

Organic vegetable proteins and oil in feed for organic rainbow trout (*Oncorhynchus mykiss*)

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Abstract

Fish meal may be partly replaced by a matrix of organic horse bean, pea and rape, and flax seed oil may replace fish oil in diets for organic rainbow trout without compromising growth performance and feed utilization.

Introduction

The production of rainbow trout according to organic certification regulations is increasing. To fulfill the demand of adequate feed there is a need to replace fish meal with organic, vegetable feed ingredients, as the principles of organic aquaculture encourage the development of feed that do not deplete global fish stocks. In addition, the organic code of practice does not allow addition of artificial amino acids to the feed, and optimization of the amino acid profile of organically based diets must therefore derive from the protein sources alone. The aim of this study was to evaluate the digestibility and growth performance of organic vegetable dietary ingredients as replacement for fish meal and fish oil in feed for organic rainbow trout (*Oncorhynchus mykiss*).

Materials and methods

Six iso-energetic and iso-nitrogenous diets were prepared (Table 1 and 2), comprising a fish meal and fish oil based control diet (A) and three diets in which the inclusion of fish meal was gradually reduced from 59 to 35 % and replaced by a matrix of organic horse bean, pea and rape protein concentrates in the proportion of 1:1:0.7 (B, C, D). In the last two diets, the inclusion of fish oil was reduced by 50 and 100 %, respectively and replaced by flax seed oil high in omega-3 fatty acids (E, F).

Diet	A	B	C	D	E	F
Fish meal	59	51	43	35	59	59
Fish oil	22	22	22	22	11	0
Flax seed oil	0	0	0	0	11	22
Horse bean	0	5	10	15	0	0
Pea	0	5	10	16	0	0
Rape	0	3	7	10	0	0
Wheat	20	14	8	2	20	20



Digestibility of dietary nutrients was measured directly using a modified, flow through Guelph System consisting of 18 tanks, and feeding each diet in triplicate (Figure 1).

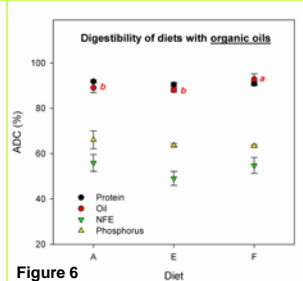
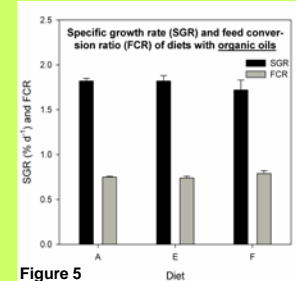
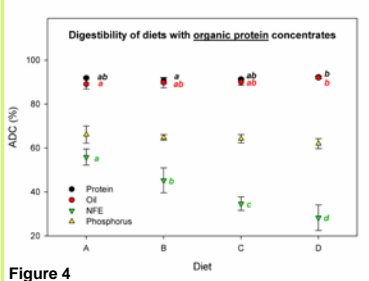
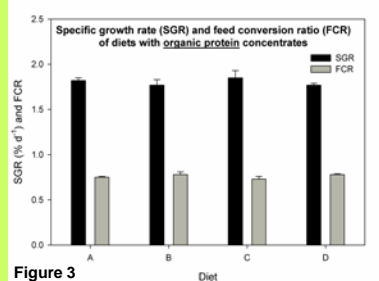
Diet	A	B	C	D	E	F
Protein	46	47	46	47	45	46
Oil	32	30	31	31	33	31
NFE	13	14	14	14	13	14
Phosphorus	2	2	1	1	2	2
Energy (MJ/kg)	26	25	26	26	26	26



Growth performance was measured using a recirculation system consisting of 12 square formed fiber glass tanks and feeding each diet in duplicate for 9 weeks, from an initial weight of 60 g to a final weight of about 200 g (Figure 2).

Results

The fish showed a relatively good growth performance with an average specific growth rate (SGR) of 1.8 % day⁻¹, and an average feed conversion ratio (FCR) of 0.75, and there were no significant differences between the groups (Figure 3 and 5). In contrast, there were significant differences in the digestibility of protein, lipid and especially NFE in fish fed diets with organic protein concentrates (Figure 4). For fish fed diets with organic oils, the digestibility of oil was significantly higher in fish fed 100 % flax seed oil (Figure 6).



Conclusion

The results indicate that fish meal may be reduced from 59 % to 35 % and replaced by a matrix of organic horse bean, pea and rape protein concentrates, and flax seed oil may replace fish oil by 100 % in feed for organic rainbow trout without compromising growth performance and feed utilization.

Acknowledgements

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