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DANGEROUS METEOROLOGICAL EVENTS AFFECTING PASTURE PLANTS IN KARAKALPAKSTAN

Annotation. This article provides information on the consequences of dangerous meteorological events, which have a negative impact on the use of agricultural land, mainly black frosts. The results of meteorological observations carried out in the regions of Karakalpakstan over a period of time are presented and analyzed. Based on the analysis, scientifically based conclusions are made and the use of modern GIS in the management of dangerous meteorological events and mitigation of their consequences in the efficient use of agricultural land and the creation of special maps in the management of meteorological events are proposed. Based on the data, a comparison of spring frosts and autumn frosts in the regions of Karakalpakstan revealed that the northern and southern parts differ from each other by 28 days. The full and effective use of the obtained results will allow getting a stable harvest of agricultural crops in the Republic of Karakalpakstan.

Key words. Strong black frost, average black frost, weak black frost, drought, snowlessness, GIS

Introduction. The main meteorological events dangerous for agriculture include black frosts, droughts, dry hot windsdust storms, hail and heavy rains in the warm period of the year and severe frosts, frost, ice, snow or thick snow, etc in winter.

Depending on the strength and duration of the black frost, the plants are partially damaged or completely destroyed by its harmful effects.

The reason for the crop frosting during black frosts is the dehydration of the plant cell protoplasm. Because when the temperature drops to 0° C or lower, the water between the plant cells freezes and absorbs the water in the cell. The cell sap thickens and the protoplasm becomes dehydrated. In addition, the increasing number of ice crystals compresses and damages the cell. Cell damage eventually results in partial or complete destruction of the plant.

Different parts of the same plant have different levels of resistance to black frosts. During the period of flowering and bud formation, black frosts from 0 to -2° C can completely destroy the crop. In plants such as lemons, oranges, mandarins, black frosts first damage the leaves (-6°... -8° C) and vines (-7°... -10° C) [7]. The twigs of these plants are more resistant to black frosts than the leaves. When a plant is hit by a cold, its leaves turn black.

Method and methodology. In our work, we focus on black frosts as they are the most dangerous for agricultural production, and they are observed in late spring, early summer, and fall. The occurrence of this phenomenon is significantly affected by the topography, soil condition, the presence of vegetation and water bodies, the cessation of black frosts in the spring, and the duration and intensity of the onset in the fall. They sometimes cause great damage to agricultural production.

For example, according to A.Q. Abdullaev and T.M. Mukhtorov, on April 22-24, 1999, the influx of cold Arctic air into the southern part of Uzbekistan caused a sharp drop in temperature, rain and snow in the foothills [2]. Such a drop in temperature has had a negative impact on agricultural crops and fruit trees in many regions. Under the influence of this black cold in Tashkent, Syrdarya, Jizzakh, Samarkand regions in the first half of April, 80-100% of the grass sprouted from seeds sown. In many regions of Uzbekistan, melons and vegetables, mulberries and vines were also damaged by the cold. Therefore, farmers replanted these crops and suffered great economic losses.

In order to develop effective measures to combat such problems, it is necessary to know the nature of their formation, their frequency and intensity in

different regions of the country and to study the changes in crop yields in connection with these events taking into account the agroclimatic features of each region [8]. Knowing the most important aspects of the black frost is a modern requirement to show on maps its distribution in the territory of our country. Scientific research has been conducted on this issue and a number of maps have been drawn as a result. GIS technology was used to create the maps [6, 9]. In order to use GIS-technology in their development, methods were developed and manuals were published: "Guidelines for the use of mathematical statistics in finding related equations in agrometeorology, the use of computers and geographic information systems" [1].

In this article we will consider the distribution of black frost in spring and autumn in the territory of the Republic of Karakalpakstan.

Black frosts are caused by a drop in temperature (below 0° C) during the hottest period of the year, which leads to traumatic damage to plants, writes G.Z. Ventskevich [3].

L. Babushkin [3] divided it into the following groups depending on the level of cold in Uzbekistan:

Weak black frosts - the air temperature on the active surface does not fall below -2° C, when the air temperature is above 0° C.

Average black frosts - the surface temperature drops to -3 ...- 4° C and the black cold surrounds the lowest air layer.

Severe black frosts - the temperature drops to -5° C and covers the surface air layer to 1.5 ... 2 meters. In the same layer, most field crops perish.

Black frosts are divided into 3 types depending on the duration of exposure: advective, radiation, radiation and mixed. During the warm periods of the year (spring and autumn), when the temperature of the air layer and soil surface drops to 0° C or lower, we call it 'the black frost'. Depending on the strength and duration of the black frost, the plants are partially damaged or completely destroyed by its harmful effects. The reason for the cold snap of crops during black frosts is the dehydration of the plant cell protoplasm [5].

Because when the temperature drops to 0° C or lower, the water between the plant cells freezes and absorbs the water in the cell. The cell sap thickens and the protoplasm becomes dehydrated. In addition, the increasing number of ice crystals compresses and damages the cell.

Results and discussion. Cell damage eventually results in partial or complete destruction of the plant. When a plant is hit by a cold, its leaves turn black. That is why such an atmospheric phenomenon that occurs in spring and early autumn which farmers call “black frost”. Black frosts in late spring and early autumn, which coincide with the most active growth period of crops for agricultural production, are especially dangerous. The following table provides a qualitative analysis of black frost based on the data of meteorological stations of the Republic of Karakalpakstan.

In the following table, we consider the dates of the last black cold in the territory of the Republic of Karakalpakstan in the basic multi-year period (Table 1).

Table 1. Differences between late spring frost and the beginning of the growing season

Meteorological station	Average date of increasing to +5	Average date of increasing to +10	Average date of last spring frost	Difference between beginning and decrease from +10	Difference between beginning and decrease from +5
Kizil-jar	4 IV	17 IV	13 IV	-9	+ 4
«Vozrojdeniya»	II IV	28 IV	21 IV	-10	+7
«Karakalpakstan	1 IV	18 IV	28 IV	-27	-10
Jaslyk	31 III	16 IV	21 IV	-21	-5
Muynak	6 IV	20 IV	5 IV	-1	+ 15
Kungrad	25 III	11 IV	12 IV	- 8	+ 1
Chimbay	25 III	10 IV	10 IV	-16	0
Nukus	23 III	8 IV	9 IV	-17	- 1
Turtkul	14 III	1 IV	1IV	-17	0

As can be seen from the table, the last spring frost in the north of the republic was on 28th of April at the Karakalpakstan meteorological station, but it was observed on 9th and 1st of April at Nukus and Turtkul meteorological stations respectively. It becomes clear that the dates of the frost between the north and south parts of the republic differed by 28 days.

Regarding the autumn frost, the first frost is important in agriculture, because it is necessary to harvest agricultural crops from the field before the first frost. We can see from the table below that the autumn frosts are not the same in the regions.

Table 2. Differences between the average date of the first autumn frost and the end of the growing season

Meteorological stations	Date of decreasing +10	Date of decreasing +5°	Date of first autumn frost	Difference compared to the	
				Below +10°	Below +5°
Kizil-jar	11 X	28 X	23 X	+ 12	-5
Vozrojdeniya	20 X	10 XI	4 XI	+15	+6
«Karakalpakstan»	9 X	21 X	25IX	-14	-29
Jaslyk	11 X	28 X	4 X	-7	-24
Muynak	20 X	9 XI	5 XI	+16	+4
Kungrad	15 X	4 XI	13 X	-2	-22
Chimbay	17 X	1 XI	12 X	-5	-20
Nukus	17 X	5 XI	11 X	-6	-25
Turtkul	21 X	10 XI	22 X	+ 1	-19

The first autumn frost occurred on 25th, 13th and 4th of October in the northern parts of the republic, that is, in Karakalpakstan, Kungrad and Jaslyk. The first frost at the Karakalpakstan meteorological station was the first in the region. This event was observed in Nukus and Turtkul on 11th and 22nd of October. Obviously, the difference between the northern and southern parts of the country is 25-28 days, as well as the spring frosts.

Conclusion. Full and effective use of the obtained results will allow getting a stable harvest of agricultural crops in the Republic of Karakalpakstan. At the same time, farmers can achieve great results if they work together with

the Department of Agrometeorological Services of Agriculture in the Hydrometeorological Department of Karakalpakstan, which is a branch of Uzbekistan Hydrometeorological Station.

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