Mineral Content of the Main Feed Ingredients Used in Poultry Biological Farms

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Abstract
In order to designate mineral premix structures for different poultry categories, bred in the biological system, this work presents the mineral content of the feed ingredients representing the base of the concentrated mixtures for poultry; we also make a comparison with the bibliographical data quoted [14, 15, 16, 17, 18, 19]. The mineral content (macro and microelements) of the analyzed feed ingredients may meet about 50-90% of the requirements of minerals for bio-bred poultry. Feed ingredients variations of mineral content may range from simple to double and they even impose chemical analyses of feed content, considering that the nutritive value charts comprise only or guiding data.

Keywords: biological farms, mineral content, poultry

1. Introduction

In the biological animal breeding system, the nutritive and implicitly the mineral percentage within the forage is very important, because, unlike the intensive system, where many nutrients may be added into food, in the biological system the supplementation conditions are rigorously regulated at EU level [1- 8].
Regarding the mineral part, the macroelements may be supplied by certified sources in the case of Ca, P, Na, Cl, and even Mg. Regarding the microelements, especially Fe, Zn, Mn, Cu, Co, I and Se, we may use the accepted inorganic mineral sources, but the levels are still controversial [9-12].
If the mineral requirements are usually satisfied by macrosalts and vitamin-mineral premixes, in the biological growth the mineral content of forage becomes the major source of macro and microelements. The degree of forage mineralization is influenced by a series of particularities related to the origin plant, among which genetic differences, botanic composition, vegetation stage, different plant parts, chemical form of mineral salts, climate, season, etc., supposing permanent chemical analyses of mineral content [13].
In order to designate some structures of mineral premixes, in this work we present the mineral content of the forage important for poultry biological farms.

2. Materials and methods

Our researches aimed at the establishment of the mineral content of the forage components used in broiler food. The broilers were grouped in experimental batches in order to assess the mineral participation of the basic ratio in comparison with

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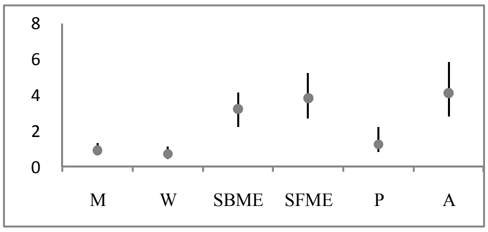
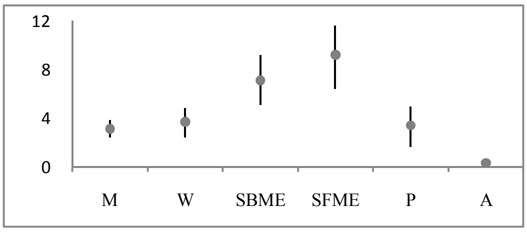
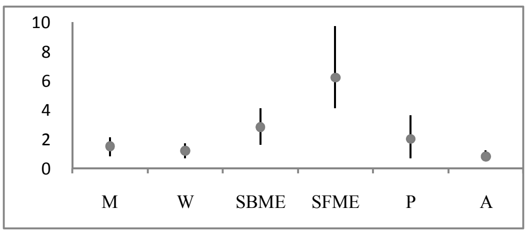
the specialty literature and with poultry requirements.
In this viewpoint, during the experiments performed in 2009, the analyses of crude chemical content of all components used in broiler feed were associated with specific macro- and microelement determinations.
The feed ingredients macroelements content was established as follows:
For Ca and Mg dosing, as quick method we used the complexometric titration in the presence of the specific indices. The phosphorus was determined by dosing the inorganic phosphorus resulted after sample mineralization.
The microelements of the feed ingredients were determined with atomic absorption spectrophotometers.

3. Results and discussion

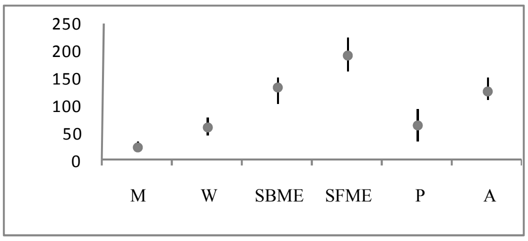
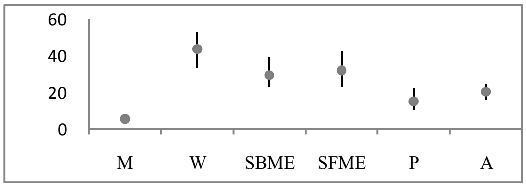
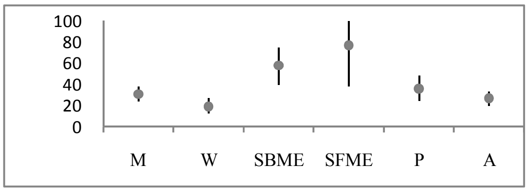
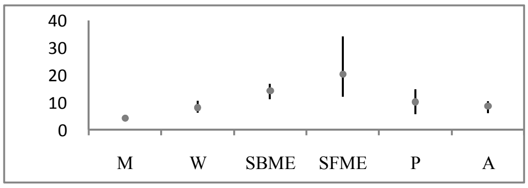
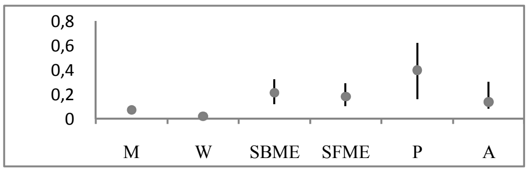
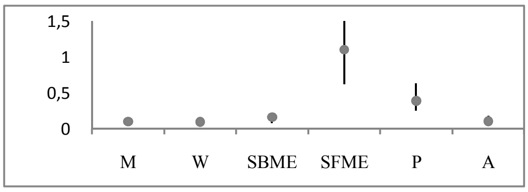
As a rule, in the intensive poultry breeding systems, feed is supplemented with macrosalts and vitamin-mineral premixes at levels that satisfy the mineral requirements, but without consideration for the forage content in macro- and microelements; on the contrary, in the biological systems, the mineral resources of the feed must be taken into consideration although this could change mineral preparations' structure and method of utilization.
In table 1, we present data related to the macroelement content and to the main statistical indices of the feed ingredients used in broiler feed.

Table 1. Statistical indices of the main studied macroelements in used feed ingredients

Macroelement	$\bar{x} \pm s_{\bar{x}}$	s	CV(%)	Graph of the min and max values
Ca				
Maize (M)	0.902±0,112	0.251	27.78	
Wheat (W)	0.704±0.122	0.273	38.80	
Soybean meal expeller (SBME)	3.200±0.348	0.778	24.31	
Sunflower meal expeller (SFME)	3.800±0.513	1.147	30.18	
Peas (P)	1.298±0.291	0.652	50.21	
Alfalfa (A)	4.100±0.525	1.175	28.65	
P				
Maize	3.100±0.287	0.641	20.69	
Wheat	3.700±0.458	1.025	27.69	
Soybean meal expeller	7.100±0.789	1.765	24.86	
Sunflower meal expeller	9.200±0.894	1.999	21.73	
Peas	3.400±0.596	1.332	39.19	
Alfalfa	0.304±0.052	0.117	0.013	
Mg				
Maize	1.500±0.239	0.534	35.59	
Wheat	1.200±0.195	0.436	36.32	
Soybean meal expeller	2.800±0.448	1.002	35.80	
Sunflower meal expeller	6.200±1.030	2.310	37.18	
Peas	2.096±0.489	1.093	52.14	
Alfalfa	0.796±0.118	0.265	33.25	

● **<u>Calcium</u>**: the most important sources of calcium are fresh alfalfa and expellers, and the cereal grains (maize and wheat) have reduced calcium content. The mean values of content in wheat, expellers and alfalfa are between the variation limits resulted successive to the processing of the data quoted by [14, 15, 16, 17, 18, 19]. From this viewpoint, the calcium content of peas is below the inferior limit, and the calcium content of the maize overtakes the superior limit. In our determinations, the calcium variation limits are usually from simple to double in all analyzed feed ingredients.

Table 2. Statistical indices of the main microelements in used feed ingredients

Microelement	$\bar{x} \pm S_{\bar{x}}$	s	CV(%)	Graph of the min and max values
Fe				
Maize (M)	20.00±3.35	7.48	37.42	
Wheat (W)	60.00±7.33	16.39	27.31	
Soybean meal expeller (SBME)	130.00±8.19	18.30	14.08	
Sunflower meal expeller (SFME)	190.00±12.00	26.90	14.18	
Peas (P)	61.00±9.95	22.24	36.46	
Alfalfa (A)	125.00±7.71	17.23	13.79	
Mn				
Maize	5.50±0.436	0.975	17.72	
Wheat	43.80±3.46	7.75	17.69	
Soybean meal expeller	29.50±3.01	6.73	22.81	
Sunflower meal expeller	32.00±3.81	8.51	26.59	
Peas	15.20±2.23	4.98	32.75	
Alfalfa	20.40±1.37	3.05	14.97	
Zn				
Maize	31.00±2.72	6.08	19.62	
Wheat	19.00±2.47	5.52	29.07	
Soybean meal expeller	58.00±7.07	15.81	27.25	
Sunflower meal expeller	77.00±10.40	23.30	30.29	
Peas	36.00±4.15	9.28	25.77	
Alfalfa	27.00±2.29	5.12	18.98	
Cu				
Maize	4.20±0.295	0.660	15.70	
Wheat	8.10±0.765	1.710	21.11	
Soybean meal expeller	14.30±1.13	2.53	17.69	
Sunflower meal expeller	20.30±3.71	8.30	40.86	
Peas	10.20±1.49	3.33	32.61	
Alfalfa	8.60±0.660	1.476	17.17	
Co				
Maize	0.070±0.011	0.025	36.42	
Wheat	0.020±0.004	0.010	50.00	
Soybean meal expeller	0.212±0.035	0.079	37.50	
Sunflower meal expeller	0.182±0.035	0.078	43.16	
Peas	0.398±0.086	0.194	48.80	
Alfalfa	0.136±0.026	0.059	43.69	
Se				
Maize	0.102±0.016	0.037	36.29	
Wheat	0.096±0.018	0.041	43.33	
Soybean meal expeller	0.160±0.011	0.035	33.54	
Sunflower meal expeller	1.104±0.214	0.478	43.33	
Peas	0.390±0.068	0.153	38.49	
Alfalfa	0.104±0.020	0.045	43.85	

● **Phosphorus**: expellers contain more P (7-9 g/kg), cereal grains have a lower content and the green forage (alfalfa) contains the lowest P level. Regarding this macroelement, the content values of the forage analyzed ranges between the limits quoted by various authors [15, 16, 17, 18, 19], with variations from simple to double in the case of maize, wheat and expeller, and bigger oscillations in peas (1/3) and alfalfa (almost 1/4).

● **Magnesium**: the most important magnesium content may be provided by sunflower meal expeller, with about 2g/kg, and the lowest value by the fresh alfalfa. The content values range between the limits mentioned in the literature in most of the cases analyzed; these values are overtaken in maize and soybean meal expeller. In the case of Mg, the variations are usually bigger, from simple to double, even to 1/5 in peas (from 0.700 to 3.600 g/kg).

The statistically-processed results regarding the microelement content of the forage studied are presented in table 2.

♦ **Iron,** according to the data available in tables, is at the inferior level in maize and soybean meal expeller and below the limits presented in the bibliography [14, 15, 16, 17, 18, 19, 20] in peas and sunflower meal expeller. With an important Fe content we may mention expellers, especially the sunflower ones, and fresh alfalfa. In the case of this microelement, we may observe (excepting peas) that the content variation limits are reduced, from 1 to 2.

♦ **Manganese**, the Mn content of the forage analyzed belongs to the bibliographical area of level [15, 16, 17, 18, 19], and the variation limits are between 1 and 2. Excepting wheat, whose mean Mn amount is 43.80±3.46 mg/kg, the assurance values of the other forage types are below poultry requirements, especially in the case of maize, whose high proportion of participation in the concentrated forage structure may generate a deficiency in this microelement [14, 21].

♦ **Zinc,** in this case, too, the determination values range between the limits mentioned in the literature [14, 15, 16, 17, 18, 19]. With significant values of this microelement, we may mention soy and sunflower, and at deficiency level – maize, wheat and peas. The variation limits of the forage zinc content usually oscillate from simple to double.

♦ **Copper** meets the normal content values in maize, wheat, peas, and at inferior level in the case of soy and sunflower, compared with the data in the literature [14, 19, 20]. In sunflower meal expeller and peas, the copper content variability is bigger than from simple to double.

♦ **Cobalt** is well represented in peas, with 0.4 mg/kg, and in the other forage analyzed the content is the same with the one quoted by the literature [17, 22, 23].

♦ **Selenium,** according to the data quoted by various authors [14, 24], it was observed in higher concentrations in soybean meal expeller, sunflower meal expeller and peas, with large variation limits.

4. Conclusions

1. The macro- and microelement amount of the forage analyzed is significant, because it may supply about 50-90% of the requirements of minerals for the biologically-bred poultry.

2. We must take into consideration the mineral content of the forage that represents the base of the concentrated mixture while preparing the supplementing mineral premixes.

3. The variations of forage mineral content from simple to double or even more impose the necessity to determine feed macro- and microelements in specialized laboratories and to take into consideration that the nutritive value tables include only guiding data.

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