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**ORIGINAL ARTICLE**

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**CONTROL OF SOME PATHOGENS BY USING SPECIAL FOLIAR FERTILIZERS**  
**CONTROLUL UNOR PATOGENI LA GRÂU PRIN ÎNGĂȘĂMINTE FOLIARE SPECIALE**

OROIAN I.

**REZUMAT**

Lucrarea prezintă rezultatele interdisciplinare obținute în câmpurile experimentale ale Departamentului de Protecția Plantelor și Departamentului de Știința Solului, precum și date care subliniază interdependența dintre satisfacerea nevoilor trofice ale plantelor de grâu și agresivitatea agenților fitopatogeni care cauzează bolile.

Rezultatele experimentale subliniază faptul că nivelul de atac exprimat prin intensitate și grad de atac este diferit atât la variantele fertilizate la sol cât și la cele fertilizate extraradicular.

Concluziile care reies în urma studiului datelor obținute reliefează faptul că aplicarea fertilizanților, indiferent de metodă, determină creșterea sau reducerea gradului de atac și manifestarea bolilor produse de ciupercile *Puccinia striiformis f.sp. tritici*, *Blumeria graminis* și *Septoria spp.*

**ABSTRACT**

The present work points out to the interdisciplinary experimental results, obtained in the experimental fields of the Plant Protection and Soil Science Department, as well as at data which stress upon the interdependency between the satisfaction of the trophically needs of the wheat plants and the aggressiveness of the pathogens which cause the disease.

The experimental results underline the fact that the attack level expressed through intensity and attack degree is different, both with the “out of root” fertilized variants and with the soil fertilization variants.

The conclusions which come off the study of the obtained data point out at the fact that the fertilizer application, no matter the method, determines the growth or the regress of the attack degree. They also have an influence upon the *Puccinia striiformis f.sp. tritici*, *Blumeria graminis* and, *Septoria spp.* fungus manifestation.

**KEY WORDS: wheat, diseases, ecological control, fertilization**

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**DETAILED ABSTRACT**

A bifactorial experience has been emplaced, using as biological material the *Apullum* wheat type. The researched factors were: the *a* factor – foliar fertilization with 12 graduations and the *b* factor – soil fertilization with 2 graduations: non-fertilized; N<sub>100</sub> P<sub>100</sub> K<sub>100</sub> .

During the experiment, soil and plant samples have periodically and at the end of the crop period been taken, and observations have been made through specific phytopathological methods, in order to determine the frequency, the intensity and the degree of the pathogens' attack.

The experimental results analysis underline the fact that, per general, fundamental fertilization applied on soil sensitivity the plants to pathogens' attack through improving the life conditions of these, especially the trophical needs, in the case of septoriosis and mildew. The basic fertilization applied to the soil in moderate and equilibrated doses determines the reduction of the yellow rust attack degree as compared to the variants which have not been soil-fertilized and where the incidence of the disease apparition is 30% higher, the difference being very significant.

Regarding the effect of some "outside the root" fertilizers about diseases appearance and manifestation, as a research result we can stand the fact that, some products especially created to complete in a balance way the nutritional needs of the cultural plants, have a significant influence to increase or decrease the diseases attack level.

From all "out of root" fertilizers experimented, its remarks as having the most important effect of protection against septoriosis Chimopar and Basfoliar 36 Extra products, where the attack level registered in plant growing period was 4%, respectively 3,13%, fact that recommend them to have a large utilization in production and as a phytoprotection unconventional method of parasites control.

The "out of root" fertilizers Terra Sorb Foliar and Folplant 231 proved to have the biggest effect in reducing the *Blumeria graminis* fungus attack. It should be remarked even the positively impact of the product Folgic NPK, Fertilly, Fertiltell, Folplant 411, Biodor and Amonil in involution of the named disease.

The most important "protection" effect against the mildew seems to be attributed to the Terra Sorb Foliar și Folplant 231 products, where the frequency of attack registered during the vegetation period was below 1%, fact which recommends them in order to be largely employed into the production processes and in phytoprotection purpose.

As a result of our experiment we can stand the fact that the application of some un-polluting foliar fertilizers represents an alternative and complementary method in integrated fight against the diseases produced by pathogens, un-excluding, at least for the moment, the polluting chemical methods.

**INTRODUCTION**

Relatively recent researches rendered obvious the tight connection between the fertilization and the protection of the agricultural cultures or the evolution and the manifestation of the diseases (BORLAN Z. and coll. 1995-1996), between the soil or the foliar fertilizers and the optimization of the soil – plant – environment system ( RUSU M. and coll., 1997-2002 ; OROIAN I., 2002 ), as well as the relation between the fertilizers in the fundamental proteosynthesis – proteolise equilibrium, which is also determinant in what concerns the apparition, the evolution and the manifestation of the parasite diseases of the plants ( CHABOUSSOU, 1998 ).

The theoretical foundation of the elaborated experiments is the idea according to which the relations between the plant and the parasite are of nutritional nature. The substances which induce the sensitivity are those which produce soluble elements from the intermediary metabolism (the soluble nitrogen and the reductive glucides) the mentioned fundamental equilibrium marking the resistance degree of the plant.

**MATERIAL AND METHOD**

Under the pedoclimatic conditions of the Transylvania Plain, on the fields of the Agricultural Research Station from Turda, on a vertic clayilluvial chernozome soil ( with a pH equivalent to 7,0 ; humus in proportion of 4,80% ; P-AL equivalent to 10,5 ppm ; K-AL equivalent to 102 ppm) a bifactorial experience has been emplaced, using as biological material the *Apullum* wheat type. The

researched factors were the following:

- the *a* factor – foliar fertilization with 12 graduations ;
- the *b* factor – soil fertilization with 2 graduations : non-fertilized ; N<sub>100</sub> P<sub>100</sub> K<sub>100</sub> .

The impact effects of the fertilizations have been noticed, especially those of the “out of root” ones at the incidence and at the level of the septoriosis (induced by *Septoria tritici*), yellow rust (induced by *Puccinia striiformis*) and mildew (induced by *Blumeris graminis* ) manifestation in what concerns the wheat cultures.

During the experiment, soil and plant samples have periodically and at the end of the crop period been taken, and observations have been made through specific phytopathological methods. It have been noticed the attack frequency and intensity and we have been calculated the degree of the pathogen’s attack.

**RESULTS AND DISCUSSIONS**

I. The experimental results analysis underline the fact that, per general, the soil fundamental fertilizations increase the frequency of septoriosis appearance, compare to unfertilized variants where the incidence of disease appearance is with 78 percent lowest, the difference being very significant (Table 1). Thus, confirm the bibliographical data concerning the tackle theme, namely the abundant nutrition breaks the physiological and biochemical balance of plants metabolism, predisposing them to pathogens’ attack.

Table 1: The Influence of the Soil Fertilizations upon the Septoriosis

Variant	Attack degree%	%	Difference	Signification
Unfertilized soil	6.48	100.00	0.00	-
Fertilized soil	11.54	178.08	5.06	***

DL 5 % = 0.54  
 DL 1 % = 0.72  
 DL 0.1 % = 0.95

Regarding the effect of some “outside the root” fertilizers about *Septoria spp.* fungus appearance and manifestation, as a research result we can stand the fact that, some products especially created to complete in a balance way the nutritional needs of the cultural plants, have a significant influence to increase or decrease the diseases attack level.

Thus, tables 2 and figure 1 reveal that from all experimental 11 variants, 8 decrease very significant the mildew attack (Folgiec NPK, Chimopar 14-9-5, Basfoliar 36 Extra, Fertilly, Fertiltell, Terra Sorb Foliar, Uwafol and Folplant 231), one has no influence (Biodor 2312) on the incidence of this disease and foliar fertilizers Folplant 411 and Amonil

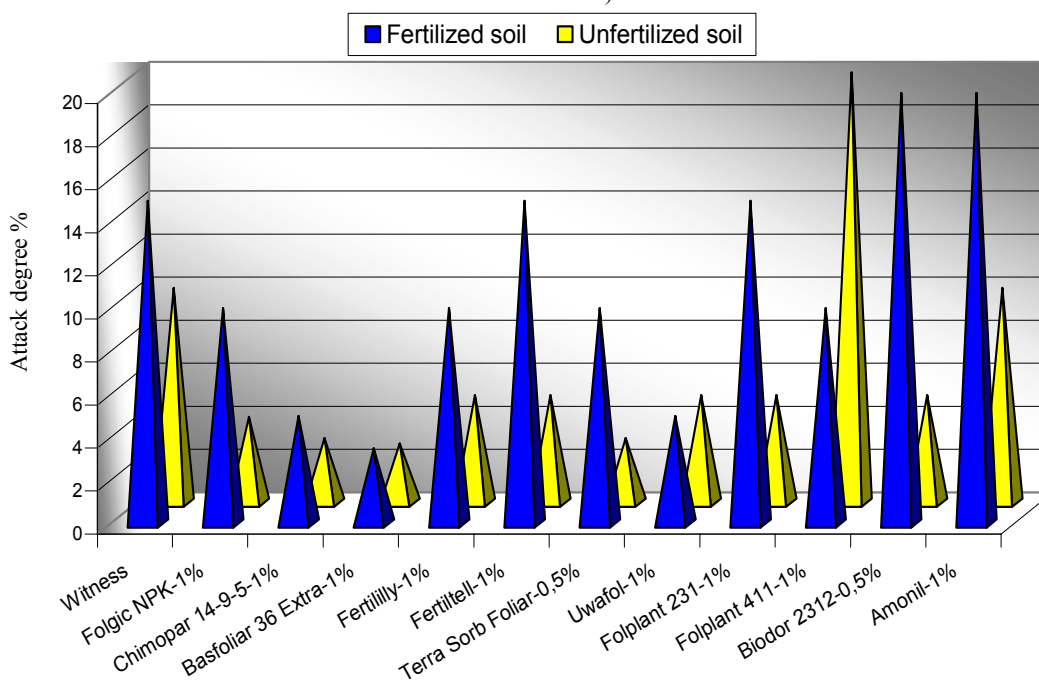
increase identical in very significant manner the mycosis manifestation.

Table 2: The Influence of the Foliar Fertilizers upon the Septoriosis

Variant	Attack degree %	%	Difference	Signification
Witness unfertilized foliar	12.50	100.0	100	-
Folgie NPK 1%	7.00	56.0	-5.50	000
Chimopar 14-9-5 1%	4.0	32.0	-8.50	000
Basfoliar 36 Extra 1%	3.13	25.0	-9.38	000
Fertililly 1%	7.50	60.0	-5.00	000
Fertiltell 1%	10.00	80.0	-2.50	000
Terra Sorb Foliar 0,5%	6.50	52,0	-6.00	000
Uwafol 1%	15.00	40.0	-7.50	000
Folplant 231 1%	10.00	80.0	-2.50	000
Folplant 411 1%	15.00	120.0	2.50	***
Biodor 2312 0,5%	12.50	100.0	0.00	-
Amonil 1%	15.00	120.0	2.50	***

DL 5% = 1.36  
 DL 1% = 1.82  
 DL 0.1% = 2.41

Figure 1: The influence of foliar fertilization about septoriosis manifestation upon wheat (Apullum variety, Turda 2000-2001)



From all “out of root” fertilizers experimented, its remarks as having the most important effect of protection against septoriosis Chimopar and Basfoliar 36 Extra products, where the attack level registered in plant growing period was 4%, respectively 3,13%, fact that recommend them to have a large utilization in production and as a phytoprotection unconventional method of parasites control.

II. The obtained experimental results regarding the yellow rust, stress upon the fact that generally, the basic fertilization applied to the soil in moderate and equilibrated doses determines the reduction of the yellow rust attack degree as compared to the variants which have not been soil-fertilized and where the incidence of the disease apparition is 30% higher, the difference being very significant (Table 3).

Table 3: The Influence of the Soil Fertilizations upon the Yellow Rust Attack

Variant	Attack degree %	%	Difference	Signification
Unfertilized soil	8.79	100	0.00	-
Fertilized soil	6.21	70.64	-2.58	000

DL 5% = 0.53  
 DL 1% = 0.70  
 DL 0.1% = 0.93

These results are different as compared to those obtained under the same experimental conditions in the cases of the mildew and of the septoriosis, where the more abundant nutrition due to the soil fertilization one single time, breaks the fundamental physiological and biochemical equilibration of the plant and predispose them to the attack of the pathogens (OROIAN I., 1998-2002).

In the case of the *Puccinia striiformis* fungus, hemiform species very well spread in the more humid and chilly areas, where it has a rapid evolution, the data obtained are explained by the moderate N-doses applied, completed by moderate and equilibrated P and K-doses, which counterbalance the unfavorable effects of the N in case this one would have applied alone. The phosphorus and the potassium moderate the unilateral effect of the N in what concerns the plant growth, they produce the thickening of the cellular walls and of the sustain tissues. They also determine the hardening of the cuticula, the accumulation of substances having a protective role in the leaf mezophil, accelerates the growth rhythm of the plants inducing thus their resistance at different diseases (rusts, septoriosis and mildew of the wheat).

In what concerns the effect of certain fertilizer upon the apparition and the manifestation of the *Puccinia striiformis* fungus, as a consequence of the researches conducted, we can appreciate the fact that certain product created especially in order to equilibrate complete the nutritive substances necessary of the

culture plants have a significant influence in reducing the attack degree of the disease.

Thus, the analysis of the forth table and of the second figure, clearly show the fact that from the eleven experimental variants, 9 very significantly reduce the attack of the yellow rust (Folgit NPK, Chimopar 14-9-5, Bastofoliar 36 Extra, Fertillyl, Fertiltell Terra Sorb Foliar, Uwafol, Folplant231, Biodor 2312), two of them having absolutely no influence upon the disease, the values being practically equal (Folplant 411 and Amonil).

Between the experimented “out of root” fertilizers, the most important “protection” effect against the rust seems to be attributed to the following products: Folgit NPK, Terra Sorb Foliar and Folplant 231, fact which recommends them in order to be largely employed into the production processes also because of the fact that in the cases of the enumerated variants the most important productions were obtained (Table 4).

The experimental results analysis underlines the fact that generally, the basis fertilized applied on soil enhances the frequency of mildew appearance, compare to unfertilized moment, where the incidence of disease appearance is with 34.2 percent lower, the difference being very significant (table 5). Thus, confirm the bibliographical general data regarding the approached theme, which means that an excessive nutrition breaks the physiological and biochemical balance of plants and bent them for pathogens’ attack.

Figure 2: The Influence of Foliar Fertilizers about Yellow Rust Manifestation upon Wheat Apullum variety, Turda 2000-2001)

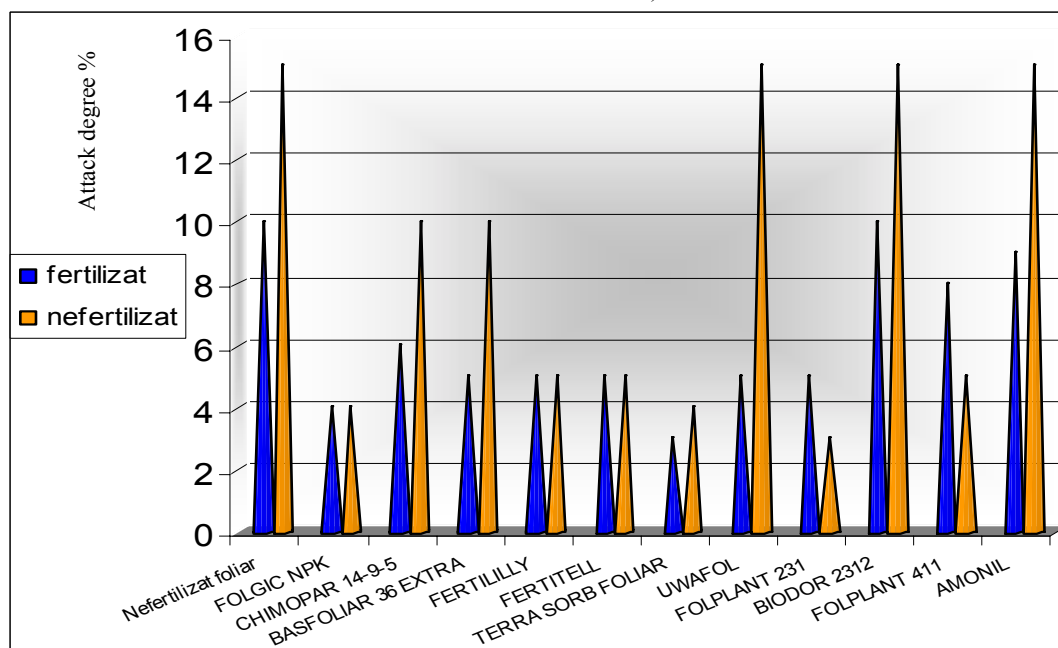


Table 4: The Influence of the Foliar Fertilizers upon the Yellow Rust Attack

Nr. crt.	Variant	Attack degree %	%	Difference	Signification
1	Witness unfertilized foliar	12.50	100.0	0.00	-
2	Folgie Npk	3.50	28.0	-9.00	000
3	Chimopar 14-9-5	8.00	64.0	-4.50	000
4	Basfoliar 36 Extra	7.50	60.0	-5.00	000
5	Fertililly	5.00	40.0	-7.50	000
6	Fertitell	5.00	40.0	-7.50	000
7	Terra Sorb Foliar	3.50	28.0	-9.00	000
8	Uwafol	10.00	80.0	-2.50	000
9	Folplant 231	4.00	32.0	-8.50	000
10	Biodor 2312	12.50	100.0	0.00	-
11	Folplant 411	6.50	52.0	-6.00	000
12	Amonil	12.00	96.0	-0.50	-

DL 5% = 1.21  
 DL 1% = 1.63  
 DL 0.1% = 2.15

Table 5: The Influence of the Soil Fertilizations upon the Mildew

Variant	Attack degree%	%	Difference	Signification
Unfertilized soil	5.20	100.0	0.00	-
<b>Fertilized soil</b>	<b>3.42</b>	<b>65.8</b>	<b>- 1.78</b>	<b>000</b>

DL 5% = 0.44  
DL 1% = 0.59  
DL 0.1% = 0.78

III. Regarding the effect of some “outside the root” fertilizers about *Blumeria graminis* fungus appearance and manifestation, as a research result we can stand the fact that, some products especially created to complete in a balance way the nutritional needs of the cultural plants, have a significant influence to increase or decrease the diseases attack level.

Thus, the analysis of the sixth table and of the third figure, show the fact that from the eleven experimental variants, 8 very significantly reduce the attach of the mildew (Folgitic NPK, Fertililly, Fertitell, Terra Sorb Foliar, Folplant 231, Folplant 411, Biodor și Amonil), two of them reduce the incidence

of disease in a distinctively significant maner (Chimopar 14–9–5, Basfoliar 36 Extra), only one (Uwafol) enhancing distinctively significant the disease manifestation with over 11% compared to the watering witness.

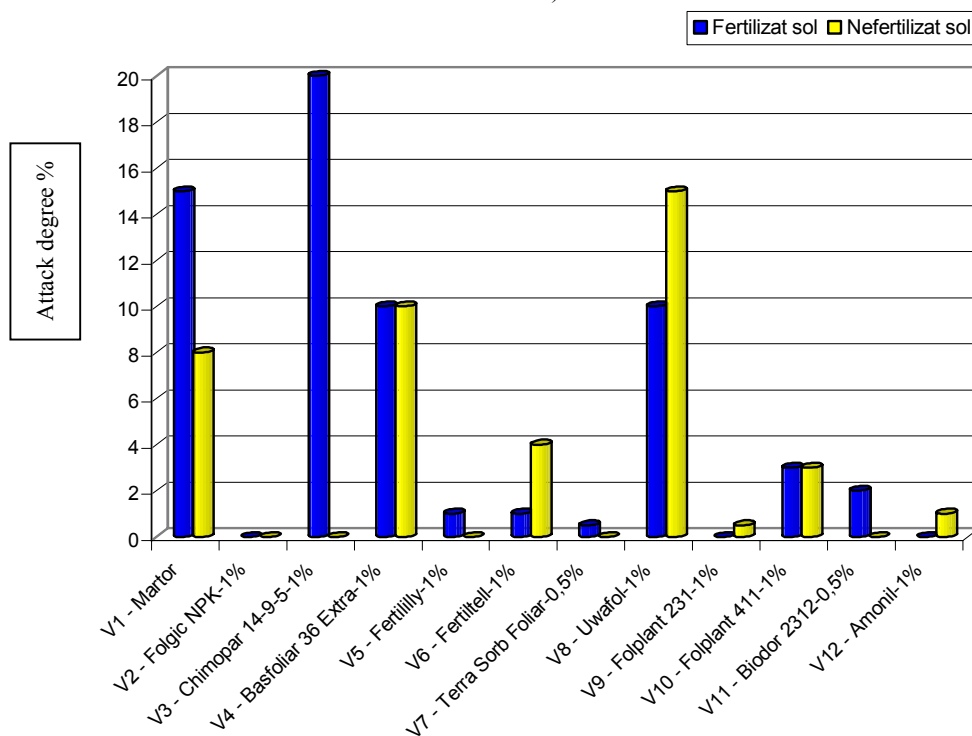
Between the above mentioned fertilizers, an important “protection” effect against the mildew seems to be attributed to the Terra Sorb Foliar and Folplant 231 products, where the frequency of attack registered during the vegetation period was below 1%, fact which recommends them in order to be largely employed into the production processes and in phytoprotection purpose.

Table 6: The Influence of the Foliar Fertilizers upon the Mildew

Variant	Attack degree %	%	Difference	Signification
Witness unfertilized foliar	11.25	100.0	0.00	-
Folgitic NPK 1%	0.01	0.1	- 11.24	000
Chimopar 14-9-5 1%	10.01	88.9	- 0.24	00
Basfoliar 36 Extra 1%	10.00	88.9	- 1.25	00
Fertililly 1%	0.50	4.5	- 10.74	000
Fertitell 1%	2.44	21.7	- 8.81	000
Terra Sorb Foliar 0,5%	0.25	2.3	- 10.99	000
Uwafol 1%	12.50	111.1	- 1.25	**
Folplant 231 1%	0.25	2.3	- 10.99	000
Folplant 411 1%	3.00	26.7	- 8.25	000
Biodor 2312 0,5%	1.00	8.9	- 10.24	000
Amonil 1%	0.50	4.5	- 10.74	000

DL 5% = 0.76  
DL 1% = 1.02  
DL 0.1% = 1.34

Figure 3 The influence of foliar fertilization about mildew manifestation upon wheat (Apullum variety, Turda 2000-2001)



**CONCLUSIONS**

- Fundamental fertilization applied on soil sensitivity the plants to pathogens attack through improving the life conditions of these, especially the trophical needs.
- The basic fertilization applied to the soil in moderate and equilibrated NPK-doses constitutes a simple, but important measure in what concerns the reduction of the attach degree of the *Puccinia striiformis* f.sp.*tritici* fungus.
- The foliar fertilizers FOLGIC NPK, TERRA SORB FOLIAR and FOLPLANT 231 have proved to the have a remarkable effect in what concerns the reduction of the yellow rust attach. Yet, one should also notice the very significant impact of the following products; CHIMOPAR 14-9-5, BASOFOLIAR 36 EXTRA, FERTILILLY, FERTITEL, UWAFOL and BIODOR 2321 in controlling the studied disease.

- Chimopar and Basfoliar 36 Extra “outside the root” fertilizers proved to have an important effect in reducing the fungus attack but we have also remarked a very significant impact of FOLGIC NPK, CHIMOPAR 14-9-5, BASFOLIAR 36 EXTRA, FERTILILLY, FERTITELL, TERRA SORB FOLIAR, UWAFOL and FOLPLANT 231 products in the septoriosiis control.
- The “out of root” fertilizers TERRA SORB FOLIAR and FOLPLANT 231 proved to have a reducing effect upon the *Blumeria graminis* fungus attack. It should be remarked even the positively impact of the product Folgic NPK, FERTILILLY, FERTITELL, FOLPLANT 411, BIODOR and AMONIL in involution of the named disease.
- The application of some un-polluting foliar fertilizers represents an alternative and complementary method in integrated fight against the diseases produced by pathogens un-excluding, at least for the moment, the polluting chemical methods.



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## ADDRESS OF AUTHORS

**Ioan Oroian:** neluoroian@yahoo.fr

University of Agricultural Sciences and Veterinary Medicine,  
Faculty of Agriculture, Phytopathological Discipline Cluj-Napoca, Romania  
Tel: +40-264-596385  
Fax: +40-264-593792

