PhD DISERTATION ABSTRACT

The PhD dissertation called ***Nutritional evaluation of certain categories of fodder used for obtaining organic production in cattle*** is structured in two parts: the literature survey and the original research plus conclusions and recommendations.

The literature survez contained three chapters:

- *chapter I* describes the current situation of organic cattle feed production with the legal issues comprising this branch of agriculture; nationally and internationally organic production statistics as well as data on agricultural land used for organic production of feed for cattle ;
- *chapter II* contains data on the nutritional value of the main categories of feed (green and dry fodder , pickled and concentrate feed) and feeding regimes used for cattle;
- *chapter III* describes certain categories of pollutants (*heavy metals* - Pb, Cd, Cu and Zn, *pesticides* - organochlorine and organophosphorus, *nitrate and nitrite*) and their concentration in certain types of soil and fodder used in cattle feeding.

The original research part is structured in six chapters as follows:

- *chapter IV* describes the purpose of the research and the materials and methods used to achieve goals;
- *chapter V* presents the research framework, the experimental scheme and the institutional and organizational framework which hosted the research; it presents management data on the two production systems (organic and conventional) from where the feed samples were collected and analyzed; sampling and laboratory sample preparation.
- *chapter VI, V, VII, VIII* and *IX* presents original research results and their discussion on gross chemical composition, nutritional value, heavy metals content - Pb, Cd, Cu, Zn, nitrates and

nitrites content of the seven types of feed (natural grassland, green alfalfa, natural hay, alfalfa hay, corn silage, maize and wheat bran) collected and analyzed in 2011-2012 from the two production systems (organic and conventional).

The research was conducted in the following units: *Research and Development Station for Cattle*, Iaşi (the "C" unit - conventional production system), *SC Multiagra SRL Botoşani LLC* (the "E" unit - ecological production system), *University of Agricultural Sciences and Veterinary Medicine* "Ion Ionescu de la Brad" from Iaşi (*Forage Quality Control Laboratory – Faculty of Animal Husbandry and Plant and Soil Analysis Laboratory - Faculty of Agriculture*) and *Department of Health, Animal Science and Food Safety*, University of Milan.

In order to determine the gross chemical composition, heavy metals concentration, pesticides residues, nitrates and nitrites content, a total of 140 laboratory samples were analyzed (5 samples for each type of feed, from both production systems); feed volume: natural grassland, green alfalfa, natural hay, alfalfa hay - 80 samples, pickled feed: corn silage - 20 samples, concentrated feed: corn, wheat bran - 40 samples.

Sampling was made in accordance with in force national standards and legislation SR EN ISO 6497:2005 and SR EN ISO 13690:2007.

Determination of chemical composition of analyses fodder samples was performed using standardized techniques and modern devices calibrated to minimize the possible errors that can occur during analysis, thus ensuring the scientific value of the results.

For chemical determinations the following standards were used: for dry matter and moisture: ISO 711:1999, ISO 6496:2001, ISO 6540:2010 and ISO 712:2005 for crude ash SR EN ISO 2171 2010, for crude protein SR EN ISO 20483:2007 and EN ISO 5983-1:2006 / AC: 2009, ISO 6492:2001 for crude fat, crude fiber to SR EN ISO 6865:2002, neutral detergent fiber and acid detergent fiber SR EN ISO 13906:2008 and EN ISO 16472:2006, for mineral composition SR EN ISO 6869:2002, EN ISO 14082:2003, for nitrates and nitrites determination SR 13175:1993 and European guidelines for the determination of pesticides EC / 657/2002.

For a better interpretation of the results the main factors (level and type of soil and treatments applied) that can influence the gross chemical composition, nutritional value, content of heavy metals, nitrites, nitrates and pesticides in the two types of production systems, were monitored.

Soil fertilization in the "E" unit, with organic production system, was made exclusively with cattle manure used on the soil surface in the pre-sowing winter season.

Depending on the culture that was to be established, manure fertilization was done differently. Thus for natural grassland the quantity of given organic fertilizer was 25 t/ha in 2011 and 20 t/ha in 2012, the land for alfalfa production received an amount of cattle manure of 40 t/ha in 2011, respectively 45t/ha in 2012, corn silage fertilization was made with a quantity of 60 t/ha in 2011 respectively 2012, for maize production organic fertilizer application was made in 2011 by an amount of 40 t/ha.

Between 2010 - 2012 weed controls in the organic production unit was done mechanically using equipment supplied; regarding pest control no substances, that can influence the research results, were applied.

In the "C" unit with conventional production system, the natural grassland fertilization was carried out with NPK 15-15-0 complex in an amount of 50 kg/ha in 2011, to which was added 30 t/ha of cattle manure and 40 kg/ha NPK 15-15-0 in 2012.

Soil fertilization for alfalfa production was made with a NPK 22-22-0 complex in an amount of 180 kg / ha in 2011 and 150 kg / ha in 2012, with the application before sowing.

For the production of corn for silage fertilization was achieved with 76 kg/ha of NPK 22-22-0 complex in 2011 and 80 kg / ha in 2012, fertilizer applied along with sowing.

Maize grains fertilization was performed by applying a NPK 22-22-0 complex in an amount of 90 kg/ha in 2011 and 100 k /ha in 2012, applied with sowing.

Treatments under conventional production system were conducted with commercial products. Thus, for alfalfa crop in 2011 was used PULSAR 40 product (active substance - *imayamox* 40g/L) in the amount of 1L/ha, and in 2012 DUAL GOLD (active substance - *S-metolachlor* 960 g /L) in an amount of 1.5 L/ha.

Both for grain maize and cornsilage in 2011 was used MILAGROEXTRA product (active substance - *nicosulfuron* 60 g/L) in an amount of 0.71 L/ha to which was added 0.6 L/ha of MUSTANG (*active-florasulam* 6.25 g/L + 2,4-D EHE 300 g/L). In 2012 the product was used ASTRAL (active substance - *nicosulfuron* 40g/L) in an amount of 1.5 L/ha with added 2 L/ha of ZEAGRAN (active substance - 90 g/L *bromoxynil* + 250 g/L *terbuthylazine*).

After statistical processing of data resulted from chemical analyzes in the two years (2011 and 2012) of research on studied fodder samples, we obtained significant differences between the two types of systems (organic and conventional); they are presented below in groups of analyzed indicators (*chemical composition* - dry matter, crude ash, organic matter, crude protein, crude fat, crude fiber, nitrogen free extract, neutral detergent fiber, acid detergent fiber, calcium and phosphorus, *nutritional value* - net energy for milk production /unit feed for lactation - NEL/UFL, net energy for meat production / unit feed for meat production - NEC/UFC, intestinally digestible proteins food originated - PDIA, intestinally digestible proteins when nitrogen in feed is limiting – PDIN, intestinally digestible proteins PDIE energy content when energy in feed is limiting, *heavy metal content* - Pb, Cd, Cu and Zn, *nitrates and nitrites* concentration and degree of contamination with pesticides).

Chemical composition (average values determined are expressed in % of DM)

Differences very statistically significant ($p<0.001$) between the two systems (conventional vs. organic) were recorded for:

- natural grassland content in: *dry matter* - 16.81±0.53 vs. 25.72±1.13 in 2011 and 15.31±0.56 vs. 22.58±1.04 in 2012, *crude ash* - 11.58±0.31 vs. 6.07±0.14 in 2011 and 10.78±0.36 vs. 7.02±0.16 in 2012, *crude protein* - 11.43±0.54 vs. 8.04±0.21 in 2011, *neutral detergent fiber* - 53.63±1.20 vs. 64.43±1.14 in 2011 and 54.42±1.66 vs. 65.23±1.11 in 2012, *calcium* - 0.561±0.02 vs. 0.701±0.02 and *phosphorus* - 0.270±0.01 vs. 0.383±0.016 in 2012;
- green alfalfa content in: *crude ash* - 8.01±0.1 vs. 10.37±0.26 in 2011 and 12.68±0.27 vs. 11.12±0.08 in 2012 and *calcium* - 1.351±0.013 vs. 0.04±1.787 in 2011 and 1.408±0.014 vs. 1,807±0,032 in 2012;
- natural hay for the content in: *crude protein* - 10.81±0.24 vs. 8.45±0.15 in 2011, *acid detergent fiber* - 42.96±0.47 vs. 34.30±0, 0.72 in 2011 and 43.98±0.48 vs. 34.27±0.70 in 2012 and *calcium* - 0.432±0.017 vs. 0.607±0.011 in 2011 and 0.462±0.032 vs. 0.632±0.014 in 2012;
- alfalfa hay for the content in: *crude ash* - 6.75±0.28 vs. 8.69±0.25 and *calcium* - 1.224±0.04 vs. 1.5±0.037 in 2011;
- corn silage for the content in: *dry matter* - 42.4±0.43 vs. 26.97±0.6 in 2011, *crude ash* - 4.11±0.07 vs. 5.11±0.11 *calcium* in 2011 and 0,219±0,001 - vs. 0.315±0.005 in 2011 and 0.229±0.001 vs. 0.396±0.008 in 2012;
- grain maize for the content in: *crude ash* - 1.19±0.02 vs. 1.03±0.02 in 2011 and 1.34±0.02 vs. 1.19±0.02 in 2102, *crude protein*, 7.44±0.07 vs. 6.53±0.3 in 2011 and 9.26±0.09 vs. 7.92±0.16 in 2102, *calcium* - 0.03±0.001 vs. 0.037±0.001 in 2011 and 0.034±0.01 vs. 0.029±0.001 in 2102 *phosphorus* - 0.337±0.015 vs. 0.285±0.002 in 2011.

Differences distinct statistically significant (*p<0.01*) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *organic matter* - 81.31±1.98 vs. 89.32±0.92 in 2011, *crude protein* - 10.24±0.60 vs. 7.83±0.19, *crude fiber* - 29.31±0.99 vs. 32.02±0.86, *nirtogen free extract* - 30.88±3.03 vs. 45.27±1.23 in 2012, *acid detergent fiber* - 25.70±1.17 vs. 30.07±0.84, *calcium* - 0.590±0.20 vs. 0.687±0.25 and *phosphorus* - 0.30±0.02 vs. 0,355±0,017 in 2011;
- green alfalfa for the content in: *organic matter* - 86.18±0.96 vs. 81.65±0.82 in 2011 and *crude protein* - 26.97±0.29 vs. 25.21±0.3 in 2011 and 28.58±0.32 vs. 26.81±0.33 in 2012;
- natural hay for the content in: *crude ash* - 5.66±0.11 vs. 6.91±0.23 in 2011 and 6.46±0.14 vs. 7.83±0.27 in 2012, *crude protein* - 9.87±0.21 vs. 8.22±0.19 in 2011, *neutral detergent fiber* - 65.38±0.86 vs. 60.9 ± 0.59 in 2011 and 65.98±1.17 vs. 62.7±0.7 in 2012 *phosphorus* -0.261± 0.017 vs. 0.331±0.01 in 2011;
- alfalfa hay for the content in: *crude protein* - 17.96±0.24 vs. 16.33±0.7 in 2011, *crude fiber* - 32.28±1.03 vs. 27.67±0.67 in 2011 and 34.36±1.1 vs. 29.45±0.79 in 2012, *nitrogen free extract* - 34.40±1.16 vs. 40.88±1.54 in 2012, *acid detergent fiber* - 33.75±0.81 vs. 28.33±0.88 and *calcium* - 1.293±0.036 vs. 1,452±0,034 in 2012;
- corn silage for the content in: *crude ash* - 5.57±0.06 vs. 6.33±0.15 in 2011, *crude protein* - 7.39±0.1 vs. 6.12±0.3, *acid detergent fiber* - 28±0.46 vs. 25.94±0.34 and *phosphorus* - 0.224±0.009 vs. 0.185±0.003 in 2011;
- wheat bran for the content in: *acid detergent fiber* - 11.53±0.20 vs. 12.84±0.48 in 2011.

Differences statistically significant (*p<0.05*) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *crude fiber* - 25.94±0.97 vs. 30.02±0.83 in 2011, *acid detergent fiber* - 26.31±1.14 vs. 31.04±0.90 in 2012;
- green alfalfa for the content in: *dry matter* - 25.8±0.28 vs. 26.32±0.86 in 2012, *nitrogen extract free* - 32.58±1.37 vs. 36.79±1.38 in 2011, *neutral detergent fiber* - 39.06± 0.5 vs. 34.91±1.29 in 2011 and 35.41±1.33 vs. 40.01±0.55 in 2012 and *phosphorus* - 0.311±0.012 vs. 0.251±0.022 in 2011 and 0.351±0.01 vs. 0.271±0.023 in 2012;
- natural hay for the content in: *crude fat* - 1.04±0.05 vs. 1.32±0.07 and *phosphorus* - 1.36±0.05 vs. 1.53±0.13 in 2011;

- alfalfa hay for the content in: *crude ash* - 6.35±0.24 vs. 7.18±0.34 in 2012, *crude protein* - 16.40±0.18 vs. 15.19±0.45 in 2011, *nitrogen free extract* - 32.28±1.23 vs. 38.80±1.57 in 2012, *acid detergent fiber* - 32.49±0.76 vs. 29.66±0.82 in 2011;
- corn silage the content in: *organic matter* - 86.96±0.85 vs. 89.92±0.64 in 2011, *nitrogen free extract* - 57±0.84 vs. 59.66±0.65 in 2011 and 50.36±0.91 vs. 53.32±0.88 in 2012, *acid detergent fiber* - 29.01±0.7 vs. 26.88±0.34 and *phosphorus* - 0.217±0.011 vs. 0.192±0.003 in 2012;
- wheat bran for the content in: *crude ash* - 4.79±0.09 vs. 4.4±0.14 in 2011, *neutral detergent fiber* - 38.40±0.2 vs. 40.73±0.72 in 2011 and 39.3±0.41 vs. 41.54±0.8 in 2012, *acid detergent fiber* - 12.07±0.23 vs. 13.74±0.54 in 2012.

Differences statistically insignificant ($p>0.05$) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *organic matter* (2012), *crude fiber* (2011) and *acid detergent fiber* (2012);
- green alfalfa for the content in: *dry matter* (2011), *crude fat*, *crude fiber* (2011, 2012), *nitrogen extract free* (2012), *acid detergent fiber* (2011, 2012);
- natural grass for the content in: *dry matter* (2011, 2012), *organic matter* (2011, 2012), *crude fat* (2012), *crude fiber* and *nitrogen extract free* (2011 and 2012);
- alfalfa hay for the content in: *dry matter*, *organic matter*, *crude fat*, *neutral detergent fiber*, *phosphorus* (2011 and 2012);
- corn silage for the content in: *organic matter* (2011), *crude protein* (2012), *crude fat*, *crude fiber* and *neutral detergent fiber* (2011 and 2012);
- grain maize for the content in: *dry matter*, *organic matter*, *crude fat*, *crude fiber*, *nitrogen extract free*, *neutral detergent fiber*, *acid detergent fiber* (2011 and 2012) and phosphorus (2012);
- wheat bran for the content in: *dry matter* (2011 and 2012), *crude ash* (2012), *organic matter*, *crude protein*, *crude fat*, *crude fiber*, *nitrogen extract*, *calcium* and *phosphorus* (2011 and 2102).

Nutritional value (the energy is expressed in kcal/kg DM and protein value in g/kg DM)

Differences very statistically significant ($p<0.001$) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *NEL / UFL* - 885±24.6 / 0.52±0.01 vs. 1053±12.07 / 0.62±0.01 in 2012, *NEC / UFC* - 766±23.26 / 0.42 ±0.01 vs. 923±11.45 / 0.51±0.01 in 2012, PDIA - 25.70±1.21 vs. 18.07±0.46 in 2011 and *PDIN* - 71.81±3.39 vs. 50.49±1.30 in 2011;

➢ natural hay for the content in: *PDIA* - 26.25±0.47 vs. 33.59±0.73 in 2011, *PDIN* - 68.19±1.48 vs. 53.30±0.96 in 2011 and PDIE - 74.84±1.06 vs. 68.08±0.61 in 2011 and 72.1±1.38 vs. 66.7±1.35 in 2012;

➢ corn silage for the content in: *PDIE* - 64.62±0.6 vs. 70.38±0.84 in 2011 and 67.9±1 vs. 77.6±1.28 in 2012;

➢ grain maize for the content in: *PDIA* - 45.52±0.40 vs. 39.91±0.11 in 2011 and 56.64±0.84 vs. 48.44±0.56 in 2012 and *PDIN* - 60.78±0.54 vs. 53.30±0.15 in 2011 and 75.6±1.12 vs. 64.7±0.75 in 2012.

Differences distinct statistically significant ($p<0.01$) between the two systems (conventional vs. conventional) were recorded at:

➢ natural grassland for the content in: *NEL/UFL* - 982±24.04/0.58±0.01 vs. 1084±11.62/0.64±0.01 in 2011, *NEC/UFC* - 853±24.47 / 0.47±0.01 vs. 955±11.73 / 0.52±0.01 in 2011, *PDIA* - 23.02±1.19 vs. 17.60±0.48 in 2012 and *PDIN* - 64.3±3.32 vs. 49.2±1.34 in 2012;

➢ green alfalfa for the content in: *NEL/UFL* - 1315±13.21/0.77±0.01 vs. 1397±13.21/0.82±0.01 in 2011, *NEC/UFC* - 1521±19.26/1638±0.84 vs 18.08±0.01/0.90±0.01 in 2011, *PDIA* - 60.63±0.66 vs. 56.66±0.67 in 2011 and *PDIN* -169.44±1.84 vs. 158±1.88 in 2011;

➢ natural grass for the content in: *PDIA* - 30.68±0.90 vs. 25.55±0.85 in 2012 and *PDIN* - 62.3±1.83 vs. 51.9±1.72 in 2012;

➢ corn silage for the content in: *PDIA* - 16.09±0.22 vs. 13.31±0.65 in 2011 and *PDIN* - 45.44±0.63 vs. 37.6 ± 1.84 in 2011;

➢ wheat bran for the content in: *NEL/UFL* – 1266±10.29/0.74±0.002 vs. 1287±10.29/0.76±0.04 in 2011, *NEC / UFC* - 15.21±1387/1394±6.71 vs. 0.003±0.76 / 0.78±0.04 in 2011.

Differences statistically significant ($p<0.05$) between the two systems (conventional vs. organic) were recorded at:

➢ green alfalfa for the content in: *PDIA* - 64.24±0.93 vs. 60.26±0.93 in 2012 and *PDIN* - 179.5±2.61 vs. 168.4±2.61 in 2012;

➢ alfalfa hay for the content in: *PDIA* - 46.41±0.51 vs. 43±1.27 in 2011 and 50.84±0.90 vs. 46.22±1.32 in 2012, *PDIN* - 105.21±1.16 vs. 97.48±2.88 in 2011 and 115.2±2.05 vs. 105±3 in 2012;

➢ corn silage for the content in: *NEL/UFL* - 1341±14.95/0.79±0.01 vs. 1390±12.47/0.82±0.01 in 2012, *NEC/UFC* - 1594±17.93/0.88±0.01 vs. 1658±15.21/0.91±0.01 in 2012.

Differences statistically significant ($p>0.05$) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *PDIE* in 2011 and 2012;
- green alfalfa the content in: *NEL/UFL* in 2012, *NEC/UFC* in 2012, *PDIE* in 2011 and 2012;
- alfalfa hay for the content in: NEL/UFL, NEC/UFC, PDIE in 2011 and 2012;
- corn silage for the content in: *NEL/UFL*, *NEC/UFC* in 2011 and *PDIN*, *PDIA* 2012;
- grain maize for the content in: *ENL/UFL*, *ENC/UFC*, *PDIE* in 2011 and 2012;
- wheat bran for the content in: *ENL/UFL*, *ENC/UFC* 2012, *PDIA*, *PDIN* and *PDIE* in 2011 and 2012.

Heavy metals content - Pb, Cd, Zn, Cu (average values determined are given in mg/kg feed at 12% moisture for Pb and Cd and in mg/kg DM for Cu and Zn)

Differences very statistically significant ($p<0.001$) between the two systems (conventional vs. conventional) were recorded at:

- natural grassland for the content in: *Cd* - 0.018±0.001 vs. 0.007±0.0004 in 2011 and *Cu* 1.16±0.036 vs. 2.04±0.045 and 1.25±0.068 in 2011 vs. 2.21±0.071 in 2012;
- green alfalfa for the content in: *Pb* - 0.12 ± 0.004 vs. 0.08±0.004 in 2011 and 0.16±0.005 vs. 0.09±0.007 in 2012, *Cd* - 0.019±0.001 vs. 0.01±0.001 in 2011 and 0.02±0.001 vs. 0.013±0.001 in 2012, *Cu* - 1.23±0.013 vs. 1.09±0.009 in 2011 and 1.26±0.055 vs. 1.81±0.057 in 2012, *Zn* - 3.276±0.118 vs. 3.646±0.110 in 2011;
- natural hay for the content in: *Cu* - 1.7±0.024 vs. 2.11±0.027 in 2011 and 1.07±0.051 vs.1.78±0.053 in 2012, *Zn* - 3.112±0.120 vs. 2,065±0,125 in 2011 and 3,013±0,134 vs. 1.935±0.117 in 2012;
- alfalfa hay for the content in: *Cu* - 1.12±0.062 vs. 2±0.071 in 2011, *Zn* - 2.085±0.126 vs. 3,421±0,148 in 2012;
- corn silage for the content in: *Pb* - 0.17±0.008 vs. 0.068±0.004 in 2012, *Cu* - 1.32±0.014 vs. 1.71±0.019 in 2011 and 1.09±0.009 vs. 2.04±0.007 in 2012, *Zn* - 3.072±0.031 vs. 3,751±0,028 in 2011 and 3,127±0,018 vs. 3,821±0,033 in 2012;
- grain maize for the content in: *Pb* - 0.14±0.001 vs. 0.03± 0.002 in 2011 and 0.11±0.009 vs. 0.02±0.001 in 2012 *Cd* - 0.017±0.001 vs. 0.008±0.001 in 2011 and 0.019±0.001 vs. 0.011±0.001 in 2012, *Cu* - 1.06±0.014 vs. 1.27±0.011 in 2011 and 2.11±0.066 vs. 1.37±0.027 in 2012;
- wheat bran for the content in: *Pb* - 0.04±0.002 vs. and 0.02±0.002 in 2011 şi 0.06±0.003 vs. 0.04±0.002 in 2012;

Differences distinct statistically significant ($p<0.01$) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *Pb* - 0.06±0.004 vs. 0.08± 0.003 in 2011 and 0.09± 0.007 vs. 0.12±0.006 in 2012;
- natural hay for the content in: *Cd* - 0.021±0.001 vs. 0.015±0.001 in 2011;
- alfalfa hay for the content in: *Pb* - 0.15±0.009 vs. 0.11±0.007 in 2012, *Cd* - 0.016±0.001 vs. 0.011±0.001 in 2012, *Cu* - 1.65±0.071 vs. 2.11±0.068 in 2012, *Zn* - 3.021±0.130 vs. 3,528±0,135 in 2011;
- corn silage the content in: *Pb* - 0.09±0.005 vs. 0.06±0.004 in 2011;
- wheat bran the content in: *Cu* - 0.95±0.010 vs. 1.02±0.012 in 2011.

Differences statistically significant ($p<0.05$) between the two systems (conventional vs. organic) were recorded at:

- green alfalfa for the content in: *Zn* - 3.02±0.085 vs. 3.345±0.080 in 2012;
- natural hay for the content in: *Pb* - 0.08±0.006 vs. 0.1±0.005 in 2012;
- corn silage for the content in: *Cd* - 0.021±0.001 vs. 0.018±0.001 in 2012;
- wheat bran for the content in: *Cu* - 1.86±0.024 vs. 1.97±0.028 in 2012 and *Zn* - 3.028±0.053 vs. 3.266±0.051 in 2011.

Differences statistically insignificant ($p>0.05$) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: *Zn*, *Cd* in 2012 and in 2011 and 2012;
- natural hay for the content in: *Cd*, *Pb* in 2011 and 2012;
- alfalfa hay for the content in: *Pb* and *Cd* in 2011;
- corn silage content in: *Cd* in 2011;
- corn grain for the content in for: *Zn* in 2011 and 2012;
- wheat bran for the content in: *Cd* and *Zn* in 2011 and 2012 in 2012.

Nitrates and nitrites content

Differences very statistically significant ($p<0.001$) between the two systems (conventional vs. organic) were recorded at:

- green alfalfa content in: nitrate (NO_3^-) 384.92 ± 8.10 vs. 108.32 in 2011 and 395.54 ± 2.02 ± 7.92 vs. 117.33 ± 2.38 in 2012 and nitrite (NO2-) 5.02 ± 0.21 vs. 1.46 ± 0.04 in 2011 and 4.98 ± 0.07 vs. 1.58 ± 0.05 in 2012;

- alfalfa hay for content: nitrate (NO_3^-) 21.02 ± 0.55 vs. 16.52 ± 0.32 in 2012 and nitrite (NO_2^-) 1.29 ± 0.06 vs. 0.89 ± 0.03 in 2011 and 1.38 ± 0.06 vs. 0.95 ± 0.06 in 2012;
- corn silage content in: nitrate (NO_3^-) 62.60 ± 2.56 vs. 14.97 ± 0.50 and 75.81 ± 0.72 vs 2011. 15.35 ± 0.48 in 2012;
- grain maize for content: nitrate (NO_3^-) 1.91 ± 0.07 vs. 1.33 ± 0.04 in 2011 and nitrite (NO_2^-) 2.60 ± 0.09 vs. 2.09 ± 0.05 in 2012;

Differences distinct statistically significant ($p<0.01$) between the two systems (conventional vs. conventional) were recorded:

- natural grassland the for content in: nitrate (NO_3^-) 50.63 ± 0.59 vs. 47.44 ± 0.89 in 2011;
- maize in: nitrate (NO_3^-) 2.16 ± 0.13 vs. 1.49 ± 0.06 in 2012 (NO_2^-) 2.42 ± 0.09 vs. 1.87 ± 0.08 in 2011;
- Differences statistically significant ($p<0.05$) between the two systems (conventional vs. organic) were recorded at:
- natural grassland for content in: nitrate (NO_3^-) 49.31 ± 1.37 vs. 43.31 ± 1.39 in 2012 (NO_2^-) 1.56 ± 0.05 vs. 1.78 ± 0.05 in 2011;
- natural grass for the content in: nitrate (NO_3^-) 13.48 ± 0.48 vs. 11.97 ± 0.57 in 2012;
- corn silage content in: nitrates (NO_2^-) 0.89 ± 0.07 vs. 0.63 ± 0.04 in 2011 and 0.93 ± 0.04 vs. 0.75 ± 0.05 in 2012;
- wheat bran content in: nitrate (NO_3^-) 2.98 ± 0.07 vs. 2.50 ± 0.08 in 2011 and 2.99 ± 0.14 vs. 2.54 ± 0.04 in 2012 (NO_2^-) 3.33 ± 0.13 vs. 2.98 ± 0.07 in 2011;

Differences statistically insignificant ($p>0.05$) between the two systems (conventional vs. organic) were recorded at:

- natural grassland for the content in: nitrite (NO_2^-) in 2012;
- natural grass for the content in: nitrate (NO_3^-) in 2011 and nitrite (NO2-) in 2011 and 2012;
- alfalfa hay for the content in: nitrate (NO_3^-) in 2011;
- wheat bran for the content in: nitrite (NO_2^-) in 2012.

Pesticide contamination

Gas chromatographic analysis of organochlorine and organophosphorus pesticide concentration of fodder samples collected from both the ecological and the conventional system, revealed that pesticide residues were below the detection limit of 0.05 mg/kg DM for organochlorine pesticides and 0.001 mg/kg for organophosphorus pesticides.

Detection of pesticides in the samples may be explain by some research conducted in the NE of Romania on various types of soil, which had the same result.

The multitude of factors that can influence the chemical composition of feed, the concentration of heavy metals, nitrate and nitrite and level of pesticide contamination, and the lack of strict and effective count of them, reflects the necessity of continuing research in this regard. In order to increase accuracy of data and for better interpretation of results, influencing factors should be monitored and limited as much as possible by organizing research in well-controlled environments.