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

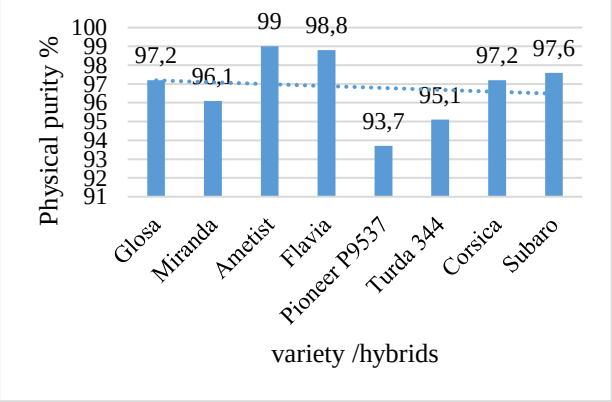

Figure 1. Physical purity of the analyzed seeds

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

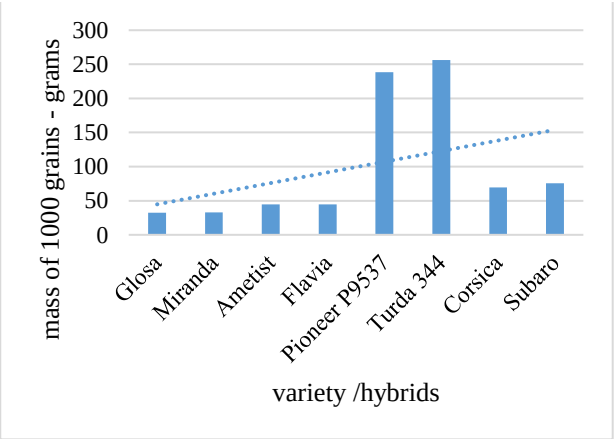

Figure 2. The mass of 1000 grains

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

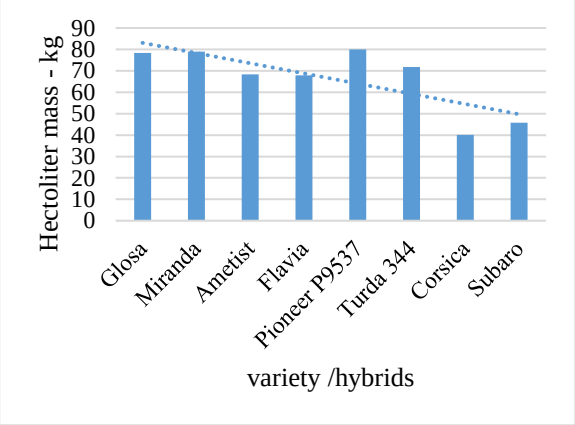

Figure 3. Hectoliter mass

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%

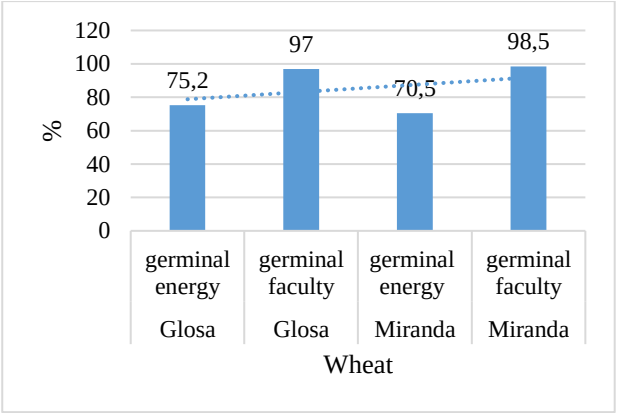

Figure 4. Germination of wheat seeds in the laboratory

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%

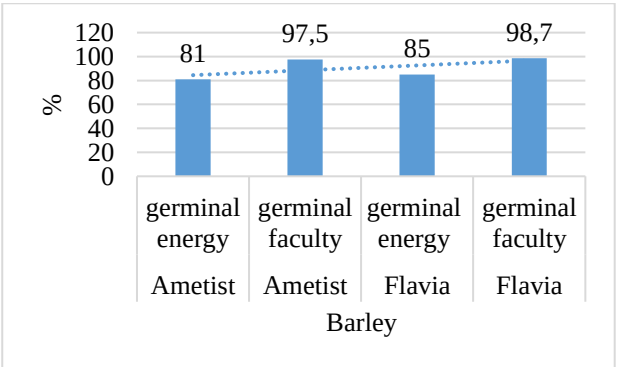

Figure 5. Barley seed germination in the laboratory

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%

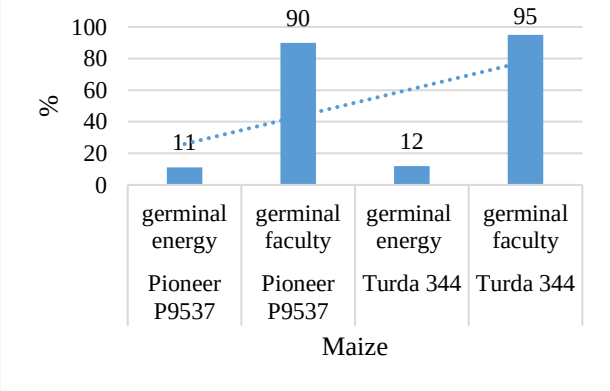

Figure 6. Germination of maize seeds in the laboratory

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%

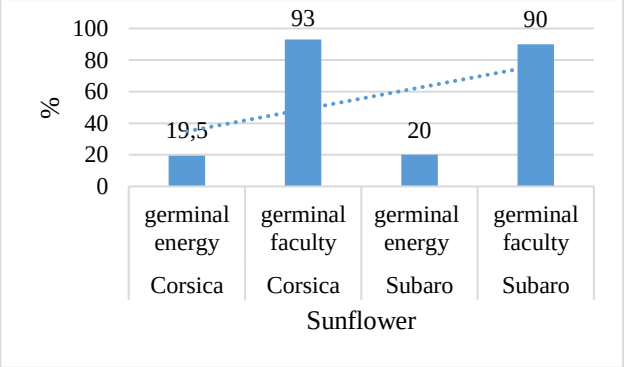

Figure 7. Germination of sunflower seeds in the laboratory

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.

5. REFERENCES

[1] Axinte M., Roman Gh. V., Borcean I., Muntean L. S., Fitotehnie", editia a IVa. Editura "Ion Ionescu de la Brad" Iasi, 2006.
[2] Bîlteanu, Ghe. Fitotehnie. Editor Ceres. Vol. I. București, 2003.
[3] Diaconu, P., Nicolae, Floarea. Elemente de biostatistică și tehnică experimentală. Editor Bioterra. București, 2001.
[4] Epure, Lenuța Iuliana, Toader, Maria, Ion, V., Controlul calității semințelor destinate semănatului. Manual de lucrări practice-Fitotehnie, Editura Universitară, București, 2011, ISBN: 978-606-591-147-5.
[5] Haș, Voichița et al., Hibridul de porumb "Turda 344", AN I.N.C.D.A. Fundulea, vol. LXXXVI, 2018, ISSN 2067-7758.

[6] Ion V., Epure Lenuța Iuliana, Tehnologia plantelor de câmp. Soiuri şi hibrizi de cereale şi leguminoase pentru boabe, Tipografia Departamentului de Învăţământ la distanţă – USAMV Bucureşti, 2005.
[7] Muntean and colab. Fitotehnie. Editor Didactică și Pedagogică RA. București, 1995.
[8] Oancea I. Tehnologii agricole performante. Editura Ceres, Bucureşti, 2003.
[9] Săulescu N. and Săulescu N. N., - Câmpul de experiență. Editura Agro-Silvică. Bucureşti, 1967.
[10] http://agrii.ro
[11] http://www.incda-fundulea.ro
[12] http://www.syngenta.ro
[13] http://www.saaten-union.ro