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DOI: 10.2478/agr-2024-0011

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

TYPOLOGY OF LIVESTOCK FARMING IN THE OASIS AGROSYSTEMS OF ADRAR (SOUTH-WESTERN ALGERIA)

Lahbib Cheikhi, Hafidha Boucherit*, Benaradj Abdelkrim

Laboratory of Sustainable Management of Natural Resources in Arid and Semi-Arid Areas, Salhi Ahmed University Center of Naama, Algeria
*Corresponding author e-mail: h.boucherit@yahoo.fr

Abstract

For centuries, the Saharan oasis agro-systems of Adrar region have fed many generations, based on an original organization, based on the efficiency of drainage water on the diversification of crop systems in association with small livestock farming. The aim of the work is to describe the systemic typology of oasis livestock farming in the Adrar region (southwest Algeria). In order to assess the livestock typology, a series of surveys were conducted on 164 farms in the oases of the study region. The analysis reveals that the production system, traditionally aimed at subsistence agriculture. The dominant production system is an intensive system, characterized by intensive mixed food crops (Phoenicuculture, arboriculture, herbaceous crops: cereals, fodder, market gardening, industrial and condiment crops), in association with livestock farming mainly of small ruminants (goats and sheep). The livestock system is characterized by a family type, small in size in traditional management. It is generally managed in stalls and its feed comes mainly from fodder crops, domestic waste and by-products of palm groves. Family livestock farming can be an important source to ensure a certain production of animal origin (milk and meat) for family self-consumption. As a result, it can contribute to ensuring food security, family financial security and improving soil fertility in oasis farm plots.

Keywords: Oasis, livestock, agrosystem, Adrar, Algeria

1. INTRODUCTION

The livestock system is the set of practices and techniques implemented by a breeder, a farmer or a community to exploit natural resources by animals and thus obtain a desired production. It is therefore a set of elements in dynamic interaction, organized by man in order to enhance the available natural resources through domestic animals to obtain varied productions (milk, meat, skins, work, manure, etc.) or to meet other objectives [1]. Livestock occupies an important place in Saharan agriculture, since it is a symbolic activity anchored in the consciousness of pastoral populations, whatever the nature of the goods they have. Family livestock farming finds its place in the perspective of economic development of the regions concerned, since it allows rural populations to live and benefit from it in an environment unfavorable to human survival and also to improve the socio-economic standard of living of rural populations, given that livestock farming is a source of subsistence for more than 30% of this population [2]. The integration of agriculture and livestock farming allows for a simultaneous and synergistic intensification of plant and animal production that meets the objectives of increasing production, income of agricultural households and more efficient use of resources [3].

The breeding of small ruminants in the oases of the Adrar region continues to be practiced despite its small-scale management and heterogeneous racial composition. This mixed breeding method constitutes a source of local supply for oasis households [4,5]. The present work aims to know the current state of livestock farming, to analyze the situation of animal production and their typology in the region of Adrar (South-western of Algeria).

2. MATERIALS AND METHODS

2.1. Study area

The wilaya of Adrar, located in the center of the Algerian Sahara in the southwest, is positioned at 27°52′00″ north latitude and 0°17′00″ west longitude, with an altitude of 259 m.

It covers an area of 222,492 km² and is approximately 1,543 km from Algiers. Adrar is geographically limited by the wilaya of Timimoune to the north, by those of Béni Abbes and Tindouf to the west, by the wilaya of In Salah to the east, and by the wilaya of Bordj Badji Mokhtar to the south. The wilaya of Adrar is divided into three large Saharan regions:

• Touat: The largest and most popular, rich in oases, foggaras, ksour and population. It extends from Tasabit to Reggane.
• Tidikelt: Extends from Aoulef to Ain Saleh.
• Tanezrouft: Extends from Reggane to the wilaya of Bordj Badji Mokhtar. Each region has unique characteristics that contribute to the diversity and appeal of this part of the Algerian Sahara.

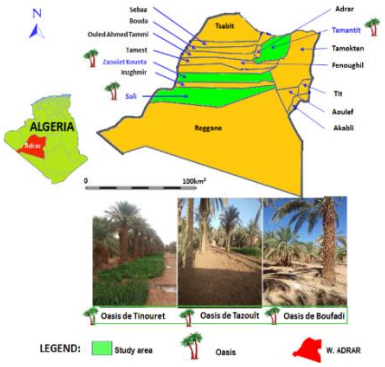

Figure 1. Location of study area

2.2. Methodological approach

The study is based on a survey carried out in 2022 on a sample of 164 mixed farms (agro-livestock).

Table 1. Characterization of the study oases

Name of Oasis	Tinouret	Tazoult	Boufadi
Commune	Sali	Zaouet Kounta	Tamntit
Geographic coordinates	26°36′8.40 ″N 0°1′5.89″ W	27°10′21.5″N 0°09′56.6″W	27°42′48.89″N 0°16′23.65″W
Area (ha)	162	105	260
Number of farms	405	120	295
Number of respondents	81	24	59

The aim is to collect information relating to the structure of the farms, the social status of the breeders and the characteristics of the livestock (types of livestock, livestock management: feeding, reproduction and habitat) in the 3 study oases (Tinouret/Sali, Tazoult / Zaouet Kounta, Boufadi/ Tamntit) of Adrar in the southwestern of Algeria.
Information was collected on the situation of the farms and the farmer-livestock farmers from the Directorate of Agricultural Services of the Wilaya of Adrar and other information was collected from the agricultural subdivisions.

3. RESULTS AND DISCUSSIONS

3.1. Agricultural situation

The agricultural area in the studied oases is 260 ha with 5340 palm trees and 295 farms in the oasis of Boufadi, 105 ha with 2110 palm trees and 120 farms in the oasis of Tazoult, 162 ha with 2590 palm trees and 405 farms in the oasis of Tinouret (Table 1). The average size of the farms is of the order of 0.5 ha in the oasis of Tazoult, 0.48 ha in the oasis of Boufadi, 0.43 ha in the oasis of Tinouret with a variation of 0.2 to 3 ha. 40% of the farms surveyed are less than 1 ha in size and 33.33% of the farms are larger than 1 ha. Concerning the main activity of the farm, 88% of the farms surveyed are mixed (crop, livestock) and 12% are of the crop-only type.

Table 2. Agricultural situation of the study oases [6]

Oasis	Tinouret	Tazoult	Boufadi
Area (ha)	162	105	260
Number of date palm trees	2590	2110	5340
Number of farms	405	120	295
Average farm size (ha)	0.48	0.50	0.43
Cultivation activity (%)	17.28	00	19
Mixed activity (%)	82.72	100	81

This phoenicicole heritage (date palm trees) is answered in all the farms playing the role of windbreak and protector of other crops against the sun.
The date palm (*Phoenix dactylifera*) is a plant known for its tolerance to extreme climatic conditions of drought and temperature; it plays a socio-economic and ecological role. It constitutes the essential element on which the entire oasis agrosystem is based [7-9] In the study oases, the workforce is completely family-based.
Women are involved in harvesting, weeding, and men take care of plowing, fertilizing, and irrigation.
For irrigating plots: the majority of respondents use water from the foggara (86.34%), with 13.66% of respondents also using water from individual wells and tap water from homes.
Water distribution is maintained by foggaras, an ingenious ancestral traditional irrigation system that is widespread in the southwest of the country [7,8].

3.2. Animal numbers of the farms surveyed

Table 3. Numbers of species surveyed in the oases studied

Oasis	Tinouret	Tazoult	Boufadi
Sheep	554	157	399
Goats	228	63	161
Poultry	113	29	72

For livestock numbers (*Table 3*), the Tinouret oasis occupies the first position with a total number of 554 sheep, 228 goats, 113 poultry, followed in 2nd position by the Boufadi oasis (with 399 sheep, 161 goats and 72 poultry) and finally the Tazoult oasis (157 sheep, 63 goats and 29 poultry) poultry).
In the study oases, the size of the herds varies between (2 to 13 heads) generally mixed (sheep, goats, poultry). The animals are kept permanently in stables (*Kouri*).

Figure 2. Types of livestock in the study oases (a- Sheep, b- Goat, c-Poultry)

In general, breeding is conducted in a traditional way followed mainly by women. The examination of the size of the herds by species, shows the dominance by sheep (2 to 9 heads per farmer-breeder) in their majority are local breeds crossed between (D'man, *Sidaouen* and *Folan*) and some head of the steppe called (*Oulad Djellal*), intended for the production of meat.

Figure 3. Sheep breeds raised by farmers (a- Sidaouen, b- Folen, c-D'men, d-Cross-breed)

According to Dollé [10], the sheep breed *D'mane* perfectly adapted to these intensified breeding systems Goats are also local breeds (3 to 6 heads per farmer-breeder) intended for the production of milk and meat. The livestock farming is integrated as an essential component of the production system and concerns sheep and goats [11]. According to Toutain [12], in the oases, livestock farming practices are quite varied more or less intensive, and revealing the availability of water and its level of exploitation.

3.3. Typology of the family livestock system in the study oases

According to Dollé, [10], indicates the presence of different forms of livestock farming are practiced in the oases around the Sahara, the most efficient ones involve on-site valorization of the oasis' fodder production. In the 3 study oases, the livestock system is of the intensive family type. It is characterized by the production method in above-ground stalls, all the feed is distributed. Small ruminants are mainly managed by two types of livestock systems:

3.3.1. Type 1: Domestic intensive livestock system (at home or permanent stall), based on sheep/goats/poultry whose numbers are small (2 to 6 heads). This herd remains all day inside the livestock housing). The three species are in permanent stalls and are raised at home (live with the family).

3.3.2. Type 2: intensive livestock system associated with agriculture in the farm, dominated by sheep farming (7-15 heads per farm) in stalls, strongly associated and linked to the crop system.

The animals are fed with feed mainly from the farm (green fodder crops: alfalfa, barley).

According to Chaabena [13], family farming consisting mainly of goats and sheep is the most practiced, as for cattle, their breeding in the Saharan zones is limited. We also find as family farming rabbits, donkeys, turkeys, mules and horses.

3.4. Livestock management (feeding and livestock buildings)

Livestock management is a sum of techniques and methods, called upon to satisfy the needs of the animals and their production, representing the know-how of the breeder, the central element of the livestock system [14].

The most common livestock management system in the study oases is an intensive system [15].

3.4.1. Feeding the herd

In the farms studied, farmer-breeders instantly use palm grove harvest waste and cereal waste to feed their animals. During the winter period and early spring, the livestock feed is based on green fodder, such as sorghum (*Sorghum bicolor*), alfalfa (*Medicago sativa*), Corn (*Zea mays*), millet (*Pennisetum glaucum*) oats (*Avena sativa*) and barley (*Hordeum vulgare*), as well as straw and cereal hay, waste from market garden crops.

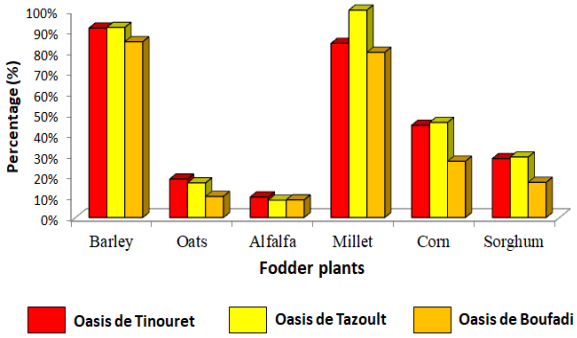

Figure 4. State of diversification of fodder crops in the study oases

Figure 5. Green fodder plants grown in the study oases (a- Sorghum, b- Alfalfa, c- Corn, d- Oats, e- Barley, f-Millet)

In summer until autumn, the main source of green fodder available is the millet (*Pennisetum glaucum*) frequently grown in the regions of Adrar and Timimoune (Touat and Gourara) Breeders generally supplement their ration with corn, wheat and barley. The supply of complementary feed is composed of mixture, palms, date waste, kernels, dried bread and waste from the food table. Sometimes barley grain and wheat bran are distributed to sheep prepared for fattening.

Watering of the animals is based on the distribution of the feed ration. Fodder resources for the surveyed herds are limited and are related to the small areas reserved for fodder.

This deficit is partly compensated by by-products from palm groves. Industrial concentrates.

3.4.2. Livestock buildings

In the study oases, livestock buildings are generally characterized by small and closed areas.

Almost all breeders (90%) house their animals in the ksar in old houses built in *toube* (clay/sand mixture), the remaining (10%) in the nearby palm grove in premises and shelters male built with zinc or palm roofs.

In general, the animals are permanently closed and do not go out, the *kouri* or livestock buildings divided into two or three parts, one to isolate the adult males, and another reserved for weaning the young.

The third for the females and the goats contains an open-air exercise area t. The breeding management of the herds is very traditional (liber), sometimes the males are permanently with the females throughout the year because of the lack of space.

Figure 6. Examples of livestock buildings in the study oases

3.5. The benefits of livestock farming

Livestock farming plays a very important role in oasis production systems [10].

Livestock farming provides multiple functions, promoting either supplementary activities to ensure household food coverage, diversification of income sources for family cash flow needs, capitalization of surpluses in the form of savings or activities to enhance the value and marketing of livestock products [16,17].

Among livestock products:

3.5.1. Milk

Milk production in the study oases appears very modest, with ewes producing between 1 and 3 liters per day (generally milk suckled by newborns), goats between 1 and 2 liters per day, In the Tinouret oasis, the 153 goats in all herds provide a quantity of 66 liters per day, with an average of 0.81 liters per goat per day. Goats are present in almost all the mixed farms studied, with a population of (1 to 4 goats). Thus, in the Boufadi oasis, the 109 goats in all herds provide 46 liters per day with an average of 0.77 liters per goat per day. Goats are present in almost all the farmer-breeders studied, but in very small numbers (1 to 3 goats). In the Tazoulet oasis, the 49 goats in all herds produce 18 liters per day, with an average of 0.75 liters per goat per day. Goats are not present in all the farms studied, the number is (1 to 4 goats per farmer-breeder) (Table 3). The goats are milked manually in the morning once a day. This milk production is intended for family self-consumption. The low milk productivity may be due to the diet or limited genetic potential [18].

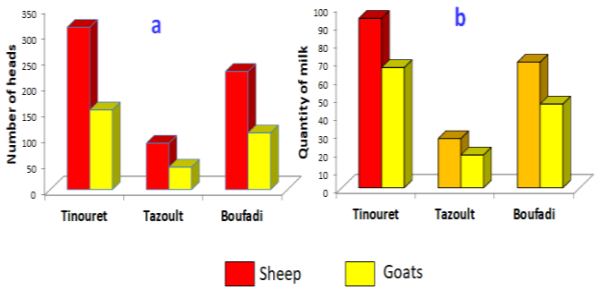

Figure 7. Milk production in the oases studied

3.5.2. Meat

The production of meat in the surveyed oases escapes any control of the services concerned. It is generally intended for family self-consumption. Because there are some clandestine slaughters (at home), the oasis farmers ensure the fattening of the sheep generally for the feast of Eid El-Adha and the socio-religious events the waada (*Zyara= Visit*), the weddings. These cases are observed throughout the Maghreb territory [19]. The slaughtered animals are of local breed with low exploits due to the lack of technical monitoring and supervision of the farmer breeders. The oasis families of this region raise their animals for self-consumption like the oases of the Maghreb countries [20, 21].

3.5.3. Organic Manure

In the study oases, livestock farming provides organic manure from herds near or in the oasis. Oasis dwellers regularly provide manure to maintain the fertilization of the plots in order to improve plant production.

According to Dollé et al. [22]; de Sainte Marie [23]; Dollé [10], indicate that livestock farming ensures the maintenance of the fertility of the oasis soils subjected to highly intensified cultivation practices. Livestock provides significant quantities of manure, used for the fertilization of agricultural land, and therefore contributes to improving the yields of the various crops. It also constitutes a source of capital available to finance the various operations necessary for the installation and maintenance of crop systems [24].

4. CONCLUSIONS

In the Saharan region of Adrar, the production systems are characterized by an oasis-type system which, since antiquity, consists of an integrated association of three strata: phoeniciculture, arboriculture, market gardening or fodder crops and small family livestock farming. The results of the study of the livestock system show the existence of small herd sizes (between 2 and 8 heads), conducted on a short-term scale with heterogeneity in the oases of Adrar (Boufadi, Tazoult, Tinouret).

The livestock management method is described as intensive. The composition of the livestock is distinguished by a remarkable racial, dominated by crossbreeds (local and introduced) of low production performance, in permanently closed habitats (stabling). Which merits the introduction of modern means of breeding (reasoning of fodder needs, food ration, breeding organization, choice of productive breeds, control of reproduction), training and popularization of farmer breeders.

Livestock breeding is generally less productive, and presents a better source of income (cash) for oasis farmers, provider of energy and local supply for the provision of animal products (meat, milk, eggs) intended for family self-consumption. It also constitutes a source of organic manure for improving soil fertility in highly intensified plots of small size.

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DOI: 10.2478/agr-2024-0012

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

STUDIES ON TECHNOLOGICAL ASPECTS OF THE SPECIES TULIPA GESNERIANA (FAM. LILIACEAE)

Sînziana Venera Morărița
Valahia University of Targoviste, 13, Sinaia Alley, Targoviste, Romania
E-mail: cristi2morarita@yahoo.com

Abstract

Flowers represent one of those perfect joys of life, they are almost always with us and surround us with their splendor, tenderness and fragrance, from the first days of our lives, at some of the most important moments in life (anniversaries, special events, baptisms, weddings, etc.); and still with the flowers we leave this world. Precisely for these reasons, flowers deserve special attention. They are described both in verse and in prose by the most famous writers, who manage to convey their beauty and tenderness to us, and the plastic artists are the ones who, through their brushes, have managed to transpose nature and especially flowers on canvas, so that to create a universe of infinite beauty, awakening strong emotions and feelings in our soul. Consequently, it is all man who has the duty to carry forward, by his own means, the art of growing flowers and to create a more beautiful and better world for everyone else. Over the years, several types of floral arrangements, garden arrangements that include flowers have been highlighted. Tulips are easy to plant and care for. These spring flowers are among the favorites of gardening enthusiasts, due to the multitude of colors, shapes and sizes in which they are found. Used in the most diverse combinations, tulips delight the eyes and soul of viewers, bringing an inner peace that we all need.

Keywords: tulip, colors, sizes, flowers

1. INTRODUCTION

Tulips are annual or perennial flowering plants, which are easily propagated by bulbs, and the production of planting material is usually carried out in greenhouses or nurseries, with the production of seedlings, in early spring. Choosing the location of the tulip culture and ensuring the vegetation factors are based, first of all, on the known requirements of these species in terms of temperature and light.
As it appears from the specialized literature and from the experience of growers, the advantage offered by tulips resides in their duration of use, in the fact that they can be obtained easily and that they are generally cheap and available to anyone.
In this paper, we have proposed to present a series of aspects regarding the influence that the provenance of the bulbs can have on the germination percentage, the duration of germination of the bulbs and the decorative value of the plants obtained.
The effect of treatments applied to the bulbs with stimulating substances was also tested.

2. MATERIALS AND METHODS

Uliești commune is located in the extreme south of Dambovita county, with Teleorman county, at the border, the main road traffic axis that crosses the center of the commune is the national road 61 Giurgiu - Ghimpati - Gaesti, and in the northern part, the commune is crossed by the Autostrada (A1) Bucharest - Pitesti. The commune has an area of 61.47 square kilometers.
The relief in general presents itself as a uniform plain without an important level difference.
The town of Uliesti is located on the right bank of the Arges river on the highest terrace, extending also on the right bank of the Neajlov river, occupying the smooth plateau called Tailors' Hill.

The main characteristics of the climate

The thermal regime of the soil has an important role, both directly and indirectly, determining the thermal regime of the air, which heats practically from the ground, which transmits the caloric radiation received from the Sun through conductivity, radiation and convection.
Temperatures over 6ºC begin to appear from March and last until November, and those that exceed 10ºC begin in April and meet until October, this being the optimal period for plant cultivation.
Compared to the average values of the soil temperature, the absolute extremes are much higher. Thus, the absolute maximum soil temperature was recorded on July 25, 2016.
During the year, the maximum monthly averages are exclusively positive.
If in July it reaches 24.6ºC. From May to August, there is a possibility that the maximum temperatures will exceed the value of 30ºC, which can trigger drought at ground level.

Atmospheric precipitation

According to the Climatological Atlas of Romania, the 500 mm isohyet crosses the basin in its middle zone; to the south the precipitation tends to 450 mm/year, while to the north it exceeds 600 mm/year.
The highest amounts of precipitation fall at the end of spring and the first half of summer (in the months of June, May, July, 38% of the total fall) and the lowest values are recorded in the months of February and March (18% of the total).
The average maximum value is recorded in June (68.6 mm) and in February the minimum occurs (23.3 mm).
Precipitation in the October-March season represents 35% (one third) of the total, while the warm season participates

with 64% (two thirds) of the total amount of annual precipitation.

Agrometeorological conditions from the winter-spring of 2022

The winter of 2022 was characterized by the lack of precipitation, accumulated over the two months, January and February of -11.5 mm and by particularly high temperatures compared to the multi-year average, +6.8º C compared to the average in January.

This drought phenomenon that started in the fall of 2020 continued in the winter and spring of 2021.

So, except for March when there was an increase of 12.9 mm compared to the multi-year average, the months of April and May were particularly dry, registering a cumulative deficit of 49.6 mm.

These against the background of the increase in the average monthly temperature, especially in the months of March and May.

In May, although the average temperature was only 26.0ºC higher than the multi-year average, there were many days when the maximum exceeded 31ºC, which caused dehydration of crops, especially those sown in autumn.

The average temperature of the 2021-2022 agricultural year is 12.5ºC, and the average precipitation of the 2021-2022 agricultural year amounts to 449.5 mm.

The 2021-2022 agricultural year was a completely atypical year.

The characterization from the climatic point of view is edifying in explaining the production results from the experimental lots as well as in terms of water losses from the soil.

Thus, the agricultural year began with a deep drought, registering in the first three months (October, November, and December) only 25.64 mm compared to 95.9 mm (multiannual average), a deficit of 68.5 mm.

In the winter period, the precipitation fell was only 75% of the multi-year average. Spring began with an excess of the multi-year average in March, after which the rainfall until August was far below the multi-year average, respectively at 40% of the multi-year average.

The last two months of the agricultural year (August and September) recorded precipitation above the multiannual average, respectively by 42 mm in August and 83.9 mm in September. During these months, significant water leaks occurred in all crops.

The varieties studied are:

- ***Verandi Tulip***

A favorite variety of florists, spectacular Dutch variety. The bud has a graceful calyx shape 10 cm high, the flower itself grows up to 55 cm.

Attracts attention from afar with silky-textured scarlet petals and yellow border.

The flowers emit a delicate aroma.

Figure 1. Verandi Tulip

The variety is part of the Triumph group, like the other representatives, it gradually opens the buds and only half, remaining in this state for up to 7 days. The petals do not lose their shine over time.

The Verandi variety is suitable for making a bouquet with yellow, white and blue flowers and fits well in a bouquet.

- ***Lalibela Tulip***

Darwin hybrid of Dutch selection, relatively recently bred by crossing wild and cultivated specimens. It is distinguished by a large calyx bud of 11 cm high. The height of the plant itself can reach 80 cm.

At the beginning of April, it blooms and until May pleases the eye. The color of the petals is bright red, uniform. It needs protection against scorching sun rays, it needs moisture.

Figure 2. Lalibela Tulip

- ***Strong Gold Tulip***

The Dutch variety belongs to the Triumph group. Its flower resembles a bright sun in its shadow.

It goes well with other flowers both in a flower bed and in a bouquet. The tulip multiplies easily and is unpretentious in care.

Figure 3. Strong Gold Tulip

The height is up to 60 cm of the whole plant and the bottle is 8-9 cm. In the flower bed, flowering occurs at the end of April or the beginning of May and lasts a long time. Prefers a partial shade or a sunny place for growth.
Care is standard for this group of tulips.
For lush flowering, bulbs should be planted in light, organically rich soil with a neutral acidity. Bulbs should be dug up annually in late June and replanted in the fall.
For each studied species, 2 experimental variants were carried out, which followed the application of some treatments before sowing.
Bulbs are planted in wide boxes 15 cm deep, being disinfected by soaking in a dark pink solution of potassium permanganate or pouring boiling water over them.

Figure 4. Planting bulbs in boxes

For the M1 variant in all species, bulbs were treated with potassium permanganate solution, a product also used as a foliar fertilizer and containing macro and micro elements. The M2 variants, made with untreated bulbs, represented the control variant.
The two main variants were divided, in turn, into 2 sub-variants, differentiated by the origin of the seeds (fruits) from the inflorescences:

- variants M1a- made with seeds (fruits) coming from the central part of the inflorescence
- variants M1b- made with seeds (fruits) coming from the periphery of the inflorescence.

The experiment scheme is present in table 1.

The soil must be light and permeable to water. For its manufacture, sand and sawdust are mixed in equal proportions. Drainage should be used: chipped brick, expanded clay, fine gravel, shell rock. To disinfect the soil, it is calcined in the oven at maximum temperature for ¼ hour. When the soil has cooled, it is watered with a dark pink solution of potassium permanganate or „Fitosporin". Drainage is treated in the same way. Bulbs are planted in wide boxes 15 cm deep, being disinfected by soaking in a dark pink solution of potassium permanganate or pouring boiling water over them.
The greenhouse is fumigated with sulfur, and the walls are wiped with a solution of copper sulfate - 1 tbsp. for 10 liters of water. The maintenance works were carried out respecting the known technologies and were identical to all the tested variants.
Bulbs imported from Holland were used for planting. Healthy tulip bulbs have brownish-brown tunics, well-ripened, hard, heavy bulbs with an undamaged disk are used for planting. Planting distances are very small, 2–3 cm, ensuring a density of 300–350 plants per square meter. The planting depth will be established so that the bulb remains outside the substrate on the upper third [6].
It is very important to direct the environmental factors (temperature, humidity, lighting) thus, throughout the actual forcing stage, the substrate is kept permanently moist and the atmospheric humidity is regulated at the level of 70-80%.
From the establishment of the experiments, respectively from the sowing, during the entire vegetation period, observations, determinations and measurements were carried out that tracked a series of plant properties (morphological and ornamental properties), depending on the variable factors of the experience.
The main determinations and observations concerned the dynamics of emergence, the dynamics of plant growth and the production of flowers and their quality.

Table 1. Scheme of experimentation

Nr. crt.	Species	Treatment	The position of the seeds in the inflorescence
1	Verandi	M1 – Treated seeds	M1a – central part
			M1b – outer part
		M2 – Untreated seeds	M2a – central part
			M2b – outer part
2	Lalibela	M1 – Treated seeds	M1a – terminal part
			M1b – base part
		M2 – Untreated seeds	M1a – terminal part
			M2b – base part
3	Strong Gold	M1 – Treated seeds	M1a – central part
			M1b – outer part
		M2 – Untreated seeds	M2a – central part
			M2b – outer part

Temperature

The first 2 months after planting in the greenhouse maintain a temperature of + 7 ... + 9 ° C.

Then the temperature is increased to + 18 ... + 17 ° C during the day and + 14 ... + 15 ° C at night. When tulips bloom, the temperature is lowered to + 15 ° C.

Figure 5. Growing bulbs (personal photos)

The first two weeks of watering are alternated with feeding 20 g of calcium nitrate diluted in 10 liters of water.

During the entire growing period, tulips are fed twice with special fertilizers for bulbous plants.

The determination of the plant height was carried out by the measurement method at the beginning of the harvesting period of the flower stalks.

The number of leaves formed was determined by counting.

The diameter of the flower bud was measured at the time of the beginning of the coloring of the bud by measuring in the area with the largest diameter, and the height by measuring from the base to the tip of the bud.

Figure 6. Tulips in the greenhouse (personal photos)

3. RESULTS AND DISCUSSIONS

Table 2 shows the percentage of emergence in the studied species, by variant, with treated and untreated seeds, treated bulbs from the Verandi and Lalibela species, or with untreated bulbs from the Strong Gold species.

The observations were made every other day for each species starting from the sixth day after sowing and up to the sixteenth day.

In the Verandi species:

- for variant M1a (bulbs treated with Fitosporin), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 85%;
- for variant M1b (bulbs treated with permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 90%;
- for variant M2a (untreated peeled bulbs), the first plants sprouted 10 days after sowing. The total emergence percentage for this variant is 75%;
- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 80%.

The best emergence percentage is represented by treated bulbs from the M1b variant, and the lowest emergence percentage is represented by the M2a variant, untreated peeled bulbs where the emergence percentage was 75% and the emergence duration was 10 days.

In the Verandi species:

- for variant M1a (bulbs treated with phytosporin), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 85%;
- for variant M1b (bulbs treated with potassium permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 90%;
- for variant M2a (untreated peeled bulbs), the first plants sprouted 10 days after sowing. The total emergence percentage for this variant is 65%;
- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 12 days after sowing.The total emergence percentage for this variant is 55%.

Table 2. Dynamics of emergence

Species	Variant	Number of bulbs	Emergence percentage after					
			4 days	5 days	6 days	8 days	10 days	12 days
Verandi	M1a	100	-	3	40	69	75	85
	M1b	100	-	7	29	64	69	90
	M2a	100	-	-	15	45	55	65
	M2b	100	-	2	30	44	50	55
Lalibela	M1a	100	-	-	3	11	26	95
	M1b	100	-	10	45	57	74	80
	M2a	100	-	-	10	59	79	75
	M2b	100	-	-	20	40	62	70
Strong Gold	M1a	100	1	9	24	37	56	88
	M1b	100	3	20	40	65	70	77
	M2a	100	-	1	10	43	69	65
	M2b	100	-	4	16	31	39	45

The best percentage of emergence is represented by bulbs treated with potassium permanganate solution from variant M1b, with 90%.

The lowest percentage of emergence is represented by variant M2a, untreated unpeeled bulbs where the percentage of emergence was 55% and emergence duration of 12 days from sowing.
In the Lalibela species, from a total of 100 bullbi sown, the percentage of emergence for both variants is as follows:
- for variant M1a (with bulbs treated with phytosporin), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 95%;
- for variant M1b (bulbs treated with potassium permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 80%;
- for variant M2a (untreated peeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 75%;
- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 70%.
The best percentage of emergence is represented by the treated seeds from variant M1b (bulbs treated with potassium permanganate solution) with 77%, and the lowest percentage of emergence is represented by variant M2a, untreated peeled bulbs where the percentage of emergence was 75% and the emergence duration of 8 days from sowing.
In the Strong Gold species, from a total of 100 bulbs sown, the percentage of emergence for both variants is as follows:
- for variant M1a (bulbs treated with phytosporin), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 88%;
- for variant M1b (bulbs treated with potassium permanganate solution), the first plants sprouted 6 days after sowing. The total emergence percentage for this variant is 77%;
- for variant M2a (untreated peeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 65%;
- for the M2b variant (untreated unpeeled bulbs), the first plants sprouted 8 days after sowing. The total emergence percentage for this variant is 45%.
The best percentage of emergence is represented by the treated seeds from variant M1b (bulbs treated with potassium permanganate solution) with 77%, and the lowest percentage of emergence is represented by variant M2a, untreated peeled bulbs where the percentage of emergence was 65% and the emergence duration of 8 days from sowing.
The varieties were grouped according to the variety they belong to, thus, the difference in the initiation of the phenological phases was observed depending on the variety and from one variety to another.
Lalibelia varieties were selected from the Darwin Hybrid variety, the varieties from this group compared to the other Triumph Verandi and Strong Gold varieties recorded the longest period until the harvesting of the flower stalks, being 105-110 days.

Another objective taken into account was the dynamics of plant growth.Special cells of 80 pieces (0.6 x 0.4) m² are used. Thus, up to 300 plants can be obtained from one square meter.

Table 3. Recording the phenological phases according to the biological characteristics of the tulip varieties

Varieties	Breed	Planting of bulbs	Start in vegetation	Flower bud emergence				Colouring of the button (15%)	
			Date	Days from the sowing	Date	Days from the sowing		Date	Days from the sowing
Darwin Hybrid	Lalibelia	16 nov. 2022	23 jan. 2022	63	07 feb. 2022	82		05 mar. 2022	108
Triumph	Verandi		27 dec. 2021	35	11 jan. 2022	54		06 feb. 2022	80
Triumph	Strong Gold		04 jan. 2022	45	20 jan. 2022	64		15 feb. 2022	90

These varieties are well rated on the market for the simple reason that they have well-developed stems and the flowers are quite long-lived, and they are also appreciated for the classic shape of the flower bud.
The variety of tulips Lalibelia, Verandi and Strong Gold have an average period of 90-108 days, with small differences from one variety to another.
The growth and development of plants is influenced by a wide range of factors, among which are very important: the quality of the planting material, the ecological conditions as well as the quality of the culture substrate, all of which condition to a greater or lesser extent the uniformity and quality of the production.

Table 4. The height of the plants according to the variety and the applied technological process

Variety	M1a (bulbs treated with phytos porin)	M1b (bulbs treated with potassium permanganate solution)	M2a (peeled untreate d bulbs)	M2b (unpeeled untreated bulbs)
Lalibelia	54	51	49	47
Verandi	38	35	33	30
Strong Gold	48	45	40	42

From the data presented in the table above, it is highlighted that depending on the cultivation method, the height of the plants varies, with the highest indices being recorded for M1a and the lowest for the M2b variant.
The highest flower stalks depending on the variety are recorded in those from the Darwin hybrid Lalibelia group, correlating with the peculiarity of the variety in this group (tall, vigorous stems).

Table 5. The quality of the flower stalks depending on the variety and the technological process applied

Variety	Plants, pcs/m²	M1a (bulbs treated with phytosporin)	
Lalibelia	320	225	99
Verandi	340	249	95
Strong Gold	310	190	115

The expenses incurred within a month are shown in the table below:

Table 6. Monthly expenses

Salaries	800 euro
Fuel	300 euro
Publicity	100 euro
Products for flower care	200 euro
Flowers	500 euro
Total	1800 euro

The flowers are sold cut for floral arrangements or bouquets or in pots.

Table 7

No. crt.	Name	Price per piece	Pieces	Est. Value
1	Lalibelia	2	1500	3000
3	Verandi	2,5	1500	3750
3	Strong Gold	2,4	1500	3600

4. CONCLUSIONS

- Growing tulips in a greenhouse requires special equipment and constant attention from the plantation owner. In case of violation of the temperature regime, insufficient humidity or improper watering, the plants will get sick and will not bloom.
- Before planting tulips, we must prepare the soil. Otherwise, the plants will get sick
- The best time to buy tulip bulbs is from the beginning of July to the end of September. At this time, it will be possible to purchase high-quality planting material.
- In order for all tulips to sprout, give beautiful buds and not get sick during the growing process, it is important to choose the right planting material.
- Growing flowers for sale requires knowledge of the technology of forcing tulips by March 8 in a greenhouse.
- Any business idea up to the stage of implementation requires a good analysis of the market, estimation of investments and possible risks associated with it.
- Growing tulips in sheltered areas can become a successful business.
- For growing tulips in the greenhouse, different varieties and hybrids are available on the market, I use bulbs from Holland, among which I remember Verandi, Lalibela Strong Gold.
- Growing tulips in forced culture is a rather difficult process that requires great care and constant supervision. Forced culture can be achieved through a set of agrotechnical measures that cause the plants to come out of dormancy and flower at a completely different time than the normal one, and its main purpose is to obtain flowers in the period from the end of the late crops to the beginning of the early ones (December-March).

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DOI: 10.2478/agr-2024-0013

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

FLORISTIC CHARACTERIZATION OF GRASSY STEPPE GROUPS IN NAAMA REGION (ALGERIA)

Wahiba Attaoui, Abdelkrim Benaradj *, Lame Bourahla

Laboratory of Sustainable Management of Natural Resources in Arid and Semi-Arid Areas, Salhi Ahmed University Center of Naama, Algeria

*Corresponding author e-mail: benaradj@cuniv-naama.dz

Abstract

The present work aims to illustrate the current state of steppe rangelands based on three plant formations: Stipa tenacissima, Lygeum spartum and Stipagrostis pengens, and to describe the different floristic processions linked to these species in Nâama region with an arid climate. The phytoecological study is based on qualitative and quantitative analyses through 150 floristic surveys carried out during the spring period of the year 2022 in Nâama region. The floristic analysis enabled the identification of 62 taxa belonging to 23 families and 53 genera. The floristic procession is very rich and diverse in the three plant formations according to the Shannon indices (between 2.85 and 3.59) and equitability (0.68 and 0.86), where Asteraceae and Poaceae dominate the herbaceous layer in the study area. The three plant formations have great ecological plasticity and occupy an important place in the steppe rangelands of Naama. They tolerate extreme environmental conditions (drought, aridity, sandy substrates) well through adaptations using various strategies for occupying these specialized environments. The floristic evaluation of the steppe rangelands is necessary, even mandatory; in order to assess the pastoral potential and to identify solutions for the restoration and rehabilitation of these degraded steppe areas.

Keywords: rangeland, Naâma, arid, floristic, steppe, characterization

1. INTRODUCTION

Algeria covers a steppe area of 20 million hectares, located between the 400 mm isohyet to the south-north and the 100 mm isohyet to the south, and occupies a central position between the Tell Atlas to the north and the Saharan Atlas to the south.

It is characterized by a set of steppe plant formations of physiognomy, with a herbaceous and/or more or less shrubby character. It is represented by 4 main categories with climatic and edaphic determinism: dominated by perennial grasses such as (*Stipa tenacissima* and *Lygeum spartum*) and steppe of chamaephytes (*Artemisia herba-alba*, *Hammada scoparia*) growing in tufts [1-4].

In the Naama region, the steppe rangelands cover a significant pastoral area of three million hectares, including more than 400,000 hectares of esparto grasslands rangelands.

They are characterized mainly by very diverse plant formations with an abundance of cespitose grasses, a shrub layer (chamephytes) and an herbaceous layer, particularly therophytes (annual species).

This area is mainly composed of esparto grasslands (*Stipa tenacissima*), esparto rangelands (*Lygeum spartum*), psammophytic rangelands with Drinn (*Stipagrostis pungens*) and shrubby steppe rangelands with Remth (*Hammada scoparia*) [3,5,6].

Despite the ecological and economic role, the Naama steppe region has been facing a process of continuous degradation for several decades that is becoming increasingly irreversible.

This is mainly the effect of the combination of anthropogenic (overgrazing, land clearing) and natural factors (aridity, drought, etc.) [3-8].

This work was carried out in the steppe plains; it aims to study the formations of alfa (*Stipa tenacissima*), Sparta (*Lygeum spartum*) and Drinn (*Stipagrostis pungens*) as well as a floristic and ecological characterization of the area through a phytoecological approach.

2. MATERIALS AND METHODS

2.1. Presentation of the study stations

In the Naama region, the choice of study stations was made according to ecological factors (floristic-ecological homogeneity), as well as the presence of the steppe formations of study: *Stipa tenacissima; Stipagrostis pungens* and *Lygeum spartum* (Table 1 and Figure 1).

Table 1. Geographic coordinates of the study stations

Stations	Steppe plant formations	Geographic coordinates
Station 1 of Djedida	*Stipa tenacissima*	33°09'82,5" N
		0°23'23,8" W
Station 2 of Souiga	*Stipagrostis pungens*	33°09'40,9" N
		0°23'09,5" W
Station 3 of Hassi Lairedj	*Lygeum spartum*	33°16'56,0" N
		0°25'21,3" W

The first station of „Djedida": it is located 10 km from the city of Naama, dominated by the steppe formation based on alfa (*Stipa tenacissima*).

The second Station of „Souiga": it is located in the place called „Souiga" 17 km in the southern part of the city of Naama at a slope reaching 3%. It constitutes a homogeneous topographical ensemble without major accident. It is dominated by the psamophytic formation based on Drinn (*Stipagrostis pungens*) or the sand well colonized in this station.

The third station of „Hassi Lairedj": it is located west of the town of Naama, 10 km towards the road to Ain Ben Khelil. It is dominated by the presence of esparto (*Lygeum spartum*) associated with other species.

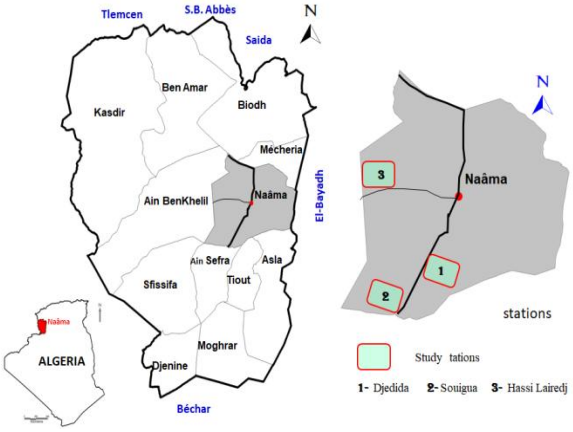

Figure 1. Location of study stations

2.2. Methodology

We carried out systematic sampling using a floristic survey with a minimum area of 100 m², which is widely used in steppe areas [1]. It consists of listing and identifying all the species encountered in the minimum sampling area [10]. Extending from April to June in 2022, the spring period of optimal vegetation, we were able to carry out 50 surveys at each station.

2.2.1. Quantitative analysis of data

- Recovery of vegetation is ideally defined as the percentage of the ground surface to be disseminated, if the aerial parts of the individuals of the species were arranged vertically on the ground [10].
- Floristic richness: The evaluation of the floristic richness will be determined by the number of species inventoried in the territory studied according to the scale of Daget and Poissonet [16].

2.2.2. Qualitative data analysis

- Biological analysis: According to the classification of Raunkiær [11] and Daget [12].
- Biogeographic analysis: In order to define the biogeographic characteristics we have chosen the studies of Quézel & Santa [13] and Le Houérou [14].
- Systematic analysis of species: The plants are identified using the following documents: new flora of Algeria [13] and Flora of Sahara [15].

2.2.3. Vegetation assessment

This assessment is determined by calculating the following indices:

- Shannon-Weaver Diversity Index (H')	$H' = \sum_{i=1}^{S} pi \log_2 pi$ Where: Pi= ni/N; ni: Coverage of species i in the survey. N: Sum of the recoveries of all species S; S: Specific richness	[18]
-Equitability Diversity Index of Pielou (E)	$E = H' / \log_2 S$ Where: **H'**: Shannon-Weaver index. Hmax ($\log_2$): Maximum theoretical diversity. S: Total number of species	[19]

3. RESULTS AND DISCUSSION

3.1. Quantitative analysis

- Recovery

Table 2. Vegetation cover rate in the study stations

Study stations	Plant steppe	Recovery (%)
Station 1 of Djedida	*Stipa tenacissima*	5% - 25%
Station 2 of Souiga	*Stipagrostis pungens*	5% - 20%
Station 3 of Hassi Lairedj	*Lygeum spartum*	5% - 20%

The average recovery in Djedida station is between 5% and 30% and in the two stations Hassi Lairedj and Souiga between 5% and 20%. The average vegetation coverage differs from one station to another, this can be explained by the diversity of the steppe formations (*Stipa tenacissima*, *Lygeum spartum* and *Stipagrostis pungens*) as well as the biotope where they develop, for example the psmmophytic steppe formation in Drinn which develop on sandy environments. This low coverage rate in the study stations is explained by the fact that the steppe formations are very open. Benaradj et al [7], indicate that the spread of dune formations in the steppe rangelands explains the low coverage of the rangelands. According to Daget & Godron [19], explain that the coverage rate is an indicator of degradation in regions threatened by desertification.

Figure 2. The levels of vegetation cover at study stations

- Floristic richness and systematic composition

Table 3. Floristic richness in the study stations

Study stations	Plant steppe	Floristic Richness
Station 1 of Djedida	*Stipa tenacissima*	53 species
Station 2 of Souiga	*Stipagrostis pungens*	25 species
Station 3 of Hassi	*Lygeum spartum*	31 species

Lairedj		

A total of 62 species are recorded in the set of three study stations. The Djedida station is characterized by the presence of 53 species, the Hassi Lairedj station with 31 species and finally the Souiga station with 25 species. According to the scale of richness of Daget and Poissonet [16], the floristic procession of the Djedida station is rich, as well as the procession of the Hassi Lairedj station and the Souiga station is quite rich.
The floristic richness in arid zone mainly belongs to annual species, environmental conditions and the relationship of all the characters (climate, edaphism and exploitation) [20].

3.2. Floristic composition

- Biological plan
All the stations have a difference from a systematic point of view. The results of the floristic composition of these stations are presented in the table below:

Table 4. Systematic characterization of the study stations

N°	Famille botanique	Djedida	Souiga	Hassi Lairedj	Study zone
1	Asteraceae	11	8	7	14
2	Poaceae	9	4	5	9
3	Fabaceae	6	1	1	6
4	Brassicaceae	4	2	1	4
5	Amaranthaceae	3	0	1	3
6	Lamiaceae	2	2	2	3
7	Borraginaceae	2	0	0	2
8	Caryophyllaceae	1	0	2	2
9	Cistaceae	2	2	2	2
10	Euphorbiaceae	2	1	1	2
11	Malvaceae	2	0	0	2
12	Zygophyllaceae	1	1	2	2
13	Apiaceae	1	0	1	1
14	Capparidaceae	0	0	1	1
15	Dipsacaceae	1	0	0	1
16	Onagaceae	1	1	0	1
17	Plantaginaceae	1	1	1	1
18	Renonculaceae	1	0	1	1
19	Resedaceae	1	0	0	1
20	Rhamnaceae	1	0	1	1
21	Scrophulariaceae	1	0	0	1
22	Tamaricaceae	1	1	0	1
23	Thymeleaceae	1	1	1	1
Total		**53**	**25**	**31**	**31**

a) *Djedida Station:* According to the table, it can be seen that the station is systematically characterized by the following floristic procession which consists of: 22 families, 50 genera and 53 species. Therefore, the station presents a clear dominance of the cosmopolitan family which is the Asteraceae family (with 10 genera and 11 species), followed by the Poaceae (with 8 genera and 9 species), then respectively by the Fabaceae family (with 6 genera and 6 species), the presence of the Amaranthaceae family with 3 genera and 3 species followed by the bigeneric families (Lamiaceae and Borraginaceae) with 2 genera and 2 species each. Families that contain only two genera and one species are Cistaceae, Euphorbiaceae, and Malvaceae. Finally, the remaining families are monospecific: Zygophyllaceae, Apiaceae, Dipsacaceae, Onagaceae, Plantaginaceae, Renonculaceae, Resedaceae, Rhamnaceae, Scrophulariaceae, Tamaricaceae and Thymeleaceae.
b) ***Souiga Station:*** It is systematically characterized by the following floristic composition: 12 families, 22 genera and 25 species. The floristic procession is characterized by the dominance of the Asteraceae family (6 genera and 8 species), followed in second position by the Poaceae family (4 genera and 4 species), followed by the Brassicaceae and Lamiaceae families (2 genera and 2 species) and the Cistaceae family with 2 genera and a single species. The remaining families are monospecific (with a single species) namely: Fabaceae, Euphorbiaceae, Tamaricaceae, Thymeliaceae and Zygophyllaceae.
c) ***Hassi Lairedj Station:*** This study station is systematically characterized by the following floristic procession which consists of: 15 families, 28 genera and 31 species. The floristic composition is dominated mainly by the Asteraceae family which is the most cosmopolitan with 6 genera and 7 species, followed in 2nd position by the Poaceae family (5 genera and 5 species), then in 3rd and 4th place by the bigeneric families of Lamiaceae, Caryophyllaceae and Zygophyllaceae (with 2 genera and 2 species) and the Cistaceae family (2 genera and 1 species). In some cases, we note the presence of monospecific families presented by a single genus and a single species such as: Fabaceae, Brassicaceae, Amaranthaceae, Euphorbiaceae, Plantaginaceae, Ranunculaceae, Tamaricaceae Rhamnaceae and Thymeliaceae
Overall, the families with the highest species content were Asteraceae and Poaceae. There is therefore a significant floristic diversity in these three steppe formations. These systematic analyses show a more nuanced diversity in families and genera in the different study stations. Asteraceae and Poaceae are two families common to the different study stations with a clear predominance in the floristic lists. These two families represent 35% of the flora. This predominance is justified since they are cosmopolitan families that are very widespread in the Mediterranean region. These families of Asteraceae and Poaceae have a greater power of adaptation to changes in ecological conditions and to anthropogenic pressures (overgrazing) in these environments [21]. The high proportion of Poaceae in the study area can be explained by the fact that these taxa have a very high possibility of tillering and a greater speed of regrowth after the passage of herds. They offer very significant fodder potential; which would encourage the exploitation of the rangelands for pastoral purposes.

3.3. Qualitative analysis

- Biological type

In the first station of Djedida, we find the following biological spectrum: Th>Ch>He>Ge> Ph. It is characterized by a strong presence of the herbaceous layer which predominates. Therophytes occupy 58%, chamephytes (21%). hemicryptophytes (17%), geophytes (2%) and phanerophytes (2%).

In the 2nd Station of Souiga: The biological type analysis in this station, shows that the biological spectrum of this station is dominated by the presence of Therophytic species (39%), followed by Chamephytic species (29%), followed by Hemicryptophytic species (26%), by Geophytes occupy the (3%) and Phanerophytes the (3%). The spectrum is of type: Th>Ch>He>Ge>Ph.

In the third station of Hassi Lairedj, the analysis of the illustrated results reveals that the dominant biological type is represented by therophytes (48%), followed by the Chamephytes (28%), and finally the Hemicryptophytes (16%), by the Geophytes occupy the (4%) and the Phanerophytes the (4%). Thus, the spectrum is comprised of (Th, Ch, He, Ge, and Ph).

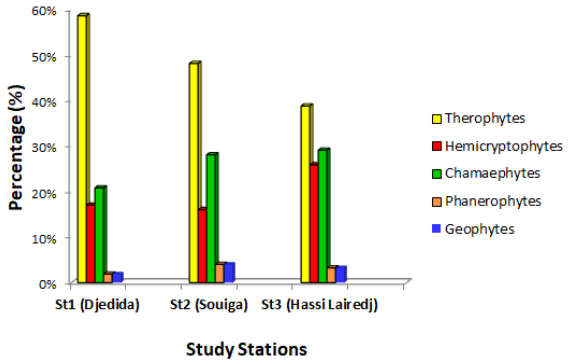

Figure 3. Diagramme of life form in the study area

The analysis of the global biological spectra shows that therophytes are the most represented throughout the study area, with rates generally exceeding 50%. The chamephytes are also well represented with different percentages, varying between 21% and 29%. The hemicryptophytes are less represented, their percentage is not negligible (19%), and followed by the geophytes and phanerophytes which record their rate of 4%. In all the study stations, the biological spectrum shows a predominance of herbaceous strata (therophytization).

In general, therophytes are the most dominant in all the studied rangelands at least in number. Their presence in arid environments is linked to their adaptation strategy. Several authors emphasize that therophytes are the biological type that directly depends on precipitation [22,23].

Emberger [24] states that the rate of therophytes increases with the aridity of the environment, for Daget [12] and Aidoud [25] therophysation is a characteristic of arid zones and expresses an adaptation strategy with regard to unfavorable conditions and resistance to climatic rigors. Therophytization described by many authors as a characterization of degraded systems is indeed valid if we have the passage from an ecosystem in good condition to another in poor condition.

- Biogeographic type

The study stations are rich in several phyogeographic elements; their distribution is different from one station to another. According to the figure, the distribution of phytogeographic types is generally as follows in the study area: Mediterranean; Endemic; Pluriregional; Saharan; Saharo-Sindian and Ibero-Mauritanian.

- Djedida Station is dominated by the presence first of the Mediterranean element (32%), followed by the Pluri-regional element with (20.75%), the Endemic element (18.87%), Saharo-Sindian element (13.24%), the Saharan element (9.83%), and the weak presence of the Ibero-Mauritanian element (5.66%).
- The phytogeographic spectrum analysis shows that the Souiga station is characterized by the dominance of the Mediterranean element with (32%), followed in second place by the Endemic element (19.35%). For the other elements are presented with low rate namely: Saharo-Sindian, the Ibero-Mauritanian element with a rate of 6.45%.
- For Hassi Lairedj Station, the biogeographic spectrum is characterized by the dominance of the Mediterranean biogeographic element with (32%), followed by the Pluri-regional element with (20%) then the endemic element with (16%).

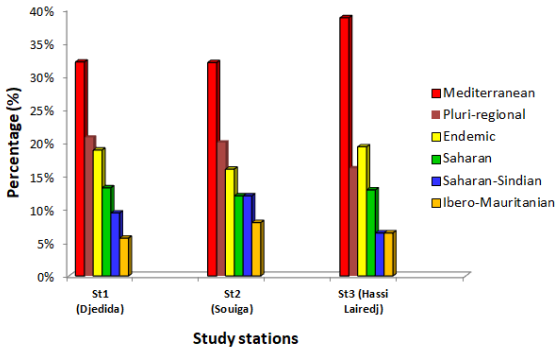

Figure 4. Biogeographic spectrum of study stations

All the study stations are characterized by a notable dominance of Mediterranean, endemic, and Saharan-Sindian species. The predominance of the Mediterranean element confirms the Mediterranean approach to the diversity of the region between the two groups: the high steppe plains and the Saharan Atlas to the South [3,7,21]. The Saharo-Arabian element increases in grazed areas. These results show an evolution of biogeographic types under the influence of changes in ecological conditions. Therefore, it appears that the study environment is diversified on the phytogeographic level [26-28]. This diversity is linked to two major series of causes: climate

changes that cause the migration of flora and long-distance transport by winds and birds [29].

3.4. Diversity indices (Shannon and Equitability) of the study stations

Table 5. Calculated diversity indices (H' and E)

Study stations	Shannon Index (H')	Equitability Index (E)
Station 1 of Djedida	3.59	0.86
Station 2 of Souiga	2.85	0.68
Station 3 of Hassi Lairedj	2.92	0.70

According to the results obtained (tab. 2), the Shannon (H') and equitability (E) indices show that they are significantly different. For Djedida station, the H' index (3.59) is average and the E index (0.86) high, which indicates that we have a fairly rich diversity, which can be explained by the dominance of annual and perennial species in the course, and the high value of the E index shows that there is a regular abundance of species.

According to Dajoz [30], the high value of the equitability index is an affirmation that there are favorable conditions for the appearance of many species and the dominance of some of them.

In the two courses of Hassi Lairedj and Souiga, they have low values of Shannon index and average values of equitability index, which shows a low diversity with the rarefaction of several species especially those that have a pastoral interest such as: *Helianthemum lippii, Salvia aegyptiaca, Saccocalyx satureioides.*

Khalid et al. [31], explain that the decrease in the value of diversity indices reveals a rarefaction close to a disappearance of certain plant species and especially those that have a good pastoral value. The impact of intensive grazing on the courses has resulted in a decrease in diversity indices [32].

4. CONCLUSIONS

In the Naama region, the steppe area is characterized mainly by low and very open plant formations, under a herbaceous, sub-shrub and exceptionally shrubby layer. The vegetation is characterized by the abundance of steppe plants (*Stipa tenacissima, Lygeum spartum, Stipagrostis pungens, Artemisia herba alba, Hammada scoparia*), but also by the frequency of annual species (therophytes). According to the floristic inventory, the floristic procession of the study area is quite rich (62 species divided into 23 families and 54 genera) with a recovery rate varying between 5 and 20%, this variation is reflected by the combined effect of climatic constraints and anthropogenic action. The analysis of the global biological spectra shows that therophytes are the most represented in all the study stations, with rates generally exceeding 50%. Chamaephytes are also well represented with different percentages, varying between 21% and 29%. Hemicryptophytes are less represented, their percentage is not negligible (18%), followed by geophytes and phanerophytes. The distribution of species expressed by adaptive strategies highlights the dominance of Therophytes and Chamaephytes in the stations. For the systematic composition, the stations are mainly dominated by Asteraceae and Poaceae. There is therefore a significant floristic diversity in these three steppe formations. These families have a greater power of adaptation to changes in ecological conditions and to anthropogenic pressures in these environments. For the biogeographic characterization, all the study stations are characterized by a dominance of the Mediterranean and endemic element.

In light of this work, it appears that these three grasses constitute a phytogenetic heritage of great interest on the social, economic and industrial levels which can play an important role in the agropastoral development of the Naama region, its current state requires us to take charge of this natural space to protect against degradation by conservation measures, rehabilitation and the integrated management of these steppe rangelands.

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DOI: 10.2478/agr-2024-0014

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

SENSORY ANALYSIS AND EMOTIONAL RESPONSE OF THE CONSUMER

Gabriela Teodorescu
Valahia University of Targoviste, 13, Sinaia Alley, Targoviste, Romania
E-mail: theo_0200@yahoo.com

Abstract

Wine is a dynamic product that has been discussed about for millennia in many areas of the world. For a product with such a legacy, which has forged links with many cultures, there should be a shared and original vocabulary. In order to meet this demand for description and assessment of wines, the sensory analysis of wine has been enhanced. But, for this we need to train and develop the capacity of judges to describe the sensory characteristics provoked by visual, aromatic and taste-sensing perceptions. Wine is not a product simple to describe and judge. In reality, the human senses have not accurate measures of these stimuli because of physiological or mental limitations (Lawless 1999). Conventional sensory analysis, as a result, seems to create a dialogue link between wine specialists and audiences. Moreover, given that consumer tastes are different and are not shaped only by the quality attributes of food.

Keywords: wine, sensory, perception, consumer

1. INTRODUCTION

Ubigli (2004) says that „sensory input, in in the most distinct direction, is improved by a richness of other details of the" hedonistic and affective type" and perception is not just about biological reaction, but also about a „activity that supplements the knowledge and introspection." If they are influenced by cuisine, emotions can have five varied sources: sensory traits, experience, previous exposure, personal or societal experience, and tertiary factors (Desmet and Schifferstein - 2008, Jiang et al. 2014, Meiselman 2015).
This study proposes to describe the connection between the emotional descriptors caused by wines and their sensorial properties.
It can be considered that the method is accessible to subjects without extensive knowledge in the field of wine, but this allows us to evaluate and differentiate wines. Interpretation of the connection of traditional technical descriptions with emotional responses can be done by wine specialists/experts.
Starting from this theory, we can also analyze whether the consumer's emotion affects mood and buying behavior.
The result of the study can be adopted by wine producers to attract various customers by using pleasant atmospheric indices. A pleasant atmosphere attracts and improves the affective engagement of the customer, which reinforces the intention of repetitive customer purchase. We can combine with the effect of some wine tastings to increase the attractiveness of the winery.
Mesias and colleagues (2013) demonstrated that common shifts in social and consumer behaviors have given chances for new possibilities in food creation. For the innovative features and reinterpretations of many items to be successful, manufacturers need to grasp the factors that influence the selection of food and determine their effect on the purchasing choice (De Pelsmaeker et al., 2015, Solheim and Lawless, 1996).
This is necessary due to the fact that in recent decades, food is becoming even more complex and complete due to consumer requirements.
Finally, a method that combines sensory and extrinsic attributes will help determine factors that lead to food production and optimize these features during their quality framework.
In research about the assessment of sensory and marketing effects on consumer choices, Booth (2014) demonstrated that good studies in food science are those that create consumer environments like a practical situation.
Grunert (in 2003) also indicates that low-calorie products are health details that underlie the first impact on the consumer and shape the election at the first purchase. Finally, sensory data and product consumption background become the main purchasing drivers.
In addition, Cardello and Sawyer -1992, Cardello - 1995 highlighted that both, sensory and hedonic anticipations are important for consumer preference and satisfaction. Normally, sensory features cannot be excluded, since they have a significant role in the final choice of the buyer.
This research can help clarify the role of intrinsic and extrinsic aspects of consumer choice by using taste as an indicator of sensory analysis.
We can verify that a common study, which combines tasting (intrinsic traits) with extrinsic product attributes, can help develop a comprehensive view of your preferences.

Sensory perception and wine analysis

For a complete evaluation of the quality and characteristics of wine, it must undergo visual, olfactory and taste inspections. Here we can include the study of how activated neural signals are transmitted, altered, and integrated into our conscious experiences.
We must not exclude the influence of environmental conditions in the generation of odour memory patterns being revealed for the correct and objective assessment of wine.

To these factors we add: normal physical and psychological condition for wine evaluation, methods of data analysis, training and evaluation of assessors, wine language, wine language, all completed with a detailed wine tasting technique.

Visual examination of wine involves the assessment of color, limpidity (clarity), intensity and other visual characteristics. The color can vary in function of the type of wine (white, rose, red) and its age. White wine: it can be yellow-green, straw-yellow or even golden, as well, and older wines tend to get a darker, golden tinge; Rose wine: varies from pale pink to salmon and intense pink; Red wine: it ranges from ruby red (young) to intense red, purple or even brick, in the case of older wines.

Limpidity (clarity) indicates whether the wine is clear and free from impurities. A clear wine looks well-groomed, and the lack of impurities suggests that the wine has been well filtered. Turbidity (opacity) may indicate a natural (unfiltered) winemaking or potential problem (such as unwanted secondary fermentation).

The intensity of color can be observed by the depth of color – from pale wines to very dark wines. This can provide clues about the type of grapes and the concentration of phenols and tannins.

Viscosity (tears or „legs" wine). Observation of „foot" or „wine tears", formed on the walls of the glass after turning it, can provide information about the content of alcohol and sugars. Wines with a high amount of alcohol or sugars will form thicker and slower-flowing tears.

Clarity and brilliance. A healthy and well-maintained wine has a vivid shine, which suggests freshness and good quality. Lack of shine may indicate less careful winemaking or faulty wine.

At the *olfactory examination* of wine, its uniqueness is given by its fragrance. In the table below are presented the types of flavors and their origin.

AROMAS *PRIMARY*	**AROMAS *SECONDARY***	**AROMAS *TERTIARY***
From grapes – typicality variety	Technological processes: film maceration, selected yeasts, malolactic fermentation, maturation in oak barrels	Maturing in bottle
Floral: acacia, chamomile, elderberry, geranium, rose, violet, honeysuckle. Green fruits: apple, gooseberry, pear, quince, grape Citrus: graft, lemon, lime, orange peel, lamiae peel Fruits with kernels: peach, apricot, nectarine Tropical fruit: banana, lichee, mango, melon, passion fruit, pineapple Red fruits: red currant, cranberry, raspberry, strawberry, cherry, plum Black fruits: black currant, blueberry, rosehip, blackberry, black cherry Candied fruits: fig, dried plum, candied fruits, raisins Herb aromas: green pepper, grass, tomato leaf, asparagus Vegetables: eucalyptus, mint, medicinal, lavender, fennel, dill Spices: black/white pepper, licorice, juniper, ginger Other: mineral, wet stones, wet wool, eraser.	Yeast: biscuit, pastries Malolactic fermentation (MLF): butter, cheese, sour cream, yogurt Oak: vanilla, cloves, nutmeg, coconut, caramel, toast, cedar, charred wood, smoke, chocolate, coffee, softwood.	Deliberate oxidation: almonds, marzipan, coconuts, hazelnuts, nuts, chocolate, coffee, caramels. Evolution of the fruit to white wine: dehydrated apricots, marmalade, dried apples, dried banana, etc. The evolution of the fruit to red wine: fig, plum, tar, dried blackberries, dehydrated cranberries, boiled blackberries, etc. Glass maturation in white wine: petroleum, kerosene, cinnamon, ginger, nutmeg, toast, cereals, mushrooms, hay, honey Glass maturation to red wine: skin, compost, soil, mushrooms, cedar, tobacco, vegetable, wet leaves, fleshy flavor, etc.

Depending on the type of wine and its evolution over time, which can last from several months to many years, olfactory sensations can be very different due to the change in the characteristics of wine with the passage of time.

Too young wine highlights a clear prevalence of secondary, winery aromas, while primary aromas are weak and tertiary aromas are non-existent. On the other hand, the bouquet of a mature wine is dominated by tertiary flavors, followed by secondary ones, while the primary flavors play the supporting role.

The bouquet of aromas of a wine is never attributed only to primary, secondary or tertiary flavors, but is the result of a combination of them, which must be pleasant and harmonious.

The taste (gustative) exam

The taste of wine is the one that influences the consumer's perception the most. Even if we talk about a small number

of typical taste sensations (sour, bitter, astringent), their combination with flavors (smell from the mouth) seems to influence the consumer's decision the most.
The prevailing taste sensations of a wine are factors in the process of wine appreciation.
Pleasure is obtained when wine is used (as usual) with food. The association often blurs the less pleasant character, balance appears, which in fact is one of desirable traits for all wines.
Even though much has been learned about the chemical origin of taste and the sense attributes in the mouth of wine, much is learned about how they are sensorially perceived, which leads to difficulties in improving their sensory perception. In fact, mixing and also the sensory analysis are the primary condition by which a desirable balance is achieved.
Properly, is more essential for any wine maker to develop sensory acuity to apply the taste attributes of the wine according to consumer preferences.

2. MATERIALS AND METHODS

For this research, we used an observational tasting sheet that includes emotional reactions and common sensory traits. Five red wines were assessed/tasted, depending on the sensory terms used in the tasting sheet, by a consumer panel (CP) consisting of 10 participants (4 women, 6 men).
Consumers have identified the main primary sensory attributes such as „complexity," „astringency" and „aftertaste or the length of the wine fragrance." The analysis did not include distinction of wine types, but analysis of the main elements and emotional aspects.
The focus was on the ability of tasters/consumers to describe the sensory features caused by visual, olfactory, and taste-sensed stimuli.
Given the primary findings obtained, we can say that traditional sensory analysis seems to create a communication and vocabulary disparity between wine experts and consumers, he said, so new methods to creating a common language and a complete analysis should be encouraged. These new strategies and interpretations can be applied outside the scope of conventional sensory analysis.
Also, another goal of the study is to improve the general tasting sheet, testing it with a broader number of consumers, untrained and without prior expertise.
We aim to: adapt the practical wine tasting sheet by including emotional feedback and conventional sensory characteristics to be used by consumers to describe and assess wines; evaluate the importance of emotions in the appreciation of wine; classify wines with different specificities using emotional responses.
The novelty of the study lies in the connection between the emotional descriptors caused by wines and their sensory features. This method is more user-friendly for uninitiated consumers, which enables them and helps to evaluate and differentiate wines. The combination of traditional technical descriptions with emotional feedback can be easily used by wine connoisseurs and food analysts. The study is also intended for wine sales professionals because the work allows to expand the concept of „non-conventional" by engaging wine consumers through tasting.
Joint analysis combining tasting (intrinsic quality) and extrinsic wine factors could help develop a comprehensive view of consumer preferences.
Theoretically, the study highlights that quality is a multidimensional concept, and consumers engage in it according to the different levels of engagement with the presented wine. Practically, the research gives manufacturers and retailers the chance to understand how quality is perceived by consumers and the different ways in which drinkers can be grouped according to the quality dimensions they prioritize. The question of whether or not quality exists or how it functions becomes secondary to the consumer's viewpoint. We need to understand consumers' opinions about the quality of wine, to which to apply existing theoretical frameworks.

3. CONCLUSIONS

With the research in mind, we hope that the interpretation of sensory responses can be improved through inputs of neuroscience, applied psychology, and philosophy, and will provide a clear understanding of wine perception and appreciation. The improvement of sensory science must adequately influence wine quality standards and the sensory evaluations of wine be approachable by audiences.
For the wine industry, it is of critical importance to produce wine without flaws and with sensory qualities that attract consumers. Applying stringent sensory analysis to help achieve this goal has become increasingly relevant, especially for a global marketplace.
At the same time, the lack of in-depth sensory techniques can lead to „accepting" some defects and reaching the market of less appealing wine varieties. The large number of wine producers, even within a single mid-sized farm and the seasonal nature of production, make it possible that few wineries apply structured sensory analysis tests and even fewer are considering customer testing. Starting from this complexity, we maintain the perspective that wine is a continuously evolving product, which means that its sensory attributes will change over time in the market, and the conclusions made at that time of the analysis may not be consistent after a year or two.
We need to enhance this process of affective consumer testing, especially for the creation of new products, from the small sensory profiling to a relatively big wine category to specific testing of the final offering, to which to add conceptual and marketing insights.
It is known that for many wine producers, a formal sensory testing process is not feasible because of the costs and expertise involved. However, although it is relatively costly, a manufacturer must weigh the cost of this kind of testing compared to the danger of entering a market with sensory-defect wine.
With this study we intend to have an overview of this new domain for wine researchers as well as for the wine producers, who must become aware of the important practical applications through direct testing of consumers, to obtain information that can guide all phases of

production and provide the market entry of wines that best meet consumer needs.

For a product with such a legacy, which has created links with many cultures, there should be a common and original vocabulary.

To meet this requirement for description and assessment of wines, the sensory analysis of wine has been established. But, for this we need to build and develop the capacity of tasters to describe the sensory features caused by visual or olfactory and taste-sensing stimuli.

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DOI: 10.2478/agr-2024-0015

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

APPLICATION TRIAL OF ESSENTIAL OIL EXTRACTED FROM *CITRUS AURANTIUM* IN FOOD PRODUCTS (MINCED MEAT)

Asma Boukhennoufa*[1,2], Yamina Maizi[2], Souhila Benmaghnia[2,3], Dalila Ferrag[1,4], Aicha Tir Touil Meddah[2], Boumediene Meddah[2], Fayçal Abdelaaziz Bouali Youcef[5], Hiba Naas[1,6]

[1]Department of Agricultural Sciences, Faculty of Science and Technology, University of Relizane, Algeria.
[2]Laboratory of Bioconversion, Microbiological Engineering and Health Safety, Faculty of Life and Nature Sciences Mustapha Istanbul University, Mascara, Algeria.
[3]Department of Microbiology and Biochemistry, Faculty of Sciences and Nature, University Batna 2, Algeria.
[4]Biotoxicology Laboratory, Department of Biology, Faculty of Naturel Science and Life, Djillali Liabes University, Sidi Bel Abbes, Algeria.
[5]Faculty of Natural and Life Sciences, Department of Biology, Abdelhamid Ibn Badis University, Mostaganem, Algeria.
[6]Laboratory of Molecular Biology, Genomics and Bioinformatics, Department of Biology, Faculty of Nature and Life Sciences, Hassiba Benbouali University of Chlef, BP. 151, 02000 Chlef, Algeria.
*Corresponding author e-mail: asma.boukhennoufa@univ-relizane.dz

Abstract

In recent years, humans have turned to herbal remedies to solve a variety of problems, both food-related and health-related. Synthetic food preservatives are now restricted in many developed countries because of their irreversible effects on the body. Therefore, the present study is an important contribution to the search for new beneficial preservatives from plants. The Citrus aurantium plant is widely used by the people of the Relizane region for therapeutic and culinary purposes. The extraction of essential oils from the fruit of this plant by hydro-distillation gave a yield of 0.09 ± 0.01%. The relative density at 20°C, the acid value, the ester value and the saponification value are in the order of 0.69 ±0.1, 44 ±3.0 mg KOH/g oil, 2.75 ± 0.5 mg KOH/g oil and 46.75 ± 5.1 mg KOH/g oil respectively. GC/MS analysis revealed the predominance of linalool (43 ± 1.5%) followed by limonene (19 ± 3%). In contrast, no alterations were detected in sample 3 in terms of odour, appearance and colour. A low number of total aerobic mesophilic flora (2×10^4 CFU/g) was recorded in the same sample, followed by sample 2 (4×10^4 CFU/g) and sample 1 (6×10^6 CFU/g). A total absence of Salmonella and Staphylococcus aureus in samples 3 and 2. While sample 1 appeared spoiled due to the presence of a load of 10^4 CFU/g of Salmonella. The Citrus aurantium essential oils appear to be a natural preservative that can be used and incorporated into many perishable food preparations.

Keywords: Preservatives, essential oils, Citrus aurantium. Total aerobic mesophilic flora, Salmonella, Staphylococcus aureus

1. INTRODUCTION

Worldwide, two million adults and three million children die as a result of eating contaminated food.

The contamination is usually caused by a harmful micro-organism or a chemical contaminant, resulting in food poisoning with serious consequences [1,2].

Bacteria with other microorganisms such as fungi, parasites and viruses are often the main cause of food poisoning cases; however, their eradication by chemical antibacterial substances certainly leads to the selection of resistant microbial strains [3,4].

For a long time, *Citrus aurantium L*, or bitter orange, has been used in several sectors; and especially in the food industry as a raw material for liqueurs and marmalades. Traditional Chinese medicine has recognized a wide use of its extracts to activate circulation, vital energy, appetite control, and weight loss. [5].

Essential oils are complex, natural and volatile compounds, which are often characterized by a powerful odor, produced by aromatic plants as secondary metabolites.

Steam distillation is the main method used to obtain them or by hydrodistillation, first developed by the Arabs in the Middle Ages [6].

Essential oils are natural extracts from medicinal and aromatic plants, characterized by their antimicrobial and antiseptic properties [7]. It should also be noted that many essential oils have antiviral, antioxidant, anti-toxic and anti-parasitic properties. More recently, anti-cancer properties have been noted [8].

The present research concerns the valorisation of *Citrus aurantium* from the region of Relizane, as a powerful food preservative, in the face of the problems encountered after the ingestion of significant amounts of chemical preservatives, having already marked by their irreversible effects on our body in the long term.

2. MATERIALS AND METHODS

Plant material

The material consists of the fruit of *Citrus aurantium* (C.a). This part is chosen because of its high frequency of use by the Relizanese population (0°33′21″ East, 35°44′14″ North of Algeria).

After harvesting, The samples were transported in sealed bags to the laboratory of the Department of Agricultural Sciences, Faculty of Natural and Life Sciences (University of Relizane, Algeria). The plant is then authenticated by a botanist from the same department., and by comparing its characteristics with those mentioned in the literature.

Minced meat

In order to study the antimicrobial effect of the essential oil of C.a, we chose minced meat, as it is an important source of contamination germs. The samples were purchased in a butcher's shop located near the covered market of Relizane city. The meat was then placed in sterile Whirl pak bags and transported directly to the laboratory in a cooler equipped with a cold accumulator.

Extraction of essential oils

Five grams of C.a fruit are placed in a flask. The whole is placed in a hydrodistillation set-up and boiled for about 3 hours. The vapour from the distillation is condensed in a refrigerator and then recovered. The distillate is then subjected to an extraction step (liquid/liquid) in a separating funnel, using cyclohexane (C_6H_{12}) and a release agent, sodium chloride (NaCl). The aqueous phase is removed. Then, the oils are recovered from the organic phase following the use of a rotavapor [9]. According to the AFNOR (1986) standard [10]. The essential oil yield is expressed according to formula (1).

$$Y\ \% = \frac{w1}{w0} \times 100 \qquad (1)$$

Where, Y: yield of essential oil w1: weight in grams of essential oil w0: weight in grams of plant material.

Conservation

After recovery of the essential oils, the samples are then stored away from air and light in stained and closed tubes, in order to avoid any kind of evaporation until the moment of use [9].

Physicochemical analysis of essential oils

Determination of relative density — According to the AFNOR standard,1986 [10]. A volume of 1 ml of the essential oil of C.a was weighed, and then the weight of the same volume of distilled water was weighed separately. The relative density was calibrated according to formula (2).

$$d_{20}^{20} = \mathrm{dt'} + 0{,}00068\ (\mathrm{t'} - \mathrm{t}) \qquad (2)$$

Where d_{20}^{20} is the reference density index. $\boldsymbol{dt'}$: refractive index. **t**: 20°C. **t'**: temperature at the time of measurement.

Determination of the acid value —One gram of essential oil was introduced into a flask to which 5 ml of ethanol is added. The whole is shaken vigorously and then titrated with an ethanolic solution of potassium hydroxide (KOH=0.1 mol/L). In the presence of 5 drops of phenolphthalein. The volume of KOH used for the neutralization is read directly on the burette [11].

The acid value (AV) is expressed by the formula (3):

$$AV = \frac{56.11 \times N \times V}{w} \qquad (3)$$

Where, N: Normality of potassium hydroxide, V: Volume of the ethanolic KOH solution used for the titration in ml, w: weight of essential oil.

Determination of ester value—A volume of 0.5 ml of essential oil and another 15 ml of KOH solution (0.5 mole/L) are placed in a flask connected to an ascending refrigerator. Then the whole is brought to the boil in a water bath. When the solution has become transparent due to the effect of heat, saponification is completed. After cooling, the solution is removed from the flask and placed in a beaker and titrated with HCl (0.5N) in the presence of 5 drops of phenolphthalein. In parallel, the blank is performed under the same conditions [12]. The ester index (EI) is calculated according to the relation (4):

$$EI = \frac{28.05}{w\ (V0 - V1)} - AV \qquad (4)$$

Where V0: volume in ml of HCl for the blank, V1: volume in ml of HCl for the determination, w: weight of the test sample.

Determination of saponification value —The saponification value (SV) is calculated according to the relation (5) [13].

$$SV = AV + EI \qquad (5)$$

Gas chromatography-mass spectrometry analysis (GC/MS)

A chromatograph linked to a mass spectrometer of the Shimadzu QP2010 type was used for the analysis of extracted oils. A DB-5 ms (25 m ×0.25 mm ×0.25 µm) was used as capillary column. A volume of 1 µL of the mixture of essential oil and cyclohexane was injected in splitless mode. A flow rate of 0.5 ml/min of helium as mobile phase was used during 4 min to browse the entire column. Equipment temperatures were fixed at 250°C and 280°C. In addition, the detector was programmed at 250 °C. A range of 35 to 400m/z at 0.3 s scan-1 was set to record the mass spectrum. After migration, the characterization was done by referring to a database, based on the comparison of retention time (RT) of compounds of these essential oils and other pure chemical compounds [14].

Tests in food products

The aim of this test is to analyse raw minced meat by determining the microorganisms it contains, in order to evaluate the effectiveness of the added essential oil of *C.a* as a preservative.

Sample preparation —The bulk sample is divided into 100 g parts. Two parts were mixed with an appropriate volume of EO: 5 µL and 15 µL. In contrast, a control sample was not added. The samples were placed in petri dishes and stored at room temperature in order to create the right conditions for the alteration of the minced meat.

Sensory evaluation — Particular attention was paid to colour, abnormal odour and the presence of exudate in order to monitor the spoilage of the minced meat [15].

Microbiological analysis

Total aerobic mesophilic flora (TAMF), *Staphylococcus aureus* and *Salmonella* were analyzed in the treated meat and the control.

Preparation of decimal dilutions —Ten grams of minced meat are mixed with 90 mL of buffered peptone water and the mixture is vortexed and allowed to stand for one hour at room temperature.

Decimal dilutions are prepared from the stock suspension.

A volume of 1 mL of the stock solution is placed in a tube containing 9 mL of buffered water, making the dilution to 10^{-1}.

After homogenization, a volume of 1 mL of water in the same way into another tube which in turn contains a fresh volume of 9 ml of buffered peptone water, to make the dilution $10^{-2}$and so on until the dilution $10^{-6}$is obtained [16].

Research and enumeration of TAMF—The enumeration of this microflora was carried out by the mass plating method of a 1 mL volume on PCA agar.

Two plates were plated from each dilution.

Incubation is done for 72 hours at 30°C [15]. The count is expressed as a forming unit using formula (6).

$$N=\frac{\varepsilon c}{(n1+0.1\,n2)d}\times\frac{1}{v} \qquad (6)$$

Where, ∑c: total number of colonies found; n1: number of plates chosen from the lowest dilution; n2: number of plates from the next dilution chosen; d: dilution factor; V: volume of the test sample in ml.

Testing and enumeration of Staphylococcus aureus—In petri dishes containing Chapman medium 0.1 mL of $10^{-5}$and 10^{-6} dilutions are spread on the surface by a spreader. The dishes are then inverted and incubated at 37°C for 24 hours [15].

Testing for *Salmonella*—As a pre-enrichment step, 25 g of each preparation was placed in 225 mL of buffered peptone water and incubated at 37°C for up to 20 hours. Enrichment was done by taking 1 mL of pre-enrichment broth, which was then placed in a 20 mL tube of broth (Cystine-Selenite).

Incubation was done at 37° for 24 hours.

Then a volume of 0.1 mL is spread on the surface of the Salmonella-Shigella medium [15].

Statistical study

The results are expressed as the mean ± standard deviation of three trials. Statistical analysis one- way (analysis of variance [ANOVA]) was applied to the data. A P value less than 0.05 is considered significant.

3. RESULTS AND DISCUSSIONS

Yield essential oils

Yield essential oils of C.a was found to be around 0.09 ± 0.01%. This is considered low compared to some plants already exploited industrially. According to the results quoted in the scientific literature, it is true that citrus fruits contain little essential oil. Essential oils obtained from the fruit of *Citrus reticulate*, *Citrus sinensis* and *Citrus paradisia* gave yields of 0.30 ± 0.01, 0.24 ± 0.01 and 0.20 ± 0.01 respectively [16]. The average yield of essential oils, of both *Citrus sinensis* and *Citrus aurantium* plants, calculated on the basis of dry matter found to be around 1.2% [17]. Fresh leaves essential oil (0.43%) were obtained with a higher yield than that from the skin (0.30%) and flowers (0.20%) [5]. A yield of 0.73% in essential oil from *Citrus aurantium* leaves obtained in the Chlef region [18]. The variability of essential oil yield can be related to several factors, geographical location, season, organ, species [19-20], extraction method [21]. and light as it also stimulates essential oil production [22].

Physico-chemical characteristics

The essential oils of the C.a fruit have a viscous, clear, white transparent liquid appearance. They are characterized by a refreshing odour characteristic of citrus fruits.

Physicochemical indices of essential oils of C.a

The physicochemical analyzes (relative density at 20°C, acid index, saponification index and ester index) are considered as parameters for characterizing and assessing the quality of essential oils or other fats. The results are summarized in table 1.

Table 1. Physicochemical indices of *Citrus aurantium* essential oils

Physicochemical indices	*Citrus aurantium*
Acid value (mg KOH/g oil)	44 ± 3.0
Saponification value (mg KOH/g oil)	46.75 ± 5.1
Ester index (mg de KOH/g)	2.75 ± 0.5
Density index	0.69 ± 0.1

In contrast, the relative densities at 20°C of three *Citrus* species essential oils obtained from the fresh fruit ranged from 0.815 ± 0.02 to 0.834 ± 0.02 [16]. A value of 0.863 of the relative density at 20°C was found in sour orange essential leaves [18]. The value of the relative density of

our sample is close to that found by Edogbanya et *al* (2019), who worked on the essential oil of the orange peel with D=0.67 to [23]. Relative density is a physical characteristic, widely used in the classification of essential oils; this data is still not sufficient for the identification of oils [24].

The acid value is a parameter that measures the amount of free fatty acids in the fat or oil [25], and also considered as an excellent means to determine its rancidity status [26]. Our results are strictly superior to those found by BrixiGormat et *al*, (2015), where they found a rate of 1.21 in the seeds of the same species, harvested in the Tlemcen region [27]. The acid value of the leaves of the same plant species was equal to 1.40. However, the ester index is equal to 12.25 [18].The AFNOR standard has set this index at a value less than or equal to 2 [24].

On the other hand, the saponification value was expressed as the sum of the acid number and the ester number. The amount of saponifiable units (acyl groups) per unit weight of fat gives the value of the saponification index. And consequently, a high value indicates a higher proportion of low molecular weight fatty acids. [28]. This parameter is quantified in the oil to measure the average molecular weight, it is also expressed in milligrams of potassium hydroxide per gram of oil tested (mg KOH /g of oil). Our results are low compared to those found in Egyptian *Citrus* seed oil which varied between 186.8 and 191.3 [29,30,25].

Essential oil analysis by GC/MS

The chromatographic analysis of C.a essential oils were grouped in table 2.

Table 2. Chromatographic analysis of C.a essential oils

Chemical compounds	Retention time (min)	Percentage (%)
Limonene	9.8	19 ± 3
Linalool oxide	11.8	10.7 ± 0.5
Linalol	13.2	43 ± 1.5
Terpineol alpha	18.7	11± 1
Unidentified compound	-	16.3

About the results observed the essential oils of this plant was rich in linalool with a percentage equal to 43 ± 1.5% followed by limonene (19 ± 3%). However, many compounds were not identified (16.3%). The results are very close to those observed in 2019 [9].

This can be explained by the proximity of the harvesting regions, because Mascara is located 60 km from the town of Relizane. Linalool (64.6% ± 0.04), α-terpineol (7.61% ± 0.03), (R)-limonene (6.15% ± 0.04) and linalyl acetate (5.02% ± 0.03) are characterized and found as major components in bitter orange flowers [31].

In parallel, the major components of Citrus aurantium essential oil leaves were linalyl acetate, linalool, α-Terpineol, geraniol and geranyl acetate [32].

The composition of essential oils is influenced by several conditions; climatic: temperature, light, water status and day length; cultivation: soil type, soil properties, soil fertility, sowing date, planting density, cultivation techniques and cultural practices: irrigation dose, mineral supply and fertilization. [33-36].

Biotechnological application of C.a essential oils as a preservative for beef mince.

The minced meat was subjected to sensory and microbiological analyses after being mixed with two different doses of C.a essential oils (5 µL and 15 µL). On the other hand, meat without EO is used as a negative control. The samples are coded as follows:

-Sam 1: minced meat without EO (negative control)

-Sam 2: minced meat with 5 µL of the EO added

-Sam 3: minced meat with 15 µL of EO added

Sensory analysis of minced meat —After 72 hours of incubation of the samples at room temperature, sam 3 remained intact in terms of appearance, colour and odour. However, macroscopic observation of sam 2 showed a slight degradation of colour and an unpleasant smell. Sam 1 was totally spoiled, a purplish colour, a foaming appearance while losing its consistency, and a rotten smell of the flesh (Fig 1).

Figure 1. Macroscopic appearance of the samples

Microbiological analysis

Figure 2 showed the count of TAMF, *Salmonella* and *Staphylococcus aureus*. In view of all the results of the microbiological analysis, samples 3 and 2 are not spoiled, given the acceptable number of TAMF (2×10^4 CFU/g and 4×10^4CFU/g) respectively and the total absence of *Salmonella* and the spoiling species, *Staphylococcus aureus*, because the Algerian official journal has set threshold values for TAMF (1.5×10^6-5×10^6CFU/g), *Staphylococcus aureus* (10^3-3×10^3 CFU/g) and a total absence of any trace of *Salmonella*. Similarly, the number of 10^4 *Salmonella* per gram of sam 1, and that of the total aerobic mesophilic flora (6×10^6CFU/g) indicate that its microbiological quality and sensory quality are totally degraded. C.a essential oil fruit can be used as a powerful preservative. Indeed, the TAMF constitutes a better indicator of overall contamination and reflects the

hygienic quality of any product through the microbiological information that it provides [37]. The addition of lemon essential oil to fresh cream has a slight effect on the bacterial flora (TAMF), but significantly reduces the number of yeasts.

This essential oil could not act as a preservative in fresh cream at concentrations of 0.125%; 0.25% and 0.5%, and it could not extend the consumption date of fresh cream after 48 hours of opening the jars [38]. Limonene was described as the majority component of *Citrus aurantium* essential oil (67.04%). This constituent contributes to the antibacterial efficacy of the tested essential oil towards microbial strains [39]. Our results are in agreement with those recorded by Frassinetti et al, (2011) where gram negative bacteria are highly susceptible to essential oils extracted from bitter orange tree [40].

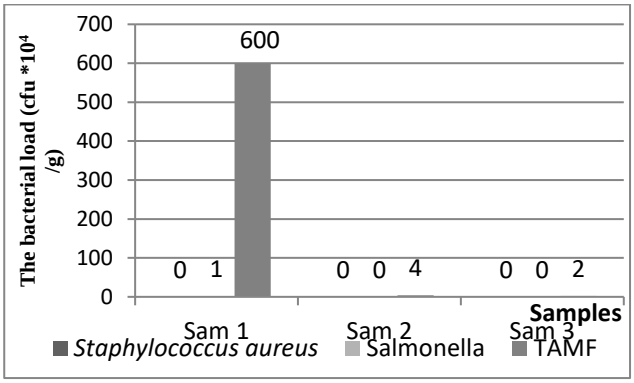

Figure 2. Enumeration of TAMF, *Salmonella* and *Staphylococcus aureus* in minced meat samples in CFU/g

4. CONCLUSIONS

The use of essential oils as antimicrobial agents has two main characteristics, on the one hand their natural origin which is a means of safety for humans and the environment and on the other hand, they do not cause any resistance to microbial germs.

The antimicrobial effect of *Citrus aurantium* essential oil can be widely used by industry as a preservative in many cosmetic, pharmaceutical and, food preparations as an alternative to chemical agents.

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DOI: 10.2478/agr-2024-0016

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

ASPECTS CONCERNING THE ECONOMIC EFFICIENCY OF FAMILY DAIRY CATTLE FARMS IN ROMANIA

Amalia-Gianina Străteanu[1], Mariana Sandu[1], Lavinia Udrea[2*], Vergina Chiriţescu[3]
[1]Center for Studies and Research for AgroForestry Biodiversity "Acad. David Davidescu", Romanian Academy, Calea 13 Septembrie, no. 13, 5th district, Bucharest, Romania
E-mail: strateanuamalia.research@gmail.com, marianasandu47@gmail.com,
[2]Valahia University of Târgoviște, Aleea Sinaia no. 13, Târgoviște, Romania
E-mail: moise_l74@yahoo.com
[3] Local Action Group Făgărașul de Sud - Ținutul Posadelor Domnești – Argeș
E-mail: v.chiritescu@yahoo.com
Corresponding author email*: moise_l74@yahoo.com

Abstract

The issue of the economic efficiency of family agricultural farms, the dairy cattle farms especially, has become more and more debated over the last few years, as the agricultural and small livestock farms need to be more and more productive in order to adapt to the eternal needs of the market, to the stronger price competition, the new environmental and socio-economic conditions. The dairy farming sector is strongly influenced by requirements regarding sanitary, ethical, animal welfare standards, and environmental factors in food production, processing, and marketing. The present scientific paper presents fundamental aspects regarding the economic efficiency of family dairy cattle farms breeding and modern development concepts of these farms in Romania`s conditions, as a European Union member country. A lot of specialized bibliographic sources have been used, as well as a lot of research reports, government programs for the development of the agricultural sector, feasibility studies, and technical-economic analyses of farms, in order to write this scientific paper.

Keywords: economic efficiency, family dairy farms

1. INTRODUCTION

The instability determined by the repetitive negative shocks created by the crises of the last 5 years or so will leave their long-term mark on the European Union, still at the same time, they represent a turning point for ensuring food security and increasing the resilience of the agricultural sector [8].
Unfortunately, the context of the current geopolitical evolution in Europe affects the E.U. and implicitly Romania, causing significant increases in production costs in all sectors of the economy.
Constraints of a formative, organizational, and technological nature leave their mark on the decisions taken within family farms, and thus economic efficiency, as far as milk cow farms are concerned, is an essential requirement for the production activity [1].
To obtain a significant competitive advantage and a high and efficient production, with a positive impact on the level of input allocation, a clear strategy is needed regarding the choice of the best options and the evaluation of the economic results within a farm.
It is absolutely necessary to find solutions for the development of livestock farms that meet the requirements of sustainable development, by implementing an integrated support system containing several work tools, starting from the strategic level of farm development and going up to analyze process and environmental technologies.
The work packages used must also include the analysis of "clean dairy productions", of "environmentally friendly" process technologies, the internal cost management system also considered from the environmental point of view, the alignment of technologies with BAT recommendations (best technologies available) integrated into the strategic model of the farm's sustainable development.
The tools for increasing eco-efficiency, such as the assessment of "clean dairy production" and environmental accounting, can be integrated into the strategic development model of the farm, so as to contribute to achieving its strategic objectives as quickly as possible, through the proactive component of which brings it as added value to the sustainable development model of the farm.
Small family farms are of great importance in Romania, because they reflect a way of life for a large part of the population living in the countryside, representing a form of ensuring daily living. In other words, the family farm is the basis of existence and should work on the principle of self-management - profitability - profit, namely from subsistence to profit [5]. Family dairy farms are those that ensure good utilization of resources, both natural and domestic. However, an important factor in the eco-efficient development of family dairy farms is their modernization, with a direct result in improving food sustainability. This not only contributes to food production that influences nutrition and health but also has a major effect on the local economy and social dynamics.
The national priorities in policies for the development and use of domestic animals, included in the Strategy for the development of the agri-food sector in the medium and long term 2020-2030 of the Ministry of Agriculture and Rural Development [6], are oriented toward the production and sustainable use of certain species and breeds with high productive potential, as well as for the maintenance and use of animal breeds in danger of abandonment,

simultaneously with the increase in production, the quality of the final products, respectively ensuring the competitiveness of family agricultural farms.
The continuation of the current practices and approaches at the farm level and the production sector would result in the inefficient use of resources and the decline of the Romanian milk and dairy products market, both at the national and European levels. Thus, Romania would no longer be able to persist in the development policies of family farms that do not ensure their own sustainability, the "exits" of process technologies being addressed, along with the consumption of resources and additional costs.

2. MATERIALS AND METHODS

This scientific paper addresses several fundamental aspects related to the issue of the economic efficiency of family dairy farms in Romania against the background of the increase in demand for food products and the current context characterized by a lack of fiscal predictability, economic instability, and uncertainties.
Thus, for the preparation of the work in good conditions and the correct presentation of the information related to the subject, the methodology used consisted of the comparative analysis of materials from specialized bibliographic sources, research reports, government programs for the development of the agricultural sector, studies of feasibility and technical-economic analysis carried out at farm level.
Also, within the comparative analysis, a series of data from the European Commission, the National Institute of Statistics, the Romanian Ministry of Agriculture and Rural Development, and EUROSTAT were used.

3. RESULTS AND DISCUSSIONS

The events that triggered the current economic and social crises demonstrated the vulnerability of the EU's food systems, implicitly Romania's, hence the importance of creating food autonomy. Even if from the point of view of structural characteristics, Romania presents a series of similarities with the agricultural sectors of the other EU member states and has a notable agricultural potential, unfortunately, the yields recorded in domestic agriculture are low, which indicates the much suboptimal use of production factors.
For these reasons, Romanian agriculture must optimally use all production factors and technological progress for sustainable productivity, which ensures economic growth and fair prices for consumers in rural areas.
The farm performance evaluation is mainly done by comparing the partial indicators of the operations that are currently carried out within the farm, and which directly target the quantity, cost and/or marginal profit of a given input per unit of production [2]. On this basis, identifying the factors that optimize the production efficiency of dairy farms is crucial in order to increase productivity and profitability and to protect animal welfare and the environment [4].
According to data provided by Eurostat, approximately 9 out of 10 of the 9.1 million farms existing in the EU are family farms, (where the agricultural workforce is exclusively family, ~ 57%, or at least half family workers, ~36%).
These farms dominate the structure of EU agriculture in terms of the number of holdings, ~93%. In Romania, the share of family farms was ~99% [14].
According to the 2020 agricultural census data in Romania, the numerical situation of family farms is as follows: farms with an exclusively family workforce 1,967,777 and farms where family workers represent 50% or more (but not 100 %), 893,704.

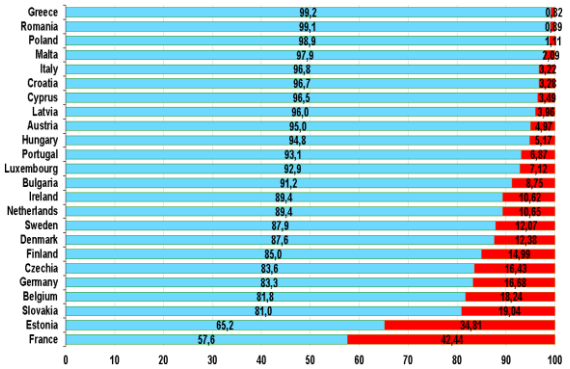

Figure 1. Distribution of farms in the EU, % of agricultural holdings - data for Spain, Lithuania, and Slovenia are not comparable with other Member States
Source: Eurostat (Agricultural Census, 2020) [16]

Regarding dairy farms in the EU, the vulnerability of farmers is caused by the fact that they are highly specialized, which leads to their income being dependent on a single commodity. The resistance to income shocks is influenced by increased price volatility. The economic survival of dairy farms is threatened by their reduced economic size, which directly influences growth rate and profitability [3].
The total production of raw cow milk produced on farms in the E.U. was 154.3 million tons in 2022, out of the total 160.0 million tons, i.e. ~96% cow's milk. From the total production of raw cow's milk produced in farms in the E.U., the amount of 145.6 million tons was delivered to dairies, and the remaining 8.7 million tons were either used on farms, consumed by the farmer and his family, sold directly to consumers, used as feed, or processed directly.
In concordance with existing statistics for an area with high potential, a dairy cow under these conditions should produce around 6,000 kg of milk per year. In the EU, the average milk yield/cow in 2022 increased, reaching 7,653 kg. Regarding average annual production in EU countries, Denmark and Estonia have the highest level, respectively 10 187 kg/cow and 10 128 kg/cow, and the lowest is registered in Bulgaria and Romania, equivalent to 3 621 kg/cow and 3 367 kg/cow (the lowest yield in the EU for milk production per cow) [13]. Also in 2022, the average monthly consumption of processed milk in Romania was 6.7 liters compared to the European average of 65-70 liters.
At this moment, the Romanian milk and dairy products market is insufficiently developed, mainly due to the reduced purchasing power, as well as the lack of education of the consumer. Under these conditions, the milk quota

allocated to Romania was only used to the extent of approximately 80%, which further increased the gap between the amount of milk that can be utilized at national level and the actual production of milk meeting the requirements of the E.U. To reduce this gap, it is necessary for Romanian cow farms, regardless of their organizational form or size, to continuously invest in the modernization of the technological process that leads to higher production, respectively to improve the quality of milk.

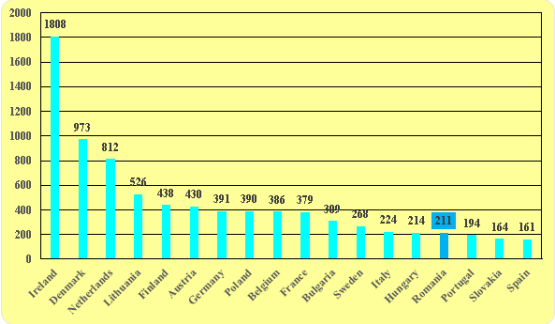

Figure 2. Total milk production per capita on 1 July 2021, in kg, in the E.U.

Source: INS - Statistical Yearbook of Romania 2023, table 23.22, page 711 [18]

The progress registered over time in the field of biotechnology allows a more precise selection of traits of socio-economic interest, resulting in the development of adaptable and efficient animals in terms of the quantity and quality of milk production.

3.1. Feasibility and opportunity of investments in family dairy farms in Romania

Analyzing the feasibility and opportunity of investments in family dairy farms in Romania, the following relevant aspects have been identified in terms of the sectoral level, market, labor force, favorable conditions, and local economies.

At the sectoral level, after a long period of stagnation and even regression, the production activity of dairy products is currently on an upward trend at the national level, this trend also being influenced by the tendency of increasing demand on the insufficient market satisfied by the offer of domestic producers and the increase in demands regarding the quality of food products and the increase in the consumption of domestic food products at the expense of imported products.

At the market level, the orientation of Romanian consumers' preferences towards whole milk and the increase in recent years at the national level of the demand for dairy products, as well as the consumption growth forecast at the level recorded in other EU countries are noteworthy. At the level of relief, soil, and climate conditions, the pedo-climatic conditions in most areas in Romania are quite favorable for the activities of raising and exploiting dairy cattle. The continental climate, with moderate amounts of precipitation and average annual temperatures of 10°-11° C, makes it possible to develop modern and competitive agriculture in most areas of our country, including in the milk cow breeding sector.

At the level of local economies and geographical positioning, it is recommended that family dairy farms near areas with high fodder potential be located, thus leading to the ensuring of the necessary raw fodder materials with minimal costs and effort. A very important element in the case of family-type farms is the fact that the profit recorded from the exploitation of dairy cows will be used for the development of the family farm, implicitly leading to an increase in the standard of living of its members.

The market for milk and dairy products is quite vast, taking into account both the main products obtained in family cow farms, namely milk and dairy products, but also the secondary products (calves, manure, residual products).

Besides, milk and dairy products are part of the category of consumer goods, of a food nature, being subject to a high frequency of purchase. Currently, the final consumers of cow's milk are divided into two main categories, namely: the village population that mainly consumes milk and dairy products from their production; the urban population that supplies itself mainly with products from the trade, lately there has been a significant increase in the share of purchases through supermarkets and hypermarkets, as well as an increase in the appetite for Romanian products. Under these conditions, store chains have become more and more interested in collaborating with Romanian milk and dairy producers, and for Romanian family farms, this can represent a definite opportunity for development. A very valuable natural fertilizer also results from the activity of family cattle farms. The amount of cattle manure per year is about 265 tons/average farm. Manure consists of manure and straw for bedding. This is the universal complex fertilizer for all agricultural crops and can be applied to all types of soil, which is an opportunity for capitalization and obtaining additional income for family dairy farms. This high-quality natural fertilizer is used on unstructured, humus-poor soils where it loosens and improves water retention, soil warming, and the activity of soil organisms.

In Romania, milk production is unevenly distributed across the territory. *The market for the production of collected cow's milk* by region is presented as follows: Central Region – 30.0%; North-West Region – 24.2%; North-East Region – 20.9%; South-East region with 9.5%; South-Muntenia region with 6.6%; Bucharest-Ilfov region with 4.9%; West Region with 2.3%; South-West Oltenia region with 1.6%.

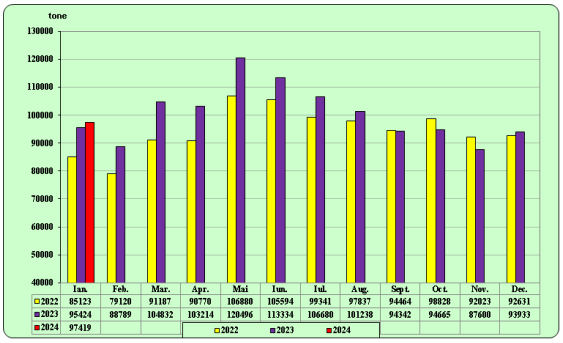

Figure 3. The dynamics of the amount of cow's milk collected by the processing units during Jan. 2022 – Jan. 2024

Source: INS - Collected cow's milk and production of dairy products [20]

The number of holdings producing cow's milk in Romania is approximately 900,000 units, with a total herd of 1,354,200 animals. The most numerous farms are those with 1-3 heads of cattle, representing over 85% of their total amount, and the vast majority of them are family farms.

The number of authorized sanitary and veterinary professional farms is 1.668 units. They own about 100,000 heads and deliver milk directly for processing, of which 889 have drawn up modernization programs for biosecurity, for the purchase of milk cooling and storage equipment and milking parlors.

In Romania, there are 223 cow's milk processing units, of which only 94 are compliant with European Union standards, and 51 factories are authorized to process compliant and non-compliant milk, without line separation. A single unit processes compliant and non-compliant milk on separate lines, and 77 units benefit from the transition period for alignment with all European Union standards, having restructuring programs. Currently, only 20% of the milk produced in Romania reaches factories for processing.

The Romanian consumer milk market, of almost 1.5 billion liters in 2022, offers three major types of products: ultra-pasteurized (UHT) milk; pasteurized milk, which, together with ultra-pasteurized milk, totals approximately 10% of the amount of consumer milk sold in Romania; unprocessed industrial milk, risky for the health of the consumer, but traditionally preferred and still having a huge share (almost 90%) in the milk sold in Romania. Raw milk also has a very important share in the subsistence trade of individual producers, being completely foreign to modern trade customs such as branding. UHT and pasteurized milk "belongs" to processing companies, smaller or larger. Brands (trademarks) in the true sense of the word only exist for UHT milk, probably because of its higher price, which allows financing a reasonable marketing budget.

As I mentioned, in Romania, the average monthly consumption of processed milk per person in 2022 was 6.7 liters, well below the European limit, the Romanian milk market is still insufficiently developed. Consumers' habit of unprocessed milk keeps many of them away from UHT milk and certified dairy products. None of the brands on the market today play a major role in educating the public about the taste and other qualities of processed milk.

In order to be able to face the rigors of an increasingly competitive market, dairy farms in the family system need to consider continuous development and making investments that allow obtaining quality products, in quantities that allow them to become constant, serious, and competitive local suppliers.

The price policy practiced by farms breeding dairy cows in the family system is based on practicing prices at an average level compared to those practiced by the competition for similar products. The strong competition that exists in the milk market limits the upward trend in prices that can be easily noticed in the case of other food products. In the case of family-run production units, the tendency for prices going up is very slow, this aspect having an impact on the entire set of competitors on the market who are in a position to go bankrupt under the conditions where they become unable to offer the products at the price set by the other market players.

To keep prices as low as possible, family dairy farms will try to permanently reduce their unit costs, both by using the most competitive technologies and by increasing labor productivity. In establishing and changing the price level, family farms will take into account several factors, the most important of which are: production and marketing costs, milk quality, market prices for similar products, the state of direct competition, the existing economic situation at the time, the legislation in force, etc. The average prices at which dairy products obtained from family-type cow farms are sold on the market are as follows: 1.4 lei/liter of milk + VAT; 15 lei/kg live calf + VAT; 60 lei/ton of manure. These are negotiable depending on the quantity purchased.

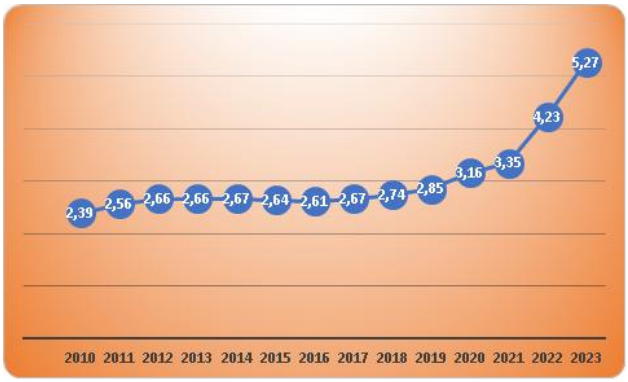

Figure 4. Dynamics of the price of fresh cow's milk sold on Romanian agro-food markets, (lei/liter)

Source: INS – TempoOnline [19]

According to the data provided by the European Milk Observatory [9] the average price of cow's milk at the farm gate in the EU in 2023, had a decrease of ~ 22%. There was also an approximately 18% price drop in Romania.

If in October 2022, the average price of milk in the E.U. for 100 kg was 56.64 euros, in the same month of 2023 it dropped to 44.2 euros, and in Romania, from 53.82 euros/100 kg it reached 44.18 euros/100 kg.

To calculate the price of a liter of milk, we must remember that 1 kg of milk = 0.97 l of milk. Thus, in the E.U., the price went down from 0.58 euro/liter to 0.45 euro/liter, in the same period of one year, and in Romania from 0.55 euro/liter to 44.18 euro/100 kg to 0.45 euro/liter.

3.2. Development directions of family dairy farms

Increasing the competitiveness of family dairy farms in Romania can be achieved through better use of resources (technical, material, human, environmental, etc.) and production factors, as well as the fulfillment of national and community quality standards.

In general, family farms adopt a system of housing dairy cows in free stalls, mechanized and semi-automated, characterized by the application of efficient cattle breeding methods. The constructive characteristics of zootechnical farms and the use of high-performance cattle exploitation technologies, with the permanent monitoring and verification of the quality of the obtained products and the state of health and well-being of the cows ensure the achievement of a high level of competitiveness for these farms in relation to similar holdings in other countries of the European Union.

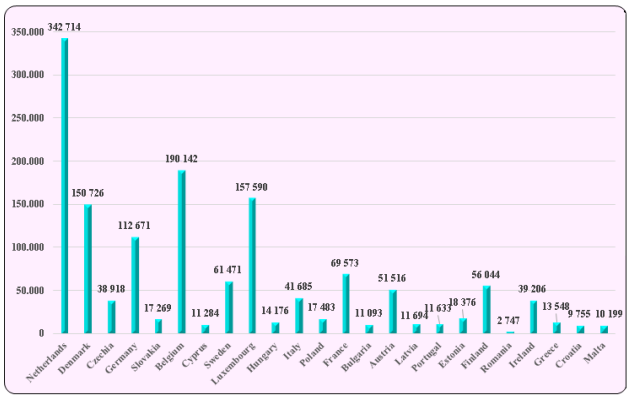

Figure 5. Average economic size of family farms in Member States, 2020 - agricultural - data for Spain, Lithuania, and Slovenia not comparable with other Member States
Source: Eurostat [15]

As can be seen from Figure 5, in Romania, the average economic output of a family farm was 2,750 euros in 2020, compared to an average of 165,456 euros for non-family farms. This suggests that many of the family farms in Romania should be considered subsistence farms [17].
Family farms strive to comply with national and European environmental protection requirements. For this purpose, within these farms, covered platforms are built for the storage of cattle manure and buried basins for the collection of liquid manure. In regard to the Community norms in the sanitary and sanitary veterinary fields, farms need to comply with the following standards for the protection of animals.
The *main directions of development of family dairy farms* are the introduction and development of new technologies and processes, diversification of production, and adjustment of the profile, level, and quality of production to market requirements. Thus, within family farms, an open system of exploitation of dairy cattle characterized by the application of efficient methods of feeding and automatic water supply can be adopted. Also, the technology of rearing dairy cattle in free stalls ensures a total area of min. 10 square meters of cattle, which creates optimal conditions for raising and exploiting animals. Resting areas for dairy and young cows can be provided with straw bedding.
Family dairy farms can have a high degree of automation of operations in the production flow. The production hall will be equipped with facilities that allow watering, maintaining, and regulating the microclimate. The technology used will allow high work productivity, rigorous sanitary-veterinary control, and high milk production thanks to the microclimate conditions that will be ensured: shelter ventilation, temperature, air humidity and lighting being regulated automatically and at optimal levels.
The facilities and equipment provided in the technological flow allow the exploitation and breeding of dairy cows to be carried out in optimal conditions. The new technologies used in the breeding and exploitation of dairy cows lead to the obtaining of quality products, to increased yields, under conditions of increased work efficiency and productivity. At the same time, through the use of these technologies, the aim is to achieve good working conditions for the staff working on the farm.
Adaptation of family farms to community standards. As regards the Community norms in the sanitary and sanitary-veterinary field, farms must comply with the following standards: minimum standards for the protection of farm animals; minimum standards for the protection of calves; meeting quality standards for raw milk. Investments in family farms must comply with Romanian legislation harmonized with European norms, respectively: meeting the standards for raw milk - Order no. 67/2009 on the approval of the Plan of measures to improve the quality of raw cow's milk [12]. In order to meet this standard, the farm will have a milk storage room equipped with a cooling tank for keeping the quantity of milk under its own conditions for a maximum of 24 hours. The milk cooling and storage process must ensure high milk quality, following national and European standards - Directive 89/362/EEC on general hygiene conditions on farms for milk production [10] and Directive 92/ 46/CEE establishing the sanitary-veterinary rules for the production and placing on the market of raw milk, thermally processed milk and milk-based products [11].
Milking is the single most important activity on a dairy farm. The management of the milking process aims to minimize bacteriological and physical contamination. The term milking refers to all aspects of the process of obtaining milk from cows quickly and efficiently while ensuring the health of the cows and the quality of the milk. Milking and milk storage processes will be carried out in such a way as to avoid any risk of milk contamination.
The disinfection of the shelter and premises will be carried out in such a way that there is no risk of introducing disinfectants into the milk or contaminating it - Order no. 868/2003 for the approval of the Veterinary Sanitary Norm regarding the Program of measures for the prevention of milk pollution, raw material with pesticide residues or substances used in agriculture and animal medical treatments [7].
Increasing the income of agricultural holdings by obtaining income from the sale of milk, calves at a maximum age of 3 months, as well as manure, given that dairy products respond to a growing demand identified on the market for domestic products.
In recent years, the orientation of Romanian buyers towards the consumption of dairy products has been noted. Romanian consumers are becoming aware of the fact that this food can become dangerous if it is not stored and

processed at the optimal temperature and if it is consumed after the expiration date.

Supporting members of producer groups or other associative forms in order to encourage the phenomenon of association between family-type dairy farms.

Economic-financial objectives. The main factors that allow for minimizing production costs and obtaining high economic profitability are: the semi-automated feeding and watering system will allow efficient use of feed consumption, avoiding feed waste; optimization of utility consumption necessary to ensure specific microclimate conditions through permanent monitoring of environmental factors (temperature, humidity, light, etc.); rigorous disease control as a result of the lack of feed and water contamination reduces medication costs and allows for quality milk production; high labor productivity due to the mechanization and semi-automation of the feeding and watering operations of dairy cows and the disposal of solid and liquid manure.

Environmental objectives. Thanks to the technology that will be adopted, the farm's activity will have minimal impact on environmental factors. The natural and automated ventilation system ensures a very good microclimate, refreshing the air in the production hall and thus significantly reducing humidity, odor, and NH3 emissions.

Use of local animal breeds. Maintaining genetic resources by increasing the number of adult breeding animals from traditional local breeds that are in danger of abandonment leads to the establishment of a source of valuable genes, well adapted to local and regional environmental conditions, which can provide a basis for continuous progress in breeding animal productivity, it can contribute to the diversification of existing populations at a certain time, it can contribute to restoring the vitality of selected lines and restoring resistance to diseases. Also, by encouraging the breeding of animals from local breeds in danger of abandonment, the local identity is preserved and the cultural-historical value of these breeds is preserved.

4. CONCLUSIONS

✓ Starting from the concept of Clean-Clever-Competitive (Clean-Clever-Competitive - 3C) promoted by the European Union, family farms must have as general objectives the development and implementation of an integrated support system to ensure the increase of economic competitiveness simultaneously with the improvement of environmental performance and the implementation of eco-efficiency tools.

✓ The increase in milk consumption per inhabitant and the achievement of a normal level for the conditions and resources of Romania, justify the investments in the branch of increasing the herds of milk cows and modernizing family-type farms. The milk deficit in the consumption of the population, and especially in the consumption of children and the elderly, amounts to over 40% of what is needed at the national level.

✓ Supporting the milk cow breeding sector, through investments in the purchase of cows for family farms and the organization of modern marketing structures in the rural environment is a strategic objective, aimed at ensuring the food security of the population and which must be considered at the regional and national level in the long term medium and long.

✓ Farms for raising dairy cows of the family type present a series of advantages, among which we cite: - credibility of the head of the farm, directly involved in its management; - cheap fodder, obtained including from own production; - stable customers and high demand in different deficient areas of the country; - the purchase of high productivity breed cows; - family participation in the farm activity; - the organization of a modern farm, of economic dimensions, which produces "ecological product" milk, which has a higher price and which can constitute a quality raw material for dairy products; - the purchase of some agricultural machinery and equipment for the performance of mechanized works in the production of fodder, the expenses for this sector being high due to the recourse to external services; - tracking the achievement of optimal ratios between specific consumptions and their conversion into products, between these consumptions and the dimensioning of expenses in such a way as to ensure obtaining a competitive price; - the achievement of advantageous prices for the producer, both as a result of selling milk on markets lacking in this product, and due to its superior quality; - strict compliance with production technology; - distribution of profit for development, so as to achieve the proposed strategic goals; - knowledge of the domestic legislation and the legislation of the European Union, to be able to benefit from the facilities created for dairy cow breeders and to comply with the regulations in force.

✓ The constructive characteristics of zootechnical farms for raising dairy cows in a family system, combined with the use of the most efficient cattle breeding technologies, with the permanent monitoring of the quality of the products obtained and the state of health and well-being of the animals can make this farm model one of the most modern and competitive cattle farms in our country, comparable in terms of economic performance to family dairy farms in other European Union countries.

✓ Romanian research can and must be a solution to the challenges of the food system, providing benchmarks and contributing through responsible innovation, fair and equitable transformation, based on principles of sustainable development and efficiency, to the development of milk-producing farms, a category in which cow farms also fall of family type milk.

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DOI: 10.2478/agr-2024-0017

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

THE INFLUENCE OF PHYSICAL-CHEMICAL PARAMETERS ON THE SENSORY EVALUATION OF SPARKLING WINES

A.A. Mihaela Dana Pop
Food Consultant PhD in Engineering Science
E-mail: winedoctorsrl@gmail.com

Abstract

Sparkling wines are wines obtained through the second fermentation of still wines, and they contain an overpressure of carbon dioxide formed during this process. Champagne is the most famous sparkling wine in the world, produced exclusively in the Champagne region of France using the bottle fermentation method, also known as the traditional or champenoise method. Another widely known sparkling wine is Prosecco, which is produced in the Treviso region of Italy using the Charmat-Martinotti method of fermentation in pressurized tanks. This article aims to provide an overview of the physico-chemical characteristics of sparkling wines made using the traditional method (such as Cava, Crémant, and Champagne) and some sparkling wines made using the tank method (such as Prosecco and Spumante), and to correlate these characteristics with the tasting notes specific to each type of sparkling wine.

Keywords: sparkling wines, sensory evaluation, physical-chemical characteristics, Champagne, Cava, Prosecco

1. INTRODUCTION. SPARKLING WINES HISTORY AND CLASSIFICATION. SPECIFIC WORDS

Sparkling wine is an alcoholic beverage bottled under pressure created by the presence of carbon dioxide obtained through fermentation.

Fizzing wine is an alcoholic beverage obtained by adding carbon dioxide through a process of pressure impregnation at low temperature.

In the sparkling wine industry, a series of established terms are used, most of which are borrowed from the French language. The most commonly used terms are:

Tirage liqueur: This is a mixture of base wine, sugar (or concentrated must), and yeast needed for the second fermentation. It is added to the wine before the second fermentation.

Expedition liqueur: This is a mixture of wine and sugar syrup (or concentrated must), which determines the sweetness (degree of sweetness) of the sparkling wine and is added before bottling.

Riddling (Remouage in French): This refers to the automatic agitation of bottles in vibrating racks or their manual turning on inclined wooden supports to move the yeast towards the neck of the bottle.

Disgorging: This is the process of removing the ice plug formed from the yeast sediment by freezing the neck of the bottle. The disgorging operation is applied only to sparkling wines produced by the traditional method and can be done manually or automatically. Along with the stopper, some of the sparkling wine is removed due to the pressure.

Figure 1. Manual disgorging in Champagne region (personal archive)

In Figure 1, a group of disgorgers can be seen performing manual disgorging in 1900 in the Champagne region of France. The picture was acquired from one of the antiquarian booksellers in Paris.

1.1. Small history of sparkling wines

1531 is the year when the first recorded sparkling wine in the world, named ***Blanquette de Limoux*** and was produced by the ***Benedictine monks*** of Saint Hilaire Abbey, near Carcassonne (France).

In 1668, the Benedictine monk from the Champagne region, ***Dom Perignon*** developed the method of obtaining sparkling wine. After visiting the monastery in Limoux, he introduced the process of disgorging, earning the title: ***Father of champagne***.

In 1895, ***Federico Martinotti*** patented a method for producing sparkling wine in pressurized tanks. This technique was further refined in 1907 by the French inventor ***Eugène Charmat,*** resulting in the modern Charmat-Martinotti Method.

In 1919, ***The Treaty of Versailles*** established that the term "***Champagne"*** could only be used for sparkling wines produced in the Champagne region of France.

1.2. Classification of the sparkling wines

The classification of sparkling wines can be made according to several physical-chemical parameters, a series of such classifications being presented below.

Depending on the carbon dioxide pressure in the bottle, measured at a temperature of 20^0C, considered the temperature at which the physical-chemical values are stable, there are:

- Standard sparkling wine - pressure min 3 bar
- Quality sparkling wines - minimum pressure 3.5 bar
- Petiant (frizante) wines - pressure 1-2.5 bar

Depending on the sugar content, sparkling wines can be classified as in table 1.

Table 1. The sugar content of sparkling wines

English language	French language	Residual sugar (g/l sugar)
Brut Nature	Dosage Zero	under 3g
Extra Brut	Extra Brut	until 6g
Brut	Brut	until 15g
Extra Dry	Très Sec	12-20g
Dry	Sec	17-35g
Medium Dry	Demi Sec	33-50g
Sweet	Doux	over 50g

Depending on the style of the base wine, Figure 2 illustrates the quantities associated with the type of wine used to produce these sparkling wines.

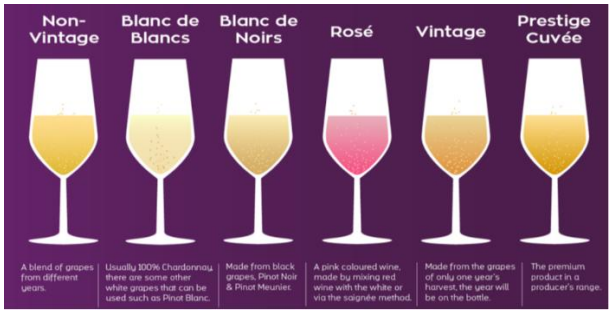

Figure 2. Classification according to the type of base wine

The most complex classification is the one according to the method of obtaining the sparkling wine and the origin of the carbon dioxide (exogenous-endogenous).

1. ***The Rural Method (Ancestral Method)*** Carbon dioxide is produced during fermentation in the bottle, without removing the yeast. The grape juice is kept sweet before the fermentation is complete and is then placed in bottles where it ferments and is delivered without removing the yeast. (Moscato Spumante, Clairette de Die, Blanquette de Limoux)
2. ***The Charmat-Martinotti Method (Tank Method)*** Carbon dioxide is produced during the second fermentation in pressurized tanks. Young wines are enriched with sugar and yeast (*liqueur de tirage*) in a pressure-resistant tank where the second fermentation occurs. The resulting carbon dioxide is retained in the wine. (Prosecco, Frizzante, Lambrusco)
3. ***The Traditional Method (Champenoise Method)*** Carbon dioxide is produced during the second fermentation in the bottle, with the yeast being removed. (*Crémant, Cava, Franciacorta, Champagne*)
4. ***The Method for Producing Fizzing Wine*** with added Carbon Dioxide**.** Carbon dioxide is added during the pressurized impregnation process, directly into the bottle.

2. SPARKLING WINES PRODUCTION METHODS

The production method of sparkling wines involves several applied methods, shown concise in Figure 3, namely:
• Classical fermentation in the bottle or Champenoise method (traditional)
• Fermentation in the bottle then transfer to the technological vessel and then re-bottling in the bottle or the Transvasier (transfer) process
• Fermentation in tanks or the Charmat Martinotti method

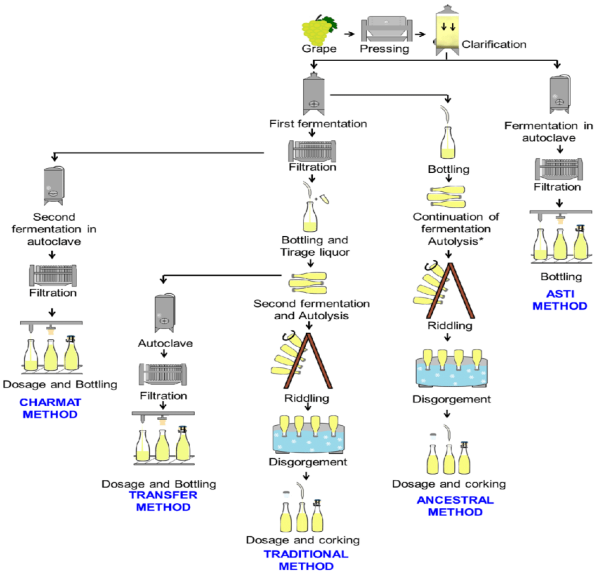

Figure 3 Sparkling production methods

3. SPARKLING WINES CHARACTERISTICS

Below will be described some types of sparkling wine on the world market and their main characteristics:
Champagne - the grape varieties allowed to be used to make champagne are: Pinot Noir, Pinot Meunier, Chardonnay, and the base wines come only from the Champagne region. The 2nd fermentation takes place in the bottle, by the traditional method with keeping at least 15 months in the bottle. The pruning of the wine and the maximum yield per hectare must be respected, as well as the pressing yield.
Cremant is produced in other production regions from France, namely: the Loire Valley, Bordeaux, Bourgogne, Limoux and Alsace. The 2nd fermentation takes place in the bottle, by the classic method with at least 9 months of storage on the yeast. There are Cremantes with different designations of origin: Appellation d'Origine Contrôlée (AOC) and Appellation d'Origine Protegé (AOP) .
Prosecco is obtained by the Charmat method, in the Treviso production area (DOC designation) near Valdodiabene, Asollo (DOCG designation). The local Glera grape variety is used in proportion to a minimum of 85% to produce a lighter sparkling wine (11% vol alc) that has become famous throughout the world.

Cava is a sparkling wine obtained by the 2nd fermentation in the bottle, by the traditional method. It is made in different regions of Spain, most often in the region of Penedes, Catalonia (DO Cava). Local grapes are used as grapes: Xarel-lo, Parellada, Macabeo, Grenache.

3.1. Physical-chemical characteristics of sparkling wines

Physical-chemical characteristics of some sparkling wine made by traditional method or by Charmat method are presented in the tables below. These results were taken from bulletins of analysis from some producers of such sparkling wines and were carried out in specialized and accredited laboratories in their countries of production (France, Italy, Spain).

Table 2 Physical-chemical characteristics of sparkling wine made by traditional method

Traditional method	Cava	Champagne Premier Cru	Champagne Grand Cru	Cremant Loire Valley
Alcoholic streght by volume, % vol alc	11.3	12.39	12.66	12.1
Total acidity exp in sulphuric acid, g/l	3.7	4.2	3.81	5.3
Volatile acidity exp in acetic acid, g/l	0.1	0.17	0.26	0.19
pH	3.1	2.97	3.15	3.27
Sugar level (glucose+ fructose), g/l	7	9.1	2.1	31.5
Total sulphur dioxide mg/l	90	67	57	72
Overpressure of carbon dioxide at 20 ^{0}C, atm	6.2	6.2	7.8	4.7

Table 3 Physical-chemical characteristics of sparkling wines made by Charmat method

Charmat Method	Pinot Grigio Spumante	Prosecco Rose Millessimato	Prosecco Brut DOCG	Prosecco Extradry DOC
Alcoholic streght by volume, % vol alc	12.03	10.87	11.21	11.09
Total acidity exp in tartric acid, g/l	6.71	5.56	5.68	5.35
Volatile acidity exp in acetic acid, g/l	0.18	0.18	0.17	0.15
pH	3.35	3.2	3.2	3.24
Sugar level (glucose+ fructose), g/l	10.6	12.3	9.4	14.35
Total sulphur dioxide mg/l	122	150	164	163
Overpressure of carbon dioxide at 20 ^{0}C, atm	4.5	5.5	4.7	5.9

For deeply analysis of these parameters there are drawn some graphics which are presented mirror like, for a better understanding:

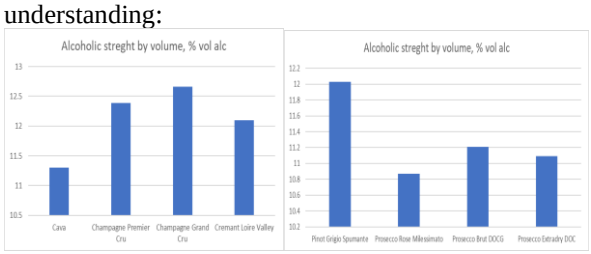

Figure 4. Alcoholic strength by volume, % vol alc.

As you may see the alcoholic strength of both types of sparkling wines are quite appropriate being spread between 10,8 and 12,5% vol alc, values which cannot influence much the sensory properties of these wines.

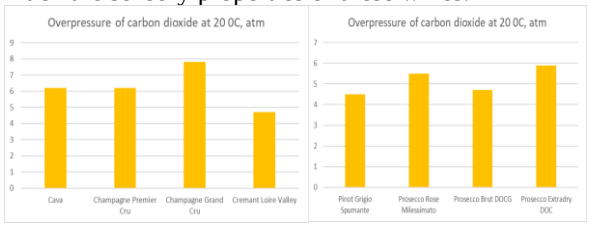

Figure 5. Overpressure of carbon dioxide at 20^{0}C in atm

The overpressure of carbon dioxide measured at 20°C ranges between 4.7 and 7.8 atm, being higher for sparkling wines made using the traditional method compared to those made with the Charmat method. This parameter influences the sensory characteristics, such as the smoothness and creaminess of the bubbles. When the pressure is higher, the bubbles are smaller and more numerous, whereas, when the pressure is lower, the bubbles are larger.

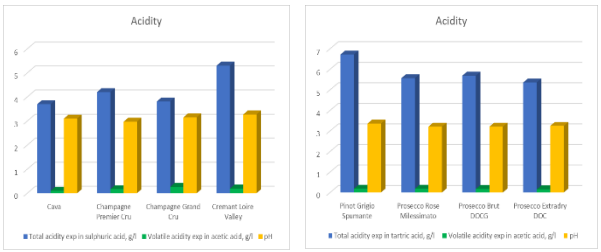

Figure 6. Acidity expressed in different parameters

In Figure 6, the acidity of sparkling wines is expressed as total acidity in sulfuric or tartaric acid, volatile acidity in acetic acid, and pH units. These values are very close for volatile acidity and does not significantly influence the sensory characteristics. The pH values range between 2.97 and 3.27 for sparkling wines made using the traditional method, and between 3.20 and 3.35 for sparkling wines made using the Charmat method. This indicates that the pH can be more easily controlled during the Charmat method. The total acidity is lower in the case of sparkling wines with a higher sugar level and higher for sparkling wines with a lower sugar level, in order to maintain the optimal palatability sensation.

3.2. Sensory characteristics of the sparkling wines

The sensory characteristics of the sparkling wines obtained by the 2 methods are presented in the 2 figures below, depending on their method of production.

The maximum rating scale used for this sensory evaluation was 20 points for each analyzed parameter, with a total of 100 points for each sparkling wine.

Figure 7. Grafic representation of sensory charateristics for spakling wines made by traditional method

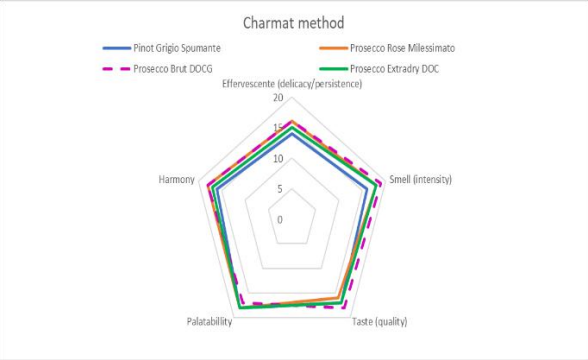

Figure 8. Grafic representation of sensory charateristics for spakling wines made by Charmat method

The sensory analysis of sparkling wines produced by these two methods was conducted by trained tasters, participants in international-level specialized juries.

From these two figures, it can be observed that the sensory characteristics of the two types of sparkling wines are not significantly different, just as the physico-chemical parameters presented in the previous chapter were not.

Taste, aroma, and overall harmony were the most appreciated sensory characteristics of sparkling wines made using the traditional method. This can be attributed, in part, to the physico-chemical values, such as acidity and sweetness, but these characteristics also depend on the length of time the yeast remains in the bottle. The longer this period, the greater the aromatic and taste complexity.

For sparkling wines made using the Charmat method, the values of sensory characteristics are lower, but much closer to one another due to the better homogenization achieved with this method, making the parameters more consistent.

In this case, there is no talk of aromatic complexity, but rather a freshness of taste and aroma—qualities that are highly appreciated in these sparkling wines. The parameters are particularly influenced by their acidity, which is usually higher.

4. CONCLUSIONS

Sparkling wine is an alcoholic beverage bottled under the pressure created by the presence of carbon dioxide, which is obtained through fermentation.

The first sparkling wine in the world appeared in France in 1531, and since then, it has delighted us with its bubbles—more or less pronounced—its bright white and sparkling rosé colors, and sometimes even red, as well as a taste with increasing complexity depending on the number of years the yeast ages in the bottle.

The alcoholic strength of both types of sparkling wines is quite appropriate, ranging between 10.8% and 12.5% alcohol by volume, values that do not significantly influence the sensory properties of these wines.

The overpressure of carbon dioxide, measured at 20°C, is higher in sparkling wines made using the traditional method compared to those made using the Charmat method. This parameter influences the sensory characteristics, particularly the smoothness and creaminess of the bubbles, which are smaller and more numerous when the pressure is higher, and larger when the pressure is lower.

Volatile acidity values are appropriate for both types of sparkling wine and do not influence the sensory characteristics.

Total acidity is lower in sparkling wines with a higher sugar content and higher in sparkling wines with a lower sugar content, in order to maintain an optimal sensation of palatability.

Taste, aroma, and overall harmony—being the most appreciated sensory characteristics of sparkling wines made using the traditional method—are influenced to a small extent by physical-chemical factors such as acidity and sweetness. However, these characteristics also depend on the length of time the yeast is kept in the bottle.

The longer this period, the greater the aromatic and taste complexity.

In the case of sparkling wines made using the Charmat method, we cannot speak of aromatic complexity, but rather of a freshness in taste and aroma—qualities that are highly appreciated by consumers and can be directly influenced by their acidity, which is usually higher.

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DOI: 10.2478/agr-2024-0018

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

THE EFFECT OF PESTICIDE AND INSECTICIDE USE ON ORCHARD SOILS – A CASE STUDY OF ORCHARDS IN DAMBOVITA COUNTY

Anca Irina Gheboianu, Liviu Olteanu
Institute of Multidisciplinary Research for Science and Technology, Valahia University of Targoviste,
13, Sinaia Alley, 130004, Targoviste, Romania
E-mail: anca.bancuta@valahia.ro

Abstract

In the early 2000s, the European Commission laid the groundwork for soil protection with a report titled "Towards a Thematic Strategy for Soil Protection"[1]. This report outlined guidelines for preserving and enhancing soil quality. As a result, understanding the levels of heavy metals in soils and their sources became a key priority for the European Union. The main objective of this study is to investigate the effect of pesticide and insecticide use on the soils of the main orchards in Dambovita County. Using WDXRF spectrometry, the elemental concentrations of As, Cd, and Pb were determined in samples collected from 10 points located in the main orchards of Dambovita County. The distribution maps obtained, as well as the comparisons made with the maximum allowable limits of pollutant elements in soils, demonstrated the impact that pesticide and insecticide use can have on soil.

Keywords: heavy metal content, fertilizers, pesticides, orchard soil, analysis

1. INTRODUCTION

Dambovita County, located in southern Romania, is nationally recognized as a major fruit producer. The area is one of the country's most important fruit-growing regions, contributing significantly to Romania's fruit production.

The most widespread types of orchards in the region are apple and plum trees. In recent years, with the increase in fruit imports (especially apples), local producers have also shifted towards other types of fruit trees: cherries, sour cherries, peaches, nectarines, and pears. Thus, Dambovita County is an important area for Romanian horticulture, with a rich tradition and great potential for the future.

To combat pests and specific diseases, as well as to maximize production, fruit producers widely use various insecticides and pesticides.

The use of pesticides and insecticides in agriculture can have a significant environmental impact, especially on soil, water, and biodiversity. The effects of these substances on soil pollution include, among other things, soil contamination, degradation of its quality, negative impacts on beneficial soil microorganisms, harmful effects on human health, and an increase in pest resistance, which harms plant health.

Pesticides and insecticides applied to crops often end up in the soil, where they can inhibit natural soil processes, such as the activity of microorganisms essential for soil fertility and structure.

Long-term pesticide use can affect the soil's structure and composition, reducing its ability to retain water and support plant and organism life. Pesticides also affect soil pH, which can influence plant growth and reduce soil biodiversity.

Some pesticides, such as those in the organochlorine class, are resistant to degradation and tend to accumulate in soil, plants, and animals. These chemicals can move up the food chain, affecting not only agricultural crops but also wildlife and, ultimately, humans.

Soils contaminated with pesticides can impact human health through food grown on such land.

Pesticides can enter plants and reach the food chain, exposing the population to risks such as chronic diseases, hormonal disorders, or even cancers.

The study of heavy metals in orchard soils is a field of interest for researchers in agriculture, environment, and public health, due to the potential impact on human health and biodiversity.

On this subject, Wang, Q., et al. [2] conducted a review on the accumulation of heavy metals such as Pb, Hg, As, and Cd in orchard soils and emphasized the importance of regular monitoring and risk assessment regarding the health of the fruits and the consumers. Additionally, Shan, C, et al. [3] analyzed the effects of long-term fertilization and agricultural practices on the accumulation of heavy metals in orchard soils. Their research highlighted the role of organic and inorganic fertilizers in heavy metal pollution. Rashid, A., et al. [4] investigated the mobility and bioavailability of heavy metals such as cadmium and lead in irrigated orchard soils, as well as how different soil amendments (organic compounds, biochar) can reduce the risks associated with heavy metal pollution.

A similar study was conducted by Liang, Q., et al. [5], who explained in their article how long-term pesticide application can increase the concentrations of heavy metals, particularly arsenic and lead, in orchard soils. Masakazu Aoyama, Ryo Tanaka, [6] also investigated the mechanisms of metal absorption by plants and the effects on fruit quality.

In Dambovita County, a previous study on the effects of insecticide and pesticide use on apple and plum orchards was published by Gheboianu et al. [7], but the current study refers only to the accumulation of heavy metals in the soil.

These examples illustrate the various sources of heavy metal contamination, including agricultural practices, pesticides, and fertilizers, and their potential negative effects on the environment and food safety.

2. MATERIALS AND METHODS

Material

The soil samples were collected trimestral from the monitored orchards located in Dambovita County.

The samples was collected at different depths (from the soil surface - 0 cm, 10 cm, 20 cm, 30 cm). Below, we present the sample coding (Table 1) as well as the location map (Figure 1).

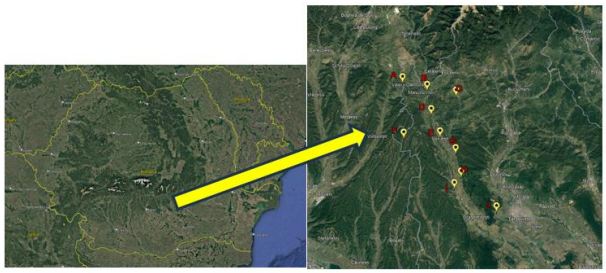

Figure 1. Location of the studied area

Table 1. Sample list details

No.	Location (Dambovita County)	GPS coordinates of the sample		Sample code		Sampling depth
		Latitude N	Longitude E			
1	Văleni	45° 9' 45.9354"	25° 10' 13.2888"	A	A0	0 cm
					A1	10 cm
					A2	20 cm
					A3	30 cm
2	Malu cu Flori	45° 8' 44.1276"	25° 11' 52.2738"	B	B0	0 cm
					B1	10 cm
					B2	20 cm
					B3	30 cm
3	Bărbulețu	45° 8' 18.6504"	25° 17' 26.5842"	C	C0	0 cm
					C1	10 cm
					C2	20 cm
					C3	30 cm
4	Gemenea - Brătulești	45° 6' 13.4274"	25° 13' 32.8146"	D	D0	0 cm
					D1	10 cm
					D2	20 cm
					D3	30 cm
5	Voinești	45° 3' 43.8258"	25° 14' 55.791"	E	E0	0 cm
					E1	10 cm
					E2	20 cm
					E3	30 cm
6	Valea Mare - Cândești	45° 3' 34.0302"	25° 9' 15.4686"	F	F0	0 cm
					F1	10 cm
					F2	20 cm
					F3	30 cm
7	Izvoare	45° 1' 50.7606"	25° 17' 22.8906"	G	G0	0 cm
					G1	10 cm
					G2	20 cm
					G3	30 cm
8	Gheboieni	44° 59' 12.9402"	25° 18' 14.31"	H	H0	0 cm
					H1	10 cm
					H2	20 cm
					H3	30 cm
9	Mănești	44° 57' 54.3456"	25° 17' 11.385"	I	I0	0 cm
					I1	10 cm
					I2	20 cm
					I3	30 cm
10	Priseaca	44° 55' 17.7198"	25° 23' 46.8348"	J	J0	0 cm
					J1	10 cm
					J2	20 cm
					J3	30 cm

Method description

For wavelength dispersive X-ray fluorescence (WDXRF) analysis, we used the WDXRF Supermini 200, Rigaku - Japan, available at ICSTM-UVT. The spectrometer is equipped with 12 places automatic sampler, and 3 position crystal changers. The detection limit is 1ppm - 10ppb and the precision is about 0.1-0.5%. X-ray fluorescence spectrometry (XRF) is a quick and efficient method for determining the concentrations of heavy metals in soil. This analytical technique can analyze a wide range of elements, oxides, and other compounds from oxygen (O) to uranium (U). XRF works by bombarding a sample with high-energy X-rays.

This causes the atoms in the sample to lose electrons from their inner shells. To fill these vacancies, electrons from the outer shells move inward, emitting characteristic X-ray radiation that is unique to each element. The intensity of this radiation is directly related to the concentration of the specific element within the sample.

All samples were transported to the laboratory, where they were dried in an oven for 24 hours at 45 °C. To measure the heavy metal content, representative samples of each soil were carefully ground into a fine powder using an agate mortar and pestle. The powdered samples were then stored in airtight containers.

For the analysis, approximately 2 g of powdered sample was used. This was mixed with 2 g of Boreoux binder (Fluxana) and homogenized, resulting in a 4 g pellet made using a Testchem pellet press with a pressure of 250 kN.

Soil pH measurements were conducted at room temperature for all samples. A 1:2.5 soil-to-water suspension was prepared, and pH was measured using an Inolab Multi 9430 meter (WTW) with automatic temperature compensation. The pH sensor model IDS SenTix 980 had an accuracy of 4.10-3 (Table 2).

Iso-concentration maps, which visually represent the spatial distribution of the elements analyzed in the soil samples, were generated using Surfer 9.0 software.

3. RESULTS AND DISCUSSIONS

Multivariate data analysis was employed to identify a potential common source for heavy metal contamination. Table 2 summarizes the pH measurements and the concentrations of arsenic, cadmium, and lead at all sampling locations. Figures 2-5 present the iso-concentration maps created for each depth level of soil sample collection.

Table 2. The contents of heavy metals (mg kg^{-1} DW) in soil samples, pH, EC

Sample code	pH	As	Cd	Pb
A0	6.69	28.81±1.32	63.42±0.62	19.35 ± 0.75
A1	6.83	29.34±0.84	67.88±1.28	19.82±0.85
A2	6.98	29.55±1.12	70.24±1.80	20.25±0.80
A3	7.09	30.41±1.26	71.08±2.04	20.55±0.75
B0	7.43	23.72±0.82	809.50± 3.86	54.15 ± 0.75
B1	7.49	24.88±1.04	824.34±4.66	55.10±0.85
B2	7.56	25.63±1.26	840.60±9.20	57.05±0.65
B3	7.69	27.03±1.28	861.28±9.84	57.85±0.85
C0	7.32	22.56±1.30	685.34±4.76	73.80±0.40
C1	7.40	23.42±1.62	690.88±6.76	75.05±0.50
C2	7.51	25.08±1.88	694.46±7.10	75.95±0.60
C3	7.68	27.12±1.64	702.32±7.40	76.25±0.55
D0	6.98	19.88±1.26	149.71±4.90	97.85±0.80
D1	7.07	21.04±1.14	153.63±3.24	98.45±1.00
D2	7.12	23.16±1.50	159.18±3.82	99.05±0.85
D3	7.25	24.95±1.45	162.44±4.10	99.55±0.75
E0	7.17	17.36±0.88	409.64±7.24	123.75±1.45
E1	7.23	18.90±0.76	412.35±5.20	124.55±2.50
E2	7.35	19.64±0.60	418.68±6.14	125.40±2.00
E3	7.37	21.72±0.94	423.80±5.8	126.80±1.55
F0	7.31	12.66±0.68	123.75±1.60	105.95±0.65
F1	7.46	13.84±0.90	131.46±2.32	106.25±0.55
F2	7.53	14.35±1.15	139.80±4.24	106.95±0.85
F3	7.71	15.08±1.22	144.65±3.60	107.35±1.05
G0	7.16	9.55±0.65	60.72±0.88	84.40±0.45
G1	7.29	10.73±0.82	62.41±1.30	84.90±0.55
G2	7.38	12.08±1.14	64.82±1.44	85.40±0.65
G3	7.47	13.36±0.94	66.94±1.30	85.95±0.50
H0	7.21	8.92±0.46	17.80±1.98	40.80±3.75
H1	7.35	9.85±0.60	19.12±1.76	41.35±1.05
H2	7.43	10.70±0.80	21.63±2.08	41.95±1.25
H3	7.51	12.06±1.08	22.84±2.32	43.05±1.05
I0	6.78	6.82±0.86	11.47±1.14	24.15±0.25
I1	6.86	7.65±0.66	12.80±1.40	24.85±0.55
I2	6.97	8.48±0.88	14.92±1.36	25.35±0.65
I3	7.15	9.22±1.06	16.84±1.10	26.05±0.55
J0	5.73	4.76±0.38	46.96±0.72	17.65±1.80
J1	5.92	5.32±0.50	48.22±1.10	18.55±0.90
J2	6.02	6.08±0.84	49.64±1.44	19.05±1.05
J3	6.24	7.16±0.86	51.86±1.38	19.45±1.35

The data are reported as the average value plus or minus the standard deviation (SD) calculated from three separate measurements.

*DW = dry weight.

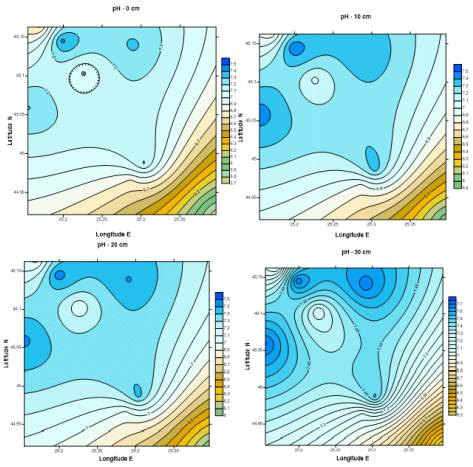

Figure 2. Iso-concentration maps showing the spatial variation of pH at different sampling depths

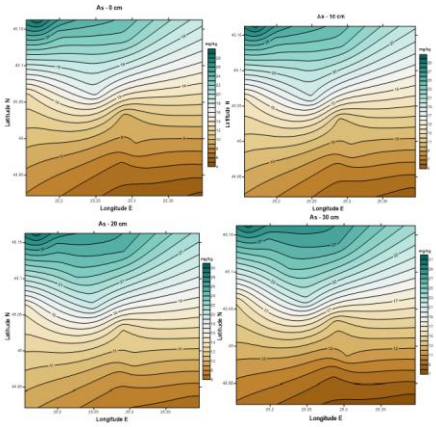

Figure 3. Iso-concentration maps illustrate the spatial distribution of As concentrations at different sampling depths

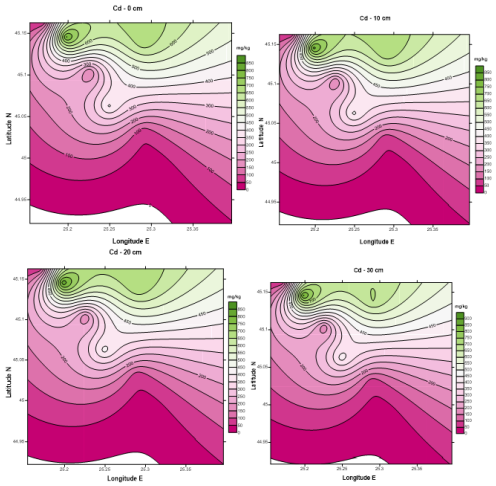

Figure 4. Iso-concentration maps illustrate the spatial distribution of Cd concentrations at different sampling depths

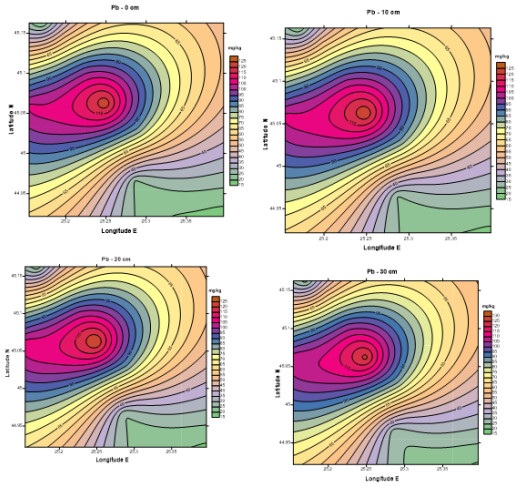

Figure 5. Iso-concentration maps illustrate the spatial distribution of Pb concentrations at different sampling depths

In general, pesticides approved in Romania by the National Phytosanitary Authority and the Ministry of Agriculture and Rural Development consist of the following main components: active substances (chemical compounds that have the desired effect on harmful organisms such as organophosphates, carbamates, pyrethroids, neonicotinoids, herbicides, fungicides), solvents and additives (organic solvents such as xylene, ethyl acetate, and stabilizers and wetting agents), and inactive ingredients – which assist in the application of pesticides (dispersing agents and surfactants).

Correlations were observed between the levels of heavy metals in the soil samples and the types and quantities of pesticides and fertilizers used in the corresponding regions.

From the data obtained, the accumulation of elemental concentrations can be observed as the depth of soil sample collection increases. Additionally, the decrease in latitude from North to South also highlights a decrease in the elemental concentrations of the heavy metals studied, as well as in the pH value.

4. CONCLUSIONS

Solutions for reducing negative impact:

• Organic farming: Using natural pest control techniques and avoiding chemical pesticides helps maintain soil health.

• Crop rotation: Alternating crops in different seasons can reduce the need for pesticides and help restore soil nutrients.

• Biopesticides: The use of biological pesticides (which break down more easily in the environment) is a safer alternative for protecting the environment.

Reducing the negative environmental impact of agriculture [8] is essential for maintaining natural balance and protecting resources in the long term. Practices such as organic farming, crop rotation, and the use of biopesticides represent effective and sustainable solutions. These measures not only improve soil and plant health but also contribute to protecting biodiversity and the quality of water and air. Implementing these strategies is an important step toward more responsible and environmentally friendly agriculture.

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DOI: 10.2478/agr-2024-0019

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

ANALYSIS ON IMPROVING THE PROCESS OF GROWING MEAT CHICKEN IN THE CONTEXT OF PRODUCTION OPTIMIZATION

Lavinia Udrea[1], Amalia Gianina Străteanu[2], Mariana Sandu[2]

[1]Valahia University of Targoviste, 13, Sinaia Alley, 130004, Targoviste, Romania
[2]Romanian Academy, Center for Studies and Researchers of Agroforestry Biodiversity, 13, Calea 13 Septembrie, 5th district, Bucharest, Romania
E-mail: moise_l74@yahoo.com

Abstract

The breeding and management of birds has represented throughout history the main occupation with regard to obtaining as quickly as possible, quantitatively but also qualitatively, valuable animal products high economic. During the study, the technological circuit within the production hall for raising broilers was monitored, in terms of managing microclimate factors in direct correlation with physiological needs of broilers as well as the evolution of hybrids, from the moment of population until reaching the specific marketing age, The proposed objective was to present the advantages of the stage rearing system to the detriment of the classic system, on permanent litter. Although this new model is not very popular among large farms due to the high implementation costs, it offers significant advantages regarding broiler health, microclimate conditions, easier manure disposal operations and shorter time required for preparation. of the rearing rooms until the next population. Ventilation, insulation or heating are the primary parameters regarding the adaptability of the chicks to the exploitation conditions. Neglecting any such factor can jeopardize the smooth running of the activity and can negatively affect biosecurity.

Keywords: resources, chicken, management, ventilation, process

1. INTRODUCTION

In zootechnical practice, the success of modern farms, regardless of the zootechnical sector we are referring to, is influenced by the ability to manage their own resources, capitalize on opportunities, the ability to coordinate the various unfavorable situations and risks that may arise. To achieve performance objectives, the presence and involvement of farmers with a vision focused from the outside inward, willing to take risks and act precociously in the new tendencies of evolution of the external environment, assuming careful research of all components, the effect of application in relation to the market and the production unit, but also the interaction of all these aspects, is necessary. The poultry industry and poultry meat production are essential components of the global food system, with chicken meat consumption continuing to grow significantly in recent years, in direct proportion to the global population growth, with food demand and accessibility increasing in the second half of the 20th century.

In this regard, broiler farming has become an important area of research and development to improve production efficiency and quality, playing a crucial role in meeting global demand. Poultry meat is one of the most important sources of affordable and nutritious animal protein.

The breeding and exploitation of poultry is primarily determined by the need to transform plant products into products of animal origin, the transformation process involving both the consumption of material resources and human labor, determining the increase in the value of zootechnical products.

The performance of poultry farms is influenced by their ability to integrate into their environment, the capacity of actions to capitalize on opportunities, the power to deal with unfavorable situations and the risks they face. Successful farms must have a vision oriented from the outside inward, the effective reporting to the trends of evolution of the external environment presupposing the careful research of all its components, the interaction between them, as well as their impact on the market and obviously on the activity of the production unit. Therefore, for the production and technology of large quantities of poultry meat, throughout history, traditional extensive breeding has been replaced by industrial exploitation, in order to uniformly satisfy different demands, by applying efficient and rapid management. For the proper functioning of a broiler farm, it is necessary to plan and follow the stages and processes: sanitation of the shelter, preparation and installation of stages, inspection of heating installations and systems, lighting, ventilation and watering, transfer of chicks and stocking of the shelter, examination of the chick population, daily recording of events (sanitary control, feeding and equipment maintenance). All these actions must be carried out by well-trained personnel, capable of managing and intervening immediately when the situation requires it, in order to prevent possible malfunctions in the equipment or systems and to maintain the welfare of the chicks in optimal parameters.

2. MATERIALS AND METHODS

The paper makes an x-ray of the data existing in the specialized literature regarding the raising of broiler chickens. The costs necessary for carrying out the activity of raising chickens have been significantly reduced in the last decades thanks to experimental

techniques and efforts made following zootechnical improvement practices correlated with innovations in the field of genetics. Building a production area in the poultry sector is a complex and important activity, which requires well-organized planning, treated with particular attention to details. Among the aspects considered essential in the management of the stocking and production unit are the sizing of buildings and annexes, lighting, heating and ventilation systems, the design and assembly of grates, the implementation of drinking lines and feeders, as well as waste management systems and general hygiene of the farm premises. Current forecasts support the hypothesis that global chicken consumption is expected to reach 41% of total international meat consumption by 2030.

3. RESULTS AND DISCUSSION

According to the National Institute of Statistics, in 2021 the number of birds slaughtered in industrial units (slaughterhouses) increased by 0.5% compared to 2020, and in terms of meat production the increase was 0.6%. The poultry sector accounts for the largest share in meat production in our country.

Building a production area in the poultry sector is a complex and important activity, which requires well-organized planning. Among the aspects considered essential in the management of the population and production unit are the sizing of buildings and annexes, lighting, heating and ventilation systems, the design and assembly of grates, the implementation of drinking lines and feeders, as well as waste management systems and general hygiene of the farm premises.

Raising broiler chickens in a protected area, in production halls, is a common practice in the modern poultry industry.

This method derives from the awareness of its numerous advantages, including:protection against external factors, predators or diseases, control of temperature, humidity, light intensity, and a more efficient increase in productivity.

Therefore, the design of the production hall aims to create spaces exclusively intended for birds (the breeding hall), and the internal organization of the shelter, feeding and watering conditions, the delimitation of buffer rooms, as well as storage spaces for various technical objects, installations or equipment.

Before starting the actual construction, the geometric parameters corresponding to the building must be taken into account, necessary for the smooth running of the activity over a long period of time, so that the initial investment has an innovative character, anticipating new trends in the industry by developing methods to minimize future interventions, carried out in order to align and modernize technologies, buildings and equipment to new market standards: openings, heights, elements related to walls, windows, floors or roofs.

The built area of the analyzed farm's shelter is 400 m, production capacity of 20-25 heads/ m up to the age of 3-4 weeks.

The foundation measures 60 cm deep and 40 cm high.

The body structure is made of metal profiles, with support pillars supported on the reinforced concrete foundation every 4 meters.

The closure and covering are made of sandwich panels, with a length of 19 meters and an opening of 8 meters. Among the interior finishes we can mention the concrete floors and stages, the lighting fixtures or the PVC joinery.

The panels measure 220 cm high at the ends and 250 cm at the top. For better thermal insulation, a 4 cm thick polyurethane foam coating was applied on top of them.

The growth and development of broiler chickens takes place on the stage, not on the litter. The reasoning derives from the need to avoid the risk of the appearance and development of contact dermatitis on the chest, knee joints or soles of the feet or damage to the plumage, thus aiming to promote aspects related to the health and appearance of the chickens. Against the background of new trends at European level, modern solutions for the maintenance of chickens intended for meat production have been approached in intensive systems in our country. The grills are suspended on a metal structure made of rectangular pipe covered in a zinc film.

Figure 1. Installation of the stages

In poultry farming, ventilation is a defining microclimate factor that decisively influences the well-being of birds. It has a significant impact on air quality, temperature and humidity inside the house. The more deficient the ventilation, the more the health and performance of broilers is affected.

Inside the house, a pleasant microclimate must be ensured, the proportion of oxygen in the air should be close to that of atmospheric air (21%). This phenomenon occurs due to the excess heat and humidity regime or the presence of suspended dust particles. Harmful gases in shelters are produced either directly, as a result of the metabolic processes of the birds, or indirectly as a result of the fermentation of solid or liquid droppings in the litter.

Exceeding the permissible limit of carbon dioxide in the shelter (5 times the proportion existing in atmospheric air) leads to various disturbances of the respiratory

system, to changes in the epidermis and mucous membranes, as well as to a reduction in appetite.
As a result of the fermentation processes of the droppings, significant accumulations of ammonia occur at the upper level of the shelter, 1.5 m above the floor, but if the air humidity registers higher than normal values, the presence of ammonia is also felt by the birds.
In the case of traditional models of permanent litter rearing, in which straw, sawdust, shavings or other hygroscopic materials with special moisture absorption qualities were placed on the entire surface of the floors, these required repeated maintenance interventions or even replacement from time to time. various causes: deterioration of the birds' plumage or legs, contamination with bacteria, viruses or parasites, increased risk of mortality due to coccidiosis.
Traditional litter is the main source of ammonia present inside poultry farms, and its quality contributes directly proportionally to the amount of ammonia volatilized and emitted from inside the house.
Therefore, the regime of the air flow introduced or removed through the intakes with the help of fans directly influences the quality and friability of the litter.
Ammonia is formed by the action of microbial enzymes as a result of the degradation of feed proteins not digested by chickens and uric acid.
Following the physical characteristics of the litter, referring specifically to friability or the presence of crust, humidity and the effectiveness of ventilation systems directly dictate the quantitative level of ammonia emissions.
During the growth period, the porosity of the litter decreases due to the accumulation of richer layers of manure.

Figure 2. Growing on the ground

Therefore, inside the halls of the poultry farm, stages were installed for raising chickens, suspended grills with a role in ensuring and maintaining health and promoting a qualitative physical appearance from a commercial point of view.
Before the production halls are populated, they must be equipped at least 24 hours in advance to ensure the optimal functionality of the assemblies and subassemblies, the drinking lines, the replacement of the drinkers, the integrity of the grates, the uniform dispersion of heat, the undifferentiated distribution of the feeders relative to the surface unit, the supply of feed, the regulation of the light intensity, etc. These works are performed in advance and with great care so as not to expose the chicken flocks to various disturbing factors.
The transfer of chicks from the incubation stations to the intensive farming farms is carried out in cardboard boxes with holes on the sides and lid. Each box usually contains 100 chicks. Overcrowding during transport or cooling during loading and unloading can lead to unwanted losses among the flock. Therefore, it is mandatory to travel in vehicles specially designed for the transport of live animals, equipped with a system for maintaining constant temperature and humidity in the cargo compartment. After transport, the chicks must be distributed evenly within the rearing room by qualified personnel. Without delay, it must be checked whether the broilers are consuming water and feed, and in case of reporting behavioral irregularities caused by various injuries among the animals, evacuation takes place.
Before introducing the chicks into the hall, it is necessary that the drinkers have already been filled for at least 2-3 hours so that the water reaches the ambient temperature in order to avoid the possible occurrence of enteritis. In the case of feed, the practice is the opposite, it must be fresh, distributed simultaneously with the stocking, to avoid the phenomenon of oxidation. Immediately after the chicks are first given food and water, they are hungry, which means that they should eat and fill their gizzards.
Estimating a full gizzard at key moments after stocking is a good method of determining the development of appetite and of verifying that the entire flock of chicks has discovered the food and water. The degree of gizzard filling should be monitored for the first 48 hours, but the first 24 hours are the most important. An initial check 2 hours after stocking will indicate whether the chicks have found food and water. Subsequent checks should be made 8, 12, 24 and 48 hours after arrival on the farm to estimate the development of appetite. To do this, samples of 30-40 chicks should be selected from 3-4 different locations in the house.In chicks that have found food and water, the goiter will be full, soft, and rounded. If the goiter is full but you can still feel the texture of the crack, it means the bird has not yet consumed enough water.The first week or acclimation week is also the most important of the entire calendar of a series of chicks, because it contributes to the adaptation of the birds to the new conditions, while developing their digestive, respiratory and locomotor systems.

4. CONCLUSIONS

Poultry breeding and management has historically represented the main occupation for obtaining as quickly as possible, quantitatively and qualitatively, animal products with high economic value.
Monitoring the technological circuit within the production hall in terms of directing microclimate factors

in direct correlation with the physiological needs of broilers as well as the evolution of hybrids, from the moment of population until reaching the specific marketing age.

The proposed objective was to present the advantages of the stage rearing system to the detriment of the classic system, on permanent bedding. Although this new model is not very popular among large farms due to the high implementation costs, it provides significant advantages regarding the health of broilers, microclimate conditions, facilitating manure disposal operations and shortening the time interval required to prepare the rearing rooms until the next population. Ventilation, insulation or heating are the primary parameters regarding the adaptability of the chickens to the operating conditions. Neglecting any such factor can jeopardize the smooth running of the activity and can negatively affect biosecurity.

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DOI: 10.2478/agr-2024-0020

THE ANNALS OF "VALAHIA" UNIVERSITY OF TARGOVISTE

ANALYSIS OF SOME AGROBIOLOGICAL INDICATORS ON THE SEEDS OF SOME CROP SPECIES

Ivona David, Sînziana Venera Morărița, Lavinia Udrea
Valahia University of Targoviste, 13, Sinaia Alley, 130004, Targoviste, Romania
E-mail: ivonadavid@yahoo.com

Abstract

In this paper, the seeds of four phyto technical plant species from the harvest of the 2022-2023 agricultural year were analyzed. The studied species were represented by two varieties or two hybrids. The species are the following: wheat (Triticum aestivum) with Glosa and Miranda varieties, barley (Hordeum vulgare) with Amethyst and Flavia varieties, corn (Zea mais) with Pioneer P9537 and Turda 344 hybrids and sunflower (Helianthus annuus) with Corsica and Subaru hybrids. The analyzed agrobiological quality indicators were the physical purity of the seeds, the mass of 1000 grains, the hectoliter mass and the germination in laboratory conditions. The results obtained showed that the analyzed parameters fall within the standards in force regarding the quality of seeds and seed material.

Keywords: quality, agrobiological indicators, varieties, hybrids, seeds, analyses

1. INTRODUCTION

When it comes to seed quality, the germination capacity, vigor and purity percentage are some fundamental indexes that must be taken into account when evaluating the quality of the seeding material.
The main quality indexes of seeds and their contribution upon the productivity on the quality of the crops were analyzed in this paper: physical purity, mass of 1000 grains, hectoliter mass and seed germination in the laboratory.
According to statistics, consumers are increasingly demanding in terms of the quality of agri-food products. Many prefer higher quality products, despite the high price.
For this reason, in this paper, some quality indicators of the seeds of some varieties of wheat, barley, as well as some hybrids of corn and sunflower, often cultivated within the Găesti agroecosystem, in Dâmbovița County were analyzed. The studied seeds were part of the crop of the 2022-2023 agricultural year.
The importance of these phyto technical crops is also shown by their inclusion in agricultural crop rotations. These crops are large water and nutrients consumers and, therefore, the culture technology applied must be consistent with the requirements of the agricultural plants, with the vegetation factors in the area, but also with the specific socio-economic factors in the zone [1]. From the point of view of the ranking of the areas cultivated with phyto technical species, they are at the top of the world ranking, due to consumer`s preferences over cereal bakery products and the products obtained from sunflower seeds (oil for human consumption, cakes and other secondary products used in animal feeding) [2].
Due to the pedoclimatic conditions in the Găesti area - Dâmbovița County and the ecological plasticity of wheat, barley, corn and sunflower occupy important areas within the agroecosystem of the county, along with trees, fruit bushes, fodder and vegetable species.
In this context, the observations within the work aimed to study the quality indicators of the cereal crops (wheat, barley, corn) and sunflower produced in Romania, Dâmbovița County, in order to evaluate the qualitative potential, both of the assortment of varieties and hybrids used, as well as cultivation areas.
A through understanding of these observations is important in the perspective orientation regarding the zoning of varieties and hybrids of agricultural species, as well as the improvement of harvest technology in the environmental protection and biodiversity conservation context.

2. MATERIALS AND METHODS

The biological material used was represented by the seeds of four species of phyto technical crops, each species being represented by two varieties or two hybrids. These are:
Wheat (*Triticum aestivum*) Glosa and Miranda varieties,
Barley (*Hordeum vulgare*), varieties Amethyst and Flavia,
Corn (*Zea mais*), Pioneer P9537 and Turda 344 hybrids,
Sunflower (*Helianthus annuus*), Corsica and Subaru hybrids
The Glosa variety was selected from the hybrid combination of three varieties, by using a biotechnological method of rapid homozygosity, which gave it a very good genetic uniformity.
The increase in production compared to the control variety Dropia was mainly due to its ability to form denser fields.
The Glosa variety is earlier to sprout, on average by 2-4 days compared to other varieties. It is resistant to powdery mildew, moderately resistant to brown and yellow rust, septoria and fusarium. It also has a good level of resistance to sprouting in the ear.
This makes Glosa superior to other varieties. Glosa is an early, drought-resistant variety of autumn wheat. In terms of productivity, Glosa surpassed the control varieties Dropia, Flamura 85 and Fundulea 4 by 10-13%, the increase in production being greater in drought conditions. The Glosa wheat variety is recommended, in

particular, for cultivation in the southern, western and eastern areas of the country [11].

The Miranda variety has a semi-erect plant bush, in the twinning phase. The leaves are medium in length and width and they are covered with a not too intense waxy layer in the second phase of the grain filling period. The average height of the plant is between 100 and 110 cm, higher than other varieties. It is a semi-early variety which sprouts 1-2 days later than the control varieties Dropia and Flamura 85. It shows good resistance to falling and winter conditions. It has a medium level of resistance to fusarium head blight and is the Romanian variety with the highest level of resistance to sprouting in the ear. It is resistant to powdery mildew and moderately sensitive to brown rust, yellow rust and septoriosis. The Miranda variety is recommended for cultivation in the western and southern areas of the country (Dobrogea and Moldova). Quality: Testing on laboratory samples, at Fundulea and at ISTIS (State Institute for Variety Testing and Registration), indicated that the Miranda variety has medium quality characteristics, but corresponding to the requirements of the milling and bakery industry standards [11].

The Ametist variety is a Romanian variety developed by INCDA (National Agricultural Reasearch and Development Institute) Fundulea, a semi-early variety of barley, with 6 rows of grains in the ear, approved in 2012. It is medium-sized, with a loose ear, resistant to wintering, falling and diseases, with protein content of 9.9-12.3%. This Romanian variety of barley promises productions of 6.5-8.7 t/ha and it can be cultivated in all areas favorable to this plant. It is a typical autumn variety, semi-early, with good twining capacity, medium height, medium-length lax spike, yellow color and long awns. It shows superior resistance to winter conditions drop, foliar and ear diseases. It has a medium resistance to barley brown reticular leaf spot [11].

The Flavia variety, a 2-row barley variety of elite genetics, which has a very good production potential. It is characterized by a good resistance to frost and late spring frosts, and it also tolerates drought and atmospheric heat well. It has a high twinning capacity and a good tolerance to foliar and spike diseases. It is recommended to be cultivated in all areas of autumn barley [13].

The Pioneer P9537 hybrid is a semi-early hybrid with extraordinary productivity. It has the ability to tolerate the heat during the flowering period, with a deep root system, very good capacity to absorb water and nutrients. It is recommended for early sowing. It is suitable for any type of soil, even in acid and clay soils. It has no competition in all culture conditions.

The hybrid TURDA 344 is a trilinear hybrid suitable for early sowing. It is a hybrid with high production potential, especially in the I and II favorability zones of Transylvania, Moldova and in the hilly areas of the west of the country [5]. The superior quality of the grains is a characteristic of this hybrid, especially through the high starch content [5]. It is a tall plant with an average cob insertion between 120 and 130 cm. The cob has a cylindrical shape, 18-20 rows of grains per cob (number of grains/rows: 40-42). The grain is dented, light yellow color. It is recommended to be cultivated in the south, southeast, center and northeast of Romania, as well as in the hilly areas in the west of the country [8]. In optimal natural and technological conditions, a density of 65000-70000 germinating grains/ha is recommended; the recommended density in irrigated conditions is between 75000-85000 germinating grains/ha.

Corsica is a hybrid with a very good production potential that responds very well to intensive cultivation conditions. Plants are medium tall, good early vigor, fast growing. It shows tolerance to downy mildew, rot and downy mildew. The recommended density is between 55000 – 60000 harvestable plants/ha [12].

Subaro is an adaptable hybrid with high and stable productions. It is an adaptable hybrid with good drought tolerance. It shows high and stable production potential, proven year after year, under farm conditions. Plants have good vigor with medium-tall height. It has a very good disease tolerance with healthy plant appearance and green stem until harvest. Subaro hybrid also shows a high hectoliter mass at harvest. The recommended density is around 55000 to 60000 harvestable plants/ha. It responds very well to intensive culture conditions [12].

Laboratory research methods

Determination of physical purity of seeds.

Physical purity represents the percentage content of pure seed from the species to be analyzed, relative to the total mass of the analyzed sample [4]. A quality seed must be free of mixtures with seeds of other crop plants and weeds, sclerotic, fungus, minerals or plant residues. Determining the physical purity had a great practical importance, because the percentage of purity is used in order to calculate the quantity of seed per hectare.

The physical purity analysis of the seeds is performed on the defined, extracted and weighed working sample. A seed physical purity analysis includes the following sequence of operations:

- separating the analysis sample into component categories,
- identification of the component categories of the sample,
-weighing the different categories of components identified in the sample,
-calculating and expressing the results in percentages

The mass of 1000 grains represents the weight of 1000 seeds at the moisture they contain at the time of determination. It is expressed in grams. For the determination, a quantity of seeds is taken, corresponding to approximately 500 seeds, impurities are removed, weighed and counted [4]. The result expresses the arithmetic mean of two parallel determinations, between which there is no greater difference than that allowed by the regulations in force.

The hectoliter mass, an indicator resulting from the assessment of grain quality according to physical criteria, represents the mass in kilograms for a seed volume of 100 liters. The hectoliter mass defines the density of the seed mass. The hectoliter mass was determined using the hectoliter scale with a capacity of 1 liter [4]. For baking grains, the hectoliter mass must not be less than 75 kg/hl.

Hectoliter mass is determined in seeds intended for sowing, food, fodder or industrial consumption.
Germination was expressed by two indices:
- the germinative energy;
- the germinative faculty.
The germinative energy represents the ability of the seeds to germinate, expressed by the percentage of pure seeds germinated normally in a time between 1/3 and 1/2 of the time established for determining the germinative faculty. Germinative faculty is the ability of seeds to germinate, expressed by the numerical percentage of pure seeds germinated normally under optimal conditions and in a certain time that is established for each individual species [6].
The germination of the studied seeds was determined in the laboratory, according to the requirements of each species and respecting the working methodology.
The main statistical indexes were calculated according to Saulescu N. and Saulescu NN "Field of Experiment", Agro-Silvică Publishing House, Bucharest 1967 [9] and Diaconu P. and Nicolae F. "Biostatistics and Experimental Techniques", Bioterra University, Bucharest, 2001 [3].

3. RESULTS AND DISCUSSIONS

Table 1. Physical purity of the seeds

Cr. no.	Species	Variety/hybrid	Physical purity (%)
1	Wheat	Glosa	97,2
		Miranda	96,1
2	Barley	Ametist	99
		Flavia	98,8
3	Maize	Pioneer P9537	93,7
		Turda 344	95,1
4	Sunflower	Corsica	97,2
		Subaro	97,6

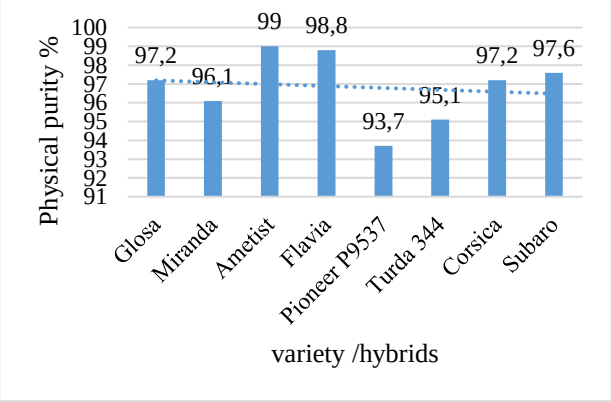

Figure 1. Physical purity of the analyzed seeds

Physical purity is an indicator of seed quality that can influence crop productivity and efficiency [8]. Table 1 shows the values obtained for the analyzed species (corresponding varieties and hybrids). A uniformity of this indicator is observed within the species (the values observed in the studied varieties and hybrids were similar).
Regarding the differences between the species, it is noteworthy that the barley presented the highest value of physical purity compared to the other studied species (99% and 98.8%). The lowest value of physical purity was presented by the seeds of corn hybrids.
Figure 1 shows the physical purity values in the seeds of the varieties and hybrids analyzed.
The highest values of this parameter were recorded for Amethyst and Flavia barley varieties (99% and 98.8%), while the lowest values were recorded for corn hybrids. Sunflower hybrids also showed high physical purity values (over 97%).

Table 2. The mass of 1000 grains

Cr. no.	Species	Variety/hybrid	The mass of 1000 grains (g)
1	Wheat	Glosa	32,5
		Miranda	33,1
2	Barley	Ametist	44,8
		Flavia	44,6
3	Maize	Pioneer P9537	238,6
		Turda 344	256,3
4	Sunflower	Corsica	69,4
		Subaro	75,4

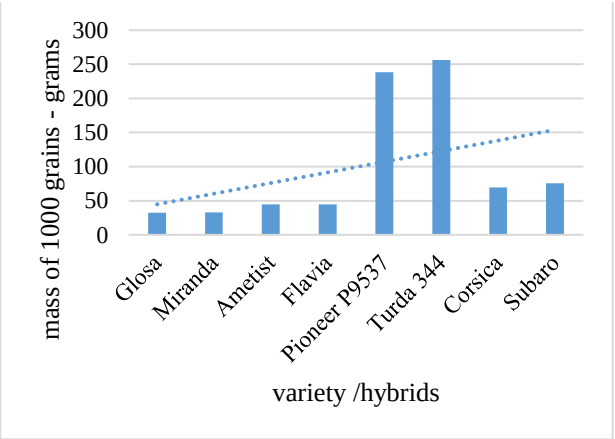

Figure 2. The mass of 1000 grains

Table 2 shows the values of the mass of 1000 seeds. It is noted that the highest values were recorded for corn hybrids, namely 256.3 and 238.6 grams.
In descending order, sunflower hybrids with values of this parameter between 69.4 and 75.4 grams are in second place, followed by barley and wheat varieties.
Figure 2 shows the mass values of 1000 seeds under a graphic form.
Regarding the uniformity of this character within the species, barley stands out, where the two varieties analyzed showed very close values (44.6 and 44.8 grams). Also, in the two varieties of wheat, very close values of the mass of 1000 grains are observed.
Large differences between hybrids of the same species were observed in maize and sunflower.

Table 3. Hectoliter mass

Cr. no.	Species	Variety/hybrid	HM (Kg)
1	Wheat	Glosa	78,3
		Miranda	79
2	Barley	Ametist	68,3
		Flavia	67,9
3	Maize	Pioneer P9537	80
		Turda 344	71,8
4	Sunflower	Corsica	40,1
		Subaro	45,7

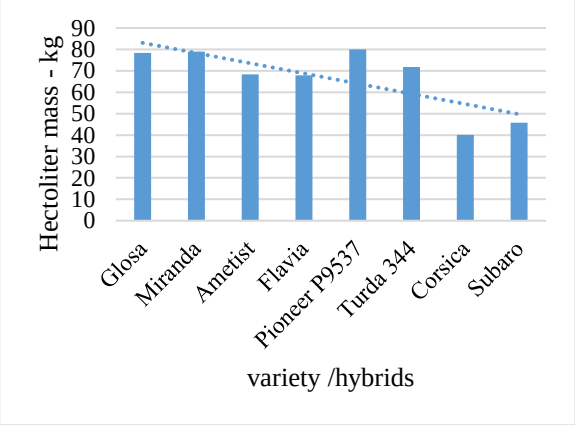

Figure 3. Hectoliter mass

The hectoliter mass is an important criterion in evaluating the quality of seeds, both in their marketing and for their use in certain industries.
Table 3 shows the hectoliter mass values recorded for the analyzed species.
The highest values were observed in corn and the lowest in sunflower.
Regarding the hectoliter mass of the varieties and hybrids analyzed (fig. 3), it can be observed that in wheat and barley, the varieties presented values close to each other, respectively 78.3 kg and 79 kg for the wheat varieties and 67.9 kg and 68.3 kg for the varieties of barley.
Instead, the corn hybrids had differences in this parameter, 71.8 kg for Turda 344 and 80 kg for Pioneer P9537 and sunflower hybrids showed a non-uniformity of this character (Corsica 40.1 kg and Subaru 45.7 kg).

Seed germination in the laboratory

Table 4. Wheat seed germination

Cr. no.	Variety	Germination energy (%)	Germination faculty (%)
1	Glosa	75,2	97
	Std. deviation	1.290994	0.57735
	C.V.	1.8%	0.6%
2	Miranda	70,5	98,5
	Std. deviation	1.892969	0.816497
	C.V.	2.5%	0.8%

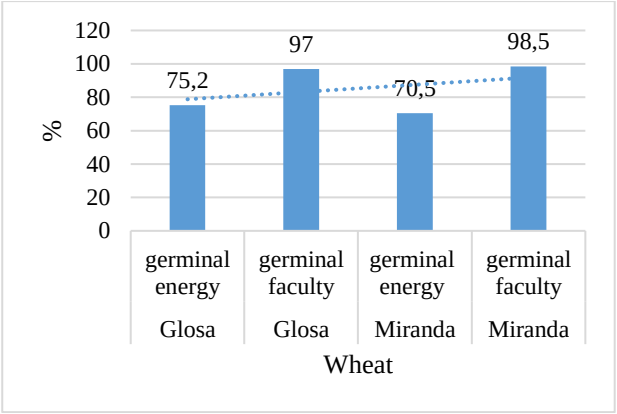

Figure 4. Germination of wheat seeds in the laboratory

In laboratory conditions, wheat seeds showed high values of germination energy (over 70%) in both analyzed varieties (table 4 and figure 4). And the germination faculty determined at 7 days showed high values in both varieties (Glosa 97% and Miranda 98.5%).
The coefficient of variation (Pearson) had very low values (0.6% and 2.5%) which indicates a high degree of homogeneity of this character and a representative average.

Table 5. Barley seed germination

Cr. no.	Variety	Germination energy (%)	Germination faculty (%)
1	Ametist	81	97,5
	Std. deviation	2.44949	1.290994
	C.V.	3.0%	1.3%
2	Flavia	85	98,7
	Std. deviation	0.816497	0.5
	C.V.	1.0%	0.5%

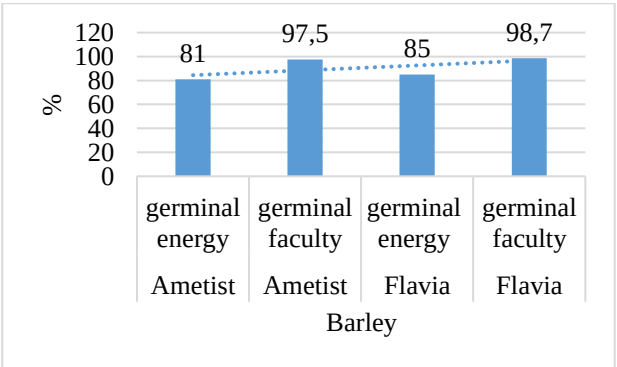

Figure 5. Barley seed germination in the laboratory

The germination energy of the barley varieties studied was between 85% for the Flavia variety and 81% for the Amethyst variety. Among the analyzed species, barley presented the highest value of germination energy. The germination capacity was also very high in both varieties, respectively 97.5% in Amethyst and 98.7% in Flavia (figure 5). The coefficient of variation (table 5) was between 0.5 and 3%, which indicates a very high homogeneity of germination in the barley species and a representative average.

Table 6. Maize seed germination

Cr. no.	Hybrid	Germination energy (%)	Germination faculty (%)
1	Pioneer P9537	11	90
	Std. deviation	1.154701	7.118052
	C.V.	10.5%	7.9%
2	Turda 344	12	95
	Std. deviation	1.414214	1.154701
	C.V.	11.8%	1.2%

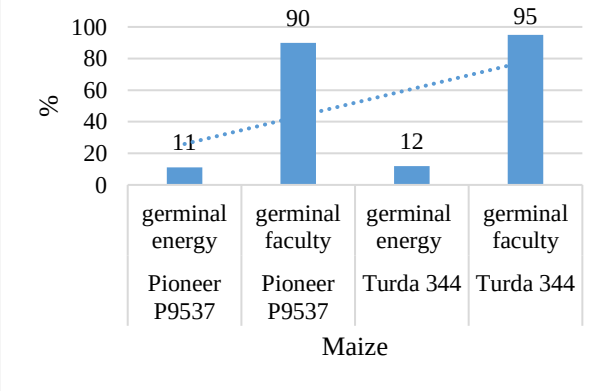

Figure 6. Germination of maize seeds in the laboratory

Table 6 shows the values of the germination energy and the germination faculty of the corn hybrids analyzed. It is observed that the germinal energy determined in the laboratory of the corn seeds had very low values in the two hybrids, respectively 11% in Pioneer P9537 and 12% in Turda 344. The germination faculty was between 90 and 95% in the analyzed hybrids.
The coefficient of variation for the germination energy parameter had values between 10.5% and 11.8%, which shows a small variation of this character and a relatively high degree of homogeneity. The coefficient of variation in the germinal faculty had values between 1.2% and 7.9% which shows a very high homogeneity of the character and a representative average.

Table 7. Germination of sunflower seeds

Cr. no.	Hybrid	Germination energy (%)	Germination faculty (%)
1	Corsica	19,5	93
	Std. deviation	1.290994	2.581989
	C.V.	6.6%	2.8%
2	Subaro	20	90
	Std. deviation	1.154701	3.651484
	C.V.	5.8%	4.1%

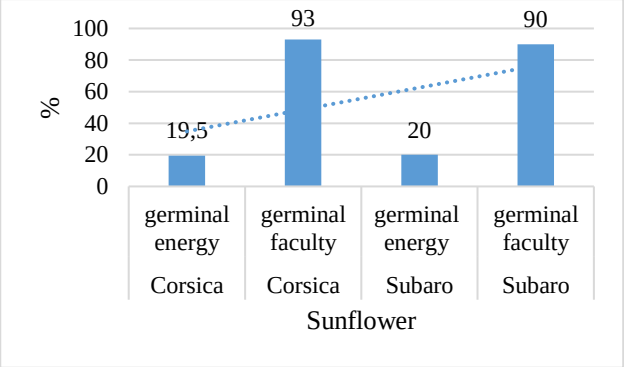

Figure 7. Germination of sunflower seeds in the laboratory

In sunflower, the germination energy had values between 19.5% and 20% in the studied hybrids (figure 7). The germination capacity determined after 7 days was 90% for the Subaro hybrid and 93% for Corsica.
The coefficient of variation was between 2.8% and 6.6% for the analyzed parameters, which shows their high homogeneity and a representative average.

4. CONCLUSIONS

The agro biological quality indicators of the analyzed species, from the harvest of the 2022 -2023 agricultural year in the Găesti, Dâmbovița agricultural ecosystem fall within the norms established by the standards in force.
The physical purity showed high values, over 95% in the analyzed varieties and hybrids, with the exception of the Pioneer P9537 corn hybrid where the purity was 93.7%.
The mass of 1000 grains, which is a characteristic of the species, showed close values in the analyzed varieties and hybrids.
The hectoliter mass recorded the highest values for corn hybrids, wheat and barley varieties. In sunflower seeds, this parameter showed low values, compared to the other species.
Germination determined in the laboratory showed the highest values for barley varieties, followed by wheat varieties. Low germination energy was observed in maize and sunflower hybrids.

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