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AGRO-TECHNICAL METHODS FOR INCREASING PRODUCTION OF SPRING BARLEY IN THE HILL OF TRANSYLVANIA

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Abstract

The formation of the spring barley crop is influenced by the variety chosen in the culture, the pedo-climatic conditions, the precursor plant and the applied technology. Experiences carried out at SCDA Turda in 2019 and 2020 have shown that spring barley grown in no-tillage technology responds favorably in achieving yield regardless of whether it rotates after sugar beet (4855 kg/ha) or maize (4735 kg/ha).

Keywords: direct sowing, spring barley, rotation, yield

JEL Classification: Q 01, Q 15, Q 16

INTRODUCTION

When establishing crop rotation in an agricultural holding, the particularities of the plants that rotate must be taken into account, and here we refer primarily to: water requirements and consumption (Ardelean, 2006) and nutrients, the possibilities of the root system for exploring of the soil horizontally and vertically, the vegetation period, etc., in order to avoid the appearance of the “soil fatigue” effect (Vasiliu, 1979 quoted by Budoï & Penescu, 1996). Crop rotation is the basic component that determines the reduction of land weeding (Berca, 2004), pest control (Lazăr et al., 1980; Boguleanu et al., 1980; Bărbulescu et al., 2000) and diseases (Perkowski et al. 2003; Munteanu et al., 1982; Bărbulescu, 2001 a, 2001 b; Bunta, 2003).

Crop rotation should be seen as a method of reducing technological costs (labor, pesticides, fertilizers, etc.) without diminishing quantitative and qualitative yield (Dincă et al., 1971; Bandici, 1997). The inclusion of legumes in crop rotation has a favorable effect on successor crops, improving the soil in nitrogen and contributing to the development of the root system (Vidican et al., 2013; Chețan et al., 2016). Poor crop rotation can promote soil compaction by limiting differences in plant root system and the major role it plays in restoring the physical properties of the soil and even in breaking the deep compacted layers. The potential for compaction at the beginning of the vegetation period also increases due to the increase in the number of passes and traffic on the ground (Canarache, 1990; Domuța, 2008; Guș et al., 1998, 2004).

Spring barley (two-row barley) must be framed in a rotation of at least 3-4 years, the best precursors are the potato and sugar beet followed by soybeans, sunflowers, maize. It is not recommended to place spring barley in monoculture, and after perennial legumes, it is preferable for barley to follow in the second year (Drăghici et al., 1975; Muntean et al., 2008; Pintilie & Sin, 1974). Due to the shorter vegetation period, between 90 and 120 days, the requirements of spring barley for fertilizers are generally lower, being able to capitalize well on the residual effect of fertilizers applied to the previous crop.

It is also not pretentious to the soil works, it can be sown in the no tillage system (directly in the stubble of the precursor plant), with the help of precision seeders whose coulters penetrate into the soil to the depth of incorporation of the seed (4 - 5 cm), simultaneously with the sowing and the fertilizers are dosed and unloaded in the seed tube. The barley forms many tillers and a high growth rate, thus making it easier to control weeds with crop problems (*Setaria* sp., *Sonchus arvensis*, *Agropyron repens*); production costs are low, making it a profitable crop; release the land early, etc. (Chețan et al., 2021).

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The Transylvanian Plain has a special aspect, being predominant the hilly areas, in which the phenomena of soil erosion by leaching are frequently encountered. Direct sowing in the vegetable residues of the previous crop (mulch) as well as crop rotation are practices that can reduce this phenomenon, contributing to maintaining and improving soil quality and achieving close harvests in value or even higher than those obtained by conventional cultivation (Rusu & Guş, 2007; Rusu et al., 2014; Cheţan, 2020). Within the Turda station, by purchasing high-performance machines and equipment, the conservative agriculture system can be practiced, both for straw cereals sown directly in the raw soil, and for maize, soybeans, peas, etc., sown in the system with minimal work that involves the basic work without turning the furrow and keeping the vegetal remains in proportion of over 30% at the surface of the soil or incorporated superficially, fulfilling the role of mulch (Ignea et al., 2013; Cheţan et al., 2019; Sucişu et al., 2019; Cheţan et al., 2020).

The paper presents the results of research on the influence of the precursor plant on the production of two varieties of spring barley sown in no tillage system, in the pedo-climatic conditions of the Agricultural Research-Development Station (ARDS) Turda.

MATERIAL AND METHOD

The researches were carried out in the period 2019-2020, at SCDA Turda located in the Transylvanian Plain, on a vertic clay-illuvial type soil, with a loam-clay or even clay-loam texture (SRTS, 2012), with neutral or weakly alkaline pH, with a medium-good and even very good supply with mobile P and very good with mobile K and with an average humus content. There are four experimental variants, the surface of each variant is 1.0 ha.

The experimental factors:

A: precursor plant, a₁ sugar beet, a₂ maize; **B:** variety, b₁ Romaniţa, b₂ Daciana; **C:** year (climatic conditions), c₁ 2019, c₂ 2020.

Barley sowing was carried out in the optimal period (March second decade) with the Directa-400 seed drill at 18 cm between rows, the seed being treated with 0.5 l/t of systemic fungicide based on prothioconazole 150 g/l + tebuconazole 20 g/l. The sowing density of 500 gg/m² was established depending on the cultural value of the seeds, the twinning capacity and the climatic conditions specific to the area. Simultaneously with the sowing, the basic fertilization was performed with N₅₀P₅₀ (250 kg/ha NPK 20: 20: 0) and completed with N₃₂Ca₈ (120 kg/ha nitrocalcar) in the phase of the end barley tillering.

The chemical treatment for weed control, at the end of the barley twinning was performed with 0.12 l/ha product based on iodosulfuron-methyl-Na 25 g/l + mefenpyr diethyl 250 g/l (safener) + 0.6 l/ha product based on 660 g/l 2.4% D acid from dimethyl amine salt (825 g/l 2.4 D dimethyl amine salt). Control of diseases and pests, first of all preventive by observing the agrotechnical measures (crop rotation, rotation, seed treatment, sowing in the optimal time, density, etc.) and curative with two chemical treatments on vegetation: I simultaneously with herbicide with 0.2 l/ha insecticide based on Tau-fluvalinate 240 g/l and 0.7 l/ha fungicide based on prothioconazole 53 g/l + spiroxamine 224 g/l + tebuconazole 148 g/l; II on the standard leaf with 0.7 l/ha fungicide based on prothioconazole 175 g/l + trifloxystrobin 150 g/l + 0.2 l/ha insecticide based on cypermethrin 100 g/l.

After harvesting the barley and weighing each variant (kg/ha), samples were taken in order to establish the grain humidity (with the Granomat PERTEN laboratory humidometer), after which it was recalculated to the STAS humidity (14%) using the correction factors (at 86% dry matter).

The experimental data were processed by analyzing the variant (PoliFact, 2015) and establishing the limit differences (LSD, 5%, 1%, 0.1%).

The climatic conditions from January to July 2019, 2020 (source: Turda meteorological station: longitude 23°47' - latitude 46°35' - altitude 427 m) are found in Figure 1 and 2.

For the last 63 years (1957-2019) in Turda, the multiannual average temperature was 9.2°C and the multiannual amount of precipitation was 531.4 mm.

January 2019 was warm (-2.2°C), February (1.7°C) and March (7.3°C) were also warm, the average temperature recorded in April (11.3°C) was close to normal for the period (10.0°C multiannual for 63 years). In May there were lower temperatures than normal (13.6°C) the month being characterized as a cool month after which temperatures increased generating a warm month (June 21.8°C). The average monthly temperature of 20.4°C recorded in July was close to the multiannual average (19.8°C). From the point of view of the pluviometric regime, in the first month of 2019 the precipitations were abundant (January 46 mm) after which the drought phenomenon was installed (February 17.7 mm and March 12.3 mm). April was very rainy (62.6 mm), the most excessively rainy month (152.4 mm) followed by a reduction in precipitation in June (68.8 mm) and July (35 mm).

The year 2020 started with a normal month in terms of temperature (average -2.2°C) but excessively dry, the rainfall recorded (10.4 mm) was below the value of the multiannual average (21.8 mm) with deviation -11, 4 mm followed by two warm and rainy months, February and March, but without raising any problems regarding the sowing of spring barley, this being done at the optimal time, between March 16th. The soil moisture in March favorably influenced the emergence of the crop. In April, a pedological drought set in, which continued until mid-June when torrential rains (115 mm) were recorded, accompanied by strong winds, with a rather low impact on the crop, the varieties created in Turda have quite good resistance to fall. In July, temperatures were close to normal, with a deviation of only 0.5°C and rainfall exceeded the multiannual average by 9.7 mm, being considered a slightly rainy month, so that the harvest took place in optimal conditions without delays, affect the quality of the grains.

Figure 1. The thermic regime, January - July 2019, 2020 at SCDA Turda

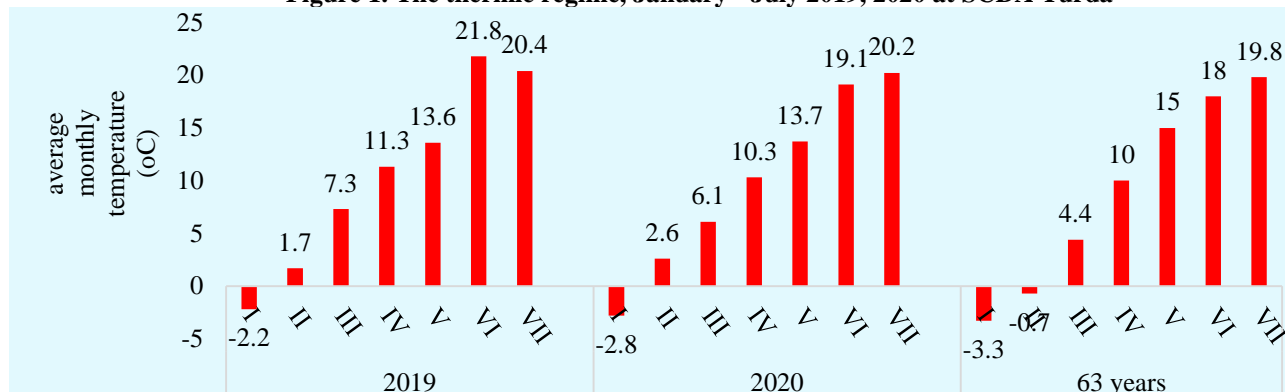
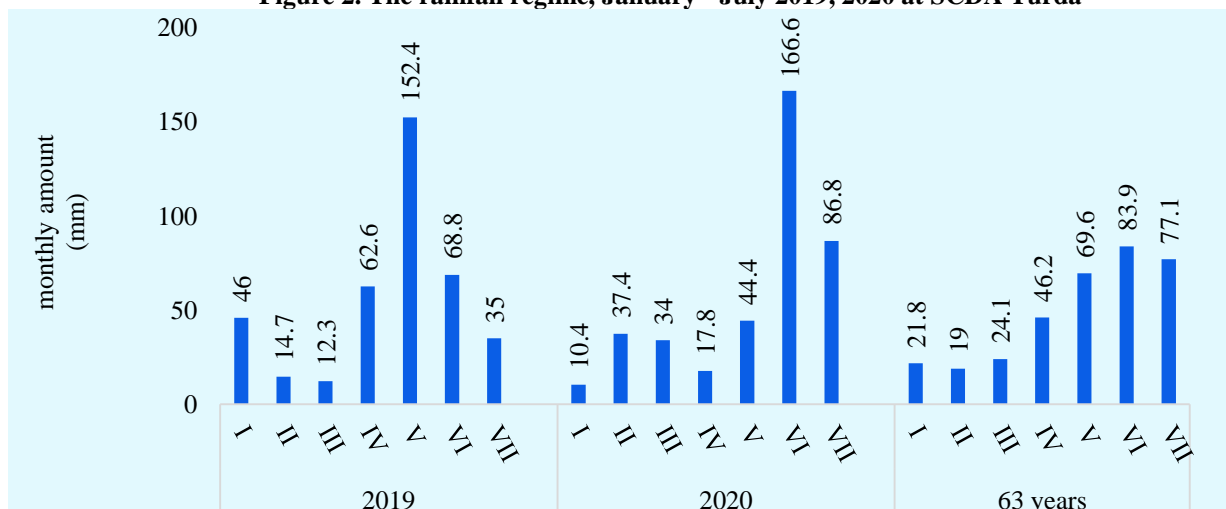


Figure 2. The rainfall regime, January - July 2019, 2020 at SCDA Turda



Specific to the two years studied, was the uneven distribution of rainfall, there were dry periods of time, with prolonged pedological droughts followed by torrential rains.

RESULTS AND DISCUSSION

Although sugar beet and maize are part of the middle group in terms of favorability as a precursor to barley, it seems that maize has significantly negatively influenced the yield potential of barley, the average recorded yield shows statistically assured differences, these being 4855 kg/ha after sugar beet (control) and 4735 kg/ha after maize (Table 1). We believe that these values are primarily due to the fact that after the beet the soil remains looser in depth which allowed a better development of the root system in barley and thus better absorption of nutrients from the soil. In fact, the vegetable remains left after the beet harvest (leaves, package, small roots, etc.) were easily destroyed during the winter. Maize harvesting was carried out with the high-capacity CASE combine, which has the advantage of chopping and spreading by-products on the ground, which decompose more slowly and seem to offer less favorable conditions for barley, which can be seen from the average yields achieved in the two years of experimentation.

Table 1. The influence of the precursor plant on the yield of spring barley, ARDS Turda

The precursor plant (A)	Yield (kg/ha)	(%)	Differences (kg/ha)	Significance
a ₁ sugar beet	4855	100,0	0,00	Ct
a ₂ maize for grain	4735	98	-120	0
LSD(5%) = 61; LSD (1%) = 149; LSD (0.1%) = 237.				

For the success of the culture, the spring barley needs approximately 180-300 mm of water for the entire vegetation period (<https://www.agrimedia.ro>). Although in 2019 between April 11 and July 10 the rainfall regime was 287 mm and in 2020 for the same period it was 251.8 mm, compared to the average of the two experimental years (control) the yield was significantly different (negative or positive) of climatic conditions. These results are due, we believe, to temperature fluctuations and the non-uniformity of precipitation during the experimental period.

Table 2. The influence of the year on the yield of spring barley, ARDS Turda

The year (B)	Yield (kg/ha)	(%)	Differences (kg/ha)	Significance
b ₀ average years	4637	100,0	0,00	Ct
b ₁ 2019	4391	95	-246	00
b ₂ 2020	4883	105	246	**
LSD(5%) = 81; LSD (1%) = 117; LSD (0.1%) = 176.				

Of the two varieties of spring barley, the genotype Romanița (control) is noted, in terms of average yield in the two years, which records yield increases (4805 kg/ha) and for the Daciana variety the difference in yield compared to the control is 335 kg/ha, presents statistical assurance and very significant negative influence.

Table 3. The influence of the variety on the yield of spring barley, ARDS Turda

The barley variety (C)	Yield (kg/ha)	(%)	Differences (kg/ha)	Significance
b ₁ Romanița	4805	100,0	0,00	Ct
b ₂ Daciana	4470	93	-335	000
LSD(5%) = 31; LSD (1%) = 51; LSD (0,1%) = 95.				

CONCLUSIONS

In the area of the Transylvanian Plain, it is recommended to cultivate the two varieties of spring barley in no tillage system, which is distinguished by average annual yields over 4000 kg/ha.

Spring barley it is more suitable if it follows after the sugar beet than if it follows after maize.

The process of harvesting the spring barley is negatively influenced by the higher temperatures in June and July 2019.

REFERENCES

1. Ardelean, Ileana (2006). Contribuții la cunoașterea și modificarea influenței rotației culturilor asupra capacității și calității recoltei de grâu cultivat pe solurile acide din nord-vestul țării. Teza de doctorat. USAMV Cluj-Napoca.
2. Bandici, Gh. E. (1997). Contribuții la stabilirea influenței premergătoarei și a fertilizării asupra dinamicii acumulării biomasei la grâul de toamnă cultivat pe soluri cu exces de umiditate, în centrul Câmpiei de Vest a României. Teza de doctorat, USAMV Cluj-Napoca.
3. Bărbulescu, Al., Popov, C., Mateiaș, M.C. (2000). Protecția culturilor de câmp împotriva bolilor și dăunătorilor. Ed. Tipo Cicero Târgu Mureș, p: 27-31.
4. Bărbulescu, Al. (2001 a). Recomandări privind protejarea culturilor de porumb și floarea soarelui împotriva bolilor transmisibile prin sămânță și sol și a dăunătorilor. Ed.Ceres. Plante tehnice, 4: 26-31.
5. Bărbulescu, Al. (2001 b). Rezultate obținute în anul 2000 în cadrul cercetărilor privind bolile și dăunătorii cerealelor privind bolile și dăunătorii cerealelor și unor plante tehnice și furajere. Probleme protecția plantelor, XXIX (2): 123-178.
6. Berca, M., (2004). Managementul integrat de combatere a buruienilor. Ed. Ceres, București.
7. Boguleanu, Gh., Bobîrnac, B., Costescu, C., Duvlea, I., Filipescu, C., Pașol, P., Peiu, M., Perju ,T. (1980).Entomologie agricolă. Ed. Didactică și Pedagogică București;
8. Budoî, Gh., Penescu, A., (1996). Agrotehnică. Ed. Ceres, București.
9. Bunta, Gh. (2003). Genetica și ameliorarea grâului. Testarea ecologică a soiurilor de grâu, orz și triticale. În Cercetări agricole în Crișana. Ed. Cord. Ciobanu, Gh. and Domuta, C., Ed. Univ. Oradea, 5-85.
10. Canarache, A. (1990). Fizica solurilor agricole, Editura Ceres, București.
11. Chețan, C., Felicia, Chețan, Gaga, I. (2020). Combaterea buruienilor din cultura de soia. Revista Agricultura transilvană, Buletin informativ, Nr. 32, martie 2020, p; 77-80, Ed. SC Ela Design SRL Turda.
12. Chețan, C., Felicia, Chețan, Ioana, Crișan, Carmen, Vasilache, Chiriță, S., Gaga, I. (2021). Tehnologia de cultivare a orzoacei de primăvară în sistem conservativ - no tillage. Revista Agricultura transilvană, Buletin informativ, Nr. 34, martie 2021, p: 24-31, Ed. SC Ela Design SRL Turda.
13. Chețan, Felicia, Chețan, C., Felicia, Mureșanu (2016). Determining the technology influence of soy on the soil, production and economic efficiency on Turda area. International Symposium "Agricultural Economics and Rural Development - Realities and perspectives for Romania", 7th edition, November 2016, ASE Publishing, Bucharest, Romania, ISSN 2285-6803 ISSN-I 2285-6803, p: 162-168.
14. Chețan, Felicia, Russu, F., Felicia, Mureșanu (2019). The long - term effect of the soil tillage and fertilization systems on certain soil attributes and on the winter wheat yields in the Transylvanian Plain. Romanian Agricultural Research no. 36/2019.DII 2067-5720 RAR 2019-1, Romania.
15. Chețan, Felicia (2019). The influence of the tillage system and the crop rotation on the soil availability in the main nutrients and the yields obtained in Turda area. International Conference "Agriculture for Life, Life for Agriculture" 6-8 June 2019, USAMV București. Scientific papers. Series A. Agronomy, Vol. LXII, No.1, 2019. ISSN 2285-5785; ISSN CD-ROM 2285-5793; ISSN Online 2285-5807; ISSN-L 2285-5785
16. Chețan, Felicia (2020). Tehnologia de cultivare a grâului de toamnă în sistem conservativ. Ed. BioFlux Cluj-Napoca, ISBN 978-606-8887-80-7.
17. Dincă, D. (1971). Influența rotației asupra producției, valorificării îngrășămintelor și calității biologice arecoltelor de grâu și porumb pe solul brun roșcat de pădure. Probleme agricole, no.9, p.56-59, p.70.
18. Domuța, C. (2008). Asolamentele în sistemele de agricultură. Ed. Universității Oradea. ISBN 978-973-759-665-9.
19. Drăghici, L., Bude, Al., Șipoș, Gh., Corina, Tușa (1975). Orzul, Ed. Academiei R.S.R., București
20. Guș, P., Lăzureanu,A., Sândoiu, D., Jităreranu,G., Stancu, I. (1998). Agrotehnică. Ed. Risoprint Cluj-Napoca, ISBN 973-9298-67-2.
21. Guș, P., Rusu, T., Ileana, Bogdan, (2004). Agrotehnică. Ed. Risoprint Cluj-Napoca. ISBN 973-656-711-7.
22. Ignea, M., Felicia, Mureșanu, Felicia, Chețan (2013). The influence of some technological factors on production obtained from the autumn wheat grown in the system with minimum soil works and the economic efficiency of crop technologies. The 4th Edition of the International Symposium, Agrarian Economy and Rural Development

- Realities and Perspectives for Romania. Vol 4 issue 2013, p: 123-129, ISSN – 2285-6803, ISSN – L – 2285-6803.
23. Lazăr, Al., Hatman, M., Bobeș, I., Perju, T., Săpunaru, T., Goian, M. (1980). Protecția plantelor (Plant protection). Ed. Didactică și Pedagogică, București.
 24. Munteanu, I., Mustea, D., Elena, Nagy, Trif, V., Maria, Munteanu, Ștefănescu, Al. (1982). Bolile grâului și combaterea lor integrată în Transilvania. Contribuții ale Cercetării științifice la dezvoltarea Agriculturii. Red. Prop. tehn. agr. București, p: 145-176.
 25. Muntean, L.S., Cernea, S., Morar, G., Duda M., Vârban, D., Muntean, S. (2008). Fitotehnie. Ed. Academic Pres, Cluj-Napoca.
 26. Perkowski, J., Wiwart, M., Buško, M., Magdalena, Laskowska, Berthiller, F., Kandler, W., Krska R., (2003). Fusarium toxins and total fungal biomass indicators in naturally contaminated wheat samples from north-eastern Poland in 2003. Food Additives and Contaminants, 2007, 24 (11), p.1292-1298.
 27. Pintilie, c., Sin, Ghe. (1974). Rotația culturilor de camp. Ed. Ceres, București.
 28. Rusu, T., Guș, P., (2007). Compactarea solurilor – procese și consecințe. Editura Risoprint Cluj-Napoca, Colecția Agraria, ISBN 978-973-751-417-2.
 29. Rusu, T., Moraru, Paula Ioana, Coste, Camelia, Căcovean, H., Chețan, Felicia, Chețan, C. (2014). Impact of climate change on climatic indicators in Transylvanian Plain, Romania. Journal of Food, Agriculture & Environment Vol. 12 (1): 469-473.
 30. Suci, Loredana, Felicia, Chețan, Felicia, Mureșanu, Chețan, C., Alina Șimon, (2019). Research regarding the influence of tillage on pathogens attack in soybean cultures. Romanian Journal for Plant Protection, Vol. XII, 2019, p: 12-18, ISSN 2248 - 129X; ISSN-L 2248 - 129X.
 31. Vidican, Roxana, Rusu, M., Rotar, I., Marilena, Mărghitaș (2013). Manualul aplicării fertilizanților. Ed. Risoprint, Cluj-Napoca.
 32. ***Meteorological Station Turda.
 33. *** Romanian Soil Taxonomy System (SRTS) 2012.
 34. ***POLIFACT, 2015. ANOVA PROGRAM
 35. ***<https://www.agrimedia.ro/articole/tehnologia-de-cultura-pentru-orzoaica-de-primavara>
 36. ***<https://www.agrimedia.ro>