

4. UTILIZATION OF ALTERNATIVE VEGETABLE PROTEIN FOR FISH FEED

Several research results have been carried out and show good results regarding the use of waste as a source of vegetable protein in fish feed. The results of these studies are presented in Table 4

Table 4. Production of Fish Farming Based on Alternative Vegetable Protein Sources

Prospective Protein	Treatment	Result	Reference
Cabbage Waste	Substitution of cabbage waste with tofu dregs, bamboo shoots and bran on the growth of pearl catfish (<i>Clarias gariepinus</i>) seeds	The results showed that the growth of pearl catfish fed with cabbage waste substitution with tofu, rebon and bran can increase the growth of pearl catfish seeds with feed efficiency of 59.74%. The nutritional content of the feed is protein (33.31%), fat (3.48%) and carbohydrates (21.63%)	[13]
Moringa leaf (<i>Moringa oleifera</i>)	Moringa leaf meal supplementation and probiotics into fish feed	The results showed that the addition of Moringa leaf flour combined with probiotics in feed gave a significant effect on absolute weight of 4.673 g, absolute length of 2.607 cm, specific weight of 2.25%, specific length of 1.07%, feed conversion 1.84%.	[14]
<i>Indigofera zollingeriana</i> leaf	Substitution of <i>I. zollingeriana</i> leaf meal plus soybean meal for fish feed	The results showed that the absolute weight growth of carp fry given 50% <i>I. zollingeriana</i> flour plus 50% soybean flour resulted in better growth than other treatments with protein retention and high protein digestibility.	[15]
Papaya leaf (<i>Carica papaya L.</i>)	Addition of papaya leaf flour and pineapple peel in commercial fish feed	The results showed that the increase in the growth of tilapia (<i>Oreochromis niloticus</i>) with the addition of 25% papaya leaf flour and 75% pineapple peel was able to increase the growth of absolute length, absolute weight, SGR, FCR and obtain the best SR results.	(Rudiansyah 2022)

Conclusion

Based on the literature study, it can be seen that various sources of vegetable protein have high abundance and diversity and have great potential to be used as sources of vegetable protein to be utilized as fish and livestock feed.

References

- [1] Sullivan, K. B. 2008. *Replacement of Fish Meal by Alternative Protein Sources in Rainbow Trout Diets*. North Carolina Wilmington.
- [2] Winamo, F. G. 1985. *Kimia Pangan dan Gizi*. Gramedia Pustaka Utama, Jakarta. 253 p.
- [3] Utama, S. 2008. Daun Pepaya dalam Ransum Menurunkan Kolesterol pada Serum dan Telur Ayam. *Jurnal Veteriner* September.
- [4] Nelwida. 2002. Pengaruh Penggunaan Tepung Daun Sengon (*Albazzia falcataria*) Fermentasi dalam ransum Terhadap Performa Ayam Broiler. Universitas Andalas, Padang
- [5] Plantamor. 2008. Informasi Spesies Kayu Apu. In: Cakmus (Ed.), Situs Dunia Tumbuhan, 12 April 2008. <http://www.plantamor.com>. (accessed in 10 Januari 2013).
- [6] Banerjee, A., S. Matai. 1990. Composition of Indian Aquatic Plants in Relation to Utilization as Animal Forage. *Journal Aquat Plant Manage*, 28: 69-73.
- [7] Pitojo, S. 2005. *Benih Kacang Tanah*. Penerbit Kanisius. Yogyakarta. 75 p
- [8] Salunkhe, O. K., S. S. Kadam and J. K. Chevan, 1985. *Postharvest Biotechnology of Food Legume*. CRC-Press Inc, Florida.
- [9] Buwono, I. D. 2000. *Kebutuhan Asam Amino Esensial dalam Ransum Ikan*. Kanisius, Yogyakarta. 57 p
- [10] NAS (National Academy of Sciences). 1994. *Leucaena: Promising Forage and Tree Crop for the Tropics 2nd Edition*. Washington: Nasional Academy of Sciences.
- [11] Restiningtyas, R., Subandiyono and Pinandoyo. 2015. Pemanfaatan Tepung Daun Lamtoro (*Laucaena gluca*) yang Telah Difermentasikan dalam Pakan Buatan terhadap Pertumbuhan Benih Ikan Nila Merah (*Oreochromis niloticus*). *Journal of Aquaculture Management and Technology*, 4 (2): 26-34.
- [12] Schlegel, H. G dan Schmidt, K. 1994. *Mikrobiologi Umum*. Gadjah Mada University Press: Yogyakarta.

- [13] Sukarti, K., Pagoray, H., and Nihlani, A. 2022. Pemanfaatan Kubis sebagai Bahan Pakan Buatan untuk Pertumbuhan Benih Ikan Lele Mutiara (*Clarias gariepinus*). *Jurnal Perikanan dan Kelautan*. 27(2): 192-200.
- [14] Sumarjan, N. S., Hilyana, S., and Azhar, F. 2022. Kombinasi Tepung Daun Kelor dan Probiotik dalam Pakan Terhadap Pertumbuhan dan Kelangsungan Hidup Benih Ikan Nila. *Buletin Veteriner Udayana* 14(3): 263-273.
- [15] Mawalgi, A., Yudha, I.G., Abdullah, L., Mulya, D. 2017. Kajian Penggunaan Tepung Pucuk Indigofera zollingeriana Sebagai Substitusi Tepung Kedelai Untuk Pakan Ikan Gurame (*Osphronemus gouramy*)(Lacepede, 1801). In: Seminar Nasional Perikanan dan Kelautan 2017, 1 November 2017, Serang, Provinsi Banten.
- [16] Radiansyah, H. 2022. Pengaruh Kombinasi Tepung Kulit Nanas Dan Daun Pepaya Sebagai Campuran Pakan Komersil Pada Pertumbuhan Ikan Nila (*Oreochromis niloticus*).

