*J. Agric. Sci. Mansoura Univ., 29 (1): 73 - 82, 2004*

# UTILIZATION OF INEDIBLE DRIED DROPPING DATES AS A DIETARY ENERGY SOURCE FOR BLUE TILAPIA (*Oreochromis aureus*) REARED IN ENCLOSURE NETS.

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## ABSTRACT

Feeding experiment was conducted in enclosure nets (100 X 100 X 100 cm in diameter) to assay partial and total substitution of inedible dried dropping dates (IDDD) without kernels instead of yellow corn for blue tilapia *Oeochromis aureus* (11.5 g/fish). Five isonitrogenous diets (30 % crude protein) were formulated with different substitution levels of 0, 25, 50, 75 and 100 % IDDD. The experimental diets were fed to duplicate groups of fish at a feeding rate of 2.5 % of body weight. The experiment lasted for fourteen weeks starting at 1st August. The results indicated that the chemical composition of IDDD was almost similar to yellow corn. The higher values of growth performance, feed intake, protein efficiency ratio and carcass crude protein were recorded by fish received diets contained IDDD up to 50 % from yellow corn. Meanwhile, the higher values of feed conversion , protein productive value, carcass dry matter content and gross energy were recorded by fish received diets contained IDDD 25 %. With increasing the level of IDDD in the diet; energy utilization and ether extract decreased while carcass ash increased comparing to the control diet. Economically, with increasing the inclusion of IDDD in the diet the cost/Kg fish gain decreased. Finally the study suggested that IDDD could replace up to 50 % of yellow corn in the diet of blue tilapia without any retardation in either growth performance or feed utilization.

**Keywords:** *Date, Tilapia and Growth.*

## INTRODUCTION

Blue tilapia, *Oreochromis aureus*, normally a drab-colored fish, turns blue with a red margin on caudal and dorsal fins as it approaches breeding age, and is therefore called the blue tilapia. This fish naturally feeds on both plankton and benthic organisms. It is more tolerant of salt and low temperature than other species (Landau, 1992). Adult blue tilapia are omnivorous fish, fry feed mainly on zooplnkton (Moriarty and Moriarts, 1973, Bowen, 1980 and Philippart and Ruwet, 1982 ). In the intensive farming of tilapia, the fish obtain the majority of their food from artificial feed and thus their growth can be related to the qualitative and quantitative of feed intake (Davis and Stickney, 1978). One of the reasons proposed for the higher dietary protein requirements of fish compared to terrestrial animals is that fish catabolise protein as an energy source, rather than depositing it as growth (Mertz, 1969). In terms of kilocalories of energy supplied, protein is the most

expensive source of energy and thus the aim in fish feeding is to maximise the utilization of protein for growth by supplying adequate amounts of alternative dietary energy source (Shiau and Huang, 1990). Tilapia can be expected to utilize dietary carbohydrates more efficiently than carnivorous fish (Yone, 1979). Carbohydrates are the least expensive source of dietary energy and are available in many tropical and sub tropical countries (El-Sayed and Teshima, 1991). Of all the plant energy sources of feedstuffs, yellow corn is considered to be the most nutritious and is used as the major carbohydrate source in many fish diets. Large proportion of animal feed ingredients is imported, e. g. fish meal, yellow corn, so foreign currency is spent by the government to import such ingredients. Therefore, encouraging production of local and non-conventional ingredients should be given primary importance (Ghazalah, *et al.*, 1998). Date palm has a wide range of existence in Arab region and Egypt especially in Siwa Oasis. Inedible dried dropping dates are candidate to play a rule in yellow corn substitution, as a non-conventional and cheap energy source containing 7.32, 5.18 and 73.9 % crude protein, ether extract and nitrogen free extract, respectively (Srour *et al.*, 2002). Therefore, the aim of the present study is to determine the influence of partially and totally substitution of inedible dried dropping dates without kernel instead of yellow corn as an energy source in the diets of blue tilapia, *Orechromis aureus*, reared in enclosure nets.

## MATERIALS AND METHODS

The experimental work of the present study was carried out in a private farm situated in Merghem region in west Alexandria, to determine the influence of partially and totally substituting of inedible dried dates for yellow corn as an energy source in the diet of tilapia (*Oeochromis aureus*).

### Fish and Culture Facilities

Tilapia (O. *aureus*) fingerlings averaging (11.5 g/fish), obtained from Maryot lake were used in the present study. One earthen pond of 0.5 feddan, 1 meter in depth (80 cm depth of water allowance), contained 10 enclosure nets (100 X 100 X 100 cm in diameter) were used in the present experiment. The enclosure nets were randomly stocked at a rate of 10 fish/enclosure net, with two replicates per treatment. Fish from each replicate were weighed at the start of each experiment and henceforth counted and weighed every 2 weeks. About 20 fish were frozen for initial proximate body chemical analysis. About 10 % of the earthen pond water were continuously changing every day. The experiment lasted for fourteen weeks starting at 1$^{st}$ August.

### Experimental Diets

Inedible dried dropping dates (IDDD) were collected from Siwa Oasis and transported to Alexandria. The kernels were removed from IDDD, then IDDD washed, and dried again (70° C for 24 hrs) before incorporated into various treatments. Five isonitrogenous experimental diets (30 % protein) were formulated,where yellow corn was substituted by 0, 25, 50, 75 and 100

% of IDDD without kernel (Table 2). All ingredients were finely ground, mixed well and completed with essential vitamins and trace minerals (NRC, 1993). The oil was added, a few drops at a time, during mixing, warm water (45° C) was slowly added under continuous mixing until the diets began to clump. The diets were formulated in small diameter (5.0 mm) pellets using a commercial meat mincer 3 times, and oven dried at 80° C for 24 hrs in a drying oven. The diets were fed to the experimental fish two times a day (at 10:00 and 14:00 hr) at a rate of 2.5 % of live body weight (readjusted every two weeks) on feed dry weight basis (6 days a week).

**Samples Collection and Analysis**

At the termination of the experiment, fish were collected, weighed and counted per each replicate from each treatment and kept frozen for whole-body composition analysis. Fish samples were pulverized, autoclaved and after words homogenized with ultra-tunax. The homogenized samples were oven dried at 60 – 80° C for 48 hrs. Body composition and chemical analysis of fish and feeds were performed using standard AOAC (1990) methods. All data were analyzed for statistical significance by using analysis of variance ( SPSS/PC program). Multiple comparisons among means were made with the Duncan's Multiple range test (Puri and Mullen, 1980).

## RESULTS AND DISCUSSION

A comparison between the proximate chemical analysis of yellow corn and inedible dried dropping dates (IDDD) is shown in Table 1. The results revealed that IDDD and yellow corn were almost similar in the contents of crude protein (CP), crude fiber, nitrogen free extract (NFE) and gross energy. However, yellow corn contained higher dry matter, ether extract and ash content than IDDD. These findings are in partial agreement with the findings of Omar and Nour (1993). Whilst the obtained results are differ somewhat in dry matter, crude fiber, NFE and gross energy with the findings of Srour *et al.* (2002), this difference may attributed to the use of IDDD without kernel in the present study.

**Table (1). Proximate chemical analysis (%) of yellow corn and inedible dried dropping dates (IDDD).**

| Ingredient | DM (%)[1] | On DM basis (%) | | | | | Gross energy Kcal/100g DM[3] |
|---|---|---|---|---|---|---|---|
| | | Crude protein | Ether Extract | Ash | Crude Fiber | NFE[2] | |
| Yellow corn | 89.14 | 8.00 | 06.4 | 4.65 | 3.90 | 77.05 | 422.21 |
| IDDD | 82.55 | 7.85 | 5.32 | 2.75 | 4.12 | 79.96 | 423.13 |

[1]DM = Dry matter.
[2]NFE = Nitrogen free extract.
[3]Gross energy, calculated on the basis of 5.64, 4.11 and 9.44 Kcal GE/g protein, NFE and lipid, respectively (NRC, 1993).

The composition and proximate analysis (%) of the experimental diets used in the experiment are shown in Table 2. The experimental diets were almost isonitrogenous and isoenergetic, about 30.124 % and 455.42

Kcal/100 g, crude protein and gross energy, respectively. The mean value of protein to energy (P:E) ratio was 66.15 mg protein/Kcal gross energy.

**Table (2): Ingredient and nutrient composition of the experimental diets containing different levels of inedible dried dropping dates (IDDD).**

| Ingredient | Diet[1] | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Fish meal | 23.00 | 23.00 | 23.00 | 23.00 | 23.00 |
| Soybean meal | 29.00 | 29.00 | 29.00 | 29.00 | 29.00 |
| Yellow corn | 45.00 | 33.75 | 22.50 | 11.25 | - |
| IDDD | - | 11.25 | 22.50 | 33.75 | 45.00 |
| Corn oil | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Vit. & Min[2]. | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| **Chemical composition %:** | | | | | |
| Dry matter (DM) | 90.70 | 90.80 | 90.77 | 90.55 | 90.45 |
| **Nutrient (%), on dry matter basis:** | | | | | |
| Crude protein | 30.15 | 30.12 | 30.11 | 30.14 | 30.10 |
| Ether extract | 9.41 | 9.40 | 9.40 | 9.39 | 9.37 |
| Crude fiber | 4.33 | 4.25 | 4.16 | 4.07 | 3.98 |
| Ash | 8.87 | 8.65 | 8.44 | 8.23 | 8.01 |
| Nitrogen free extract | 47.24 | 47.57 | 47.89 | 48.21 | 48.56 |
| Gross energy (Kcal/100g) | 453.03 | 454.13 | 455.38 | 456.77 | 457.80 |
| Protein/Energy Ratio (mg/Kcal)[3] | 66.55 | 66.33 | 66.12 | 65.98 | 65.75 |

**[1]Diets 1, 2, 3, 4 and 5 contained 0, 25, 50, 75 and 100 % IDDD replacing yellow corn, respectively.**

**[2]Meveco premix Co. (Abou Sultan, El-Esmaaelia), Vit. & Min., every 1.5 kg contain Vit. A 125 million IU, $D_3$ 3 million IU, E 15 g, $K_3$ 2.5 gm, $B_1$ 1.5g, $B_2$ 5 g, $B_6$ 2 g, Pantothanic acid 10g, $B_{12}$ 0.01g, Nicotinic acid 30g, , Folic acid 1.2 g, Fe 30g, Mn 60g, Cu 10g, I g, Cobalt 0.25 g, Se 10 g and Zn 55g.**

**[3]Gross energy, calculated on the basis of 5.64, 4.11 and 9.44 Kcal GE/g protein, NFE and lipid, respectively (NRC, 1993).**

The effects of dietary IDDD replacement levels instead of yellow corn on growth performance of blue tilapia (*O. aureus*) are illustrated in Table 3. The results showed that the higher values of growth performance were recorded by fish received diets contained IDDD up to 50 %. There were insignificantly ($P > 0.05$) differences among the fish received diets contained 0, 25 and 50 % IDDD instead of yellow corn.Similarly, insignificantly ($P > 0.05$) differences were found between the fish received diets contained 75 and 100 % IDDD. However, there was a significantly ($P < 0.05$) difference between the two fish groups. Meanwhile there was insignificantly ($P > 0.05$) difference between fish received diets of 50 and 75 % IDDD in specific growth rate % (SGR %). Similar results have been obtained by Srour *et al.* (2002) with catfish (*Clarias gariepinus*). The same authors found that ADG and SGR % were significantly higher in fish fed 25 % DDD instead of yellow

corn compared to the control diet with 100 % yellow corn. Similarly, Yousif *et al.* (1996) found that blue tilapia fed diet contained 25 % of date had higher growth performance than the control diet contained 100 % yellow corn. Also, Omar and Nour (1993) found that incorporation of 25 % immature dates fruit dropping (IDF) in the diets of Nile tilapia (*O. niloticus*) resulted in a significantly lower growth performance compared to the control diet (100 % yellow corn).

**Table (3): Growth performance of blue tilapia (*O. aureus*) fed on the experimental diets containing different levels of inedible dried dropping dates (IDDD).**

| Diet No. | Levels of IDDD % | Initial weight (g/fish) | Final weight (g/fish) | Gain (g/fish) | ADG[1] (mg/fish/day) | SGR[2] (%/day) |
|---|---|---|---|---|---|---|
| 1 | 0 | 11.5 | 41.25[a] | 29.75[a] | 303.57[a] | 1.27[a] |
| 2 | 25 | 11.5 | 39.85[a] | 28.35[a] | 289.30[a] | 1.20[a] |
| 3 | 50 | 11.5 | 39.05[a] | 27.55[a] | 281.10[a] | 1.17[ab] |
| 4 | 75 | 11.5 | 35.40[b] | 23.90[b] | 243.85[b] | 1.08[bc] |
| 5 | 100 | 11.5 | 34.25[b] | 22.75[b] | 232.15[b] | 1.04[c] |

**Means in each column not sharing the same superscript are significantly different ($P< 0.05$).**

**ADG[1] = Average daily gain (g/fish/day): gain/experimental period.**

**SGR[2] = Specific growth rate (%/day): ($ln\ wt-ln\ wi/T) \times 100$, where *wt* is weight of fish at time *t*, *wi* is weight of fish at time 0, and *T* is the experimental period in days.**

Srour *et al.* (2002) found insignificant different in the growth (final weight and weight gain) between Nile tilapia fed diet contained 25 % DDD instead of yellow corn and the control diet contained 100 % yellow corn . The present study demonstrated that blue tilapia could utilize up to 50 % IDDD instead of yellow corn without any retardation in growth. The higher utilization of blue tilapia from the diet contained 50 % IDDD may be related to several factors. First, the dates in the present study were used without kernels and this may increase the diet palatability. Second ,the occurrence of natural food besides the artificial diet in the present experiment enabled the fish to utilize from each feed. Finally, Blue tilapia may utilize IDDD as an energy source more better than Nile tilapia.

Results presented in Table 4 showed the effects of dietary IDDD replacement levels instead of yellow corn in the diet of blue tilapia (*O. aureus*) on feed and nutrient utilization. Fish received diets contained 0, 25 and 50 % IDDD recorded higher feed intake values than that contained 100 % IDDD instead of yellow corn. Insignificant ($P > 0.05$) differences were noticed among fish had diets contained 0, 25 and 50 % IDDD also among those contained 75 and 100 IDDD instead of yellow corn in protein efficiency ratio (PER). Regarding the feed conversion ratio (FCR) and protein productive value % (PPV %), there were insignificantly ($P > 0.05$) differences between fish received diets contained 0 and 25 % and also between 75 and 100 % IDDD replacement diets. However, there was a significantly ($P < 0.05$) difference between the two groups. An over look to energy utilization (EU),

the results indicated that with increasing the level of IDDD substitution in the diet instead of yellow corn EU decreased. The obtained results are in agreement with those obtained by Yousif *et al.* (1996) on blue tilapia. Feed was utilized more efficiently at lower level of dried dropping dates (25 %) and tilapia were able to consume more feed when they fed at low level of DDD (Srour *et al.*, 2002). Moreover, the values of protein and energy utilization of Nile tilapia (*O. niloticus*) and Catfish (*C. gariepinus*) were decreased as DDD increased. Omer and Nour (1993) reported that feed and nutrients utilization by Nile tilapia fed diets contained different varieties of IDF were similar to corn grain diet and the differences between them were insignificant.

**Table (4): Feed and nutrients utilization of blue tilapia (*O. aureus*) fed on the experimental diets containing different levels of inedible dried dropping dates (IDDD).**

| Diet No. | Levels of IDDD % | Feed intake (g/fish) | FCR[1] | Protein utilization | | EU[4] % |
|---|---|---|---|---|---|---|
| | | | | PER[2] | PPV[3] % | |
| 1 | 0 | $41.19^{a}$ | $1.39^{a}$ | $2.35^{a}$ | $37.39^{a}$ | $26.84^{a}$ |
| 2 | 25 | $39.93^{a}$ | $1.41^{ba}$ | $2.32^{a}$ | $37.06^{a}$ | $26.26^{b}$ |
| 3 | 50 | $39.3^{ab}$ | $1.43^{b}$ | $2.31^{a}$ | $34.16^{b}$ | $23.69^{c}$ |
| 4 | 75 | $36.6^{bc}$ | $1.54^{c}$ | $2.18^{b}$ | $31.70^{c}$ | $21.60^{d}$ |
| 5 | 100 | $35.19^{c}$ | $1.55^{c}$ | $2.16^{b}$ | $30.74^{c}$ | $02.95^{c}$ |

**Means in each column not sharing the same superscript are significantly different ($P< 0.05$).**

**[1]FCR = Feed conversion ratio: total dry diet fed (g)/total wet weight gain (g).**

**[2]PER = Protein efficiency ratio: wet weight gain (g)/amount of protein fed (g).**

**[3]PPV = Protein productive value (%): $(P-P_0)\ 100/P_i$ where $P$ is protein content in fish carcass at the end of the experiment, $P_0$ is the protein content in fish carcass at start of experiment and $P_i$ is the protein in feed intake.**

**[4]EU = Energy utilization (%): $(E-E_0)\ 100/E_i$ where $E$ is the energy in fish carcass (Kcal) at the end of the experiment, $E_0$ is the energy in fish carcass (Kcal) at the start of the experiment, and $E_i$ is the energy in feed intake (Kcal).**

Dates contain about 70-80% simple sugars (glucose and fructose). Carbohydrate utilization by fish varies and remains obscure (Shiau and Peng, 1993 and Wilson, 1994). It is well known that herbivorous and omnivorous fish can efficiently utilize dietary carbohydrates and therefore these fish are cultured practically with diets containing large amounts of carbohydrates (Shimeno *et al.*, 1979). Tilapia species have been demonstrated to utilize complex carbohydrates, such as dextrin or starch, for growth more readily than simple sugars such as glucose (Shiau and Lin, 1993). Conversely, the high fiber content of the dried fresh date fruits may have affected the availability of nutrients to fish in the higher levels (75 and 100 % IDDD instead of yellow corn in diets).

The effects of partial or total dietary substitution of IDDD instead of yellow corn on carcass composition of blue tilapia, *O. aureus*, are shown in Table 5. The results indicated that there were insignificantly ($P > 0.05$) differences between fish received diets contained 0 and 25 % IDDD,and also among fish received diets contained 50, 75 and 100 % IDDD in carcass dry

matter. Meanwhile, there was a significantly ($P < 0.05$) difference between the two groups. Similarly, insignificant differences were noticed among fish fed diets contained 0, 25 and 50 % IDDD, also among fish fed diets contained 50, 75 and 100 % IDDD in crude protein. Whilst, significant ($P < 0.05$) differences between the group of fish had 0 or 50 and 75 or 100 % IDDD instead of yellow corn were observed. Furthermore, there were significantly ($P < 0.05$) differences between fish received the control diet (100 % yellow corn) and the fish fed other diets that contained different levels of IDDD in carcass ether extract. Moreover, as the level of IDDD increased , carcass ash content increased. Also, insignificant ($P > 0.05$) difference was noticed between fish received diets contained 0 and 25 % IDDD in gross energy. However, a significantly ($P < 0.05$) difference was recorded between this group and the fish fed the other levels of IDDD in the diets. The present results are in partial agreement with the findings of Omar and Nour (1993). Srour *et al.* (2002) showed significant increases in dry matter, crude protein, ether extract and energy content, however ash content decreased as compared with the initial fish body composition. Conversely, Yousif *et al.* (1996) reported that increasing body protein content and decreasing fat were observed in *O. aureus* fed diets supplemented with date.

**Table ( 5): Carcass composition of blue tilapia ( *O. aureus*) fed on the experimental diets containing different levels of inedible dried dropping dates (IDDD).**

| Diets No. | Levels of IDDD % | Dry matter | % on dry matter basis | | | Gross energy (Kcal/100g) |
|---|---|---|---|---|---|---|
| | | | Crude protein | Ether extract | Ash | |
| Initial | | 23.8 | 52.80 | 27.48 | 19.72 | 558.01 |
| 1 | 0 | 27.60$^{a}$ | 54.40$^{a}$ | 28.90$^{a}$ | 16.70$^{d}$ | 580.47$^{a}$ |
| 2 | 25 | 27.75$^{a}$ | 54.20$^{a}$ | 28.25$^{b}$ | 17.55$^{c}$ | 573.20$^{a}$ |
| 3 | 50 | 26.50$^{b}$ | 53.50$^{ab}$ | 27.45$^{c}$ | 19.05$^{b}$ | 561.68$^{b}$ |
| 4 | 75 | 26.45$^{b}$ | 52.70$^{b}$ | 27.00$^{c}$ | 20.35$^{a}$ | 552.63$^{c}$ |
| 5 | 100 | 26.25$^{b}$ | 52.65$^{b}$ | 26.90$^{c}$ | 20.90$^{a}$ | 551.96$^{c}$ |

**Means in each column not sharing the same superscript are significantly different ($P< 0.05$).**

Data of feed cost required for production of one Kg gain of tilapia, *O. aureus*, fed various levels of IDDD instead of yellow corn are presented in Table 6. Results revealed that as the IDDD levels increased, the cost of feeds to produced one Kg gain of fish decreased and the change in feed cost/kg gain increased. The inclusion of IDDD into the diet at 25, 50, 75 and 100 % instead of yellow corn, resulted in decreasing feeding costs (LE/ton feed) with 4, 9, 13 and 18 %, respectively compared with the control diet (100 % yellow corn). The lowest cost of feed /Kg fish gain and the higher change in feed cost/ kg gain were 3.165 and 8.63 % with the diet contained 100 % IDDD instead of yellow corn, respectively. The change (%) in feed cost/ kg gain increased with increasing the level of IDDD in the diets. The present

results are in harmony with the findings of Srour *et al.* (2002) with Nile tilapia and catfish.

**Table (6). Cost (L.E) of feed required for production of one Kg gain of blue tilapia (*O. aureus*) fed diets containing different levels of inedible dried dropping dates (IDDD).**

| Diets No. | IDDD levels % | Feed cost (LE/ton feed) | Amount of feed /one Kg gain (Kg) | Cost of one kg fish gain (LE) | % Change in feed cost/ kg gain |
|---|---|---|---|---|---|
| 1 | 0 | 2492 | 1.39 | 3.464 | * |
| 2 | 25 | 2379 | 1.41 | 3.355 | 3.15 |
| 3 | 50 | 2267 | 1.43 | 3.242 | 6.41 |
| 4 | 75 | 2155 | 1.54 | 3.318 | 4.22 |
| 5 | 100 | 2042 | 1.55 | 3.165 | 8.63 |

*** Diet 1 used as a base for calculation.**
**Cost in LE/ton: Fish meal 5000, Soybean meal 2300, Yellow corn 1100, IDDD 100, Corn oil 5000 and Min. & Vit. mix. 8000.**

From the obtained results it could be concluded that growth performance and feed utilization suggested the use of IDDD instead of yellow corn up to 50 % in the diets of tilapia, *O. aureus*. The economical evaluation results showed that the cost of one Kg fish gain is in favor of increasing IDDD level in the diet up to the higher level, i.e. 100 % replacement. However, the 50 % substitution IDDD level could be accepted,since the cost/kg gain is 2.4 % higher that when 100 % IDDD was replaced yellow corn.

## ACKNOWLEDEMENT

This work is a part of a project on "Studies on Fish Culture in Merghem region" funded by Regional Councils for Agricultural Research and Extension, Agricultural Research Center, Ministry of Agric. & Land Recl., A.R.E.

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# الاستفادة من بلح التمر الغير صالح للأكل كمصدر للطاقة فى عليقة البلطى الحسانى المستزرع فى سياج شبكية.

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أجريت هذه الدراسة فى سياجات شبكية بأبعاد (١٠٠ X ١٠٠ X ١٠٠ سم) لتقدير مدى الاستفادة من إحلال بلح التمر (بدون النواة) الغير صالح للأكل محل الذرة الصفراء فى عليقة البلطى الحسانى (١١,٥ جم). فقد تم تكوين ٥ علائق متساوية فى محتواها من البروتين (٣٠ %) وبمستويات إحلال ٠ و٢٥ و٥٠ و٧٥ و١٠٠ بلح تمر غير صالح. غذيت الأسماك فى مكررتين وبمعدل تغذية ٢,٥ % من وزن الجسم. وكانت مدة التجربة ١٤ أسبوعا ابتداء من ١ أغسطس. وقد أشارت النتائج إلى تقارب قيم التحليل الكيماوى لكل من الذرة الصفراء وبلح التمر الغير صالح. وكانت أعلى قيم لكفاءة النمو وكمية الغذاء المستهلك و كفاءة البروتين والمحتوى من البروتين فى الأسماك المغذاة على علائق تحتوى حتى ٥٠ % بلح تمر غير صالح بدلا من الذرة الصفراء. بينما كانت أعلى قيم التحويل الغذائى ونسبة إنتاجية البروتين و المحتوى من المادة الجافة والطاقة فى الأسماك المغذاة على علائق تحتوى على ٢٥ % بلح تمر غير صالح بدلا من الذرة الصفراء. أيضا مع الزيادة فى معدل إحلال بلح التمر محل الذرة الصفراء قل معدل الاستفادة من الطاقة والمحتوى من الدهون وزاد المحتوى من الرماد. واقتصاديا كلما زاد معدل الإحلال كلما قلت تكلفة إنتاج الكيلو من الأسماك. وتقترح هذه الدراسة إمكانية إحلال التمر الغير صالح للأكل محل ٥٠% من الذرة الصفاء دون أى فقد فى النمو أو الاستفادة من الغذاء.