CRUISER 350 FS - A NEW PRODUCT FOR MAIZE AND SUNFLOWER SEED TREATMENT AGAINST *Tanymecus dilaticollis* Gyll.

Alexandru Bãrbulescu[1)], Ion Voinescu[1)], Dan Sadagorschi[2)], Aurel Penescu[2)], Constantin Popov[1)], Silviu Vasilescu[1)]

ABSTRACT

Maize leaf weevil *Tanymecus dilaticollis* is the most dangerous soil pest of maize and sunflower, the first ranged in spring field crops in Romania. This pest is able to induce high yield losses and even to compromise the crops. The seed dressing with carbofuran products provides satisfactory protection of these crops against the pest. This method replaced the use of organo-chlorine insecticides applied for many years, as dusts, which contributed to environmental pollution and destruction of useful fauna. However, the very high toxicity of carbofuran to men and animals, as well as a tendency for *T. dilaticollis* to develop tolerance to this compound, necessitated the development of seed treatments using less toxic products, such as Cruiser 350 FS. The experiments were done in the laboratory, under artificial infestation, and in the field, in plots cropped successively over the last three years with maize, thus favouring pest reproduction. The efficacy of the Cruiser 350 FS, a thiamethoxam based product, was compared with a carbofuran based product, as standard. Evaluation of chemicals was done in relation to values of attack intensity, and the percentage of plants escaping the pest attack for field trials only. The behaviour of maize and sunflower hybrids to Cruiser 350 FS was examined in several localities under field conditions. The percentage of emerged plants was assessed in treated and untreated plots. Trials revealed very good results obtained by the use of Cruiser 350 FS, providing satisfactory protection of maize and sunflower crops against *T. dilaticollis.* As differences between the rates are not high, it means that from economic standpoint the doses of 9 l/t seed for maize, and 10 l/t seed for sunflower are most interesting. Being a product with much lower toxicity than older alternatives, it is possible for unauthorized persons to apply this seed treatment, which is not permitted when using carbofuran. Almost all maize and sunflower hybrids tested showed good tolerance to the Cruiser 350 FS, even at the high rate of 20 l/t seed.

Key words*:* insecto-fungicides, seed, treatment*, Tanymecus*

INTRODUCTION

Maize leaf weevil (*Tanymecus dilaticollis*) is the most dangerous soil pest in the early vegetation phases of maize and sunflower, the first ranged spring field crops in Romania (Paulian et al., 1969; Paulian, 1973). The pest has a restricted distribution, and is mainly limited to Romania and neighbouring countries to the east, south and west. It mainly occurs in the South, South - East and east of the country, while in the North and Centre of the country it has no economic significance.

Though it is considered to be polyphagous, *T. dilaticollis* exhibits preference for maize, a crop which provides optimal development for the larvae and is the most preferred food by adults (Bãrbulescu and Voinescu, 1998). Due to this fact, the traditional practice of cropping maize after maize for several consecutive years greatly contributes to the reproduction of this insect and thus to an increase in its population. In a not too distant past, populations of this insect sometimes attained densities above 60 adults/m².

As a result of the attack caused by adults, even before emergence of plants above soil surface, high harvest losses can frequently be recorded, sometimes compromising not only maize crops, but also sunflower and sugarbeet. Paulian (1972) showed a yield loss of 34% maize grains when pest density ranged between 25 - 30 individuals/m². Out of more than 3 millions ha cropped with maize and more than 600,000 ha with sunflower, about one third of area requires chemical treatment against maize leaf weevil. The control of this soil pest was based, in a long period of time, nearly exclusively on organo-chlorine insecticides, applied as dusts (Paulian, 1972). Unilateral, irrational and excessive use of these treatments resulted in environmental pollution and the destruction of beneficial fauna. *T. dilaticollis* also became tolerant to some chemicals. These reasons determined the replacement of organo-chlorine insecticides, as they provided only a very low extent of outbreak limitation, at a high cost.

[1)] Research Institute for Cereals and Industrial Crops, 8264 Fundulea, Cãlãra°i County, Romania
[2)] University of Agricultural Sciences and Veterinary Medicine, Bucharest, Romania

The very good results obtained in controlling this pest by seed treatment with products based on carbofuran determined the promotion and generalization of this method, which is modern, efficient, economic and less polluting. As a result, insecticides applied as powders were given up towards the end of the 1980s (Bărbulescu et al., 1988, 1989).

The high toxicity of carbofuran to men and animals, as well as a possible onset of tolerance of maize leaf weevil to this product, has imposed the improvement of seed treatment methods using less toxic products, however able to protect maize and sunflower crops against soil pests.

MATERIALS AND METHODS

The experiments were carried out both in the laboratory and the field, in three localities. The Cruiser 350 FS was tested at several dosages/t seed, using a carbofuran based product, registered in this country for treatment of maize and sunflower seeds against this pest, as a standard.

In the laboratory, under controlled environmental conditions, the efficacy of chemical treatment of maize and sunflower seed was established at a density of seven adults per plant, except for the first trial in 1999, when four adults per plant were used. Infestation with adults previously collected in the open field, was performed at the beginning of plant emergence above the soil surface. Attack rating was done four to six days after infestation. Each plant was assessed on a scale of 1-9, where 1 represented an unattacked plant and 9- a completely destroyed plant.

In the field, the experiments were carried out in plots cropped successively over the last three years with maize, thus favouring pest reproduction. To avoid migration of *T. dilaticollis* adults from one plot to another, the experimental plots were laterally isolated with a 2 m wide strip sown with pea, a plant repellent to this insect (Paulian, 1972; Paulian and Popov, 1977). Evaluation of chemicals was done having in view the attack intensity va-lues, assessed at the end of the maximum attack period by rating plants on the scale of 1-9, and the percentage of plants escaping pest attack.

The behaviour of maize and sunflower hybrids to the Cruiser 350 FS was examined in several localities under field conditions, using the rate of 10 l/t seed and 20 l/t seed for both crops. Sowing was performed as early as possible in spring. The percentage of emerged plants was assessed in treated and untreated plots.

RESULTS AND DISCUSSIONS

In order to fully understand the role of chemical treatment of seeds in protecting plants from the attack of maize leaf weevil, it is useful to outline some features specific to this species. Economic significance is dependent on the attack by overwintering adults, after their appearance at the soil surface. Larvae do not induce obvious damage.

This insect overwinters in the adult stage in the soil, at 40 - 60 cm depth or more, while its occurrence in the upper soil layers takes place by the second half of March or at the beginning of April. Thus during plant emergence, even in the case of a very early sowing, the whole adult population is present at soil surface, and ready to start attacking young plants even before their appearance at the soil surface. If this period of plant emergence corresponds to warm weather, with temperatures above 20°C and without rainfall, the danger of attack by this pest is very high.

The need for a high solubility of the insecticide used for seed dressing should be stressed, together with a rapid translocation of the active ingredient within the germinating seed and in the young plants, so that the lethal dose for the pest occurs at the time of attack onset. From this point of view, it is worth noting that Cruiser 350 FS applied to seed is rapidly taken up by roots of germinating seedlings respectively, and is translocated to the cotyledons and leaves (Senn et al., 1998).

When analysing data regarding the efficacy of the chemical treatment of maize (Figure 1) and sunflower (Figure 2) seeds against the attack by maize leaf weevil under laboratory conditions, it should be noted that for all experimental doses of Cruiser 350 FS good results have been obtained, similar or better, compared to the standard. Certain differences of values reffering to the attack intensity are to be remarked, as depending on the product dose. The lowest attack values were recorded with the highest active ingredient amount per tone of seed. When assessed in terms of adult density per plant, the values of attack intensity were, generally, similar to all trials performed at seven adults/plant, but these values were lower in the case of trials with four adults/plant.

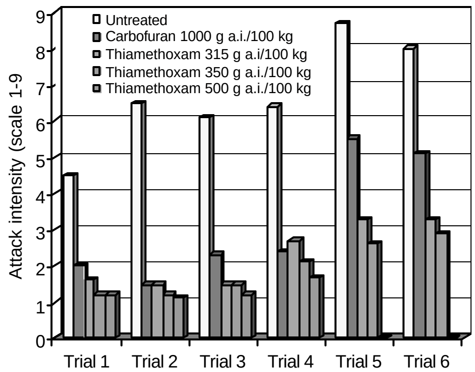

Figure 1. Efficacy of Cruiser 350 FS against *Tanymecus dilaticollis* in maize under laboratory conditions (trials 1-4 in 1999, trials 5-6 in 2000)

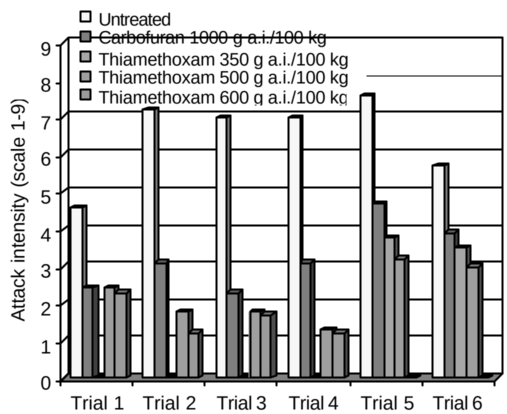

Figure 2. Efficacy of Cruiser 350 FS against *Tanymecus dilaticollis* in sunflower under laboratory conditions

(trials 1-4 in 1999, trials 5-6 in 2000).

Refferring to the control experiments with maize leaf weevil under field conditions, it is evident that, due to different climate conditions, the intensity of attack varied from one locality to another, and from year to year. The heaviest outbreaks occurred at Valu lui Traian in 1999. Therefore, the attack values recorded differed to a certain extent depending on the pest infestation level. In general, the attack values for Cruiser 350 FS, in terms of both attack intensity and percentage of plants escaping damage, were much reduced compared to those in the untreated check, and similar or even less compared to those of the standard product.

When considering the attack values recorded for different experimental rates of Cruiser 350 FS, it was observed that for maize a dose of 9 l/t seed provided a lower efficacy under a heavy outbreak. Good results were obtained for 10 and 14,3 l/t seed, respectively (Table 1). As differences between these rates are not high, that means that from an economic standpoint the dose of 9 l/t seed is interesting. As for sunflower, data obtained revealed similar levels of efficacy at rates of 10, 14.3 and 17.1 l/t seed respectively. In economic terms, the dose of 10 l/t seed is the most interesting (Table 2).

Table 1. Efficacy of Cruiser 350 FS against *Tanymecus dilaticollis* in maize, under field conditions *

Treatment	Dose l/t seed	Attack intensity (1 - 9)			Saved plants (%)		
		1998	1999	2000	1998	1999	2000
Untreated	-	6.1	6.5	5.4	64	59	73
Carbofuran 350 (std)	20	2.9	4.2	3.2	96	80	98
Cruiser 350 FS	9	3.3	3.8	2.7	91	87	99
Cruiser 350 FS	10	3.0	3.2	2.4	94	94	100
Cruiser 350 FS	14.3	2.8	2.9	-	96	95	-

* means of 3 localities

Table 2. Efficacy of Cruiser 350 FS against *Tanymecus dilaticollis* in sunflower, under field conditions *

Treatment	Dose l/t seed	Attack intensity (1- 9)			Saved plants (%)		
		1998	1999	2000	1998	1999	2000
Untreated	-	4.7	4.3	3.4	81	84	88
Carbofuran 350 (std)	28	2.7	2.5	2.4	96	92	97
Cruiser 350 FS	10	2.5	2.6	2.4	96	93	98
Cruiser 350 FS	14.3	2.3	2.3	2.1	97	96	99
Cruiser 350 FS	17.1	2.2	2.1	-	98	98	-

Particular attention has also been paid to data referring to the tolerance of various maize and sunflower hybrids usually used in this country (Table 3, 4). From this point of view, almost all hybrids tested showed good tolerance to Cruiser 350 FS at a rate of 10 and 20 l/t seed for both crops. Nevertheless, in the Northern area of the Country (Suceava), the germination of early maize hybrids was affected.

Table 3. Behaviour of some maize hybrids to the seed treatment with Cruiser 350 FS

Variants	Treatment	Fundulea		Secuieni		Valu lui Traian	
		Emerged plants, %	% from check	Emerged plants, %	% from check	Emerged plants, %	% from check
	1	79	100	72	100	79	100
NEPTUN	2	92	116	59	82	78	99
	3	88	111	56	78	76	96
LSD = 5 %		25.02		13.62		11.62	
	1	83	100	82	100	58	100
OVIDIU	2	89	107	85	104	68	117
	3	89	107	84	102	65	112
		8.06		10.84		9.73	
	1	84	100	56	100	70	100
PALTIN	2	84	100	55	98	87	124
	3	89	106	51	91	86	123
LSD = 5 %		18.07		15.01		5.19	
	1	85	100	72	100	84	100
RAPID	2	96	113	77	107	70	83
	3	89	105	78	108	61	73
LSD = 5 %		12.78		27.80		6.89	
	1	86	100	62	100	74	100
ªOIM	2	85	99	66	106	81	109
	3	82	95	66	106	76	103
LSD = 5 %		11.12		4.72		16.95	
	1	87	100	61	100	79	100
OCTAVIAN	2	93	107	69	113	80	101
	3	89	102	69	113	77	97
LSD = 5 %		19.46		27.52		18.07	
	1	83	100	84	100	70	100
RAPSODIA	2	93	112	84	100	73	104
	3	88	106	79	94	71	101
LSD = 5 %		19.74		18.84		15.56	
	1	70	100	73	100	72	100
FUNDULEA 376	2	86	123	76	104	67	93
	3	86	123	76	104	72	100
LSD = 5 %		6.67		5.56		9.45	
	1	93	100	65	100	80	100
VULTUR	2	93	100	64	98	75	94
	3	86	92	67	103	71	89
LSD = 5 %		15.84		2.24		25.29	
	1	86	100	81	100	66	100
CAMPION	2	81	94	86	106	80	121
	3	82	95	73	90	71	107
LSD = 5 %		21.96		15.29		3.50	
	1	89	100	82	100	72	100
RIVAL	2	98	110	81	99	86	119
	3	91	102	76	93	84	117
LSD = 5 %		16.40		13.90		11.39	
	1	85	100	66	100	82	100
GRANIT	2	89	105	76	115	84	102
	3	88	103	67	101	82	100
LSD = 5 %		24.74		21.40		13.90	
	1	86	100	80	100	77	100
ROBUST	2	90	105	74	92	78	101
	3	82	95	70	87	74	96
LSD = 5 %		19.46		24.18		17.79	

T1 - TMTD (std.)
T2 - Cruiser 350 FS 10 l/t
T3 - Cruiser 350 FS 20 l/t

Table 4. Behaviour of some sunflower hybrids to the seed treatment with Cruiser 350 FS

Variants	Treatment	Fundulea		Secuieni		Valu lui Traian	
		Emerged plants, %	% from check	Emerged plants, %	% from check	Emerged plants, %	% from check
FAVORIT	1	69	100	80	100	79	100
	2	81	117	86	107	70	89
	3	72	104	71	89	68	86
LSD = 5 %		12.78		18.62		12.68	
HERCULE	1	73	100	75	100	74	100
	2	74	101	81	108	75	101
	3	43	59	80	107	73	99
LSD = 5 %		9.17		21.40		25.02	
JUSTIN	1	69	100	79	100	85	100
	2	81	117	86	109	88	103
	3	79	114	84	106	84	99
LSD = 5 %		7.94		13.90		19.96	
PERFORMER	1	73	100	72	100	81	100
	2	78	107	76	105	86	106
	3	67	92	73	101	84	104
LSD = 5 %		3.29		10.84		16.12	
RAPID	1	63	100	76	100	60	100
	2	48	76	77	101	70	117
	3	45	71	79	104	68	113
LSD = 5 %		6.19		7.78		24.46	
SELECT	1	59	100	75	100	78	100
	2	73	124	78	104	80	103
	3	68	115	77	103	78	100
LSD = 5 %		9.17		9.45		15.84	
SPLENDOR	1	73	100	85	100	81	100
	2	82	112	86	101	81	100
	3	63	86	85	100	77	95
LSD = 5 %		13.34		7.78		16.68	
SUPER	1	55	100	70	100	67	100
	2	56	101	76	108	68	101
	3	52	94	74	106	67	100
LSD = 5 %		28.80		6.33		15.29	
HS 2411	1	78	100	76	100	76	100
	2	89	114	79	104	76	100
	3	85	109	82	108	76	100
LSD = 5 %		8.89		5.89		12.26	
HS 2422	1	80	100	79	100	75	100
	2	88	110	79	100	88	117
	3	83	104	76	96	81	108
LSD = 5 %		11.78		2.50		25.62	
HS2524	1	71	100	70	100	81	100
	2	71	100	70	100	75	92
	3	69	97	80	114	70	86
LSD = 5 %		19.73		20.85		24.10	
HS 2526	1	60	100	75	100	80	100
	2	68	113	76	101	78	97
	3	59	98	76	101	72	90
LSD = 5 %		5.25		18.36		14.45	
HS 2528	1	78	100	65	100	68	100
	2	80	102	73	112	77	113
	3	76	97	71	109	73	107
LSD = 5 %		15.01		12.51		14.73	

T1 - Apron (std.) ;
T2 - Cruiser 350 FS 10 l/t ;
T3 - Cruiser 350 FS 20 l/t

CONCLUSIONS

Tanymecus dilaticollis is the most dangerous soil pest of maize and sunflower crops in Romania. Chemical seed treatment provides satisfactory protection of maize and sunflower crops against this pest. This method determined the replacement of organo-chlorine insecticides applied as dusts, which contributed to environmental pollution and the destruction of beneficial fauna. The Cruiser 350 FS ensures suitable protection of maize and sunflower crops, which is generally similar or better to that given by the standard product, carbofuran. The Cruiser 350 FS being a product with much lower toxicity than older alternatives, this affords the possibility of applying this seed treatment by the unauthorized persons, which is not allowed when using carbofuran. Almost all maize and sunflower hybrids trialled showed good tolerance to the Cruiser 350 FS at the experimental rates used.

REFERENCES

Bãrbulescu, A., Popov, C., Voinescu, I., 1988. Reducerea poluãrii mediului prin aplicarea tratamentului chimic al semintei pentru combaterea unor dãunãtori ai culturilor de cereale. Probleme de protectia plantelor 16: 41–46.

Bãrbulescu, A., Voinescu, I., Gheorghe, M., Mateias, M.C., Bratu, R., Bucureanu, E., Sãpunaru, T., 1989. Tratamentul chimic al seminþei, componentã a luptei integrate împotriva unor dãunãtori ai culturilor de câmp. Anale Institutul de Cercetari pentru Cereale si Plante Tehnice 57: 367–376.

Bãrbulescu, A., Voinescu, I., 1998. Evolutia gãrgãriþei frunzelor de porumb (*Tanymecus dilaticollis*) in diferite culturi în functie de planta premergãtoare. Anale Institutul de Cercetari pentru Cereale si Plante Tehnice 65: 321–326.

Paulian, F., Popov, C., Dinu, Maria, 1969. The corn leaf weevil (*Tanymecus dilaticollis* Gyll) in Romania and its control. Contemporary Agricultura 5-6: 643-652, Novi Sad, Jugoslavia.

Paulian, F., 1972. Gãrgãrita frunzelor de porumb *(Tanymecus dilaticollis* Gyll.) ºi posibilitãti de combatere. Redacþia Revistelor Agricole, Bucuresti: 57 pp.

Paulian, F., 1973. Contribuþii la cunoasterea dezvoltãrii, ecologiei ºi combaterii speciei *Tanymecus dilaticollis* Gyll. Teza de doctorat. Institutul Agronomic Nicolae Balcescu, Bucuresti.

Paulian, F., Popov, C., 1977. Einfluss des Diapauseregims auf das Vermehrungspotetial von *Tanymecus dilaticollis* Gyll (*Curculioidae*). Archiv fur Phytopathologie und Pflanzenschutz, Helf 1, Band 13: 53-60.

Senn, R., Hofer, D., Hoppe, T., Angst, M., Wyss, P., Brandl, F., Maienfisch, P., Zang, L., White, S., 1998. CGA 293'343: a novel broad-spectrum insecticide supporting sustainable agriculture worldwide. The 1998 Brighton Conference - Pests & Diseases 1: 27-36.

Table 1. Soil manifests some physiological and enzymic potentials and chemical contents necessary for determining the soil fertility

Main physiological potentials:	Main enzymic potentials:	Main chemical contents:
1. Respiration	1. Catalase	1. Humus (Ct%)
2. Biomass	2. Saccharase	2. Extractable carbon (Ce%)
3. Cellulolyse	3. Urease	3. Humic acids (Cah%)
4. Di-nitrogen fixation	4. Total phosphatases	4. Fulvic acids (Caf%)
5. Proteolise		5. Total nitrogen – Kjeldahlization – (Nt%)
6. Ammonification		6. Organical phosphorus (PO%)
7. Nitrification		7. Acidity
		8. Base saturation

Table 2. Absolute and relative values for respiration potential (mg CO2/100 g soil d.w./24 h), cellulolytic potential (g decayed cellulose / 100 g cotton tissue d.w. / 18 days) and Indicator of Vital Activity Potential (IVAP %) from different soil types

Soil type	Absolute values				
	Respiration (R)	Cellulosolyse (C)	R%	C%	IVAP%
Vermic – typical chernozem	b 33.45	b 40.0	22.30	40.00	c 31.15
Cambic chernozem	a 40.70	a 47.3	27.13	47.30	b 3721
Argiloilluvial chernozem	a 45.30	a 59.4	30.20	59.40	a 44.80
Brown – reddish soil	b 33.50	b 39.7	22.33	39.70	c 31.01
Albic luvisol	c 13.90	c 15.3	9.27	15.30	e 12.28
Albic luvisol	a 39.80	c 13.9	26.53	13.90	d 20.22
Maximum Empiric Value (MEV)	150	100			
LD 5%	3.2	7.4			3.33
1%	4.2	9.8			4.43
	5.5*	12.7*			5.76*
*) utilized LD for comparison					

Table 3. Absolute and relative values for following potentials: catalase (cm^3 O_2/minute), saccharase (mg monoses / 24 h), urease (mg NH_4+ / 24 h) and total phosphatase (mg P / 24 h), all values are reported to 100 g soil d.w. and the Indicator of Enzymic Activity Potential (IEAP %) from different soil types

Soil type	Absolute values	Relative values

	Catalase (K)	Sac-charase (Z)	Urease (U)	Phos-phatase (F)	K%	Z%	U%	F%	IEAP%
Vermic – typical chernozem	a 1607	b 2744	c 35.8	b 2.81	80.35	78.40	23.87	11.24	a 48.46
Cambic chernozem	b 737	b 2320	a 81.1	a 5.60	36.85	66.29	54.07	22.40	a 44.90
Argiloilluvial cher-nozem	b 870	d 945	c 32.4	b 2.39	43.50	27.00	21.60	9.56	b 25.41
Brown – reddish soil	c 313	e 699	e 18.2	b 2.36	15.65	19.97	12.13	9.44	d 14.30
Albic luvisol	c 364	d 967	d 30.3	b 3.14	18.20	27.63	20.20	12.56	c 19.65
Albic luvisol	d 71	c 1882	b 43.3	b 2.64	3.55	53.77	28.87	10.56	b 24.19
Maximum Empiric Value (MEV)	2000	3500	150	25					
LD 5%	85	71	2	0.71					2.32
1%	113	94	3	0.95					3.08
0.1%	147*	122*	4*	1.23*					4.01*
* utilized LD for comparison									

Table 4. Absolute and relative values from the soil chemical analyses: humus (Ct%), extractable carbon (Ce%), humic acids (Cah%), total nitrogen (Nt%), organical phosphorus (P mg/100 g soil d.w.) and pH-H_2O and the Chemical Synthetic Indicator (CSI %)

Soil type	Absolute values						Relative values						
	Ct	Ce	Cah	Nt	PO	pH	Ct	Ce	Cah	Nt	PO	pH	CSI%
Vermic-typical chernozem	1.56	0.56	0.41	0.19	6.56	7.97	36.71	40.00	51.25	76.00	25.23	96.02	a 70.93
Cambic cher-nozem	1.55	0,74	0.59	0.14	7.46	7.29	36.47	52.86	73.75	56.00	28.69	87.83	b 66.69
Argiloilluvial chernozem	1.27	0.61	0.43	0.15	13.97	6.74	29.88	43.57	53.75	60.00	53.73	81.20	b 64.69
Brown-reddish soil	0.76	0.38	0.26	0.11	3.56	4.68	17.88	27.14	32.50	44.00	13.69	56.39	d 41.72
Albic luvisol	1.32	0.80	0.28	0.11	4.79	4.89	31.06	57.14	35.00	44.00	18.42	58.92	c 48.02
Albic luvisol	0.81	0.36	0.09	0.08	8.45	4.62	19.06	25.71	11.25	32.00	32.50	55.66	d 39.88
Maximum Em-piric Value (MEV)	4.25	1.40	0.80	0.25	26	8.30							
LD 5% 1% 0.15													1.91 2.55 3.32*

* utilized LD for comparison

Table 5. Conversion of the Note of Humic Class (NHC) of humus horizons from the soil colour of qualitative description (Chiriþã, 1955), to the Interval of Soil Humus Content (ISHC)

Note of	Soil colour description referring to the	Interval of Soil Humus

Humic class (NHC)	humus content of horisons in soil profile	Content (ISHC) Ct%
1.	Soil without humus; very light colour in superior horizon; yellowish, whitish, whitish - grey	< 1
2.	Soil meagre in humus; brown – yellow-ish; yellowish – brown; brown - grey	1 – 1.49
3.	Soil with moderate content in humus; chestnut, brown, reddish-brown, grey - brown	1.5 – 1.99
4.	Soil rich in humus, black colour	2 – 3
5.	Peaty soil, peat, swamp. Hardly one sees the minerals in organical matter	It is not used. They are not agricultural soil

Example of calculation for Humic Global Index (HG) for a Vermi-typical chernozem:

HGI = 4 (2.5) + (0.5) + 2 (1.8) + 2 (2.2) = 19.5

Note: - figures in front of the parentheses = not of humic class horizons in soil profile

- figures into the parantheses = dimension in decimeters of horison

Transformation of Humic Global Index in Pedo-Genetical Indicator (PGI%):

$$PGI\% = \frac{HGI x 100}{MEV}$$

MEV = 20 (a very fertile soil from Mileanca, Botoºani (county)

Consequently, $PGI\% = \frac{19.5 x 100}{20} = 97.5$

Table 6. Calculation made for determining Humic Global Index (HGI) and Pedo-Genetical Indicator (PGI%) for analysed soils

Station and soil type	Horizon	Thickness dm	Humus Ct%	Humic group	HGI ?(2 x 4)	PGI%

					colons	$\frac{HGIx100}{MEV}$
Colons	1	2	3	4	5	6
Valul lui Traian	Ap1	2.5	2.01	4		
Constanþa County	Ap 2 h	0.5	1.55	3	19.5	97.5
Vermic-typical cher-nozem	Am k	1.8	1.49	2		
	Ac k	2.2	1.09	2		
Fundulea	Ap	1.8	1.72	3		
Cãlãraºi County	Ap h	1.2	1.72	3	15.4	77.0
Cambic cher-nozem	Am	1.5	1.38	2		
	AB	1.7	1.21	2		
Caracal	Ap 1	1.8	1.77	3		
Olt County	Ap 2	1.4	1.68	3	17.8	89.0
Argiloilluvial chernozem	Am	1.8	1.40	2		
	AB	2.3	1.31	2		
ªimnic	Ap	2.0	0.87	1		
Dolj County	Ao	1.2	0.62	1	8.1	40.5
Brown-reddish soil	AB	1.7	0.39	1		
Albota						
Argeº County	Ap + Er	2.7	0.96	1	2.7	13.5
Albic luvisol						
Livada						
Satu-Mare County	Ap + Er	2.7	0.92	1	2.7	13.5
Albic luvisol						

Table 7. Modular and synthetic indicators of fertility level of different soil types

Soil type	IVAP (%)	IEAP (%)	BSI(%) = $\frac{IVAP+IEAP}{2}$ (Biological Synthetic Indicator)	CSI (%)	VETL(%) = $\frac{BSI+CSI}{2}$ (Vital, Energetic and Trophic Level)	PGI(%) (Pedo-Genetical Indicator)	SISF(%) = $\frac{VETL+PGI}{2}$
Vermic-	c	a	a 38.17	a	a 54.55	97.5	a 76.02

typical chernozem	31.15	48.46		70.93			
Cambic chernozem	b 37.21	a 44.90	a 41.05	b 66.69	a 53.87	77.0	c 65.43
Argiloilluvial chernozem	a 44.80	b 25.41	b 35.10	b 64.69	b 49.89	89.0	b 69.44
Brown-reddish soil	c 31.01	d 14.30	c 22.65	d 41.72	c 32.18	40.5	d 36.34
Albic luvisol	e 12.28	c 19.65	d 15.96	c 48.02	c 31.88	13.5	e 22.74
Albic luvisol	d 20.22	b 24.19	c 22.20	d 39.88	c 31.04	13.5	e 22.27
LD 5%	3.33	2.32	1.86	1.91	1.35		1.35
1%	4.43	3.08	2.47	2.55	1.81		1.81
0.1%	5.76*	4.01*	3.32	3.32*	2.35*		2.35*

*) utilized LD for comparison