ANNALS OF THE UNIVERSITY OF CRAIOVA

Series: ✔*Biology*
✔*Horticulture*
✔*Food products processing technology*
✔*Environmental engineering*

Vol. XXIX (LXV) - 2024

PROMOTING A NEW SPECIES IN CULTURE TO INCREASE THE FERTILITY OF ACID SOILS IN NORTH-WESTERN ROMANIA USING MODERN AGRICULTURAL MACHINES

Mondici Susana[1*], Ács Péter-Balázs[1], Smit Gergely-Andrei[1], Goga Nicolae[1], Bănățeanu Cecilia[1], Ursan Patrick[1], Pădureanu Vasile[2], Şugar Ioan Radu[3]
[1] Agricultural Research and Development Station Livada, 7 Baia Mare St., Livada, Romania, Tel/Fax: 0261 – 840 -018, e-mail: scdalivada@yahoo.com
[2]Transilvania University of Brasov, Faculty of Food and Tourism, 148 Castelului, St., Brașov, Romania
[3]Technical University of Cluj-Napoca, Faculty of Engineering, 62A Dr. Victor Babeș St, Baia Mare, Romania
***Corresponding author: E-mail*:** mondicisuzana@yahoo.com

Keywords: *acid soil, new species, technological links, productions*

ABSTRACT

The research conducted at Livada ARDS in the 2023-2024 agricultural year aims to identify new plant species with high yield, quality, and adaptability to acidic soils. By cultivating and expanding these species, we can select those with the widest ecological plasticity for use in green crops (cover crops), animal feed, human food, and biomass production. This cannot be done without modern agricultural machines and drones.

INTRODUCTION

In the end of the millenium we saw a shift in agricultural research towards revisiting concepts that underpinned intensive technologies reliant on fossil energy resources. In response to rising energy costs and environmental concerns, there has been a growing focus on annual/perennial legumes and sustainable technologies that reduce pollution while maintaining high and stable yields. On acidic soils with low organic matter content, research is needed to quantify and evaluate the performance of plant species from other ecological areas that could serve as important sources of food, fodder, and biomass. Additionally, diverse crop rotations can help to increase and maintain soil fertility through symbiotic nitrogen fixation.

MATERIAL AND METHODS

The research was conducted under the soil and climate conditions of the Livada Agricultural Development Research Station, Satu Mare county, on an albic luvisol. The research aims to improve the use of acidic soils by introducing new acid-tolerant crops, such as buckwheat, chickpea, mustard, sweet sorghum, broad beans, and lentils. These crops can have a positive impact on the agricultural ecosystem by increasing soil fertility and exhibiting allelopathic, fungicidal, insecticidal, and nematocidal effects, which can reduce the need for chemical inputs. The soils used in the research are argiloiluvial soils with the following chemical and physical properties:

Table 1

The main physico-chemical parameters of clay-alluvial soil

Orizontul Adâncimea orizontului Adâncimea probei	UM cm cm	Ap 0-27 0-5	 15-25	Eaw 27-40 27-38	$2Bt_1w$ 40-53 40-50	Bt_2w 53-99 60-75	 80-95
Humus (Cx1,72)	%	1,56	1,50	0,60	0,54	0,54	0,24
N total	%	0,100	0,088	0,054	0,062	-	-
C:N	-	9,20	9,53	11,27	10,69	-	-
pH în apă	-	5,40	5,75	5,58	5,13	5,49	6,33
SB	me/100 g sol	3,55	4,41	4,67	9,75	11,88	13,81
Ca^{2+}sch	me/100 g sol	2,58	3,27	3,42	6,35	7,67	8,09
Mg^{2+}sch	me/100 g sol	0,82	1,07	1,11	2,97	3,75	5,26
K^{+}sch	me/100 g sol	0,12	0,05	0,11	0,27	0,23	0,17
Na^{+}sch	me/100 g sol	0,03	0,01	0,03	0,16	0,24	0,29
$V_{8,3}$	% din T	42,1	58,8	61,1	64,0	75,6	85,8
P-AL	ppm	28,0	28,3	17,6	-	-	-
K-AL	ppm	74	75	77	-	-	-
Argilă (<0,002 mm)	%g/g	18,1	19,2	20,5	32,0	32,3	28,6
Conductivitatea hidraulică	mm/h	15,03	-	6,39	-	0,30	0,30

* Analyzes performed at ICPA Bucharest

The soil is characterized by:

- A B horizon, more or less developed, with a clay content of 30-35%. Poor drainage can lead to water stagnation on the surface during heavy rainfall, requiring measures to improve soil physical conditions.
- Relatively high apparent density, indicating compaction.
- Slightly to moderately acidic pH, with a trend towards acidification.
- Low humus content, primarily composed of fulvic acids, indicating a depleted humus profile.

Humus depletion is a trend in the evolution of organic matter content in these soils.

- Aluminum ion presence, due to increasing potential acidity, necessitates periodic soil limings.
- The low humus-to-nitrogen ratio (15.6) indicates a preference for organic fertilization over mineral fertilization (Davidescu 1981).

Climatic elements of the area

- According to the Köppen classification, the research area falls under the Cfbx climate province, characterized by a humid continental climate.
- Average annual temperatures range from 8˚C to 11.6˚C. The sum of useful temperatures (>10˚C) in the lowland area oscillates between 1200 and 1450˚C.
- The average annual temperature in Livada over the past 60 years is 9.9˚C.
- At Livada, the average annual rainfall over 60 years is 751.4 mm, with an irregular distribution during the growing season.
- The 2024 vegetation period experienced a significant rainfall deficit compared to the multi-year average, with differences ranging from 2.7 to 58.6 mm in February, March, April, May, July, and August. This deficit negatively impacted spring crop production.
- In addition to the rainfall deficit, temperatures were higher than average every month during the January-August period of 2024, with positive deviations ranging from 1.6 ºC in May to 7.4 ºC in February.
- The following table presents the climate data recorded in Livada during January-August 2024 (Table 2):

Table 2

Annual and multiannual temperatures (ºC) and precipitation (mm) recorded at ARDS Livada 2024

Factor	ian	febr	mart	april	mai	iuni	iuli	aug
Temperatures **°C**								
decade 1	4,5	6,4	9,2	14,8	17,3	20	22,8	21,4
decade 2	-0,4	6,1	7,5	12,5	15,9	20,3	27,9	25,2
decade 3	-0,6	10,1	11,2	12,1	19,1	23,7	22,4	24,0
Average	0,1	7,5	9,3	13,1	17,4	21,3	24,4	23,5
Multiannual	-2	0,1	4,7	10,5	15,8	19	20,5	19,9
Difference	1,9	7,4	4,6	2,6	1,6	2,3	3,9	3,6
Precipitation **mm**								
decade 1	26,7	9,4	9,8	9	8,4	35,8	21,8	13,2
decade 2	34,6	8	15,2	16,5	6,5	75,4	0	0
decade 3	14,6	24,1	15	16,1	15,3	36	5,8	2,5
Sum	75	41,5	40	41,6	30,2	147,2	27,6	15,7
Multiannual	49,3	44,2	45,7	50,9	75,5	90,8	80,8	74,3
Difference	25,7	-2,7	-5,7	-9,3	-45,3	56,4	-53,2	-58,6

For the 2023-2024 growing season, the plot was previously planted with wheat, which was harvested on June 7, 2023. The land was then superficially disced to encourage the growth of volunteer wheat and weeds. On September 6, 2023, after the land was covered with sedge and weeds, Glyphosate herbicide (4 L/ha) was applied to control perennial weeds. After a 21-day weed control period, the soil was prepared for planting through plowing, discing, and the use of a complex soil processing aggregate (Solaris). Two experimental factors were included: factor A with two levels (a1 - amended, a2 - no liming) and factor B with two levels (D1 - tenth 1, D2 - tenth 2). For factor A, the tillage was divided into two treatments: one was amended with Teracalco (1.0 t/ha) on September 26, 2023, using a fertilizer spreader. The crops are arranged perpendicular to factor A, with each crop having two variants representing factor B.

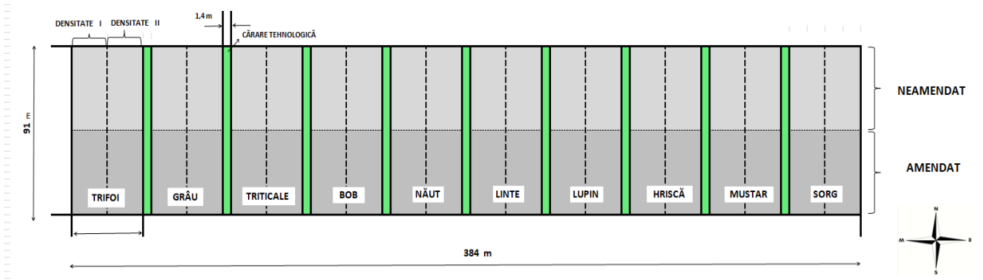

Figure 1. Experimental field sketch

A complex fertilizer (18-46-0) was applied at a rate of 500 kg/ha to the entire experimental area on September 27, 2023, before sowing.

Autumn sowings of red clover, wheat, and triticale were conducted using Wintersteiger Plotseed TC seeders in September and October 2023.

Figure 2. Sowing spring crops -2024-

1. Red clover

For red clover, the variety sown within the project was "David Liv", created at Livada ARDS. It is a synthetic diploid variety approved in 2015, an early variety with good resistance to fall, wintering, drought and foliar diseases. It lends itself to both spring and autumn sowing. The red clover crop was sown on 28.09.2023.

The variants placed were:

V1 – with liming with two densities
D1 - 674 g.g./m2 (15 kg/ha)
D2 - 1124 g.g./m2 (25 kg/ha)
V2 – no liming with two densities
D1 - 674 g.g./m2 (15 kg/ha)
D2 - 1124 g.g./m2 (25 kg/ha)
The sowing depth was 1 cm and the row spacing was 12.5 cm.

2. Wheat

For the establishment of the wheat crop, "Biharia", a new Romanian variety created at ARDS Lovrin, registered in 2021, was sown. It has a medium vegetation period, short waist (approximately 80 cm), resistance to winter and drought, good tolerance to frost and heat, resistant to specific diseases, having a high tolerance to soil acidity. The wheat was sown on 10.10.2023, the variants being:

V1 – with liming with two densities
D1 - 423 g.g./m2 (180 kg/ha)
D2 - 587 g.g./m2 (250 kg/ha)
V2 – no liming with two densities
D1 - 423 g.g./m2 (180 kg/ha)
D2 - 587 g.g./m2 (250 kg/ha)
The sowing depth was 4 cm and the distance between the rows was 12.5 cm.

3. Triticale

The triticale variety sown was Negoiu, created at INCDA Fundulea, registered in 2012. Negoiu has high resistance to low temperatures, fast growth rate, thick elastic straw, resistant to falling, medium resistant to brown rust and medium

sensitive to powdery mildew and yellow rust, resistant to ear sprouting. Triticale was sown on 10.10.2023.

The variants include the two factors of agrochemical liming and density, each with two gradations:

V1 – with liming and two densities
D1 - 323 g.g./m2 (150 kg/ha)
D2 - 538 g.g./m2 (250 kg/ha)
V2 – no liming with two densities
D1 - 323 g.g./m2 (150 kg/ha)
D2 - 538 g.g./m2 (250 kg/ha)

The sowing depth was 4 cm and the distance between the rows was 12.5 cm.

For spring crops (Year I): chickpeas, broad beans, lentils, buckwheat, mustard, lupine, sweet sorghum, prior to sowing, with the preparation of the seedbed, the complex fertilizer (18-46-0) 200kg/ha was administered on 01.03.2024. Between March and May of 2024, the spring sowings (chickpeas, broad beans, lentils, buckwheat, mustard, lupine, sweet sorghum) were carried out with experimental plot seeder (Wintersteiger Plotseed TC).

4. Chickpeas

For chickpeas, the variety sown within the project was "BURNAS", created at ARDS Teleorman. It is a variety approved in 2006, very resistant to drought and has a very good resistance to anthracnose. The chickpea crop was sown on 21.03.2024.

The variant placement was:

V1 – with liming with two densities
D1 - 35 g.g./m2 (140kg/ha)
D2 - 45 b.g. (180kg/ha)
V2 – no liming with two densities
D1 - 35 g.g./m2 (140kg/ha)
D2 - 45 b.g. (180kg/ha)

The sowing depth was 4 cm, and the distance between the rows was 25 cm in both variants.

5. The broad bean

For the establishment of the crop culture, the variety "SUPERAGUADULCE" was sown, it is a variety with large grain, it has moderate requirements regarding heat, but it is demanding regarding humidity. Due to the size of the beans (large bean) and the TGW was over 1500 g, the sowing was done manually, not being able to adapt any of the equipment systems. The bean crop was sown on 21.03.2024, the variants being V1- with liming and V2 – no liming, in both cases sown with two densities. The sowing density was:

V1 – with liming with two densities
D1 - 30 g.g./m2 (450kg/ha)
D2 - 40 g.g./m2 (675 kg/ha)
V2 – no liming with two densities
D1 - 30 g.g./m2 (450kg/ha)
D2 - 40 g.g./m2 (675 kg/ha)

The sowing depth was 8 cm, and the distance between the rows was 25 cm.

6. Lentils

Lentils were sown in early spring as in the case of leguminous crops within the project, the date of sowing being 21.03.2024, as the delay makes the emergence uneven. The variety sown was "VELVET" green lentils. The lentil culture variants were:
V1 – with liming with two densities
D1 - 250 g.g./m2 (75 kg/ha)
D2 - 300 b.g. (89 kg/ha)
V2 – no liming with two densities
D1 - 250 g.g./m2 (75 kg/ha)
D2 - 300 b.g. (89 kg/ha)
The sowing depth was 4 cm, and the distance between the rows was 12.5 cm in both variants.

7. Buckwheat

The buckwheat variety sown was the "PANDA" variety, a variety that stands out for its high resistance to diseases, survives well the cold periods of spring, and drought even during the flowering period. Buckwheat was sown on 21.03.2024, the variants being the following:
V1 – with liming with two densities
D1 - 200 g.g./m2 (60 kg/ha)
D2 - 250 b.g. (80 kg/ha)
V2 – no liming with two densities
D1 - 200 g.g./m2 (60 kg/ha)
D2 - 250 b.g. (80 kg/ha)
The sowing depth was 3 cm, and the distance between the rows was 25 cm in both variants.

8. Mustard

To establish the mustard culture, the variety "MARYNA" was sown, and the date of sowing was 21.03.2024.
The variants were: V1- with liming and V2 – no liming, in both cases sown with two densities.
V1 – with liming with two densities
D1 - 200 g.g./m2 (14kg/ha)
D2 - 300 g.g./m2 (21 kg/ha)
V2 – no liming with two densities
D1 - 200 g.g./m2 (14kg/ha)
D2 - 300 g.g./m2 (21 kg/ha)
The sowing depth was 1.5 cm and the distance between the rows was 25 cm.

9. Lupine

The "MIHAI" variety, approved by ISTIS in 2015 and patented in 2017, was obtained through a breeding process within the USAMV Iași Faculty of Agriculture. This variety was sown within the project on 21.03.2024 including the following variants:
V1 – with liming with two densities
D1 - 50 g.g./m2 (150kg/ha)
D2 - 70 g.g./m2 (210 kg/ha)
V2 – no liming with two densities

D1 - 50 g.g./m2 (150kg/ha)
D2 - 70 g.g./m2 (210 kg/ha)
The sowing depth was 5 cm and the distance between the rows was 25 cm.

10. Sugar sorghum

On 10.05.2024, sorghum, hybrid "ALIZE", was sown, which is a semi-early hybrid with excellent tolerance to breakage, drought, shaking and Fusarium. The variants sown were:
V1 – with liming with two densities
D1 - 11 g.g./m2 (4 kg/ha)
D2 - 17 g.g./m2 (6 kg/ha)
V2 – no liming with two densities
D1 - 11 g.g./m2 (4 kg/ha)
D2 - 17 g.g./m2 (6 kg/ha)
The sowing depth was 4 cm and the distance between the rows was 50 cm.

RESULTS AND DISCUSSION

Despite all the advances made in agriculture in the last century, weeds are still present in cultivated land. Weed control in the crops included in these researches was carried out with the following herbicides:

The red clover was herbicided post-emergence on 26.03.2024 with an anti-gramine herbicide, Gramin 1.5l/ha (active substance - 50 g/l quizalofop – P - ethyl) and with the anti-dicotyledonous herbicide Basagran 2l/ha (active substance - bentazone 480 g/l) + Break Thru adjuvant 100 ml/ha on 10.05.2024. Despite advancements in agriculture, weeds remain a persistent problem in cultivated land. Weed control in the red clover crop was achieved through post-emergence herbicide applications:

- Gramin (1.5 L/ha active substance - 50 g/l quizalofop – P - ethyl) was applied on March 26, 2024, to control grasses.
- Basagran 2l/ha (active substance - bentazone 480 g/l) + Break Thru 100 mL/ha was applied on May 10, 2024, to control broadleaf weeds.

The wheat and triticale crops were treated with the herbicide Bizon 1l/ha (diflufenican 100g/l + penoxulam 15g/l + florasulam 3.75g/l) applied post-emergence in the spring on 26.03.2024. In the spring post-emergence application of the new herbicide Bizon 1l/ha, herbicide which is recommended to be applied in autumn to a BBCH 11-23, it proved good selectivity and efficacy also in the case of application in early spring.

The mustard crop was herbicided pre-emergence (26.03.2024), immediately after sowing, the herbicide applied was Metax 500 SC 1.5l/ha (active substance - 500 g/l metazachlor). It is a selective herbicide for the control of annual monocotyledonous and dicotyledonous weeds.

To control monocotyledonous and dicotyledonous weeds in the brad bean crop, on 10.05.2024 the following post-emergence herbicides were applied: Basagran 2l/ha (active substance - bentazone 480 g/l) to combat dicotyledonous weeds + Pantera 40 EC 1l/ha (the active substance - 40 g/l quisalofop-p-tefuril) for the control of monocots and the adjuvant Break Thru 100 ml/ha which potentiates the effects of pesticides.

On the buckweath crop herbicide was not applied, because no selective and effective herbicide was found, as no herbicides were approved for this crop. Although

herbicide was not applied, the buckwheat plants competed well with existing weeds, being maintained by manual hoeing.

Weed control in chickpea, lentil and lupine crops was achieved with the herbicide Challenge 4l/ha (active substance - aclonifen 600 g/l) applied pre-emergent on 26.03.2024. Challenge is approved for the control of annual dicotyledonous weeds and some annual monocotyledonous weeds as well.

In the lupine crop, as well as in the other leguminous crops in the research, Ambrosia artemissifolia causes the biggest problem in terms of weeding, because this weed is not combated by the herbicide Challenge and others.

The sorghum crop was pre-emergently herbicided on 10.05.2024 with the herbicide Stomp Aqua 3l/ha (active substance - 455g/l pendimethalin). On 18.06.2024, a post-emergence herbicide was carried out with the herbicide Dicopur Top 1l/ha (344 g/l 2,4 D acid from dimethylamine salt and 120 g/l dicamba), a systemic herbicide, to combat dicotyledonous weeds. These herbicides were very effective in keeping the crop clean until harvest.

From the phytosanitary aspect, crop protection consists in preventing and controling diseases and pests, reducing damage, ensuring and raising the quality and quantity of agricultural production. The fight against pests, which continue to affect agricultural production to a considerable extent, is continuous. Disease and pest control measures should be applied in an integrated system based on knowledge of the specifics of the disease or pest, the biology of the pest, the phenophase of the plant in correlation and interdependence with environmental factors.

Figure 3. Image from the Clover experimental field -2024-

In the clover crop, the prevention of the attack of some highly damaging pathogens in our area (Sclerotinia trifoliarum, Erikss) transmissible through soil and seed was done by treating the seed with the fungicide Dividend M 030 FS (difenconazole 30g/l) in a dose of 1.0 l/t (in 1:10 dilution).

The wheat crop is affected by more than 150 parasitic diseases. Some of these, such as powdery mildew, rust, septoria, fusarium wilt, downy mildew, root and stem base diseases, occur with high frequency year after year. In favorable environmental conditions, combined with the sensitivity of the varieties, they determine the limitation of production below the level of the applied technology.

Wheat parasites spread through seeds, through harvest residues, through overwintering weeds, and some persist for a long time in the soil. The prevention of diseases transmissible through the soil and seed (downy mildew) was achieved by chemically treating the seed with the fungicide AMIRAL PROFFY 6FS, in a dose of 0.5 l/t, in a 1:10 dilution. There was no recorded plant with a blight or mildew attack.

Against the foliar pathogen complex, preventive and therapeutic treatment was applied on 04/09/2024, in the BBCH 35-37 phenophase, with the fungicide FALCON 460 EC, in a dose of 0.8 l/ha diluted in 150 l/ha, and on 10.05.2024, in the BBCH 55 phenophase, with the fungicide Nativo PRO 325 SC, in a dose of 0.6 l/ha.

The fight against diseases of a systemic nature, transmissible through seed and soil in triticale, was done by the preventive treatment applied to the seed with the fungicide AMIRAL PROFFY 6 FS (tebuconazole 60g/l) in a dose of 0.5l/t in a dilution of 1:10. The treatment had a very good effectiveness, not a single ear with the symptom of scurf or scurf was registered. The attack of foliar diseases manifested itself very intensively since sunrise, requiring foliar treatments that were applied in the phenophase BBCH 36 (09.04.2024) with the fungicide FALCON PRO in a dose of 0.8 l/ha, diluted in 150L/water/ ha and in the BBCH 55 phenophase (10.05.2024) with the fungicide NATIVO PRO 325SC 0.6l/ha in 150 l water/ha.

In 2024, the chickpea crop at the Livada Agricultural Research and Development Station benefited from a remarkable agricultural season, characterized by an optimal phytosanitary condition. The seeds were preventively treated before sowing with the fungicide DIVIDEND M030 FS, in a dose of 0.5 l/t, using a dilution of 1:10. This treatment provided effective protection against potential fungal diseases, preventing the appearance of any pathogens in the crop throughout the vegetative cycle.

The study did not record any manifestation of fungal or bacterial diseases during the entire vegetation period. Common pathogens in chickpea crops, such as Ascochyta rabiei or Fusarium oxysporum, were not identified in the monitored plots, which underlines the effectiveness of the treatment applied to the seed and the favorable agrotechnical conditions. The absence of any disease symptoms allowed healthy and vigorous plant development, resulting in a phytosanitary unaffected chickpea crop.

However, a specific pest, Helicoverpa armigera, known for its impact on leguminous crops, including chickpea, was found. Infestation with this pest was observed throughout the experiment, but without significant damage.

The broad bean crop in this area was significantly affected this season by a complex of pathogenic factors. Before sowing, the seeds were treated with the fungicide DIVIDEND M030 FS, preventive for possible pathogens transmissible through soil or seed. The crop was invaded by the black beet aphid (Aphis fabae) with a frequency of 100%. Following this massive infestation, multiple treatments were carried out with insecticides such as MAVRIK 2F at a dose of 0.2 l/ha in 150l water/ha, MOSPILAN 150 g/ha and CIPERGUARD MAX at a dose of 40 ml/ha.

Figure 4. Image from the experimental field broad bean -2024-

The lentil crop within the Livada Agricultural Research and Development Station presented an exceptional phytosanitary status, due both to the favorable agroclimatic conditions and the implemented phytosanitary measures. Before sowing, the seeds were treated with the fungicide DIVIDEND M030 FS at a dose of 0.5 l/t, using a dilution of 1:10. This treatment played an essential role in the preventive protection against fungal diseases, ensuring the optimal health of the crop throughout the vegetative cycle.

Throughout the growing season, no significant symptoms of fungal or bacterial infections were observed, common pathogens such as Colletotrichum truncatum (anthracnose) or Fusarium spp. being absent from the lentil crop. The effectiveness of the fungicide treatment and the continuous monitoring of the phytosanitary status contributed decisively to the prevention of the development of pathogens, maintaining the lentil crop in an optimal phytosanitary status.

Buckwheat culture was distinguished by a particularly favorable phytosanitary evolution. The seeds were subjected to a preventive treatment with the fungicide DIVIDEND M030 FS, in a dose of 0.5 l/t and a dilution of 1:10, ensuring the necessary protection against possible fungal infections that could affect the crop in the early stages of development.

Throughout the growing season, no problems related to fungal or bacterial diseases were reported. Buckwheat, known for its natural resistance to pathogens, did not show symptoms indicating the presence of specific pathogens, such as Alternaria or Botrytis, which frequently affect other crops. The total absence of these diseases is due to both effective seed treatment and favorable growing and maintenance conditions, which supported the overall health of the plant.

Mustard was affected in 2024 by the pathogens Erysiphe comunis, which causes powdery mildew of crucifers, and Alternaria brassicae, which causes black spotting of sheaths. Powdery mildew attack was manifested on leaves and flower peduncles. The maximum level of attack was observed in the flowering phase of plants with a frequency of 100% and a degree of attack between 15.3% and 25.2%. Gradings of the desimi and agrochemical liming factors did not produce differences in attack. The attack of alternaria was more intense on siliques with values of the degree of attack of 7.3%-10.1% without significant differences depending on the agrochemical liming or the plant species.

The protection of the crop against pest attack was achieved by applying 3 treatments with insecticides aimed at protecting the leaves and inflorescences. The first

treatment was applied on 04/09/2024 with the product MAVRIK 2F in a dose of 0.2 l/ha in 150 l water/ha. The treatment was aimed at combating ground fleas (Phyllotetra atra and Phyllotetra nemorum) that cause leaf damage. Adults bore the upper epidermis in the form of small holes 1.5,-2 mm diameter) with a strong attack the leaves dry up. At the time of treatment, the number of insects on the plants was 7-10.

The second treatment was aimed at combating the pests mentioned in the first treatment and the Melighetes aenus pest that affects flower buds. It was applied on 13.05.2024 with the product MOSPILAN 150 g/ha in 150 l of water. The number of insects per plant in the pre-treatment phase was 5-10. The staggered flowering of the plants and the favorable conditions for the pest required a new treatment on 26.04.2024 with the product CIPERGUARD MAX in a dose of 40 ml/ha. There were no differences in the attack of the pests according to the graduations of the desimi factors and agrochemical liming.

Figure 5. Image from the Mustar experimental field -2024-

In the phytosanitary field of lupine, a preventive treatment was applied to the seed to combat pathogens transmissible through soil and seed with the fungicide DIVIDEND M 030 FS (difenconazole 30g/l) in a dose of 1l/t in a dilution of 1:10. Lupine mosaic disease caused by Lupinus Virus 1, Mastenbroek, was manifested in the culture from the seed treatment experience. The percentage of infected plants was 0.2-0.3%, no differences in attack were observed depending on the agrochemical liming or decime. Attacked plants are smaller than healthy ones and have a rigid habitus. The upper leaves are small stiff erect wrinkled and have light green (yellow) spots or streaks alternating with portions of normal color. The flowers of these plants abort in a percentage of 70-80%. In the upper part of the stem, a large number of thin, filiform shoots are formed, giving the infected plants a bushy appearance. Brown necroses appear along the shoots and petiole of the leaves. The disease is transmitted by seed and the infection by aphids. The control method consists in removing plants with mosaic symptoms from the culture.

Among the diseases caused by pathogenic fungi, fusariosis and anthracnose were observed. Fusarium wilt, caused by the pathogen Fusarium spp., causes fusarium wilt of plants, attacking the roots, crown and base of the stem, which rot, causing the plants to turn white and dry. The disease is transmitted through seed and soil, and the obvious symptom of wilting is manifested in the budding and flowering phase. The frequency of the attack had values below 0.3% (sporadic),

without differentiation between the decime factors and the agrochemical liming. The most dangerous disease in sweet white lupine, with manifestations in some years until the crop is compromised, is anthracnose, produced by Ascochyta lupinicola. The disease manifests itself at first in the form of circular, oval or slightly elongated spots, gray in color, with reddish-brown edges. The most serious form is on flowering shoots, where the spots are 15-30 mm in size, brick-colored, with tissue destruction at the level of the attack and bending or curving of the shoot.

Figure 6. Image from the experimental field Lupine -2024-(Manifestation of anthracnose)

The effectiveness of fungicidal treatment is high only when applied preventively (before the onset of the disease). The treatment was applied in the preceding phase of budding, with the product MERPAN 80 WP, in a dose of 1.5 kg/ha. Against the background of the fungicide treatment, the level of disease manifestation had values of the degree of attack of 1-2%, without differentiation depending on the agrochemical liming or the number of plants. No pest attack affecting the crop was observed.

The sorghum crop is frequently attacked by the pathogen Sphaceloteca sorghi which causes panicle blight. The infection is germinal and reproduces by chlamydospores in the soil or on the seed. The fight against this pathogen can only be achieved through the preventive treatment applied to the seed. The treatment was done with the fungicide DIVIDEND M030 FS in a dose of 0.5 l/t in a dilution of 1:10. No tantrums were observed. During the vegetation period, mainly after the appearance of the panicles, characteristic symptoms appeared on the leaves and leaf sheaths, specific to the bacterial attack, produced by Xanthomosa holcicola associated with Pseudomonas anthropogoni

The disease manifests itself as spots, initially small hydrous ovals, with time the spots grow to 2-3 cm wide and 10-15 cm long, rust-colored and with clearly demarcated edges. Often the spots become bright red with red edges, in an advanced stage of the disease and in conditions of humidity and high temperatures, necrotic streaks appear next to the spots. The distinguishing feature between the two pathogens is the bacterial exudate produced in wet weather, which is grayish white in the case of Xantomonas and charcoal brown in the case of Pseudomonas.

The manifestation had a continuous evolution, being favored by high atmospheric temperatures, reaching the phenophase of full ripening on 01.09.2024 at a frequency level of 100% and an attack level of 45-55%. Foliar treatments with fungicides were not made (the level of disease manifestation exceeding PED only towards the end of the vegetation period). No differences were observed in the degree of attack depending on the agrochemical liming or plant species.

The agrochemical liming factor was achieved by applying in the period preceding the preparation of the germinal bed on the version amended with Teracalco in a dose of 1.0t/ha. After one year, no changes in the pH were observed through soil determinations, the values being 4.96 for the amended and 4.84 for the no liming.

The production data regarding the influence of liming in the mustard and lupine crop shows a positive influence, but in the other studied crops the influence of liming was a negative one. From the point of view of density, there are positive production differences at D2 in both gradations of the agrochemical liming factor, with the exception of the lentil crop where at D1 (amended) production was exceeded by 33kg/ha compared to D2. Also in the sorghum culture, on both graduations of factor A (agrochemical liming) at D1 (11 b.g./m2) higher productions were recorded by 361kg/ha compared to D2 (17 b.g./m2). The productions obtained from the crops studied are presented in table 3:

Table 3

Yield obtained in the year 2024

No.	Culture	Yield kg/ha			
		With liming		Without liming	
		D1	D2	D1	D2
1	Wheat	4767	5189	4913	5202
2	Triticale	4962	6104	5367	6378
3	Mustard	61	97	36	36
4	Broad bean	111	211	167	189
5	Lentil	383	350	600	792
6	Buckwheat	383	625	731	1170
7	Chickpeas	650	791	1093	1111
8	Lupine	3027	3639	2569	2933
9	Red clover (biomass)	36800	50800	43800	56000
10	Sorghum	5072	4694	5555	5211

D1 – density 1
D2 – density 2

CONCLUSIONS

In the conditions of some edaphic factors with a low level of fertility and in the conditions of some climatic factors that manifested themselves in the year 2024 at an extreme level (drought), the production level of some crops (buckwheat, chickpea, lupine, lentils, sweet sorghum) shows the possibility promotion of new plant species in the north-west of the country.

At the same time, the placement of experiences on weed control opens new opportunities for testing the effectiveness of herbicides and combinations of herbicides, the time of application and the phytotoxicity reaction for each individual plant.

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