EXPLORING THE PRETABILITY POTENTIAL OF TRITICALE CULTIVATION IN THE LĂPUȘ DEPRESSION, ROMANIA: A SCIENTIFIC ANALYSIS

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Abstract. Two factors were studied between the years 2021-2022 and 2022-2023 in Jugăstreni, Vima Mică common, Maramureș County, in the Lăpuș Depression, Romania: fertilizers and herbicides and their impact at production of triticale crop. Before applying anything, a soil profile was realized to find out the type of the soil, quality class and credit points. The soil type is typical luvosol, the quality class of the soil is II, with 64 evaluation points. For the fertilizers the production was monitored and for the herbicides the frequency and resistance of the weeds. Four variants of fertilizers were administrated in four repetitions and also three variants of herbicides, having one variant without any herbicide as a comparison. The productions obtained were 7469.75 kg/ha for the first fertilization option and 9047 for the 4th fertilization option. During the growth stages of triticale, the observations about weeds and plants were made and data collected. The quantities of fertilizers were established after the first soil analysis made at OSPA Cluj-Napoca, and the herbicides were chose considering the area and what is mostly used by the farmers and depending on what type of weeds appear frequently in triticale crop.

Keywords: *triticosecale*, soil, fertilizers, growth.

INTRODUCTION

Triticale (*x Triticosecale Wittmack*) offers a large range of cultivars whose development shows a wide range of responses to temperature, photoperiod and vernalization (Giunta et al., 2020). Triticale (×*Triticosecale Wittmack*), a hybrid of wheat (*Triticum ssp*.) and rye (*Secale ssp*.), has become an important feed cereal globally (Lilia Levy Hänerv et al., 2013). However, research on this cereal is limited. Nutrients are essential for optimal growth and development of plants. Nutrient availability and composition in the soil varies largely from region to region. The deficiency of essential nutrients may cause chlorosis, necrosis and stunted growth that eventually cause significant crop loss (Bonia Francis et al., 2023).

Romania is by excellence a cereal grower. The top species are soft and hard wheat, barley, 2-row barley and to a lesser extent, in specific ecological niches, rye is cultivated and in mountains Einkorn (*T. monococcum ssp. monococcum*) is also cultivated. From 2007 until now, the ameliorative progress in Romania is quantified by the total quantity of cereals which has constantly increased in recent years. Thus, wheat delivered with 272% more; triticale and rye increased 301% and 62%, respectively (Fig. 1). Triticale average production in the country has steadily increased, according to TEMPO online database between 2007-2021. Gallila Butnaru et al., in ”Triticale improvement: problems and prospects in the west part of Romania (2022)”, mentioned that fluctuations of production show that the genetic basis and triticale breeding programs are well and suitable, and that in extreme conditions (frost and

drought) the yield capacity being higher than wheat, aspects highlighted by cultivators of Bihor County (A. Feher and M. Rat).

The tradition and customs as well as market demand are unfavorable factors for the cultivation of triticale. And yet in these unfavorable conditions, triticale is slowly but surely gaining ground in Romania's economy (Gallila Butnaru et al., 2022).

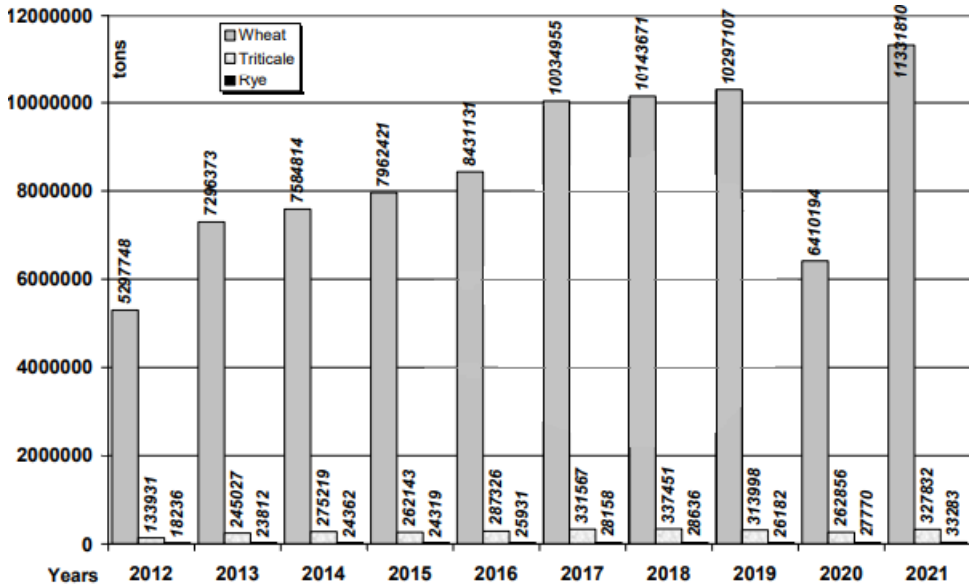

Fig. 1. The total yield harvested in Romania during 2012-2021 to wheat triticale and rye (Tones)

Source: Own developing inspired by Gallila Butnaru et al., 2022

MATERIALS AND METHODS

Cereal grain yield is affected by fertilizer application strategies. In order to quantify the performance of triticale cultivars for use as energy crops, field experiments with either modified quantities of fertilizers applications were designed at one location in Romania over a two year period. In the same time, a series of herbicides were tested to see the efficiency considering the most common weeds that appear in triticale crop.

Lăpuș Depression has 918 km² and various relief units from massive volcanic mountains, to mountains, depressions and hilly areas. The variety of landforms, the particularities of the climate and the different nature of the rocks are elements that determined a rich and varied vegetation (Geography of Romania Vol. III, 1987).

The study was carried out in the period 2021-2022 and 2022-2023 in the pedoclimatic conditions of Maramureș County. The experimental filed was installed in April 2022 and also in April 2023, as a bifactorial experience: fertilizers and herbicides. The variety used was Trismart, sown in autumn – October.

The experimental field was located in Jugăstreni, Vima Mică, a commune with average annual temperature about 9.3°C and average annual precipitation about 800 mm. The geographical coordinates are as follows: 47°23′42″N 23°39′51″E.

To determinate the type of soil, a soil profile was realized and to find out the values of pH, nitrogen, phosphorus and potassium the samples were taken to OSPA Cluj-Napoca. The profile was made in 2020 before starting the experience (Fig.2). After getting the results, quantities of fertilizers were established considering the needs of the culture, the present nutrients found in the soil and going to the maximum active ingredient of nitrogen admitted by the legislation.

The evaluation of soil suitability for triticale cultivation was carried out through the natural assessment of the land using the methodology developed at the national level (MESP, 1987). Since there are no specific indicators for triticale in the methodology, the certification was equated with wheat and barley (Table 1). The boning results that the land is of grade II quality for autumn cereals with 64 evaluation points.

Table 1.

The experimental land credit card

No. Ind.	Indicator name	Code ind.	Limits of framing	Credit options for	
				WH (wheat)	BR (barley)
3C	Average annual temperature (corrected)	08.5	8.1 – 9.0^{0}C	1	1
4C	Average yearly precipitation (corrected)	0575	551 - 600 mm	1	1
14	Gleasing	0	Absent	1	1
15	Pseudoglisation	0	Absent	1	1
16	Salination/alkalization	00	Absent	1	1
23A	Texture (0-20cm)	LP - 43	40 - 43	1	1
33	Slope	07	5.1 – 10.0%	1	1
38	Slip	00	Absent	1	1
39	Groundwater depth	15.0	≥ 10.1	0.8	0.8
40	Flooding	0	Absent	1	1
44	Total strength	- 05	- 10…0	1	1
61	Content of $CaCO_3$	00	Absent	1	1
63	Reaction (0-20cm)	6.1	5.9 - 6.4	1	1
133	Edaphic volume	088	76 - 100	1	1
144	Humus reserve	090	61 - 120 t/ha	0.8	0.8
181	Excess of humidity	1	Absent	1	1
Product of credit ratings coefficients				0.64	0.64
Evaluation points				64	64
Quality class				II	II

Source: MESP, 1987, Vol. 1-3

Fig. 2. Preparing soil profile and samples for laboratory analysis (2020)

RESULTS AND DISCUSSIONS

The statistically results were structured in tables including the data and the explanations. The soil type is a typical luvosol with a pH between 5.47 and 6.04, week to moderate acid, as first soil analysis show (Table 2).

Table 2.

Physical-chemical analysis of the soil, number 318/13.09.2020

No.	Sample identification		Place	Name analysis/UM			
	Lab. No.	Sample no.		pH	Nitrogen%	Mobile Phosphorus ppm	Mobile Potassium ppm
1	4353	V1R1	Jugăstreni, Maramureș County	6.04	0.168	10	556
2	4354	V1R2		5.65	0.188	11	460
3	4355	V1R3		5.89	0.222	14	460
4	4356	V1R4		5.60	0.268	16	414

5	4357	V2R1	5.76	0.160	8	478
6	4358	V2R2	5.84	0.197	13	416
7	4359	V2R3	5.87	0.196	11	524
8	4360	V2R4	5.67	0.179	21	506
9	4361	V3R1	5.94	0.181	8	588
10	4362	V3R2	5.84	0.104	20	430
11	4363	V3R3	5.73	0.177	14	494
12	4364	V3R4	5.75	0.192	20	700
13	4365	V4R1	5.76	0.188	22	540
14	4366	V4R2	5.57	0.186	15	478
15	4367	V4R3	5.75	0.190	12	540
16	4368	V4R4	5.45	0.189	12	336

Source: OSPA Cluj-Napoca (2020)

The pH of the soil is mostly between 5.45 and 5.89 and is moderately acidic. Values such as 5.94 and 6.04 represent a slightly acidic pH.

Regarding nitrogen, most values are recorded between 0.160 and 0.197, which represents a good supply of this element. Values like 0.222 and 0.268 suggest a very good supply. Phosphorus has values between 10 and 16, which means a rather poor supply of this element. However, the presence of values such as 20, 21 and 22 suggests a moderate supply. Potassium has high values, starting from 414, 416 and even going up to 700. This is an indicator of the excessive presence of this element in the soil.

From these analysis results the fact that the soil is pretty week supplied with nitrogen and phosphorus and has an excessive quantity of potassium. For this reason, it was decided to apply fertilizers with elements that are found in moderate or weak quantities in the soil, nitrogen and phosphorus. The quantities of active ingredients applied on each variant are as follows:

A factor – fertilizers

- V1 80 N, 70 P, 0 K (a.i./ha)
- V2 110 N, 90 P, 0 K (a.i./ha)
- V3 140 N, 110 P, 0 K (a.i./ha)
- V4 170 N, 130 P, 0 K (a.i./ha)

The herbicides were chose considering the area and what is mostly used by the farmers and depending on what type of weeds frequently appear in triticale crop.

The most common weeds are:

- *Galeopsis tetrahit* with 10, 11 plants on a surface about 0.25m²
- *Trifolium spp.*, a few plants on the same surface, as being identified with the same

metric frame

- *Atriplex patula,* only few plants and here and there also has been observed
- *Viola arvensis*
- *Symphytum officinale*
- *Rumex crispus* and some species of *Poa spp.*

The commercial herbicides used are the following:

B factor – herbicides

- ✓ B1 untreated group
- ✓ B2 COMOD SUPERSTAR 50 SG (tribenuron-methyl 50%) + FOXTROT 69 EW

(fenoxaprop-P-ethyl 69 g/l + cloquintocet mexil 34.5 g/l (safener)) – applied postemergence

- ✓ B3 HUDSON (200 g/L fluroxypyr) - applied postemergence
- ✓ B4 GRANSTAR SUPER 50 SG (25% thifensulfuron-methyl + 25% tribenuron-methyl) – applied postemergence.

Considering the treatment scheme, there were used substances for weeds control in the different phenophases of the triticale plants, starting from 2-3 internodes till 5 internodes as being the last phenophase when herbicides can be applied on the culture without affecting it. The experience was realised on an autumn culture, using the Trismart variety, sown in October both experimental years, 2021 and 2022. Trismart is a rustic variety produced in Romania, with a very good adaptability to different areas and conditions, with a good resistance to falling and to diseases. It is a semi-late variety with a high crop yield. Most of the farmers declares themselves satisfied with this harvest, being used mostly for animal feed.

The experimental filed was installed in the spring, as soon as the weather permitted (April 2022) and the fertilizers were applied in the same period (Figure 3).

Fig. 3. Experimental filed installation, before and after fertilisation

After the first round of fertilization, observations considering the modifications on the quantity of soil elements were made by another soil analysis at OSPA Cluj-Napoca. The results are presented in the next table (Table 3).

Table 3.

Physical-chemical analysis of the soil, number 104/11.11.2022

No.	Sample identification		Place	Name analysis/UM			
	Lab. No.	Sample no.		pH	Nitrogen%	Mobile Phosphorus ppm	Mobile Potassium ppm
1	4712	V1R1	Jugăstreni, Maramureș County	5.72	0.178	6	414
2	4713	V1R2		5.95	0.152	20	460
3	4714	V1R3		5.81	0.159	10	460
4	4715	V1R4		5.90	0.157	18	592
5	4716	V2R1		5.89	0.162	8	410
6	4717	V2R2		5.87	0.180	24	540
7	4718	V2R3		5.76	0.169	22	460
8	4719	V2R4		5.65	0.170	14	384
9	4720	V3R1		5.59	0.171	76	364
10	4721	V3R2		5.53	0.173	34	500
11	4722	V3R3		6.09	0.155	10	560
12	4723	V3R4		5.45	0.168	42	480
13	4724	V4R1		5.42	0.178	68	560
14	4725	V4R2		5.10	0.182	81	396
15	4726	V4R3		5.36	0.197	23	364
16	4727	V4R4		5.50	0.161	18	524

Source: OSPA Cluj-Napoca (2022)

The pH of the soil is mostly between 5.10 and 5.89 and is moderately acidic. Values between 5.90 and 6.09 represent a slightly acidic pH. Up to this point, no significant differences were registered. In the case of nitrogen, it can be seen that all values are below 0.200, respectively 0.152 and 0.197, which means that the soil has a moderate supply of this element after fertilization. For phosphorus, the effect of fertilization is the most visible, its values being more varied compared to the basic soil analyses. From values like 6 and 8 which indicate a very low supply of this element, to values like 76 and 81 which indicate a very good supply. Potassium values are still high, although changes in its values can be observed, from 364 to 592, indicating still a very good supply.

As can be seen, after fertilization, the content of nitrogen and phosphorus was influenced. Although potassium was not added, it can be seen that the rest of the elements also influence its content. The effect of fertilization can also be observed on production. From the first observations it appears that the highest production is registered with the 4th fertilization option, 9047 kg/ha, with the largest amount of fertilizer (Figure 4) and the lowest, 7469.75 kg/ha, with the first fertilization option.

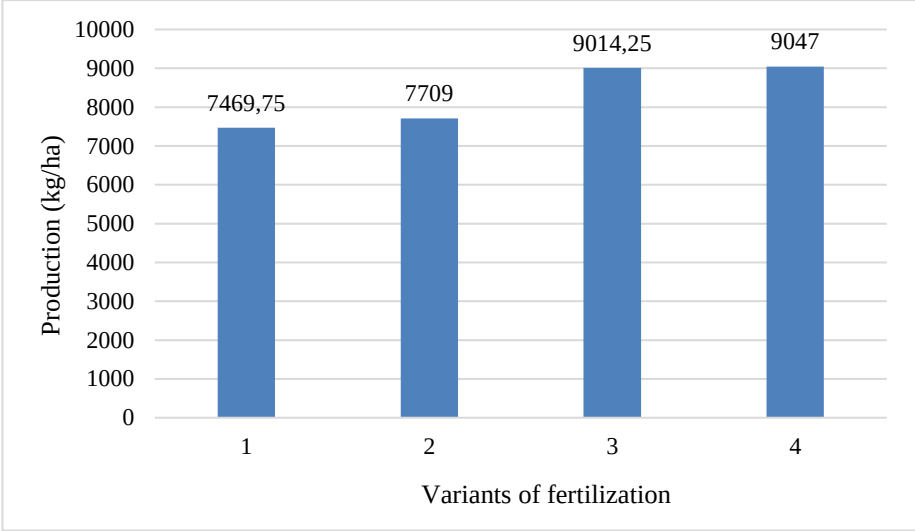

Fig. 4. Production (kg/ha)

CONCLUSIONS

Triticale is a challenge for Romanian farmers due to its adaptability and plasticity. The boning results that the land is of grade II quality for autumn cereals with 64 evaluation points. According to the first observations made, productions between 7469.75 kg/ha and 9047 kg/ha were obtained. It is necessary to establish the proper doses of fertilizers to avoid the falling of the plants which can be taken as a disadvantage. To reveal the qualities and advantages of this culture, a better information about triticale is recommended. This culture is mostly used in animal feed, having satisfying results mixed with other cereals. Its use in human nutrition is less common, due to the fact that is more used in the production of healthy food.

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