Minireview Article

Potential Use of Ipil-Ipil (*Leucaena leucocephala Lam.*) As Fish Feed Ingredient: A Minireview

ABSTRACT

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Keywords: Clarias gariepinus; Tilapia zilli; growth; feed.

1. INTRODUCTION

Leucaena leucocephala (Lam), commonly known as *Leucaena* or white lead tree is one of the suitable plant protein alternatives to fishmeal for fish feed due to its medium-high protein content, suitable levels of amino acids and most importantly, very affordable market price tag [1]. However, in compiling fish feed ingredients attention must be emphasized at the optimal level in feed and appropriate processing related to the presence of several limiting factors such as high crude fiber and antinutrient factors.

One of the efforts that can overcome dependence on imported feed raw materials is the use of local raw materials for the manufacture of fish feed. One of the local raw materials that has the potential to be used as raw material for fish feed is Ipil-Ipil leaves (*Leucaena leucocephala*). *Leucaena leucocephala* plant is a local biological resource that has the potential to be used as a source of vegetable protein. The use of *Leucaena leucocephala* leaves has been widely applied as feed raw materials in aquaculture activities, such as tilapia, rohu fish, and *Indian snakehead fish, Channa puncate* (Putra *et al*. 2019)

Leucaena leucocephala is one of the potential sources of vegetable protein for fish and livestock feed [2]. *Leucaena leucocephala* leaf flour and the seeds have a fairly high protein content of around 25%. However, it is also known that *Leucaena* contains mymocin which is able to inhibit protein biosynthesis in animals so that it has an impact on decreasing the growth rate. Using leaf meal as a supplement for broilers, a daily growth of 100-110 g per week can be determined; in addition, in quantities not exceeding 5% of the diet, leaf meal could be used with other xanthophyll sources to give a satisfactory color to the carcass. Adult chickens fed with Leucaena leaf

meal up to 7% of the diet showed an increase in the use of crude protein and metabolizable energy. Feeding broiler chicken with boiled *L. leucocephala* meal (10% of the diet) was recommended since it furnished high carcass and meat attributes of broiler chicken [1]

Chart 1 : The taxonomy of *Leucaena leucocephala* is as follows [3].

Kingdom	Plantae
Subkingdom	Tracheobionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Fabales
Family	Fabaceae-Pea family

Limited supply of quality feed raw materials is the main obstacle to the creation of sustainable aquaculture business activities during competition with other food production business activities (FAO 2006). High-quality sources of feed protein such as fish meal and soybean meal meal are increasingly limited, because the stock of trash fish in the sea as raw materials for fishmeal production is running low, so the price is increasing, and the price of soybeans is increasingly unaffordable. Consequently, efforts to find alternative sources of raw materials that have high nutritional value and abundant availability are the main focus of attention for fish nutrition farmers and researchers today. The high price of feed is due to the increase in the price of feed raw materials. Fish feed raw materials such as fish meal, soybean meal, cornmeal and Meet Born Meal flour are still dependent on imports[4]. As a result, the selling price of feed at the level of fish farmers is quite expensive.

2. NUTRIENT CONTENT OF IPIL-IPIL (*Leucaena leucocephala*)

Leucaena leucocephala is a multipurpose tree and provides fuel wood, green manure, improves degraded lands and can be used as a cover crop. Leucaena leaf is known to contain about 22.7% crude protein [5] (and survives well on degraded soils which are low in nutrients. It has bipinnate leaves, lanceolate leaflets and has flat pods containing small seeds. The leaves and seeds contain the antinutritional factor mimosine [6] . Mimosine is known to inhibit the growth of animals, especially nonruminants. Leucaena leucocephala is available in almost every geographical location in Ghana and grows fast. Its leaves are a good source of protein and needs to be examined in greater detail on its suitability for the African catfish, Clarias gariepinus. Leucaena seed protein isolates with relatively low mimosine levels have been prepared successfully by isoelectric precipitation of seed kernel proteins. Protein isolate preparation could itself be considered as a means of using Leucaena proteins for food purposes, with minimal mimosine toxicity [7]. All parts of *L. leucocephala* such as leaves, young stems, flowers, pods, including grain, can be consumed by livestock [4]. *Leucaena leucocephala* is an important source of animal feed because it is rich in protein, essential amino acids, minerals, carotenoids, and vitamins [3].

L. leucocephala leaves contain crude fiber by 6.15%, cellulose by 12.56%, hemicellulose by 8.34%, tannins by 4.5% and mimosine by 2.2%. Tannins and mimosine are anti-nutritional substances that can interfere with the absorption of nutrients in the digestive tract and affect fish growth Tannins are protease enzyme inhibitors so that they inhibit protein digestibility in the fish digestive tract, lowering the value of feed palatability so that the amount of feed consumption and fish growth decreases. Therefore, efforts are needed to reduce the high value of crude fiber and the content of anti-nutritional substances in *L. leucocephala* leaves, one of which is by carrying out the fermentation process [8], [9]. (Putra et al. 2019)

Table 1. Proximate analysis of *Leucaena leucocephala* on various plant parts meal

Chemical compounds	Parts of plant	
	Leaf	Seed
Crude Protein (%)	24.2	31.1 ± 0.4
Crude Fat (%)	6.5	5.6 ± 0.4
Crude Fiber (%)	21.5	13.2 ± 0.2
Crude Ash (%)	7.5	4.5 ± 0.5
Dry Matter (%)	88.2	94.8 ± 0.1

Energy (Kcal/kg)	2450	2573.3 ± 4.2

References : [1]

Table 2. Minerals of *Leucaena leucocephala* on seed and leaf meal

Minerals	Leaves	Seeds
Sodium	1.0 g/kg	61917 ± 2751 mg/g
Potassium	5.5g/kg	29272 ± 3893 mg/g
Calsium	6.2 g/kg	261742 ± 17284 mg/g
iron	12.7 mg/kg	2602 ± 225 mg/g
Magnesium	1.9 g/kg	39979 ± 3423 mg/g
Copper	7.2 mg/kg	-
Zinc	58.0 mg/kg	2200 ± 109 mg/g
Mangan	44.0 mg/kg	-

References [10]

3. EFFECT OF IPIL-IPIL (*Leucaena leucocephala*) AS FISH FEED

Several researchers have tested the effect of giving *Leucaena leucocephala* plants to several types of fish. Therefore, dependable indices are necessary to determine the growth performance of the fish fed with formulated feed. The parameter such as feed conversion ratio, weight gain, feed consumed and protein efficiency ratio are relevant examples of such indicators that reflects how effective a feed fed to the fish can be in order to evaluate the profitability of a fish farm. Based on the researches, the experimental diets indicating that the levels of incorporation of Leucaena leaf meal did not affect the palatability of the diets, instead there was observed significant increase in growth as the inclusions levels increases. This could be due to the processing technique applied which involved soaking and drying the leave hence reducing the antinutrient in Leucaena leaf meal which is mainly mimosine. The survival rate recorded in the experiment could be credited to good management practices in the feeding and water quality management by monitoring the water quality characteristics during the experimental periods.

The addition of *Leucaena leucocephala* leaf meal showed positive results on the growth performance of Tilapia zilli fingerlings showed an improved performance from the view point of specific growth rate, weight gain and feed conversion ratio, this is an indication that all the fishes in the experiment accept the various gradient levels in their feed. The effect of using *Leucaena leucocephala* leaf meal in this study established that it could be used at recommended level of inclusion in the diet of Tilapia zilli. the use of plant protein, Leucaena leucocephala leaf meal to replace animal protein in the diet of Tilapia zilli fingerlings in order to reduce competition between man and animal which often times precede the scarcity and over prizing of it as emphasized by [11]

The addition of *Leucaena leucocephala* leaf to African Catfish (*Clarias Gariepinus*) with a concentration of 0% (control) showed the highest value and the least value was recorded in treatment with the concentration of 100%, it showed a negative effect for the fish's health. The relative weight gain value also reduced with increase in leucena inclusion level. Control diet had the highest value of 30.10 and this was significantly different from other treatments. There was was a significant difference between the control diet with the other treatments. the highest value connoting poor feed conversion was recorded in Treatment V (100%). Reduced weight gain, SGR, PER and higher FCR values at higher seeds meal proportions (> 50%) in fishmeal diet indicated poor utilization of LSM by fish [12]. It is well known that the efficiency of feed utilization and consequent growth performance is affected by the quality of dietary protein. The poor nutrient utilization may not totally be hinged on the fibre content of the test diets as this was

generally less than 10% [13]. A summary of the effects of the addition of seeds and leaves of *Leucaena leucocephala* on various fish can be seen in Table 3

Table 3. The effects of the addition of seeds and leaves of *Leucaena leucocephala* on fish

Fish	Parts of Ipil-Ipil	Concentration of Addition (%)	Weight Gain and Growth Rate (g)	Reference
Tilapia zilli	Leaf	0	3.30	[14]
		2.5	3.50	
		5	2.81	
		7.5	3.56	
		10	3.29	
Clarias Gariepinus	leaf	0	4.29±0.72	[12]
		10	3.81±0.11	
		20	4.3±1.13	
		30	3.23±0.59	
Clarias Gariepinus	seeds	0	3.49	[13].
		25	2.75	
		50	2.40	
		75	1.51	
		100	1.27	
Clarias Gariepinus	Leaf	0	0.081	[15]
		5	0.088	
		10	0.087	
		15	0.090	
		20	0.090	

4. CONCLUSION

Leaf meal and seed meal contain proteins, fibre, energy, and dry matter. The highest protein content is found in seed meal. Leaf meal showed positive results on the growth performance is highly nutritious and can be incorporated in animal diets, including fish as a feed ingredient. *Leucaena* seeds meal can replace a feed ingredient on a fish diet. However, for optimum production of the fish feed, higher seeds meal proportions (>50%) in fishmeal diet indicated poor utilization of seeds meal by fish. The proportions was recommend at 10% inclusion level of seeds meal in fishmeal diets.

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