TRENDS IN AGRICULTURE SCIENCE
Popular Article
Vol.3 Issue 03 March 2024, Page: 1595-1597

Chicken Feather Hydrolysate as A Nitrogen Rich Fertilizer

Kritika Kesta*, Sunita Devi, Kumari Manorma, Megha Sharma
Department of Basic Sciences, Dr. YSP University of Horticulture and Forestry, Nauni, Solan 173230
https://doi.org/10.5281/zenodo.10850203

Introduction

Chicken feathers are produced by many poultry processing plants including poultry farms as a by-product, led to environmental pollution. About 5 million tons of feathers are produced from poultry-processing plants every year. Feathers contain about 90 percent keratinous protein. Keratin is biologically insoluble, recalcitrant and biochemically rigid molecule which is resistant to degradation by most common proteolytic enzymes. Their proper and ecofriendly disposal is a major constraint for these processing plants and poultry farms. Additionally, the potential risks due to disposal of these wastes are aggravated as a consequence of the decreasing amount of land available for their disposal as well as environmental pollution of both air and underground water resources along with protein wastage like keratin (Chauhan and Devi 2020). Generally, physico- chemical methods are employed for their disposal which however, led to the deterioration of their nutritional quality as feathers are a good source of peptides, essential amino acids, and minerals like N, phosphorus, potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), manganese (Mn), zinc (Zn), and copper (Cu). Biodegradation of feathers by keratinolytic bacteria is therefore an efficient, cost-effective, and environmental - friendly method for bioconversion of feather waste into nutritionally balanced, digestible, and nitrogen - rich feather lysate.

Chicken Feather Hydrolysate (CFH): Preparation and chemical composition

Chicken feather hydrolysate is prepared by proteolysis of keratinolytic microbes. CFH is rich in minerals, peptides and amino acids which can be easily absorbed by the plant roots and can be translocated to the plant tissues (Figure 1 and Table 1). These nutrients in the hydrolysate facilitates the growth of microbes in the rhizosphere that promotes the uptake and utilization of nutrients from the soil. The application of hydrolysate enhances the water-holding capacity, C/N ratio, and mineral content of soil. The plant-growth-promoting activities of hydrolysate potentiate its possible use in organic farming and improve both the soil ecosystem and microbiota. Height of

Published: 21 March. 2024
ISSN: 2583-7850

plant, leaf number, shoot dry biomass, root length, root surface area, and root dry biomass significantly increased by the application of chicken feather protein hydrolysate (Vavrova et al. 2022).

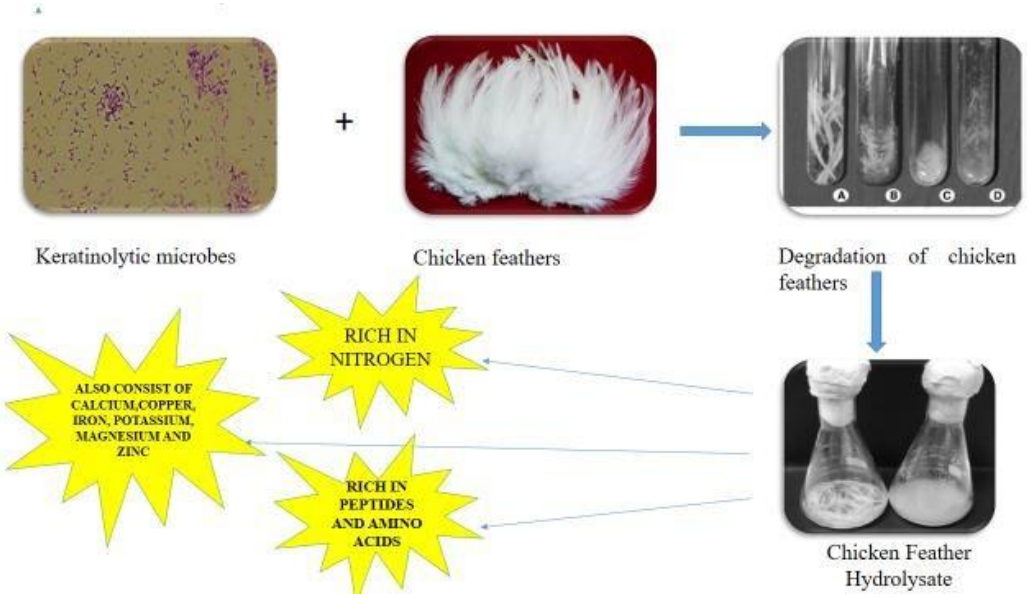

Figure 1. Chicken Feather Hydrolysate

Table 1. Chemical composition of feather hydrolysate (Sobucki et al .2019)

Sr. No.	Nutrient	Feather hydrolysate (mg/L)
1.	Ca	9.83
2.	Cu	0.11
3.	Fe	0.35
4.	K	250.0
5.	Mg	7.78
6.	Mn	0.07
7.	N	1536.50
8.	Zn	0.73

Applications Of CFH As N-Rich Fertilizer

Organic fertilizers are recognized as alternatives to synthetic sources as they have the potential to increase soil quality from both agricultural and environmental perspectives.

- Tryptophan released during feather hydrolysis acts as a precursor for the production of

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ISSN: 2583-7850

indole-3-acetic acid (IAA), an essential phytohormone that prompts cell division and elongation, embryogenesis, apical dominance, and root growth in plants that promotes the uptake of water and nutrients from soil (Bhari et al. 2021).

- The vegetative growth parameters of greenhouse lettuce were assessed for different treatments in comparison to urea which is the most common commercial N fertilizer. Leaf numbers increased during the cultivation period that is 60 days and, as early as the 18th day, lettuce fertilized with CFH displayed increased numbers in comparison to the other treatment (Sobucki et al .2019).
- Chicken feather hydrolysate obtained using *Streptomyces sampsonii* has been reported to signifcantly increase plant height of wheat crop, as well as microbial count and proteolytic activity in barren agricultural land (Bhari et al. 2021).
- The yield response of Cantaloupe (*Cucumis melo*), pepper (*Capsicum annuum*), and tomato (*Lycopersicon esculentum*) was increased with the application of chicken feather hydrolysate. This study also demonstrated that organic fertilizers can provide multiple benefits for specific vegetable production systems, including fertility improvement, an increase in soil microbial populations, and a reduction in the incidence of soilborne disease (Vavrova et al. 2022).

References

Bhari R. et al. 2021. Chicken Feather Waste Hydrolysate as a Superior Biofertilizer in Agroindustry. *Curr Microbiol* 78, 2212–2230. https://doi.org/10.1007/s00284-021-02491-z.

Chauhan S and Devi S. 2020. Optimization of cultural conditions for enhanced keratinase production by *Bacillus cereus* N14 obtained from the poultry farm of Himachal Pradesh (India). *Int. J. Chem. Stud.* 8(2), 2610-2619. https://doi.org/10.22271/chemi.2020.v8.i2an.9145.

Sobucki L et al. 2019. Feather hydrolysate as a promising nitrogen-rich fertilizer for greenhouse lettuce cultivation. *Int J Recycl Org Waste Agricult.* 8 (Suppl 1), 493–499. https://doi.org/10.1007/s40093-019-0281-7.

Tamreihao et al. 2018. Feather degradation by keratinolytic bacteria and biofertilizing potential for sustainable agricultural production. *J. Basic Microbiol.* 1-10. https://doi.org/10.1002/jobm.201800434.

Vavrova, K et al. 2022 Waste Feathers Processing to Liquid Fertilizers for Sustainable Agriculture—LCA, Economic Evaluation, and Case Study. *Processes*, 10, 2478. https://doi.org/ 10.3390/pr10122478.

Published: 21 March. 2024
ISSN: 2583-7850