U.S. Grains Council

South East Asia

Final Report

Feeding trial of DDGS for Common Carp

Activity No. M06GX64322: DDGS Feeding Trials and Field Research

Submitted by:

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Title: Use of DDGS for feeding Common Carp under commercial condition

Goal: Determine the impact of feeding increasing levels of Corn Distillers Dried Grains and Solubles (DDGS) on the performance of Common Carp reared under floating cages

Abstract

Feeding trial on common carp has been conducted in Hoa Binh reservoir, Hoa Binh Province, Vietnam to measure the optimum inclusion of Dried Distiller Grain Solubles in the feed. The trial was performed using common carp fish with initial weight 26-51g raised for more than 3 months up to around 200 g in floating cages placed in a reservoir. Four dietary treatments containing DDGS at 0%, 5%, 10% and 15% were formulated in similar dietary energy (2.9 Mcal/kg) and protein level (26%) of feed, composed mainly with soybean meal, wheat by products, rice bran, fish meal, meat and bone meal and fish oil. Results of feeding for 3 months showed that increasing level of DDGS in the diet did not affect growth rate and feed consumption of the fish. There was an indication that fish fed 10% and 15% DDGS grew in faster rate (40 g/month) than that fish fed lower level (0% and 5%) of DDGS (28 g/month). Fish survivability rate was around 99.3-99.5% and there was no different due to the dietary treatment. Fish meat evaluation at end of trial indicated no different in moisture, protein and fat content and meat color was similar among the dietary treatment. In conclusion the DDGS can be included in common carp diet up to 15% and did not affect the growth performance and meat quality.

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Introduction

Aquaculture is one of the fastest growing food producing industries in the world. Fish meal has traditionally been used in commercial fish feed as a major source of dietary protein for many years. However, when global fish meal production declines and fish meal prices increase, fish nutritionists begin considering less expensive plant protein sources. Plant protein sources have traditionally been considered to be inferior to fish meal in fish diets. However, when two or more complimentary plant protein sources, such as distiller's dried grains with solubles (DDGS) and soybean meal, are added to the diet, the potential exists to replace all of the fish meal in the diet.

Limited data was available on feeding value of DDGS for fish feed. DDGS has been fed successfully to catfish; Tidwell et al. (1990) conducted an experiment over an 11-week period where channel catfish fingerlings were fed diets containing 0%, 10%, 20% and 40% distillers grains with solubles, replacing some of the corn and soybean meal. After the 11-week feeding period, there were no significant differences in individual fish weight, percentage survival, feed conversion or protein efficiency ratio among dietary treatments. In 1993, Webster et al. conducted feeding study to juvenile catfish and suggested that up to 30% DDGS can be added to channel catfish diets with no negative effects on growth performance, carcass composition or flavor qualities of the filets. Therefore, DDGS is considered an acceptable ingredient in diets for channel catfish (Tidwell et al., 1990; Webster et al., 1991).

Wu et al. (1994) reported that diets containing either corn gluten meal (18%) or DDGS (29%) and 32% or 36% crude protein, resulted in higher weight gains for tilapia than fish

fed a commercial fish feed containing 36% crude protein and fish meal for tilapia with initial weight of 30 g. In a subsequent study, Wu et al., (1996) evaluated the growth responses over an eight week feeding period of smaller tilapia (0.4 g initial weight and concluded that feeding diets containing 32%, 36% and 40% protein and 16- 49% protein-rich ethanol co-products will result in good weight gain, feed conversion and protein efficiency ratio for tilapia fry.

Common Carp is one of major fish grown in Asia and is considered popular species for human consumption. It is grown in a pond water or cage system in reservoir. Common carp is cultured until market size in the range of 500- 800 g. Common Carp 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 (26%) 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 common carp 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.

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Materials and Methods

Feeding trial was carried out at Hoa Binh Reservoir, Hoa Binh province belong to Duc Hung Trade Company, ltd, Vietnam from September to November, 2007. Feeding trial comprises 4 dietary treatments comprise:

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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 Quang Viet Feedmill and Trading Co. Ltd., Km 64 + 500, Highway 5A, Kim Thanh District, Hai Duong Province, Vietnam 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 Common Carp feed containing different level of DDGS

Ingredient	DDGS 0%	DDGS 5%	DDGS 10%	DDGS 15%
SBM (%)	44.50	46.42	41.71	40.12
Cassava (%)	20.00	20.00	20.00	20.00
Rice bran (%)	15.00	15.00	13.40	10.00
Fish meal (%)	5.00	5.00	5.00	5.00
Meat & bone meal (%)	5.00	2.12	5.00	5.00
Wheat pollard (%)	4.60	1.10	-	-

DDGS (%)	-	5.00	10.0	15.00
Fish oil (%)	2.90	2.89	2.89	2.88
Corn Gluten meal (%)	1.00	-	-	-
MCP (%)	1.00	1.47	1.00	1.00
Vit. and Min. mix for Fish (%)	0.50	0.50	0.50	0.50
Lecithin (%)	0.50	0.50	0.50	0.50
Total	100.000	100.000	100.000	100.000
Calculated Nutrient				
Digest. Energy (Mcal/kg)	2.90	2.87	2.90	2.92
Protein (%)	29.1	28.7	29.0	29.1
Fat (%)	8.0	8.0	8.4	8.3
Crude fiber (%)	4.9	5.0	4.9	4.9
Ash (%)	8.1	8.0	8.2	8.0
Phosphorus, Total (%)	1.18	1.17	1.17	1.15
Lysine (%)	1.67	1.67	1.64	1.62
Methionine (%)	0.43	0.43	0.44	0.45
Met. + Cyst. (%)	0.87	0.87	0.89	0.92
ω 3 fatty acids (%)	1.0	1.0	1.0	1.0
ω 6 fatty acids (%)	0.7	0.9	1.1	1.2

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 Common Carp fish at size 26-51 g. The fish was grown in floating cage made of nylon net (mesh 1) at size 2x2x2 m (effective volume for water 6 m^3) containing 1200 fish per cage. Each treatment was replicated 5 times and the trial was performed for 3 months to reach marketable size which approximately 200 g.

Feeding system.

At least 12000 fingerling of Common Carp at size 10 g (20 cages x 600 fish= 12000) 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 15:30 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 2 weeks while total weighing was performed every month and then at final when they reach at approximately 200 g. The daily mortality and feed consumption was recorded. At end of trial, three common carp from each treatment

were randomly selected for analyzing the nutritional value in the Common Carp meat by measuring the protein, fat and moisture content of fish. Samples of feed (250g) was collected and analyzed in laboratory for protein, fat and ash.

Statistical analyses

Randomized Completely Design with 4 treatments and 5 replicates containing 1200 fishes per replicate cage was used in this trial for each species of fish. Data was analyzed using computer program (SAS ver. 6.12) and any significant different due to the treatment was further analyzed using Duncan.

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Results and Discussion

Body weight change in Common Carp during feeding different level of DDGS for 3 months period is presented in Figure 1. Body weight increased as fish grow as expected, from around 26-51 g to around 200 g in 3 months. Feed containing DDGS was readily consumed by Common Carp which may indicate that there was no palatability problem associated with DDGS in feed.

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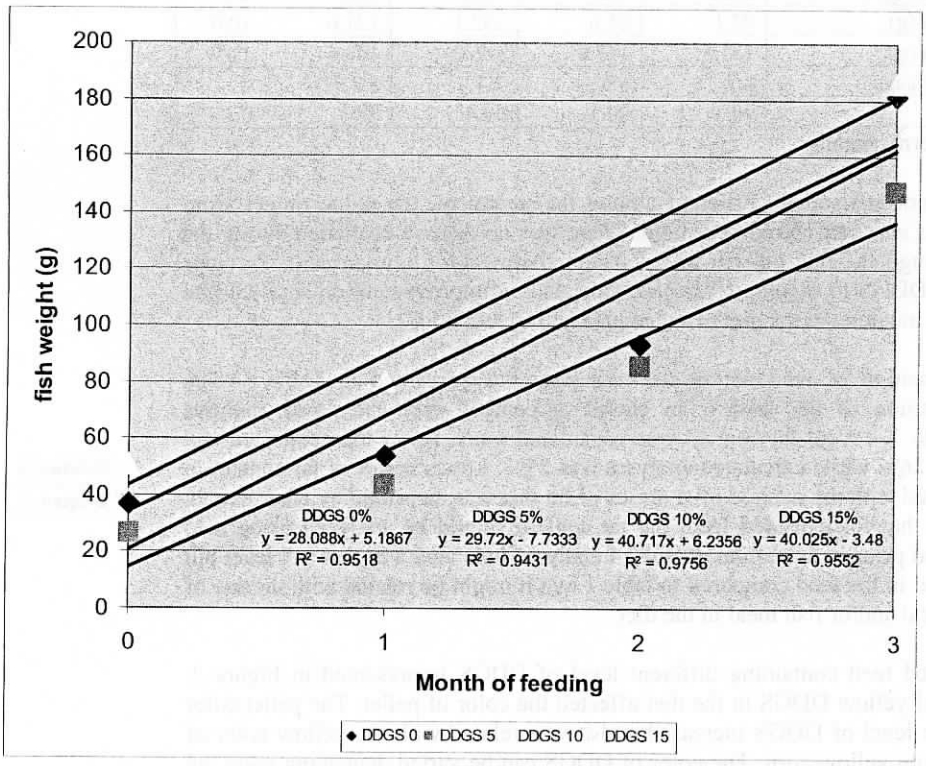

Figure 1: Growth rate of Common Carp fed different level of DDGS for 3 months

Based on change of fish body weight, there is no clear difference between the treatments due to high variability among the body weight. Further regression analyses were used to

compare the growth rate due to the treatments. The result in Figure 1 indicated that coefficient of regression for treatment DDGS 10% and 15% were 40.7 and 40.0 respectively while regression coefficient for DDGS 5% and 0% were 29.7 and 28.1. This result showed clearly that feeding DDGS at 10% and 15% gave a higher growth rate compare to that fed 0% or 5%.

Body weight changes and survivability of common carp after feeding Dried Distillers Grains and Solubles at different level is presented in Table 2.

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

Descriptions	DDGS 0%	DDGS 5%	DDGS 10%	DDGS 15%	SEM
No. of fish /cage	1200	1200	1200	1200	
Ave initial weight (g)	36.9	26.2	50.7	41.6	4.9
Weight at 2 months (g)	54.0	43.3	80.2	66.6	6.6
Weight at 3 month (g)	93.1	85.6	132.1	121.6	10.0
Weight at 4 month (g)	181.5	147.8	186.0	168.6	11.9
Number Fish died /cage	8.2	6.6	7.4	8.2	
Survival rate (%)	99.3	99.5	99.4	99.3	0.1

SEM = standard error means

Survival rate is not statistically different among the treatment, the value ranges from 99.3-99.5% and it was considered very high. There was no disease challenge during the fish culture although the fish growth was considered slow for common carp. Previous study of feeding DDGS to tilapia in Vietnam indicated an improvement on survival rate when DDGS was included in the diet (Tangendjaja and Chien, 2007).

Proximate composition of feed during the trial period is presented in Table 3. The expected composition of the feed is in closed agreement with calculated analyses presented in Table 1, except fat content was considered much lower than expected and protein was only 26% while calculated analyses was 29%. Lower result of fat content in the feed was related with the method of analyses of fat that was measured by ether extract. It was suggested that for extruded feed, the fat content should be analyzed using acid hydrolyses method prior to extraction. Result of analyses indicated a higher ash level but lower protein level in the feed compared to table 1 and it might be related with the use of meat and bone meal and/or fish meal in the diet.

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Picture of extruded feed containing different level of DDGS is presented in Figure 2. Increasing level of yellow DDGS in the diet affected the color of pellet. The pellet color was lighter as the level of DDGS increased and it was related with the yellow color of DDGS derived from yellow corn. The color of DDGS can be varied depending upon the raw materials used in ethanol production and DDGS derived from wheat is normally darker color than that derived from yellow corn.

Table 3. Proximate composition of feed containing different level DDGS

Feed	Protein %	Lipid(%)	Ash %
DDGS 0%	25.00	1.58	11.11
DDGS 5%	25.23	1.51	10.39
DDGS 10%	25.73	1.25	10.28
DDGS 15%	25.97	1.73	10.86

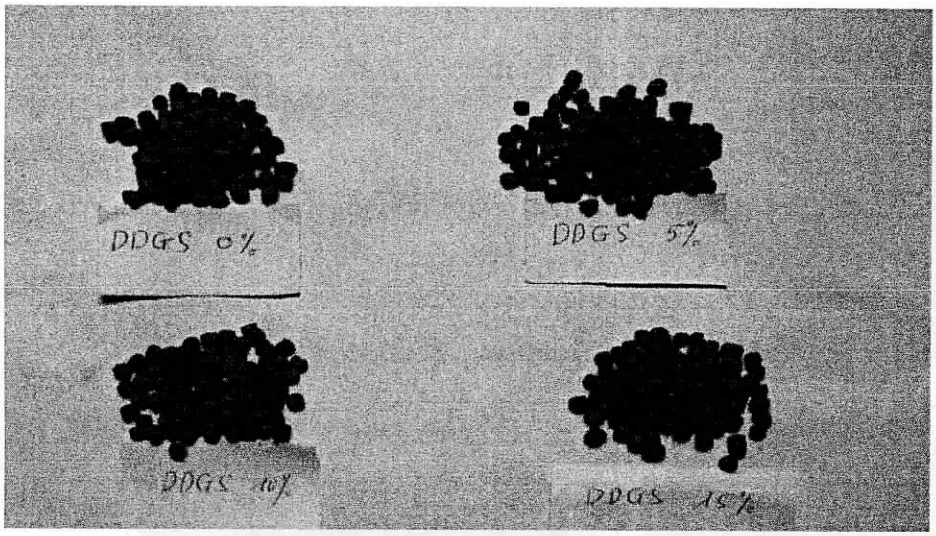

Figure 2. Pellet color of fish feed containing different level of DDGS
Features: 0% DDGS: Dark brown; 5%DDGS:Brown; 10%DDGS: light brown; 15% DDGS pale yellow

Chemical composition of the fishes fed different level of DDGS is presented in Table 4 while color of fish meat is shown in Figure 3.

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

Table 4: Nutritional composition of Common Carp meat fed different level of DDGS

Treatments	Moisture (%)	Protein (%)	Fat (%)
DDGS 0%	68.8	16.3	14.5
DDGS 5%	68.1	16.4	13.9
DDGS 10%	68.1	16.4	13.8
DDGS 15%	68.6	16.6	13.2

SEM	0.8	0.4	0.5

SEM = standard error means

Results of analyses indicated that there is no different in composition of the fish after feeding diets containing different level of DDGS. Fat content in whole fish was not different among the treatment and similar to protein content. DDGS has been reported to contain higher xantophyll level than that found in corn. The yellow color in DDGS may have an effect to color of the flesh; however color of fish is not affected by feeding DDGS as presented in Figure 3.

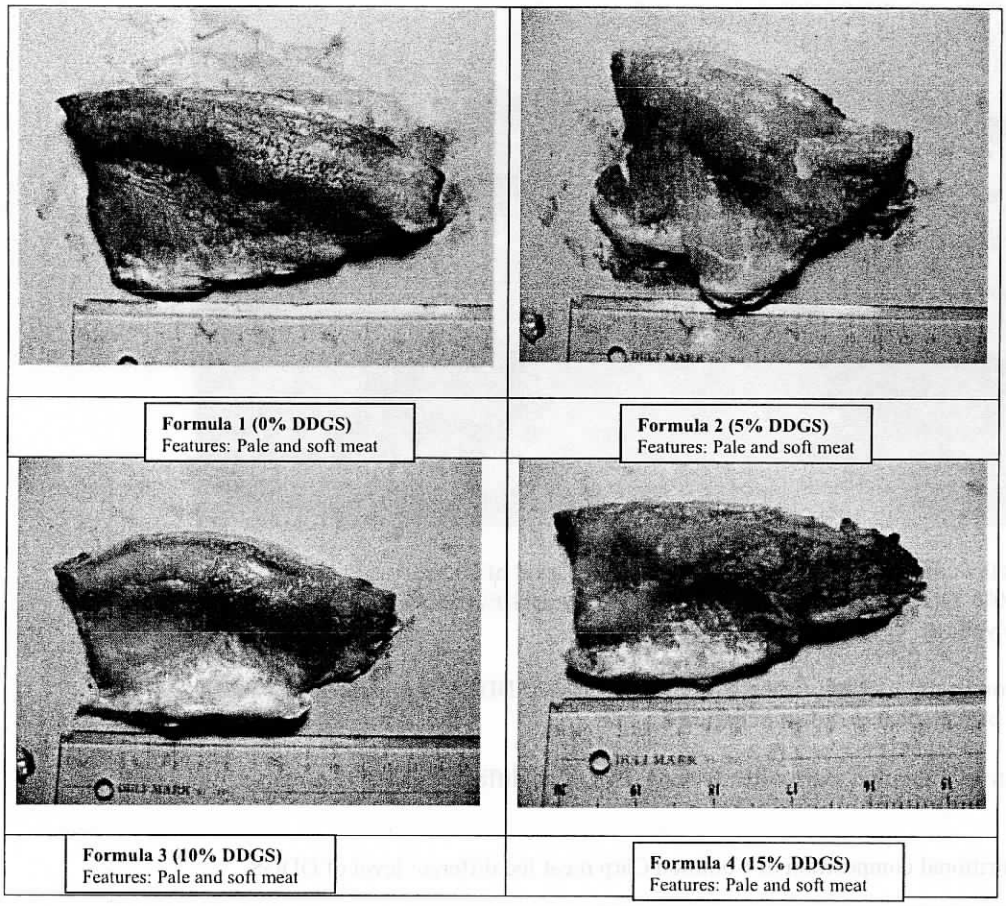

Figure 3. Picture of Common Carp flesh after feeding DDGS at different level for 3 months

Conclusion

DDGS can be fed to growing common carp to 15%; however there is an indication that feeding at 10%-15% gave a faster growth rate than that fed 0% and 5%. Feeding DDGS up to 15% in the diet for 3 months did not affect fish chemical composition and color of fish.

Acknowledgements

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