ECOLOGICAL RESEARCH ON THE TRITICOSECALE CROPS FOUNDED ON THE PODZOLIC SOIL OF ALBOTA - ARGEŞ

CONTENTS OF THE THESIS

The triticale (triticosecale) growing is a demand of the present agriculture and it consists of operating less productive for wheat and corn areas, acid areas, drought-stricken or sloppy areas and surfaces poor in nourishing elements.

These are the ecological factors that are studied and searched for the establishment of the growing of triticale on the acid soils of Albota, in Argeş district:

a) climatically factors represented by: temperature, humidity, the length of the brightness of the sun, the light;
b) geographical factors represented by altitude;
c) agrotechnical factors represented by the density of the founded crop and the reaction of answer of the breed of triticosecale at the administrating of nitrogen chemical fertilizers.

The objectives of the thesis

The main objectives put forward are:

- quantifying of the reaction of the phosphorus and nitrogen foliar fertilizers with chemical micronutrients in autumn triticosecale;

- determining the influence of the fertilizers on the content of protein, wet gluten and other quality indicators;

- the economic efficiency of the achieved production;

- increasing the farmers confidence in order to grow the effectiveness of crops on poor soils of podzolic type.

First part – THE DEGREE OH KNOWLEDGE

CHAPTER 1

Researches on triticosecale crops in Romania

1.1.1. The history of triticale

Triticale species, which can be successfully seeded in conditions of organic culture, had a relatively short evolution; the first wheat-rye hybridization being performed by WILSON, in 1875 (VARUGHESE and collaborators, 1996). In our country the first early hybrids of wheat and rye were described in 1927 (SĂULESCU, 1927), and the first octoploid form of triticale was obtained in 1939 (PREDNICEANU, 1952). But a systematic program of improvement on this species was initiated at I.C.C.P.T. Fundulea in 1971.

CHAPTER 2

The biology of triticosecale

2.1.1. The spread of species in crops

Triticale (triticosecale) is part of the kingdom *Plantae*, the sub-kingdom *Tracheobionta*, class *Liliobsida*, order *Cipperalis*, family *Poaceae*. Binominal nomenclature is X *Triticosecale Witt*, ex. A Camus and it is a corn plant obtained by crossing wheat with rye, by methods of improvement. This corn plant shows tolerance to

the toxicity of aluminum ions, which determines its culture can be placed on acid soils, and limestone amendment of them no longer needed.

The advantage that this species gives is the capacity to achieve high yields of grain and biomass in a large variety of pedoclimatic conditions and with crop technologies with lower inputs than other cereal straw. This advantage made triticale become a culture increasingly appreciated by farmers, at present being in continuous expansion. There were several triticosecale varieties recorded in Romania till present day, but with the introduction into production of varieties of semi-dwarf stature plants (Titan and Trilstar, carrying the RHt_1 gene, that was transferred from the wheat) or varieties with high output potential and stability, the expansion in production of triticale species is growing (ITTU and collaborators, 2004). In Romania, in the year 2008, triticosecale was grown on about 20,000 ha, with the continuous increase in the future of the area of the crop.

CHAPTER 4

Ecological characteristics of the experimental field

4.1.5. Climatic characterization of the area

The climatic zone is characterized by an average annual temperature of 9.8^0C (2.4^0C in January and 20.8^0C in July), with an average annual amount of rainfall between 450-700 mm, evapotranspiration 662 mm and an aridity index of 34. The natural vegetation is typical in the area of oak forests and the agricultural use is arable.

After the criterion real climatic zones, DISSESCU (1952) fits the podzolic soils in the south zone of the country in the climate region Dfbx, characterized by cool summers and harsh winters.

Rainfall is continental, with a peak in June. CANARACHE and his collaboratos (1987) located it in a climatic zone two, moderately warm and semi-moist.

Table No. 17

Main characteristics of climatic zone two (by CANARACHE and collaborators, 1987)

Specification	**Values**
Average annual temperature	8.0-10.5
Solar radiation (Kcal/cm^2)	114-128
Sum of temperatures higher than 0^0C	3,400-4,100
Sum of temperatures higher than 10^0C	2,800-3,500
Sum of temperatures above 10^0C effective	1,100-1,600
Average annual rainfall mm	450-700
Average rainfall mm (April - October)	325-475
Evapotranspiration gap mm (April - October)	220-391

Table No. 21

Air temperature (^{0}C). Monthly and annual average (1970 – 2008)

Weather Station	Month												Annual	Broad
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
Drăgăşani	-2.4	-0.5	4.8	10.9	16.2	19.8	21.9	21.1	17.0	11.2	5.2	0.0	10.4	24.3
Piteşti	-3.2	-1.2	4.2	10.0	15.3	18.8	21.9	20.1	16.2	10.4	4.6	0.2	9.76	24.9
Rm. Vâlcea	-2.4	-0.4	4.9	10.8	16.0	19.3	21.3	20.7	16.8	11.0	5.0	0.2	10.3	23.7
Tg. Jiu	-2.5	-0.4	4.9	10.8	15.8	19.4	21.6	20.7	16.9	11.0	4.9	-0.1	10.2	24.1

Table No. 25

The chemical attributes of the soil with experiences, in Albota

soil	**pH**	**Al ppm**	**Pppm**	**N ppm**
Brown luvic	4.90-5.00	49.00	23.07	13.30

By administrating foliar fertilizers we ensure environmental protection of the soil because nutrients are managed and assimilated in the leaf mass and are not administrated directly into the soil.

These are the foliar chemical fertilizers we used (with equivalent prepared solution in 300 l water / ha and which we also used on the podzolic soil of Albota, Argeş):

a1 - Microfert U

a2 - Plantfert

a3 - Nutrient Express

These foliar nutrients were administrated in spring of 2007 and 2008 in phases of twinning and of skin respectively.

There were studied the following technical parameters:

a) the number of ears per square

b) the number of small ears per ear

c) the number of grains in the small ear

d) the number of grains in the ear

e) 1,000 grain mass (MMB)

f) the hectoliter mass (MH)

g) the amount of wet gluten

h) the amount of proteins

i) the amount of ashes.

Second part – PERSONAL RESEARCH

CHAPTER 5

The material and the experimental method concerning ecological research

To achieve this thesis we performed a total of three environmental experiences:

First experience:

Studies and research on the influence of planting density in correlation with the varieties on the production and quality of autumn triticosecale established on acid soils.

Second experience:

Studies and research on the influence of foliar chemical fertilizers containing nitrogen, administrated on autumn triticale created on acid soil.

Third experience:

Studies and research on nitrogen management in seven varieties of triticale and the productions obtained.

5.3. Chemical fertilizers used

For the second experience – studies and research on the influence of foliar chemical fertilizers containing nitrogen administrated on autumn triticale – there were investigated a

total of three foliar fertilizers applied to the variety of GORUN: MICROFERT-U-, PLANTFERT and NUTRIENT EXPRES.

5.4. Experimental method

5.4.1. Experimental method performed in field

First experience:

Studies and research on the influence of planting density in correlation with the varieties on the production and quality of autumn triticosecale.

We have studied two factors.

Factor A, autumn triticale varieties, with graduations:

a1 - STIL

b1 - GORUN

c1 – PLAI

Factor B, planting density of autumn triticale, with graduations:

b1 - 300 germinable seeds per square

b2 - 400 germinable seeds per square

b3 - 450 germinable seeds per square

b4 - 500 germinable seeds per square

Second experience:

Studies and research on the influence of foliar chemical fertilizers containing nitrogen, administrated on autumn triticale.

Factors included in the study:

Factor A – foliar fertilizers with nitrogen potassium and micronutrients, applied by splashing or by spraying the plants in a solution with a concentration of 1-2% (1-2 liter per 100 liters of water):

a1 - Microfert U

a2 - Plantfert

a3 - Nutrient Express

Factor B – implementation phase, with these graduations:

1. Phase twinning of autumn triticosecale

2. Phase skin of autumn triticosecale.

Third experience:

Studies and research on nitrogen management in seven varieties of triticale and the productions obtained.

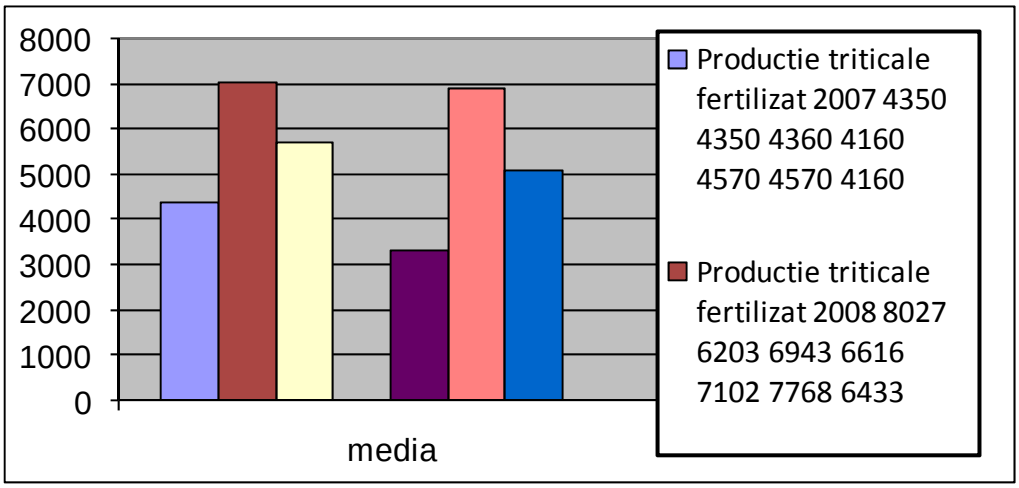

Figure No. 9 – Nitrogen fertilized production

Table No. 45

The influence marked by the variety (a) and the planting density of autumn triticale (2007-2009)

Version	Combination	Organic production		Difference	Significance
		kg/ha	%		
1	a_1b_1	12,261.33	153.2	+4,255.90	***
2	a_1b_2	10,178.67	127.1	+2,173.24	***
3	a_1b_3	7,364.33	92.0	-641.10	-
4	a_1b_4	5,612.00	70.1	-2,393.43	000
5	a_2b_1	11,287.33	141.0	+3,281.90	***
6	a_2b_2	9,781.00	122.1	+1,775.57	***
7	a_2b_3	7,192.65	89.8	-812.76	0
8	a_2b_4	5,446.66	68.0	-2,558.76	000
9	a_3b_1	9,070.67	113.3	+1,065.24	**

Version	Combination	Organic production		Difference	Significance
		kg/ha	%		
10	a_3b_2	7,522.33	94.0	-483.10	-
11	a_3b_3	5,774.00	72.0	-2,231.43	000
12	a_3b_4	5,570.00	69.6	-2,435.43	000
13	$\overline{X}$	8,005.43	100.0	0.00	
DL 5% 764,15 DL 1% 1.038,66 DL 0,1% 1.391,10					

Table No. 46

Relationship variety (a) x planting density of autumn triticale (b) on different graduation, on the organic production (2007 – 2009)

Factor „A" (variety)	Factor „B" – planting density				Factor „B" averages			
	300	400	450	500	Organic production	%	Difference	Significance
	b_1	b_2	b_3	b_4				
STIL	12,261.31	10,178.6	7,364.3	5,612.00	8,854.08	109.4	+765.66	-
GORUN	11,287.33	9,781.00	7,192.6	5,446.67	8,426.92	104.2	+338.50	-
PLAI	9,070.68	7,522.32	5,774.0	5,570.00	6,984.25	86.3	-1,104.17	-
$\overline{X}$	10,873.10	9,160.65	6,777.0	5,542.88	8,088.42	100.0	0.00	
%	134.4	83.8	83.8	68.5	100.0	DL 5% 1.01 DL 1% 1.53 DL 0.1% 2.46		
Difference	+2,784.69	-1,311.42	-1,311.4	-2,545.51	0.00			
Significance	**	-	-	00	Mt			
DL 5% 1,486.06 DL 1% 2,250.35 DL 0.1 % 3,615.12								

Figure No. 13 – Triticale ears, variety Stil, July 2008, Albota

Table No. 67

The influence of foliar fertilizers (a) and of the management stage (b), on the organic production at the variety GORUN (2007 – 2009)

Version	Combination	Organic production		Difference	Significance
		kg/ha	%		
1	Unfertilized (Mt.)	7,118.00	100.0	0.00	Mt.
2	a_1b_1	8,412.33	118.2	+1,294.33	***
3	a_1b_2	8,211.31	115.4	+1,093.33	***
4	a_2b_1	7,959.00	111.7	+841.00	***
5	a_2b_2	8,157.00	114.6	+1,039.00	***
6	a_3b_1	8,080.00	113.5	+962.00	***
7	a_3b_2	8,169.33	114.8	+1,051.33	***
DL 5% 325.67 DL 1% 457.17 DL 0,1% 645.39					

Table No. 68

The influence of foliar fertilizers (a) and of the management stage (b), on different graduations, on the organic production, at the variety GORUN (2007 – 2009)

Factor „A” (the fertilizer)	Factor „B” (implementation phase)		Factor „B” averages			
	autumn	spring	Organic production	%	Difference	Significance
	b_1	b_2				
Unfertilized	7,118.00	7,118.00	7,118.00	100.0	0.00	Mt.
MICROFERT U	8,412.33	8,211.33	8,311.83	116.8	+1,193.83	**
PLANTFERT	7,959.00	8,157.00	8,058.00	113.2	+940.00	**
NUTRIENT EXPRES	8,080.00	8,169.33	8,124.67	114.1	+1,006.67	**
Organic production	7,892.33	7,913.92		DL 5% 380.10 DL 1% 698.04 DL 0,1% 1,546.69		
%	100.0	100.3				
Difference	0.00	+21.58				
Significance	Mt.	-				
DL 5% 268.77 DL 1% 493.59 DL 0,1% 1,093.68						

From de data presented in *Tables no. 67 and 68* we find these:

- The higher result was obtained with the foliar fertilizer MICROFERT U, in V1 and V3, with productions of 8,412.33 and 8,211.33 kg / ha;

- These results are due equally to the water in the prepared solutions for foliar splashing, which have crossed the 2007 drought effect;

- The increase production compared to the untreated variant is 1,300 kg / ha (*Table no. 37*);

- MICROFERT U foliar fertilizer achieved full production in phase of twinning;

- PLANTFERT and NUTRIENT EXPRESS reacted favorably in phase of skin.

CHAPTER 7

Economic efficiency of experimental variations

Table No. 79

Economic efficiency of technological factors, in conjunction with the variety (2007 - 2009)

Version	Combination	Average production obtained kg/ha	Sale price ron/kg	Total expenditure ron/ha	Total revenue ron/ha	Profit Ron/ha	Profit rate %
1	a_1b_1	7,298.5	0.60	2,948.40	4,379.20	+1,430.77	32.7
2	a_1b_2	6,524.67	0.60	2,965.06	3,914.80	+949.74	24.3
3	a_1b_3	5,571.00	0.60	2,969.14	3,3342.60	+373.46	11.2
4	a_1b_4	4,069.67	0.60	2,934.88	2,441.80	-493.07	-20.2
5	a_2b_1	6,602.33	0.60	2,830.93	3,961.40	+1,130.46	28.5
6	a_2b_2	7,039.67	0.60	2,909.47	4,223.80	+1,314.31	31.1
7	a_2b_3	5,628.00	0.60	2,858.58	3,376.80	+518.22	15.3
8	a_2b_4	4,515.00	0.60	2,828.59	2,709.00	-119.59	-4.4
9	a_3b_1	5,832.66	0.60	2,745.10	3,499.60	+754.50	21.8
10	a_3b_2	5,062.31	0.60	2,728.44	3,037.40	+308.96	10.2
11	a_3b_3	4,910.67	0.60	2,755.10	2,946.40	+191.31	6.5
12	a_3b_4	3,749.33	0.60	2,711.07	2,249.60	-461.47	-20.5
13	$\overline{X}$	5,567.04	0.60	2,848.73	3,340.20	+491.47	14.7

Table No. 80

Economic efficiency of technological factors, in conjunction with the foliar fertilizers we used for variety GORUN (2007 – 2009)

Version	Combination	Average production obtained kg/ha	Sale price ron/kg	Total expenditure ron/ha	Total revenue ron/ha	Profit Ron/ha	Profit rate %
1	Unfertilized	5,398.00	0.60	2,812.03	3,238.80	426.77	13.2
2	a_1b_1	5,704.67	0.60	2,933.49	3,422.80	489.31	14.3
3	a_1b_2	5,931.67	0.60	2,949.38	3,559.00	609.61	17.0
4	a_2b_1	5,605.67	0.60	2,989.06	3,363.40	374.34	11.1
5	a_2b_2	5,805.00	0.60	3,003.02	3,483.00	479.98	13.8
6	a_3b_1	5,998.33	0.60	3,005.55	3,599.00	593.45	16.5
7	a_3b_2	6,169.00	0.60	3,017.50	3,701.40	683.88	18.49

CHAPTER 8

Conclusions and suggestions

8.2.7. Research results on soil efficiency

The acid soils of Albota, in Argeş district, gave very good productions in terms of foliar fertilization applied in phases of twinning and skin;

The foliar chemical fertilizer, absorbed by leaf mass, are organic for the soil;

The foliar fertilizer applied ensures also the scarcity water, helping to increase the production of triticosecale;

Triticale crop gives efficiency to the acid and poor soils.

8.3. Suggestions

Results of research on applied technology, meaning planting densities and foliar fertilization, have led to the following recommendations:

- In the area we can grow successfully varieties of triticale STIL and GORUN.
- In this area we can grow triticale on small density of 300 b.g. / ha, in normal weather years.
- In the area we can grow triticale on larger density of 450 b.g. / ha, in dry years.
- The best foliar fertilizer for triticale is NUTRIENT EXPRES, applied to vegetation at the stage of skin.