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Introduction

The percentage of crude protein required in poultry-feed, and particularly in duck-feed, is generally obteined using oil extracted soy-bean. This vegetable protein is not cheap because soy-bean is little cultivated in European countries, so almost all soy-meal must be imported. For these reasons some research has been carried out to study the possibility of reducing the protein content of the diet and to study the possibility of substituting soy-bean meal with other vegetable products in diets for Muscovy ducks (Leclerq and De Carville, 1978; Leclerq and De Carville, 1979; Mori and Romboli,1983). Several feeds of vegetable origin, similar to soy-bean in crude protein content, are produced in European countries (oil extracted meal of sunflower, colza and tomato seeds, lupin meal etc.) and can theoretically replace soy-meal in duck mash with consequent economic advantages. Since the production of colza meal has increased remarkably in CEE countries (in 1984-85 CEE production was 3,384,000 tons - U.S.D.A., 1984), in the present research we have studied the possibility of partially substituting soy-bean and corn with colza in diets for Muscovy ducks.

Materials and Methods

Oil extracted colza meal produced from rape cultivated in Central Italy and commonly found on the Italian market was used in the experiment.

Four samples of the R.S.M. were analysed (the results are reported in table 1). Dry matter, crude protein, crude fats, crude fibre and ash were analysed according to A.S.P.A. (1980)methods; V.O.T. (vynil-5-oxazolidine-1,3-thione-2) and I.T.C. (total isothiocyanate)were analysed according to N.G.D. (1976) methods; E.A. (erucic acid) percentage was determined by a C. Erba gas-chromatograph (Martillotti et al., 1979) on the ether extract after preparation of methyl esters (A.O.A.C., 1980).

COMPOSITION IN g PER 100g OF PRODUCT.	
Dry matter	91,50± .44
Crude protein	37.97± .35
Ether extract(1)	6.65± .31
Crude fibre	13.42± .98
Ash	7,40± .40
N-free extract	34.56±1.33
VOT(expr.like 5vinil-1, 3 oxazolydin-2-tione)	.63± .05
ITC (expr.like butenil isotiocianate)	.10± .002
COMPOSITION IN g PER 100g OF FATTY-ACIDS.	
Erucic acid	4.46± .21

(1)After acid hydrolysis.

Table 1 - Chemical composition of the colza meal (oil extracted) used in the experiment.

For the trial, one hundred and twenty one-day-old Muscovy ducklings (45 males and 75 females) were obtained from a local commercial hatchery and randomly distributed into six pens (three pens of 15 males each and three pens of 25 females each). The pens (m 2.0 x 2.5) were located in a windowless poultry house. The floor of the pen was covered with a deep litter except under the automatic drinker where there was a small slatted-floor (m .5 x .5). Each experimental group, comprising one each of the male and female groups, was fed with two differently formulated diets: starter (from birth to 41 days old) and finisher (from 42 days old to slaughtering-age). The experimental diets (table 2) were formulated as follows:

Experimental group 1 – A maize-soya based diet as control;
Experimental group 2 – A maize-soya based diet with 10% colza meal (with the same protein content as the control diet);
Experimental group 3 – A maize-soya based diet with 10% colza meal and 1.2% soy-bean oil (with the same protein and M.E. content as of the control diet).

	Diet number					
	1		2		3	
	Starter	Finisher	Starter	Finisher	Starter	Finisher
INGREDIENTS,						
Yellow corn, 8.4% protein...%	70.55	75.60	67.55	71.60	67.55	71.60
Soybean meal, 48.5% protein.%	25.00	20.00	18.00	14.00	16.80	12.80
Rapeseed meal, 38% protein..%	---	---	10.00	10.00	10.00	10.00
Soybean oil.....%	---	---	---	---	1.20	1.20
Dicalcium phosphate.....%	2.20	2.20	2.20	2.20	2.20	2.20
Limestone.....%	1.00	1.00	1.00	1.00	1.00	1.00
Salt.....%	.30	.30	.30	.30	.30	.30
Premix (*).....%	.50	.50	.50	.50	.50	.50
D,L-Methionine.....%	.25	.20	.25	.20	.25	.20
L-Lysine.....%	.15	.15	.15	.15	.15	.15
Amprol plus.....%	.05	.05	.05	.05	.05	.05
CALCULATED ANALYSIS,						
Dry matter.....%	89.3	89.2	88.6	88.5	88.8	88.6
Metabolizable energy..Kcal/Kg	2960	3015	2862	2904	2951	2983
Crude protein.....%	17.73	15.91	17.75	16.34	17.25	15.81
M.e/C.p.....%	167	190	161	178	171	189
Ether extract.....%	2.62	2.76	3.77	3.89	4.97	5.08
Crude fibre.....%	3.81	3.61	4.57	4.40	4.49	4.32
Ash.....%	6.17	5.94	6.42	6.23	6.34	6.16
N-free extract.....%	58.95	60.93	56.11	57.64	55.75	57.26
Calcium.....%	.978	.966	1.022	1.012	1.019	1.009
Phosphorus (total).....%	.700	.684	.749	.735	.742	.728
Methionine.....%	.536	.509	.551	.532	.543	.524
Methionine pus cystine.....%	.801	.744	.786	.758	.782	.742
Lysine.....%	1.031	.897	1.020	.912	.986	.878

(*) The premix furnished the following amounts of other ingredients per Kilogram of feed: vitamin A, 8000 IU; vitamin D_3, 2000 ICU; vitamin B_1, 1.5 mg; vitamin B_2, 3 mg; vitamin B_6, 1.5 mg; vitamin B_{12}, .015 mg; vitamin E, 7.5 mg; v itamin K, 1.5 mg; vitamin PP 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;

Table 2 – Composition of diets used in the experiment.

Feed and water were provided ad libitum. A surround ring (ø = 1.5)hea ted with an infra – red heater was used for the first four weeks. the artificial day – length was 24L : 0D from the sta rt to 28 days, then was gra dually decre ased, and, from 35 days to slaughtering age the pho toperiod was 14L : 10D ac cording to the usual breeding technology (Avanzi, 1985).

Every day max. and min. temperatures in the poultry house were noted(fig. 1), as were, on alternate weeks, the live weight and the feed intake. At the end of the trial (62 days for the females and 68days for the males) all the bir ds were slaughtered (bled with killing pliers after electric stunning) then plucked (with dry-plucker) and dissected. The bled and plucked weight, head and neck weight, leg weight, vi scera weight, liver weight, gizzard weight and ready-to-cook carcass weight we re determined immediately after slaughter. The abdo-minal fat weight and breast

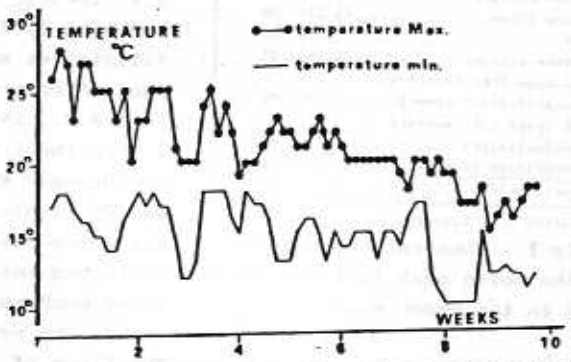

Fig. 1 – Ambient temperature observed in the poultry house.

muscle weight were determined after cooling (+ 5°C and 80% R.U. for 24 h). The dry matter (A.S.P.A., 1980), I.T.C. and V.O.T. content of breast muscles (N.G.D., 1976), and E.A. percentage in abdominal fat (A.O.A.C., 1980; Martillotti et al., 1979) were determined only on a sample, 5 males and 5 females, from each experimental group.

Results and Discussion

The results of the chemical analyses of the colza meal we used are better than for the R.S.M. of the old varieties which were usually cultivated in Italy (Conte et al., 1982) but worse than for those genetically improved for a low erucic acid and glucosinolate content (Sosulski, 1977; Sosulski et al., 1977; Mc Cuaig et al., 1977; Martillotti et al., 1979). In agreement with Martillotti et al. (1979), but in contrast to Piva et al. (1985), we found a high percentage of ether extract in the meal. The high value we found is probably due to the tecnological method used for the extraction (Martillotti et al., 1979). This high value is not good for poultry feeding because it increases the E.A. content of the diet, which, with sinapine, glucosinolates and V.O.T., depresses growth and feed consumption (Piva et al., 1983; Sim et al., 1985).

The results of the trial (table 3) show in fact a delay in the growth of the birds fed with diets containing colza meal, probably due to the reduction of feed consumption: in fact, no differences were found in the feed conversion index (fig.2).

BODY WEIGHT AT AGE	♂♂ Diet number 1	♂♂ Diet number 2	♂♂ Diet number 3	♀♀ Diet number 1	♀♀ Diet number 2	♀♀ Diet number 3
1 d	45± 2	47± 3	46± 4	46± 2	46± 3	46± 4
14 d	318± 35^{a}	294± 36^{a}	237± 23^{b}	256± 40	254± 28	262± 39
28 d	1233±114^{a}	1157±101^{a}	996± 65^{b}	830±107	852± 77	876±116
42 d	2473±215^{a}	2325±162^{ab}	2117± 84^{b}	1564±170	1577± 97	1593±178
56 d	3570±165^{a}	3399±176^{ab}	3115±124^{b}	2217±170^{a}	2045±146^{b}	2170±205^{ab}
62 d	4002±155^{a}	3842±164^{b}	3807±159^{b}	2345±154^{a}	2166±145^{b}	2311±209^{a}
68 d	4082±183^{a}	4030±225^{ab}	3896±214^{b}			

Note: means in the same line bearing different superscripts are significantly different (P<.05).

Table 3 - Performance of males and females when fed experimental diets.

A different response to the variation of the energy-protein ratio was observed in males and females. The increase in energy content and M.E./protein of the diet is good for females but has a negative effect on males. This fact confirms the necessity of formulating two different feeds: one for males and

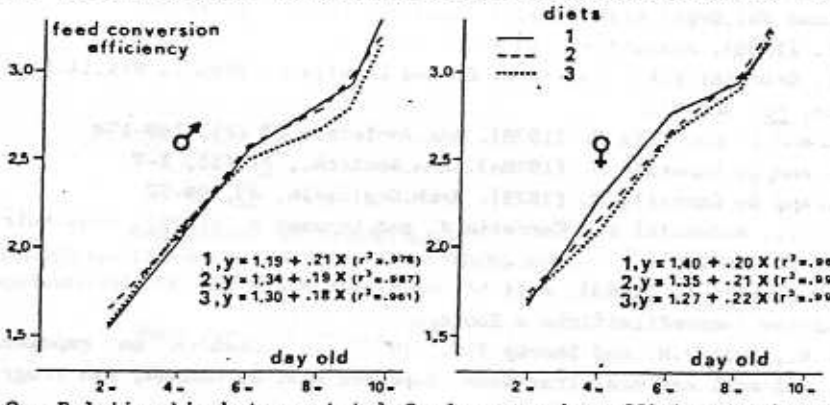

Fig. 2 - Relationship between total feed conversion efficiency and age of the birds (comparison of regression lines, slopes and elevations, not significant; Snedecor and Cochran, 1967).

one for females.

Slaughtering data (table 4) for the three groups differ only in the fat content of the carcasses. The introduction of R.S.M. causes a reduction of abdominal fat in the ready-to-cook carcass, both in males and females. The contemporary addition of oil to the mash increases the fat content of the carcass, which, however, is still lower than in the control group. The reduction in feed intake due to the introduction of colza meal is probably the cause of the observed improvement of the carcass (Leclerq and De Carville, 1978a). No residues of V.O.T., I.T.C. or E.A. were found in the meat and fats of the birds fed with diets containing colza meal. No fishy odour or taste was found in the boiled or roasted meats.

	♂♂ Diet number			♀♀ Diet number		
	1	2	3	1	2	3
% LIVE WEIGHT.						
Bled and dryplucked weight...	91.47	92.06	91.36	91.17	91.82	92.20
Head and neck weight.....	12.29	12.77	11.71	12.07	12.61	12.33
Leg weight.....	2.91	2.63	2.77	2.31	2.60	2.39
Viscera weight.....	6.27	6.05	6.50	6.64	5.76	6.31
Liver weight.....	2.09	2.19	2.26	2.20	2.32	2.39
Gizzard weight.....	2.44	2.61	2.55	2.67	2.82	3.01
Ready to cook carcass.....	64.63	65.57	64.98	63.58	64.30	64.47
Refrigerating weight loss....	1.16	1.26	1.33	1.20	1.18	1.07
% READY-TO-COOK CARCASS.						
Abdominal fat.....	3.09^{a}	2.54^{b}	2.97^{ab}	3.26^{a}	2.61^{b}	2.97^{ab}
Breast muscles.....	16.94	15.52	15.15	15.55	15.64	16.73
% BREAST MUSCLES.						
Dry matter.....	22.30	21.58	21.67	22.29	22.99	22.14

Note: means in the same line bearing different superscripts are significantly different (P<.05).

Table 4 - Slaughtering data of males and females.

Conclusions

Up to 10% of the Brassica napus oleiferaea oil exctracted seed meal currently produced in Central Italy may be included in diets for growing Muscovy ducks. The introduction of the R.S.M. slightly reduces growth but doesn't increase the feed conversion index, and it improves the quality of the ready-to-cook carcass.

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Zusammenfassung: UNTERSUCHUNGEN ÜBER RAPS-EXTRATIONSCROTT (R.E.S.) FUR MUSCHUNSENTEN FÜTTERUNG.

Mann hat die Möglichkeit der partialen Erzetzung von Soya-extrationscrott und Mais durch Rapsextrationscrott (R.E.S.) fur fütterung der wachsenden Muschunsentenkuken geprüft.

Die Enten die mit R.E.S. gefüttert worden waren zeigten weniger fütteraufnahme in vergleich zu kontrollEnten und hatten auch weniger Körpergewicht zugenommen.

Es wurden keine unterschiede bei den verschiedenen Versuchen festgestellt ausgenommen den abdominalen Fettgehalt der geringer war bei den Enten mit R.E.S. gefuttert.

Résumé: LE TOURTEAU DE COLZA DANS L'ALIMENTATION DES CANETONS DE BARBARIE

On a étée etudiée la possibilité de remplacer le tourteau de soya et le mais par le tourteau de colza (au niveau du 10%) dans l'aliment des canetons de Barbarie.

L'emploi du 10% de tourteau de colza dans l'aliment n'altère pas l'indice de consommation, ralentit légèrement la croissance et tend à améliorer les caractéristiques de la carcasse de canard. Le retard de croissance correspond en majeure partie à une réduction des lipides de réserves (graisse abdominal)

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