EFFECTS OF *CAMELINA SATIVA* MEAL ADDITION IN QUAILS' FEED

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Abstract. *The integration of Camelina sativa in Romania and its cultivation on the lands located in the Moara Domnească Educational Farm, Ilfov county, was carried out in order to obtain an ecological, sustainable culture that would support the protection of the environment without polluting the air, surface waters, underground waters and the soil. In the current context of the circular economy, we integrated camelina meal, the Mădălina variety, into quail feed. The study was performed on a sample of 200 birds for 14 days in optimal temperature and humidity conditions, thus researching different integration options such as the farmer's simple feed option, mix of camelina meal with farmer's feed, mix of probiotic-enhanced camelina meal and feed used by the farmer. Quails fed camelina meal-enhanced forage and probiotic had 4.06% higher productivity than those fed camelina meal-enhanced forage and 11.30% higher productivity than those fed only forage. No major changes were observed in quail births and deaths.*

Keywords: *Camelina sativa*, circular economy, camelina meal, biotechnologies, quails

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1. Introduction

With the integration of Romania into the European Union and the implementation of new environmental protection strategies at the global level, numerous environmental problems were highlighted such as global warming, reducing the carbon footprint, the integration and intensification of ecological agriculture, the use of alternative, renewable and ecological fuels, the practice of new agricultural technologies that are friendly to the environment, the protection of soil, water, the water table but also the air, including in agricultural practices, the integration of plants in a sustainable circular economy in which their components can be included in various fields of activity with minimal pollution impact or that even bring benefits to the environment.

The research was carried out with the goal to capitalize the *Camelina sativa* oleaginous plant, more precisely the Mădălina camelina new variety, in order to

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identify its potential as a source of polyunsaturated fatty acids to be added to the animal feed.

Field research was carried out at the Moara Domnească didactic farm in Ilfov county, belonging to the University of Agronomic Sciences and Veterinary Medicine Bucharest.

Camelina (*Camelina sativa L. Crantz*) is an oleaginous plant with the popular names gold of pleasure or false flax. It is an annual member of the *Brassicaceae* family [1, 4, 6] of southeastern Europe and the steppe region of southwest Asia [5].

The variety chosen for the research was a camelina new variety called Mădălina (obtained by the USAMV collective - together with a collective from the Fundulea National Research and Development Institute, through classical breeding and adapted for the climatic conditions in Romania, being resistant to frost).

The plant has a fairly high average and total height. The seed contains a small concentration of erucic acid [3]. The leaf rosette is medium in length (limb and petiole), narrow in width and weak marginal dentition. The leaves have a medium green color and are pubescent.

This variety has an early inflorescence. The petals of the flower are yellow, short and narrow. The length of the silicva (between the peduncle and the tip) is average, and its tip is short.

Throughout the culture we followed the microbiological evolution of the soil, the evolution of the plant and the culture as a whole, the ways in which the plant was cultivated and exploited.

For the valorization of the seeds, they were carefully selected and sifted, to be cold-pressed with the help of the Pure Nature CZ R 109 press from the laboratory of fermentative biotechnologies, within the Faculty of Biotechnology, USAMV Bucharest.

In order to use the scrap obtained after pressing camelina seeds, for animal feed, we focused on the quail species.

Compared to rapeseed, the meal has a low content of erucic acid ($C_{22}H_{42}O_2$). Thanks to these qualities, camelina meals can be used with great success in animal feed [3].

The meal resulting from the cold pressing of camelina seeds, the Mădălina variety, was also used in quail feed to monitor the nutritional contribution it brings to the quail egg.

2. Materials and methods

We chose for experiments, a quail farm in Ilfov county with a capacity of over 3,000 quails from the town of Cornetu, which has all the related certifications and documents, where we did research on feed, feed improved with camelina meal, improved feed with probiotic-enhanced camelina meal and the effect on quail egg (Figure 1).

Fig. 1. Quails

The experiment consisted of feeding 200 quails with each type of food, such as, mix of camelina meal and probiotic-enhanced camelina meal. Duration of the experiment was 2 weeks, time needed to highlight the evolution of the quail egg. Before starting the experiment, bacteriological analyzes were carried out at IBNA Balotești for NC farm, camelina meal without probiotic and camelina meal with probiotic.

The camelina seeds, Mădălina variety, were carefully selected and sifted through a small-mesh sieve, without any other vegetative remains. For the purposes of research, 50 kg of *Camelina sativa* seeds, Mădălina variety, were used.

2.1. Probiotic incorporation into camelina meal

After cold-pressing the camelina seeds, the resulting meal was placed in a metal bowl and prepared for homogenization with the probiotic.

The necessary steps to prepare the probiotic meal:
1. Preparation of the probiotic inoculum by passing them from the solid medium into 10 ml MRS and cultivating for 24 hours at 27^0C;
2. Preparation of probiotic inoculum: a quantity of 4 ml of suspension was taken from the pre-inoculum and was inoculated in 36 ml of liquid

Pediococcus spp. isolated from Kombucha medium for 24 hours at 27^0C with shaking at 130 rpm.
3. Fermentation of camelina meal: the meal was weighed in five polyethylene bags with a capacity of 5 liters (1 kg amount of meal), inoculated with the MRS suspension obtained previously, and then composted.
4. The samples were processed as follows: 100 ml of probiotic were added to each kg of camelina meal, the contents of the bag were homogenized and shaken.
5. The samples were placed in drying trays in an even layer and placed in a dry (thermostat) at 37-38^0C, until the humidity of about 60-65% was reached.
6. After drying, the samples were packed in paper bags and stored in a cool place with low relative humidity.

2.2. Method for determining fatty acids from quail egg

The method is applied to the analysis of egg samples in which the yolk is analyzed, from which the fat is extracted and in which the concentration of fatty acids will be expressed in grams of FAME /100g total FAME (Fatty Acid Methyl Esters).

The working method is in accordance with:

- Part 1. Preparation of methyl esters - SR CEN ISO/TS 17764-1: 2008;

- Part 2. Gas-chromatographic method - SR CEN ISO/TS 17764-2: 2008.

The principle of the method: The transformation of the fatty acids from the analyzed fat sample into methyl esters, followed by the separation of the components on a capillary chromatographic column, their identification by comparison with standard chromatograms and the quantitative determination of fatty acids (g FAME /100g total FAME - (Methyl esters of fatty acids).

3. Results and Discussions

Mădălina variety can be cultivated both in classical conditions and in the ecological system [2].

In the present research, it was cultivated both in classical conditions (with the addition of fertilizers) and in an ecological system, aiming at the valorization of all the products obtained after pressing the seeds and the recirculation of plant residues by incorporation into the soil and the reduction of carbon emissions.

3.1. Analysis results of camelina meal

Following the analyzes carried out, the following were found:
1. *Salmonella sp.* is not present in any analyzed element;

2. *E. coli* were detected in larger quantities in the feed, exceeding the normal limits (140>100 col/g). In camelina meal, *E. coli* is not present, instead in camelina meal with probiotic it is present in a very small amount 0.7<100 col/g;
3. Total coliforms are present in very small amounts;
4. TGC (total germ count) is present in very small amounts.

3.2. Analysis results of quail egg

Legend:
1. Quail egg yolk samples (before starting the experiment);
2. Quail egg yolk samples + NC + meal (after 2 weeks) (Figure 2);
3. Quail egg yolk samples+ NC + meal + probiotics (after 2 weeks) (Figure 3).

Fig. 2. Eggs from quail fed forage improved with camelina meal

Fig. 3. Eggs from quail fed feed improved with camelina meal and probiotic

Quail egg evolution is essential to observe the nutrient intake of camelina meal and probiotic-enhanced camelina meal in terms of monounsaturated and polyunsaturated fatty acids.

We followed the evolution of the quail egg at the beginning of the research, during the research and at the end, after two weeks (Table 1).

According to quail egg yolk analyses, we observe a slight improvement in polyunsaturated fatty acids (Omega-3) and Omega-6 in egg samples assigned to birds with camelina meal and probiotic-enhanced camelina meal (Figure 4).

Table 1. Average results of Ω3 and Ω6 fatty acid content in egg yolk samples, depending on the degree of unsaturation

No.	*Category*	*Ω3*	*Ω6*	*Ω6/Ω3*
1.	Quail egg	3.05	19.92	6.53
2.	Quail egg with fodder and meal	4.60	21.22	4.62
3.	Quail egg with probiotic-enhanced meal feed	4.56	21.50	4.72

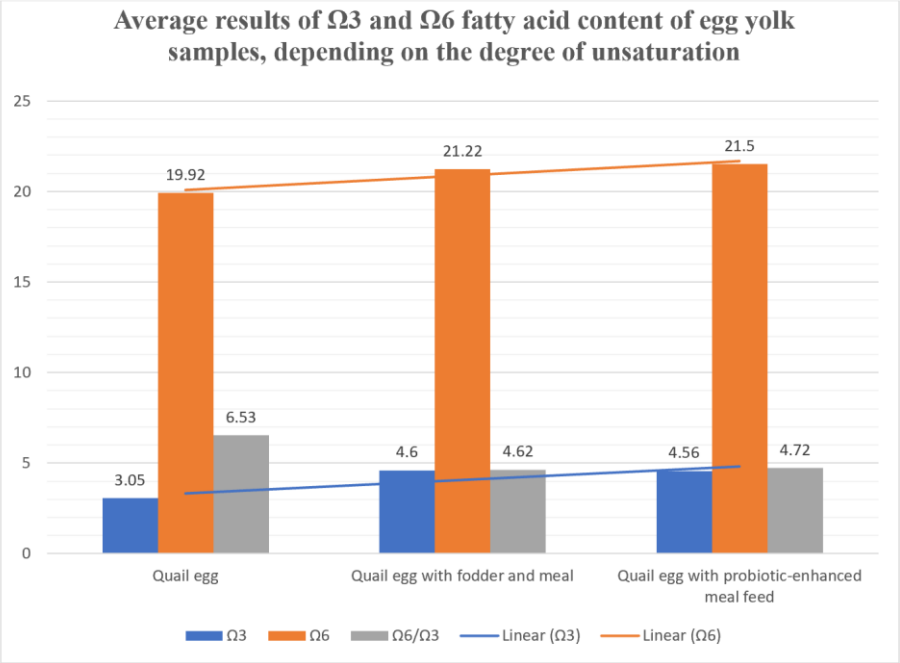

Fig. 4. Average results of Ω3 and Ω6 fatty acid content of egg yolk samples according to the degree of unsaturation

Conclusions

(1) Following the research, camelina meal can be integrated into quail feed, bringing nutritional input to the quail egg in polyunsaturated fatty acids Omega-3 and Omega-6.

(2) Quails fed camelina meal-enhanced forage and probiotic had 4.06% higher productivity than those fed camelina meal-enhanced forage and 11.30% higher productivity than those fed only forage.

(3) A sample of 200 quails were fed each type of food for 14 days.

(4) Quails fed only forage had an average productivity of 11.5 eggs (2,300 quail eggs produced in 14 days);

(5) Quail fed with camelina meal improved forage had an average productivity of 12.3 eggs (2,460 quail eggs produced in 14 days);

(6) Quails fed the improved feed with camelina meal and probiotic had an average productivity of 12.8 eggs (2,560 quail eggs produced in 14 days).

(7) Camelina meal together with the probiotic isolated from Kombucha (*Pediococcus spp.*) contributes to a higher productivity of quail eggs, implicitly a higher intake of nutrients.

(8) Probiotic incorporated in camelina meal and mixed with the farmer's feed, brought a significant contribution to the assimilation of fatty acids by the quails.

(9) No major changes were observed in quail births and deaths.

R E F E R E N C E S

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