EVALUATION OF FARMMADE DIETS CONTAINING DISTILLERS DRIED GRAINS WITH SOLUBLES ON NILE TILAPIA PRODUCTION IN COMMERCIAL EARTHEN PONDS.

R.M. Abou-Zied and M.M.E. Hassouna

Animal Production Department, Faculty of Agriculture, Fayoum University, Egypt.

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SUMMARY

A total number of 425000 fingerlings of mono sex Nile tilapia, *Oreochromis niloticus*, of 5.5 g initial body weight were randomly allotted equally in 17 earthen ponds , one feddan each, in commercial farm at Behera Governoratr. Fish were fed three diets. The first two are farm made diets contained Distiller's dried grains with solubles (DDGS) at 30% of diet and 25% of plant protein percentage without or with local fish meal (T1& T2 respectively, 5 ponds each). The third one was a manufactured diet (in 7 ponds). Fingerlings were housed for 255 days; feed was offered 3 times daily at the rate of 5% of body weight during the first 30 days and then decreased to 3% for six days a week until harvesting. Farm made diets were formulated using mixer and simple piston. Data collected were on growth performance, feed utilization, survival rate and economic efficiency. Results showed that diets with DDGS without local fishmeal recorded the highest economic efficiency followed by that contained fish meal, then the manufactured one. However final body weight, weight gain, average daily gain and specific growth rate was the best with the manufactured diet.

Keywords: *DDGS; Growth performance; feed utilization; economic efficiency and Nile tilapia (Oreochromis niloticus)*

INTRODUCTION

Feed is generally the largest expenditure in semi intensive and intensive tilapia culture operations, and protein is the most expensive component of feeds. Efforts to reduce feed costs have resulted in increased use of plant proteins in diet formulations as replacements of expensive animal ingredients.

The DDGS product has moderate protein content (30% crude protein) with fewer antinutritional factors but a higher fiber content than is found in commonly used plant protein sources. At present, DDGS are widely used as a protein supplement in terrestrial animal feeds. Results of earlier studies based on growth performance and feed utilization efficiency, indicated that DDGS is a good ingredient in feeds for several fish species, including rainbow trout *Oncorhynchus mykiss* (Cheng and Hardy 2004), channel catfish *Ictalurus punctatus* (Tidwell *et al.* 1990; Webster *et al.* 1991, 1992a, 1992b; 1993; Li and Robinson 2007; Lim *et al.*, 2009; Li *et al.*, 2010: Xhou 2010 and Li *et al.*, 2011), and tilapias *Oreochromis spp.* (Wu *et al.* 1996; Lim *et al.* 2007; Lim and Yildirim-Aksoy 2008; Shelby *et al.* 2008)

In Egypt the manufactured feed are costly and its ingredients are insufficient enough. Commercial farms tried to make their diets using simple machines like (quern, mixer and piston) especially in Kafr El-Sheikh and Behera Governorates. They reduced the selling prices by about LE 1000/ton. Therefore, the present study aimed to compare two formulated diets in fish farms with that manufactured in a factory regarding Nile tilapia production with simple economic evaluation.

MATERIALS AND METHODS

This study was conducted at a commercial farm located in Behera Governorate, Egypt where it started at the first week of April 2010 and terminated at the second week of December 2010 (255 days period).

Experimental Fish:

A total number of (425000) mono sex Nile tilapia *(Oreochromis niloticus)* fingerlings of 5.50 ± 0.28 g initial body weight in average that obtained from nursing pond located at the same farm, in Behera Governorate Egypt. The fish were allotted randomly into 17 earthen pond (one feddan/each). Accordingly 25000 fish were stocked/ each earthen pond. They represented two formulated diets (T1 &T2) each in 5 replicates each 7 replicates for the and third manufactured diet in 7 ponds (T3).

Experimental Dietary treatments:

Three diets were used to compare between manifactured diet (T_3) and two formulated diets (T_1 and T_2) using mixer and simple piston, Table 1. The first and second diets were formed in the farm by using DDGS at 30% of diet. The first diet had no animal protein and the second contained 20% local fishmeal. Each diet contained 30.2% CP and 3.536 kcal/g ME. Diets were fed to fish at a rate of 5% of the total body weight at the first month then decreased to 3% until harvesting (255 days duration). Fingerlings were fed 3 times daily at 8 and 11 am and 4 pm 6 days / week. Feed amount was adjusted every 21 days intervals in response to fish weight (fasted 24 h).

Table (1): Composition and proximate analysis of feed (on as fed basis).

Item	Treatments		
	T_1	T_2	T_3
Ingredients			
Local fish meal 36 CP%	0.0	20.0	
Soybean meal 44 CP%	45.0	30.0	
DDGS 26 CP%	30.0	30.0	
Wheat bran 12.5 CP%	24.0	19.0	
Vitamin & minerals	1.0	1.0	
Chemical composition			
DM	89.11	89.91	91.52
Crude protein, CP	30.21	30.21	30.34
Ether extract, EE	6.69	9.34	7.42
Ash	6.68	10.13	7.33
Crude fiber, CF	7.85	6.35	6.87
Nitrogen free extract, NFE[1]	37.68	33.88	39.56
GE, kcal/g[2]	4.136	4.159	4.246
Metabolizable energy, Kcal/g[3]	3.494	3.525	3.590

1. Calculated by differences. NFE = OM -(CP + EE + CF)

2. Calculated according to NRC, 1993.

3, Metabolizable energy (ME):- calculated using values of 4.50, 8.15 and 3.49 K Cal for protein, fat and carbohydrate, respectively according to Pantha (1982).

@ Joetrade manufactured diet diet.

Growth, feed and economic parameters:

Growth parameters were initial weight (IW), final weight (FW), average weight gain (AWG), daily gain (ADG), specific growth rate (SGR), feed conversion ratio (FCR), feed intake(FI), survival rate (SR) and net returns.

Analytical Procedure:

Experimental diets were analyzed for their proximate composition in triplicates following the methods described by AOAC 1995. The Metabolizable energy (ME) content of the tested diets were calculated using values of 4.50, 8.15 and 3.49 Kcal for protein, fat and carbohydrate respectively according to Pantha (1982). Water temperature, pH and dissolved oxygen (DO) throughout experimental periods were measured periodically in the morning and at noon by centigrade thermometer, Orion digital pH meter model 201 and oxygen meter, Cole Parmer model 5946 and Hanna instruments ammonia test kit (HI 4829) respectively.

Statistical Analysis:

Data were statistically analyzed in a one- way analysis of variance using SPSS (1997). Mean of treatments were compared by Duncan (1955) multiple range test when the variance analysis was significant.

RESULTS AND DISCUSSION

Water quality:

Water quality parameters measured were suitable for the normal growth of tilapia. Average values recorded for temperature, pH, DO and total ammonia-nitrogen were: 28.5 ± 1.0 °C, 7.8 ± 0.4, 6.3 ± 0.8 mg/L and 0.12 mg/L, respectively. Such trend was mentioned by Tahoun 2007; Khalfalla *et al.* 2008 and Stickney 1986.

Growth performance:

Data obtained from this trial are presented in Table 2. There were no significant differences ($P<0.05$) in initial weight and SGR among fish fed different diets.

Final mean weight, weight gain and average daily gain were significantly ($P<0.05$) better with manufactured diet, T_3, while lower values were recorded with T_1 and T_2. These results may be due to increasing digestible values of extruded manufactured diet while the formulated diets which contain DDGS probably need to be more balanced.

This study demonstrated DDGS, when used in combination with local fishmeal, to be a suitable protein source for tilapia diets at 30% of the diet. Results demonstrated that 30% DDGS with or without local fishmeal can be used as a suitable protein source for Nile tilapia in general as mentioned by different workers. Lim *et al.*, 2007, Webster *et al.*, 1991 and Xhou *et al.*, 2010 suggested that growth in channel catfish juveniles fed diets with 35-40% DDGS was equivalent to fish fed a standard commercial anufactured formulation. In a follow-up study, Webster *et al.* (1992a, b) reported no differences in growth or survival in channel catfish fed diets containing 35% DDGS and either 0%, 4%, 8%, or 12% fish meal, indicating that a diet with all plant protein sources can totally replace fish meal in channel catfish diets without sacrificing weight gain or FCR. Coyle *et al.* (2004) found that Nile tilapia fed a combination of 30% DDGS +8% fishmeal did not significantly differ in growth response from a reference diet while fish fed a diet containing 30% DDGS +46% soybean meal had significantly lower WG and PER and significantly higher FCR.

Table (2): Effect of feeding DDGS on productive performance of Nile tilapia through the experimental period.

Parameters	Treatments			SED
	T_1	T_2	T_3	
Initial mean body weight, g	5.40	5.40	5.70	0.790
Final mean body weight, g	255^{b}	234^{c}	270.70^{a}	5.322
Weight gain, g [(1)]	249.60^{b}	228.60^{c}	265.0^{a}	5.282
Average daily gain, g [(2)]	1.000^{a}	0.917^{b}	1.060^{a}	0.020
SGR, % /day[(3)]	1.52	1.48	1.52	0.055

** Average in the same row having different superscripts differ significantly P≤0.05.*

** SED is the standard error of difference*

Experimental period = 255 days

(1) = Final weight - Initial weight

(2) = Weight gain, g /period in days.

(3) = 100 (ln Final weight-ln Initial weight)/period in days, where ln is the natural log.

Feed utilization:

Feed intake, feed conversion ratio (FR) and survival rate of fish fed the three different diets are shown in Table 3. Feed intake significantly decreased with manufactured diet T_3 and increased gradually in T_1 and T_2. FCR values were significantly different between treatments ($P<0.05$), the best FCR was recorded in T_3 (commercial diets). The lowest FCR was recorded with T_2 (DDGS + local fishmeal). These results agreed with the results of Robinson and Lim (2008) and Zhou *et al.* (2010) who obtained significantly better FCRs in channel catfish fed on SBM plus DDGS diet compared with those fed SBM basal diet. Ingledew (1999) estimated that 3.9% of the total biomass of DDGS was yeast, with 5.3% of the protein content contributed by yeast protein. Yeasts are rich in protein, B-complex vitamins, and b-glucans. Therefore, fermentation could increase the digestibility of plant dietary protein sources.

Table (3): Effect of feeding DDGS on feed utilization of Nile tilapia through the experimental period.

Parameters	Treatments			SED
	T_1	T_2	T_3	
Feed intake, g/fish	497[a]	512[a]	469.5[c]	9.54
FCR	1.99[b]	2.24[a]	1.77[c]	0.046
Survival rate%	95.65[a]	92.60[b]	95.71[a]	1.361
Feed intake, ton/pond	11.885	11.852	11.234	

** Average in the same row having different superscripts differ significantly P≤0.05.*
** SED is the standard error of difference*

Economic evaluation:

The effect of diets containing DDGS compared with manufactured diet on economic evaluation is shown in Table 4. Although the increase in growth performance parameters and feed utilization of the manufactured diet (T_3), the net returns of fish fed diets contained DDGS improved net returns with the plant protein diet (T_1) followed by T_2, respectively, these results followed the same direction of Coyle *et al.* (2004).

Table (4): Effect of feeding DDGS on economic efficiency of Nile tilapia through the experimental period.

Parameters	Treatment		
	T_1	T_2	T_3
Costs, L.E/pond			
Feed	29715	27260	35950
Fish	5000	5000	5000
Other costs	6500	6500	6500
Total costs, L.E.	41215	38760	47450
Pond biomass, kg	6096	5419	6478
Selling price, L.E/ pond	48768	43352	51824
Net returns/pond	7553	4592	4374

Price of one kg selling fish = 8 L.E
Price of kg feed = 2.50, 2.30 and 3.20 L.E. for diet 1, 2 and 3 respectively

In conclusion feed formulated in the farm using DDGS at 30% considered cheaper than that purchased from factories, fish sizes ranging from 250-350 g have the same price in the sale and thus differences in feed cost is added to the economic benefit of feed formed in the farm.

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تقييم علائق مجهزة بالمزرعة تحتوى نواتج تقطير الحبوب مع سوائلها على إنتاجية البلطي النيلى فى أحواض أرضية تجارية.

رمضان محمد أبوزيد و محمد حسونة.

قسم الإنتاج الحيوانى- كلية الزراعة - جامعة الفيوم- مصر.

وزع 425000 إصبعية بلطي نيلي أحادى الجنس (بوزن ابتدائي 5 جم/ الإصبعية) بالتساوي عشوائيا إلى 17 حوض أرضى (كل منها واحد فدان) بمزرعة تجارية بمحافظة البحيرة. وغذيت الأسماك على ثلاثة علائق . اثنان منها يحتويان على نواتج تقطير الحبوب مع سوائلها (تم تجهيزها باستخدام خلاط ومكبس) بمعدل 30% من العليقة و 25% من البروتين النباتي بدون (معاملة أولى) أو مع مسحوق سمك محلى (معاملة ثانية) حيث وضعت العليقة الأولى في 5 أحواض والثانية في 5 أحواض أخرى، ووضعت العليقة الثالثة المصنعة في 7 أحواض. وغذيت الأسماك بمعدل 5% خلال الثلاثين يوم الأولى ثم غذيت بمعدل 3 % 6 مرات أسبوعيا حتى الحصاد بعد 255 يوم. أخذت بيانات عن النمو والانتفاع بالغذاء ومعدل البقاء والكفاءة الاقتصادية.

أوضحت النتائج أن العليقة التى احتوت نواتج تقطير الحبوب مع سوائلها بدون إضافة مسحوق سمك كانت الأفضل من الناحية الاقتصادية. ولكن من ناحية النمو كانت العليقة المصنعة بالمصنع هي الأفضل.