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Use of NIRS technology for setting the optimal wheat-triticale ratio to improve the nutritional value of bakery products influenced by technological and biological factors

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Abstract

The paper present a way to use NIRS technology in order to highlight the nutritional value of mixtures in different proportions of wheat-triticale. For this purpose we chose a wheat variety-Turda 2000 and triticale variaty-Titan found in an polifactorial experience to S.C.D.A. Turda The experience base fertilization was underwent with two graduations (F1and F2) for each wheat and triticale and have chosen three different mixtures (M1,M2,M3) The advantages of using NIRS technology (Near Infrared Reflectance Spectroscopy) are: fast method of analysis, lesser amounts of sample required and not destroy the material. The samples were collected by standard collection and the quality parameters followed were: ash content (%), starch content (%),protein content (%), oil content (%), sugar content(%), fiber /NDF content (%) and energy value content(%). Note that the main factors are influenced by technological factors but the fibre content is not influenced by ferilization which is the most important contribution that comes with triticale.

Keywords: wheat, mixtures, triticale, NIRS technology, quality

1. Introduction

Internationally, triticale has found great success in a very large number of ethnic cereal-based foods.Although data with the most recent Canadian varieties are lacking , triticale is considered a very suitable grain for human diets, due to its high energy and lysine levels. For bread (leavened) products, triticale lacks the gluten strength found in wheat, but its flour can be incorporated in leavened products in mixtures with wheat , where it gives a nutty flavour to products. Spring and winter triticale varieties are suitable for use in the conversion process, offering high crop yield potential and potentially low price when compared to wheat. As a food grain, triticale uses- although in many cases proven to be suitable – have not been extended to the commercial level. Given its generally inferior bread making, particularly if wheat flour is available. In limited cases and due to wheat shortages, triticale has been used, particularly by small scale landholders, alone or blended with wheat, for the manufacture of local homemade breads. Rolled triticale and whole meal flour, whole meal specialty breads, and other healt foods have been marketed in small amounts in different countries (are given in parentheses proportion of triticale flour): Australia (80%), Brazil (35%), Germany (40%), Poland (80%), Russia (80%), USA (50%) [1-4].

Triticale contain dietary fiber is cellulose (the part of a plant) which cannot be digested by the human intestinal tract.

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It prevents constipation, hemorrhoids, also reduces blood sugar fluctuations and helps lower cholesterol. [5-7]

2. Materials and Method

For study we chose a wheat variety-Turda 2000 and triticale variaty-Titan found in an polifactorial experience to S.C.D.A. Turda-2009 harvest. We chose Turda 2000 variaty because is recommended to grow in Transylvania areas and northden of Moldova The planned and milling quality is very good. Triticale variate was chosen for these advantages that we have: Height short of plant, recommended for Transilvania, high resistance to low temperatures, Rapidly increasing resistance to wintering, Genetic resistance to a broad spectrum of diseases, The rainy weather on maturity grain of triticale may germinate in ear, which influences the quality and productivity of grain, grain production 4000-6000 kg / ha.

The results obtein at ICDA Fundulea in the breeding program were reported to be competitive with those recorded in other programs in the world evidenced by the Titan variety registration in Canada, France, Hungary. These varieties have undergone polifactoriale experience that has the following factors and graduations.

F factor – basic fertilization with microelements
F1 $N_{40}P_{40}$ kg/ha at sowing
F2 $N_{40}P_{40}$ kg/ha at sowing + $N_{20}P_{200}$ kg/ha at the resumption of vegetation in spring

M factor –reprezent by :
M1 - 50:50 (%) wheat:triticale
M2 - 70:30 (%) wheat:triticale
M3 - 30:70 (%) wheat:triticale

The 2 and 3 variant is reported from the first variant. Sampling was done according to Stas Sampling and quality parameters was determined with NIRS technology(Near Infrared Reflectance Spectroscopy) followed were: ash content (%), starch content (%),protein content (%), oil content (%), sugar content(%), fiber /NDF content (%) and energy value content(%). Statistical data processing was done by ANOVA double test, and DUNCAN test and significance establish was determining by limited differences like DL or LSD.

3. Results and Discussion

In the next 7 tables are presented the interaction between fertilization and three diferent ratio whit:triticale as: M1, M2, M3, on content of: ash content (%), starch content (%),protein content (%), oil content (%), sugar content(%), fiber /NDF content (%) and energy value content(%).

Table 1. Influence of fertilization and the mixtures of ash content

Interaction M/F	Ash	%	Difference %	Significance
M1 F1	1.48	100.0	0.00	Mt.
M2 F1	1.50	101.7	0.02	-
M3 F1	1.14	77.4	-0.33	000
M1 F2	1.88	100.0	0.00	Mt.
M2 F2	1.64	87.2	-0.24	000
M3 F2	1.49	79.2	-0.39	000

DL (p 5%) - 0.07; DL (p 1%) - 0.12; DL (p 0.1%) - 0.20

Table 2. Influence of fertilization and the mixtures of starch content

Interaction M/F	starch	%	Difference %	Significance
M1 F1	61.74	100.0	0.00	Mt.
M2 F1	60.82	98.5	-0.93	000
M3 F1	62.59	101.4	0.85	***
M1 F2	58.13	100.0	0.00	Mt.
M2 F2	57.84	99.5	-0.29	000
M3 F2	60.35	103.8	2.22	***

DL (p 5%) -0.07; DL (p 1%) - 0.11; DL (p 0.1%) - 0,18

Table 3. Influence of fertilization and the mixtures of crud protein content

Interaction M/F	Protein	%	Difference %	Significance
M1 F1	11.81	100.0	0.00	Mt.
M2 F1	11.93	101.1	0.13	-
M3 F1	11.40	96.5	-0.41	00
M1 F2	14.88	100.0	0.00	Mt.
M2 F2	15.49	104.1	0.62	***
M3 F2	14.03	93.3	-0.85	000

DL (p 5%) - 0.15; DL (p 1%) - 0.24; DL (p 0.1%) - 0,42

Table 4. Influence of fertilization and the mixtures of oil content

Interaction M/F	Oil	%	Difference %	Significance
M1 F1	1.19	100.0	0.00	Mt.
M2 F1	1.36	114.3	0.17	**
M3 F1	1.23	102.9	0.03	-
M1 F2	1.20	100.0	0.00	Mt.
M2 F2	1.28	106.6	0.08	-
M3 F2	1.14	94.5	-0.07	-

DL (p 5%) - 0.09; DL (p 1%)- 0.14; DL (p 0.1%) - 0.24

Table 5. Influence of fertilization and the mixtures of sugar content

Interaction M/F	Sugar	%	Diference %	Significance
M1 F1	4.61	100.0	0.00	Mt.
M2 F1	4.77	103.5	0.16	***
M3 F1	5.05	109.5	0.44	***
M1 F2	4.30	100.0	0.00	Mt.
M2 F2	4.65	108.3	0.36	***
M3 F2	5.06	117.7	0.76	***

DL (p 5%) - 0.02; DL (p 1%)- 0.03; DL (p 0.1%) - 0.05

Table 6. Influence of fertilization and the mixtures of NDFfibre content

InteractionM/F	NDF	%	Diference %	Significance
M1 F1	8.90	100.0	0.00	Mt.
M2 F1	9.94	111.7	1.04	***
M3 F1	9.43	105.9	0.53	***
M1 F2	8.59	100.0	0.00	Mt.
M2 F2	8.07	93.9	-0.53	000
M3 F2	8.54	99.4	-0.05	0

DL (p 5%) - 0.04; DL (p 1%) - 0.06; DL (p 0.1%) - 0.11

Table 7. Influence of fertilization and the mixtures of NDFfibre content

Interaction M/F	ME	%	Diference %	Significance
M1 F1	12.08	100.0	0.00	Mt.
M2 F1	12.00	99.4	-0.7	-
M3 F1	11.97	99.1	-0.11	-
M1 F2	12.00	100.0	0.00	Mt.
M2 F2	12.12	101.0	0.12	-
M3 F2	12.09	100.8	0.09	-

DL (p 5%) - 0.13; DL (p 1%) - 0.20; DL (p 0.1%) - 0.37

As can by see from table 1 the ash content for 2 and 3 mixtures is distinctly significant negative from blank. It is not observe an influence of fertilization on ash content.Table 2 show as in terms of mixtures influence that M3 has a very significant positive value from blank, and the second mixtures M2 has a very significant negative value from blank.

In this case the starch content it is not influence by fertilization. Table 3 refers to crud protein and observe that in terms of mixtures influence that M2 is distinct significant positive from blank and M3 has a very significant negative difference from blank. Fertilization in this case F2 at M2 is very significant positive value from blank.

About oil content as can be see in table 4 it is not significant influenced by fertilization. An influence of mixtures contribution we see at M2 the content is positive distinct significant for blank, and M3 is insignificant from blank. In table 5 about sugar content we observe that mixtures M2 and M3 are very positive significance value from blank both F1 and F2 agrfond. In terms of fiber content the interaction between mixtures and fertilization we observe that on F1 agrofond M2 and M3 is very significant positive value from blank and on F2 agrofond we observe on decrease of M2 and M3 mixtures. Table 7 shows that the energy value it is not influence by fertilization and the mixtures variants shows insignificant from blank

4. Conclusion

The research conducted on the three blends of wheat: triticale proportion influence by technological factors allow us to draw the following conclusions:

- In terms of ash content triticale content decreases with increasing ash content.
- It should be noted that nitrogen fertilization leads to increased the crud protein value and the remaining indices seem to be not positively influenced by fertilization
- Note that the mixtures made where the predominant wheat have higher indices and where triticale predominates in terms of nutritional value can be successfully used in bakery.
- NDF (neutral detergent fibre) less digestible fiber like cellulose, hemicellulose, lignin are digested slowly that the body needs to function normally and this study shows that the NDF value does not depend on fertilization.
- Related to energy value ME(MJ/kg) it is seem to be the same for each ratio wheat : triticale like M1,M2,M3.
- The advantages of using NIRS technology (Near Infrared Reflectance Spectroscopy) are: fast method of analysis, lesser amounts of sample required and not destroy the material.

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