

## ECONOMIC LOSSES FROM REDUCED HUMUS CONTENT IN THE SOIL DUE TO THE COMBUSTION OF DRY GRASS

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**Abstract:** *Burning of dry grass and leaves is an acute environmental problem throughout the world and in Ukraine. The reasons for this are low level of education, inadequate legislation and lack of control of the relevant environmental authorities. The combustion of dry grass decreases the content of humus in the soil that affects the organisms living in it and results in significant economic losses. Formed during the combustion gases are harmful to humans.*

**Keywords:** *grass burning, humus content, economic losses*

One of the causes of land degradation is a humus content reduction, which is not only due agroexhaustion but also during thermal processing of topsoil by dry grass and leaves burning.

The total effect of land degradation is reducing of their productivity. A decrease in performance could cause a food crisis in the country. This means that the wealth and economic stability of the country is significantly reduced [1].

In determining the value of economic losses from land degradation need to know what is the purpose of the soil. It is also important to distinguish between the concept of "soil" and the concept of "land." Classification of soils based on the principle of their origin and development. The concept of "land" is broader - it includes all the economic system in which the land exists, namely the full range of environmental factors, natural production conditions that determine plant growth and development, conditions of agricultural land use and, therefore, affect the outcome of economic human activities.

Burning dry grass is often done on grasslands, pastures, along roads, ditches, railroad tracks - the lands where crops are not grown.

Assessment of land degradation is a complex procedure and includes the following: expert opinion, distance measurement, changing productivity (yield), field monitoring

Evaluation cannot be done without the actual sampling, regardless of the scale and the method used. Samples of soil or vegetation, taken at specific locations are analyzed to obtain the most reliable information about the biophysical properties of degraded land.

In this paper for the approximate estimation of economic losses from reduced humus content in the soil by burning dry grass used a simple approach: the decrease of humus content causing material damage the same as costs equivalent to replenish humus content making humus on the same land area.

For the determination of humus (and other components) in the soil profile power  $H$  cm, using the formula

$$G = 1000 \times H \times \rho \times \omega_{\text{hum}} \quad (1)$$

where G - humus content (kg / ha) in soil layer capacity H cm

$\rho$  - density of soil, g/cm<sup>3</sup>

$\omega_{\text{hum}}$  - mass fraction of humus in the soil [2].

Thus, loss of humus is expressed by:

$$\Delta G = 1000 \times H \times \rho \times \Delta \omega_{\text{hum}} \quad (2)$$

$$\Delta \omega_{\text{hum}} = \omega_{\text{beforeburning}} - \omega_{\text{afterburning}} \quad (3)$$

Obviously, the losses are F (UAH) decrease in humus content  $\Delta G$  (kg/ha) due to burning dry grass on a land area of S (ha) will be determined by the empirical formula:

$$F = \Delta G \times A \times S \quad (4)$$

Three soil types were used to study: dark gray podzolic, gray podzolic and light gray podzolic. Samples were taken in areas where burning dry grass held annually, and where burning is not made about 5-10 years. Determination of humus by Tyurin method in selected soil samples showed that they belong to a very lowhumus (1-2%) and lowhumus (2-4%). Number of humus gradually decreases with depth.

To analyze the content of humus should be selected and investigate the soil surface layer (10 cm), as he undergoes thermal effects during burning dry grass. To assess the degree of soil degradation and land use indicator parameters, for which the established thresholds to determine the loss of their natural and economic importance. These indicators include power abiotic (sterile) application, filtration rate, loss of soil mass, humus content, etc. Soil degradation and land on each of these indicator parameters is characterized by five degrees: 0 - undisturbed, 1 - slightly degraded, 2 - medium degraded, 3 - severely degraded, 4 - very degraded.

The content of humus grading is reflected in Table 1

*Table 1: Determination of soil degradation by decreasing humus content [3]*

Indicator parameter	Rate of degradation				
	0	1	2	3	4
reducing humus content in the soil, %	<10	10-20	21-40	41-80	>80

It should be noted that burning dry grass affects the soil as organic matter in the very moment of combustion, when the temperature at the surface reaches 300-400°C, decomposing and burning muck, and then, over time, preventing an annual reproduction humus by humification of stubble-root remains. After all, the result produced each year and gets into the soil to 15-30 t/ha phytomass containing 4-10% N. In addition, high temperature kills bacteria surface layer of soil that are responsible for the humification of plant residues. Clearly, with increasing depth of the humus content is less correlated with combustion temperature factor, and depends largely on the process of humification.

Therefore, as can be seen from Table 2, a decrease of humus content after burning dry grass for soil samples, selected at a depth of 5 cm lower than for samples taken at a depth of 10 cm

*Table 2: Results of determination of humus content in the soil samples*

Kind of soil	Depth, cm	Intensity of grass burning	Soil content, %		Relative humus content reduction, %	Rate of degradation
			before burning	after burning		
dark gray podzolic	5	grass not burn more than 10 years	3.0		-	-
	10		2.3			
	5	every year	2.4	2.0	17	1
	10		2.2	2.1	5	0
gray podzolic	5	grass not burn more than 5 years	2.5		-	-
	10		1.9			
	5	every year	2.0	1.4	30	2
	10		1.8	1.7	6	0
light gray podzolic	5	grass not burn more than 5 years	2.0		-	-
	10		1.8			
	5	every year	1.8	1.5	17	1
	10		1.8	1.7	6	0

It is known that the formation of humus layer thickness of 1 cm in the nature conditions needs for about several thousand years. Therefore, burning dry grass that has become in our time of huge proportions, it seems at least frivolous and even criminal. It is also known that a decrease of humus content in the soil by 1% leads to a decrease in the yield of 500 kg of grain units.

Calculated estimated losses  $F$  (UAH) decrease in humus content  $\Delta G$  (kg/ha) due to burning dry grass on a land area of  $S$  (ha) of land on which burnt dry grass and soil samples were taken for the study of humus content are presented in Table 3.

*Table 3: Estimated cost of humus decreasing in different kinds of soil*

Capacity of the soil profile, H, cm	Density of soil $\rho$ , g/cm <sup>3</sup>	Humus content, %		Mass fraction decreasing of humus in the soil $\Delta\omega_{\text{hum}}$ , %	Loss of humus $\Delta G$ , kg/ha	Cost of decrease humus content on a land area of 1 ha F, UAH/ha
		before burning	after burning			
dark gray podzolic soil						
5	1.2	2.4	2.0	0.4	2400	25680
gray podzolic soil						
5	1.1	2.0	1.4	0.6	3300	35310
light gray podzolic soil						
5	1.1	1.8	1.5	0.3	1650	17655

To assess the value of humus out of that one ton of litter farmyard manure of cattle during humification forms 75 kg of humus [4]. Then its value can be set at a price corresponding to the cost of manure on his application. Price of this manure is now around 800 UAH/t. That cost of humus  $A = 800/75 = 10.70$  UAH/kg.

Land price decreases not only the loss of humus, but from the consequent parallel deterioration of other parameters. Thus, with a decrease of humus content, soil becomes vulnerable to erosion, including wind. With significant impressions soil erosion and appropriate climatic conditions may have dust storms (typical of southern Ukraine). Even if the intensity of wind erosion is low, decrease crop yields resulting locating their soil particles that move at a certain speed with the air flow. The shelter belts die due to the such filling.

Considered problem is versatile: depending on many factors and not only affects individual organisms, but also on the ecosystem as a whole, so calculate the economic damage from it is extremely difficult. It is impossible to confine price of soil degradation and land. We take into account

other negative consequences: pollution by combustion products (locally exceeding MCL) violation of the composition and structure of the soil (soil mass loss due to wind erosion, pollution air), immediate and remote effects on living organisms (diseases, reducing the size), habitat which includes burned land, the impact on human health (of disease), and others. Method of calculation of economic losses such should also consider the nature of land area, which burned dry vegetation and costs (feasibility) alternative ways of treatment of dry grass or leaves.

Regarding the latter, such so-called "correct" ways of regulating research problem should include timely mowing grass in autumn, mulching and composting.

And the most effective way to deal with the problem should be investigated improve environmental education and public environmental awareness and responsibility for the environment. It should be in universities, schools and even kindergartens before "hot" seasons arson autumn and spring to hold lectures (games) on "Impact of dry grass and leaves burning on the environment." Be sure to engage in such outreach media. While the younger generation may realize the seriousness of the problem. After all, history shows that when fertile soil becomes empty, it led to the death of entire nations and civilizations.

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