

## ROMANIAN WHEAT – STRATEGIC PRODUCT FOR NATIONAL ECONOMY

Gheorghe Valentin ROMAN<sup>1</sup>, Adrian Cristinel NIȚU<sup>2</sup>, Nastasia BELC<sup>3</sup>,  
Enuța IORGA<sup>3</sup>, Iulia NIȚU<sup>4</sup>, Lenuța Iuliana EPURE<sup>1</sup>

<sup>1</sup>University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd,  
District 1, 011464, Bucharest, Romania

<sup>2</sup>Sanitary Veterinary and Food Safety Office of Dambovița County, 35 I.C. Brătianu Blvd.,  
Târgoviște, Romania

<sup>3</sup>National Institute of Research & Development for Food Bioresources, 5 Băneasa Ancuța Street,  
District 2, Bucharest, Romania

<sup>4</sup>University “Valahia” of Targoviste, Faculty of Environmental Engineering and Food Sciences,  
18-24 Unirii Blvd, Târgoviște.

Corresponding author email: romangv@agro-bucuresti.ro

### Abstract

*Wheat has always been an agricultural crop and a product of the greatest importance to human existence and activity. It is a component of the field crops assortment in Romanian agriculture, an important source of income for farms and rural households, whose harvest is used as raw material in the milling and baking industry, but also represents an important article for domestic and international trade. Wheat fits well with agricultural vocation of Romania and should be considered a strategic product for the national economy, for reasons that require special attention on the productive potential, but especially on crop quality. Wheat is grown in average on about 2,100 thou ha per year and produces over 5,500 thou tones on average and over 7,000 thou tons in good years, which covered the requirements for domestic consumption and are designed, as a rule, for export availability too.*

*Assortment of wheat varieties grown in Romania includes over 100 varieties, Romanian creations and imported. Romanian varieties sown areas represent about 70% of the total wheat grown areas.*

*Based on these considerations, based on the initiative of central agricultural authorities, the National Institute of Research&Development for Food Bio-Resources, in collaboration with regional agricultural institutions organized a nationwide study on the quality of wheat grains produced in Romania. For more than 10 years were analyzed the wheat quality, for each variety, county, geographical area and agricultural year and the evolution of the grown varieties.*

*Based on these results, we found that the physical-chemical quality of the harvest of wheat produced in Romania, especially in West Plain, in Oltenia Plain and South Plain and Dobrudja, meets the requirements for the assessment category very good for the bakery, including the terms contents in proteins and wet gluten.*

*On the other hand, the quality of the wheat crop was affected, in some small areas of cultivation and only in certain years, grain buds attack, the significant presence of sprouted grains, harmful or toxic seeds, and, quite seldom, the ergot.*

**Key words:** Romanian wheat, growing areas and productions, quality of the harvest, wheat varieties.

### INTRODUCTION

Romania is a cultivator and a traditional producer of wheat grains. Romanian agriculture produce enough wheat to meet domestic consumption, and the Romanian ever enrolled between agricultural regions leading provider of high quality wheat for international trade.

Agricultural areas in Romania meet suitable conditions for wheat growing (according to studies, 20% of arable land offers very favorable conditions for wheat and 70% offer favorable conditions), which are favorable pre-

requisite for good yields and high quality (Roman, 2011). Quality for bread wheat grain and flour obtained by grinding depends on a large number of factors: the choice of the varieties grown; natural conditions for plant development; applied technology; storage, transport and processing conditions (Nitu, 2010). In this context, research in this paper aimed to study the status of wheat growing area and production according to the natural conditions of agricultural regions and the assortment of varieties. Have also been studied the physical and chemical indicators of wheat

yields produced in Romania, in order to assess the potential quality of both varieties used and growing areas.

## MATERIALS AND METHODS

The study was conducted based on national statistical data (National Statistical Yearbook) and information provided by R&D network of the Romanian Academy of Agricultural and Forestry Sciences, related to the wheat crop and assortment of varieties. The study on the quality of wheat crops harvested in the years 2003-2010 was conducted in six agricultural regions of Romania, namely: Southern Plain and Dobrudja (counties Braila, Calarasi, Constanta, Giurgiu, Ialomita, Ilfov, Teleorman, Tulcea), Western Plain (Arad, Bihor, Satu Mare, Timis) Oltenia Plain (Mehedinti, Dolj, Olt), Southern Hilly Region (Arges, Buzau Caras-Severin, Dâmbovita, Gorj, Prahova, Valcea) Moldova (Bacau, Botosani, Galati, Iasi, Neamt, Suceava, Vaslui, Vrancea) Transylvania (Alba, Bistrita-Nasaud, Brasov, Cluj, Covasna, Harghita, Hunedoara, Maramures, Mures, Salaj, Sibiu) (Figure 1) (The Catalogue "Quality of Cereals").

In this respect, in Romania operates a national program approved by the Ministry of Agriculture and Rural Development, which is reviewed annually of wheat crop for baking quality. To determine harvest quality, in each county, wheat are sampled after a well-defined methodology (2003-2010). Samples are taken from the territory and are subject to a set of tests carried out in laboratories of the National Institute of R&D for Food Bio-Resources, Bucharest, by standardized and RENAR accredited methods, namely: Hectoliter mass (using hectoliter balance, ISO 7971-2 / 2002); grains moisture (drying in the oven, ISO 7970/2002); broken and shriveled grains; germinated grains; grains with *Fusarium*; grains with grains bugs attack (*Eurygaster* and *Ailia*); toxic and/or harmful seeds; grains with *Tilletia* attack; ergot presence (ISO 7970 '2001); protein content (Kjeldahl method); wet gluten content and Gluten-Index; Gluten Deformation Index; Falling Number (Hagberg-Perten method) (Belc et al., 1998; Nitu, 2010; Roman et al., 2003; Toader, 2008).

The data have been statistically processed and interpreted, separately for different wheat

growing areas (counties and regions), and cultivated varieties. Statistical processing included calculation of averages, coefficients of variation, significance of differences and differences limits. The results allow drawing conclusions on the status and evolution of wheat crop and wheat crop quality in Romania, depending on the region of growing, variety, climate conditions of different agricultural years.

## RESULTS AND DISCUSSIONS

### *Climatic conditions in wheat growing areas.*

Figure 1 shows that, on average over the period analyzed, there were annual amount of rainfall of over 550 mm in all wheat growing areas; it is to emphasize 668.7 mm in Transylvania and 729.3 mm in Southern Hilly Region.

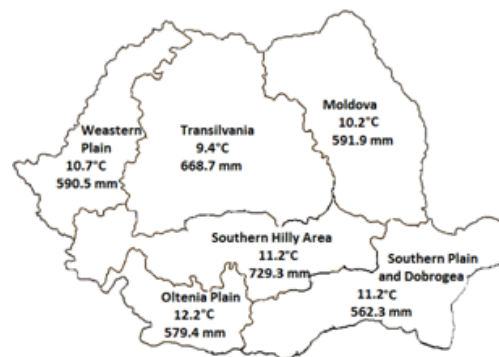


Figure 1. Annual rainfall (mm) and air temperatures (°C) in Romania (mean values 2003-2010)

Average annual air temperatures were 11.2 to 12.2°C in the Southern part of the country, from 10.2 to 10.7°C in Moldova and Western Plain and below 10°C in Transylvania. It should be noted that in all studied years and regions, rainfall and temperatures exceeded multiannual averages. Unequal distribution of rainfall and high temperatures imprinted the hot and dry character to the years 2003 and 2007, which was reflected in week results of wheat crop.

***Wheat grown areas and yields.*** On average, between 2003-2010 (Figure 2) were grown with wheat annually in Romania 2,101 thou ha and 5,562 thou tons were harvested, resulting in an average of 2,647 kg/ha. Except for the years 2003 and 2007 (1,748 thou ha and 1,965 thou ha respectively), the areas under wheat

exceeded 2,000 thou ha, and maximum was recorded in 2005 (2,475 thou ha). Distribution on national territory of wheat growing areas and their share of total grown area have a certain stability over time. In this respect, Southern Plain and Dobrudja are highlighted with an average of 34.3% of the nationwide, followed by about 20% in Oltenia Plain, 15% in Western Plain, 12% in Moldova, and 9-10% in South Hilly Region and in Transylvania (Epure, 2006; Nitu, 2010).

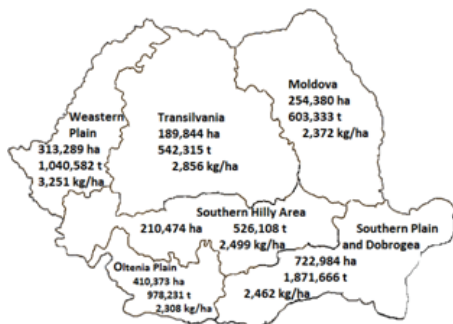


Figure 2. Wheat growing areas and yields in Romania (mean values 2003-2010)

By comparison, total wheat production and the contribution to national production of different growing areas were highly variable from year to year, under the influence of temperature and precipitation conditions. Total production ranged from 2,486 thou tons in 2003 (an average of 1,422 kg/ha) and 3,026 thou tons in 2007 (1,540 kg/ha) (years with insufficient rainfall during wheat vegetation period) to 7,812 thou tones in 2004 (3,402 kg/ha) and 7,180 thou tons in 2008 (3,403 kg/ha) (Roman et al., 2011).

It can be seen that in the period under review, agricultural years were of different degree of favorable for wheat crop and this was reflected in crop size (and quality). On the other hand, the diversity of natural conditions in different Romanian agricultural areas located at the confluence of large geographical areas and under the influence of very different climates (excessive temperate continental climate in the Eastern part Romania, specifically for Russian Great Plain; oceanic climate in Western Plain and Transylvania, specifically for Western Europe; Mediterranean climate in Banat and Oltenia regions, specifically for South Europe), determined that different degree of

favorability of wheat growing regions vary in the same agricultural year, and as a result, the share in national wheat yields of wheat harvested in different regions vary considerably from one year to another. In this regard, the greatest variations were found in the Southern Plain and Dobrudja which contributes an average of 30.8% to the national yield (3.2% less than the percentage of wheat acreage), with variations from only 12% (severe drought in 2003), to 30.1 and 32.7% in 2004, 2007, 2005 and up to 43.1% in 2008 (the two dry were taken only 1,500 kg/ha in average in the area). A more stable yield was recorded in Transylvania (average production of over 2,200 kg/ha in all years), Southern Hilly Region and even Moldova. Western Plain contributed on average 21% of the national harvest, therefore exceeded 6% share of cultivated area, and has achieved higher production averaged of 3,251 kg/ha (in all the years have resulted over 2,500 kg/ha and in 2004 were harvested 4,059 kg/ha).

**The assortment of wheat varieties.** Of the study showed that, in the analysed period in Romania were grown 123 varieties of wheat, of which 46 Romanian varieties. It has also been reported the introduction of new varieties of Romanian wheat breeders creations (Crina, Glosa, Dor, Izvor, etc.) that have been fast and well received by farmers and the increased tendency to take over foreign varieties (of firms from Hungary, France, Austria, Serbia, etc.); some of the new wheat varieties introduced into culture in Romania were not tested in the official testing network of the State Institute for Testing and Recording Varieties (ISTIS) and not included in the Official Catalogue of Agricultural Crops Varieties in Romania (Nitu, 2004; Nitu, 2010; National R&D Institute of Food Bio-Resources, 2003-2010).

Assortment diversity of varieties available to growers Romanian is well illustrated by the data in Figure 3. From figure shows that in the Southern Plain and Dobrudja, and Transylvania the assortment was formed in 33-41 Romanian varieties, which were numerically from 42.4 to 43.9% of total cultivated varieties. By comparison, the extremes were found in Moldova, with 34 varieties grown in total, of which 79.4% Romanian varieties, and in the Western Plain, with 82 varieties, of which only 28% of Romanian varieties.

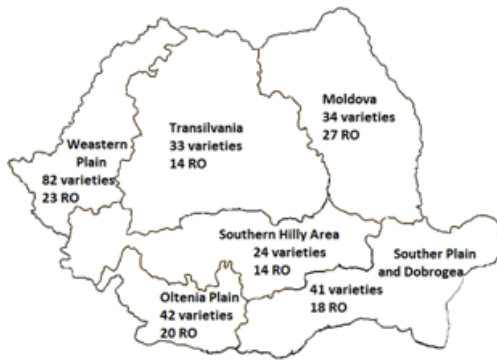


Figure 3. Assortment of wheat varieties cultivated in wheat growing regions of Romania

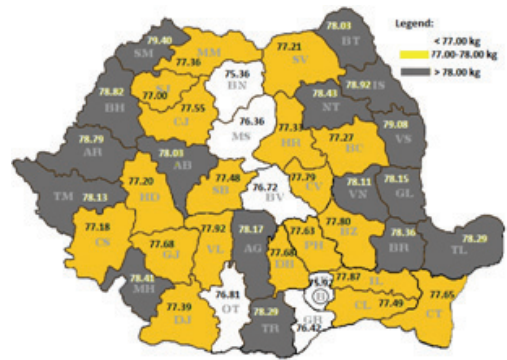


Figure 4. Hectolitre mass (kg/hl) of wheat harvest in Romania (2003-2010)

In terms of areas sown every year, however, prevailed Romanian varieties with 60-70% of the total shares, of which valuable varieties were: Boema, Dropia, Crina, Rapid, Flamura 85, Fundulea 4, Romulus (NARDI Fundulea creations); Alex, Ciprian, Lovrin 34 (ARDS Lovrin); Briana, Albota, Trivale (ARDS Albota-Pitesti); Simnic 30 (ARDS Simnic); Ariesan, Transilvania, Turda 95 (SCDA Turda); Aniversar, Gasparom (ARDS Suceava), to which have been added in recent years varieties Glosa, Dor, Izvor, Delabrad, Turda 2000, and other. Of foreign varieties were grown in a stable on large areas is to mention Serina, Renan, Apache, and other.

**Quality of wheat harvest.** Hectolitre mass (Figure 4) showed zonal averages over 77 kg/hl; below 75 kg/hl hectoliter mass (the recommended minima for bread wheat) were recorded in the Southern Plain and Dobrudja (in 2003 and 2009) and in Oltenia Plain (2003). Regional average *protein contents* ranged from 12% (minimum recommended for bread wheat) and 13% (Figure 5); values over 13% protein were determined in Southern Plain and Dobrudja (in dry years 2003 and 2007), Western Plain (in 2003, 2006, 2007) Oltenia Plain (2003 and 2007), Southern Hilly Region (2003 and 2007), Moldova (2003) and Transylvania (2003 and 2009).

Under 12% protein resulted in South Plain and Dobrudja (in the year 2006), Western Plain (2004) Oltenia Plain (2004, 2005, 2006), Southern Hilly Region (2006, 2008), Moldova (years 2004, 2005, 2008) and Transylvania (2004, 2005, 2008).

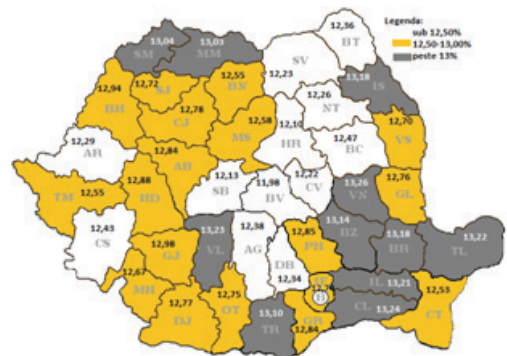


Figure 5. Protein content (%) of wheat harvest in Romania (2003-2010)

In terms of *wet gluten*, regional mean values ranged between 24 and 26%, with a maximum of 25.88% in Western Plain and a minimum of 24.95% in Oltenia Plain (Figure 6); these values meets the requirements for bread wheat.



Figure 6. Wet gluten content (%) of wheat harvest in Romania (2003-2010)



Values over 26% wet gluten were determined in Southern Plain and Dobrudja, in South Hilly Region and in Oltenia Plain (in the years 2003 and 2007), in Western Plain (2003, 2006, 2007, 2008), in Moldova (year 2003) and in Transylvania (2003, 2006, 2007, 2009). Values below 22% wet gluten were found in Southern Plain and Dobrudja (2006 and 2009), Oltenia Plain and Southern Hilly Region (2005 and 2006), and Transylvania (2004).

*Gluten Index* (Figure 7) registered values of above 65 in all wheat growing areas in Romania (these values are considered optimal for backing grains), except Transylvania (57.39), an area where, in 2003, the average was below 40 (values below 65 indicate a gluten not able to form a good bread structure). This means a generally good and very good quality of gluten; it is to emphasize in some years, and in some areas, there may be situations to harvest wheat grains with worse gluten quality.



Figure 7. Gluten Index (mm) of wheat harvest in Romania (2003-2010)

Mean *Gluten deformation Index* ranged between 3.40 mm and 5.43 mm Moldova Southern Plain and Dobrudja, which reflects, in this regard, good quality of wheat crop in Romania (Figure 8).

*Germinated grains in the ear* represented more than 1% (the maximum allowed) in Southern Plain and Dobrudja and in Oltenia Plain (in the years 2003 and 2009, especially in Giurgiu county), in Southern Hilly Region (2005 and 2009, especially in Prahova and Valcea counties), in Moldova (2008 and 2009, especially in Iasi and Botosani counties), and in Transylvania (2003, 2008 and 2009, in

Maramures, Salaj, Sibiu, Bistrita-Nasaud Harghita, Alba counties). In Western Plain have not found annual average higher as 0.5% of germinated grains and the highest percentage (average 2003-2010) was determined in Transylvania (1.08%) (Figure 9).

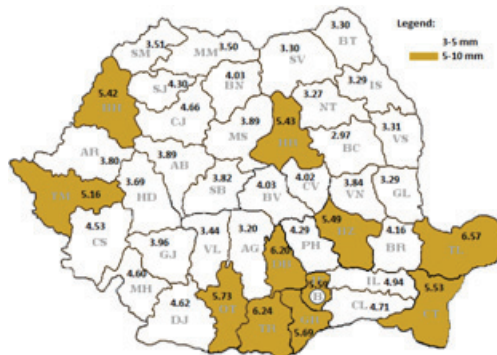


Figure 8. Gluten deformation Index (mm) of wheat harvest in Romania (2003-2010)

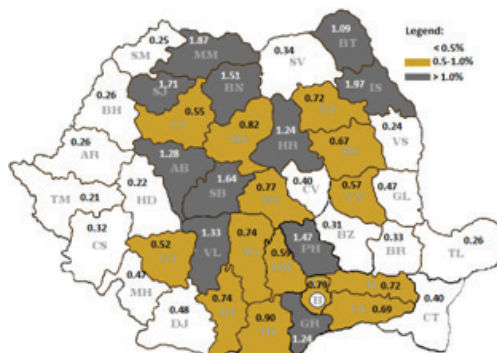


Figure 9. Germinated grains in the ear (%) of wheat harvest in Romania (2003-2010)

Of pests that affect the yield amount and quality, grain bugs (*Eurygaster* sp., and *Aelia* sp.) can create special problems; as a result, is not accepted the presence of attacked grains by grain bugs in baking wheat.

In research conducted on average over the period analyzed (Figure 11), grain bugs attack over 1% was revealed in the Southern Plain and Dobrudja (Ialomita and Teleorman counties, especially in Calarasi and Constanta, with more than 2% attack) and in Oltenia Plain (Olt county) (2003 and 2009), in Western Plain (2003 and 2004), in Southern Hilly Region and

Transylvania (2003); in Moldova annual average values were below 0.5% attack.

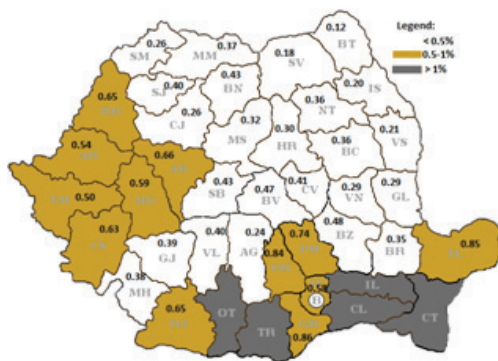


Figure 10. Grain buds attack (*Eurygaster* and *Aelia*) of wheat harvest in Romania (2003-2010)

In 2003, grain bugs attack was favored by dry and hot weather (Figure 12), so that the percentage of attacked grains was extremely high in some areas. Can be observed values over 5% registered in Ilfov and Olt counties and over 3% in Prahova, Teleorman, Giurgiu, Dâmbovita, Hunedoara, over 2% in Alba, Constanta, Ialomita, Sibiu, Buzau, Bacau and over 1% in most other counties.

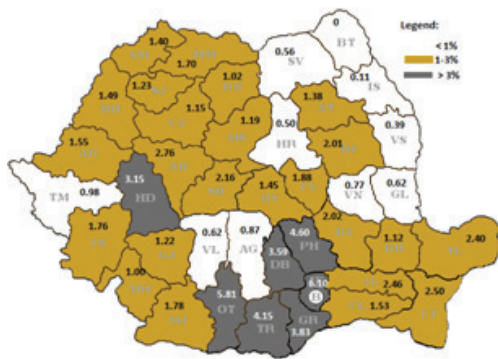


Figure 11. Grain buds attack (*Eurygaster* and *Aelia*) of wheat harvest in the year 2003 in Romania

Research have shown in some samples of wheat with harmful and/or toxic seeds, with values above 0.05% (maximum acceptable) in the Southern Plain and Dobrudja (in 2008), in Oltenia Plain (2003, 2007 and 2008) and in Southern Hilly Region (2007); in Western Plain, Moldova and Transylvania the percentage of harmful and/or toxic seeds was

low (below 0.05%) and the highest values were determined in Oltenia Plain.

*Fusarium* attack on wheat grains in the analyzed years have a low zonal average accounted, the highest value being found in Transylvania (0.40%) and the lowest in Oltenia Plain (0.09%).

Percentage of broken and shriveled grains was generally less than 3% and not more than 2.13% in the Western Plain and least 1.56% in Moldova (compared to 5% maximum acceptable). It should be emphasized that in all wheat growing areas was observed grains with *Tilletia*, but in insignificant values (below 0.02%, against 0.05% acceptable limit). Also ergot attack frequency was sporadic (usually under agreed maximum of 0.05%). Higher percentages of ergot were reported in the year 2005 (very rainy), in Oltenia Plain (5.39% in Dolj county) as well as in Moldova (0.65% in Galati county).

## CONCLUSIONS

Research has shown that wheat (winter wheat) - traditional crop for this geographical area - falls among the five basic agricultural crops of Romanian agriculture, with corn, sunflower, rapeseed and potato.

Wheat is grown in average on about 2,100 thou ha per year and produces over 5,500 thou tones on average and over 7,000 thou tons in good years, which covered the requirements for domestic consumption and are designed, as a rule, for export availability too.

Wheat growing areas are concentrated in the plains, especially in the Southern Plain and Dobrudja (on average 34% of the total wheat area and 30% of the total production), followed by Western Plain (12% of area and 15% of production) and Oltenia Plain (20% of the cultivated area and 17% of the national harvest).

Average annual production of wheat grown in Romania ranged from 1,422 kg/ha and 3,403 kg/ha, so very different from one year to another, with a remark on the Western Plain, with average productions of over 2,500 kg/ha in all years and over 4,000 kg/ha in the most favorable year 2004.

At current prices prevailing external market of 263-298 USD/tons, Romania wheat is cost

effective and can build a significant source of revenue for farmers and national economy.

Assortment of wheat varieties grown in Romania includes over 100 varieties, Romanian creations and imported. Romanian varieties sown areas represent about 70% of the total wheat grown areas.

Of Romanian varieties, especially popular for farmers, depending on growing areas, are varieties Boema, Glosa, Alex, Briana, Ciprian, Delabrad, Izvor, Albota, Ariesan, Transilvania, who gradually replacing old varieties like Drobia, Flamura 85, Lovrin 34.

Based on research results, and on physico-chemical characteristics it can be seen that wheat yields produced in Romania fits into the category of good assessment for bakery.

In some areas, especially in the Western Plain (2003, 2006 and 2007), Oltenia Plain and the Southern Plain and Dobrudja (2003 and 2007), wheat quality correspond to requirements for a category very good assessment for bakery, including in terms of protein and wet gluten content. On the other hand the quality of the wheat crop was affected in some cultivation areas of the country and years of grain bugs attack (*Eurygaster* and *Aelia*), the significant presence of germinated grains, harmful and/or toxic seeds, and, quite seldom, ergot.

#### ACKNOWLEDGEMENTS

This research work on wheat grains quality was carried out by the National Research &

Development Institute of Food Bio-Resources of Bucharest, with the support of the Ministry of Agriculture and Rural Development.

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