THE SOIL – PLANT – ANIMAL RELATIONSHIP AS AN ECOPATHOLOGICAL INDICATOR IN DAIRY COWS

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Abstract
As a result of nutrition intensification in cattle , in order to enlarge milk production, metabolic disorders occur that, most often, evolve asymptomatically. Outside of this "productive forcing", other causes that may influence the occurrence and evolution of nutritional metabolic pathology need to be taken into consideration, such as: food deficiencies, forestomach and liver malfunctions, secondary infections of the uterus and mammary gland. Our research study has also taken into consideration the geographic location of the farm, and the industrial enterprises nearby that have polluted the surrounding area, but are no longer in function. Still the long term effects regarding environment pollution are still a matter, which is why we have taken water and soil samples and also decided to determine the metabolic profile of the clinically healthy cows, testing their blood. Trough our results, we were able to interpretate the soil-plant-animal relationship, and by obtaining a valuable ecopathological indicator, we have been allowed to understand and explain the origin of the reproductive and nutrition problems in clinically healthy and highly productive cows around this area.

Key words: ecopatologie, prifil metabolism, pollution, productive override

INTRODUCTION

The breeding of animals dates thousands of years ago and has been developed along with the uprising human necessity to use animals in order to obtain food supplies such as meat and other sub products (Bavaru, A. et. al., 2007, Bran, F. 2004). During the evolution of human society, great progress has been made, but, unfortunately, progress also lead to some inconvenience such as industrial pollution (Rojanschi, V. et. al., 2002).

Although environmental pollution has been an issue for some time, nowadays stopping or at least slowing down the process is the main goal, in order to avoid global warming or the toxic effects that pollution has on all live beings.

The industrial establishments near cities and animals, are the main cause of accidental or professional illness in humans and animals. Animals usually develop asymptomatic forms, difficult to diagnose until they show classic signs of intoxication or other genetic, proliferative or autoimmune diseases (Ionita, L., 2008, Radoi, I., 2003).

We have approached this ecopathological matter because soil, plant and water pollution in the research area are real and important with regard to the industrial units that either have stopped working or decided to purchase filters which allow them to function near urban establishments or ranches (Stanica-Ezeanu, D. 2005).

The researched area is located near the capital and is known to have been polluted with heavy metals, nitrous oxides and other industrial wastes that have exceeded the maximum level of concentration in the atmosphere. Although these units no longer function ore are soon to be closed, pollution and it's consequences will persist many years from now, affecting the water table, the soil and nearby vegetation (Pătroescu, M., Borduşanu, M.,1999).

We have decided to do some experiments on several cows in a farm located near industrial factories involved in air, soil and water pollution and to solve the soil-plant-animal issue by analyzing providers and by monitoring the metabolic indicators in milk cows that have never showed signs of any intoxication or illness that could have lead to important economical loss (Ghergariu, S., 2000, Parvu, G., 1992, Smith, R.D., 2006).

MATERIALS AND METODS

Although industrial pollution was never spectacular enough to cause irreparable damage, it constantly exceeds the limits and is therefore an inconvenience to both human and animal environments.

At that time, the media wrote that the area has been compromised and the authorities said that industrial factories such as ''Acumulatorul" and ''Neferal'' have destroyed the area with their toxic wastes that consisted in Lead, Copper, Zinc, Aluminum, heavy metals, acids, cyanides, Sulfur oxide and other powders .

The area has been polluted for over 40 years, the maximum level of contamination being exceeded over 20 times at the gate of the factory and 5 to 7 times higher on an 8 kilometer radius. After many years of activity, a mysterious hill emerged near the industrial platform as a consequence of spreading the toxic wastes.

The farm is located several km away from these industrial units. Water and fodder samples were sent to the laboratory in order to determine the physical, chemical, microbiological and toxicological indicators and also the metabolic profile of the cattle has been monitored through blood work, clinical exams and epidemiological investigations.

RESULTS AND DISCUSSION

Stages of our research:

1. Epidemiological surveys. On this farm, the cattle had stunning milk productions, reproductive issues, respiratory pathology in calves during cold seasons, few cases of neonatal diarrhea and asymptomatic nutritional and metabolic disorders. The quality of the milk was faultless due to the prophylactic measures taken before and after the milking process and also as a result to advanced technologies used to collect the milk.

2. Clinical examination. Observation sheets have been drawn for the cows included in the trial. The nutritional and metabolic disorders were dominant in the pathological process, reproductive issues such as infecundity and placenta retentions and feet problems are daily matters that need solving.

3. The studies showed that clinical exams are not conclusive and that in order to establish a certain diagnosis of nutritional deficiencies and metabolic disorders, laboratory tests are needed, such as biochemical blood indicators and hematology. A significant number of cows has been monitored and also the hematological profile of 8 dairy cows and 6 pregnant cows. The hematology results are shown in table 1.

The increased milk productions, along with a properly adjusted nutrition show that the hematology results are within normal limits with insignificant fluctuations.

The byochemical blood profile has been determined on a number of 9 cows in a stable, and the results are shown in table 2.

Table 1

Hematology results in dairy and pregnant cows

Hematologic hallmarks	I.U.	Pregnant cows (N=6)		Dairy cows (N=8)	
		*Reference values	Result	*Reference values	Result
No. erythrocytes	mil/mm^3	6,5±1	8,19±1	6,5±1,4	12,2±1,4
Mean corpuscular volume	%	38±4	34,5±4	35±3	35±3
Hemoglobin	g/dl	10,5±1,2	10,5±1,2	10,2±1	10,2±1
VEM	μ^3	58,4±2,6	50,4±2,6	53,4±2,2	53,2±2,2
MCHC	Pg	17±3,5	17±3,5	16±2,5	16±2,5
CHEM	g/dl Er	27,6±1,5	30,7±1,5	29,1±2,1	29,1±2,1
No. leukocites	mii/mm^3	7,7±1,5	10,7±1,5	8±1,5	8±1,5
Lymphocytes	%	53±7	53±7	55±8	51±8
Segmented neutrophils	%	32±13	32±13	28±11	28±11
Young neutrophils	%	1,5±1,5	2±1,5	1±1	1±1
Eosinophils	%	6±2	2±2	4±1,5	4±1,5
Monocytes	%	4±2	1±2	4±2	4±2
Basophils	%	0,5±0,5	0	0,5±0,5	0,5±0,5

*after Parvu, G. (1992)

Regarding the low protein values found in all cows, the diet may be improved with protein suppliments. The fat values are within normal limits.

The enzymatic activity: low values are not important in setting a diagnosis, but, an increase in enzymatic activity may reveal the level of injury that an organ has suffered.

Table 2

Biochemical exams in 9 dairy cows

N0 crt	Hallmark	I.U.	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6	Sample 7	Sample 8	Sample 9
1	Total protein	g/dl	6,65	6,14	6,46	6,08	5,10	6,65	5,68	5,59	5,70
2	Albumin	g/dl	2,37	2,75	2,77	2,83	2,39	2,57	2,76	2,86	2,61
3	Urea	mg/dl	11,5	10,52	6,15	8,23	9,53	6,97	7,31	13,55	16,63
4	Creatinine	mg/dl	1,85	1,52	1,46	1,48	1,10	1,14	0,92	0,93	0,98
5	Total cholester	mg/dl	42,7	59,42	54,24	58,24	40,15	42,26	63,98	59,69	50,04
6	AST	U/l	88,4	88,4	96,7	70,0	95,6	80.4	78,3	59,5	77,2
7	ALT	U/l	12,9	33,6	36,9	34,5	37,5	32,5	20,7	26,5	16,9
8	Alkaline phosphat	U/l	76.5	463,1	102,2	155,9	178,7	181,4	210,2	284,6	184,1
9	GammaGT	U/l	15,6	16,9	14,2	15,2	16,2	16,5	14,0	13,3	12,5
10	CPK	U/l	79.9	92,2	60,8	56,3	28,2	32.2	45,0	38,9	57,8
11	Vitamin E	µg/ml	-	1,2	1,1	-	-	-	-	3,4	4,2
12	Beta caroten	µg/dl	79,05	146,33	156,42	95,87	52,14	68,96	70,64	62,23	18,50
13	Alkaline reserve	mEq/l	28,2	28,2	29,2	28,2	29,3	27,1	26,1	28,3	28,2
14	Ca	mg/dl	6,98	7,13	7,74	7,09	7,75	7,35	6,69	6,42	7,71
15	P	mg/dl	5,59	5,11	5,51	5,88	6,46	7,38	6,83	7,95	7,37
16	Mg	mg/dl	2,57	2,81	2,48	2,52	2,65	2,84	2,54	2,79	2,44
17	**Se**	**ppm**	**-**	**0,018**	**0,028**	**0,024**	**0.018**	**-**	**0,026**	**-**	**-**
18	Fe	µg/dl	-	-	-	-	-	235,9	301,8	207,5	112,6
19	Cu	µg/dl	-	-	-	-	-	66,4	67,7	59,5	67,7
20	Zn	µg/dl	-	-	-	-	-	190	200,0	125,4	98,6

An increased aspartate transaminase (AST) value represents an indicator of hepatic activity in ruminants. Increased AST indicates hepatic disorders in cows suffering form parasitic, viral or bacterial infestations, toxic contamination but most of all the mycotoxical factors that are elevated in all analysis reports.

Low levels of vitamin E were found, in corelation with a low selenium level caused by the polluted soil ar plants – plants either take a small quantity of selenium form the soil or the selenium may interfere with ellements such as cadmium, strontium, lead and others. The poor food intake, improper water that contains high levels of sulfates or nitrates or other contaminants can also be a problem in the absorbtion of selenium.

The main clinical issues of highly productive cows are infecundity and placentar retentions , issues that could also be explained by the low levels of vitamin E and selenium.

4. Water analysis. According to certified analysis reports (see tables 3 and 4) drinking water indicators are within normal ranges. The physical and chemical exams showed the presence of nitrates and chlorides, but within normal limits therefore could not affect the health condition of the animals and the microbiological results concluded an admissible number of total germs and was negative for E. Coli and other enteric bacteria.

Table 3

Phisycal and chemical exam of the water

Sample No.	Nitrates mg/dm^3	Nitrates mg/dm^3	Ammonia mg/dm^3	Chlorides mg/dm^3	pH
1	abs	3,14	abs	31,95	7,45
2	abs	3,28	abs	31,95	7,50
Method	SR 3048/2-96	SR 3048/1-96	SR ISO 5664/01	SR ISO 9297/2001	SR ISO 10523/97

Table 4

Microbiological exams of the water

Sample No.	NTG/ml at 22^0	Coliforms/100 ml	E.coli/ 100 ml	NTG/ml at 37^0	Enteric bacteria/100 ml
1	□100	Abs	Abs	□20	Abs
2	□100	Abs	Abs	□20	abs
Method	EN ISO 6222	ISO 4831/2006	ISO 9308/1	EN ISO 6222	ISO 7899/2

5. Laboratory tests on fodder. Plants around the farm , that animals eat , were tested but all indicators were normal except the low level of selenium: 10 times lower in triticals, 3 times lower in wheat, barley and oatmeal. The pedological data confirmed the low levels of selenium in the soil.Two samples were sent to the laboratory for toxicological exams and the results are shown in tables numbers 5 and 6.

Table 5

Volume fodder sample (hay without grasses)

Element	Measurement units	Allowed values	Result
Pb	mg/kg	0,2	undetectable
Cd	mg/kg	0,02	0,063

Table 6

Volume fodder sample (wheat straw)

Element	Measurement units	Allowed values	Result
Pb	mg/kg	0,2	undetectable
Cd	mg/kg	0,02	0,116

Table 7

Physical and chemical results on 7 fodder samples

	Humidity %	Raw protein %	Se ppm	Zn ppm	Fe ppm	Cu ppm	Mn ppm
Triticals	14,90 (-)	10,16 (-)	0,023 (0,15-0,23)	9,35 (-)	30,89 (-)	6,15 (-)	40,90 (-)
Wheat	12,24 (13)	12,06 (11,5)	0,039 (0,15-0,23)	38,99 (34)	36,73 (70)	7,75 (7,2)	37,31 (57)
Oatmeal	11,34 (12)	10,37 (10,5)	0,054 (0,15-0,23)	33,76 (32)	61,80 (78)	21,84 (5,8)	51,09 (55)
Barley	10,18 (12)	9,95 (10,0)	0,036 (0,15-0,23)	56,03 (26)	83,39 (8,7)	21,84 (5,8)	35,19 (21)
Sun-flower	9,77 (10)	35,76 (29-34)	0,115 (0,15-0,23)	31,57 (55)	133,44 (417)	50,39 (28,7)	52,01 (53)
Gramfor	9,34 (-)	19,68 (-)	0,068 (0,15-0,23)	25,70 (-)	275,1 (-)	97.13 (-)	81,65 (-)
PVM	3,4 (-)	-	-	12135,8 (-)	5882,11 (-)	5435,11 (-)	6800,14 (-)

Legend: in parentheses are reference values

Results of the analysis show that the levels of lead in plants and blood do not exceed the allowed values but the levels of cadmium are 3 to 5 times higher than allowed. We are certain that also other toxic elements resulted from the industrial pollution, such as strontium and nickel have elevated levels that interfere with microelements like selenium, iron, copper, iodine, vitamins and many more (table 7). Putting an ent to industrial pollution is a very delicate issue, considering the fact that the contamination persists many years after the factories have stooped working. These polluting elements that we have identified conclude the fact that even though the factory in no longer in function, pollution continues amd will continue to exist.

One thing is certain: in all the years the factory has functioned, no clinicals cases of intoxication in animals have been reported. In the years to come, careful monitoring of the area is required, in order to develop a metabolic profile that will allow feature generations the breed animals in the compromised area.

CONCLUSIONS

1. The main goal of our study is to find a corespondance between the vital elements in a reproductive cycle, in this case the soil-plant-animal relationship as an ecopathological indicator in a farm located near a highly polluted area.
2. We have investigated the elements of this relationship by following these steps: epidemiologic survey, clinical exams, metabolic profiles and water and fodder analysis.
3. Of all the indicators in our metabolic profile, the most significat seems to be the low selenium and vitamin E levels in the blood of the examined cows.
4. The degree of pollution seems to be closely related to the low selenium and vitamin E levels, elements which are directly responsable for the health and reproductive function in dairy cows.
5. In our opinion, surroundings also must be investigated in order to determine the level of pollution in the area and the period of time necessary to drain the toxic wasted from the soil.
6. We consider that our purpose has been reached, because we managed to corelate the soil-plant-animal relationship and all it's direct or indirect implications.

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