

Lupins in UK

Agriculture & Aquaculture



Aquaculture

Executive Summary Results

Introduction

Soybean meal (SBM) is a key plant protein component in many aquafeeds due to its high protein content; however increased global demand for SBM for both human consumption and animal feed in both developed and developing countries has escalated its price.

Lupins, (*Lupinus* sp.) are a high protein, high energy, nitrogen-fixing grain legume with the ability to be cultured in northern climates. Their high protein (of up to 42%) and oil content far outstripping that of peas and beans. As such they are the only UK crop with a protein and oil composition that can effectively compete with imported soya to provide a comparable UK-grown vegetable protein source for farmed animals. Lupins contain low levels of anti-nutritional factors (ANF's) and non-starch polysaccharides which may reduce feed intake, growth, nutrient digestibility and utilization and disease resistance. However the use of exogenous solid state fermentation products (Synergen™) has been shown to reduce the effects of ANF's and enhance dietary performance.

The effect of replacing soya protein concentrate with different (white, yellow and narrow leafed) lupin seed meals with and without the addition of a solid state fermentation product was investigated in several fish species: juvenile mirror carp, Black Nile tilapia and rainbow trout.

Juvenile mirror carp (*Cyprinus carpio*) and white lupin (*L. albus*)

www.aber.ac.uk/nile-tilapia

Substitution of up to 25% of the soya protein concentrate by white lupin seed meal in diets for mirror carp did not have any significant negative effect on growth performance, feed utilization and carcass composition.

The addition of the solid state fermentation product Synergen™ significantly improved growth and performance parameters, improved gut morphology and the utilization of nutrients in all dietary treatments.

The diet with white lupin meal at 12.5% substitution of the soya protein concentrate with the addition of 0.1% Synergen™ had significantly improved growth performance and feed utilization when compared to all the other dietary treatments.

Black Nile tilapia (*Oreochromis niloticus*) and yellow lupin (*L. luteus* cv. Pootalong) and narrow leafed lupin (*L. hirsurtus* cv. Sanobar)

www.aber.ac.uk/mirror-carp

Black Nile tilapia (initial average weight 36.22g ±0.16) were stocked into 90l tanks at 26°C±1. The fish were subjected to a 49 day feeding trial with practical diets containing yellow lupin (*L. luteus* cv. Pootalong) or narrow leafed lupin (*L. hirsurtus* cv. Sanobar) with 0% and 0.1% inclusion of Synergen™, in duplicate. Performance was tracked weekly (Table 1). Fish were sampled for gut morphology, haematology. Microbiology, enzymatic activity and whole carcass composition.

No statistical differences in mean specific growth rate (SGR) or feed conversion rate (FCR) were observed

Table 1

Fish performance of Nile tilapia fed practical diets containing yellow or narrow leafed lupin with and without inclusion of Synergen™

Diet	SGR	FCR	WG (g)	FW (g)	K-F
Yellow Lupin Control	2.12	1.40	64.43 ± 5.32 ^{ab}	100.67 ± 5.03 ^a	2.04 ± 0.13
Yellow Lupin Synergen™	2.35	1.24	77.72 ± 1.20 ^c	114.12 ± 1.08 ^b	2.06 ± 0.03
Narrow leafed Lupin Control	2.22	1.27	61.66 ± 2.43 ^a	98.01 ± 3.1 ^a	2.01 ± 0.07
Narrow leafed Lupin Synergen™	2.37	1.21	74.59 ± 2.09 ^{bc}	110.60 ± 2.12 ^{ab}	1.96 ± 0.03

between treatments, however tendencies towards improved performance (SGR and FCR) are apparent with the inclusion of Synergen™. Average fish weight (FW) was significantly different between the dietary treatments (P=0.02). The average fish weight of the yellow lupin with Synergen™ treatment (YLS) was found to be significantly higher than the narrow leafed lupin (BLC) or yellow lupin (YLC) control diets. Average fish weight gain (WG) was found to be significantly different between treatments (P=0.02). The average WG of narrow leafed lupin with Synergen™ treatment (BLS) was significantly higher than BLC. Similarly WG of YLS fed fish was greater than both YLC and BLC. No significant differences in k-factor were observed between dietary treatments.

Rainbow trout (*Oncorhynchus mykiss*) and yellow lupin (*L. luteus* cv Pootalong) and 0.1% and 0.5% inclusion of Synergen

www.aber.ac.uk/rainbow-trout

Previous studies have focused on exogenous enzyme activity as an effective dietary aid in finfish species cultured in warmer water. The results of this trial consistently suggest that 0.5% Synergen™ inclusion in a practical trout diet with high plant ingredient content can improve fish performance at a mid-range rainbow trout culture temperature. It can be speculated that the experimental ingredient increased bioavailability of nutrients and/or reduced ANFs.

Conclusion

All the experiments carried out with the lupin meals show that they are effective in aquafeeds as substitutes for soya protein concentrates. The addition of Synergen™ in every case has improved performance in temperate and warm water finfish species and facilitated the effective use of plant ingredients in aquafeeds and production.

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