STUDY OF SOME QUALITATIVE PARAMETERS OF HAIRY VETCH WITH CEREALS WINTER CROP MIXTURES CULTIVATED IN THE CONDITIONS OF WESTERN ROMANIA (CASE STUDY)

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Abstract. *The use of the annual legumes (vetches)in mixtures with cereals for forage as winter crops is a rational way of using the land surface and to improve the seedbed for the spring cash crop. This forage cropping system is encouraged by the agricultural policies from the E.U. because it contributes to the preservation and improvement of soil fertility. The goal of this work is to assess some forage features of several mixture variants of hairy vetch (Vicia villosa Roth.) and cereals with different participation rates of the legume and cereals. The cereals used in this research were four genotypes of wheat (Alex, Ciprian, Crişana and line 6111), two oat genotypes (Sorin and line 2515), one barley variety (Ametist) and one Triticosecale variety (Haiduc). The researches were developed at the Station of Agricultural Research and Development from Lovrin (Timiș County, Romania) on a chernozem soil. The considered participation rates of the hairy vetch – cereals seed mixtures were 2:1 and 1:2, there being used 16 mixture variants. The forage features analysed were fresh fodder yield, dry matter yield, dry matter content, crude protein yield and crude protein content. The forage obtained in the case of early harvesting of hairy vetch mixtures with triticale have the best results as fresh fodder yield. Grater yields of the hairy vetch mixtures with other cereals can be obtained also by later harvesting compared with triticale mixture, respectively (1-2 weeks). Winter crop forage mixtures of hairy vetch with cereals are a great option for livestock feeding with fresh fodder early in spring. The proportion of vetch and cereal in mixture had a great influence on the dry matter yield and crude protein yield and this can be managed by the farmer according with the nutritional needs of his livestock. The use of annual legumes - cereals mixtures as winter crop has numerous benefits from productive and ecological points of view because they act as a cover crop and after harvesting of the fresh fodder the remains are improving the growing condition for the following crop by increasing of soil N content, organic matter content in soil, porosity, percolation etc.).*

Keywords*: annual legumes-cereals mixtures, forage, hairy vetch, cereals, participation rate.*

INTRODUCTION

The cultivation of the mixtures of annual legumes with cereals has many benefits because this crop can be used in many ways, respectively fresh fodder, hay, silage, grains production, cover crop *etc*. Other advantages of this crop are low maintenance cost and the fact that in the temperate area they can be included in a system of successive cropping.

According with SOLATI *ET AL.* (2016) the demand for proteins sources is very high in the European Union mainly due to the dependence for the imported soybean for the livestock, from this point of view the composition in amino acids of the legumes and grasses is a feasible alternative.

Researches of BEN YOUSSEF *ET AL.* (2019) suggest that the mixtures of legumes with cereals have significant results in comparison with the pure stands from the point of view of dry matter yield, efficiency in the use of the resources and economic efficiency in the conditions of low input farming. Similar results were obtained by SEYEDEH *ET AL.* (2010),

recommending the mixtures of 50:50 hairy vetch and barley as producing the highest yield with the highest quality.

According with literature, the mixtures of nitrogen-stabilizing species (leguminous as *Vicia* spp.) and cereals used for the feeding systems of livestock in farm represents the best choice because it provides seasonal forage that can help to the decrease of the animal load on the pasture and in the same time had a great contribution to the increase of the soil fertility [RAHMATI *ET AL.*, 2012].

The use of the fertilisation for the increase of the forage yield and quality is highlighted in many researches with emphasis on nitrogen application [AGAPIE *ET AL.*, 2016; AGAPIE *ET AL.*, 2018]. Thus, according with CARPICI E.B.*ET* TUNALI M.M. (2012) the fertilisation of the hairy vetch with barley mixture with nitrogen has a good influence on the yield of dry matter and protein content of the forage, in the case of poor soils.

The literature shows many examples of the potential uses of the hairy vetch – cereal mixtures. Thus, BASHYAL *ET AL.* (2019) in the researches of hairy vetch mixtures with cereal rye had analysed the effect of this mixture on weed suppression and pest control, showing that the increase of hairy vetch rate from 33% to 66% had a relevant trend in this way. Also, there is an increased interest in the cultivation of hairy vetch as winter cover crop in upland farms from Japan in rotation with rice with good results in the soil improvement by nitrogen fixation [ZOUGMORE *ET AL.* 2006 CITED BY SEYEDEH *ET AL.*, 2010]. Other researches referring to the use of hairy vetch – cereal rye mixture as cover crop refers to the decomposition of organic matter and nitrogen release [SIEVERS *ET* COOK, 2018; THAPA *ET AL.*, 2018; DHAKAL *ET AL.*, 2020], and denitrification and mineralization of nitrogen (ROSECRANCE *ET AL.*, 2000). The same mixtures used as cover crops by POFFENBARGER *ET AL.* (2015) show that the proportion of the species in the mixture influences the performance of the expected results.

The goal of this work is to assess some forage features of several mixture variants of hairy vetch (*Vicia villosa* Roth.) and cereals with different participation rates of the legume and cereals.

MATERIAL AND METHODS

The leguminous species used in this research was hairy vetch (*Vicia villosa* Roth.), and the cereals were four wheat (*Triticum aestivum* L.) genotypes (Alex, Ciprian, Crișana and line 6111), two oat (*Avena sativa* L.) genotypes (Sorin and line 2515), one barley (*Hordeum vulgare* L.) variety (Ametist) and one triticale (*x Triticosecale* Wittm. ex A. Camus.) variety (Haiduc).

The researches were developed at the Station of Agricultural Research and Development from Lovrin (Timiș County, Romania) on a chernozem soil, slightly gleyic. the altitude of the experimental plot is 90 m a.s.l., the climate is characterised by a multiannual average temperature of 10.7°C and rainfall amount of about 520 mm.

The biological material was seeded on 3rd October 2017 at a distance between rows of 12.5 cm and a sowing rate of 150 kg/hectare for both participation rates of hairy vetch - cereals used in the experience (2:1 and 1:2). The fresh fodder samples were harvested in 17 April 2018 at the phenophase of beginning of flowering of hairy vetch.

The considered participation rates of the hairy vetch – cereals seed mixtures were 2:1 and 1:2, there being made 16 mixture variants (Table 1). The experimental field was organized in randomized blocks with three replicates, the surface of every plot was 15 m^2 (5 m x 3 m).

The features analysed were fresh fodder yiled, dry matter yield, dry matter content, crude protein yield and the crude protein content.

Table 1

Experimental variants of the hairy vetch with cereals mixtures

Variant	Participation rate	Mixture (hairy vetch and cereal) seeding rate
V1	2:1	Vicia villosa 100 kg/ha^{-1} + Triticale Haiduc 50 kg/ha^{-1}
V2		Vicia villosa 100 kg/ha^{-1} + oat Sorin 50 kg/ha^{-1}
V3		Vicia villosa 100 kg/ha^{-1} + oat line 2515 50 kg/ha^{-1}
V4		Vicia villosa 100 kg/ha^{-1} + barley Ametist 50 kg/ha^{-1}
V5		Vicia villosa 100 kg/ha^{-1} + wheat Crişana 50 kg/ha^{-1}
V6		Vicia villosa 100 kg/ha^{-1} + wheat Ciprian 50 kg/ha^{-1}
V7		Vicia villosa 100 kg/ha^{-1} + wheat Alex 50 kg/ha^{-1}
V8		Vicia villosa 100 kg/ha^{-1} + wheat line 6111 50 kg/ha^{-1}
V9	1:2	Vicia villosa 50 kg/ha^{-1}+ Triticale Haiduc 100 kg/ha^{-1}
V10		Vicia villosa 50 kg/ha^{-1}+ oat Sorin 100 kg/ha^{-1}
V11		Vicia villosa 50 kg/ha^{-1}+ oat line 2515 100 kg/ha^{-1}
V12		Vicia villosa 50 kg/ha^{-1}+ barley Ametist 100 kg/ha^{-1}
V13		Vicia villosa 50 kg/ha^{-1}+ wheat Crişana 100 kg/ha^{-1}
V14		Vicia villosa 50 kg/ha^{-1}+ wheat Ciprian 100 kg/ha^{-1}
V15		Vicia villosa 50 kg/ha^{-1}+ wheat Alex 100 kg/ha^{-1}
V16		Vicia villosa 50 kg/ha^{-1}+ wheat line 6111 100 kg/ha^{-1}

Dry matter content was determined by drying for 72 hours the fresh fodder samples at 103 ^{o}C. The measurement of crude protein content was done by using the Kjeldahl method. The samples were analysed in the Laboratory of the Research Platform from Banat's University of Agricultural Sciences and Veterinary Medicine "King Michael I of Romania" from Timişoara.

RESULTS AND DISCUSSIONS

The results regarding the fresh fodder yield (Figure 1) harvested on 17 April 2018 were comprised between 29.68 t/ha (V1) and 17.35 t/ha (V16). The differences between the two participation rates had slightly lower values in the case of the 1:2 vetch-cereal participation ratio compared with 2:1. The mixtures V1 and V9 with hairy vetch – triticale had greater yields at the moment of harvesting compared with all the others, but the mixture with greater participation rate of hairy vetch brought the best yield from the experience.

Dry matter yield is an important indicator of the forage yield and is represented in Figure 2. The greatest dry matter yield was obtained in the variant V1 (5.02 t/ha) and the lowest in the case of variant V8 (3.38 t/ha). The best dry matter yield were determined for the mixtures of hary vetch with triticale, as it was in the case of fresh fodder yield, respectivelly the variants V1 and V9. Other researches have highlighted similar results, respectively hairy vetch mixture with triticale had a greater yield of dry matter in comparison with hairy vetch cultivated in pure stands [BINGOL *ET AL*., 2007 CITED BY CARPICI E.B.*ET* TUNALI M.M., 2012; BEN YOUSSEF *ET AL.*, 2019].

Dry matter content is other important quality indicator of the forage and the results obtained for the hairy vetch – cereals mixtures are represented in the Figure 3. The greatest dry matter content was obtained in V10 (20.96%) and the lowest dry content was determined in V8 (16.75). The results regarding the dry matter content had in general greater rate in the variants with the greatest participation rate of the cereals, similar results being obtained by SEYEDEH *ET AL.* (2010).

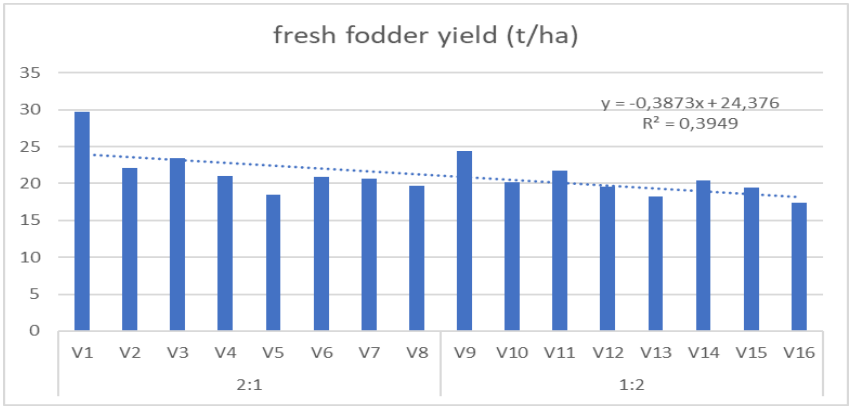

Figure 1. Fresh fodder yields (t/ha) of the winter crop mixtures of hairy vetch and cerelas cultivated at Lovrin (harvested on 17 April 2018)

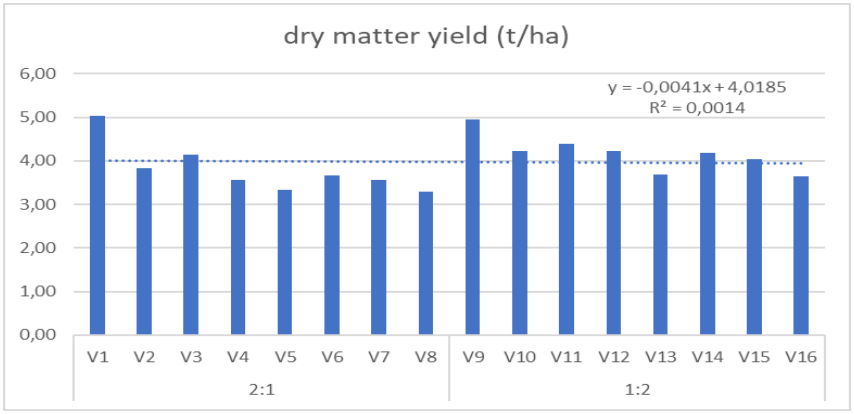

Figure 2. Dry mater yields (t/ha) of the winter crop mixtures of hairy vetch and cerelas cultivated at Lovrin (harvested on 17 April 2018)

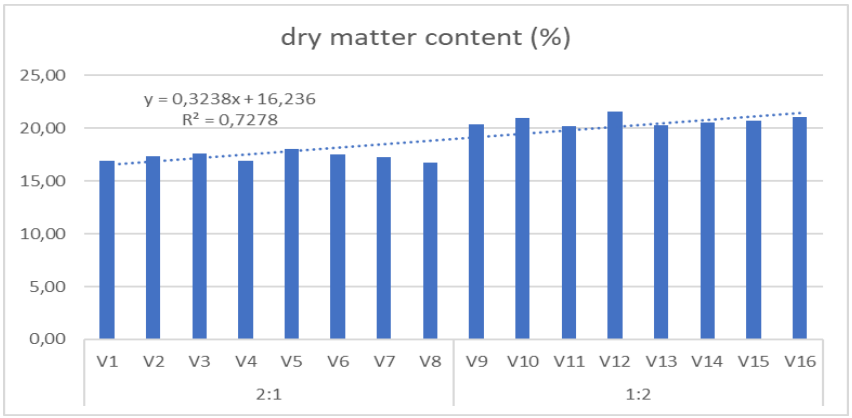

Figure 3. Dry mater content (%) of the winter crop mixtures of hairy vetch and cerelas cultivated at Lovrin (harvested on 17 April 2018)

The results regarding the crude protein yield are represented in Figure 4 and are obtaned by considering the crude protein content from the dry matter yield. The average data obtained show that the greater yield was obtained in the case of V12, respectivelly 3.83 t/ha, the lowest yield being determined in V1, respectivelly 2.15 t/ha.

Crude protein content (%) from forage (Figure 5) was comprised between 18.9 % (V13) and 12.7 % (V1).

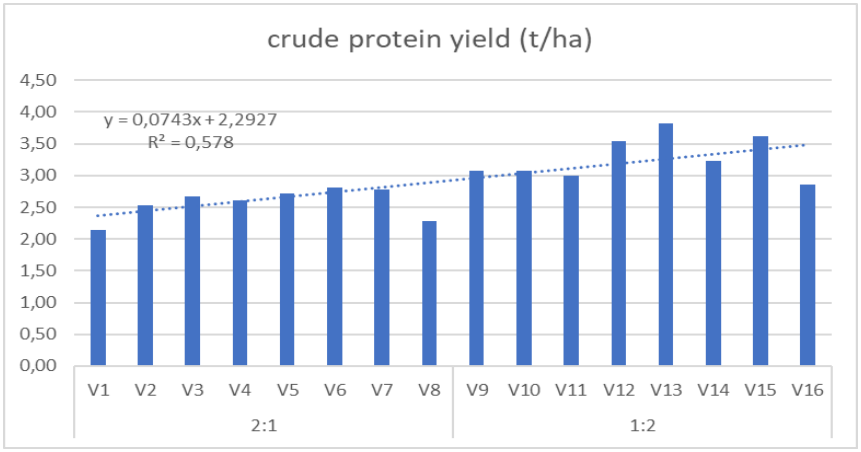

Figure 4. Crude protein yields (t/ha) of the winter crop mixtures of hairy vetch and cerelas cultivated at Lovrin (harvested on 17 April 2018)

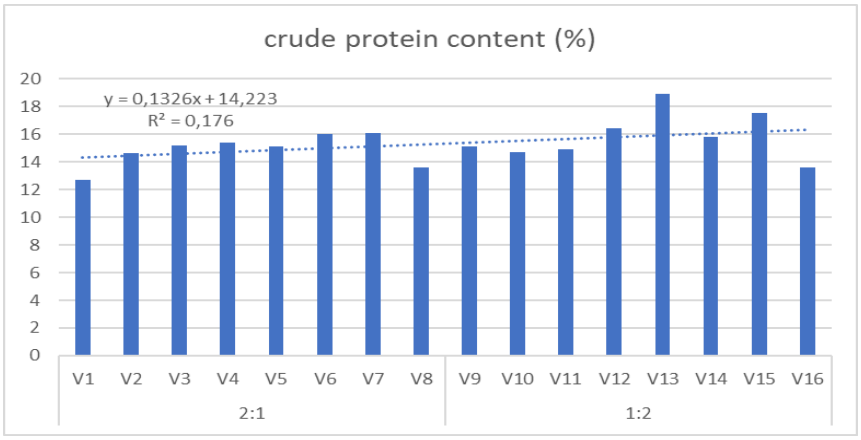

Figure 5. Crude protein content (%) of the winter crop mixtures of hairy vetch and cerelas cultivated at Lovrin (harvested on 17 April 2018)

According with CARITA *ET AL.* (2016) crude protein content is higher in the mixtures of legumes with cereals compared with triticale and oat in pure stands.

CONCLUSIONS

In the case of early harvesting the hairy vetch mixtures with triticale have the best results. Grater yields of the hairy vetch mixtures with other cereals can be obtained by later harvesting, respectively (1-2 weeks).

Generally, the winter crop forage mixtures of hairy vetch and cereals are a good option for livestock feeding. The proportion of vetch and cereal had a great influence on the dry matter production and crude protein production and this can be adjusted by the farmer according with the needs of his livestock.

The use of such mixtures has numerous benefits both productive and ecological because they can act as a cover crop and because after harvesting they are able to improve the growing condition for the following crop by increasing the nitrogen from the soil, organic matter content of the soil, porosity, percolation *etc*.

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