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NUTRITIONAL VALUE OF TRITICALE (TRIJUMF) FOR BROILER DIETS

Vera DJEKIC[1*], Tatjana PANDUREVIC[2], Sreten MITROVIC[3], Vera RADOVIC[4], Jelena MILIVOJEVIC[1], Vladan DJERMANOVIC[3]

[1]Center for Small Grains, Kragujevac, Serbia
[2]Faculty of Agriculture, University in East Sarajevo, Bosnia and Herzegovina
[3]Faculty of Agriculture, University of Belgrade, Zemun, Serbia
[4]Faculty of Agronomy, University of Cacak, Serbia
(Corresponding author: verarajicic@yahoo.com)

Abstract

The aim of this study was to determine a way on how to investigate the effect of triticale on growth performance, production and slaughter characteristics of broiler chicks. The research was carried out on 200 broiler chickens, hybrid Ross 308. On that occasion, two groups of broiler chickens were formed with 100 broiler chicks in each group, namely control group (classic mixture fo broilers fattening) and experimental group (mixture with triticale genotype Trijumf). The experiment lasted 49 days. As criteria for utilization of triticale in the present study, production traits, and body weight and weight gain. The results showed that the experimental group of broiler chickens that were fed with a mixture of triticale (triticale genotype Trijumf), achieved better production results ($P<0.05$).

It can be concluded that triticale can be used as an untraditional source of energy in broiler diets to get best performance and as god source of income as the control.

Key words: *broiler, growth, feeding, triticale*

Introduction

Triticale, as a new type of highly successful small grains, deserves more attention. Thanks to intensive breeding program at the Center for Small Grains, in Kragujevac, two new domestic and commercial cultivars are to be found on the list of varieties.

When talking about grain yield, newer varieties of triticale mainly reached the level of leading wheat while having surpassed varieties of rye, barley and oats (Đekić et al., 2011.a).

Triticale is a convenient feed for all animals representing a high source of energy. Protein yield per unit area also represents an important indicator of the economic importance. The above characteristics are important for the biological value and product processing quality for both human nutrition and animal diets (Đekić et al., 2011.a). Nutritional value of grains depends on the protein content, and thus the products. Proteins with a higher content of indispensable amino acids have a higher nutritional value where the most important role has lysine content as the first deficit amino acid in grains. Triticale has a higher percentage of protein and lysine compared to the parental species and a lower energy value compared to corn and wheat (Đekić et al., 2012.a).

Triticale is already widely used for poultry feed (broilers, laying hens) worldwide. The quality of poultry products can be modified or enhanced by adding triticale as feed meal for animal feed. Therefore a considerable scientific interest in the use of triticale in animal feed has appeared in recent years, though the data on published research in the areas of productivity of poultry and quality of meat and eggs being scantier than those of the positive impact of this type of small grains to ruminants and pigs. Tests in broiler production include determination of the effects of diet mixtures with different amount of triticale on the

performance of both quantitative and qualitative traits of broiler meat. More studies applied examining of the nutritional value of triticale on product line features of heavy hybrids in the world (Ruiz et al., 1987; Vieira et al., 1995; De Brum et al., 2000; Camiruaga et al., 2001).

Barneveld and Cooper (2002), examined six varieties of triticale in forage mixtures for broiler fattening. Total feed consumption per kilogram of body weight of chickens ranged from 1.75 to 2.24 kg. Savage et al., (1987) point out that the use of triticale in the diet of chickens improve physical and sensory properties of cooked meat. When substituting wheat with triticale in mixtures for fattening broilers, no significant change in the production and carcass traits of chickens occurs (Đekić et al., 2011.b; 2012.b). The problem of adding commercial enzymes in the forage mixture had been solved with application of triticale for broilers fattening and mixtures for laying hens Vohra et al., (1991), what reduced overall feed production costs. Different formulations or participation of triticale and wheat in feed mixtures broilers fattening had been examined by Sarker et al., (2006). The same concluded that the highest body weight at the end of the experimental period had achieved chickens who were fed with the following formulations: W40T60 i W60T40. The lowest mortality was found in the group that was fed with mixture which did not include triticale. Korver et al., (2004) prefer triticale in relation to wheat due to higher average weekly weight gain of chickens upon the same amount of ingested food. Hermes and Johanson, (2004), claim that triticale in the diet of heavy line hybrids and who participated in various proportions in the mixture for broilers showed no adverse effects on performance traits of chickens. The biggest weight of tested chickens was achieved with 10% of triticale in fattening feed for broilers, while feed conversion was higher for formulations with 15% of triticale.

Numerous studies suggest that triticale successfully replace part of corn, wheat or barley in animal feed without negative consequences to the impact of domestic animals (De Brum et al., 2000; Hermes et Johanson, 2004; Đekić et al., 2011.a; 2012.a). Triticale is a convenient feed for all animals since represents a high source of energy. Because of favorable enzyme composition, triticale grains favorably effect the intestinal tract of monogastric animals (Barneveld et Cooper, 2002; Korver et al., 2004; Sarver et al., 2006).

The aim of of these studies, with respect to all above-mentioned, was to determine the effects of triticale on growth rate, feed consumption and feed conversion and performance traits of broiler chickens.

Materials and methods

The tests in this study were conducted on broiler chickens, hybrid Ross 308. Chickens were divided into two groups per 100 chickens. The first, control group received a mixture without the addition of triticale, and the second, experimental group received the same mixture supplemented with 7.5%, 12%, 15% and 18% of triticale (cv. Triumph) produced at the Center for Small Grain, Kragujevac. Four compounds were used in feeding: starter, grower I, grower II and finisher. The composition and quality of the mixture is shown in Table 1. Fattening lasted 49 days. Chickens were given food and water *ad libitum* during the experiment. Health state and mortality was observed with the groups examined during the fattening. Their body weight was measured once a week. After the final fattening and 12 hours of fasting, the chickens were slaughtered and the carcass weight measured.

The basic chemical composition (moisture, crude protein, crude fat and mineral matter) of complete mixture for chicken feed was determined by methods A.O.A.C. (1984). Calcium and phosphorus content was determined by the Regulations on sampling methods and methods of performing physical, chemical and microbiological analysis of animal feed (1987).

Table 1. Composition (%)and the quality of the mixtures used in the experiment

Feed (%)	Starter		Grower I		Grower II		Finišer	
	K	O	K	O	K	O	K	O
Wheat	40,0	31,2	42,0	28,8	43,6	27,1	48,8	28,6
Corn	21,0	21,0	20,0	20,0	20,0	20,0	20,0	20,0
Triticale		7,5		12,0		15,0		18,0
Soya bean meal	29,7	30,9	27,1	28,1	24,7	25,4	20,9	22,0
Sunflower seed pellets	2,5	2,5	3,0	3,0	3,5	4,0	3,5	4,0
Soya oil	3,15	3,25	4,55	4,7	5,05	5,25	4,15	4,7
Chalk	1,2	1,2	1,0	1,1	1,0	1,1	0,7	0,8
Monocalcium phospate	1,0	1,0	0,9	0,85	0,75	0,7	0,5	0,45
Premix	1,45	1,45	1,45	1,45	1,45	1,45	1,45	1,45
Total:	100	100	100	100	100	100	100	100
Chemical composition:								
Crude proteins, %	22,37	22,40	20,17	20,27	19,70	19,82	18,42	18,49
Fat, %	6,36	6,38	9,51	9,54	9,90	9,79	8,47	8,54
Crude fiber, %	3,17	3,18	3,43	3,43	3,58	3,58	3,23	3,27
Ash, %	6,88	6,40	5,89	5,87	5,99	5,95	5,64	5,65
Nitrogen (ekstrah.)%	45,61	46,26	46,78	46,43	46,40	46,22	48,79	49,22
Metabolic energy, MJ/kg	12,59	12,68	13,39	13,39	12,86	12,87	13,39	13,40
Ca, %	1,29	1,16	0,79	0,85	0,79	0,85	0,88	0,90
P (adoptable), %	0,53	0,34	0,42	0,42	0,42	0,42	0,64	0,66

*Premix composition (content of 1 kg of mixture): Vitamin A-9000 IU, Vitamin D3-3300 IU, Vitamin E-30, 0 IU, Vitamin K-2, 2 mg thiamine (B1) -2.2 mg; riboflomin (B2) -8.0 mg; pantothenic acid-12 mg niacin-66, 0 mg pyridoxine (B6) -4.4 mg, folic acid 1.0 mg-550 mg of choline, vitamin B12-0, 022 mg biotin -0.20 mg with 0-0.30-0, 45%, Mn-100 mg-75 mg Zn, W-0, 45 mg-8 mg Cu, Se-0, 10 mg-100 mg Fe.

Common indicators of variation in statistics were calculated on the basis of actual research results: average values error of arithmetic mean and standard deviation. Statistical data processing was done in the module Analyst Program SAS/STAT (SAS Institute, 2000).

Results and discussion

Performance results of both groups have been thoroughly monitored during the analysis of observed performance. Monitoring is done on a weekly basis. It is an extended fattening period of seven weeks. Table 2 shows the average body weight of broiler chickens, provenance Ross 308 per groups.

Based on the data obtained from Table 2, it can be concluded that in the first period, after the completion of fattening with starter mixture, control group achieved a higher body weight at the end of the second week of the experiment (398,265 g). In the second fattening period, at the end of the fourth week (after the grower diet and mixtures) control group had a slightly higher body weight of broiler chickens, by 24.544 g higher compared to the experimental group. On 49th day, (the end of feeding period) body weight of the broilers of the experimental group using triticale in mixtures was increased by 46,437 g compared to the control group where no triticale was used. The chickens of the experimental group also have statistically higher body weight compared to the control group ($P<0.05$). Our results are in agreement with results of Korver et al., (2004), Sarker et al., (2006) i Đekić et al. (2012.b).

Data obtained indicate that triticale has great potential as feed for chickens because it might replace wheat in diets for broilers fattening while would cause no significant changes in their production and carcass traits. Body weight of chickens fed with triticale is not different

from the values obtained in feeding broilers with wheat (Vohra et al., 1991; Korver et al., 2004).

Table 2. Body weight of chickens tested by weeks of age (g)

Age (days)	Group	N	$\bar{x}$	S	$S_{\bar{x}}$	C.V.	F_e	Relevance
1	K	100	41,250	3,852	0,385	9,337	0,632	NS
	O	100	40,881	3,930	0,277	9,613		
7	K	99	146,869	19,738	1,984	13,439	0,750	NS
	O	95	149,105	21,381	1,551	14,340		
14	K	98	398,265	57,397	5,798	14,412	0,182	NS
	O	95	395,000	63,413	4,600	16,054		
21	K	97	730,619	101,554	10,311	13,900	0,018	NS
	O	94	728,883	103,735	7,566	14,232		
28	K	97	987,629	96,031	9,750	9,723	4,583	*
	O	94	963,085	89,410	6,521	9,284		
35	K	96	1415,260	132,368	13,510	9,353	1,732	NS
	O	94	1395,585	111,903	8,161	8,018		
42	K	96	1896,875	207,462	21,174	10,937	0,217	NS
	O	94	1887,926	116,439	8,492	6,168		
49	K	96	2302,552	163,784	16,716	7,113	4,587	*
	O	94	2348,989	177,271	12,929	7,547		

NZ-P>0,05; *-P<0,05; **-P<0,01; ***-P<0,001

Since feeding has a different effect depending on the age of poultry this allows a better understanding of the overall effects of feed with triticale (Table 3).

Table 3. Daily and weekly weight gain of chicken groups examined, (g)

Group	Daily gains						
	I	II	III	IV	V	VI	VII
K	15,06	35,26	47,02	34,97	62,57	62,26	61,56
O	15,43	34,26	46,60	32,49	67,71	70,12	68,79
Group	Weekly gains (g)						
	I	II	III	IV	V	VI	VII
K	105,42	246,84	329,17	244,76	438,00	435,81	430,94
O	107,98	239,84	326,18	227,41	473,27	490,87	481,55

Analyzing data from table 3 it can be concluded that there were some differences between the two groups of chickens from the perspective of average daily gain. The chickens of the control group had the lowest daily gain of 15.06 g in the first week of fattening. Chickens of the experimental group had 34, 26 g in the second week, 46.60 g in the third week and 32.49 g in the fourth week. Chickens of the control group had 62.57 g in the fifth week, 62.26 g in the sixth week and 61.56 g in the seventh week).

Chickens of the control group had the lowest weekly gain: (105.42 g) in the first week, 438 g in the fifth, 435.81 g in the sixth and 430.94 g in the seventh week of fattening. The biggest weekly gain in the I, V, VI and VII week had the experimental group of chickens that were fed with triticale. In the case of feeding with forage mixtures in which no triticale was added (control group), a total of 4 broiler chickens died. If this value is put in relation with mortality upon dietary forage mixture with triticale (6 chickens) it is possible to draw the conclusion that triticale in mixtures for broiler chickens fattening has no negative effect on the health of poultry (Table 4). The results are better with the use of triticale varieties than those stated by Korver et al., (2004) and Hermes et al., (2004).

Table 4. Consumption and feed conversion during the study period (49 days)

Groups	Mortality, %	Production index	Feed consumption,kg	Feed conversion, kg/kg
K	4,0	182,784	5,682	2,468
O	6,0	185,518	5,703	2,429

The value of production index was higher in the group fed with triticale (185,518).

By the end of the experimental period (49 days) the highest feed consumption per chicken had the experimental group of chickens (5,703 kg). Feed conversion was somewhat better in the experimental group of chickens (2.429 kg / kg) than in the control group (2,468 kg/kg). The results obtained in terms of feed conversion and total feed consumption per kilogram of body weight of chickens were in accordance with the results obtained by Camiruaga et al., (2001), Cooper et Barneveld, (2002), and slightly worse than the results obtained by De Brum et al., (2000), Korver et al., (2004). Despite the reduced opportunities for comparisons with data from the literature available it can be concluded that the results of this study were in accordance with the results stated by Barneveld and Cooper (2002), Hermes and Johansson (2004), and Đekić et al. (2011.b; 2012.b).

Conclusion

Based on the obtained results it can be concluded that chickens fed with forage mixtures including triticale achieved slightly higher body weight and better feed conversion compared to the control group of chickens. Slightly higher mortality of broiler chickens had a group fed with a mixture where triticale was added.

Data obtained indicate that triticale has great potential as feed for chicken. Body weight of chickens fed with triticale did not significantly differ from those of chickens fed on wheat, as a feed component of the forage mixture, so triticale can successfully replace the wheat in diets for broilers fattening, which would cause no significant changes in the production and carcass traits.

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Reference

Association of officinal analitical chemistry (A.O.A.C.) (1984): Official methods of Analyzis, 14th ed., Washington, D.C.

Barneveld R.J. and Cooper K.V. (2002): Nutritional quality of triticale for pigs and poultry. Proceedings of the 5 th International Triticale Symposium, Poland, vol. 1, 277-282.

Camiruaga M., Garcia F., Elera R., Simonetti C. (2001): Respuesta Productiva de Pollos Broilers a la Adición de Enzimas Exógenas a Dietas Basadas en Maiz o Triticale. Enero-Marzo, vol. 28, núm. 1, Páginas 1-59.

De Brum P.A.R., Zannoto D.L., Gvidoni A.L., Rosa P.S., De Lima G.J.M.M., Viola E.S. (2000): Triticale in diets for broilers. Pesquisa Agropecuaria Brasileira, vol. 35, Is. 2, 229-239.

Đekić Vera, S. Mitrovic, M. Milovanovic, N. Djuric, Branka Kresovic, Angelina Tapanarova, V. Djermanovic, M. Mitrovic (2011.a): Implementation of triticale in nutrition of non-

ruminant animals. African Journal of Biotechnology. 27 June, ISSN 1684-5315, Vol. 10 (30), 5697-5704.

Đekić Vera, S. Mitrovic, Vera Radovic, N. Djordjevic, Tatjana Pandurevic (2011.b): The effect of different triticale on the body weight and weight gain in fattening chickens. International Scientific Symposium of Agriculture "Agrosyim Jahorina 2011", AGROSYM, 10-12. November, Jahorina, 356-362.

Đekić Vera, M. Milovanovic, Mirjana Staletic, V. Perisic (2012.a): Triticale implementation in nonruminant animal's nutrition. Proceedings of IV International Symposium of Livestock Production, 9-12 September, Struga, Republic of Macedonia, Macedonian Journal of Animal Science, Vol. 2, No. 1, 41-48.

Đekić Vera, Mitrović S., Vera Radović, Đermanović V., Tatjana Pandurević (2012.b): Applicability of triticale in the diet of broiler chickens. Proceedings. 47rd Croatian and 7rd International Symposium on Agriculture, 13.-17. Februar, Opatija, Croatia, p. 664-668.

Hermes J.C., Johanson R.C. (2004): Effects of Feeding Varios Levels of Triticale var. Bogo in the Diet of Broiler and Layer Chickens. Journal of Applied Poultry Research, 13, 4 ProQuest Agriculture Journals, 667-672.

Korver D.R., Zuidhof M.J., Lawes K.R. (2004): Performance Characteristics and Economic Comparison of Broiler Chickens Fed Wheat and Triticale-Based Diets. Poultry Science 83, (5), 716-725.

Ruiz N., Marion E., Miles R.D., Barnes R.B. (1987): Nutritive value of new cultivars of triticale and wheat for broiler chick diets. Poultry Sci. 66, 90-97.

Sarker N.R., Haque M.E., Haque K.S., Haque Q.M.S., Waddington S.R. (2006): Triticale fodder and grain utilization by dairy cattle and poultry in Bangladesh. International Maize and Wheat improvement Center (CIMMYT), Uttara, Dhaka-1230, Proceedings of the 6th International Triticale Sympozium, 108-113.

SAS Institute (2000): SAS (Statistical Analysis System). User's guide: Statistics. SAS Institute Inc. Cary, NC.

Savage T.F., Holmes Z.A., Nilipour A.H., H.S. Nakaue (1987): Evaluation of cooked breast meat from male breeder turkeys fed diets containing varying amounts of triticale, variety Flora. Poultry Sci. 66, 450-452.

Službeni list SFRJ (1987): Pravilnik o metodama uzimanja uzoraka i metodama vršenja fizičkih, hemijskih i mikrobioloških analiza stočne hrane, 15.

Vieira, S.L., Penz A.M., Kessler A.M., Catellan E.V. (1995): A nutritional evaluation of triticale in broiler diets. J. Appl. Poultry Res. 4, 352-355.

Vohra P., Bersch C., Qualset Q., Baker R. (1991): Triticale: Alternative cereal grain in broiler starter diets. Calif. Agric. 45, 34–37.