

## **ENVIRONMENTAL RISK IN ROMANIAN VINEYARDS**

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### **Abstract:**

*Agricultural activity, unlike other economic areas, is accompanied by a high degree of risk and uncertainty, caused mainly by environmental factors.*

*The influence of weather on growth and developing processes of crops, orchards and vineyards is the science which studies and determines agricultural biotope necessary to achieve optimal biological productivity. Thus, agro meteorology involves agro-climatic resources' management and conservation in developing agricultural production process (weather - deepening relationship).*

*Agriculture, as user of agro meteorological information, recover their combination with specialized information (agricultural, technological, economic, etc.) for preventing and minimizing climatic risk upon plant species, but also for establishing sustainable development strategies.*

*In order to prevent and reduce the negative impact on wine production, it is necessary to monitor weather forecasts and hazardous to achieve decision-making system of protection and assurance wine production.*

**Keywords:** natural hazards, traceability, agro meteorological monitoring, risk management.

**JEL Classification:** Q10, Q13, Q51, Q56.

### **INTRODUCTION**

The risk and its management approach issues and terminologies of identification, measurement and treatment of exposure to potential losses. Although they are not dramatic, many negative events of not such big amplitude that have been accumulated, can threaten, in this case, the survival of wine business by reducing the grape production under the agreed standard, breaking in the current operations or slowing down the economical development.

The risk, found out at the limit between certainty and uncertainty, is, in theory, the phenomenon that derives from circumstances for which the manager is able to identify possible events and even the probability of their materialization, but, without being able to specify unequivocally which one of these events is going to happen.

The risk concept is used to describe situations and events with uncertain results.

The analysis of a risk usually begins with classifying the domain – natural risks, political risks, social risks, judicial risks, technological risks and economical risks.

The natural risk, produced by natural agents, affects directly the grape production and indirectly the wine production. Because of the damages that certain extreme agents produce (the prolonged drought, flooding, hailstone, extreme temperatures) on the foremost source of supply, respectively the vine production, there appears a conduction of the negative events downstream of their distribution channel. The registration of grape production lower than expected may cause the decrease of the revenues in the wine industry, for example, even if the price is increased.

In Romania, the natural risks on the agricultural production are very large because of the succession between the drought period and the overflow period.

Other agents of natural risks that may affect the vine and wine sector are the biological ones, like insects, viruses and bacteria etc., affecting the product whatever its processing stage might be.

In the vine sector, the technological risks are generated, first of all, by the accidental modifications of the environmental conditions.

### **Material and method**

The environmental agents - too high or too low temperatures, strong winds, excessive or the shortened humidity, abundant rains, drought, the early frost of spring or late frost of autumn etc. - with negative action on the agricultural crops and, default, on the vine plantations, represent a permanent risk on the vine production referring to the possibilities and probabilities of some variations of the results compared to the values or levels evaluated initially.

The climatic and soil conditions, decisive for choosing a place to establish a vine plantation, refer to the sum of the degrees (over 2500°C – 1400°C, useful temperature), the absolute minimal temperature (-35°C), the length of the sun shine, (over 2500 hours in the vegetation period), favourable annual precipitation (600-800mm., of which 350-400mm in the vegetation period). This favourable information is completed by the selection of the field that has to be saved from hailstone, late autumn frosts and early spring frosts. The fields with southern, south-eastern, or south-western exposure are the recommended ones because they dispose of more radiation and solar light. Also, the ideal fields are those with moderate calcium content, slope with at most 24% and 40-600m altitude with the underground water at depths more than 2-3 m.

Initially, the deployment and development of a vine plantation is carried out after a prior study of the environmental conditions congruent with the requirements of the species towards these. This aspect is of great importance, having repercussions on the product and the production, representing, therewith, the start of the traceability realization.

In a specialized study, based on a questionnaire and using the differential semantic scale, in Dobrogea area, it turned out that the agents that affect the most the grape production are abundant rains and drought (table 1).

Table 1

**The estimation of the negative impact of the restrictive environmental agents on the grape production**

The environmental agent	The differential semantic scale (1-5) *
Drought	3,8
Abundant rains	3,6
Frosts	3,4
Strong winds	2,2

\***Mark:** 1- very low strength; 2 – low strength; 3 – average; 4 – strength 5 – very strength

**Source:** Boboc D., Manole V. and Raluca Andreea Ion, *Researches of risks caused by environmental conditions upon vine plantation in Romania.*

*Case study – vine area of Dobrogea*

In the same context, but using the ranking scale, the estimation of vine sensitivity to environmental restrictive conditions is presented in table 2. It results that vine is sensitive to drought and low temperatures.

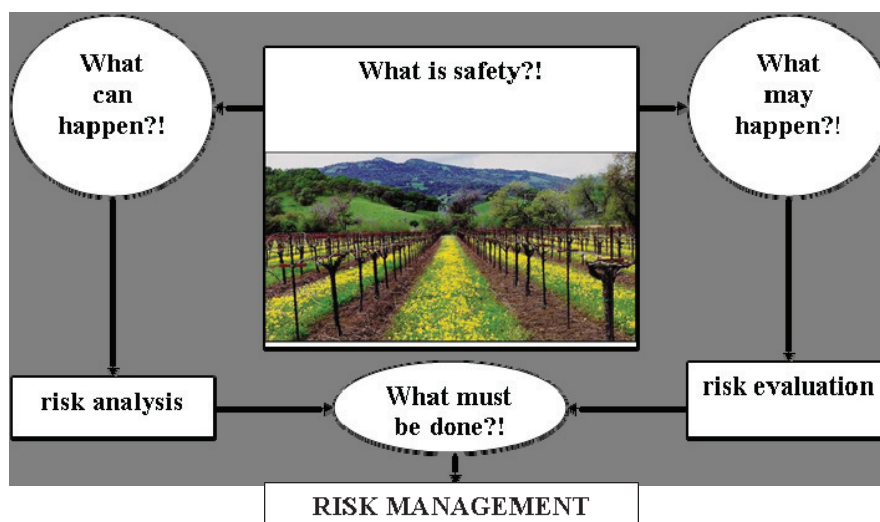
Table 2

**Vine sensitivity to weather conditions in Dobrogea**

The environmental agent	Ranking scale: Sensitive, average, tolerable
Drought	2,4
Abundant rains	2,2
Abundant water on soil	1,2
Strong winds	2
High temperatures	1,6
Low temperatures	2,4

**Source:** Boboc D., Manole V. and Raluca Andreea Ion, *Researches of risks caused by environmental conditions upon vine plantation in Romania. Case study – vine area of Dobrogea.*

The risk concept, by Borter, 1999, is defined through its components (fig. 1). *The Analysis of the Risk* represents its systematic characterization and, if possible, the quantification of a risk from the perspective of its happening probability and the perspective in terms of dimension of its consequences. *The evaluation of the risk* is the point of the significance of the agreed risks based on the comparison between the advantages and disadvantages involved by a possible “event”. *The risk management* is the implementation stage of the measures and methods necessary to the achievement of the proposed safety level, in the context of the adaptation to the environmental transformations.



**Fig. 1 – Structure of the risk concept (adaptation after Borter, 1999)**

Risks can be insurable because they can be calculated<sup>1</sup>:

$$risk = p_{ei} \times a_{p/c}$$

where:

$p_{ei}$  = probability of the production of the  $i$  event

$a_{p/c}$  = amplitude of the loss or the gaining associated with business, in the case of the production of the  $i$  event.

<sup>1</sup> Popescu Nela, *Noi tendințe în analiza riscului afacerilor comerciale*, Teză de doctorat, 2004

Unlike the risk, the uncertainty appears when at least one of the actions of the economical agent has associated more possible consequences, the main reason being the one that the agricultural producer cannot control perfectly the environment where he deploys his activity. Modelling uncertainty is a scientific demarche that involves knowledge about the theory of the probabilities. Every uncertain event is associated with a probability of apparition. Theoretically, it is conceded that every agent has its own low of individual probability.

So, we mark with  $x = (x_1, x_2, \dots, x_n)$  the monetary gaining vector  $x_i$  for each estate of the nature  $I = 1, 2, 3, \dots, n$ ; the  $x$  vector is the distribution support. Or:  $p = (p_1, p_2, \dots, p_n)$ ,  $\sum_{i=1}^n p_i = 1$  is used to note the probabilities vector.

Specialists make a difference between the risk and the uncertainty notions. Knight believes that the risk covers the uncertainty notion when the probability distribution of the aleatory perspective that the agent must compare is known by him. In the case of uncertainty, contrariwise, the probability distribution of these perspectives is unknown to the agent.

The most known appreciation criterions of aleatory perspectives are: criterion of mathematical hope of winning, criterion hope-variation and criterion of utility hope. Among these, criterion of mathematical hope of winning is the most simple. In this model, all the probability distribution relative to the financial consequences may be characterized by a single number: mathematical hope of winning (the average). If  $a = [x; p]$ ,  $x, p \in R^n$  represents a lottery, mathematical hope of winning is the number  $E(a) = \sum_{i=1}^n p_i \cdot x_i$ .

The agricultural producer has to choose between two situations (lotteries!), so he has to compare their mathematical hope and chooses the one that offers the bigger gain, so he chooses the mathematical criteria of hope maximization (E criteria)<sup>1</sup>.

The literature also debates the issue of the point of aversion at risk; there are many models to measure it (ex. The Arrow-Pratt Model). To this end, the economical agent can express itself through behaviours like: aversion to risks (riskophobe), neutrality to risk, and „enjoying” of risk (riskophile).

In order to forewarn the risks of the unprocurement of the grape production, the producer must ensure their harvest through the agricultural assurance system.

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<sup>1</sup> Gheorghită, M., *Modelarea și simularea proceselor economice*, Editura ASE, București, 2002

## Results and discussions

*The agro meteorological monitoring, as solution to forewarn the risks.* The monitoring of the climatic agents is part of the National Weather Administration attributions. The data and information used for monitoring refer to agro meteorological and weather characteristics costumed in vine regions validated and administrated according to informational programs<sup>1</sup>.

This way, it is referred to daily monitoring of agro meteorological parameters to estimate the fortunately agro climatic point for the main agricultural cultures in Romania. It is marked out the intervals and agricultural regions affected by extreme weather phenomenon, and also their impact on the growth and development process of crops and vine cultures.

The specialised information is reproduced using tables that synthesize graphics and representative spatial maps, at the whole agricultural territory of the country level, being used as analysis and interpretation material to frame a weather report (weekly, monthly and seasonal diagnosis and prognosis).

The way of selection, drawing out and automatic procession of weather data (the minimal and the utmost temperatures in the air, total and actual precipitations, humidity relative average, the duration of sun shine and the average speed of the wind) are realized using the synoptic data base (from the ORACLE table with synoptic data), using the AGRO-SYNOP application.

The adaptation of agro meteorological data involves:

- the calculation of some agro meteorological indicators, particular to vine cultures, on characteristic intervals for the calendar year;
- the calculation of potential vapour-perspiration along the vegetation period, using the Penman-Montheith method encompassed in the CropWat model;
- the spatial detailing of humidity relays approachable to the plants, that allow the current evaluation of the ground water supply point correlated to the requirements of the vine along the growth and development phase.

All this information identifies in due time the most vulnerable agricultural areas at unfavourable meteorological phenomenon, assuring the operative information and the scientific underpinning of the managerial decision regarding the emergence and the extending of risks situations in the domain.

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<sup>1</sup> Administrația Națională de Meteorologie

The operational analysis agro meteorological program of meteorological parametric dynamic with impact on the vine culture admits *the elaboration of recommendations regarding the field selection to locate the grapevine and the use of alternative technologies and practices*, with the aim of forewarn and decrease the impact of meteorological phenomenon in vine culture.

### **Conclusions**

- Romania is a vine culture country, a fact marked out through tradition: it produces grapes, it processes them, but it also comes to the fore because of the consumption.
- The location and development of a vine culture plantation are realized according to the suitability of the species towards the environmental agents; the aspect has a major importance to realize the traceability of the product.
- Agriculture, and, default, vine culture, is attended by a high risk point, mainly attended by a risk caused by climatic agents.
- It is necessary to forecast and to monitor the dangerous meteorological phenomenon, to realize the decisional protection system and to assure the vine culture.
- The environmental agents with intense negative action against the grape production are the drought and abundant rains, but, if the versant is not developed, there appears the erosion risk.
- To forewarn the unprocurement risk of vine culture, the producers must ensure their harvest through the agricultural assurance system.
- Through the morphological and physiological characteristics, the grapevine can supply itself with water from large depth and can turn to profit the sandy areas from regions affected by the phenomenon of transforming into desert.
- The grapevine culture involves low production costs, potential for export (the high quality of the product and the diversified assortment makes it competitive in the external market), and high revenues of additional income or expenditures economies for those who do not have as main activity agriculture etc.

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