**STUDIES ON FISH FEED FORMULATION**

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**Abstract**

Good nutrition in animal production systems is essential to economically produce a healthy, high-quality product. In fish farming, nutrition is critical because feed represents 40-50% of the production costs. Fish nutrition has advanced dramatically in recent years with the development of new, balanced commercial diets that promote optimal fish growth and health. The development of new species-specific diet formulations supports the aquaculture (fish farming) industry as it expands to satisfy increasing demand for affordable, safe, and high-quality fish and seafood products. Conducted experiments on studies on fish feed formulation at CIPHET, Ludhiana. The present study evaluates the importance of Fish feed pellets as alternative feed ingredients for fish feed preparation. Commonly available materials i.e., debittered mustered oil cake, Fish meal, maize powder, and mineral powder. The crude protein content of the ingredients ranged from 10 to 60 % and the crude lipid contents were recorded as 4 to 12%. Crude fiber contents were between 1 and 8 % and ash contents ranged from 6.9 to 38 %. In this, we are finding the minimum volume of pellets is 700.4 mm3 and maximum volume is 925.504 mm3 and the minimum density of pellets is 0.00092 g. mm-3 and the maximum density of pellets is 0.00107 g. mm-3 of the pellets. The 0.5838g weight of the pellet will take less time to dissolve completely when compared with more 0.9127g weight of pellet.

**Keywords :** Crude Protein, Crude Lipid, Crude Fiber, Density, Pellets, Volume

**Introduction**

The manufacture of compound pellet feed consists of a series of operations, the end goal being combine several raw materials in previously determined proportions for the precise nutritional objective. The feed production involves grinding of raw materials mixing steam condition palletization grading and packing which contribute to the production of good quality feeds.

The diversity of forms (crumbles and different sizes of granules/pellets) and properties (physical resistance to holding and to leaching in water susceptibility to rehydration, sinking, and floating) required for feeds of aquatic animals impose significant adaptation to manufacturing processes.

Feed formulation is essentially applied nutrition. A number of terms and expressions are introduced that will be put to practical use as information is presented on the nature and qualities of various feed stuff and the information presented on the nutrient requirements of fish. A precise understanding of these terms is essential to their correct application. One must recognize that some of these terms have a built-in error that cannot be escaped. This does not eliminate their usefulness in feed formulation. However, one must appreciate the fact that some are useful approximations of the values and not true values.

The terms that one needs to understand to formulate practical fish diets are: crude protein level; energy level, either expressed as metabolizable energy (ME) or as digestible energy (DE); specific amino acid levels; crude fiber level; and ash level. Since most complete practical fish diets are supplemented with a vitamin premix at levels in excess of the dietary requirement, this category of nutrients will be ignored temporarily. The potential problems occur when one fails to recognize that all of the above-mentioned terms, except ME and DE, represent the quantity or level of a nutrient in the feed as determined by chemical tests on a specific sample of feedstuff. These chemical tests generally correlate well enough with biological methods of feed evaluation (growth studies, tissue, levels) to be very useful to feed formulators, but they are still chemical tests that are subject to an experimental error during nutrient level determination. For example, the proximate composition of fish meals changes during the spawning season. Generally, the lipid levels increase before spawning and decrease after spawning. This will alter the percent of protein, ash, and carbohydrates in the fish meal as the seasons change. Similarly, many plant feed stuffs vary in proximate composition with their stage of maturity at harvest, location grown, and other environmental conditions, such as the weather. Tabled values represent an average value that is usually close enough to the actual value to allow accurate feed formulation. However, one must be aware that assumptions are being made in order to recognize the potential sources of error that may exist.

Metabolizable, energy and digestible energy values are obtained biologically and, thus, should accurately represent the true energy value of feedstuffs to fish. However, ME values may be obtained in different ways (faces collection methods) and thus may be subject to experimental error. It has recently been reported that the digestibility of feed by rainbow trout was lower at 7° than at 11°C or 15°C. At 11°C and 15°C body size (18.6 g, 207.1 g, or 585.7 g) did not affect feed digestibility. The digestibility of carbohydrates and energy was slightly reduced by meal size in rainbow trout fed at 1.6 percent body weight. Protein and lipid digestibility was not reduced by meal size. Obvious differences exist between fish species in nutrient digestibility, especially in the carbohydrate fraction of feed. Herbivorous and, to a lesser extent, omnivorous fish have longer digestive tracts than carnivorous fish and are able to obtain more digestible energy from carbohydrates. An awareness of these facts will prevent misuse of ME and DE values.

Each feedstuff in any diet formulation should be present for a specific reason; i.e., it is a good energy source, it is rich in limiting amino acid, etc. In addition, each feedstuff in a particular diet formulation should be the least costly ingredient available for its particular function in the diet. This leads to another assumption in feed formulation; that is, any nutrient in particular feedstuff, such as an amino acid, is just as valuable as the same nutrient in any other feedstuff. This allows feed formulators to interchange one feedstuff with another as cost and availability change. Thus, it is assumed that there is no "ideal formulation", but rather an almost infinite number of possible feed formulations that met the nutritional needs of the fish equally well. While this assumption may not be entirely valid and some nutritional judgment must be employed in any feed formulation, it does seem to be valid in most cases. As with the previously mentioned assumption, an awareness of the potential pitfalls involved is necessary for the fish feed formulation so that allowances can be made in diet formulation and problems can be anticipated and avoided.

**MATERIALS AND METHODS**

## Balancing Crude Protein Level

**Material required**

1. De-bittered mustard oil cake
2. Maize powder
3. Fish meal
4. Mineral mixture

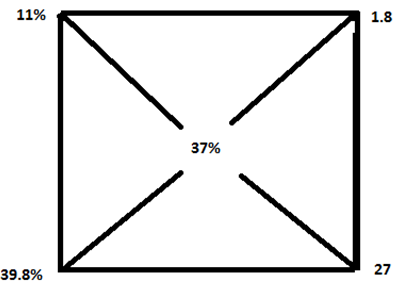
* Crude protein which is less than 20% is called’ basal feed’.
* Crude protein which is greater than 20% is called ‘protein supplements

**Protein supplements**

Debittered mustered oil cake and fish meal having the protein supplements.

The average protein supplements of DMOC and FM is = (23.6+56)/2 = 39.8%

A square is constructed and the 2 feed stuffs are the kept on the two left corners along with the protein content of each. The desired protein level of the feed is placed in the middle of the square. Next, the protein level of the feed is subtracted from that of the feed stuffs, placing the answer in the possible corner from the feed stuff. Ignore positive or negative signs.



3% addition to compensate leaching

Maize powder =1.8/28.8×100 =6.25%

protein supplements =27/28.8×100 =93.75 %

DMOC+FM =93.75%

DMOC =93.75/2=46.875%

FM =93.75/2=46.875%

Total Composition

Maize powder = 6.25 gm

DMOC = 46.875 gm

FM = 46.875 gm

Total = 100 gm

Check Correction

Maize powder = 6.25×11/100 =0.68

DMOC = 46.875×23.6/100=11.0625

FM = 46.875×56/100 =26.25

Now, total amount = 0.68+11.0625+26.25=37.99= 38%

Therefore, for 1kg of feed formulation

maize = 62.5gm

DMOC = 468.75gm

FM = 468.75gm

Total = 1000 gm

**Working Procedure**

1. In the first step, Dry fish is grinding and sieved and cleaned after that collect fish meal powder of 468.75gm.
2. Debittered mustard oil cake also grinding and sieving and cleaning after that collect DMOC 0f 468.75gm.
3. Maize is grinding and sieving and cleaning after that collect Maize powder of 62.5gm is collected.
4. We have to take directly mineral mixer of 20gm from the market.
5. Mix all the raw materials in one bowl and added 90ml of water to it and mix thoroughly
6. We have to take the mixed raw material in a bowl and keep it in the cooker which is having 1liter of water then boil it for 10 to 15 minutes for moisture.
7. After that we have to mix the powder thoroughly and slowly, and we have to drop the powder into the pelletizer

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| --- | --- | --- |
| C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170925_113024.jpg  grinding the raw materials | Sieving of raw materials | Weighing of raw materials powder |
| **C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170925_102412.jpg**Mixing of raw materials powder with water | C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170926_115725.jpg  Cooking of raw material powder | C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170926_124951.jpg  Mixing of cooked raw materials powders |
| C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170926_125051.jpg  Pouring of raw materials powder in pelletizer | C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170927_103836.jpg  Drying of pellets in solar dryer | C:\Users\ciphet\AppData\Local\Microsoft\Windows\INetCache\Content.Word\IMG_20170926_125335.jpg  Final product |

1. And finally, we got the pellets from the outlet of the pelletizer after that keep it in a solar tray dryer for some time (2-3hr) for removing moisture in the pellets and finally got the pellets in finished form. **Flow chart.1.** Manufacturing floating extruded fish pellet feed

Mixing

Conditioning (20-30sec, 140-160°c) humidification (water and/or steam)

Packaging and distribution

Calibration/sieving

Crumbling

Coating/spraying

Cooling

Drying

Possible reprocessing of the particles

Extrusion

Addition of liquid ingredients

Mineral and vitamin complement

Weighing/measuring

Grinding

Receiving

Raw materials

**Flow chart.2.** Manufacturing pellets (sinking)

Raw materials

Coarse grinding

Receiving

Fine grinding

Dosing

Addition or liquid ingredients

Minerals and vitamin complement

Mixing

Conditioning (20-30sec.115-140°c) Water saturated steam

Pelleting (2.5\*4mm)

Reprocessing of fine particles (<0.6mm)

Drying

Cooling

Pellets (2.5mm)

Crumbling

Calibration sieving

Possible packing, delivery and distribution

**RESULTS AND DISCUSSION**

**Pellets (sinking)**

five distinct weights 0.9127 gm**,** 0.6124 gm, 0.7832 gm, 0.5838 gm**,** and 0.6648 gm. According to Fig.1, the weight of the pellet of 0.9127 gm takes the shortest time to sink at 0.0192 sec, while the weight of the pellet of 0.5838 gm takes the longest time to sink at 0.0198 sec. This is owing to the difference in weight between pellets i.e when compared to a pellet with less weight, the pellet with more weight sinks faster.

**Fig.1.** Time taking for the sinking of Pellets (sec)

According to Fig..2, a pellet weighing 0.9127 gm takes the most time to dissolve, 32.24 minutes, and a pellet weighing 0.5838 gm takes the shortest time, 24.5 minutes to dissolve entirely. This is related to the weight differential between pellets i.e the weight of the pellets grows, and so does the time required to dissolve the pellets.

**Fig. 2.** Time is taken for Dissolving of Pellets (min)

**Fig. 3.** Density vs Volume

Fig..3, shows how the diameter, length, and weight of the pellets are used to calculate their volume and density. In this experiment, we used 10 replications and found that the highest volume and density of pellets were 925.504 mm3 and 0.00107 g. mm-3, respectively. The maximum length of 34.1 mm and weight of 0.995 gm, with a diameter of 5.88 mm account for this. The minimum volume and density of pellets were 684.685 mm3 and 0.00106 g. mm-3 this is due to the minimum length of 24.72 mm and weight of 0.7317 gm, with a diameter of 5.94 mm. The volume and density of pellets are determined not only by their weight but also by their length and diameter.

**Conclusions**

Based on the foregoing findings, we can conclude that the protein additions in the pellets are extremely advantageous to the growth of the fish. The crude protein concentration of the components in the protein supplements ranged from 10 to 60 % with crude lipid amounts ranging from 4 to12 %. The crude fiber level ranged from 1 to 8 % whereas the ash contents ranged from 6.9 to 38 %. In this, we have discovered the pellets have a minimum volume of 00.400 mm3 and maximum volume is 925.504 mm3 and the minimum density of pellets is 684.685 g. mm-3 and the maximum density of pellets is 0.00107 g. mm-3 of the pellets. When we compare the 0.5838 gm weight of the pellet to the 0.9127 gm weight of the pellet, it will take less time to dissolve entirely.

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