International Journal of Applied Engineering Research
ISSN 0973-4562 Volume 10, Number 10 (2015) pp. 25721-25727

http://www.ripublication.com

Use Of Geosynthetic Nonwoven Roll Material For The Restoration Of The Natural And Technogenic Systems

[1]Puchkov Mikhail Yuryevich, [1]Lysakov Maxim Arkadyevich, [2]Loktionova Elena Gennadyevna, [3]Puchkova AlyonaMikhaelovna, [2]Yakovleva Lyudmila Vyacheslavovna, [2]Andrianov Vladimir Aleksandrovich

[1]Vserosiysky research institute of the irrigated vegetable growing and melon growing, 414056, Russia, Astrakhan Region,Kamyzyak, Lyubich St., 16
[2]Astrakhansky state university, 414056, Russia, Astrakhan, Tatishchev St., 20a
[3]OOO Rosekostroy, 414056, Russia, Astrakhan, Tatishchev St., 20a

Abstract

Studying of opportunity introduction natural the phytocenoticstructures in natural and technogenic systems subject to degradation processes was a research objective. As technogenic components of the studied system were selected nonwoven geosynthetic materials of PolyfeltGes.m.b.H company (Austria) - Polyfelt.PGM 14 and PolyfeltTopTex.As a natural component were selected representatives of perennial grassy plants of family of Bluegrass (Poáceae) kind of slender wheatgrass (AgropyrumtenerumVaseg) of a grade "Ozernensky" of selection of FGBNU Vserosiysky research institute of the irrigated vegetable growing and melon growing.This sortwas created and selected as the steadiest against growth in the extremely arid conditions of Northwest Prikaspiya. Experiences were put in approximately to working conditions in the territory of a stationary area "Limansky" located in the Limanskydistrict of the Astrakhan region.
By researches it is establishedthat the creation of complex "natural technogenicsystem - geotextile - a plant" should be used geotextile lower density (PolyfeltTopTex). In this case, seeding adapted perennial cereal crops is done before rolling geotextiles.The geotextile materials Polyfelt.PGM 14 and PolyfeltTopTex possess high hygroscopicity in this connection promote accumulation and deduction of moisture in the soil and promotes the best rooting of plants.

Keywords: geosynthetic rolled material, natural and technogenic systems, fitotsenoza, the degraded territories, long-term cereal cultures, a wheat grass a slender wheatgrasssortOzernensky.

1. INTRODUCTION

Due to the increased technogenic load of natural ecosystems,experiencing the destroying influences tekhnosisty which leads to conflict in the Biosphere – Technosphere.Because of excessive simplified technical systemswhich need a continuous stream of energy at the expense of the person and inability of such systems to take energy from environment, and also are incapable of self-stabilization and self-development that hinders their coevolutionwith natural systems.In connection with what similar systems are doomed to destructions leading to the impetuous growth of entropy. In turn this process leads to an incommensurable stress natural ecosystems and as a result to their destruction.

For the prevention of destructive influence of technogenic systems on natural it is necessary to complicate technogenic system for the account introduction in its structure natural a component the most adapted for technogenic conditions [1, 2].These natural formations can serve phytotsenotichesky structure capable of forming a consortium with other structures biocenotic natural ecosystems.Due to this process there is an interaction of natural ecosystems to the technogenic. Because of this process natural and technogenic systems merge in a uniform complex.

Creation of similar complexes especially actually in the sphere of road construction, at construction of oil and gas, mining complexes, and construction of other constructions, and also at creation of pasturable ecosystems [3, 4].

In this context, the aim of this study was to explore the possibility of introducing natural phytocenotic structures in natural and technogenicsystems are subject to degradation processes.

2. RESEARCH METHODS

The object of research was served by the created natural and technogenic system "natural and technogenic system – geotextiles - a plant".

The subject of the researchwasserved adaptation indicators of plants in relation to geotextiles.As technogenic components of the studied systemwere selected nonwoven geosynthetic materials company PolyfeltGes.mbH (Austria) - Polyfelt.PGM 14 and PolyfeltTopTex.

Polyfelt.PGM 14 – the geosynthetic nonwoven rolled material of production PolyfeltGes.m.b.H (Austria) developed for construction, repair and for reconstruction of highways. Features of structure of material that it consists of endlessfilaments of polypropylene.

PolyfeltTopTex - mechanically fastened nonwoven synthetic material that has good air permeability consisting of polypropylene and having resistance to UV radiation.It is applied as a protective cloth at shelter of agricultural plants from negative factors of the environment.

Table 1 shows the characteristics of Polyfelt.PGM 14 and PolyfeltTopTex 110A [7, 8].

Tab. 1. Technical characteristics of Polyfelt.PGM 14 and PolyfeltTopTex.

Indicators [Standard]	units	Polyfelt PGM 14	PolyfeltTopTex 110 A
The maximum durability at stretching the longitudinal [EN ISO 10319]	кН/m	9	10
The maximum durability at stretching of the cross [EN ISO 10319]	кН/m	9	7
The maximum lengthening at the maximum loading (longitudinal + cross)2 [EN ISO 10319]	%	55	70
Tensile strength (greb-method) [ASTM D 4632]	Н	520	-
Lengthening (greb-method) [ASTM D 4632]	%	more 50	-
Thickness at loading 2 кН/m^2 [EN ISO 9863-1]	Мм	1,1	0,9
The surface density [EN ISO 9864]	г/$м^2$	140	110
Coefficientofvariation	%	less 10	-
Length	М	-	50
Meltingpoint[ASTM D 276]	°С	165	-

As a natural component were selected by representatives of perennial herbaceous plants of the family Bluegrass(Poaceae) kind of slender wheatgrass(AgropyrumtenerumVaseg) of a grade "Ozernensky" of selection of FGBNU Vserosiysky research institute of the irrigated vegetable growing and melon growing.This grade was created and selected as the steadiest against growth in the extremely arid conditions of Northwest Prikaspiya [5, 6].

The experiments were laid in the approximate production conditions in the territory of the stationary area"Limansky" located in Limansky district of the Astrakhan region.Passed construction of the highway of federal Moscow-Astrakhan-Makhachkala value in 200-ah meters. Researches took place from April 1 to September 1, 2014.

Weather conditions during researches differed in the following characteristics. During the spring period it is quite humid,, frequent fogs, soil moisture was in the range of 40% -70%, the temperature of 5 ° C to 30 ° C heat.The summer period differed in enough dryness, humidity of the soil made 7%, temperature fluctuated from 28° C to 40° C is warm, the stock to moisture in the soil was not lower than 10 mm (humidity of wilting point for sandy loam soils 4%).

In this experiment we used more profoundscheme of sowing (6-8 cm) in comparison with standard (2-3 cm).It is connected with the special weather conditions developing during the late autumn and early-spring periods.Besides at this time there are often strong squally wind blowing that could trigger the upper soil horizon.

To determine the possibility the introduction of natural phytocenotic structures in natural and technogenic systemssubject to degradation processes of the system by

attaching phytosystems (plants) through artificial substrate to substrate degraded technogenic systems were based on the following experiments.

In the first option of experience is sowing 100 seedsof slender wheatgrasson a geomaterial surface with seal to the soil on depth of 6-8 cm (fig. 1)In the second option of experience sowing of 100 seeds slender wheatgrass were carried out under a geomaterial surface with seal to the soil on depth of 6 - 8 cm (fig. 2).

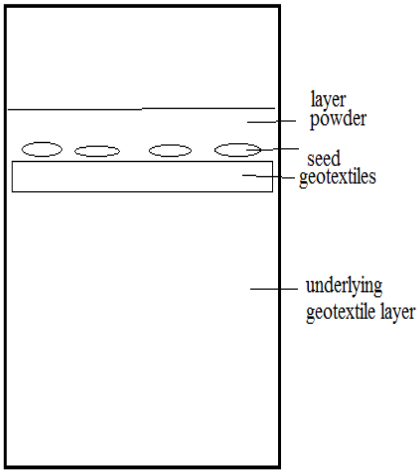

Fig. 1. Sowing seeds is carried out on the geotextile

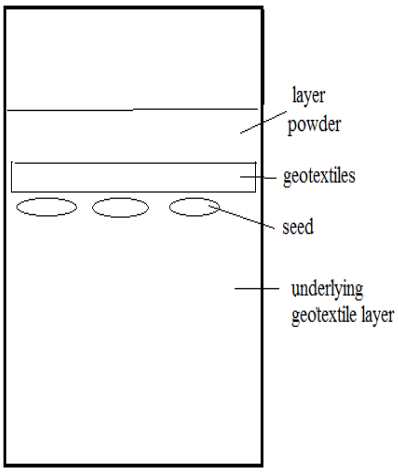

Fig. 2. The sowing of seeds is carried out before the rolling of geotextile

3. RESULTS

Results of researches show, plants in a stage of seedlings differently reacted on geosynthetic the material Polyfelt.PGM 14 and PolyfeltTopTex.

First, it depends on the morphological and physiological characteristics of cereals and technical characteristics of the material particularly on its density.Cereal long-term herbs belong tohemicryptophytesthat is their apical meristem is in a zone of a root neck and is shipped on 0,5-1 cm in the soil.When seeds of this type of a plant are located under geosynthetic material, a sheet tube moving apart fibers of material comes to a day surface.

If density of material is high, the plant doesn't have enough energy to move apart the fastened fibers and to pass to a sheet tube through geotextiles. The geotextiles of PolyfeltTopTex at the expense of lower density have good biothroughput potential. Therefore sheet plates of plants pass through geotextiles (tab. 2, fig. 3, 4).

Table 2. Quantity of the sprouted seeds.

Brandgeotextiles	Polyfelt.PGM 14	PolyfeltTopTex
Indicators	Option 1	Option 1
Quantity of plants last growth point through geotextiles,%	21	100
Quantity of the plants which sprouted and didn't pass growth point through geotextiles%	79	100
	Option2	Option 2
Quantity of plants on geotextiles, %	100	60
Quantity of plants at which the root passed through geotextiles, %.	100	60
Quantity of not sprouted seeds, в %	-	40

Additional roots of a plant have to pass in option when seeds of plants are seeded on a geotextiles surface, through geotextiles.Apical meristem which is covered with a root cap. In this case density of geotextiles has paramount value.

Fig. 3. PolyfeltTopTex, option 1

Fig. 4. PolyfeltTopTex, option 2

From experience with geotextiles of the Polyfelt PGM 14 brands not all passed additional roots through geotextiles, because of big density (tab. 3, fig. 5, 6). Results with Polyfelt.PGM 14 and PolyfeltTopTex options are presented in table 3.

Table 3. Biometric indicators of plants.

Indicators	Polyfelt.PGM 14				PolyfeltTopTex			
	Option2		Option1		Option2		Option1	
Length of land part of a plant, ($x\square \pm ts_{x\square}$)sm	8,8±5,2		17,35±3		16,65±2,9		14,7±1,7	
Root length, ($x\square \pm ts_{x\square}$)sm	6,25±1,0		6,65±1,4		5,35±0,9		6,5±0,97	
Total of land part of a plant, %	21		60		100		100	
Total of underground part of a plant,%	100		100		100		60	
The length of the leaves, ($x\square \pm ts_{x\square}$) sm	1 leaf	2 leaf	1 leaf	2leaf	1 leaf	2 leaf	1 leaf	2leaf
	7,8± 1,5	7,2± 1,5	12,5 ±1,9	9,9± 1,4	13,9 ±3,1	10,2 ±1,5	12,7 ±1,4	9,6± 1,6
Phenologicalstage	Tillering		Tillering		Tillering		Tillering	
Plantswithoutleaves, %	79		-		-		-	
Quantity of leaves at plants, ($x\square \pm ts_{x\square}$) unit	2±0		2,1±0.2		2,2±0,29		2,3±0,3	

When using geotextiles for crop plants, it serves as a substrate fixer seed structureless soils prevents blowing plant seeds.

Fig. 5. Polyfelt.PGM 14

Fig. 6.PolyfeltTopTex

Under the influence of geotextiles in the soil formed favorable temperature and hydrological conditions for the germination of seeds of plants.

4. CONCLUSION

GeosyntheticPolyfelt.PGM 14 nonwoven fabric has the high density therefore sheet plates of plants badly get through it, the root system passes also badly. Therefore the material Polyfelt.PGM 14 can't be used as a substratum.

GeosyntheticPolyfeltTopTex nonwoven fabric possesses low density therefore through it easily pass sheet plates and root systems of plants. Therefore it can be used with success as a substratum for fixing of seeds of plants both under a surface and on its surface.

All studied geosynthetic materials Polyfelt.PGM 14 and PolyfeltTopTex possess high hygroscopicity and consequently promote accumulation and deduction of moisture in the soil.

REFERENCES

1. FORSCHUNG STRASSENBAU UND STRASSENVERKEHRSTECHNIK (analytical report) Publishing house Bundesmin. furVerkehr, Bau- u. Wohnungswesen, Abt. Strassenbau, Strassenverkehr, Bonn, 2004 г., P. 142.
2. John N. W. M. Geotextiles. — Taylor & Francis, 1987. — 347 p.
3. SCHRODER HARTMUT F., BERICHTE DER BUNDESANSTALT FUR STRASSENWESEN. STRASSENBAU: S [Text] / SCHRODER HARTMUT F. // Publishing houseWirtschaftsverl. NW, Bremerhaven, 2005, P. 44.
4. SILVA L.F.D., CONFRE J.A. MODELING OF GEOTEXTILES AND OTHER MEMBRANES IN THE PREVENTION OF REFLECTION CRACKING IN ASPHALTIC [Text] / SILVA L.F.D. // PUBLIC ROADS, Publishing houseSuperintendent of Documents, № 3 (57) 1994, P. 12-18.
5. Lysakov, M. A. Selection of grades - phytoameliorants for restoration of the degraded Northwest Prikaspiya's pastures. [Text] / M. Yu. Puchkov, A.Ya. Lozitsky, N. V. Simanskova, M. A. Lysakov.//Modern problems of science and education. 2014. No. 2. Page 615.
6. Puchkov, M. Yu. New grades of long-term herbs for Northern Prikaspiya [Text] / N. V. Simanskov's arid zone, A.Ya. Lozitsky, M. Yu. Puchkov.//Adaptive forage production. 2013. No. 1 (13). Page 50-53
7. Protective cloth of PolyfeltTopTex [Web resource] of http://www.izomin.info/izomin/gidroizolyatsiya/polyfelt-toptex.html. Date of the address of 30.03.15.
8. Geotextiles of Polyfelt PGM for road construction [Web resource] of http://www.soyuzstroy.com/produkciya/geotextile/proizvoditeli-marki/polyfelt/pgm. Date of the address 30.03.15