REHABILITATION OF DEGRADED SOIL BY PHITOMELIORATON

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Results of experiments with establishing of vegetation coenosis effect to the ecotypes characteristics were done. Ecological structure and flora composition of the plants associations was analyzed. The best variants to stimulate humus aggregating and turfing are carried out.
Les resultats des experiences avec la detection de la vegetation coenosis l'effet vers ecotypes aux caracteristiques etaient faits. La structure ecologique et la composition de la flore des associations des plantes etaient analyses. Les meilleures variantes pour stimuler humus, en joignant et turfing sont decouverts.

Introduction

Extensive agricultural approach to arable lands leads to reducing of humus. Arable layer of soil has been dissipated as a result of wind and water erosion and also as a result of its long-term irrigation. Natural zone vegetation types are being destroyed; hayfields and pasture areas are being reduced. In connection with the problem of soil rehabilitation is especially impotent. Artificial recovery of zone bio- and geocoenosis, natural overgrowing (forming of follow lands), sowing of herbs - these are only some of numerous biological scientific methods available in the system of soil-protecting methods (Dzibov, 1985; Ziman, et al., 1975). For the purpose of the soil formation process prognosis and discovering of vegetable top effect of ecotopes our research of succession processes of forming coenosis, its flora composition and coenosis structure was carried out.

Materials and methods

The matter of experiment was a model in steppe department of Nikita botanical Gardens at the selected area of land 0.4 ha with the south chernozem which is typical for sub zone of dry steppe. The area was divided on plots (2 x 5 meter) and sown with steppe dominants picked up in various parts of the Crimea (Southern Ukraine), national park Askania-Nova and some lawn serials. A part of the plots was left for replantation of turf and self-overgrowing. Ecological, biological and soil examination of the three areas including agricultural steppe mentioned above, the fallow land recovered naturally (in dendropark) and crops of the same kind of *Poa angustifolia* was carried out. As a control the data obtained from soil samples analysis of ploughed field were used. All the objects of experiment are situated at the territory of steppe part of Crimea, 25 km to north from city Simferopol. The soil of the all plots is represented by south carbonate chernozem with deep ploughing on Pliocene clay.
Geobotanical investigation of vegetation and description of plants was carried out by V.N. Golubev (1981), nomenclature of association by E.M. Lavrenko (1940). As an indirect indicator of turf generating ability, vegetation mobility of cereals and other coenosis components the scale of abundance Braun-Blanket (Valter, 1982) and common descriptive coating (CDC) was used. Direct watching of objects without settling of regular grounds carried out the research of vegetation changes of the areas mentioned above. Soil profiles were timed to standard plots of coenoses. Flora composition and structure of these coenosises were discovering their typical features and reflecting basic direction of demutation processes. Soil profiles, with selection of samples on genetic levels, were done to describe soil conditions of the plots mentioned. Value of pH, content of humus and mobile types of nutrient matters were analyzed in soil by conventional methods (nitrate nitrogen -

potentiometrically, potassium and phosphorus by Machigin method and structural condition of s by Savvinov (Vadunina et al, 1986).

Results and discussion

Agricultural steppe - the model of steppe coenosis created artificially. We had noticed that flora variety of coenosis was not changed for last 4 years (93 varieties). During first 12 years there were equal number of thick turf and rhizome components, but at the present time total number of long-rhizome and friable turf perennial crops increased: *Poa angustifolia* (4), *Koeleria cristata* (3-4), *Cynodon dactylon* (3-4), *Festuca regeliana* (2-3). The number of lawn and mesophil steppe coenosis components increased too: *Vicia tenuifolia, Coronilla varia, Elitrigia repens, Trifolium ambiguum*. These components are forming monodominant aggregation the zone of those is increased considerably. We refer these phenomena to the mesophitisation of area due to its protection for the last years. As a result in areas with maximum CDC (up to 90-100 %) thick turf *Festuca rupicola*, thick felt aggregation is increased considerably. The area of local herbs at plots has been extended. These local herbs refer to *Stipa-Festuca* groups of feather grass: *Stipa capillata* (2), *S. ucrainica* (2), *S. lessingiana* (2). Soil section 1 m^2, was done fragment association like: *Festuca rupicola + Poa angustifolia* [+ *Koeleria cristata - Melilotus officinalis - Cynodon dactylon*]. Research of section morphology has showed that maximum turfing of soil is notices at the agricultural steppe where it achieves 20-25 cm. Under these conditions, the upper part of soil profile is transpierced by the roots of vegetation perennial herbs more than other part (80-100 cm). This fact stimulated forming of lump-granular and lump-powder structure of soil (table 1). Data of chemical composition (table 2) confirms about almost 3 times increasing of nitrate nitrogen either in soil layer 0-20 cm or ever lower on profile comparing other plots. Such phenomena are possibly being due to mineralization of root remnants atrophied. Maximum content was also the content of K_2O that was notified even in layer 80-100 cm. Aggregation of humus (comparing with other variants) prevails to depth of 60 cm. Humus content is getting reduced with depth fluently.

Fallow land was investigated in dendropark. The plot investigated is 15-years old fallow land which variety in investigation in connection with heterogeneity of relief (hollows and hills) and ecology of biotope (shadowing due to tree-tiers with general closeness of crown 0,2-0,3 and open spaces. Flora variety of the system formed is surely at the second place after agricultural steppe (50 varieties) due to the long-term period of demutation in herbage all the stage of succession are noticed that is due to vegetation heterogeneity of fallow land. Perrennial and annual weeds don't form homogeneous accumulations with the exception of *Elytrigia repens* and *Hieracium nigrisetum*, which occupy the territory from 20 to 50 m^2. There are various stages at vegetation thick turfy groups with prevailing of *Festuca rupicola.* There are some territories where *Poa pratensis* and *P. angustifolia* also prevail together with *Festuca rupicola.* Motley grass is represented by *Vicia tenuifolia* (2), *Achillea setacea* (1-2), *Coronilla varia* (1-2), *Plantago lanceolata* (1-2), *Cichorium intybus* (2). As for annual crops, one can watch *Aegilops cylindrica* (1-2), *Anisantha sterilis* (2). Anneal and biennial weeds are scattered almost around the whole territory: *Torilis japonica, T. arvensis, Barkhausia rhoeadifolia, Sonchus asper, Picris rigida, Erodium cicutanium* and *Alyssum hirsutum.*

Soil profile is done within the association like *Festuca rupicola + Poa pratensis* [+ *Poa angustifolia - Coronilla varia*]. At profile (8-10 cm) turfing of soil is noticed. Under these conditions maximum transpiring of roots is watched in the layer 0-50 cm, the structure is lumpy; the soil lacks nitrogen the most, comparing with other variants. Data of humus aggregation are given in table 2.

Homogenous crop of *Poa angustifolia* (lawn) age eight years old were investigated at the territory in immediate proximity to agricultural steppe. The size of CDC of herbage of this coenosis is achieving 90 %. Crops are only partly weeded with *Plantago lanceolata, Convolvulus arvensis, Taracsacum officinale, Picris rigida and Alyssum hirsutum*. High purity of the crops shows considerable harmonization at the crops, normal condition and comparative at herbage thinness. For the period of

development coenosis was affected by various kinds of anthropogenic influence depending on experiment purpose (watering, fertilizing and mowing). At the present time only mowing is done (once a year).

Table 1. Structural condition of soil under the turfing.

Variant	Layer of soil, cm	Content of aggregates 0.25-10 mm, % of air-dry soil		Coefficient of structural
		Dry sowing	Wet sowing	
Agricultural steppe	0-20	72.8	49.5	2.7
	20-40	55.6	57.6	1.2
	40-60	41.0	65.1	0.7
Fallow land	0-20	70.3	60.1	2.4
	20-40	68.5	66.9	2.2
	40-60	60.4	66.6	1.5
Lawn	0-20	79.7	68.8	3.9
	20-40	71.6	69.9	2.5
	40-60	64.7	71.8	1.8
Arable land	0-20	42.8	60.9	0.6
	20-40	34.3	61.3	0.5
	40-60	52.7	68.9	1.1

Data of soil research show valuable aggregates and the highest coefficient of soil structuring at all layers investigated (table 1). The process of humus aggregation is a little bit behind the procession in agricultural steppe, but leaves behind the fallow land. Such phenomena are explained by polycomponent of model for soil model and climate recourses used. Expenditure of energy to coenobionts is found out to be the least. Outstripping of the soil structuring process and humus aggregation is explained by intensification of the turfing process due to active sowing of herbs and growing of viable seeds sowing when creating lawns.

Arable-land. Long-term ploughing of the soil for various crops has resulted in forming of clod-lumpy and lump-dusty structure. So soil structure becomes worse and even lost. Its agricultural value because of clods formed there are particles of size more than 10 mm at the layer of 20-40 cm. These particles are 65 % at the layer. This fact is possibly due to hardening of the soil by agricultural implements. Coefficient of structuring is very low but water-stable structure available, possibly due to carbonate composition of soil (table 1).
Value of pH has been not changed considerably (table 2). One has noticed only reducing of pH in layer 0-20 cm (up to 8.35-8.47) comparing with ploughed area (pH=8.6). It shows small acidification of soil by the excretion of roots of perennial herbs. Content of mobile phosphorus forms is not large and is not changed considerably. In layer 0-20 cm the concentration of these forms is maximal at ploughed field, as well as potassium because of soil fertilizing. Turfing did not produce the effect to mobile forms of phosphorus aggregation.

Table 2. The changes of some characteristics of soil under the different conditions of the experiment.

Variant	Layer of soil, cm	pH	Humus, %	Content of mobile nutrient matters, million $^{-1}$		
				$N\text{-}NO_3$	P_2O_5	K_2O
Agricultural steppe	0-20	8.45	2.74	6.7	6.8	250
	20-40	8.56	2.56	3.5	6.8	250
	40-60	8.54	2.34	4.2	6.7	214

	60-80	8.65	1.36	3.0	5.8	190
	80-100	8.66	-	-	3.2	180
Fallow land	0-20	8.35	2.64	1.8	8.4	184
	20-40	2.23	0.48	1.6	8.4	160
	40-60	8.65	1.94	1.4	10.6	130
	60-80	8.85	0.84	-	3.7	104
	80-100	8.93	-	-	-	-
Lawn	0-20	8.47	2.54	2.1	6.5	220
	20-40	8.50	2.42	2.2	8.6	180
	40-60	8.65	2.27	2.2	7.2	90
	60-80	8.72	0.84	1.9	8.2	90
	80-100	8.83	-	-	6.4	100
Arable land	0-20	8.60	2.42	2.9	9.0	280
	20-40	8.50	2.45	2.2	8.4	240
	40-60	8.35	1.60	4.0	6.0	150
	60-80	8.57	1.44	1.5	6.5	140

Conclusions

Variant of either natural or artificial turfing results in improving of nutrient aqueous and air condition of soil, aggregating of nitrates, potassium, recovery soil structure and intensification of the humus aggregation. The best variant is the variant of agricultural steppe model applied by combined method of turf replantation and sowing of seed herbs prevailed in steppe to the soil damaged. Such variant of biological recultivation is difficult and laborious, so is not possible to be used with soils lost their fruitful layer completely. In connection with this the variant of creating the model of natural coenosis by sowing seeds of all kinds at natural flora seeds should be used. In our experiment sowing of lawn herbs been found out to be the most effective way especially for soil structuring. This way is least laborious when recovery soil fertility. Although the comparability of this experiment is conditional at this stage we have a positive results. Future investigation in this area is supposed to increase comparability of individual variants.

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