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EFFECT OF SORGHUM ON PRODUCTIVE PERFORMANCES AND SLAUGHTERING TRAITS OF DUCK.

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SUMMARY

Two experiments were carried out during one year to evaluate performance of growth and carcass characteristics of local strains of Muscovy (MD) and Common ducks (CD) fed with diets containing sorghum. In the first trial ducks fed *ad libitum* three experimental isoenergetic and isoproteic diets, where the principal cereal components were corn (diet A), corn and high tannin sorghum, HTS, (diet B), HTS (diet C). In the second trial ducks fed *ad libitum* three experimental diets where sorghum based diets were supplemented with synthetic aminoacids during starter and finisher periods (diet A1=corn; diet B1= low tannin sorghum, LTS; diet C1= LTS and HTS). Individual live weight and feed consumption per pen was recorded weekly and a sample from each group of duck was slaughtered at the traditional age (11 weeks for MD and 8 weeks for CD) to record the slaughtering traits.

Live weights of MD and CD fed with diet C were lower than live weights of birds fed with the other two diets (MD: 2053 g vs 3537 g vs 3000 g and CD: 1520 g vs 1805 g and 1738, P<.01).). Results show that high concentrations of tannin reduce food intake, particularly in MD, affect the productive efficiency and slaughtering traits as breast muscles and increase skin with subcutaneous fat incidence.

Productive performances of MD and CD fed with LTS and HTS-based diet (C1) did not show any lack of growth, probably for the amino acids additions. Only in MD fed with diet A1 and C1 than in birds fed with diet B1 higher values of RCC resulted. As regards RCC yield an higher incidence of breast muscles appeared in MD fed with diet A1 than in group fed with diet C1, where it is possible to recognize a tendence to higher percentage of skin and a greater proportion of the other components of RCC, as wings, back and bone. As regards RCC rate in CD no statistical differences result for the principal component of RCC.

INTRODUCTION

Between cereals which growth during the hot season sorghum is one of the most resisting fault of water. It can survive to dry periods and gives good productions. For these reasons sorghum is one of the most important cereal in the Developing Countries, on account of its growing capacity in semi-arid areas which characterizes the tropics and subtropics.

A great number of researchers (Gualtieri and Rapaccini, 1990; Rigoni et al., 1987; Lucbert and Castaing, 1986; Elkin et al, 1978; Rostagno et al., 1973) studied the nutritional features of many sorghum cultivars as a possible substitute for corn in poultry diets and Elkin et al. (1990) provided some results on employment of sorghum in duck feeding. It is difficult to compare the results of the different feeding trials (Gualtieri and Rapaccini, 1990) on account of the variability of the chemical composition of the various cultivars. However the use of the sorghum should be limited on account of the anti-nutritional effects related to its tannin content. In these last years new low tannin sorghum lines has been selected and new hybrids produced. These new hybrids give similar results to corn in poultry feeding since sorghum is the most similar cereal to corn, when tannins are removed. Therefore this grain can be employed also in commercial diets.

Italian strains of ducks were not submitted to specific genetic programs to improve their performances. These ducks give lower performances of ducks bred in other countries but are characterized by a reduced content of fat in their carcasses and by a good rusticity (Paci et al., 1992, 1993).

The purpose of present study was to evaluate the performance and the characteristic of the carcasses of the Muscovy and the Common ducks bred in Italy and fed with diets containing sorghum.

MATERIAL AND METHODS

Two experiments were carried out during one year: 136 Muscovy ducks males (MD) and 212 Common ducks females (CD) were used in the first trial and 132 Muscovy ducks males and 225 Common ducks females were used in the second trial. All the ducks belonged to local strains and were not selected for growth speed. The ducklings of each experiment, randomly chosen, were bred in 18 different pens, inside a window-less poultry house from one day to 28 days old (day-light: 23L:1D). At the age of 29 days the birds were transferred to open air pens. The density in each pen was 3 males/m^2 or 5 females/m^2. In the first trial ducks fed *ad libitum* three experimental isoenergetic and isoproteic diets, where the principal cereal components were corn and/or high tannin sorghum (HTS), during starter and finisher periods (diet A=corn, diet B=corn and sorghum, diet C=sorghum) (table 1). In the second trial ducks fed *ad libitum* three experimental diets where sorghum based diets were supplemented with synthetic aminoacids during starter

Table 1 - Diet compositions used in the 1st and 2nd trial.

FIRST TRIAL.		STARTER PERIOD (1-42 days)			FINISHER PERIOD (43 days-slaught. age)		
Ingredient		DIET A	DIET B	DIET C	DIET A	DIET B	DIET C
Corn, yellow grain	%	69.00	36.50	---	75.00	41.00	---
Soybean meal (44%)	"	26.00	23.50	18.5	20.00	16.00	13.00
High-tannin Sorgum	"	---	34.00	74.00	---	36.00	78.00
Dicalcium phosphate	"	1.50	1.50	1.50	1.50	1.50	1.50
Calcium carbonate	"	1.00	1.00	1.00	1.00	1.00	1.00
Sodium cloride	"	.15	.15	.15	.30	.30	.30
dL-methionine	"	.35	.35	.35	.10	.10	.10
Lysine	"	---	---	---	.10	.10	.10
Premix *	"	1.00	1.00	1.00	.90	.90	.90
Vegetable oil	"	1.00	2.00	3.5	1.00	3.00	5.00
Calculated analysis							
Metabolizable energy	MJ/Kg	12.52	12.23	12.05	12.81	12.77	12.57
Protein	%	17.93	18.39	18.18	15.57	15.50	16.04
Fat	"	3.54	4.20	5.35	3.72	5.36	6.91
Fibre	"	3.82	3.93	3.96	3.58	3.61	3.72
Ash	"	5.72	5.76	5.71	5.70	5.67	5.71
Methionine	"	.63	.64	.63	.26	.26	.26
Meth.+cyst.	"	.90	.90	.89	.48	.48	.48
Lysine	"	.91	.88	.79	.85	.78	.74

SECOND TRIAL		STARTER PERIOD			FINISHER PERIOD		
Ingredient		DIET A1	DIET B1	DIET C1	DIET A1	DIET B1	DIET C1
Corn, yellow grain	%	70.00	---	---	75.90	---	---
Soybean meal (44%)	"	26.00	24.00	22.00	20.00	18.00	16.50
High-tannin Sorghum	"	---	---	36.00	---	---	37.90
Low-tannin Sorghum	"	---	69.00	35.00	---	75.25	38.20
Dicalcium phosphate	"	1.50	1.50	1.50	1.50	1.50	1.50
Calcium carbonate	"	1.00	1.00	1.00	1.10	1.00	1.00
Sodium cloride	"	.15	.10	.85	.30	.30	.30
dL-methionine	"	.35	.50	.65	.10	.35	.50
Lysine	"	---	---	---	.10	.10	.10
Premix *	"	1.00	1.00	1.00	1.00	1.00	1.00
Vegetable oil	"	---	2.00	2.00	---	2.50	3.00
Calculated analysis							
Metabolizable energy	MJ/Kg	12.30	12.21	11.94	12.51	12.63	12.35
Protein	%	18.02	17.96	18.32	15.72	15.87	16.06
Fat	"	2.58	4.16	4.11	2.74	4.81	5.18
Fibre	"	3.85	3.41	3.60	3.59	3.14	3.29
Ash	"	5.73	6.41	6.48	5.90	5.56	6.84
Methionine	"	.63	.76	.90	.26	.58	.72
Meth.+cyst	"	.90	1.04	1.17	.49	.83	.95
Lysine	"	.90	.85	.77	.85	.79	.70

* Per kilogram of diet: vitamin A 8.000 IU, cholecalciferol 2.000 IU; vitamin B1 1.5 mg; riboflavin 3 mg; vitamin B6 1.5 mg; vitamin B12 15 µg; D-α-tocopherol acetate 7.5 IU; menadione sodium bisulfite 1.5 mg; niacin 25 mg; D-pantothenic acid 8 mg; choline chloride 500 mg; Co .2 mg; Fe 30 mg; I 1.4 mg, Mn 80 mg; Cu 1.5 mg; Zn 30 mg; B.H.T. 50 mg.

and finisher periods (diet A1=corn; diet B1= low tannin sorghum, LTS; diet C1= low and high tannin sorghum) (table 1).

Individual live weight and feed consumption per pen was recorded weekly. A sample from each group of duck was slaughtered at the traditional age: 11 weeks for MD and 8 weeks for CD. The ducks were electrically stunned (200 V per 5") then bled and dry-plucked. The ducks were dissected and the following traits were weighed: dry-plucked and bled carcass, neck with head, giblets, gizzard, liver, ready to cook carcass, abdominal fat. After 24h cooling the following traits were weighed: ready to cook carcass, legs, skin with subcutaneous fat and breast muscles. Data were analysed by variance analysis to test the effect of diet within the different category of duck (Wilkinsons, 1988).

Results

Live weights, feed intake and feed conversion ratios (FCR) of the MD fed with different diets in the two experiments are shown in table 2.

In the first trial, live weights of MD fed with diet A were significant higher than live weights of birds fed with the other two diets; between these last two groups, the group fed with the diet containing corn and HTS, showed better live weights than the group fed the HTS-based diet (3537 g vs 3000 g and 2053 g respectively, P<.01). The lowest live weights and the lowest feed consumption performed in group C resulted in the highest FCR than those observed in the groups fed with diet A and B (4.2 vs 3.0 and 3.3, respectively, P<.01). In the second trial, where corn-based diet (diet A1), LTS-based diet (diet B1) and LTS and HTS-based diet (diet C1) were provided, productive performances of ducks did not show significant differences. The greater aminoacids additions in both sorghum-based diets B1 and C1 than in the control diet (A1) may explain these results.

Productive performances of the Common duck fed with diets employed in the two trials are reported in table 3.

In the first experiment, birds fed with diet A and diet B showed live weights similar and significant higher than live weights of group fed with diet C (1805 g and 1738 g vs 1520g; P<.01). No significant differences were observed for feed intake and FCR between groups. Also in the second trial the different diets showed a significant effect on live weight of Common ducks. Birds fed with diet C1 showed a better growth than the group fed with diets A1 (2076 g vs 1962 g respectively, P<.01) and the lowest FCR, probably due to the greater amount of aminoacid additions.

In table 4 the slaughtering traits of Muscovy ducks at the traditional age are reported in relationship to the different diets of both experiment.

In the first trial ready-cook-carcass did not show significant differences between groups, even if ducks fed with diet C provided the lowest value (60% vs 62% and 62%). In birds fed with diet C the breast muscles incidence was significantly lower than in the others two groups (14% vs 17% and 18%, P<.01) and skin with subcutaneous fat resulted in higher proportion than ducks fed with diet A and B (21% vs 19% vs 17%, P<.01). In the second trial higher values of RCC resulted in ducks fed with diet A1 and C1 than in birds fed with diet B1 (63% and 63% vs 62%, respectively; P<.05). As regards RCC yield an higher incidence of breast muscles appeared in group fed with diet A1 than in group fed with diet C1 (19% vs 18%, P<.05) where it is possible to recognize a tendence to higher percentage of skin and a greater proportion of the other components of RCC, as wings, back and bone.

The data related to the effect of different diets on slaughtering traits of CD are shown in table 5.

In the first trial breast muscles proportion was higher (P<.01) in ducks fed with diets A and B (11% and 12%) with respect to birds of diet C (7%), while the skin with subcutaneous fat and abdominal fat were superior in diet C than diet A and B (35% vs 28% and 27%, P<.01; 3% vs 2% and 2 %, P<.05, respectively). In the second trial the principal component of carcass did not show significant differences while leg proportion resulted lower and abdominal fat was superior in diet C1 than in diet A1 (9% vs 10%, P<.01; 1.5% vs 1.1%, P<.05).

Discussion

The carried out trial gives an experimental contribution to the knowledge of the effect of sorghum on productive performances and slaughtering traits of ducks. As regards the productive performances the results confirmed the equivalent nutritive value of corn and low tannin sorghum supplemented with synthetic aminoacids based-diets and the possibility to employ corn or low tannin sorghum with high tannin sorghum based-diet in duck.

These results show that high concentrations of tannin reduce food intake, particularly in MD, and depress growth in both species as it was observed by Chang and Fuller (1964), Rostagno et al. (1973), and Armstrong et al. (1974) in chicks. Leg abnormalities characterized by an outward bowing of the legs, whose

etiology was investigated by Elkin et al. (1978), appeared also in few ducks of our experiment. Furthermore the dietary addition of aminoacids seems to improve productive efficiency in birds.

As regards the slaughtering traits a clear and significant effect of employment of high tannin sorghum based diet affects the principal component of RCC, the breast muscles, when this is used alone and without suitable aminoacid addition.

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Table 2 - Muscovy duck: productive performances of the 1st and 2nd trial in (period 1-77 days).

	FIRST TRIAL		
	DIET A	DIET B	DIET C
	n=45	n=46	n=45
	x ± σ	x ± σ	x ± σ
Live weight (g)	3537A±312	3000B±423	2053C±307
Feed intake (g/day)	136a±2.2	127ab±3.5	111b±3.9
FCR	3.0B±.20	3.3B±.09	4.2A±.26
	SECOND TRIAL		
	DIET A1	DIET B1	DIET C1
	n=44	n=45	n=43
	x ± σ	x ± σ	x ± σ
Live weight (g)	3453±225	3414±284	3354±237
Feed intake (g/day)	152±9.06	149±3.92	148±6.39
FCR	3.5±.15	3.4±.09	3.5±.15

Values with different letter in row (A, B, C) are significantly different ($p<.01$) and (a, b) are significantly different ($p<.05$) within each trial.

Table 3 - Common duck: productive performances of the 1st and 2nd trials in (period 1-56 days).

	FIRST TRIAL		
	DIET A	DIET B	DIET C
	n=68	n=71	n=70
	x ± σ	x ± σ	x ± σ
Live weight (g)	1805A±163	1738A±271	1520B±177
Feed intake (g/day)	98±5.6	84±7.8	82±5.7
FCR	3.2±.10	3.3±.08	3.4±.18
	SECOND TRIAL		
	DIET A1	DIET B1	DIET C1
	n=75	n=75	n=75
	x ± σ	x ± σ	x ± σ
Live weight (g)	1962B±194	1976AB±198	2076A±186
Feed intake (g/day)	125±4.3	121±3.0	121±9.5
FCR	3.7±.06	3.5±.02	3.3±.32

Values with different letter in row (A, B) are significantly different ($p<.01$) within each trial.

Table 4 - Muscovy ducks: slaughtering traits observed in the 1st and 2nd trials (77 days old).

			FIRST TRIAL		
			DIET A	DIET B	DIET C
		n	x ± σ	x ± σ	x ± σ
Live weight	g	45	3683±138.0A	3433±126.4B	2569±215.7C
Ready-Cook Carcass	% l.w.	45	62.2±1.39	61.9±1.73	59.7±2.12
Abdominal Fat	"	45	1.9±.37	1.9±.64	1.7±.61
Skin with subcut. fat	% RCC	30	18.9±1.22AB	17.3±1.78B	21.2±1.72A
Breast muscles	"	30	17.2±1.22A	17.8±1.83A	13.5±1.43B
Leg	"	30	10.7±.59	10.2±.83	10.3±.64
			SECOND TRIAL		
			DIET A1	DIET B1	DIET C1
		n	x ± σ	x ± σ	x ± σ
Live weight	g	45	3460±176.2	3430±156.6	3358±176.1
Ready-Cook Carcass	% l.w.	45	62.9±1.29a	61.8±1.29b	62.8±.87a
Abdominal Fat	"	45	1.0±.31	1.2±.30	1.3±.31
Skin with subcut. fat	% RCC	45	16.4±1.99	17.1±1.76	17.0±1.89
Breast muscles	"	45	19.4±1.32a	18.1±1.73ab	17.8±1.47b
Leg	"	45	10.4±.39	10.3±.45	10.5±.97

Values with different letter in row (A, B, C) are significantly different (p<.01) and (a, b) are significantly different (p<.05) within each trial

Table 5 - Common ducks: slaughtering traits observed in the 1st and 2nd trials (56 days old).

			FIRST TRIAL		
			DIET A	DIET B	DIET C
		n	x ± σ	x ± σ	x ± σ
Live weight	g	46	1806±61.8A	1807±78.5A	1521±85.3B
Ready-Cook Carcass	% l.w.	46	56.5±2.37	55.9±1.78	55.1±2.16
Abdominal Fat	"	46	2.2±.57b	2.1±.50b	3.3±.65a
Skin with subcut. fat	% RCC	30	27.7±2.92B	26.6±3.21B	34.9±2.08A
Breast muscles	"	30	11.2±1.46A	11.9±2.74A	7.4±1.34B
Leg	"	30	10.9±.70	10.5±.80	9.5±.76
			SECOND TRIAL		
			DIET A1	DIET B1	DIET C1
		n	x ± σ	x ± σ	x ± σ
Live weight	g	45	1889±153.1	1893±145.9	1966±158.8
Ready-Cook Carcass	% l.w.	45	57.0±1.77	58.1±1.70	58.2±1.56
Abdominal Fat	"	45	1.1±.35b	1.4±.46ab	1.5±.52a
Skin with subcut. fat	% RCC	45	25.7±2.50	26.5±3.24	26.4±3.24
Breast muscles	"	45	15.5±1.76	15.1±1.07	16.1±1.53
Leg	"	45	9.6±.60A	9.2±.71AB	8.70±.67B

Values with different letter in row (A, B) are significantly different (p<.01) and (a, b) are significantly different (p<.05) within each trial.

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Can you recommend a limit for the content of tannin in the diet? How is the effect of tannin on meat taste?

At present time it is not possible to suggest the higher limit for tannin content in duck diets. We can only affirm that it is possible to use a high tannin sorghum in duck diets till the level of 35%. Of course the use of HTS in the diet reduce the AA availability so that the AA content of the diet must be increased.

Regarding the meat taste no change was noted by 6 judges on roasted meat. The only characteristic of the carcasses of the ducks fed with sorghum instead of maize was the colourless of the skin and the fat.

What is the cause for bowing legs?

There is no certain cause but only two hypothesis on the action of tannins:

the first hypothesis (according to Giles, 1980) is that the observed leg abnormalities may be related to the mineral deposition and or the collagen formation with tannins acting on either the digestive tract or directly on the bone tissue.

the second hypothesis (according to Elkin, 1978) is that tannins can cause an alteration of the organic matrix of the bones.

Both hypothesis are based on the results observed in poultry feeding trials and on physiological considerations based on the fact that the reduction of AA availability is always linked with a general reduction of the availability of minerals (e.g. P) and micro elements (e.g. Fe and Cu).

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