N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES OF AGRICULTURAL SCIENCES
ISSN 2224-526X
Volume 1, Number 43 (2018), 74 – 78

UDC 631.4:626.875(574.51)

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HYDROTHERMAL REGIME OF THE CENTERS OF THE MOBILE BARCHANS FORMED AS A RESULT OF ANTHROPOGENIC DEGRADATION OF SANDY SOILS OF DESERTS

Abstract. The article provides the data of the seasonal hydrothermal regime of the centers of the mobile barchans formed from sandy soils as a result of anthropogenic degradation, which were widely spread in Southern Balkhash region. The results of observations which are carried out in March-August months on a middle part of a slope of barchans at depths of 0-20, 20-40, 40-60, 60-80, 80-100 cm in the direction of the summer dominating winds show that the highest humidity was observed in March (4.71-7.06%) which gradually decreases in May up to 3.62 – 4.73%, in June up to 1.55-4.54%, in July up to 1.16-3.63% and in August up to 0.71-1.45%. In July-August months, at a depth of an arrangement of root system of saplings (20-60 cm) of sand binding shrubbery it decreases lower than the level of wilting moisture of plants (1.7%). Such condition of humidity of sand under optimum conditions of its temperature does not give the chance of saplings survival. It is also established that because of the mobility of the top layers of barchans and falling asleep or blowing of saplings leads to exposure of root system.

Key words: sand, degradation, desert, barchans, hydrothermal regime.

Introduction. Sandy soils of deserts suffered by anthropogenic degradation are widely spread as the integrated or separate form in semi-desert and desert regions of Balkhash-Alakol and Ili valleys of Almaty district. Average yearly temperature in these regions in the period of 1935-1995 was increased up to 1.4°C, in vegetative season of plants up to 1.0°C, and in October-March was increased up to 2°C [1]. It took place around terrestrial globe from 1980 up today under the conditions of increasing of air average yearly temperature up to 0.4°C [2]. Such case was not observed in our planet for the last 1000 years. It is expected that in the new 21st century the increasing of global warming up to 1°C will propel borders of desert and semi-desert regions to the north and south [3]. Then it becomes evident that the above mentioned cases increase the risk of adverse influence on design and structure of gray-brown, uncovered and sandy soils of deserts which were formed in the given region.

Since the mid of 1990s due to disappearance of state agriculture and head of cattle distribution between private farms, every farm begun to settle in scattered form separately in the territory of former state farms. After a while, within 5-7 days, in places of their settlement sandy soils of deserts suffered to degradation changes and begun to become the mobile barchans. Nowadays they become constant companion of every farm and give rise to economic expenditures by worsening their ecologic and social situation. For this reason, in order to find out the effective phytomeliorative ways of restoration of these lands, it is necessary to investigate their seasonal hydrothermal regimes, the peculiarities of land terrain and other properties.

Object of research and methods. Object of our research is the center of the mobile barchans formed from sandy soils of deserts because of anthropogenic degradation in Southern Balkhash region. Area of research is located on west side of Bakbakty village. Because of the fact that a rice state farm was formed here previously (up to 1960) scrubs which initially grew on an ordinary sandy soil of desert were weeded out, as a result of which they formed the mobile barchans. Today they cause some inconveniences for citizens of Bakbakty village, especially citizens of the end houses located on west of village have to force to mess around with sand scouring which covers their houses.

Area of research consists of three mobile sandy barchans which are interconnected in the form of an ellipse (picture).

View of sandy barchans

Barchans stretched out from southward to north. High fluctuations between their highest (accumulative) and the lowest (deconstructive) parts is 4.4 meters. The angle of their slope changes from 15 up to 250.

Identification of the seasonal temperature regimes of sandy barchans was carried out on a middle part of west slope of barchans with establishing special thermometers at depths by 0, 20, 40, 60, 80, 100 cm; measurements were carried out in the middle of every month from March till September at 01.00 PM by Astana time. In this area soil field moisture was identified with soil temperature at depths by 0-20, 20-40, 40-60, 60-80, 80-100 mcm. It was explored through drying of the given soil in a thermostat at a temperature of +105 ^{0}C within 6 hours [4].

The results of research and discussion. To strengthen the mobile barchans by phytomeliorative method it requires to identify how much its humidity conditions and temperature correspond to the requests of plants which grow there. This is the reason why we investigate the regime of humidity of west slope of barchans towards a prevailing wind.

"Wilting moisture" of soil is connected with its properties and type of vegetation also with stage of development [5]. By efficiency of the plant, it refers to categories of humidity which is very difficult to absorb. It includes a full and some freely connected part of the water which secured to parts of soil [6]. Thus, the degree of wilting moisture of soil is considered as boundary humidity identifying useful and useless degree for plants. In a case when the degree of humidity in a soil rises up to the degree of wilting moisture then physiological and biochemical processes occurring in plants are violated, plant stops to grow and withers. If it continues within several days then plant dies. Taking into account this situation in 2017, we measured the seasonal water regime of the mobile barchans located near Bakbakty village. Their results are in table 1.

Data on table show that in March humidity of barchans gradually increased from the top layer to bottom one. In this period its humidity of 0-100cm layer hesitated between 4.71-7.06%, i.e., it shows that it is enough for saplings production because wilting moisture of soil is about 1-1.5% [5]. In our case