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Azolla as Lowcost Supplement and Live Stock Feed for Ompok Pabda

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A B S T R A C T

For the present study, four Azolla species i.e. *Azolla Mexicana, A. pinnata, A. circinata* and *A. rubra* were used as live stock feed for growth of *Ompok pabda*. The research work was conducted for a period of six months i.e., June to December, 2019. Nutritional analysis like proteins, lipid and phenol content was observed. Due to this high nutritional value of these Azolla species were used as live stock feed for *Ompak pabda*. Various Azolla diets 0, 20, 40, 60, 80 and 100% were supplemented and growth performance of *Ompak pabda* was subjected to 16 weeks. Growth parameters like initial weight, fresh weight, weight gain and mortality rate was studied. Maximum weight gain (3.10±0.03) was recorded by using 20% diet of *Azolla pinnata* followed by *A. circinata* (2.98±0.07). It is evident that naturally and easily available low cost Azolla species are the live stock feed for *Ompok pabda*.

Keywords: Ompok pabda, Protiens, Aminoacids. Aquaculture

1. Introduction

Azolla pinnata is a freshwater floating aquatic plant, familiar for its high biomass and protein yield, which can be practised as a direct feed for fish or a substitute protein source diet ingredient. Azolla has attained its value in aquaculture because of higher crude protein content (13% to 30%) and essential amino acid (EAA) composition which is rich in lysine than any other green forage crops and aquatic macrophytes. Even though it has high nutritional value and relative ease to produce in ponds, reports on utilization of Azolla are extremely limited. Among aquatic ferns and small leafed floating plants, genus Azolla is native to the tropics, subtropics, and warm temperate regions of Africa, Asia, and America. The distribution of Azolla all over the world in fresh water ecosystems of temperate and tropical regions are also important (Kathirvelan *et al*., 2015).

Azolla ferns possess a unique feature of Nitrogen fixating Cyanobacteria, Nostoc, in the cavities of their leaves. Due to its high growth capacity and Nitrogen fixation rates, Azolla has been used in the fields of Paddy as a biofertilizer in South-east Asia for several centuries. Utilization of Azolla as a biofertilizer expands the sustainability of cultivation of rice by reducing the fertilizer necessity and also reduces nitrogen and greenhouse gas (GHG) emissions from the fields of paddy (Paul Brouwer *et al*.,2018).

Azolla can be used as an alternative for concentration, fodder or feed, hence, supplying a sustainable feed for live stock, as it possess most of the nutrients which are required for almost all classes of livestock, including poultry and fish.

Aquaculture is the fastest growing food producing sector and is perceived to have the greatest potential to meet the growing demand for aquatic food (Kumari *et al*., 2017). World aquaculture production is likely to grow continuously, but at slow rate (FAO, 2014). These fish species have been reported to convert raw protein from *Azolla* into the best edible protein, thus reduces the cost of production of feeds (Datta, 2011). Also, it is reported to have important components which enhance performance of fish (Cohen *et al*., 2002) reported the presence of the 3-Deoxyanthocyanins which are the only known flavonoids of *Azolla*.

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However, in Andhra Pradesh, Azolla cultivation is limited to the coastal Andhra and Rayalaseema Districts. A gaining importance of Azolla as Live feed stock for better application to improve the yield *Ompok pabda*. There were no studies on this *Ompok pabda* growth and production in Andhra Pradesh. In this paper we optimize the azolla species as low cost live stock feed for *Ompok pabda*.

2. Materials and methods

2.1. Production of Azolla for livestock feeding

Azolla for smallholder dairy farming in India has been described as follows. The farmer should select a shaded pond close to the house (to ensure regular upkeep and monitoring) and to a water source. An area of 4-4.5 m² and 10-15 cm deep can produce about 2 kg/d of fresh azolla, enough to supplement 2 dairy cows. A plastic sheet should be spread in the pond and properly secured. To initiate azolla growth, sieved fertile soil mixed with cow dung and water (or biogas slurry) should be added as fertilizer and the pond should be inoculated with fresh azolla culture (about 800 g for a 2 m² pond). The crop is maintained by application of about 1 kg of cow dung and 80-100 grams of superphosphate every 2 weeks. The first crop should be ready in 15-20 days and can then be harvested daily. The pond needs to be emptied once in six months. Azolla produced in excess should be dried in the shade for later use (Giridhar *et al*., 2013).

2.2. Fish

Azolla is an appropriate supplemental feed for herbivorous fish such as *Ompok pabda*. Some trials have shown that *Ompok pabda* can consume azolla 0 – 100% of their weight per day. Various diets (0, 20, 40, 60, 80 and 100%) of dry Azolla were used in this study. Three replicates were maintained.

2.3. Statistical Analysis

For this study statistical analysis of all the data were calculated. Three replicates were maintained for each treatment. ANOVA two way and Duncan's multiple test was carried out and the results were considered to be significant at $P<0.05$.

3. Results and Discussion

For this study various nutritional parameters nitrogen, phenol, protein and lipid content were estimated. *Azolla circinata* has showed maximum nitrogen content 1.21±0.01 (Table-1). The present investigation reveals rapidly growing nitrogen fixing Azolla species potentially and chemical composition are suitable live stock feed for *Ompok pabda*. Azolla production in some Asian Countries, China and Vietnam declined (perhaps due to the increasing use of land for food production) and azolla development worldwide did not live up to initial expectations, due to serious constraints such as water availability, difficulties in maintenance and handling, high labour requirements and limited knowledge on the specific needs of each azolla species (Van Hove *et al*., 1996).

Table-1: Nutrient composition of Azolla species on dry weight basis

4. Azolla species	**5. Composition (%)**				
	6. Nitrogen	**7. Phenol**	**8. Protein**	**9. Lipid**	**10. Biomass kg^{-1} DW**
11. A. circinata	12. 1.21±0.01	13. 85.4± 0.7	14. 13.2.±0.7	15. 20.4±0.5	16. 18000
17. A. pinnata	18. 0.78±0.05	19. 101.6±0.3	20. 12.0.±0.5	21. 50.5±0.2	22. 13000
23. A. rubra	24. 0.65±0.03	25. 94.5±0.7	26. 11.5.±0.8	27. 60.5±0.8	28. 11000
29. A. mexicana	30. 0.89±0.01	31. 110.5±0.1	32. 15.4. ±0.3	33. 120.2±0.9	34. 11500

* Each data is an average of three replicates

Protein content was ranged from 11.5±0.8 to 15.4±0.3% was showed by all the four species studied. High protein content increases the diet value of fisheries. Construction of proteins and use of amino acids were used as a source of energy (Fox *et al*., 1994; Shau, 1998).

Azolla mexicana showed the high lipid content 120.2±0.9 in this study. Similarly lipids are most important source in animal tissues stored as triacyl glycerols in adipose tissue (Izquierdo et al., 2000; Sargent *et al*., 1998).

The results obtained on the growth parameters and mertality of *Ompak pabda* were observed by using different *Azolla* species. The growth parameters (Table-2) of *Ompak pabda,* by using various diets of *A. circinata*. Among them maximum weight 2.98±0.07 was recorded by 20% diet supplemented and the mortality rate was maximum 28.07±2.2 by 60% diet.

Table-2: Growth performance of OMPOK PABDA fry fed on diets containing different levels of *A. circinata*

35. Diet	36. Initial weight (g/Fish)	37. Fresh weight 38. g/Fish	39. Weight gain (%g/fish)	40. Mortality (%)
41. 0%	42. 3.33±0.01	43. 5.78±0.1	44. 2.45±0.99	45. 12.23±0.5
46. 20%	47. 3.25±0.01	**48.** 6.23±0.3	49. 2.98±0.07	50. 11.05±2.2
51. 40%	52. 3.41±0.02	**53.** 4.18±0.6	54. 2.77±0.04	55. 13.08±3.1
56. 60%	57. 3.28±0.03	**58.** 4.88±0.5	59. 1.60±0.02	60. 28.07±2.2
61. 80%	62. 3.32±0.01	**63.** 5.35±0.3	64. 2.03±0.02	65. 19.11±0.7
66. 100%	67. 3.35±0.02	**68.** 5.17±0.2	69. 1.82±0.08	70. 33.23±1.5

*The overall model is significant with p<0.05

Similarly maximum weight and growth rate may be due to their individual growth and food habits of major carps were represented by Alikunhi, 1957. For the application of *A. pinnata* diets *Ompok pabda* growth was maximum (3.10±0.03) increased (Table-3). Two hundred folds increase in the fresh weight of *Ompok pabda*, when compared to initial weight. Mortality rate was ranged from 10.12±0.4 to 24.51±1.6.

Table-3: Growth performance of OMPOK PABDA fry fed on diets containing different levels of *A. pinnata*

71. Diet	72. Initial weight	73. Fresh weight 74. g/Fish	75. Weight gain (%g/fish)	76. Mortality (%)
77. 0%	78. 3.33±0.01	79. 6.15±0.2	80. 2.82±0.01	81. 10.12±0.4
82. 20%	83. 3.25±0.01	**84.** 6.35±0.4	85. 3.10±0.03	86. 12.22±2.7
87. 40%	88. 3.41±0.02	**89.** 5.19±0.7	90. 1.78±0.05	91. 11.12±2.2
92. 60%	93. 3.28±0.03	**94.** 5.18±0.4	95. 1.90±0.01	96. 19.15±3.2
97. 80%	98. 3.32±0.01	**99.** 5.25±0.1	100. 1.93±0.09	101. 24.51±1.6
102. 100%	103. 3.35±0.02	**104.** 6.23±0.3	105. 2.88±0.01	106. 22.67±1.9

*The overall model is significant with p<0.05

A high mortality rate 34.25±3.1 was shown by 60% diet supplemented to Ompok (Table-4). Mortality was an important factor for Aquaculture for the profit of farmers. By supplementing *Azolla mexicana* maximum fresh weight was recorded by all the percentages. More than 5 grams weight gain was recorded. Research and promotion of azolla as a livestock feed has been increasing. Because azolla has a higher protein content (19-30%) than most green forage crops and aquatic macrophytes, and an essential amino acid composition (notably lysine) favourable for animal nutrition, azolla can be a valuable protein supplement for many species, including ruminants, poultry, pigs and fish (Hasan *et al*., 2009). Ompok initial weights are ranged from 3.25±0.01 to 3.41±0.02 was used in this study. Maximum growth and fresh weight was recorded from 100% of *A. mexicana* diet supplemented (Table-4).

Table-4: Growth performance of OMPOK PABDA fry fed on diets containing different levels of *A. mexicana*

107. Diet	108. Initial weight	109. Fresh weight 110. g/Fish	111. Weight gain (%g/fish)	112. Mortality (%)
113. 0%	114. 3.33±0.01	115. 6.27±0.5	116. 2.94±0.04	117. 10.35±0.1
118. 20%	119. 3.25±0.01	**120.** 6.13±0.1	121. 2.88±0.09	122. 21.15±3.5
123. 40%	124. 3.41±0.02	**125.** 5.22±0.7	126. 1.81±0.05	127. 18.11±2.4
128. 60%	129. 3.28±0.03	**130.** 5.89±0.6	131. 2.61±0.03	132. 34.25±3.1
133. 80%	134. 3.32±0.01	**135.** 6.15±0.5	136. 2.83±0.04	137. 26.22±0.5
138. 100%	139. 3.35±0.02	**140.** 6.32±0.3	141. 2.97±0.01	142. 31.13±2.7

*The overall model is significant with p<0.05

The results obtained from the Table-5, maximum weight gain 2.92±0.89 was recorded by 20% diet supplemented to *Ompok pabda* and minimum by 1.99±0.17 showed by 60% diet of *A. rubra*. The mortality rate was maximum 45.22±1.2 was recorded from this study. Aquaculture's success and continuing growth have never been more important for our world (George, 2011).With the world population currently over 6 billion, and forecasts exceeding 8 billion by the year 2030, the consumption of seafood at that time is predicted to reach between 150-160 million tons (Katiha *et al*., 2005).

Table-5: Growth performance of OMPOK PABDA fry fed on diets containing different levels of *A. rubra*

143. Diet	144. Initial weight	145. Fresh weight 146. g/Fish	147. Weight gain (%g/fish)	148. Mortality (%)
149. 0%	150. 3.33±0.01	151. 5.55±0.1	152. 2.22±0.09	153. 16.35±1.7
154. 20%	155. 3.25±0.01	**156.** 6.17±0.9	157. 2.92±0.89	158. 17.22±3.1
159. 40%	160. 3.41±0.02	**161.** 6.22±0.1	162. 2.81±0.08	163. 25.22±4.7
164. 60%	165. 3.28±0.03	**166.** 5.27±0.2	167. 1.99±0.17	168. 32.55±3.5
169. 80%	170. 3.32±0.01	**171.** 6.15±0.7	172. 2.83±0.69	173. 29.23±1.7
174. 100%	175. 3.35±0.02	**176.** 6.24±0.8	177. 2.89±0.78	178. 45.22±1.2

*The overall model is significant with p<0.05

Azolla is an appropriate supplemental feed for herbivorous fish such as *Ompok pabda*. Some trials have shown that *Ompok pabda* can consume azolla 0 – 100% of their weight per day. Various diets (0, 20, 40, 60, 80 and 100%) of dry Azolla were used in this study. Three replicates were maintained.

4. Conclusions

From the results it seems to be best substitute of protein from expensive sources such as Ompok fish meal depending on feeding habitats of the species. Due to high nutrient content of *A. rubra* supplementation shows to have a positive effect on growth performance of Ompok fish and reduce the cost of feeding from fish meal and fish oil diet.

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