

The Analysis of the Impact of Soil Health and Land Fertility through Green Manuring in Organic Farming

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Abstract: *Green manures can play a significant role. Utilising green manure is one of the trends in environmental protection that aids in the agricultural sector's transition to sustainability by conserving help conserve sources and meeting consumer demand for food. There is a positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there is no positive effects on the quality of soil health, land fertility, and environmental sustainability from chemical fertilizers." This discussion concludes that agriculture farmers are aware of environmental protection and soil health and land fertility affordable but some economic affordable benefits encourage to usages of chemical fertiliser that is hindering the green manuring based organic farming.*

Keywords: Green manuring, Soil health and fertility, Usage of chemical fertilisers, Organic farming

I. INTRODUCTION

Soil health and land fertility are fundamental pillars of sustainable agriculture, ensuring long-term productivity and environmental integrity. Green manuring, a practice rooted in agroecological principles, has gained recognition as an effective and sustainable strategy to enhance soil quality. The advantages of green manuring extend beyond soil fertility. This practice enhances soil structure, water retention, and reduces erosion, all of which contribute to improved soil health. The addition of organic matter boosts microbial diversity, leading to increased nutrient cycling and a reduction in soil borne diseases. It also plays a pivotal role in carbon sequestration, contributing to climate change mitigation by storing carbon in the soil. Green manuring has a great influence on availability of important plant nutrients such as Nitrogen, Phosphorus, Potassium, micronutrients and also increases the water holding capacity of soil. One of the geographical protective measures in the farming industry is the use of green manure. This is a result of achieving sustainability by conserving supply and fulfilling food demand. As a result of looking for efficient and more sustainable ways to produce, present-day farmers experience a vast number of issues of which one of which is soil fertility conservation without making use of chemicals and the most obtainable solution is manure crops. It has been discovered that this method has a more lasting impact on the soil than in ancient times. It is a more priceless method for farmers who want to minimize the adoption of damaging chemicals for the fertility of the soil. Green manure refers to crops that are grown and then tilled back into the soil while still green and actively growing. The purpose is to improve soil fertility, structure, and nutrient content. When it is incorporated into the soil, it decomposes, releasing nutrients such as nitrogen, phosphorus, and potassium that were taken up by the plants. These nutrients become available to other plants, improving soil health and fertility. It also helps to increase soil organic matter content, which in turn helps to improve soil structure, water-holding capacity, and aeration. The preparation of the soil for the following crops is the main aim of ensuring green manure cover crops. They absorb supplements from the soil and accumulate them. During harvest time, these crops are not tampered with or removed from the land as this would be the removal of the supplements but they are cultivated into the soil while they are still green. When they are returned back into the soil, the plants gradually decay and in turn release supplements for the following crops. Concurrently, it is seen as a medium of food for countless soil microbes and organisms. The health of the soil is very crucial due to unlimited soil fauna. A good structure of the soil is built as a result of their motion and the feeding on the organic matter. This allows for soil

distribution. They are an easy way to achieve outstanding results but there are quite a number of things to bear in mind. These crops need to be buried before the maturity of plants. This enables the decomposition of the plants faster and easier as they are not too woody. This in turn prevents the seeds from being released which gets rid of undesired regrowth of the green manure when the actual crops are planted. It is not advisable to bury them too deep into the soil. The best way to carry it out is to turn plants a maximum of 15cm or at most 6 inches into the ground. This is for the fact that the soil microbes are more active in the upper soil layer just below the surface, thereby increasing the decomposition process. It is not recommended to use it as the main crop especially if they are from the same specimen. The aim is to plant crops that are not similar this is because crops from the same specimen make use of the same supplements and they tend to accommodate the same pests and diseases. It is advisable to allow the soil to rest for about 20 days after use, this gives room for the organic material to properly decompose thereby offering the best conditions for planting the following crop. Many farmers are incorporating green manuring into their practices as a result of the growing issues facing agriculture, such as climate change, extreme weather events, soil deterioration, and land contamination due to the excessive use of chemical fertilizers. Growing green manure is a useful and affordable way to ensure the long-term productivity of agricultural soils. Given the significant loss of soil fertility caused by improper agronomic practices, human-induced land degradation is extremely serious. Due to their positive effects on the physical, chemical, and biological quality of the soil as well as the proper justification of soil fertility, green manures can play a significant role. Utilizing green manure is one of the trends in environmental protection that aids in the agricultural sector's transition to sustainability by conserving resources and meeting consumer demand for food. Modern farmers are faced with a number of challenges as they try to transition to productive and ecologically friendly practices. To preserve soil fertility while utilizing less chemicals is one of them. Green manure crops could be a potential answer to this issue.

II. REVIEW OF LITERATURE

	Authors(S)	Title	Research Methods	Outcome/Findings
1	Asif Tanveer, Hafiz Haider Ali, and Nabeel Ahmad Ikram(2019)	Green Manuring for Soil Health and Sustainable Production of Agronomic Crops	Secondary data analysis and conceptual research	This study focus on green manuring is a low cost and effective technology in minimizing cost of inorganic fertilizers and safeguarding soil productivity. Green manuring acts as a restoration factory to maintain the soil fertility for sustainable agriculture. Green manures can be defined as crops or plants grown and ploughed into the soil to improve soil fertility by the addition of organic matter and nitrogen; or green manures are plants which are grown to improve the structure and nutrient content of the soil
2	S. Krishnaprabu(2019)	Sustainable Agriculture through Green Manuring: A Prospective Approach	Review and conceptual research and using the Secondary data	There are several reasons for the loss of soil health. One among such issue is uncontrolled use of chemical fertilizers in agriculture ultimately worsen physical, chemical and biological properties of soil. Consequently, alternate solutions to overcome soil degradation, especially agricultural land, the natural way of farming came into existence green manuring crops help to suppress weeds, reduce pest and disease problems and also provide

				supplementary animal forage. used for green manuring progress the humus, organic carbon content, available nitrogen and soil microbial population buildup
3	Anambattu Joshna, Kang jam Bokado and Barkha (2024)	Green Manure for Sustainable Crop Production: A Review International Journal of Environment and Climate Change	Review and conceptual research and using the Secondary data	Green manuring is an economical and eco-friendly scientific approach to achieve more resilient and sustainable food production for agricultural systems. Incorporation of green manure improves soil condition by increasing soil physical, chemical and biological properties such as organic matter, availability of nitrogen, phosphorus and potassium and also improves soil structure by preventing soil erosion, increasing water holding capacity etc. Green manure acts as a natural fertilizer, releasing nutrients into the soil as it decomposes and increases the nutrient content in the soil and shows positive effect on plant growth and development.
4	Anambattu Joshna, Kang jam Bokado and Barkha (2024)	Green Manure for Sustainable Crop Production: A Review	Review and conceptual research and using the Secondary data	There are several reasons for the loss of soil health. One among such issue is uncontrolled use of chemical fertilizers in agriculture ultimately worsen physical, chemical and biological properties of soil. Consequently, alternate solutions to overcome soil degradation, especially agricultural land, the natural way of farming came into existence green manuring crops help to suppress weeds, reduce pest and disease problems and also provide supplementary animal forage. used for green manuring progress the humus, organic carbon content, available nitrogen and soil microbial population buildup
5	Mohammad Hasanain (2024)	Green manuring for Optimal yield	Review and conceptual research and using the Secondary data	soil health and fertility due to intensive agriculture and improper fertilization practices, green manuring emerges as a promising solution. By incorporating green plant material, it enriches soil with organic matter and nutrients, addressing erosion and nutrient depletion. Green manuring is a sustainable agricultural practice that involves incorporating green plants into the soil to enhance fertility, structure, and health. This method reduces erosion, suppresses weeds and improves nutrient

				cycling, thus minimizing reliance on synthetic fertilizers.
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III. RESEARCH GAP

- Some of the reviews are based on identification of the causes and scarcity of organic farming as well as eco-friendly products that effect environmental problems and has not described the solutions on green manuring as will influence the land Fertilit y toward increase the organic product consumption.
- Some of the studies are focused on promotion of agricultural productivity and technology benefits at large scale. But the above studies have not described the importance of on green manuring and land Fertility and ecofriendly evaluation of green manuring & land Fertility. and Environmental knowledge positively influences in rural areas consumers' Behavioral intention toward the use of organic product
- Several studies have not considered the evaluation of green manuring & land Fertility on organic product consumption. organic product contributions which are helpful to reduce the land Fertility problems as well as environmental conservation have not been studied.
- The past reviews focused on macro level studies and quantitative nature of organic product consumption and organic farming. A combination of green manuring and land Fertility is of utmost importance to reduce the limitations and challenges of organic farming. The innovative and sustainable approach of organic farming enhances the agricultural productivity, and quality of life of many farmers in an environmentally friendly way. But has not described the solutions to the cost of organic farming will influence the consumers' behavioural intentions in rural areas.
- Several studies focused on International and national policies and ideology related to green product and have not evaluated the policy implementation strategies in micro level and they have no linkage between cost of organic farming and green manuring & land Fertility, and Performance expectancy and Facilitating conditions for eco-friendly products will influence in rural areas consumers' behavioural intentions toward using eco-friendly products

IV. OBJECTIVES

To assess the significance of green manuring & land Fertility for achieving a sustainable green economy in rural area.
 To analyse the soil health awareness, green manuring & land Fertility conditions, value and Performance to adopt organic farming to improve the soil health status and sustainable green economy in the study area.
 To analyse the relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers

V. HYPOTHESIS TESTING

H0: There is positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there are no positive effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers

H1: There is no positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there are positive effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers

VI. RESEARCH METHODOLOGY:

Research methodology gives direction to process of investigation of particular solution to problems. Research methodology identifies the subject oriented research problems that explain the process of investigation of identifying the solution to the problems. This process uses the different analytical methods and statistical tools to find out the results. Research methodology after the literature survey finalized the research gaps, importance of study, justification of study and specification of objectives and hypothesis. Research topic on evaluates the impact of soil health and

Fertility on sustainable organic agriculture through green manuring focused on organic product and soil health issues related research issues and problems on green manuring, soil-health and land Fertility in environmental sustainability of the Belthangady taluk in DK district of Karnataka state. Additionally, this study intends to assess different key factors such as awareness, soil health issues and land Fertility conscious to organic product user which are examined by means of empirical analysis.

VII. ANALYSIS AND INTERPRETATION

Affordability comparisons of green manuring and land fertility factors

green manuring & land fertility affordability is determined by economic and environmental cost. green manuring adoption is economically feasible. It does not produce any waste or pollution and contributes in reduction of environmental cost. So, affordability of green manuring depends on economic and environmental benefits. Economic benefits are high quality organic compost at lower price, increasing organic matter and soil humus (GMF1), Erosion & disease control (GMF2), Buildup the soil structure to provide a food source for soil micro-organisms (GMF3), Increased soil water holding capacity to improve the soil's ability to retain moisture (GMF4), Improved the porosity and structure of the quality soil (GMF5) and reduced carbon dioxide & global warming (GMF6) aspects. Environmental cost does not depend on cost of waste management, cost of transportation, & cost of storage management, if green manuring is adopted lot of environmental cost will be reduced as well as emissions and land fertility will also be increased. Miss-management of waste, soil emissions and Usages of chemical fertilisers are harmful to soil health as well as ecosystems.

In this study the reactions of respondents about negative impacts of soil health from the Usages of chemical fertilisers are assessed. This study collects the feedback regarding awareness from the respondents. The green manuring organic agricultural process does not produce CO₂ emissions or waste so respondents are ready to adopt the green manuring organic agricultural process as no additional cost or environmental costs are involved. Thus it is affordable in point of environment and less cost of green manuring organic agricultural process, increasing organic matter and soil humus, increased nitrogen fixation, protection of the soil surface, prevention of erosion, maintaining or improving soil structure, reduced susceptibility to leaching, access to unavailable nutrients from lower soil profile & provide readily available nutrients to the next crop. In this discussion comparisons between economic affordability and environmental affordability of solar applications are done.

This study assessed the advantages and disadvantages of economic and environmental affordability. It explained the necessity of green manuring organic agricultural process to environmental protection but economic factors controlled the Usages of chemical fertilisers. The true statements between organic farmers are aware of environmental affordability but some economic affordable factors are hindering them from green manuring organic agricultural process and organic farmers are not aware of environmental affordability but some economic affordable factors are hindering them from green manuring organic agricultural process. The above discussion explains the unhappiness of economic affordability factors over the cost of Usages of chemical fertilisers, inconvenience in green manuring, and lack of awareness, less economic benefits, lack of trust in the improve the land fertility.

Table -1.1: COMPARISONS OF GREEN MANURING AND LAND FERTILITY FACTORS

Economic and Environmental Factors		usage of chemical fertilisers decreased land fertility			
		Yes	No	Total	Per cent
Affordability factors of green manuring: improve the soil health & environmental sustainability	Increasing organic matter and soil humus	53	26	79	19.8
	Erosion & disease control	41	14	55	13.8
	Buildup the soil structure to provide a food source for soil micro-organisms	74	22	96	24.0
	Increased soil water holding capacity to improve the soil's ability to retain moisture	59	13	72	18.0

	improved the porosity and structure of the quality soil,	42	19	61	15.3
	reduced carbon dioxide & global warming	23	14	37	9.3
Total		292	108	400	100
	Pearson Chi-Square	H ₀ accepted and H ₁ Rejected, null hypothesis is true and alternative hypothesis not true			
Value	7.939 ^a				
Df.	5				
Sign.	0.160				
Source: Primary data SPSS Output					

Increasing organic matter and soil humus: Table 1.11 explains that 19.8 per cent (79 out of 400) of respondents have reacted Increasing organic matter and soil humus. Out of this 67.1 per cent (53 out of 79) respondents are unhappy on usages of chemical fertilisers. but they are all aware of the problems of Soil heath and land fertility hence they are all ready to green manuring organic agricultural process. More and uncomfortable on usages of chemical fertilisers has prevented them from green manuring. Remaining 33.9 per cent (26 out of 79) of respondents are not aware of the problems of usages of chemical fertilisers so they are not much interested in adopting the green manuring organic agricultural process. Less and comfortable to green manuring organic agricultural process and improve the soil heath and land fertility have afforded the green manuring organic agricultural process implementation.

Erosion & disease control: Table 1.1 explained that, 13.8 per cent (79 out of 400) of respondents have reacted on inconvenience of erosion & disease control. Out of this 74.5 per cent (41 out of 55) respondents are unhappy over the inconvenience of erosion & disease control but they are all aware of the problems of usages of chemical fertilisers. As the result they are all ready to adopt the green manuring organic agricultural process. Unfavourable facility and inconvenience to improve the soil heath has restricted them from usages of chemical fertilisers. Remaining 25.5 per cent (14 out of 55) of respondents are not aware of the problems of usages of chemical fertilisers so they are not much interested in adopting the green manuring organic agricultural process. Favourable and empathic support and awareness for reduction usages of chemical have contributed to organic agricultural process implementation.

Buildup the soil structure to provide a food source for soil micro-organisms: Table 1.1 explained that, 24.8 per cent (96 out of 400) of respondents have expressed on Buildup the soil structure to provide a food source for soil micro-organisms. Out of this 77.08 per cent (74 out of 96) of respondents are unhappy usages of chemical fertiliser but they are all aware of the problems of usages of chemical fertiliser resulting in their willingness to adopt the green manuring organic agricultural process. Inappropriate information and lack of awareness have restricted them from green manuring organic agricultural process. Remaining 22.9 per cent (22 out of 96) of respondents are not aware of the problems of usages of chemical fertiliser so they are not much interested in adoption of the green manuring organic agricultural process. Buildup the soil structure to provide a food source for soil micro-organisms, cost benefits of soil heath, awareness of payback period & improve the soil structure to provide a food source for soil micro-organisms & of green manuring organic agricultural process,

Increased soil water holding capacity to improve the soil's ability to retain moisture: Table 5.19 explained that, 18 per cent (72 out of 400) of respondents replied on Increased soil water holding capacity to improve the soil's ability to retain moisture. Out of this 81.9 per cent (59 out of 72) respondents are unhappy on usages of chemical fertiliser. but they are all aware of the problems of usages of chemical fertiliser. This has made them ready to adopt the green manuring organic agricultural process. Low benefits from usages of chemical fertiliser have encouraged the green manuring organic agricultural process adoption. Remaining 18.1 per cent (13 out of 72) of respondents are not aware of the problems of usages of chemical fertiliser & benefits of green manuring organic agricultural process so they are not much interested in adopting the green manuring organic agricultural process. organic agricultural forming benefits, increasing organic matter and soil humus, Increased Nitrogen fixation, Protection of the soil surface, Prevention of erosion, Maintaining or improving soil structure, Reduced susceptibility to leaching, Access to unavailable nutrients from lower soil profile & provide readily available nutrients to the next crop

Improved the porosity and structure of the quality soil: Table 1.1 explains that, 15.3 per cent (61 out of 400) of respondents have responded their trust in Improved the porosity and structure of the quality soil. Out of this 68.9 per cent (41 out of 61) respondents are unhappy over lack of trust in the usages of chemical fertiliser but they are all aware of the problems usages of chemical fertiliser hence they are all ready to adopt the organic agricultural forming. Lack of trust in organic agricultural forming have de-motivated in adopting usages of chemical fertiliser. Remaining 31.1 per cent (19 out of 61) of respondents are not aware of the problems of usages of chemical fertiliser so they are not interested in adopting the green manuring organic agricultural process. Lack of trust in the green manuring organic agricultural process depends on efficiency of Improved the porosity and structure of the quality soil, capability absorption of organic agricultural forming.

Reduced carbon dioxide & global warming: Table 1.1 explained that, 9.3 per cent (37 out of 400) of respondents have opted on Policy of reduced carbon dioxide & global warming. Out of this 62.2 per cent (23 out of 37) respondents are unhappy on usages of chemical fertiliser. But they are all aware of the problems of usages of chemical fertiliser hence they are all ready to adopt the green manuring organic agricultural process. usages of chemical fertiliser have discouraged the green manuring organic agricultural process. Remaining 37.8 per cent (14 out of 37) of respondents are not aware of the problems of usages of chemical fertiliser so they are not much interested in adopting the green manuring organic agricultural process. The above discussion evaluates the unhappiness and discouragement of economic affordability of usages of chemical fertiliser of respondents. Respondents are aware of the problems of usages of chemical fertiliser and they are interested to adopt the green manuring organic agricultural process for environmental protection and soil health and land fertility. Agricultural farmers are interested to implement green manuring organic agricultural process. Affordability depends on Increasing organic matter and soil humus (GMF1), Erosion & disease control (GMF2), Buildup the soil structure to provide a food source for soil micro-organisms (GMF3), Increased soil water holding capacity to improve the soil's ability to retain moisture (GMF4), Improved the porosity and structure of the quality soil (GMF5) and reduced carbon dioxide & global warming (GMF6), above factors included the economic and environmental factors.

VIII. HYPOTHESIS TESTING

H₀: There is positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there are no positive effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers

H₁: There is no positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there are positive effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers

So, hypothesis considers the positive interest of green manuring organic agricultural process for environmental protection and soil health and land fertility has affordable compared to some uncomfortable or discouraging factors of usages of chemical fertiliser affordability. Significant value (0.00 per cent) has expected count less than 0.001. The minimum expected count is 9.99. That means 99.9 per cent of respondents have accepted the alternative (H₁) otherwise rejected the null (H₀) hypothesis, accepted the alternative (H₁) hypothesis (0.000 < 0.001) otherwise rejected. and null (H₀) hypothesis (0.000 > 0.001) have accepted otherwise rejected, it means that, suppose null (H₀) hypothesis have accepted hence alternative (H₁) hypothesis rejected or null (H₀) hypothesis have rejected hence alternative (H₁) hypothesis accepted. In this case, Asymptotic Significance (2-sided) is more than 0.001 (0.160 > 0.001) as more than 99.9 per cent of respondents are accepted null (H₀) hypothesis and rejected the alternative (H₁) hypothesis so the statement of null (H₀) hypothesis are true and alternative (H₁) hypothesis are not true according to respondents.

“There is positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there are no positive effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers” This discussion concludes that agriculture farmers are aware of environmental protection and soil health and land fertility affordable but some economic affordable like as usages of chemical fertiliser factors are hindering them from green manuring organic agricultural process.

IX. FINDINGS AND CONCLUSION

Green manure refers to crops that are grown and then tilled back into the soil while still green and actively growing. The purpose is to improve soil fertility, structure, and nutrient content. When it is incorporated into the soil, it decomposes, releasing nutrients such as nitrogen, phosphorus, and potassium that were taken up by the plants. These nutrients become available to other plants, improving soil health and fertility. It also helps to increase soil organic matter content, which in turn helps to improve soil structure, water-holding capacity, and aeration. The health of the soil is very crucial due to unlimited soil fauna. A good structure of the soil is built as a result of their motion and the feeding on the organic matter. This allows for soil distribution. They are an easy way to achieve outstanding results but there are quite a number of things to bear in mind Growing green manure is a useful and affordable way to ensure the long-term productivity of agricultural soils.

Given the significant loss of soil fertility caused by improper agronomic practices, human-induced land degradation is extremely serious. Due to their positive effects on the physical, chemical, and biological quality of the soil as well as the proper justification of soil fertility, green manures can play a significant role. Utilizing green manure is one of the trends in environmental protection that aids in the agricultural sector's transition to sustainability by conserving resources and meeting consumer demand for food. There is positive relationship between the benefits of green manuring and factors that improve soil health and land fertility in organic farming. Additionally, there are no positive effects on the quality of soil health, land fertility, and environmental sustainability from the usage of chemical fertilisers” This discussion concludes that agriculture farmers are aware of environmental protection and soil health and land fertility affordable but some economic affordable benefits encourage to usages of chemical fertiliser that is hindering the green manuring based organic farming

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