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Scientific Study on *Vrikshayurvedic* Farming in Greengram

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ABSTRACT: A field experiment was carried out at the southern farm of Karunya Institute of Technology and Science, Coimbatore during *Rabi* season 2022-2023 to study the utilization of leaves and leaf extract of trees for eco-friendly *Vrkshayurvedic* farming in greengram (*Vigna radiate* L). *Vrikshayurvedic* farming in pulses reduces the needs of harmful and unhealthy chemical fertilizers and pesticides, hence contributing to the sustainable agricultural farming. This experiment involved nine different treatments, each with varying combinations of GLM and tree leaf extracts. These different green leaf manures were used in this experiment (*Albizia lebbek, Pongamia pinnata, and Delonix regia*), applied at a rate of 2 t/ha as basal nutrition in the main plot. The tree leaf extracts of *Moringa oleifera, Morinda tinctoria, and Annona squamosa,* was applied at a rate of 5% as three foliar sprays at 20, 40 and 60 days after sowing (DAS) in the sub plot, there were significant differences in the growth and yield attributes of greengram due to the different treatments applied. The plot that received *Pongamia pinnata* as green leaf manure with foliar spraying of *Moringa oleifera* recorded higher yield of 952 kg/ha, and also all yield parameters were found to be high in this treatment. Economic analysis showed that this treatment combination also had the maximum net return of Rs. 39647 ha^{-1} and a benefit cost ratio of 1:2.25.

Keywords: Greengram *Vrkshayurveda*, green leaf manure, foliar spraying, growth, yield, economics.

INTRODUCTION

Pulses is the second most important crop in of Indian agriculture after cereals as they are rich in protein and plays a vital role in human diet. Globally, pulse crop covers an area of 93.54 million hectares, with production around 92.13 million tonnes productivity was around 985kg/ha (FAOSTAT, 2020). Pulse crops are grown in India in an area of about 287.83 lakh hectares with a production 254.63 lakh tonnes and an average productivity of 885 kg/ha (MoA & FW, Gov 2021). In Tamil Nadu, pulse is grown in about 8.03 lakh hectares with a production of 4.72 lakh tones and productivity of 588 kg ha^{-1} (MoA & FW, Gov 2021). India is the largest producer (25% of global production), consumer (27% of world consumption) and importer (14%) of pulses in the world.

Greengram (*Vigna radiata* L.) is one of the most widely cultivated pulse crops in the country and it is the third most important pulse crop of India grown in nearly 16 per cent of the total pulse area of the country (Greengram Outlook Report, 2021). It is a short duration crop and is an important grain legume containing a high amount of digestible protein, amino acids, sugar, minerals, soluble dietary fibres, and vitamins. It is cultivated across seasons, in different environments, and in variable soil conditions of the South and South-East Asia, Africa, South America, and Australia. It's high time to explore fully the information available in the ancient texts and to find a new way out and accordingly a field experiment was conducted.

Though green manuring (GM) and (or) green leaf manuring (GLM) used to be followed widely by farmers in yesteryears, but, declined gradually due to intensive Agriculture practices and increased availability of chemical fertilizers at subsidized rates thus usage, with a view to maximize productivity from minimum land (Ramanjaneyulu *et al.*, 2021).

The use of leaves of leguminous trees are used traditionally in agriculture as green leaf manures, because of its high nutrient content and faster decomposition are well known. The incorporation of green leaf manure and foliar spraying of green leaf extracts are found to have favorable effect on growth and yield of many crops (Swaminathan, 2012). *Vrikshayurvedic* farming is the traditional and natural ways of food production and adopting indigenous practices and methods for cultivation of crops. Here

tree leaves are used as green leaf manure and leaf extracts are used as foliar spray for crops. The tree leaf extracts would be used as growth stimulants, pest and disease control agents which will reduce the inorganic usage of chemicals and fertilizers to a certain extent from food production.

Vrikshayurvedic farming in pulses reduces the needs of harmful and unhealthy chemical fertilizers and pesticides, hence contributing to the sustainable agricultural farming. This study is aimed to investigate the effects of green leaf manure and green leaf extracts on the growth and yield of greengram. Also, the nutritional and promotional benefits of trees and their extracts to grow food crops without the use of fertilizers and herbicides are being tested in this research.

MATERIAL AND METHODS

The experiment was conducted during *Rabi* season of 2021-22 in, Karunya Institute of Technology and Sciences, Coimbatore. The experimental site is geographically located in the Western agro-climatic zone of Tamil Nadu at 10º 56′ latitude and 76º 44′E longitude at an elevation of 474 m above mean sea level. The field is located in the western agro climatic zone of Tamil Nadu. The experiment was laid out in a split plot design with three replications. Treatments consisted of incorporation of three green leaf manures *Albizia lebbek* (L.) Benth, *Pongamia pinnata* (L.) and Pierre, *Delonix regia* (Raf.) @ 2 t/ha in main plot and foliar spraying of leaf extracts of *Moringa oleifera* L. (*Murungai*), *Morinda tinctoria* Roxb. (*Manchanathi*) and *Annona squamosa* L. (*Seethapal*) @ 5 % respectively, in subplot. Co8 variety of greengram was raised with a spacing 30 × 10 cm.

The green leaf manures were collected and incorporated in the field @ 2 t/ha and allowed for 45 days for decomposition. The leaf extract of tree species was prepared by grinding the leaf with distilled water at 1:1 proportion and the foliar spraying of leaf extracts on greengram were done on 20, 40, and 60 DAS.

RESULT AND DISCUSSION

The growth characteristics like plant height, LAI, dry matter production showed significant response to green leaf manures and foliar spraying of leaf extracts (Table 1).

The incorporation of green leaf manures had significant effect on height of greengram. The plant height was higher (38.53 cm) in M_2 (*Pongamia pinnata*) which was followed by M_1 (*Albizia lebbek*) with plant height of (33.50 cm). The foliar spraying of leaf extract had a significant effect on height growth of greengram. The higher plant height (37.23 cm) was recorded in S_3 (*Annona squamosa*), and which was followed by S_1 (*Moringa oleifera*) (32.63cm) at harvest stage. The possible reason for the observed increase in growth and yield of greengram when treated with decomposed green leaf manure from *Pongamia pinnata* could be the consistent supply of nutrients to the plants. The decomposition of the green leaf manure might have resulted in the release of nutrients from the leaves, which then stimulated cell division and elongation in the greengram plants, leading to increased growth and yield. The similar result was observed in greengram by (Tripathi *et al.*, 2000) and in by Kavitha *et al*. (2005).

The leaf area index (LAI) is a measure of the total leaf area of a plant relative to the area of the ground surface it covers. The incorporation of green leaf manures had significant effect on leaf area index (LAI) of greengram. However, *pongamia pinnata* (M_2) registered higher LAI of 2.59 which was followed by *Albizia lebbek* (M_1) which recorded the LAI of 1.64. The foliar spraying of leaf extract also had a significant effect on LAI in greengram. The higher LAI of 2.04 was recorded in S_3 (*Annona squamosa*), which was followed by S_1 (*Moringa oleifera*) with a value of 2.02. This might be due to availability of nutrients to the crop during different growth phases and could have improved the LAI (Patel *et al*., 2003). This finding was also in close conformity when *Moringa oleifera* was experimented as foliar spray in maize by Biswas *et al*. (2016).

The incorporation of green leaf manures had significant effect on dry matter production (DMP) of greengram. At harvest stage the higher DMP (2004.56 kg/ha) was recorded in M_2 (*Pongamia pinnata*), which was followed by M_1 (*Albizia lebbek*) with DMP of 1716.54 kg/ha. The foliar spraying of leaf extract had a significant effect on DMP of greengram. At harvest stage of higher DMP (1835.72 kg/ha) was recorded in S_1 (*Moringa oleifera*), which was followed by S_3 (*Annona squamosa*) 1667.50 kg/ha. The increased plant height and LAI observed in this treatment could have also contributed to the higher dry matter production by utilizing the photosynthesis process more efficiently. These findings are consistent with the results reported by Kumar *et al*. (2011); Swaminathan and Gururajan (2005) in green gram.

The incorporation of green leaf manures had significant effect on number of pods per plant in greengram. The maximum number of pods per plant (34.56) had been recorded in M_2 (*Pongamia pinnata*). It was followed by M_1 *(Albizia lebbek*) which recorded (24.22) pods per plant. The foliar spraying of leaf extract also had a significant effect on number of pods per plant of greengram. The maximum number of pods per plant (30.66) had been recorded in S_1 (*Moringa oleifera*). It was followed by S_3 (*Annona squamosa*) recorded the number of pods per plant (26.03). Similar results were also obtained by Abusuwar and agohassan 2017 in mungbean when moringa leaf extract was applied the number of pods were increased.

The incorporation of green leaf manures had significant effect on grain yield of greengram. The yield was higher (952 kg/ha) in M_2 (*Pongamia pinnata*) and it was followed by M_1 (*Albizia lebbek*) (819.76 kg/ha). The foliar spraying of leaf extract had significant effect on grain yield of greengram. S_1 (*Moringa oleifera*) recorded higher grain yield of 852.61 kg/ha. It was followed by S_3 (*Annona squamosa*) recorded the grain yield of 778.85 kg/ha. Application of green manure increase the number of soil microbes in the soil, which it enhances the formation of root hairs in plants, which will increase the uptake capacity of the roots. This

occurs because the soil microbes secrete growth hormones and other substances that stimulate the growth and development of roots, leading to an increase in the number and length of root hairs. As a result, the plant can more efficiently absorb essential nutrients and water from the soil, which can ultimately lead to increased growth and yield (Suguna & Swaminathan 2012; Sakthivel *et al.*, 2012).

Stover yield was found to be higher (1216.69 kg/ha) in M_2 (*Pongamia pinnata*). It was followed by M_1 (*Albizia lebbek*) (1037.72 kg/ha). The foliar spraying of leaf extract had significant effect on stover yield of greengram. S_1 (*Moringa oleifera*) recorded higher stover yield of 1101.49 kg/ha. It was followed by S_2 (*Annona squamosa*) recorded the stover yield of 1015.45 kg/ha. The foliar application of tree leaf extracts increased yield and nutrition of green gram, due to the presence of microelements and plant growth regulators (Zodape *et al.*, 2010).

Economics. Economics or monetary return of any cropping system is supposed to be the most important aspect from the crop production point of view. Higher net return of Rs 28854 ha^{-1} was recorded in M_2S_1 (*Pongamia pinnata* + *Moringa oleifera*) followed by treatments M_2S_3 (*Pongamia pinnata* + *Annona squamosa*) with net return of Rs. 31,223 ha^{-1}. The higher benefit cost of ratio of (2.59) was obtained in M_2S_1 (*Pongamia pinnata* + *Moringa oleifera*), followed by treatments M_2S_3 (*Pongamia pinnata* + *Annona squamosa*) with a benefit cost ratio of (2.25). This might be due to the availability of nutrient through green leaf manure which minimized the expenditure. Similar results were also observed by Patel *et al*. (2003).

Table 1: Effect of *Vrkshayurvedic* practices on plant height, LAI, DMP, Number of pods, Grain yield and Stover yield in greengram.

Treatment	Plant height (cm)	LAI	DMP (kg/ha)	No of pods	Grain yield	Stover yield
GLM-Incorporation (M)						
M_1- *Albizia lebbek*	33.50	1.64	1716.54	24.22	819.76	1037.72
M_2- *Pongamia pinnata*	38.53	2.59	2004.56	34.56	952.71	1216.69
M_3- *Delonix regia*	28.80	1.27	1363.93	21.19	588.07	735.02
SEd	0.92	0.08	77.72	1.06	27.26	33.96
CD (p=0.05)	2.62	0.23	221.58	3.03	77.71	96.82
GLE Foliar Spraying (S)						
S1 - *Moringa oleifera* L	32.63	2.02	1835.72	30.66	852.61	1101.49
S2 - *Morinda tinctoria*	30.96	1.44	1581.81	23.29	729.10	872.49
S3 - *Annona squamosa* L	37.23	2.04	1667.50	26.03	778.85	1015.45
SEd	1.68	0.08	86.66	1.37	40.37	48.90
CD (p=0.05)	3.71	0.18	190.92	3.03	88.93	107.73
Interaction M × S						
M at S						
SEd	2.55	0.14	145.13	2.22	63.26	77.05
CD (p=0.05)	5.84	0.34	346.69	5.22	146.98	179.44
S at M						
SEd	2.91	0.14	150.11	2.38	69.92	84.70
CD (p=0.05)	6.67	0.34	358.58	5.61	162.45	197.27

Table 2: Effect of *Vrkshayurvedic* practices on Net return and B:C ratio in greengram.

Treatment	Net return (Rs/ha)	B:C ratio
M_1S_1	20752.0	1.83
M_1S_2	23139.6	1.93
M_1S_3	28854.9	2.16
M_2S_1	39647.0	2.59
M_2S_2	25806.4	2.03
M_2S_3	31223.0	2.25
M_3S_1	18258.0	1.73
M_3S_2	7482.2	1.30
M_3S_3	5302.3	1.21

CONCLUTIONS

The results indicate that the use of organic inputs, such as *Pongamia pinnata* and foliar sprays of *Moringa oleifera* or *Annona squamosa*, not only improve the yield but also increases the profitability of greengram cultivation in irrigated condition.

FUTURE SCOPE

The future scope of *Vrikshayurvedic* farming looks promising, as it offers a sustainable and eco-friendly approach to agriculture. It emphasizes the use of natural inputs and traditional farming practices to maintain soil health, improve plant growth, and enhance crop yields. The present scenario of agriculture is analysed in India, it is clear that in an attempt to grow more food, soil

health and ecological balance are lost. So *Vrikshayurveda* has a solution to the food problems faced by mankind in a sustainable way.

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Conflict of Interest. None.

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