P480 K240		17,0	17,7	18,2
8. N200 P600 K300		17,4	18,1	18,7
When maintained at 75% relative humidity relative to limited soil moisture capacity				
9. N0 P0 K0		15,2	15,6	15,8
10. N120 P360 K180		16,3	16,8	17,2
11. N160 P480 K240		16,8	17,4	17,8
12. N200 P600 K300		17,1	17,8	18,3

As can be seen from the table, the water capacity of these lands increased with the increase in the moisture content of sandy soils and the rate of fertilizers used in clover care. In particular, the water capacity of sandy soils was 16.4% by absolute weight when maintained without fertilizer at 85% relative to the limited field wet capacity (var.1). According to the rate of application of mineral fertilizers (2-4 var.), this indicator was equal to 18.0-18.9%. A similar relationship was noted when irrigation was carried out at 80 and 75% relative to the limited field moisture capacity. However, in these cases, when clover was maintained at 75% moisture relative to the limited field moisture capacity, sandy soils resulted in relatively low water holding capacity. For example, the water capacity of sandy soils under clover maintained without fertilizer at 80% relative to the limited field moisture capacity was 16.2% by absolute weight. In the areas where mineral fertilizers were used (6-8 var.), depending on their rate, this indicator was 17.6-18.7%.

Depending on the rate of fertilization, the water capacity of sandy soils increased by 15.8-18.3% by the end of the experiment in the options where irrigation was carried out at 75% relative to the limited field moisture capacity. Therefore, in order to increase the water capacity of sandy soils, it is required that the soil moisture should not be less than 80% compared to the limited field moisture capacity.

In conclusion, the use of regular irrigation and mineral fertilizers in clover cultivation led to the improvement of physical and water-physical properties of sandy soils. In the first year, soil moisture should be reduced to 85 percent compared to the limited field moisture capacity, and in the second and third years, soil moisture should be reduced to 80 percent compared to the limited field moisture capacity, and 160-200 kg of nitrogen, 480-600 kg

of phosphorus, and 240-300 kg of potassium per hectare for three years. as a result of clover maintenance, the volume mass of the soil in a 1-meter datum is up to 1.37 g/cm³ compared to the initial (1.41 g/cm³), water permeability is 4.07-4.04 mm compared to the initial (4.21 mm/min.) / min. decreased to 3.2-3.7 percent, and as a result, the moisture content increased.

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