

FISH FOOD FORMULATION IN AQUAPONICS SYSTEM UTILIZING A REQUISITE PROTEIN SOURCES

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Abstract: Aquaponics is a consolidated culture of Aqua farming and agro farming. Toxic free organic food production is the main issue of this farming system. Fish, plant and bacteria are initial part of this system. Fish waste used in this system as a nutrient for crop production. Fish are fed with artificial feed for running this system cyclically. Protein is the basic nutritional element for growth of the fish in natural condition. Generally animal proteins are provided to any closed systems fish culture's for fulfil the desired protein level. In this site different sort of fish food are prepare for two different habitat Indigenous fish species. High quality plant proteins are mix with commonly found animal proteins, only for getting optimum fish production from this system. Moringa leaf, soya bean, milk powder, Egg yolk, dry shrimp meal, wheat flour are used as a protein source for making the fish food. Pearson's fish food formula are apply here for making the balanced protein diet for fish. Discharge of water is not possible in aquaponics system. So selection of specific protein sources and proper food will be assured to minimize the uneaten waste in this system.

Key words: Aquaponics, Protein Sources, Feed Formulation, Fish Habitat.

I. INTRODUCTION

Our farmers apply various kind of inorganic herbicide and pesticides for their crop production which destroy the life of our aquatic organisms, Run of these chemical fertilizers causes eutrophication of inland water bodies and near shore coastal water. Which creates obstruction of fish migration route (FAO, 1998). It destroy the Inland fish culture and fertility of the land naturally. Our agro and aqua farming seriously affected by this fact. Aquaponics can be solve the problem easily. In Aquaponics systems, pollution is drastically reduced because the water and wastes contained in this system are recycled instead of being dumped into the ground water. The fish and plants are grown in Intensive aboveground systems. As a result food is produced without the loss of valuable flatlands (Scott jones, 2002). The farming technique of aquaponics system is totally different from our traditional agro and aqua farming technique. Soil less plant culture are emerge here for avoid the soil born disease and keep the water pollution free. Water quality maintained up to quality control point. In this system fish, bacteria and plant play a significant role of running the whole process successfully. Fish waste act here as an organic fertilizer for a plant. Fish waste are rich in ammonia, which converted into nitrite by nitrosomonas bacteria, then nitrite fixing bacteria converted nitrite into nitrate which is used as a nutrient for plant growth. By these, plants get nutrients as fertilizer and nitrates been less toxic to fish; fish grows better than normal aqua farming (Ranajeet shanbhag, 2013). Information regarding proper balanced diet for fish and formulation of fish feed in this system will be very effectual for running this system successfully. Assortment of feed ingredient for making the fish feed is an intricate fact in Aquaponics system. Nutritional requirement of fish are same as by requirement of most other animals. Proteins, lipids, carbohydrates, vitamins, minerals, and water are the basic nutrition requirement of fish (Juli – Anne B et al.). Usually fish needs more proteins in their diet, for this reason the utilization of proteins is more important for fish than for other animals. Proper protein rich balanced diet is essential for growth, reproduction and physiological function of fish. (Marko B. Stankovic et al., 2011).

II. MATERIAL AND METHODS

Fish feed are usually categorised by fish habitat, feature of digestive tract, availability of feed ingredient in local market, nutritional component of fish, price of ingredient, and acceptability of food by fish. Ages of fish are an important factor when formulate the feed for specific habitat fishes.

A. Sort of fish species for which those feed are formulated: One Carnivorous habitat fish species *Pangasius pangasius*, and other fish species *Cirrhinus mrigala* which is included in omnivorous habitat group, are taken for experiment basis. Different types of feed are formulated depend on their age group and feeding habitat also. Feed are formulated for starter and grower age level of fishes in aquaponics system.

B. Maintenance of Nutrition level:

Table 1:

Basic amount of Nutrition level maintained for feed formulation in this case

Fish species	Amount of nutrition level maintained (percent by dry diet)				
	Proteins	Carbohydrates	Lipids	Vitamins	Minerals
Omnivorous habitat fish <i>Cirrhinus mrigala</i>	35- 40%	30-35%	15-20%	1-2.5%	1-2.5%
Carnivorous habitat fish <i>Pangasius pangasius</i>	40-45%	10-25%	26- 28%	1-2%	1-2%

C. protein sources are mainly used:

Table 2:

(Two type of protein sources are used for this purpose).

Protein sources		Nutritional element per 100 g			
No:	Plant protein sources	Protein (In g)	Carbohydrate (In g)	Fat (In g)	Energy (Calories)
1.	Moringa leaf (<i>Moringa oleifera</i>)	27.1	38.2	2.3	205
2.	Soya bean	37.0	29.5	18.0	428
3.	Wheat flour	13.0	72.0	2.5	340
No:	Animal protein Sources				
1.	Milk powder	21.0	60.0	20.0	470
2.	Dry shrimp meal	51.7	0	3.44	253
3.	Egg yolk	15.86	3.59	26.54	322

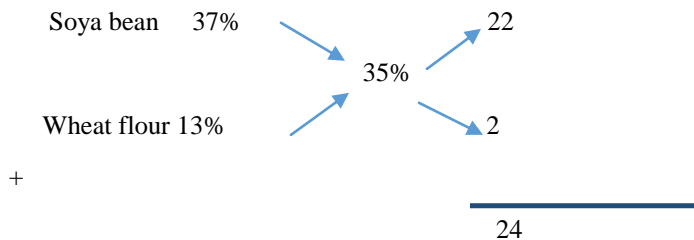
D. Utilizing Pearson Square Fish Feed Formula for prepare protein rich diet:

Feed No-1:Preparation of feed using two plant protein sources to make feed

The crude protein % of 2 ingredients:

- Soya bean includes 37% protein
- Wheat flour includes 13% protein

Total 35% protein level maintained by use these two protein sources



- % of soya bean is calculated as:
- $(22 \times 100) / 24 = 91.66$
- % of Wheat flour is calculated as:
- $(2 \times 100) / 24 = 8.33$

Then in next step:

- The contribution from Soya bean meal is:
- $91.66\% \times 37 = 33.91$
- The contribution from Wheat flour meal is:
- $8.33\% \times 13 = 1.08$
- The Total is $(33.91 + 1.08) = 34.99\%$ Protein

Feed No – 2: Preparation of feed using two plant protein and two animal protein sources to make feed

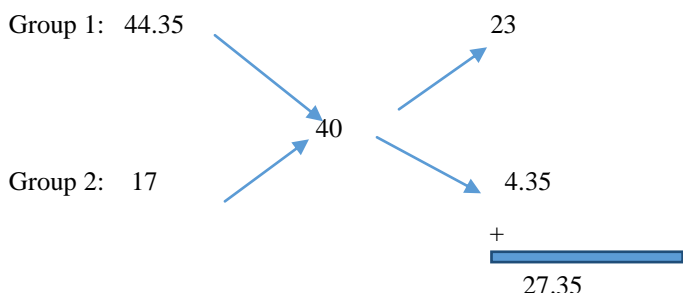
The crude protein % of 4 ingredients:

- Dry shrimp meal includes 51.7% protein
- Soya bean meal includes 37% protein
- Milk powder includes 21% protein
- Wheat flour includes 13% protein

The protein sources are divided into 2 groups by their High protein level and their low protein level.

- Group 1 is $(51.7 + 37) / 2 = 44.35$
- Group 2 is $(21 + 13) / 2 = 17$

Total 40 % protein level maintained by use these 2 groups of protein



- % of group 1; $(23 \times 100) / 27.35 = 84.09$
- % of group 2; $(4.35 \times 100) / 27.35 = 15.90$
- Then calculate:
- Group 1 ingredient %: $84.09 / 2 = 42.04$
- Group 2 ingredient %: $15.90 / 2 = 7.95$

The contribution of 4 ingredients are given below:

% of shrimp meal $51.7\% \times 42.04 = 21.73$

% of soya bean meal $37\% \times 42.04 = 15.55$

% of milk powder meal $21\% \times 7.95 = 1.66$

% of wheat flour meal $13\% \times 7.95 = 1.03$

The Total is $(21.73 + 15.55 + 1.66 + 1.03) = \underline{39.97\% \text{ protein}}$

Feed No – 3, are made by using one animal protein source and three plant protein sources, Moringa leaf are used for fulfil the 4 ingredients course of protein sources. Moringa is the best source of plant protein, it includes 27.1% protein per 100 g. Using Moringa leaf as a plant protein source with Soya bean meal protein source, Wheat flour protein source, and one animal protein source-Dry Shrimp meal are 4 ingredients used to make a feed which belongs 45 % protein level.

E. Feed Formulation: Feed are formulated here as a semi purified and pellet able. Fish are prefer long and thin pellet, so pasta maker are used for this purpose to make long and thin pellet. Water is an essential elements when making food, so accurate proportion of water used here for getting better results. Mainly Feeds are formulated to be dry, keep a final moisture content of 6–10%, for making a semi-moist feed use water with 35–40% water or wet with 50–70% water content. Necessary tools and work schedule are follow when any fish food are prepared. Step wise description are given below:

Step 1: Collect the all ingredients from local market as fresh sample, and washed them thoroughly, then dry in sun heat for 4 days by covering them with cloth net which ensure better quality of ingredient. Sometimes the protein composition are denatured by high heat. So hot air oven are avoid for this purpose.

Step 2: Blender machine is used in this next step for grinding the grain of the ingredients. Ingredients are weight first one by one before being powder format.

Step 3: Take a bowl and mix all measured ingredients for 5 minutes. Carbohydrate and protein element of the ingredients when mixed then add natural vitamin, natural antibiotic and antioxidant composition.

Step 4: Add some mineral water and mixing the ingredients for 10 minutes.

Step 5: Add additional lipid, here refined soybeans oil are used as a lipid source. Because of easy availability. Mixing process time is continue for next 5 minutes also.

Step 6: Making dough as a semi moist by using accurate portion of boiled hot water, maintain water temperature $45^{\circ} - 50^{\circ} \text{C}$. at that time.

Step 7: Hot extrude dough are passing into pasta maker and make specific size pallet for fish.

Step 8: pallets are dried in room temperature for 3 days then they are kept in a double plastic zigzag bag and store in a freeze for future use.

III.RESULT AND DISCUSSION

Fish eat different types of food at their different age level. When *Pangasius pangasius* fish fry are taken for rearing in aquaponics system, Animal protein source milk powder and egg yolk are used for their feeding. Water quality will be detoriate to use excessive quantity of milk powder and egg yolk also. So right proportion of milk powder and egg yolk composition are used according to their body weight. Which helpful to maintain the desired water quality. For *Cirrhinus mrigala* fry, feed no -1 can be used. At the growing stage of two different kind of fishes, feed no -2 and feed no- 3 can be applied for better growth of fish and get immunity power of disease resistance in captive condition. Vitamins and trace elements also essential for prepare a strong food. Basically Fish feed Manufactures Company when made their feed, they used chemical attractant, preservatives, antibiotic, and drugs. Use of these commercial feed sometimes damage the cycle of whole aquaponics system. Maintain of good water quality is the main function of this system. Uneaten food by fish which contain chemical attractant can change the pH of water in this systems. So organic element of vitamins and minerals are add here when feed are formulated. Honey, garlic, turmeric, salt are used as an antibiotic, antifungal, antioxidant component basis. Dry Moringa powder contains more protein content then the fresh leaf. Moringa contain high vitamin component and trace elements also, so it can be added in the food for fulfil the gap of natural vitamin and trace elements sources. Fish feed are formulated here to follow the Pearson protein diet formula. When fish are made in semi moist condition, it will be take in mind that fungus will be attack the feed at any time in storing condition, so feed should be stored in freezer by using double bags. Air tight container used for store dry feed only. Dry Moringa powder have high fibre, so when make food for carnivorous fish species (*Pangasius pangasius*) then used it as a protein source should be avoided, because their digestive tract function cannot allow to absorb high fibre. But fresh moringa leave used as a vitamin and trace elements sources for food. In India Animal protein source dry shrimps are costly ingredient for making fish food. Only egg yolk is the cheapest source of animal protein. When Plant protein sources are mix with animal protein sources for making fish diet, it can be minimized the cost of feed.

IV.CONCLUSION

Fish feed formulation for fish in aquaponics systems is a tricky process. In aquaponics system, water quality can be changed by uneaten fish food. For this one reason, whole system can be collapsed. In aquaponics system, feed should be given at right proportion, to maintain fish body weight. Preference of food is another crucial point when make the food for fish. Selection of protein sources, making type of feed, procedure of feed formulation are most important initial part of fish feed formulation. Protein rich diet of fish are essential for getting healthy fish production from any captive fish culture system.

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