

## USING FULL FAT SOYBEAN IN BROILER DIETS AND ITS EFFECT ON THE PRODUCTION AND ECONOMIC EFFICIENCY OF FATTENING

### UTILIZAREA FULL FAT SOYA IN NUTRETURILE COMBinate PENTRU BROILERI SI EFECTUL ACESTEIA ASUPRA PRODUCTIEI SI EFICIENTEI ECONOMICE A INGRASARII

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#### REZUMAT

Acest studiu a avut ca scop testarea unor retete noi de nutreturi combinate bazate pe full fat soya destinate ingrasarii puilor brileri Arbor Acres. In acest sens s-a utilizat un esantion de 520 pui, impartiti in doua grupe: grupul M, care a fost hranit cu o receptura de NC bazata pe porumb, srot de soia, ulei si faina de peste si grupul FFS, hranit cu o alta reteta al carei ingredient de baza este full fat soya. Retetele au fost stabilite in trei variante pentru fiecare stadiu de ingrasare: pornire, crestere si finisare. Pe parcursul ingrasarii, au fost inregistrati si comparati urmatorii parametri tehnologici: sporul mediu zilnic si total in greutate, consumul zilnic si total de furaje. De asemenea, 8 dintre puii ingrasati au fost sacrificati, determinandu-se rezultatele privind componentele carcasei, randamentul la taiere, precum si compozitia chimica a carniei si raportul dintre acizii grasi saturati si nesaturati. S-a observat ca lotul de pui FFS a inregistrat performante superioare in procesul de ingrasare: un spor mai bun, un consum specific ceva mai redus, dar si costuri mai reduse cu furajarea si ingrasarea in comparatie cu lotul de pui M. De asemenea s-a constatat ca dieta pe baza de full fat soya asigura cresterea procentului de proteina bruta in carnea de pui si imbunatateste raportul dintre acizii grasi, in favoarea celor nesaturati, conducind la o calitate superioara a grasimii.

**Cuvinte cheie : nutreturi combinate, full fat soya, pui broileri, ingrasare eficienta, calitatea superioara a carniei si grasimii**

#### ABSTRACT

This study aimed to test new diet formulae based on full fat soybean destined to Arbor Acres broilers fattening. A sample of 520 chickens, divided into two groups was used: M-Group, fed with a diet containing maize, soybean meal, oil and fish meal and FFS Group, fed with another diet mainly containing full fat soybean and other components. The diets have been elaborated in three alternatives for each fattening stage: starter, grower and finisher. During the fattening, the main parameters have been recorded and compared between the two groups: daily and total live weight gain, daily and total food consumption, as well as feeding and fattening costs. A number of 8 fattened chickens were slaughtered and we also determined slaughter output, the components of carcass, the chemical composition of chicken meat and the ratio between saturated and unsaturated fatty acids. The FFS plot recorded higher fattening performances, that is a higher daily and total gain, a lower food consumption, but also lower feeding and total costs in comparison with the other group. We have noticed that FFS diet assured an increased crude protein percentage inside chicken meat and a more convenient ratio between the fatty acids, in favour of the unsaturated ones, resulting to a high meat and fat quality.

**Keywords: diet, full fat soybean, broilers, effective fattening, high meat and fat quality**

## DETAILED ABSTRACT

Consumer is the market barometer. More and more consumers require high quality meat, including chicken meat. Any poultry breeder, like any other farmer is interested to increase economic efficiency in the process of fattening. Feeding is a one of the most technological factor that must be scientifically handled and kept under a continuous control. The nutritionists offer new improved solutions of diets to match the farmers' needs. This study is referring to such a new diet based on full fat soybean (FFS) with a good impact on chicken broilers fattening. The diet has three alternatives for each fattening stage: **starter**: 27.70 % full fat soybean, 10 % soybean meal, 5 % fish meal; **grower**: 33.80 % FFS, 7 % soybean meal, 3 % fish meal; **finisher**: 41 % FFS, 1.3 % oil. In addition, each diet included corresponding zoofort, minerals and amino acids to balance the ration. The economic and financial effects of these new diet formulae were tested on a sample of 260 Arbor Acres broilers for a 42 days period of fattening. The results were compared to the records got by M group consisting of the same number of chickens ( 260 heads ) , fed with a classic diet as follows : **starter** : 57.55 % maize, 31.30 % soybean meal, 2.70 % oil, 5 % fish meal; **grower** : 53.77 % maize, 33.30 % soybean meal, 5.20 % oil and 3 % fish meal; **finisher** : 57.99 % maize, 30.20 % soybean meal and 6.70 % oil. The diets were also balanced with minerals, vitamins and amino acids. The FFS group obtained the following fattening performances: 2,230.96 g/head live weight at the end of the fattening, 50.92 g/head daily gain, 4,136.88 g cumulated food consumption, 97.87 g /head/day average food consumption, 2,180.50 g/head total gain. We have noticed that the FFS group recorded a higher daily and total gain and a higher final live weight, but a lower food consumption than the M group fed with the classic diets. From an economic point of view, fattening based on FFS diet formulae is more effective than the one based on a classic feeding. In case of FFS group, the average fattening cost was USD 1.795 /head instead of USD 1.858/head in case of M group. The share of feeding cost within the total fattening costs is 60.66 % in case of FFS group compared to 60.38 % in case of M group. The average fattening cost was USD 0.823/kg gains in case of FFS broilers, by 5.30 % lower than the one recorded by M group. After slaughtering 8 fattened chickens, we have realized that FFS group obtained better results concerning slaughter output, components of carcass, chemical composition of chicken meat and the ratio between saturated and unsaturated fatty acids. Therefore, the FFS diet assured an increased gross protein percentage inside chicken meat (85.01 % in breast and 75.12 % in upper leg meat) and a more convenient ratio between the fatty acids (1:2.53 in breast and 1:2.65 in upper leg meat). The main conclusion is that the use of diet formulae based on FFS could successfully replace maize, soybean meal and oil in the content of the ration, could also assure high performances in broilers fattening under lower costs and a high meat and fat quality.

## INTRODUCTION

Animal nutrition is more and more required to offer a large variety of feeding solutions in broilers fattening. Starting from the purpose that feeding has to cover, the nutritionists pay attention especially to raw materials quality, chemical composition, content in valuable nutritive components. Full fat soybean could be an alternative to substitute components such as soybean meal and oil, traditionally used in various diets for broilers fattening so far. The results obtained by various authors showed that the diets based on full fat soybean have a benefic effect both upon daily and total gain, but also on meat quality. Therefore, such a raw material could be a tool to increase economic efficiency in the process of fattening, but also to improve the protein and fat content in chicken meat.

## MATERIAL AND METHOD

To test the new diet formulae for Arbor Acres broylers, a sample of 520 chickens, divided into two groups was used: M Group, fed with a diet based on corn, soybean meal, oil and fish meal and FFS Group, fed with another ration based on full fat soybean, replacing soybean meal and oil. The main items of the chemical composition of full fat soybean used in the experiments were the following ones: 37.72 % crude protein, 4.57 % crude fibre, 0.37 % calcium, 2.90 % lysine, 0.66 % metionine, 0.89 % phosphorus, fatty acids: 55.48 % linoleic acid, 20.33 % oleic acid, 7.33 % linolenic acid, 2.98 % stearic acid, 13.60 % palmitic acid, 0.22 % miristic acid, 0.06 % lauric acid. The content of the diets is presented in table 1 and the nutritive value of the diets is shown in table 2. For each experimental plot, the main technological parameters of broilers fattening were recorded and compared between them: daily gain by fattening stage and age, total gain, daily and total food consumption, food consumption per kg gain. A number of 4 female chickens and 4 male chickens were slaughtered. After slaughtering, we determined: slaughter output, the share of various carcass components, chemical composition of chicken meat taken out of breast and upper legs and the specific ratio between saturated and unsaturated characterising fat quality. We also payed much attention to the financial aspects comparing fattening and total costs, of which by cost item: medicines, one

day chickens, labour, fattening cost/broiler, feeding cost/head, cost/kg live weight. All these indicators were expressed in USD for each plot and fattening stage.

## RESULTS AND DISCUSSION

**The technological parameters of fattening** are shown in table 3. Despite that, we have differently fed the two groups of broiler chickens, we have not noticed any substantial gap between plots of the same age and in the same fattening stage. However, the broilers fed with FFS diet recorded a higher daily gain, with a good impact on their final live weight. The average food consumption and specific consumption recorded by FFS plot was lower than the ones registered by M group. At the end of the fattening, a broiler from the FFS group weighted 2,180.50 g /head, by 42.18 g more than a chicken from the M group.

**Slaughter output** has been almost the same, no essential differences between the two groups: 78.54 % for M and respectively 78.61 % for FFS group. The broilers fed with FFS diet recorded 1,663.39 g weight of the eviscerated carcass by 14.12 g heavier than the one belonging to a broiler traditionally fed.

**The percentage of various carcass components was:** 25.91 % breast, 27.13 % upper legs, 5.79 % organs, 14.82 % back, 8.68 % wings, 0.70 % abdomenon fat for the FFS group. These percentages are a little higher than the ones recorded by the M group.

**The chemical composition** of chicken breast and upper legs as well as the ratio between saturated and unsaturated fatty acids are presented in table 4. Meat provided by FFS broilers has a higher content of crude protein and less crude fat. Feeding based on full fat soybean is changing the fatty acids profile advantaging the unsaturated ones and reducing the ration between saturated and unsaturated fatty acids. This was due to the fatty acids composition of FFS and M diets. FFS includes more polyunsaturated acids with a deep influence on fat quality of meat and M diets are based on oil, consisting of a mixture of animal and vegetal fats containing mainly saturated and less unsaturated acids. The profile of fatty acids in breast and upper leg meat is presented in table 5.

Table 1. The content of the Diets used for Arbor Acres broilers feeding / Continutul retetelor de nutret combinat utilizate in hranirea brilerilor Arbor Acres

Raw materials / Materii prime	Starter ( 0-14 days ) Pornire ( 0-14 zile )		Grower (15-28 days) Crestere (15-28 zile )		Finisher (20-42 days ) Finisare (20-42 zile )	
	M	FFS	M	FFS	M	FFS
Maize (Porumb)	57.55	53.05	53.77	51.82	57.99	52.75
Full fat soybean (37.72 % C.P.)	-	27.70	-	33.80	-	41.00
Soybean meal ( Srot soia )	31.30	10.00	33.30	7.00	30.20	-
Oil ( Ulei)	2.70	-	5.20	-	6.70	1.30
Fish Meal (Faina de peste)	5.00	5.00	3.00	3.00	-	-
Monocalcium Phosphate (Fosfat monocalcic )	1.40	1.40	1.60	1.40	1.70	1.70
Chalk (Creta furajera)	1.20	1.10	1.30	1.20	1.40	1.35
Salt (Sare)	0.25	0.25	0.25	0.25	0.30	0.30
Zoofort A1	1	1	1	1	-	-
Zoofort A2	-	-	-	-	1	1
DL-Methionine	0.38	0.37	0.39	0.40	0.43	0.43
L-Lisine	0.22	0.13	0.19	0.13	0.28	0.17
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 2. Nutritive Value and Energy Level of the experimental Diets / Valoarea nutritive si nivelul energetic al retetelor experimentale

Nutrients Elemente nutritive	Starter Pornire		Grower Crestere		Finisher Finisare	
	M	FFS	M	FFS	M	FFS
Metabolisable Energy Energie metabolizabila Kcal/kg	3,082	3,100	3,172	3,166	3,283	3,283
Crude Protein / Proteina bruta	23.44	23.38	22.97	22.83	20.16	20.17
Crude Fats / Grasimi brute	5.83	8.28	7.77	9.31	9.09	11.77
Crude Fibre Celuloza bruta	3.28	3.42	3.42	3.57	3.28	3.54
Lisine: -total lisine -available lisine	1.40 1.23	1.40 1.23	1.36 1.20	1.36 1.18	1.21 1.09	1.21 1.08
Metionine: - total metionine - available metionine	0.70 0.66	0.70 0.66	0.71 0.68	0.70 0.66	0.69 0.66	0.70 0.66
Metionine+cistine : - total metionine + cistine - available metionine + cistine	1.08 0.94	1.08 0.93	1.04 0.95	1.04 0.92	0.99 0.92	0.99 0.88
Available phosphorus Fosfor disponibil	0.45	0.47	0.46	0.46	0.44	0.44
Calcium	0.96	0.94	0.92	0.90	0.87	0.89

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The specific indicators reflecting economic efficiency in broilers fattening are shown in table 6. All the figures show that the use of diets based on full fat soybean is more effective. The total feeding expenses were USD 283.22 less by USD 8.69 for the FFS group than in case of M group. The total cost of fattening recorded by the same group was USD 466.85 by USD 16.3 smaller than the cost registered

by the M group. Taking into account the whole length of fattening (42 days) and all the 520 broilers, the total costs of the experiments reached USD 950 of which 60.5 % feeding costs, 10.1 % one day chicken costs, 1.9 % medicines, 10.3 % labour and 17.2 % indirect costs. As a result both feeding cost/head and total cost/capita are lower in case of the FFS group of chickens.

Table 3. Technological Parameters in Arbor Acres Broilers Fattening\* / Parametrii tehnologici in ingrasarea broilerilor Arber Acres

Parameter	M.U	1-14 days		15-28 days		29-42 days		Total 1-42 days	
		M	FFS	M	FFS	M	FFS	M	FFS
Initial Live Weight/Greutatea vie initiala	g/he ad	50.82	50.36	399.50	404.31	1102.27	1113.29	50.82	50.36
Final Live Weight/Greutatea vie finala	g/he ad	399.50**	404.31**	1102.27**	1113.29**	2189.14**	2230.96**	2189.14**	2230.96**
Daily Gain/Sporul mediu zilnic	g/he ad/day	24.91	25.28	50.20	50.64	77.62	79.83	50.91	50.92
Cumulated Food Consumption Consumul cumulat de furaj	g	540.38	538.08	1446.15	1411.90	2251.97	2186.90	4238.50	4136.88
Average Food Consumption	g/he ad/day	38.60	38.43	103.30	100.85	160.85	156.21	100.45	97.87
Specific Consumption	g/g	1.55	1.52	2.06	1.99	2.07	1.96	2.06	1.90
Total gain	g/he ad	348.74	353.92	702.8	708.96	1086.68	1117.62	2138.32	2180.50

\* All the data have been statistically processed. There are no significant differences between the experimental broiler groups concerning the technical parameters of fattening , except final live weight ( \*\*).

Table 4. Chemical Composition and fatty acids ratio in Broilers Breast and Upper Legs Meat at 42 days / Compozitia chimica si raportul acizilor grasi in carnea de piept si pulpe a broilerilor la 42 de zile

Parameter	M		FFS	
	Breast Piept	Upper Leg Pulpe	Breast Piept	Upper Leg Pulpe
A.Chemical Composition (Compozitia chimica)				
Dry Matter(Substanta uscata)	92.26	92.01	91.19	91.85
Crude Protein(Proteina Bruta)	83.93	73.62	85.01	75.12
Crude Fat (Grasime Bruta)	3.47	14.43	3.15	12.95
Ashes(Cenusa)	3.79	3.79	4.10	3.94
B.Fatty Acids Ratio (Raportul acizilor grasi )				
Saturated/Unsaturated Fatty Acids Acizi grasi saturati/Acizi grasi nesaturati	1/ 2.51	1 / 2.79	1/ 2.53	1 / 2.65

Table 5. Composition of Fatty Acids in Breast and Upper Leg Meat, / Compozitia acizilor grasi in carnea de piept si pulpe

Type of Fatty Acid Tipul de acid gras	M		FFS	
	Breast / Piept	Upper Leg / Pulpe	Breast / Piept	Upper Leg / Pulpe
Miristic Acid	0.59	0.57	0.55	0.62
Palmitic Acid	21.89	19.29	21.59	20.19
Palmitoleic Acid	1.85	4.48	1.02	4.21
Stearic Acid	6.05	6.43	5.99	5.78
Oleic Acid	36.11	38.16	35.38	36.21
Linoleic Acid	33.54	30.70	34.87	30.20
Saturated Fatty Acids / Acizi grasi saturati	28.53	26.29	28.13	26.50
Mono and Polyunsaturated Acids Acizi mono si polinesaturati	71.50	73.41	71.27	70.62
Saturated/Unsaturated Fatty Acids Ratio / Raportul dintre acizii grasi saturati si nesaturati	1:2.51	1:2.79	1:2.53	1:2.65

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Table 6. Parameters of Economic Efficiency in Arbor Acres Broilers Fattening/Parametrii eficientei economice in ingrasarea broilerilor Arbor Acres

Parameter	M.U.	Starter / Pornire		Grower / Crestere		Finisher / Finisare		Total Fattening Total ingrasare	
		M	FFS	M	FFS	M	FFS	M	FFS
Total feeding costs / Cheltuieli totale cu furajarea	USD	38.01	38.52	103.35	98.55	150.55	146.15	291.91	283.22
Total costs of fattening / Cheltuieli totale de ingrasare	USD	62.90	63.49	171.03	162.41	249.22	240.95	483.15	466.85
Total food consumption	kg	140.50	139.90	376.00	367.00	585.50	568.60	1102.00	1075.50
Feeding cost / Costul furajarii	USD/head	0.146	0.148	0.397	0.379	0.579	0.562	1.122	1.089
Fattening cost	USD/head	0.241	0.244	0.657	0.624	0.958	0.927	1.858	1.795
Cost/kg gain	USD/kg gain	0.693	0.689	0.935	0.881	0.882	0.829	0.869	0.823

## CONCLUSION

-The use of diets based on full fat soybean and destined to Arbor Acres fattening is leading to a higher daily and total gain, a higher final live weight, a lower food consumption under an increasing fattening profitableness.

-Soybean meal and oil could be successfully replaced by full fat soybean within the formula in the

following proportions: 67 %, respectively 100 % (starter), 78.98 %, respectively 100 % (grower) and 100 %, respectively 80.60 % (finisher).

-Feeding and total fattening costs are lower in case of using FFS diet formulae.

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