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THE IMPACT OF NATURAL RISKS ON AGRICULTURAL DEVELOPMENT OF THE REPUBLIC OF MOLDOVA

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Abstract

Climate, topography and soil are natural conditions of basic agricultural yields. In general, Moldova has favorable climatic conditions and relief. Soils in the North have a high degree of fertility, while the central and southern regions are of average fertility. At the same time natural calamities such as droughts, late spring frosts, hail and floods have a destructive impact on crops. Climate instability is one of the main causes of unstable yields and is an inherent risk for agriculture of the country. More than that, most of the plots lose their natural fertility and require rehabilitation.

Key words: *agriculture, climatic conditions, losses, risk*

INTRODUCTION

Processes and natural phenomena, although law-like, maintain randomness. Although appearing as a necessity in the evolution of the system, they are manifested as random, going from this point of view, in the sphere of chance and the unexpected sphere.
Natural risk is a function of the probability of damage and the likely consequences as a result of a specific event, it being understood as measure the size of a natural "threat".
The most part of the Republic of Moldova is situated in the sub-humid area with frequent droughts during the period plant vegetation, which is why it is critical to undertake adaptation measures of Moldovan agriculture to climate change.
Due to high dependence on climatic conditions, agriculture is the most vulnerable sector of the Moldovan economy to climate change. Climate instability is one of the main causes of yield unstable and is an inherent risk for the country's agriculture.
Climate changes are likely to adversely affect grain production, which plays a crucial role in ensuring food security. Normally, Moldova there is no shortage of basic foodstuffs, and in normal years are the means to ensure basic food for people. A constant problem, though, is very unhealthy and unbalanced diet, which many Moldovans prefer for economic or cultural reasons. However, the present disastrous condition of agriculture is determined by a number of macroeconomic and structural policies. [4]

MATERIALS AND METHODS

For revealing the problem was used literature, the National Bureau of Statistics of the Republic of Moldova to the Ministry of Agriculture, State Hydro Meteorological Service data and data derived from research conducted by the author. Based on accumulated data calculations were performed for analysis of the main crop productivity under the influence of drought, drought affected area, sum assured and level of crop insurance coverage against major natural hazards. For data interpretation collected and calculations made Analytical method was applied calculation method tabular and graphical method. In order to interpret the results of the analysis method was applied. To made conclusions the author have focused on the method of induction and deduction.

RESULTS AND DISCUSSIONS

In the field of natural risks in agriculture are climate risks, environmental risks and biological hazards, represented in figure 1.

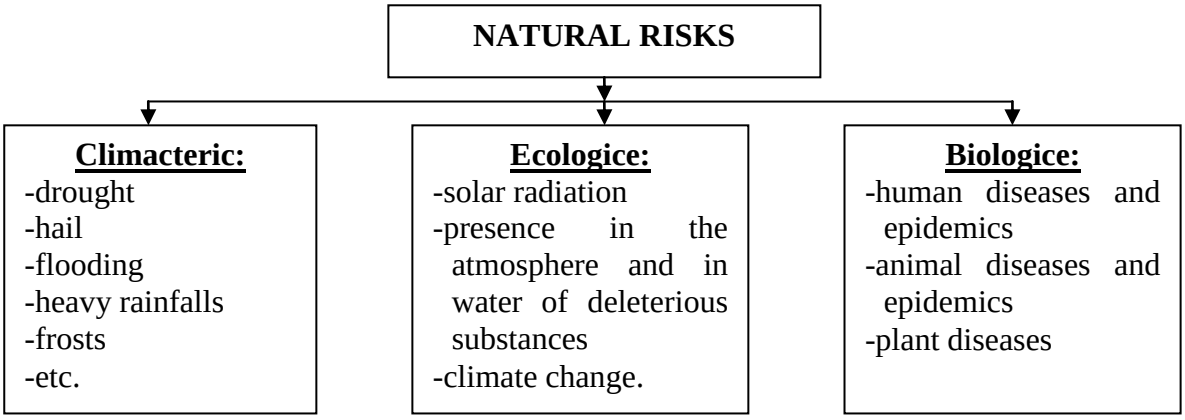

Figure 1. Classification of natural risks.
Source: elaborated by author

Climate risks – is the possibility of obtaining losses due to climatic changes. Any climatic risk phenomenon by way of manifestation, is a deviation from the multiannual average and the size of the deviation depends, therefore, and its consequences. Among climate risks shall be listed: drought, hail, torrential rains, floods, frost, freeze, heavy snow falls, ice, etc.
Republic of Moldova being located in a climate with insufficient moisture of periodically subject to influence of particularly strong droughts (once in 50 years), strong droughts (once in 6 years), medium droughts (once in 4 years).
Among all climatic phenomena, the drought can be considered the most complex because their onset several factors namely rainfall, water supply plant available soil, humidity and air temperature, wind speed, and so on, they the main climatic parameters that define the state during dry weather or drought.
Although droughts can register throughout the year, with the largest occurring in late summer and early autumn, in our country this phenomenon is repeated with a frequency of 3-5 years and includes generally south and center the country. Drought leads to losses (from 10 to 50%) of agricultural crops. Drying up of rivers and groundwater lowering may embarrass localities of drinking water supply.
In the last two decades droughts were reported more frequently, and they are becoming more intense. Thus, during the years 1990 - 2011 in the republic there have been 10 years (1990, 1992, 1994, 1996, 1999, 2000, 2001, 2003, 2007, 2011) with droughts of different intensity, which led to lower yields of agricultural crops.

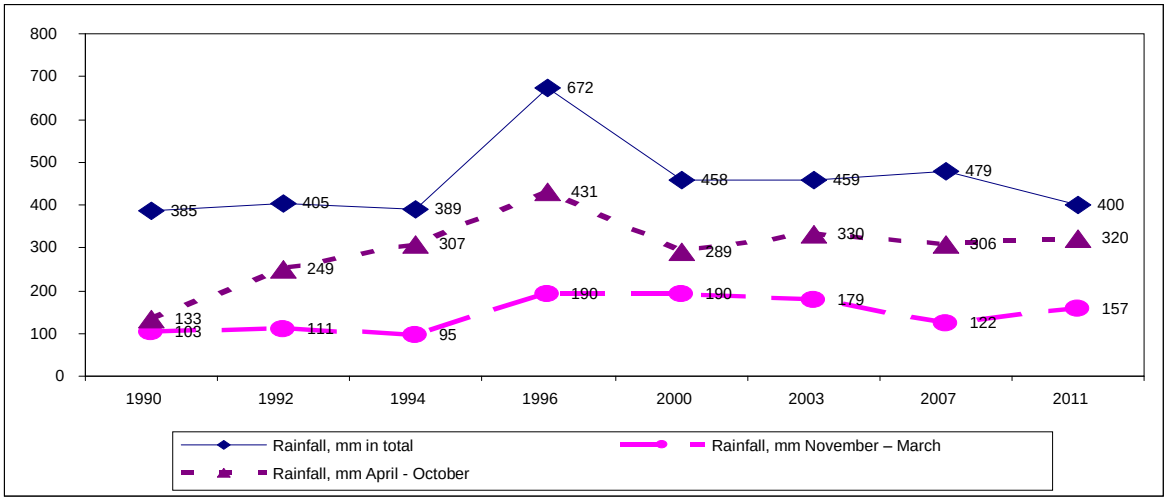

Figure 2. The amount of precipitation in the driest years in the Republic of Moldova
Source: elaborated by author based on data of the State Hydro Meteorological Service

The data presented in Figure 2 we observe that during the analyzed period the smallest amount of precipitation was recorded in 1994, followed by 2011.

Low amount of precipitation in the driest years in the past has influenced the yield per hectare change the main cereal crops in Moldova.

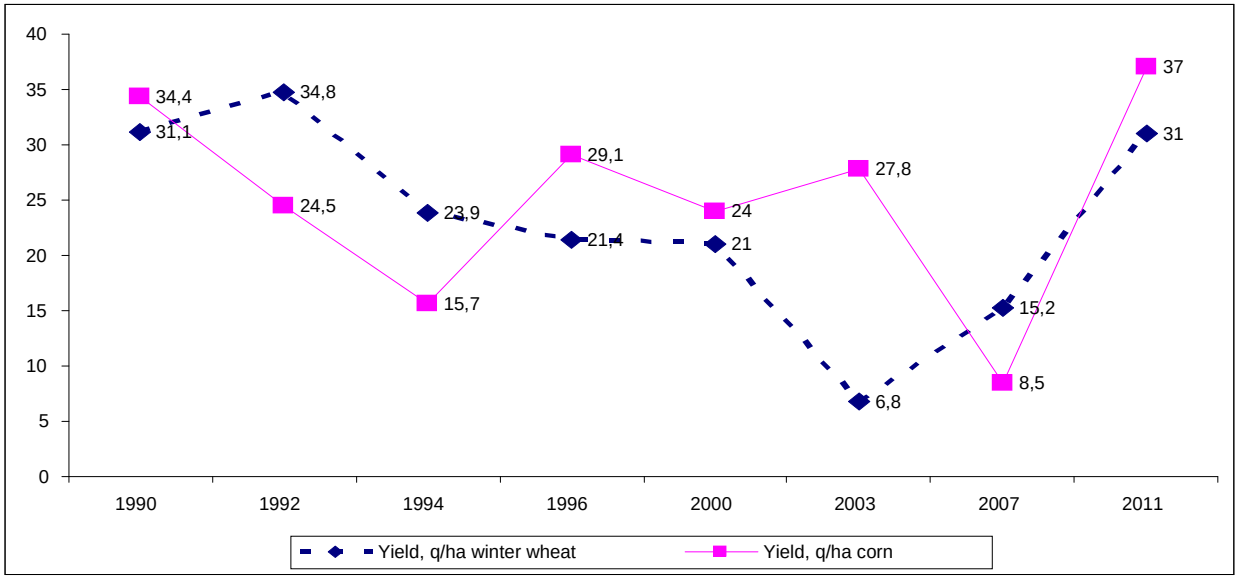

Figure 3. Yield per hectare of major cereal crops in the Republic of Moldova in the driest years
Source: elaborated by author based on data of the National Bureau of Statistics

The data presented in Figure 3 is observed that the low productivity of winter wheat in the driest years recorded in 2003, and the highest yield was recorded in 1992. The situation is different with regard to corn crop, the lowest yield was recorded in 2007 and the highest in 2011.

Consequences of the drought intensity are determined both by the extent, timing, and how the affected area. Droughts that comprise a surface area of up to 10% of Moldova's territory were assessed as local 11-20% are considered - large, 21-30% - very large, 31-50% - extreme and above 50% appreciate that catastrophic droughts, as it causes losses of national economy. Table 1 presents calculations for each season and year.

Table 1. Assessment area affected by drought on the territory of the Republic of Moldova

Years	Spring		Summer		Autumn	
	Occupied area,(%)	Type of droughts	Occupied area,(%)	Type of droughts	Occupied area,(%)	Type of droughts
1990	7	local	67	catastrophic	60	catastrophic
1992	27	extensive	60	catastrophic	40	extreme
1994	87	catastrophic	40	extreme	100	catastrophic
1996	68	catastrophic	49	extreme	44	extreme
2000	75	catastrophic	55	catastrophic	49	extreme
2003	86	catastrophic	61	catastrophic	26	very extensive
2007	78	catastrophic	77	catastrophic	-	-
2011	-	-	-	-	80	catastrophic

Source: elaborated by author based on data of the State Hydro Meteorological Service

By analyzing the data of Table 1 we see that for the Republic of Moldova in the spring season prevails vast and catastrophic droughts in summer extreme droughts occur more

frequently and catastrophic droughts have a high frequency in autumn.
Thus, the droughts of 1994, 2000, 2003, 2007 and 2011 were rated as the worst in terms of intensity and catastrophic by surface area occupied.
The farmer to prevent any damage caused by natural hazards shall be necessary to ensure production at an insurance company.
Insurance schemes are a cost-effective way to spread risk over a long period of time and in a large number of people.

Table 2. Level of insurance coverage of agricultural crops against drought in the Republic of Moldova

Districts of the country	Covered surfaces, ha				
	Winter wheat	Winter rape	Winter barley	Sugar beet	Total
Drochia	-	70	35	-	105
Fălești	-	-	-	45	-
Florești	170	-	70	-	240
Glodeni	100	100	100	-	300
Râșcani	396	-	-	-	396
Sângerei	1023	130	120	-	1273
Total	-	-	-	-	2314

Source: elaborated by author based on source [3]

Analyzing the data presented in Table 2 we see that hail risk insurance in Moldova is concentrated more in the north of the country, which has the largest share in the district of Singerei.
A more favorable situation in terms of security is recorded for the hail risk.
Hail is a climate risk, although rare, can produce in a short time of large proportions natural disasters, local or regional, depending on Cumulonimbus cloud path that has generated it.
Hail the type of atmospheric precipitation is composed of spherical particles or chunks of ice with the size from 5 to 55 mm and sometimes higher. In the area of the hail this dangerous phenomenon occurs most frequently in the country in July - august, affecting the northern, north - east and west areas, where the average per year are recorded two days with hail. Material damage caused by hail can be up to 2% of potential Gross Domestic Product. Being a phenomenon whose maximum frequency is carried out during the warm season, hail capture agricultural crops in different stages of development, affecting the smooth running of the biological cycle. It is enough to hail one case in a critical stage of plant development for the whole harvest to be compromised.
The hail may have little effect, given its size and density of the fallen grains are smaller, shorter growing seasons and advanced stage of vegetation.
Moldovan agriculture losses caused by torrential rains and hail in 2011 exceeded 20 million lei (1.7 million dollars). According to the Civil Protection and Emergency Situations Service of MIA, for the whole country, rains and hailstorms have affected 5,100 hectares of sowing, 272 hectares of vineyards and 140 hectares of orchards.
Hardest affected localities were from Stefan Voda (Marianca Lower Copceac Slobozia Crocmaz, Carahasani, Cioburciu, Tudor, Purcari Ştefăneşti) and Ungheni (Costuleni and Mill Valley), where material damages constituted to 8,000,000 and respectively 6 million lei.
The largest share of total insurance in Soldanesti district holds an area of 2,823 hectares or 16.08% of the total, followed by Rascani district with a share of 15.17% and Edinet district accounting for 15.09%, other districts with a lower share in total, the lowest share being held by Donduseni district only 0.42%.
Environmental risks represent the possibility material losses as a result of the worsening state of the environment. Environmental risks manifest themselves in different ways: increased solar radiation, climate change, toxic releases to air and water. As a result, different mutations occurring living organisms, most often harmful to man, it reduces agricultural output quality. Reducing environmental risks requires huge material costs. This is a global problem and its solution takes only the competence of state.

Table 3. Coverage level of agricultural crops hail insurance in Republic of Moldova

Districts of the country	Covered surfaces, ha						
	Winter wheat	Winter rape	Winter barley	Orchards	Sugar beet	Other cultures	Total
Briceni	901	95	10	228	-	-	1230
Dondușeni	-	20	-	57	-	-	77
Drochia	850	294	89	-	551	429	2213
Edineț	1916	207	98	143	-	291	2655
Fălești	-	-	-	-	315	278	593
Florești	170	-	70	-	201	905	1346
Glodeni	100	100	100	-	-	15	315
Ocnița	352	32	28	12	37	116	577
Râșcani	1336	230	49	246	45	763	2669
Sângerei	1023	130	120	105	-	159	1537
Soroca	1243	245	60	-	-	-	1548
Șoldănești	2082	319	302	-	20	100	2823
Total							17583

Source: elaborated by author based on source [3]

Biological risks represent the possibility of material losses related to the biological nature of living organisms used in agriculture. The size of risk influences: fulfilling complex of technological operations, compliance and retention terms for agricultural production. In addition, plants and farm animals suffering from diseases and pests.

Biological risks affecting the conditions of life and activity of people being endangered animals and plants and there also the danger of spreading the mass of infectious diseases, human life and health is endangered.

Epidemics and outbreaks are of biological risk category, which are seasonal, being favored by certain criteria (economically disadvantaged areas, the risk of transmission of pathogens increased due to climatic factors favoring environment in urban areas or in areas where permanent or seasonal).

Epidemics (the mass impaired of infectious diseases) arising from high activity in nature and among people of many pathogens of infectious diseases and in certain weather conditions or other circumstances (natural disasters, water pollution and air with viruses and bacteria, and radioactive chemicals, etc.) can be triggered in a particular area or across the country. The most common infectious diseases can be considered typhoid and paratyphoid diseases, acute intestinal diseases, viral hepatitis, diphtheria, cholera, plague, etc.)

Disease outbreaks (mass illness of domestic animals) in some areas of the country are recorded as swine fever, Newcastle's disease, etc.. Epizootic outbreak shall be a consequence of the high concentration of animals and birds in some households, along with neglect prevention diseases. Annual losses of livestock and poultry reach from 0.5 to 2% of the overall population of the country.

Epiphytotic (mass impaired plant) - are possible practically every year and it is rather generally local. Their onset is a consequence of non-plant processing technologies and the use of chemical and biological substances. Total damage caused by epiphytotic can amount to 30-40% annually.

Epidemics and outbreaks have occurred in recent years almost the whole country without the surface areas affected to be sufficiently large or constant surface to define statistically significant. [1]

CONCLUSIONS

Captivating conditions present climate conditions in Moldova are quite favorable for agriculture, even though the country has a shortage of moisture. At the same time during the last two decades climatic conditions became more unstable. During this period agricultural sector suffered severely because of droughts, soil erosion and wind, storms and heavy rains, hail, spring frosts and floods.

Order to face climate change need to apply modern agricultural technologies to increase production while protecting and enhancing the land resources in production. Application of modern agricultural technologies promotes the concept of optimizing and ensuring yields and profits.

For risk mitigation of droughts triggered in the agriculture are used multiple methods: irrigation, cultivation of drought-resistant plant species and application of use of fertilizers.

In order to increase of agricultural crops resistance in high thermal conditions and terms than moisture deficit in the soil productive, work is carried out to improve the selection and crop plants, leading to obtain hybrids with deeper root system, which can use reserve water from greater depths.

In the case of hail that affects agricultural regions, timely dissemination of weather forecasts warning radars developed based on meteorological information and satellite images, allow appropriate measures as prevent the formation of clouds and hail spray in them, some chemicals which causes rains before the formation of ice granules, demarcation of areas affected by this phenomenon and cultivating plants resistant to hail netting covering valuable agricultural plantations (fruit trees, vines etc.), farmland insurance against the risk of falls hail.

In order to reduce biological risks of contagious animal diseases is necessary disease prophylaxis and compliance with technologies and processing the plants, the use of chemicals and respecting the biological standards.

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