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THE PLACE OF GLOSA C1 IN SUSTAINABLE AGRICULTURAL DEVELOPMENT

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Abstract. Sustainable agriculture is a system of farming that is based on providing the necessary resources for current human populations while preserving the planet's capacity to sustain future generations. Over the last five decades, technologies, irrigation and mechanisation used efficiently have led to increased productivity and quality of agricultural products. But we can't just talk about the positive effects of intensive agriculture, it also has negative effects, it has led to water pollution with chemicals, soil degradation, impoverishment of flora and fauna. Following the sustainable agriculture movement that addresses the social, economic and environmental role of agriculture. [1,2]
To implement sustainable agricultural practice, it is crucial to take a holistic approach and recognize the interconnectedness between individual farms, local ecosystems, communities and even the entire planet. Such a perspective requires coordinated and collaborative efforts in research and education, with a focus on integrating diverse disciplines. In the transition to sustainable agriculture, responsibility does not fall on the shoulders of a single entity, but is shared between farmers, processors, government policy-makers, traders and consumers, each with a key role to play in the process.

Keywords: *sustainable agriculture, agriculture 4.0, wheat glosa c1, plant morphology*

Introduction

Agriculture 4.0 is expected to bring significant improvements globally, in particular by increasing productivity and efficiency in agricultural and food production systems, improving the quality and affordability of agricultural products, adapting production to climate change, reducing food waste and making optimal use of natural resources in a sustainable way, all leading to lower environmental impacts. However, integrating these technologies brings a number of challenges, including high costs - robots and related technologies are not cheap, the necessary IT infrastructure, the adjustment of farms to new operating models, the maintenance and servicing of this equipment, and above all, the need for people to understand and adopt these new technologies. [3]

Most farmers are not familiar with how to properly work with satellites or with involving robots in farming processes. Also, a good agronomist is not necessarily also an expert in digital technologies and automation, just as this applies to staff in agricultural institutions. Therefore, knowledge transfer and skills training in new technologies is essential for all those involved in agriculture and food production, from government to specialists, farmers, technicians and consultants in the field.

It is of crucial importance to prepare young people for the age of Agriculture 4.0 by introducing them to new technologies (such as robotics and programming, which are already included in many high school curricula in various countries) as early as high school. Advanced use of technology will attract technically well-prepared young people to the agricultural field. The advancement of Agriculture 4.0 will open up new opportunities that could attract young entrepreneurs to the sector, helping to solve the problems of rural-urban migration. [3]

Material and methods

The biological material used in the experiment was wheat variety: Glosa c1.

The wheat variety GLOSA was obtained at INCDA Fundulea from the complex hybrid combination Delabrad "S"/Dor "S"//Bucur, by individual selection following rapid homozygosity through the Zea system. F1 hybrid plants grown in the greenhouse were pollinated with maize pollen, resulting in haploid embryos. These were cultured in vitro and the resulting seedlings were treated with colchicine to double the chromosome number, resulting in completely homozygous genotypes. This ensured superior plant uniformity of this variety.

Morphological characteristics. The Glosa variety has a semi-erect plant bush in the budding stage. The flag leaf has a semi-folded habit after the flowering phase, and the leaf blade and sheath have a low waxiness in the second part of the grain filling period. The average height of the plant is 85-95 cm, similar to or slightly higher than that of the varieties Flamura 85 and Fundulea 4.

The spike is white, aristate, cylindrical and of medium density.

The berries are medium-sized, elongated, red in colour and, under normal growing conditions, have a mass per 1000 berries of 42-43 g and a hectolitre mass of 76-79 kg/hl.

Growing period 232-245 days.

Physiological characteristics. Glosa is an early variety, similar to or slightly earlier than Flamura 85. It has good droop resistance, is winter-hardy and drought- and drought-tolerant and has good resistance to sprouting.

The Glosa variety has medium resistance to brown rust and is resistant to mealybug and current races of yellow rust.

The production capacity of Glosa exceeded the production of the control variety Flamura 85 by 13% in multi-year tests in the ASAS network stations. The yield increase was mainly due to its ability to form thicker fields.

The quality of the Glosa variety is characterised by hard gluten, with a sedimentation index similar to Dropia and Flamura 85, but clearly superior to Fundulea 4.

Protein content and bread volume were on average similar to those of Flamura 85. Cultivation area The Glosa variety has rapidly expanded in cultivation, being recommended mainly for the southern, western and eastern areas of the country.

Glosa has also performed well in international trials and is now registered in Hungary as Khungloria.

In the Republic of Moldova, the Glosa autumn wheat variety achieved an average yield of 6.03 t/ha during the trial period. It is registered for cultivation in the central and southern part of the country.

Applied technologies

Soil tillage

Soil tillage that has been carried out are: manual digging and manual harrowing.

The digging was done manually with the help of the harrow and hoe. The digging was carried out at a depth of approximately 25 cm on 12 October 2017. Another soil tillage was raking and shredding of soil clods.

Fertiliser application

The specific nutrient intake per tonne of product is between 20-30 kg N, 12-15 kg P2O5 and 27-30 kg K2O [5].

Fractional application of chemical fertilisers ensures that plants are supplied throughout the growing season and grain production can be increased. [5]

The soil on which wheat sowing was carried out, although fertile, but still foliar fertilizer (SOLUCAT 20-20-20) was applied to wheat at 3-4 sib stage on April 14, 2018. The fertilizer was applied on the aerial side of the plant.

Sowing and sowing

Sowing is a particularly important link in the technological chain of wheat cultivation. If carried out under optimum conditions, sowing ensures that the plants sprout uniformly and develop normally during the active period of autumn vegetation, going through the setting and hardening-off phases with good development of the root system, stages which ensure that the plants survive the winter cold with minimum losses. [5]

Such a crop regenerates vigorously in spring, with rapid occupation of the land and suppression of any weeds. It is very important to respect the optimum sowing time. This can contribute 40-50% and sometimes 80% of the wheat yield.

As a rule, sowing starts when the air temperature is 13-15°C and should be completed in 10-15 days when the temperature reaches 8-9°C. Depending on the weather, sowing can start 6-7 days earlier or later.

It is important that during the autumn growing season the wheat spends 40-50 days at temperatures above 5°C, accumulates 450-550 degrees Celsius, develops its root system well and accumulates sugars in the leaves and the setting node, which help it to overwinter without losses.

Sowing density is 450-550 germinable grains/m^2, resulting in at least 600 ears at harvest. Use 200-250 kg of certified seed per 1h. The quantity used depends on the moisture content of the soil, the quality of the seedbed preparation, the optimal sowing time, etc.

When using SUP-type seed drills, the row spacing will be 12.5 cm and some imported drills can achieve 18 cm between rows. Seeding depth is the decisive factor in achieving crop uniformity. It depends on the soil, moisture content, seed size and variety characteristics. Under normal conditions, the sowing depth is 4-5 cm. In intensive varieties, which have a shorter coleoptile, the depth should not be more than 4 cm. On light soils lacking moisture, sowing can be carried out at a depth of 6 cm in the topsoil.

Earlier sowing is not recommended because: the plants grow too vigorously and become susceptible to overwintering; they are attacked by aphids which can cause viroids, yellowing and dwarfing of the plants; they can be attacked by cereal flies, mealybugs, rusts; in winter they easily decay and are destroyed by frost; high temperatures in autumn can cause physiological disorders which, in spring, lead to stagnation of growth and even loss of plants; the plants are prone to drooping and bolting.

Nor should sowing be delayed because: they do not go through all the phases of vegetation in the autumn (germination, sprouting, rooting, setting, hardening off), they are affected by the first frosts, they extend their vegetation into the summer, when the water reserve in the soil is low, shrivelling sets in and there is a danger of the berries drying out, the plants are not resistant to drought, they cannot use the nutrients in the soil and vegetation is delayed.

Each day of delay in sowing in October leads to production losses of 30-50 kg/ha, and in November production drops daily by 60-100 kg/ha. [5]

Sowing wheat Glosa c1

Sowing was carried out on an experimental field of 10 m^2, in three variations of eight rows each. The average number of seedlings per 1 m^2 was 200 plants.

The row spacing was 12.5 cm and the sowing depth was 4 cm in the Glosa variety.

Seed development periods and phases

From fertilisation to full maturity, the seed goes through a series of complex transformations. This biological process can be divided into several periods and phases, which are analysed in more detail for cereal plants. The Russian scientist N. Kuleșov separates this development process into three periods: formation, filling and maturation. Another researcher, I. Strona, highlighted 6 phases in this process:

1. Creation - the phase between fertilization and the formation of the growing point. At this stage, the seed is already formed; when the plant eventually breaks off, it may form a weak but viable germ. MMS about 1g. Duration of period is 7-9 days.

2. Formation - phase between creation and establishment of definitive length. It is during this phase that the differentiation of the embryo becomes definitive. Seeds turn green. Starch grains appear. The seed contains a lot of free water and little dry matter. MMS is about 8-12 g. During this period all the components of the seed are formed. Duration of period - 5-8 days.

3. Filling - the phase between the beginning of starch deposition in the endosperm and its cessation. During this period the width and thickness of the seed increases and the endosperm tissue is formed. Because of the accumulation of dry matter, seed moisture is reduced to 38-40%. The period lasts on average 20-25 days.

4. Maturation - the phase that begins when the seed stops filling; the accumulation of plastic substances stops or is slow. During this period, polymerisation and ravelling processes predominate. Moisture is reduced to 18-12% and in cases of drought - to 7-8%. The amount of free water is reduced sharply, even to the point of complete disappearance. The seed matures and can be used for technical purposes, but its development is not finished. Physiological processes of transfer of chemical substances take place in the seed and the seed acquires an absolutely new seed property - ordinary germination capacity. As seed development continues, two further periods must be highlighted.

5. Post-harvest ripening - complex biochemical transformations take place in the seed. Synthesis of high-molecular linkages occurs, free fatty acids are converted to fats, carbohydrate molecules are combined, germination inhibitors are converted to other substances, fermenter activity ceases, air and water permeability of the seed coat increases. Seed moisture is balanced with relative air humidity. Respiration ceases. At the beginning of the period, the germination capacity of the seeds is low and at the end of the period it becomes normal. The length of the period depends on the characteristics of the species, variety and environmental conditions and varies from a few days to several months.

6. Full maturation - the phase that begins when the plant achieves normal germination capacity, i.e. the seeds are ready to start a new cycle in the life of the plant. Slow ageing of the colonies occurs, accompanied by weak respiration. The seeds remain in this state until germination or perish due to ageing or long storage.

The periods are further divided into smaller stages of seed development, called phases. Thus, the filling period includes four phases and the ripening period - two.

Prelactic phase. At this stage, the seed content is watery, it has a milky appearance because starch is deposited in the endosperm, the seed coat is green, the moisture content is 75-70%, the free water content is 3-4 times higher than that of the bound seed. Dry matter accumulation is 10%. Duration of the phase - 6-7 days.

Milky phase. At this phase the berries contain a milky white liquid. Moisture content reaches 50%, the ratio of free to bound water is 1.5:1. The accumulated dry matter represents about 50% of the weight of the ripe berries. The duration of the period is 7-10 days, in some cases 15 days.

Dough phase. At this stage the seed has the consistency of dough. Chlorophyll is broken down, a small amount of it is retained in the seed coat. The moisture content of the grain is reduced to 45%. The ratio of free to bound water is 1:1. The amount of dry matter varies within 85-90% of the maximum. Phase duration is 4-5.

Grain ripening lasts 6-12 days and is divided into two phases.

The ripening phase in the fallow - the endosperm is waxy, flaky, yellow coating, chlorophyll is practically absent, and in the ratoon, moisture is reduced to 30%. Towards the end, the volume becomes maximum and the increase in dry matter ceases. The duration of the phase is 3-6 days.

Hard maturity stage - the endosperm is hard and, when fractured, becomes mealy or glassy; the husk is dense, leathery, typical in colour; depending on climatic conditions, the moisture content is 8-22%. The amount of free water is considerably reduced and varies between 1-8%. The duration of the phase is 3-5 days. Afterwards, consumption of the dry substance begins. In production and in some scientific research, this phase is called the full maturity phase. Seed capacity and production characteristics in the process of grain formation and development vary considerably. In the milky grain stage, seed yield varies considerably. although growth power and germination capacity succumb to seed yield at the dormant and hard maturity stages.

The duration of seed formation and ripening periods and phases and their character are determined not only by the biological characteristics of the species and varieties, but also to a large extent by the soil and climatic conditions of the year and region, which affects the quality of the seed and influences its physical properties and its seediness. The provision of optimum water, temperature and nutrients helps to increase the duration of the seed formation period. Such conditions favour the formation of ground seeds in which large quantities of organic substances accumulate, MMS increases, their surface becomes smooth, red or yellow. As a rule, these seeds have high seed qualities and production properties. [7]

Even though the climate in the Republic of Moldova is favourable for cereal production, droughts often occur during critical periods of development, with varying degrees of damage.

Harvesting

Harvesting was carried out only manually in three rounds. The first round was harvested on 15 June 2018 from an area of 1m^2. The second variant was harvested on 24 June 2018 from an area of 1m^2. The third variant was harvested on 2 July 2018 from an area of 1m^2.

Observations and determinations

A series of field observations were made during the growing season on each variant at the same growing stage and biometric measurements were made in the laboratory at harvest.

Thus, observations and determinations were made in the field during the growing season on the following aspects:

- number of plants sown/m2;
- number of plants sprouted/m2;
- number of plants at winter entry/m2;
- number of plants at winter emergence (frost resistance)/m2;
- plant height - average of 10 plants from three harvest points;
- number of ears/m2;
- average yield harvested from an area of 1m2.

In the laboratory they were determined:

- the number of grains in the ear
- mass of 1000 grains - determined by weighing a sample taken from the seed harvested from the plots at each harvest point;
- yield for each variety.

Equipment used during the research in the field

A number of tools and apparatus were used during the calculations and determinations on wheat grains:

- watch glass;
- ruler;
- analytical balance;
- tweezers;
- pots for storing wheat seeds;
- metric frame;
- measuring ruler

Two rulers were used to measure the length of the ears, one of them was fixed on A4 size millimetric paper, and the second ruler was placed straight with the tip of the ear. The picture below shows the photo that was taken during the measurement

The counting of the grains was done manually with tweezers. The grains were counted of wheat from all ears that were harvested from an area of 1m^2.

An analytical balance was used to determine the mass. With this balance the mass of 1000 grains was determined for each variant of sowing time, the mass of the ears and the mass of the grains obtained from the harvesting of ears from 1m^2.

Another work carried out in the seed drill is to find out the mass of 1000 grains, the mass of all the ears harvested from 1m^2, the mass of the grains obtained from 1m^2.

Results and discussions

In order to estimate the yield and calculate the average recorded on the 1 ha area, the following aspects were followed: plant density, average number of ears per square metre, average number of berries per ear and absolute weight of these berries.

The determinations were carried out in three working points for each variant.

Soil temperature

Soil temperature plays an important role in the development of wheat seed, and its growth. Soil temperature measurements were made at the beginning of the sowing seasons using an electronic thermometer. Temperature measurements were taken twice a day, the first measurement was taken at 8:00 in the morning, and the second measurement - at 13:00. These soil temperature measurements were taken until at least 70% of the seedlings had sprouted.

For the first variant of the sowing time the temperature measurement was carried out for ten days, on the tenth day about 70% of the plants sprouted. Sowing was carried out on 13.10.2017, and sprouting of 70% of the plants was recorded on 22.10.2017.

The second variant of sowing time soil temperature measurements were carried out, which lasted for ten days as in the first variant, on the tenth day about 70% of the plants were sprouted. Sowing was carried out on 17.10.2017 and 70% of the plants were sprouted on 26.10.2017.

The third seeding time was measured soil temperature for 30 days until 70% of the plants had sprouted. This tillage period was with cooler air temperatures than the two variants. Sowing was carried out on 27.10.2017 and sprouting of 70% of the plants on 30.11.2017. [6,8,10]

Table 1.1 Soil temperature

Agricultural year	Soil	Variant	Soil temperature °C		Difference °C
		harvest	Hours 8:00	Hours 13:00	
2017-2018	Glosa c1	1	+15	+16	1
		2	+15	+16	1
		3	+7	+8	1
		Average	12	13	1

Source: Elaborated by the author based on research

From the given table we can observe that the optimum temperature for the development of wheat seed is 15 °C which is present at the first and second sowing season, at this temperature the wheat seed develops better in the soil and the sprouting of the plant starts to occur.

Results on the time from sowing to sprouting

The determination was carried out for each variety on an area of 1 m^2. From sowing to sprouting, the number of days required for the germination-sprouting process varied for the three variants.

From the data shown in Table 1.1 it can be seen that the time from sowing to sprouting varied for the three variants from 4 days to 21 days.

Table 1.2. Period from sowing to emergence

Soil	Agricultural yrar	Sowing date	Sprouting date
Glosa c1	2017-2018	13 october 2017	22 october 2017
		17 october 2017	26 october 2017
		27 october 2017	30 november 2017

Source: Elaborated by the author based on research

Due to the climatic conditions recorded during the growing period from sprouting to germination, it can be observed that the sprouting period is directly proportional to the sowing period. Thus, the earlier the sowing period, the faster the uniform sprouting of plants within the variants.

In the agricultural year under study, in the first variant, sprouting was observed four days after sowing, with this variant having the shortest period.

The second variant recorded 6 days from sowing to sprouting, this period also correlating with high temperatures.

The longest period from sowing to sprouting was recorded in the third variant, with the plants needing 21 days to sprout. [6,8,10]

Results on plant emergence

According to the field data, the degree of plant emergence was closely related to the climatic conditions during the sowing-emergence period. Thus the year 2017-2018 had very sunny and warm days in October, but towards the end of October the beginning of November the temperature dropped sharply, because of this the sprouting was poor.

Table 1.3 Degree of sprouting of Glosa c1 wheat plants

Agriculture year	Variants sown	Glosa variety c1		Sprouting percentage
		Sown plants	Sprouted plants	
2017-2018	1	400	312	78%
	2	400	236	59%
	3	400	216	54%
	Average	400	254,6	63,6 %

Source: Elaborated by the author based on research

Although sowing was done with 400 germinable grains/m^2, the average number of sprouted plants was 254.6 sprouted plants/m^2.

With the help of this diagram we can observe and understand the degree of sprouting of wheat seeds. As we can see the number of sprouted plants is lower than the number of sown seeds. The main factor is the temperature of the environment and the soil. In November the air and soil temperature started to drop and the seeds that did not germinate remained in the soil until spring. The highest sprouting rate of wheat is in the first sowing season, due to the fact that during this period the soil and air temperature was optimal for good germination of seeds in the soil. We can observe a decrease in sprouting due to the decrease in environmental temperature. [6,8,10]

Plant density in spring

Measurements were taken in spring at each point where measurements were taken and at the onset of winter, measurements were taken on the 1m2 area using the metric scale.

The number of plants recorded in early spring, i.e. in March, averaged 255 plants sprouted/m^2, and in May when the plant counts were taken the average was 309 plants sprouted/m^2.

Table 1.4 Number of plants/m^2

Agriculture year	Soil	Variants	Number of plants/m^2			Difference
			Autumn	Spring March	Spring May	
2017-2018	Glosa c1	1	312	320	368	+8
		2	236	245	304	+9
		3	216	200	256	-16
		Media	254,6	255	355	0,33

Source: Elaborated by the author based on research

Losses were minimal due to the high fence holding back cold air currents. In the first and second variants the number of plants increased on average by 8.5 plants and in the third variant it decreased by 16 plants. On average losses are 0.33 plants/m^2. [6,8,10]

Biometric measurements

At maturity biometric measurements were made on the number of ears/m^2, length of ears, number of berries in ear, plant height, mass of 1000 berries, yield recorded.

Number of ears/m^2

For each sowing season at maturity in the field, measurements were made on the number of ears/m^2. [6,8,10]

Table 1.5 Number of ears/m2

Agricultur year	Soil	Variant	Number of ears/m2
2017-2018	Glosa c1	1	368
		2	304
		3	256
		Average	309,3

Source: Elaborated by the author based on research

It was found that the number of spikes/m^2 in the three variants ranged from 256 to 368 spikes/m^2, giving an average value of 309.3 spikes/m^2.

Herringbone length

To record the data obtained, 10 spikes were harvested from each variant, measurements were taken with the ruler and averaged. [6,8,10]

Table. 1.6 Synthesis of data on ear length

Agricultur year	Soil	Number of variant	Herringbone length (cm)
2017-2018	Glosa c1	1	8,18
		2	8,01
		3	7,89
		Average	8,026

Source: Elaborated by the author based on research

Wheat ear length of Glosa c1 ranged from 7.89 to 8.18 cm. The average length found was 8.026 cm. The ears that were measured were spontaneously picked from each variant at 1m^2.

Figure 1.1. Determination of herringbone length (original)

Figure 1.2.Counting the grains in the ears. (original)

Number of beans in ear

By counting the grains in the ear I found an average for 10 ears in each sample analysed. According to the results we can see that the highest number of grains is in variants two and three equal to 35 grains in the ear. The third variant having an average of 34 grains shows that the number of grains is approximately equal in all three variants. The average number of grains for the three variants equals 34.9 grains in the ear, approximately 35 grains. [6,8,10]

Table. 1.7. Synthesis of number of grains in ear

Agriculture year	Soil	Number of variants	Number of grains in ear
2017-2018	Glosa c1	1	34,1
		2	35,4
		3	35,3
		Average	34,9

Source: Elaborated by the author based on research

Plant thallus

Prior to harvesting the plants for biometric measurements in the laboratory, the plants were measured for height. From the base of the soil, 10 plants were measured from each working point using a ruler. [6,8,10]

Table 1.8 Summary of plant height

Agriculture year	Soil	Number of variants	Plant thallus cm
2017-2018	Glosa c1	1	79,4
		2	71,9
		3	61,9
		Average	71,06

Source: Elaborated by the author based on research

Plant height measurements were performed on 10 randomly selected plants in each of the variants. By performing the waist measurements we found the average waist length in each of the variants. The highest value of the wheat thallus was in the first variant with an average value equal to 79.4 cm. In variant two the average waist length was 71.9 cm, which is about 9 cm less than in variant one. The lowest waist value was recorded for the last variant with an average value of 61.9 cm. The average waist value for all variants is 71.06 cm.

Mass of 1000 grains

In the year 2017-2018, the variety Glosa c1 recorded values between 38.8 - 40.80g. In the first variant the mass of 1000 berries recorded a value of 38.8g, in the second variant the mass of 1000 berries recorded an average value of 42.8g. The third variant recorded a value equal to 40.3g. The average value for the three variants is 40.63g. [6,8,10]

Recorded yield

In the 2017-2018 crop year, Glosa c1 yields ranged from 349.4 g/ha on average at the third sowing time variant to 529.2 g/ha at the second sowing time variant. The average between the three sowing times found 456.16 g/m^2. [6,8,10]

Table 1.9 Yields of Glosa c1

Agriculture year	Soil	Number of variants	Production (g/m^2)
2017-2018	Glosa c1	1	489,8
		2	529,2
		3	349,4
		Average	456,16

Source: Elaborated by the author based on research

Obtaining data from harvesting wheat grains from 1m^2 at each sowing time, we applied a formula to find the amount of wheat that could be obtained from 1ha sown.

Summary of experimental results

Following the results of the statistical interpretations, it can be seen that all variants had statistical coverage, with both positive and negative differences.

In the agricultural year 2017-2018 all the variants of sowing seasons showed significantly good values. The quantity of grains from different sowing times varied. From the data obtained we could see that the best sowing times are sowing times I and II. These sowing times obtained the highest values.

References:

1. Agricultura durabilă, prezent şi trecut, Agricultura durabila: prezent si viitor | EcoMagazin.ro
2. Agricultura durabilă: Calea spre un Pământ sănătos și un viitor durabil Agricultura durabilă: Calea spre un Pămînt sănătos și un viitor durabil (ecology.md)
3. Agricultura 4.0, Ce este agricultura 4.0 – Educatie Agricola
4. Boieriu I., Eustaţiu N., 1973 – Cultura grâului, Editura Ceres, Bucureşti)
5. Borlan Z. Și colab., *Optimizarea agrochimică a sistemului sol – plantă,* 1984
6. Cercetări cu privire la caracterele cantitative ale spicului la triticum aestivum L. Ştefan SANDIC, Galina LUPAŞCU, Svetlana GAVZER, Elena SAŞCO Institutul de Genetică şi Fiziologie a Plantelor al AŞM
7. Extras din teza de doctorat Nicolae Gheorghiev, Studiul semințelor al culturilor de câmp, Chișinău,2010)
8. Instrucţiunea privind modul şi condiţiile de stocare, recepţionare, păstrare, împrospătare şi eliberare a grîului alimentar, porumbului şi crupelor din rezervele materiale de stat. Coordonat: Ministerul Agriculturii şi Industriei Alimentare. mun. Chișinău.
9. Institutul Național de Cercetare – Dezvoltare Agricolă, Institutul National de Cercetare - Dezvoltare Agricola Fundulea (incda-fundulea.ro)
10. Тищенко В.Н., Чекалин Н.М. Корреляционно-регрессионный анализ количественных признаков у озимой мягкой пшеницы: Генетические корреляции между количеством междоузлий и другими признаками и индексами у селекционных линий озимой пшеницы // Генетические основы адаптивной селекции озимой пшеницы в зоне лесостепи. - Полтава, 2005.