International Journal of Plant & Soil Science

Volume 37, Issue 6, Page 441-448, 2025; Article no.IJPSS.136987
ISSN: 2320-7035

Evaluation of Fish Waste Compost as a Fertiliser for Agricultural Use: A Study in Mizoram, India

Nongmaithem Leindah Devi [a], Athokpam Herojit Singh [a], Jotish Nongthombam [b*], Joshikumar Khangembam [b] and K. P. Chaudhary [b]

[a] Department of Soil Science and Agricultural Chemistry, College of Agriculture, Central Agricultural University, Iroisemba, Imphal, Manipur, India.
[b] K.V.K, Aizawl, C.V. Sc. & A.H., Central Agricultural University (I), Selesih, Aizawl, Mizoram, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ijpss/2025/v37i65523

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy.Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://pr.sdiarticle5.com/review-history/136987

Original Research Article

Received: 06/04/2025
Accepted: 09/06/2025
Published: 17/06/2025

ABSTRACT

Nearly 75% of the total weight of the fish is generated as solid waste in the form of gut, head, skin, bones, fins and frames after processing. The fish wastes (FW) rich in nitrogen (N), potassium (K), phosphorus (P) and trace minerals can serve as raw material for the production of many nutritive and non-nutritive products. The study aimed to evaluate the compost prepared from fish waste, which was used as a fertiliser for agricultural use. The study was conducted under pot culture experiment was conducted in a pot culture with broccoli crop (*Brassica oleracea*) at KVK, Aizawl farm, C.V. Sc. & A.H., CAU (I), Selesih, Mizoram, India. The research was conducted with eleven treatments with three replications. A pot experiment was conducted to study the effectiveness of

**Corresponding author: E-mail: jnongthombam@gmail.com;*

Cite as: *Devi, Nongmaithem Leindah, Athokpam Herojit Singh, Jotish Nongthombam, Joshikumar Khangembam, and K. P. Chaudhary. 2025. "Evaluation of Fish Waste Compost As a Fertiliser for Agricultural Use: A Study in Mizoram, India". International Journal of Plant & Soil Science 37 (6):441-48. https://doi.org/10.9734/ijpss/2025/v37i65523.*

this compost on broccoli. Data for yield attributes such as plant height (cm), no. of leaves per plant (nos.), stem diameter (cm), width of the curd (cm) and weight of the curd per pot (g) were recorded. All the data of observations recorded in the experiments were statistically analysed, and the critical differences (CD) were worked out at a 5% probability level. There was a positive correlation between the plant height, no. of leaves per plant, stem diameter (cm), width of curd (cm) and weight of the curd per pot (g). Treatments (T_{11}) recorded the highest among all treatments, i.e., 25.2 (no. of leaves per plant), 4.58 (stem diameter, cm), 15.97 (width of the curd, cm) and 272.20 (weight of the curd per pot, g). Ascorbic acid content in broccoli crop was recorded higher in 100% fish waste compost with vermiwash (50%) and *Phlogacanthus pubinervius*(50%) (T_{11}), i.e., 70.25 (mg/100g). Hence, results from these experiments show that this fish waste compost was highly effective on the broccoli and conclude that fish compost can be used as a fertiliser in agricultural practices. It is an effective compost which can enhance yield, yield attributes and quality of broccoli.

Keywords: Fish waste; compost; broccoli; fertiliser; agriculture.

1. INTRODUCTION

India is the world's second-largest aquaculture nation and third-largest fish producer after China, with a tremendous 11-fold leap from 0.75 million tonnes in 1950 to 9.6 million tonnes by 2012-13. There are around 26% of total food stocks (156.4 million tons) which have not found any application yet, accounting globally to 40.66 million tons of waste. The latest estimates by the FAO report that global catches, including aquaculture, marine and inland fisheries, account for 178.5 million tons of live weight, of which 156.4 tons are destined for human consumption and 22.2 tons for non-food uses (Caruso et al., 2020). Nearly 75% of the total weight of the fish is generated as solid waste in the form of gut, head, skin, bones, fins and frames after processing. Currently, the post-catch fish losses represent a huge economic and environmental concern occurring in most fish distribution chains, with large amounts of landed fish lost or discarded between landing and consumption (Coppola et al., 2021; Devi et al., 2024). The fish wastes (FW) rich in nitrogen (N), potassium (K), phosphorus (P) and trace minerals can serve as raw material for the production of many nutritive and non-nutritive products (Ghaly *et al.,* 2013). The present level of annual fish production of Manipur (27 lakh population) is to the tune of 33,000 tonnes in 2022 (Fisheries Department, Manipur, 2023) as against the total requirement of about 40,000 tonnes (Dorothy*et al.,* 2018). This shortfall of about 7,000 tonnes is imported from other states of the country. The solid waste material of the fish will be transformed into compost for the improvement of soil fertility owing to high contents of nutrients, such as N, P, and calcium (Illera *et al.,*2015). This fish compost also acts as organic fertiliser as it feeds the soil rather than crops to maintain optimum soil health with its vibrancy and resilience, and thereby making the soil capable of supplying all the essential nutrients to the crop for its proper growth and development. Applications of chemical fertilisers have robbed the soil fertility and have resulted in health and environmental hazards. On the other hand, the use of organic waste as fertilisers will improve the soil structure, water holding capacity, microbial biomass, and nutrient availability and will pave the way for sustainable agricultural practices (Ravisankar *et al.,* 2021).

Broccoli is semi-strong against coldness and has good market value (Sermenli *et al.,* 2011; Ouda and Mahadeen, 2008). Inorganic nitrogen fertilisation plays an essential role in increasing broccoli yield and quality (Tiwari *et al.,* 2017). But organic manure plays an important role in plant growth as a source of major micro and macro nutrients in available forms during mineralisation, and impairing the physical and physiological properties of soil. Organic production also improved the growth of crop products (Borguini *et al.,* 2013). The study includes fish waste compost, locally available bio-pesticide, which controls the pest, and vermiwash to enrich the nutrients of the crops. However, little is known about the influence of the addition of fish composts in combination with vermiwash and biopesticides (*Artemesia nilgarica (Leibakngou)*, *Vitex negundo (Urikshibi)* and *Phlagacanthus pubinervius (Nomangkha angangba*) on the yield and yield attributes of crops. With this background, the following objective of evaluation of fish waste as compost as fertiliser and its effect on broccoli was taken up. The study aimed to evaluate the compost prepared from fish waste, which was used as a fertiliser for agricultural use.

2. MATERIALS AND METHODS

Preparation of fish compost: The solid FW, such as gut, head, skin, bones, fins, scale and intestine, were collected and chopped into finer forms. This chopped FW (w/w) 80% was mixed with sawdust 20%, whole banana, jaggery and distilled water were placed layer by layer in the compost basket bin. Later, the compost was stirred continuously in the interval of 3-4 days until the final fish compost was formed. It took 120-140 days to form fish waste compost.

Preparation of biopesticides and collection of vermiwash: *Artemesia nilgarica (Leibakngou)*, *Vitex negundo (Urikshibi)* and *Phlagacanthus pubinervius (Nomangkha angangba*) were used as biopesticide in this study. *Artemesia nilgarica* leaves of 500 gm were crushed and the extract were dilute to 500 ml of distilled water. Similarly for *Vitex negundo* and *Phlagacanthus pubinervius* were prepared separately. For the study, 50% concentration solutions of each extract were used for foliar spray during the critical growth stages of the crop growth. Vermiwash collected from demonstration farm of KVK Aizawl, Central Agricultural University, Selesih, Mizoram, was also used for foliar spraying at periods of crop growth.

Experimental sites: The study was conducted under pot culture experiment was conducted in a pot culture with broccoli crop (*Brassica oleracea*) at KVK, Aizawl farm, C.V.Sc.&A.H., CAU (I), Selesih, Mizoram (Fig. 1). The variety 'Fantasy' CLX3512 developed by H.M. Clause Pvt. Ltd was used. The plant has vigorous growth habitat which bears smooth leaves which are dark green, it has a round head which is compact and bluish green in colour.The pot culture soil was loamy in texture with 480.9 kg ha^{-1}available N,9.78 kg ha^{-1} P_2O_5, 319.1 kg ha^{-1} available K_2O and a pH value of 5.42 (Table 1).

Treatment details of the pot culture experiment: The research was conducted with eleven treatments with three replication consisting of control, inorganic fertilizer application, fish waste compost pellets as basal fertilizer (810 gm $plant^{-1}$ was incorporate with the soil), foliar application of vermiwash, three different bio pesticides ie.: *Artemesia nilgarica*, *Vitex negundo* and *Phlogacanthus pubinervius* were given as foliar spray at 20 DAT (Days after transplanting) and 40 DAT and 60 DAT. Concentrations of the bio-pesticides given to the plants were 50%. The recommended doses of the fertiliser were 180:80:60 Kg ha^{-1} N, P_2O_5 and K_2O. The treatment details are given as: T_1: Control, T_2: Inorganic fertilizer (100%) (RFD:180:80:60 Kg ha^{-1} N, P_2O_5 and K_2O), T_3: Fish compost (100%), T_4: Vermiwash (50%) (foliar spray), T_5: *Artemesia nilgarica (Leibakngou)* (50%)(foliar spray),T_6: *Vitex negundo (Urikshibi)* (50%) (foliar spray), T_7:*Phlagacanthuspubinervius (Nomangkha angangba*)(50%) (foliar spray), T_8: Fish compost (100%)+ Vermiwash (50%), T_9: Fish compost (100%)+Vermiwash (50%)+ *Artemesia nilgarica*(50%), T_{10}: Fish compost (100%)+ Vermiwash (50%)+ *Vitex negundo* (50%), T_{11}: Fish compost (100%)+ Vermiwash (50%)+*Phlagacanthus pubinervius*(50%). The treatments were replicated thrice and were arranged in a completely randomised block design for the research study.

Fig. 1. KVK, Aizawl farm, C.V.Sc.&A.H., CAU (I), Selesih, Mizoram

Data for yield attributes such as plant height (cm), no. of leaves per plant (nos.), stem diameter (cm), width of the curd (cm) and weight of the curd per pot (g) were recorded. Ascorbic acid analysis was done as a quality parameter (Hudson *et al*., 1985).

3. STATISTICAL ANALYSIS

All the data of observations recorded in the experiments were statistically analysed, and the critical differences (CD) were worked out at a 5% probability level.

4. RESULTS AND DISCUSSION

4.1 Nutrient Content in the Fish Compost and Biopesticides

The final product of the fish compost was dark brown, crumbly and smelled like earth (Table 2). The pH of the fish waste compost pellets was 6.80, EC was 2.97(dS/m), and organic carbon content was 0.81 per cent. Total major nutrient content in fish waste compost pellets was 3.66 per cent of nitrogen, 1.03 per cent of phosphorus, and 1.2 per cent of potassium (Table 2).

In vermi wash, the pH was found to be 7.48, EC was 0.25 (dS/m), and organic carbon content was 0.008 per cent. Total major nutrient content in vermi wash was 0.01 per cent of nitrogen, 0.0025 per cent of phosphorus, 0.063 per cent of potassium (Table 2).

For *Phlogacanthus pubinervius,* the pH was found to be 6.43, EC was 0.15 (dS/m) and organic carbon content was 0.002 per cent. Total major nutrient content in *Phlogacanthus pubinervius* was 0.0090 per cent of nitrogen, 0.0004 per cent of phosphorus, 0.031 per cent of potassium (Table 2).

In *Artemesia nilgarica,* the pH was found to be 6.51, EC was 0.19 (dS/m), and organic carbon content was 0.002 per cent. Total major nutrient content in *Artemesia nilgarica* was 0.008 per cent of nitrogen, 0.0005 per cent of phosphorus, 0.038 per cent of potassium (Table 2).

For *Vitex negundo,* the pH was found to be 6.48, EC was 0.15 (dS/m), and organic carbon content was 0.002 per cent. Total major nutrient content in *Vitex negundo*was 0.0090 per cent of nitrogen, 0.0005 per cent of phosphorus, 0.037 per cent of potassium (Table 2).

4.2 Influence of Fish Waste Compost on Crop Growth and Yield of Broccoli

Plant growth and yield attributes, yield of broccoli, were significantly influenced by application of fish waste compost. Results reveal that maximum plant growth and yield attributes were obtained in 100% fish waste compost with Vermiwash (50%) and *Phlagacanthus pubinervius*(50%), which was followed by foliar application of Fish waste compost (100%) + Vermiwash (50%) + *Vitex negundo* (50%) in all growth stages. Plant height of broccoli crop that received 100% fish waste compost with Vermiwash (50%) and *Phlagacanthus pubinervius* (50%) (T_{11}) was recorded the highest with a height of 16.3, 30.5 and 39.6cm at 30, 60 and 90 DAT (Table 3). This was followed by Fish waste compost (100%) + Vermiwash (50%) + *Vitex negundo* (50%) (T_{10}) that recorded with a plant height of 16.2, 30.3 and 39.7 cm at 30, 60 and 90 DAT correspondingly (Table 3). Increased plant growth was also found by the application of organic manure, and was supported by the work of Singh *et al.*(2014) in broccoli and Tiwari *et al.* (2017) also reported an increase in growth and yield of broccoliby application of liquid manure and fish oil emulsion.

Table 1. Physico-chemical analysis of the initial soil of pot culture

Sl. No.	Initial Soil Sample
pH	5.42
EC	0.11 dS/m
OC	1.79%
N	480.9 kg/ha
P	9.78 kg/ha
K	319.1 kg/ha
Soil texture	Loam
Bulk density	0.85 Mg m^{-3}

Similar to plant height, no. of leaves per plant, stem diameter (cm), width of curd (cm) and weight of the curd per pot (g) were improved in the treatments where application of fish waste compost was given. Treatments (T_{11}) recorded the highest among all treatments, ie, 25.2 (no. of leaves per plant), 4.58 (stem diameter, cm), 15.97 (width of the curd, cm) and 272.20 (weight of the curd per pot, g) (Table 3). The findings were corroborated with the findings of Muoneke *et al.*(2014) and Jigme *et al.*(2015) that organic fertilisers increase the yield attributes in broccoli. It has been found that organic fertiliser has an important influence on the slow release of

Table 2. Nutrient content in the fish waste compost, vermi wash and biopesticides (*Phlagacanthus pubinervius, Artemesia nilgarica and Vitex negundo)*

Parameters	Fish waste compost	Vermi wash	*Phlagacanthus pubinervius*	*Artemesia nilgarica*	*Vitex negundo*
pH	6.42	7.48	6.43	6.51	6.48
EC (dS/m)	2.97	0.25	0.15	0.19	0.15
OC(%)	0.81	0.008	0.002	0.002	0.002
N(%)	2.47	0.01	0.0090	0.008	0.009
P(%)	0.6	0.0025	0.0004	0.0005	0.0005
K(%)	1.2	0.063	0.031	0.038	0.037

Table 3. Yield and yield attributes and ascorbic acid content of broccoli

Treatment details	Plant height (cm)			No. of leaves per plant	Stem diameter (cm)	Width of the curd (cm)	Weight of the curd per pot (g)	Ascorbic acid (mg/100g)
	30 DAT	60 DAT	90 DAT					
T_1	14.9	19.9	26.4	12.5	3.42	10.3.	101.60	64.34
T_2	15.4	21.0	27.5	17.1	4.05	10.7	135.20	65.53
T_3	15.7	24.2	34.4	20.6	4.32	12.9	165.40	68.92
T_4	15.7	22.0	29.8	17.6	4.19	12.2	150.10	67.42
T_5	14.9	20.3	26.7	15.3	3.45	10.8	103.20	64.47
T_6	15.0	20.3	26.8	14.8	3.49	10.6	102.40	64.44
T_7	15.5	21.0	27.2	16.9	3.50	10.5	102.90	64.47
T_8	16.0	30.6	38.2	22.4	4.49	15.46	268.20	70.15
T_9	15.8	29.8	38.4	25.1	4.56	15.84	271.20	70.18
T_{10}	15.7	30.5	39.1	27.3	4.52	15.92	271.80	70.21
T_{11}	15.8	30.6	39.6	25.2	4.58	15.97	272.20	70.25
Sem	0.08	0.24	0.33	0.29	0.06	0.20	2.96	0.82
CD	0.25	0.71	0.99	0.86	0.19	0.58	8.74	2.42

Table 4. Correlation studies of yield and yield attributes in broccoli

	30 DAT (plant height)	60 DAT (plant height)	90 DAT (plant height)	No. of leaves per plant	Stem diameter (cm)	Width of the curd (cm)	Weight of the curd per pot (g)
30 DAT (plant height)	1						
60 DAT (plant height)	0.799	1					
90 DAT (plant height)	0.820	0.984	1				
No of leaves per plant	0.813	0.948	0.959	1			
Stem diameter (cm)	0.897	0.885	0.921	0.907	1		
Width of the curd (cm)	0.798	0.989	0.989	0.955	0.910	1	
Weight of the curd per pot (g)	0.807	0.991	0.979	0.948	0.919	0.990	1

nutrients which support root development, leading to higher yield and quality of broccoli plants (Hameeda *et al.,*2007) and on cauliflower (Al-Nasir, 2002).

There was a positive correlation between the plant height, no. of leaves per plant, stem diameter (cm), width of curd (cm) and weight of the curd per pot (g), which was shown in table in Table 4.

4.3 Influence of Fish Waste Compost on Ascorbic Acid Content in Broccoli

Ascorbic acid content in broccoli crop was recorded higher in 100% fish waste compost with vermiwash (50%) and *Phlogacanthus pubinervius* (50%) (T_{11}), ie70.25 (mg/100g) (Table 3). The present findings were similar to *Ghurbat et al. (2016) that*adding organic fertiliser caused significant positive differences in vitamin C%, and Tiwari et al. (2017 also reported that the quality parameters were increased significantly due to the good assimilation of nutrients and by better management of organic manuring.

5. CONCLUSION

The solid waste material of the fish will be transformed into fish compost for the improvement of soil fertility. The locally available bio-pesticide will also be used to control the pest, and vermiwash to enrich the nutrients of the crop. It can be concluded that fish waste compost is an effective compost which can enhance yield, yield attributes and quality of broccoli.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

ACKNOWLEDGEMENT

The authors are especially grateful to Rt. Dr. M. Premjit Singh (Ex. VC) Central Agricultural University, Imphal and Rt. DR. JM Laishram (Ex, Dean) and Dr. Indira Sarangthem (Dean) CAU, Imphal for their valuable suggestions during the course of investigation. The authors are very highly pleased to acknowledge University Grants Commission (UGC) for providing financial assistance under Post Doctoral Fellow (2017-18) awarded to N. Leindah Devi.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Al-Nasir, F. (2002). Effect of organic fertilizers on yield and nutrients concentration of cauliflower plant. *Arch. Acker-Pfl. Boden*, *48*, 37–47.

Borguini, R. G., Bastos, D. H. M., Moita-Neto, J. M., Capasso, F. S., & Torres, E. F. S. (2013). Antioxidant potential of tomatoes cultivated in organic and conventional systems. *Braz Arch Biol Technol*, *56*, 521–529.

Caruso, G., Floris, R., Serangeli, C., & Di Paola, L. (2020). Fishery wastes as a yet undiscovered treasure from the sea: Biomolecules sources, extraction methods and valorization. *Marine Drugs*, *18*(12), 622.

Coppola, D., Lauritano, C., Palma Esposito, F., Riccio, G., Rizzo, C., & de Pascale, D. (2021). Fish waste: From problem to valuable resource. *Marine Drugs*, *19*(2), 116.

Devi, N. L., Singh, A. H., Nongthombam, J., Kumar, S., & Chaudhary, K. (2024). Fish waste compost - A fertilizer for organic agriculture. *Journal of Experimental Agriculture International*, *46*(11), 778–785.

Dorothy, M. S., Monsang, S. J., Sribidya, W., Parhi, J., & Bidyasagar, S. (2018). Present status and future prospects of fisheries in Manipur. *Indian Journal of Ecology*, *45*(1), 222–226.

Fisheries Department Manipur. (2023). https://www.ceicdata.com/en/india/fish-production/fish-production-manipur

Ghaly, A. E., Ramakrishnan, V. V., Brooks, M. S., Budge, S. M., & Dave, D. (2013). Fish processing wastes as a potential source of proteins, amino acids and oils: A critical review. *Journal of Microbial & Biochemical Technology*, *5*(4), 107–129.

Ghurbat, H., Mohammed, Taha, Z., Sarhanand, & Teli, J. A. (2016). Effect of mulching and organic fertilizer on growth, yield and quality of broccoli (*Brassica oleracea var. italica*). *Journal of Zankoy Sulaimani Part-A- (Pure and Applied Sciences)*, *18*(1), 20–212.

Hameeda, B., Harini, G., Rupelal, O. P., Reddy, & Gopal. (2007). Effect of composts or vermicomposts on sorghum growth and

mycorrhizal colonization. *African J. Biotechnol.*, *6*, 9–12.

Hudson, D. E., Cappellini, M., & Lachance, P. A. (1986). Ascorbic acid content of broccoli during blanching. *Journal of Food Quality*, *9*, 31–37.

Illera Vives, M., Labandeira, S. S., Brito, L. M., López-Fabal, A., & López-Mosquera, M. E. (2015). Evaluation of compost from seaweed and fish waste as a fertilizer for horticultural use. *Sci. Hortic.*, *186*, 101–107.

Jigme, Nipon Jayamangkala, Sutigoolabud, P., Inthasan, J., &Sakhonwasee, S. (2015). The effect of organic fertilizers on growth and yield of broccoli (*Brassica oleracea L. var. italica*Plenck cv. Top Green). *Journal of Organic Systems*, *10*(1), 9–14.

Munoneke, C. O., Okpara, D., Ofor, C., Orji, R., Onwuka, J., &Ibiam, B. (2014). Organic/inorganic leaf amaranth production: The case of poultry manure, fish effluent and NPK fertilizer. *Proc 4th ISOFAR Sci Conf Building Organic Bridges. Organic World Congress 2014, Istanbul, Turkey* (eprint ID 23126).

Ouda, B. A., & Mahadeen, Y. (2008). Effect of fertilizers on growth, yield, yield components, quality and certain nutrient contents in broccoli (*Brassica oleracea*). *Int J Agric Biol*, *10*, 627–632.

Ravisankar, N., Ansari, M. A., Panwar, A. S., Aulakh, C. S., Sharma, S. K., Suganthy, M., Suja, G., & Jaganathan, D. (2021). Organic farming research in India: Potential technologies and way forward. *Indian Journal of Agronomy*, *66* (5th IAC Special Issue), S142–S162.

Sermenli, T., Mavi, K., & Yilmaz, S. (2011). Determination of transplanting dates of broccoli (*Brassica oleracea L. var. italica*Plenck) under Antakya conditions. *Journal of Animal and Plant Sciences*, *21*(4), 638–641.

Singh, A., Maji, S., & Kumar, S. (2014). Effect of biofertilizers on yield and biomolecules of anti-cancerous vegetable broccoli. *Int J Bio-resour and Manag.*, *5*, 262–268.

Tiwari, S. K., Maji, S., Kumar, S., Govind, Meena, K. R., Yadav, R., & Kumar, A. (2017). Effect of liquid manure and fish oil emulsion on the growth, yield and quality of broccoli (*Brassica oleracea var. italica*vc KTS-1). *Environment & Ecology*, *35*(1B), 484–489.

Peer-review history:
The peer review history for this paper can be accessed here:
https://pr.sdiarticle5.com/review-history/136987