U.S. Grains Council

South East Asia

Final Report

Feeding trial of DDGS for Tilapia fish

Activity No. M05GX54318

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December 2006

U.S. Grains Council
South East Asia

Title: Use of DDGS for feeding red tilapia under Vietnam condition

Goal: Determine the impact of feeding increasing levels of Corn Distillers Dried Grains and Solubles (DDGS) on the performance of Tilapia fish reared under commercial conditions in Vietnam.

Summary

Feeding trial on tilapia has been conducted in a fish farmer in Hanoi, Vietnam to measure the optimum inclusion of Dried Distiller Grain Solubles in the feed. The trial was performed using tilapia fish with initial weight 190g raised for 4 month up to around 800-900 g in floating cages placed in a reservoir. Four dietary treatments containing DDGS at 0, 5, 10 and 15% were included in similar dietary energy (2500 kcal/kg) and protein level (30%) of feed composed mainly with soybean meal, corn, rice bran and fish oil. Results of feeding for 4 months showed that increasing level of DDGS in Tilapia diet increased growth rate and improve feed efficiency. The best performance was found when DDGS is included at 15% in combination with soybean meal. The use of DDGS also improves survivability of the fish from 94% in treatment without DDGS to 97.3% in treatment with 15% DDGS inclusion. Fish meat evaluation at end of trial indicated no different in chemical composition. In conclusion the DDGS can be included in Tilapia diet up to 15% and may improve the growth performance.

Introduction

Red tilapia is one of major fish grown in Vietnam and is considered popular species for human consumption. It is grown in a pond water or cage system in reservoir. Red tilapia is cultured until market size in the range of 500- 800 g. Red tilapia feed is commonly made of several ingredients such as soybean meal, wheat by products, fish meal, rice by product etc. Dried Distillers Grains and Soluble is by product of ethanol production made of corn and produced in a significant amount in US and other countries. It has been shown to be economically feasible for animal feed especially in dairy cattle, swine and poultry. However, information on the use of DDGS for feeding fish is limited, despite a high protein content (28%) and relatively cheaper cost of feed ingredients. With increasing of DDGS production in USA, the availability of DDGS for export to SEA will increase. Information on feeding value of DDGS for Tilapia would be useful for fish farmers in the region. It is expected that such type of information can be generated locally under South East Asia condition.

Methodology

Feeding trial was carried out at experimental farm of Le Hung Vy, Binh Son, Song Cong district, Thai Nguyen Province, Vietnam. Feeding trial comprises 4 dietary treatments comprise:

DDGS 0%. Control diet without DDGS contains only vegetable protein
DDGS 5%. Diet contains 5 % DDGS
DDGS 10%. Diet contains 10% DDGS
DDGS 15%. Diet contains 15 % DDGS

Feed for trial was manufactured at Research Institute for Aquaculture facility in Hanoi using locally available ingredients either produced locally or imported. Dietary formula containing 0,5,10 and 15% of DDGS is presented in Table 1.

Table 1. Dietary composition and calculated nutrient of tilapia feed containing different level of DDGS

	DDGS 0%	DDGS 5%	DDGS 10%	DDGS 15%
Soybean Meal 47	58.54	56.58	56.37	57.85
Corn Yellow	23.56	28.15	27.13	20.72
Rice Bran 10	11.41	3.75	0.00	0.00
Fish Oil	2.89	2.88	2.87	2.87
Mono Cal. Phos (21)	2.49	2.53	2.51	2.46
Vitamin Mix	0.50	0.50	0.50	0.50
Mineral Mix	0.25	0.25	0.25	0.25
Choline Chloride (60%)	0.20	0.20	0.20	0.20
Antimold	0.10	0.10	0.10	0.10
Antioxidant	0.03	0.03	0.03	0.03
Stay C 35	0.03	0.03	0.03	0.03
DDGS (Distillers Grain Solubles)	0.00	5.00	10.00	15.00
Calculated Nutrient				
CRUDE PROT (%)	29.87	29.68	30.32	31.77
FAT(%)	6.87	6.37	6.23	6.45
FIBRE (%)	4.38	3.99	3.96	4.26
Calcium (%)	0.54	0.54	0.54	0.54
Av. Phosphorus Fish (%)	0.49	0.50	0.50	0.48
Total Phosphorus (%)	1.15	1.07	1.04	1.07
LYSINE (%)	1.75	1.71	1.72	1.79
METHIONINE (%)	0.42	0.43	0.44	0.47
MET. + CYS. (%)	0.90	0.91	0.95	1.00
TRYPTOPHAN (%)	0.38	0.38	0.38	0.40
THREONINE (%)	1.15	1.15	1.18	1.25
Magnesium (%)	0.27	0.24	0.23	0.24
Dig. Energy Fish(Carp) (kcal/kg)	2465	2442	2484	2588
Dig. Protein Fish (%)	25.95	25.70	26.15	27.24

DE/DP Fish	95	95	95	95
Starch (%)	20.28	22.26	20.73	15.83
wn:3 total (%)	0.90	0.90	0.90	0.90
wn:6 total (%)	0.52	0.45	0.55	0.80
Vitamin C (ppm)	105	105	105	105

The dietary formulas contained similar Digestible Energy and Crude Protein value include amino acids. The feed was processed using wet extruder to produce complete feed in floating form. The size of pellet was 3-4 mm. Each dietary treatment was fed to red tilapia fish at size 50 g. The fish was grown in floating cage made of nylon net (mesh 1) at size 2x2x2 m (effective volume for water 6 m3) containing 400 fish per cage. Each treatment was replicated 3 times and the trial was performed for 4 months to reach marketable size which approximately 800 g.

Feeding system.

At least 6000 fingerling of common carp and tilapia at size 190 g (12 cages x 400 fish= 4800) was purchased from supplier and was adapted in the cages before the trial is started. Initially feed was offered at 5% biomass and fed 4 times per day at 7:30 am, 10:30 am, 13:30 pm and 15:00 pm. Amount of feed given was based on 95% satiation. Initial of feed was given at amount that can be consumed by fish within 10 minutes multiplied by 90% and was given in that amount for 5 days. The following 5 days was given at full amount therefore the average would be 95% satiation. This calculation was repeated again for every 10 days period. All feed was placed in special feeding boxes and cages were covered by nylon net to prevent an escape.

Measurement

Fish was sampled and weighed every month while total weighing was performed when they reach market size at approximately 800 g. The daily mortality and feed consumption was recorded. At end of trial, three red tilapia from each treatment were randomly selected for analyzing the nutritional value in the red tilapia meat by measuring the protein, fat and ash content of fish. Feed conversion ratio was calculated and corrected for the mortality weight. Cost of feed per kg body weight gain was calculated.

Samples of feed (250g) was collected and analyzed in laboratory.

Statistical analyses

Randomized Completely Design with 4 treatments and 5 replicates containing 600 fishes per replicate cage was used in this trial for each species of fish. Data was analyzed using computer program and any significant different due to the treatment was further analyzed using Duncan.

Results and Discussion

Body weight change in tilapia during feeding different level of DDGS for 4 month period is presented in Figure 1. Body weight increased as fish grow as expected, variation in fish growth seemed to low in this trial as demonstrated in standard deviation of the graph. Feeding with increasing level of DDGS showed a better growth rate and it was noticed after feeding for 2 months. Feed containing DDGS was readily consumed by tilapia which may indicate that there was no palatability problem associated with DDGS in feed. There was no indication of disease in fish during the trial period.

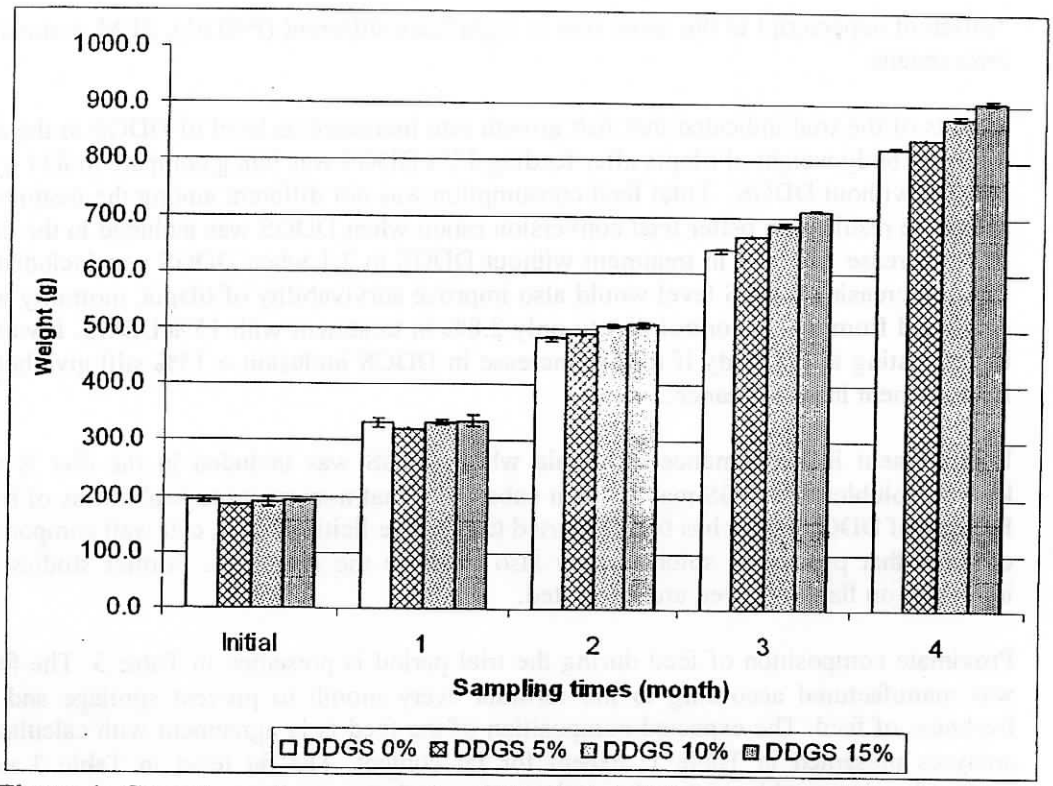

Figure 1: Growth performances of red tilapia fed different level of DDGS during 4 month culture period (Error bars are standard deviation of mean-SE values)

Performance of red tilapia after feeding Dried Distillers Grains and Solubles at different level is presented in Table 2.

Table 2. Performance of Red Tilapia fed different of DDGS after 4 month culture period (mean values)

Descriptions	DDGS 0%	DDGS 5%	DDGS 10%	DDGS 15%	SEM
No. of fish	400	400	400	400	
Ave initial weight (g)	193.5	184.4	190.0	192.5	5.6
Total Initial weight (kg/cage)	77.6	73.6	76.0	77.2	
Number tilapia at harvest	376	381	389	389	
Ave weight at harvest (g)	824.2^{a}	839.3^{b}	879.4^{c}	907.4^{d}	3.2
Total biomass at harvest (kg)	309.8	319.7	342.3	353.2	
Ave weight gain (g)	630.7^{a}	654.9^{b}	689.4^{c}	714.9^{d}	5.0
Total feed consumed (kg)	575.8	575.8	575.8	575.8	
Feed Conversion Ratio	2.48^{a}	2.34^{b}	2.16^{c}	2.09^{d}	0.02
Mortality rate (%)	5.9^{a}	4.8^{b}	2.7^{c}	2.8^{c}	0.2
Survival rate (%)	94.1	95.2	97.3	97.2	

*different superscript at the same row is significant different (P<0.01), SEM = standard error means

Results of the trial indicated that fish growth rate increased as level of DDGS in the diet increase, body weight of tilapia after feeding 15% DDGS was 908 g compare to 824 g for fish fed without DDGS. Total feed consumption was not different among the treatments and these resulted on better feed conversion ration when DDGS was included in the diet. FCR decrease from 2.5 in treatment without DDGS to 2.1 when DDGS was included at 15%. Increasing DDGS level would also improve survivability of tilapia, mortality was decreased from 6% in control diet to only 2.8% in treatment with 15% DDGS. It would be interesting to get study if further increase in DDGS inclusion > 15% still give better improvement in performance.

Improvement in performance of tilapia when DDGS was included in the diet is not known, solubles in DDGS may contain substances that may promote healthiness of fish. Feeding of DDGS to pig has been reported to improve ileitis of pigs, cell wall component of yeast that present in solubles may also improve the immunity. Further studies on immunity on fish, however, are warranted.

Proximate composition of feed during the trial period is presented in Table 3. The feed was manufactured according to the formula every month to prevent spoilage and to freshness of feed. The expected composition of the feed is in agreement with calculated analyses presented in Table 1, except for fat content. The fat level in Table 3 was analyzed using soxhlet extraction using ether and it may cause a lower result than expected. Different method of analysis may have different result, for extruded feed, AOAC suggested using acid hydrolysis prior to extraction.

Table 3. Proximate composition of feed analyzed from different batch of manufacturing during the trial period.

Dietary Treatment	Moisture (%)	Crude Protein (%)	Ash (%)	Fat (%)
1st Batch				
DDGS 0%	9.35	32.08	7.41	3.51
DDGS 5%	9.18	32.23	6.05	4.93
DDGS 10%	8.25	33.46	6.43	4.42
DDGS 15%	9.78	33.87	6.54	4.07
2nd Batch				
DDGS 0%	9.62	32.32	6.54	4.26
DDGS 5%	9.24	32.11	6.62	4.55
DDGS 10%	9.13	32.07	6.71	4.52
DDGS 15%	9.36	32.25	6.63	4.42

3rd Batch				
DDGS 0%	9.81	32.52	7.10	3.57
DDGS 5%	9.52	31.90	6.10	4.21
DDGS 10%	9.85	31.96	6.22	3.50
DDGS 15%	9.57	32.09	5.96	4.38
4th Batch				
DDGS 0%	10.62	32.52	6.90	3.21
DDGS 5%	10.79	31.90	6.12	4.00
DDGS 10%	10.07	31.96	6.23	3.34
DDGS 15%	10.11	32.09	6.45	4.05

Composition of tilapia after feeding DDGS at different levels is presented in Table 4.

Table 4: Nutritional composition of tilapia meat fed different level of DDGS

Treatments	Dry matter (%)	Protein (%)	Lipid (%)	Ash (%)
DDGS 0%	28.64	17.36	8.91	3.47
DDGS 5%	29.93	16.79	9.28	3.82
DDGS 10%	30.16	17.05	8.92	4.07
DDGS 15%	29.97	15.96	5.63	4.24

Results of analyses indicated that there is no different in composition of the fish after feeding diets containing different level of DDGS. DDGS contains xantophyll that may have an effect to color of the flesh, however xantophyll analyses has not been performed in this trial. Further study on the effect of xantophyll in DDGS to fish quality may be necessary.

Conclusion

After 4 month culture period, the best growth rates of red tilapia were obtained in the 10% and 15% DDGS feed treatments ($P<0.05$). The lowest growth rate was presented in the 0% DDGS feed. The lowest FCR of for whole culture period was obtained to be 2.1 which is presented in the treatment of 15% DDGS feed treatment. The highest survival rates (97.3%) were also obtained in the 10 and 15%DDGS treatments. There was no effect of feeding DDGS up to 15% on fish chemical composition.

Acknowledgements

We would like to acknowledge the financial support of the US Grains Council for this experiment.