Scope
Volume 14 Number 02 June 2024

Impact of Varied Organic Manures and Biofertilizers on the Economic Feasibility of Fenugreek Cultivation

Shubhi Agrawal[1], Khuraijam Panthoi Chanu[2], Vaibhav Bopche[3] and Abha Sharma[4]

Amity Institute of Organic Agriculture,
Amity University Uttar Pradesh, Noida, India

Corresponding author: Abha Sharma

Abstract

Organic manures and biofertilizers can improve the health of agricultural systems by positively impacting soil structure and microbial populations. The research focused on fenugreek, a member of the Fabaceae family known for its culinary and medicinal properties. During the Rabi season 2023-24, a study was conducted at the Amity Institute of Organic Agriculture's research farm at Amity University Noida (Uttar Pradesh) to investigate the effects of various organic manures and biofertilizers on fenugreek yield. The experiment was designed in a randomized block pattern with six treatments replicated three times. A study was conducted to compare the outcomes of new approaches to standard methods and assess their economic viability in the field. The results showed that treatments that included biofertilizer's and organic manures yielded higher net returns and benefit-cost ratios than treatments that only employed organic manures. The numeric calculations indicated that using organic manure combinations was economically viable, with T4 (vermicompost + Azotobacter) providing the greatest net return of 119,389 rupees. These findings demonstrate the potential of organic inputs in sustainable fenugreek cultivation, providing farmers and stakeholders with valuable information to support environmentally friendly agricultural practices.

Keywords: Organic manures, FYM, vermicompost, poultry manure, plant growth parameters, yield.

Introduction Fenugreek (*Trigonella foenum-graecum)* is a perennial member of the Fabaceae family, which is distinguished by its leguminous nature. Fenugreek is classified within the Trigonella genus, a group including many species recognized for their aromatic characteristics and diverse applications ranging from culinary to medicinal. Fenugreek is distinguished by its trifoliate leaves, little white blooms, and unique seeds. The plant is well-known for its high concentration of bioactive components like alkaloids, flavonoids, and saponins. Smith, P., et al. (2016). A taxonomic viewpoint is required for a complete analysis of the costs and benefits associated with various organic inputs Bugg, R. L., et al. (2008).

The Mediterranean region, which includes Western Asia and Southern Europe, was its native habitat **(USDA, 2021).** The spread of fenugreek to China and India throughout the Middle Ages increased its range of geographical distribution. **(Ahmad *et al.*,2015)**

Fenugreek seeds are well-known for their high protein content, making them an important dietary source. Fenugreek seeds are also high in dietary fibre, which helps with digestion. Fenugreek seeds are high in minerals including iron, calcium, and magnesium. Fenugreek seeds include a variety of B-complex vitamins, which help to maintain overall nutritional balance. Fenugreek seeds have antioxidant qualities that are beneficial to health and battle oxidative stress**. Al-Jasass *et al.* (2012)** investigate the antioxidant capacity of fenugreek seeds, revealing information on their role in health promotion.

Recent data analysis identifies a few countries as leading exporters of fenugreek. India is the world's top-growing nation for fenugreek. More than 80% of the nation's fenugreek is produced in Rajasthan alone; other regions that are experiencing growth include Gujarat, Madhya Pradesh, Chhattisgarh, and Uttar Pradesh. India, for example, stands out as a major exporter due to its extensive fenugreek cultivation **(FAO). (2022).** The output of fenugreek seed in 2019–20 amounted to 1,88,480 tons, coming from 1,20,340 hectares of land. This represents 11.22% and 69.29% of the total area and production of seed spices. As of right now, fenugreek yields 1566 kg/ha **(DASD, Kozhikode). November 1, 2009**

Fenugreek seeds and leaves add distinct flavours and aromas to a variety of dishes. The slightly bitter taste of the seeds makes them a popular spice in curry blends, and the leaves add a unique flavour to dishes like fenugreek-infused flatbreads and stews.

Fenugreek has been used in traditional medicine for centuries because of its potential health benefits. The herb is known for its anti-inflammatory properties and is frequently used to treat conditions like inflammation and digestive problems **Sharma, R. D. (1986).** Fenugreek is widely recognized for its galactagogue qualities, which make it a popular choice for nursing mothers who want to increase the production of breast milk. Studies have indicated that fenugreek possesses anti-inflammatory and antioxidant properties, ascribed to its flavonoids and saponin constituents. These characteristics are being investigated for possible uses in the treatment of oxidative stress and inflammatory chronic illnesses HASSAN *et al* (2017).

Fenugreek has entered the business world by being used in the creation of perfumes and cosmetics. The herb's aromatic characteristics make it a significant ingredient in the fragrance business, contributing to the development of perfumes, soaps, and lotions **Neelakantan,*et al.*,(2014).** Research has examined the possible benefits of fenugreek for managing diabetes, specifically in terms of lowering blood sugar levels.

Chemical fertilizers are designed to supply precise nutrient formulas quickly. Chemical fertilizers' immediate availability of nutrients can result in rapid initial growth responses.

Concerns have been raised, however, concerning the potential long-term consequences on soil health and environmental sustainability. **Zhang and Chen (2012)** explore nutrient utilization efficiency, emphasizing the importance of nuanced nutrient control in chemical fertilization. Chemical fertilizers are vital for providing crops with the nutrients they need, but an excessive, irregular, and frequent application of them deteriorates the soil's physical and chemical qualities, diminishes the quality of the products generated, and ultimately results in decreased crop yields. However, the advent of commercial cultivars and intensive cultivation techniques for the sustainability of agricultural output has led to an increase in the demand for micronutrients. Using all available techniques, including chemical, organic, and biological fertilizers, is necessary to maintain the level of soil fertility. As such, it is essential to apply all available nutrient sources while taking cost into account and to complement the crop's required nutritional balance with chemical fertilizers**. (Chiranjibi Thapa.,et.al 2022)**

Organic farming practices, including various organic manures, can impact the nutritional composition of fenugreek seed. **Gajbhiye *et al.* (2019)** show how organic manures affect nutritional quality, providing insight into prospective consequences on fenugreek.

Singh *et al.* (2016) present a review of biofertilizers in sustainable agriculture, laying the groundwork for further research on their possible influence on fenugreek seed. Organic fertilizers originating from natural sources such as compost, manure, and plant leftovers provide a holistic approach to soil enrichment. Organic matter application promotes nutrient release and microbial activity over time. Organic manures and biofertilizers have a good effect on soil structure and microbial populations, according to studies such as those by **Adholeya and Kaur (2005) and Garg et al. (2006),** which can improve the overall health of the agriculture system. Meanwhile, biofertilizers are live microorganisms that form symbiotic connections with plants, promoting nutrient mobilization and uptake Rajput, R. C., et al. (2012)**.** The nutrient mix of organic and chemical fertilizers has a significant impact on plant growth. Organic manures, which are high in a variety of nutrients, lead to more balanced soil nutrition. Chemical fertilizers, on the other hand, may be deficient in organic matter, which is necessary for improving soil structure. **Marschner's (2011)** research emphasizes the importance of nutrient interactions and availability in shaping plant responses to various fertilizer types.

The impact of organic vs. chemical fertilizers on soil health and microbial activity is a critical part of the organic vs. chemical fertilizer argument. According to **Drinkwater et al. (1998),** legume-based cropping systems, which are frequently connected with organic farming, have lower carbon and nitrogen losses, indicating greater soil health. According to research on fenugreek growth, both organic and chemical fertilizers can significantly influence plant development. However, as **Cassman and Pingali (1995)** note, the long-term benefits of organic manures are critical for sustainable agriculture.

Zhang and Chen's (2012) research sheds light on the multidimensional nature of nutrient utilization efficiency and its impact on crop output.

Goyal et al. (1999) highlight the economic benefits of increased soil microbial characteristics under organic techniques.

The study "Impact of Varied Organic Manures and Biofertilizers in Fenugreek (Trigonella foenum-graecum) Cultivation" was directed at the economic feasibility of fenugreek.

Materials and Methods: -

The pursuit of sustainable and environmentally conscious agricultural methods is critical in the ever-changing landscape of agricultural activities. This study was carried out during the Rabi season of 2023-2024.

This study's contents and methodology have been carefully vetted to offer a rigorous and systematic approach. In experimental plots, standardized fenugreek seeds were grown under regulated environmental conditions. To reduce biases, the experimental design includes randomized blocks, and various organic inputs, including compost, vermicompost, and farmyard manure, will be strategically applied at different growth phases. These organic inputs will be supplemented by biofertilizers enriched with beneficial microorganisms. Data collection will be extensive, encompassing a wide range of plant development and yield.

The study's robustness will be strengthened further by statistical studies such as Analysis of Variance (ANOVA) and regression analyses, which will reveal trends and make scientifically solid conclusions. This study aims not only to add empirical evidence to the discourse on sustainable agriculture, but also to provide practical insights for farmers, policymakers, and agricultural practitioners attempting to balance productivity and environmental stewardship in fenugreek cultivation. We hope that this investigation will pave the path for more informed decision-making, supporting a more resilient and environmentally sustainable future for fenugreek farming.

Location: -The experiment occurred at the Amity University Organic Farm in Noida, Uttar Pradesh, at 28.5440° N and 77.3330E longitudes and 200 meters above mean sea level.

Climate: -Noida (UP) has semi-arid and subtropical weather, with hot, dry summers and freezing winters. It is in the "Trans-Gangetic plains" agro-climatic zone. May and June are the warmest months, with maximum temperatures regularly ranging between 40°C and 45°C. January is the coldest month, with minimum temperatures frequently ranging between 4°C and 7°C. It will progressively climb from February to June before declining as the southwest monsoons approach. The mean hottest temperature for the trial period was 35.21°C, and the mean lowest temperature was 23.74°C. 141.26 mm of rainfall fell during the monsoon season. The average amount of sunlight per day has dropped to approximately four. zero hours. The average relative humidity (RH) throughout the test was 60.5%. Climate data were acquired from the Indian Meteorological branch in Faridabad (UP) during the experiment.

Result and Discussion

The study named "**Impact of Varied Organic Manures and Biofertilizers on the Economic Feasibility of Fenugreek Cultivation**" was conducted during the rabi season of 2023-2024 at Amity University's Organic Agriculture Farm in Noida, Uttar Pradesh. The study's findings are given and discussed below.

Economic Analysis

The economic analysis calculates the net profit of various medicines. This study trial used a range of organic manures and biofertilizers in different treatment combinations. Calculating farming costs and earnings. fluctuate due to variable yields. In this study, the benefit-cost ratio (B/C ratio) and maximum net returns are determined. Fenugreek production necessitates a B/C ratio greater than 1. If it is less than one, fenugreek won't work correctly. If it is less than zero, the grower or farmer has made a loss.

Cost of Cultivation (Rs/ha)

The table below shows how organic manures and bio-fertilizers impact crop costs. The cost of cultivation includes all fixed and variable expenditures incurred during crop production. T1 (Farm Yard Manure) had the highest culture cost. T6 (control) had the lowest cultivation costs.

Gross Return (Rs/ha)

The table below depicts the impact of treatments on gross returns. In T4, vermicompost with azotobacter produced the highest gross return, but in T6, control produced the lowest gross return.

Net Return (Rs/ha)

The table below again illustrates how treatments affect net return. T4 (vermicompost + azotobacter) had the highest net return, while T6 (control) had the lowest net return.

B: C Ratio

The table below illustrates how therapies influence the B: C ratio. T3 (poultry manure) had the highest B: C ratio and T2 (Vermicompost) had the lowest.

1.Cost of Cultivation

Sr. No.	Particulars Of operation	Inputs	Rate/Unit (D)	Cost (D/ha)
A. Land preparation				
1	Ploughing by disc plough (one)	Tractor drawn disc plough	2500/ha	2500
2	Disc harrowing (one)	Tractor drawn disc harrow	2000/ha	2000
3	Planking (one)	Tractor drawn planker	1000/ha	1000
4	Layout and bed preparation	8 labour	500/man day	4000
5	Manures application (Vermicompost, FYM, Poultry manure)	5 labour	300/man days	1500
B. Sowing				
1	Cost of seed	12 kg seed	90/kg	1080
2	Seed sowing	4 labour	500/man day	2000
C. After Care				
1.	Organic fertilizer application (FYM)	8 labour	300/man days	2400

2.	Gap filling and thinning	5 labour	300/man days	1500
2.	Weeding and hoeing	10 labour	300/person-days	3000
3	Irrigation (3 times)	Three labour	300/person-days	900
D. Harvesting		Ten labour	400/person-days	4000
E. Miscellaneous		-	-	1000
Total Cost				26,880

2.Cost of treatments

Sr. No.	Particulars	Input	Rate/unit (`)	Cost (`/ha)
1	Vermicompost	3 ton	6500/ton	19,500
2	FYM	20 ton	600/ton	12000
3	Poultry manure	3 ton	3250/ton	9750
4	azotobacter	0.25 kg	200/kg	50

3.Benefit-Cost ratio (B: C)

Sr. No	Treatments	Yield (q/ha)	Returns	Gross returns (D)	Cost of cultivation Rs/ha	Net returns/ha	B:C ratio
		Green yield	Green yield				
1	T_1	27.19	89727	89727	38,880	50,847	1.30
2	T_2	29.86	98538	98538	50,280	48,258	0.95

3	T_3	41.52	137016	137016	33,380	1,03,636	3.10
4	T_4	51.43	169719	169719	50,330	1,19,389	2.37
5	T_5	32.57	107481	107481	33,430	74,051	2.21
6	T_6	19.67	64911	64911	26,880	38,031	1.41

Conclusion

Based on a recent study conducted in Amity Institute of Organic Agriculture's research farm in Amity University Noida, Uttar Pradesh, it has been found that growing Fenugreek *Trigonella foenum graecum* with Vermicompost and azotobacter (T4) leads to significantly higher net returns compared to other organic manures and biofertilizers. Furthermore, the cultivar grown with poultry manure showed nearly equal growth and yield characteristics with a substantially higher cost-benefit ratio (3.10) compared to vermicompost + azotobacter (2.37) and all other treatments.

References

1. Adholeya, A., & Kaur, A. (2005). "Decomposition of different organic materials in a semi-arid tropical soil under long-term field conditions." Bioresource Technology, 96(5), 653-660.
2. Al-Jasass, F. M., et al. (2012). "Nutritional Composition of Fenugreek Seeds and Its Potential as a Functional Food." Food & Nutrition Research, 56(1), 16767.
3. Awais Ahmad, [a,1] Salem S. Alghamdi, [a,*] Kaiser Mahmood,[b,2] and Muhammad Afzal[a,3]Fenugreek a multipurpose crop: Potentialities and improvements National Institutes of Health.2015;21-23
4. Bhojanagouda P. Evaluation of fenugreek genotypes under the northern transitional belt of Karnataka. M. Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka India, 2011.
5. Bugg, R. L., et al. (2008). "Organic Farming, Soil Health, and Food Quality: Considering Possible Links." Advances in Agronomy, 98, 1-36.
6. Cassman, K. G., & Pingali, P. L. (1995). "Intensification of irrigated rice systems: Learning from the past to meet future challenges." Nutrition Research, Bioresource Technology, 6(12), 1354-1364.
7. Chiranjibi Thapa , Shiwanand Pandey , Virendra Kumar and Manoj Kumar Effect of Integrated Nutrient Management on Growth and Yield Characteristics of Cauliflower (Brassica oleracea var. botrytis L.) cv. Snow Crown Biological Forum – An International Journal 14(4): 31-39(2022
8. Datta S, Chatterjee R. Performance of Fenugreek (*Trigonella foenum-graecum* L.) genotypes under the new alluvial zone of West Bengal. J. Spices and Aromatic Crops. 2004; 13(2):132-134.
9. Directorate of Arecanut and Spices Development Ministry of Agriculture and Farmers Welfare DASD, Kozhikode). November 1, 2009
10. Drinkwater, L. E., Wagoner, P., & Sarrantonio, M. (1998). "Legume-based cropping systems have reduced carbon and nitrogen losses." Nature, 396(6708), 262-265.

11. Gajbhiye, A., et al. (2019). "Effect of Organic Manures on Nutritional Quality and Antioxidant Activities of Aloe vera (L.) Burm. f." Journal of Pharmacognosy and Phytochemistry, 8(3), 4714-4718.

12. Goyal, S., Chander, K., Mundra, M., & Kapoor, K. K. (1999). "Influence of inorganic fertilizers and organic amendments on soil organic matter and soil microbial properties under tropical conditions." Biology and Fertility of Soils, 29(2), 196-200.
13. Hassan, N. A., Salem, M. B., Sayed, A. A., & El-Seady, R. (2017). "Influence of fenugreek seeds content on quality attributes and antioxidant activity of flat bread." Journal of Food Science and Technology, 54(3), 667-676.
14. Kuri BR, Jat NL, Shivran AC, Saharawat YS, Bana RS, Dadarwal RS. Effect of time, varieties and plant growth regulators on growth, physiological indices, and productivity of coriander (*Coriandrum sativum*). Indian J. Agro. 2015; 60(3):464-470.
15. Malik TP, Tehlan SK. Performance of fenugreek (*Trigonella foenum-graecum*) genotypes for growth and seed yield. Ann. of Hort. 2009; 2(2): 237-239.
16. Neelakantan, N., Narayanan, M., de Souza, R. J., van Dam, R. M., & Koh, W. P. (2014). "The effect of fenugreek supplementation on plasma testosterone and markers of oxidative stress in male subjects." Phytotherapy Research, 28(2), 182-185.
17. Rajput, R. C., et al. (2012). "Biofertilizers in Agriculture: An Overview." Journal of Agroecology and Natural Resource Management, 1(2), 69-75.
18. Sharma, R. D. (1986). "Effect of fenugreek seeds and leaves on blood glucose and serum insulin responses in human subjects." Nutrition Research, 6(12), 1353-1364.
19. Singh, R. P., et al. (2016). "Biofertilizers in Sustainable Agriculture: An Overview on Concepts, Approaches, and Technologies." 3 Biotech, 6(1), 1-13.
20. Zhang, F., & Chen, X. (2012). "Nutrient use efficiency of crops: Concepts and approaches." Springer Science & Business Media. 54(3), 667-676