Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(6): 1799-1802
Received: 13-09-2018
Accepted: 15-10-2018

R Vijaykumar
Department of Silviculture & Agroforestry, College of Forestry. Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Biswarup Mehera
Department of Silviculture & Agroforestry, College of Forestry. Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Neelam Khare
Department of Silviculture & Agroforestry, College of Forestry. Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Sameer Daniel
Department of Silviculture & Agroforestry, College of Forestry. Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Neeta Shweta Kerketta
Department of Silviculture & Agroforestry, College of Forestry. Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Correspondence
R Vijaykumar
Department of Silviculture & Agroforestry, College of Forestry. Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, Uttar Pradesh, India

Evaluate the organic manure for growth and economics for rice cultivation using system of rice intensification (SRI) method under citrus based agroforestry system

R Vijaykumar, Biswarup Mehera, Neelam Khare, Sameer Daniel and Neeta Shweta Kerketta

Abstract
To find out the best organic manure for using of System of Rice Intensification (SRI) method is an important tool to obtain high growth and yield of rice under Citrus based agroforestry system in Kharif season. Planting in college of Forestry SHUATS Allahabad UP India, an experiment was carried out in *kharif* seasons of 2017 in RBD design with three replications nine treatments. The results revealed that SRI recorded significantly higher values for all growth parameters, plant height cm, No of tillers hill^{-1}, leaf area index, flag leaf length cm, and Dry weight gm, was significantly After harvesting time The result recorded the higher Gross return (ha-1) 87.092, Cost of cultivation (ha-^{1}) 56.390, Net return (ha-1) 30.701, and Benefit cost ratio (B.C. ratio). 1:5.4 was in the treatment T_5 75% (RDN through FYM+ 25% RDN through PM), significantly. Rice under Citrus based agroforestry system, respectively.

Keywords: Rice, organic manure, FYM, poultry manure, vermicompost, SRI method citrus.

Introduction
Agroforestry is the combination of agriculture and silviculture in one system where the species changes between perennials, annuals and utilization of, for example green manure, coppicing, diverging crop rotation, mulching, contour hedgerows or alley cropping. In agroforestry systems complementarily between the components is crucial to its success, and avoiding competition between different crops and trees are therefore one of the important factors to take into account when choosing species. This means that every agroforestry system must be adapted to the specific environment and socio-economic context (Nair, 1993) [12]. Defined Agroforestry as the deliberate growing of wood perennials on the same unit of land as agricultural crops and /or animals, either in some form of spatial mixture or sequence. He also mentioned that there must be a significant interaction (positive and / or negative) between the woody and non woody component of the system, either ecologically and / or economically**.** The Agroforestry farmers allocated more land to agricultural crops relative to forest crops in the ratio 4:1. Various levels of agricultural and forest crop combinations to reduce risk were made. Risk adverse farmers plant more forest crops on their Agroforestry farms. Citrus: (*Citrus Auriculum)* Citrus belong to family *Rutaceae*, it is a native of central Nagpur. It has been introduced much in South and Southeast Asia, Africa, South America and the Caribbean. It occurs mostly in lowland dry to humid tropics (600-1700mm annual rainfall) on normal soils but not waterlogged sites. (Donatus Ebere okwu, 2008). Citrus is mainly grown in arid irrigated and sub-mountain zone of Punjab. Due to higher juice content and better price it has becomes very popular among the farmers

Rice (*Oryza sativa* L.) Among cereal crops, rice (*Oryza sativa* L.*)*, belongs to the family *Gramineae*, is a major source of food after wheat for more than 2.7 billion people on a daily basis. It is the most important crop of India and second most important crop of the world. It is planted on about one-tenth of the earth's arable land and is the single largest source of food energy to half of humanity particularly in Asia where rice is the staple food. Major growing states in the country are WB, AP, CH, TN, KR, Assam, MS, Orissa, PB and GJ. Rice consumes 70% of water used in Agriculture; hence judicious use of water for rice production in a sustainable manner has become prime importance. Cereals are the member of grasses, which belong to family *Gramineae* (*Poaceae*) cultivated for edible components of their grain composed of the endosperm, germ and bran and they are particularly important to humans because of their role as staple food crops in many regions of the world.

In their natural form, they are rich source of carbohydrates, protein, vitamins, minerals and fats. Approximately 50% of the world's calories are provided by rice, wheat and maize. India shares the world's 21.6% rice production and accounts for 40% of the food grain production (Singh and Singh, 2011) [17] in India.

SRI Method of Rice: SRI production and raises the productivity of land, labour, water and capital through different practices. Under SRI technique seedlings of the age 11-12 days have been transplanted at the spacing of 25 × 25 cm. For one hectare of transplanting 1/5th of seed rate is required compared to traditional system of rice cultivation. That means, instead of 25 kg/ha under traditional cultivation, it requires only 5 kg/ha seeds under SRI. Not only that, but instead of flooding the paddy field, soil should be kept moist during vegetative phase under SRI and only at later stages from panicle initiation till physiological maturity 5 cm water height should be maintained. Under SRI methodology is of interest, because of its potential to achieve higher yield at lower cost of production along with saving of 40% water (Rao *et al.*, 2005; Anon, 2009). An integrated nutrient management plays a vital role in sustaining both the soil health and crop production on long term basis (Mamtameena *et al*., 2014) [9]. The integrated nutrient management primarily relates to combined application of different sources of plant nutrient (organic and inorganic) for sustainable crop production without degrading the natural resource on long term basis. Application of organic manure *viz.*, FYM, vermicompost, poultry manure and castor cake may serve as source of macro and micro nutrients as well as aggregating agent. Tzudir and Ghosh (2014) opined that the integration of organic and inorganic sources of nitrogen provides an approach for feeding rice plant with nutrients as and when needed. This may lead to considerably improved rice yields by minimizing nutrient losses to the environment and managing the nutrient supply, and thereby, result in high nitrogen use efficiency (Kumar and Yadav, *et al* 2008. Recent field experiments have demonstrated that integrated use of nutrients may lead to significant increase in crop yields, while substantially reducing nutrient losses (Ghosh, *et al* 2015).

Material and Methods

Experimental site The field experiment was conducted during Kharif season of 2017 at the Dept of Agroforestry, forest nursery of college of Forestry Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad UP.

Soil analysis Soil samples were collected randomly from 15-30 cm depth within each 10 m interval at the three physiographic positions of the experimental field prior to sowing and after harvest of the crop. Soil samples were air-dried, gently ground and passed through 2 mm sieve. The Sand 51.40), Silt 16.3,clay 29.57 textural class sandy loam Methods employed International Pipette Method (Piper, 1950) The soil organic matter was estimated by "Hydrochloric and Oxidation Method" as suggested by "Walkley and Black, 1965). The p^H of the soil was determined by Glass electrode p^H method. The results of the soil analysis were presented Chemical composition of soil in Citruse field Organic carbon (%) 0.69%, Total Nitrogen (N) kg ha^{-1} 53 kg ha^{-1}. Phosphorus (P) kg ha^{-1} 28.7 kg ha^{-1}.Potassium (K) kg $ha^{-1,}$ 23 kg ha^{-1}.Soil pH (1:2 soil water suspension w/v) 8.1. Methods employed Glass electrode p^H method Walkey and Black Method (Walkey and Black, 1965)

Treatment details and field layout

The field experiment was laid out in RBD randomized block design with three replications. The experiment comprised 9 treatment combinations consisting of three levels of Organic manure (FYM 10 t/ha, PM2t/h, VC5t/h). Rice variety NDR 3112 was grown within the alleys of 10 year old Citrus (*Citrus Auriculum)* plantation. The citrus trees were planted at a spacing of 4 x 4 m. Rice was transplanting at 25X25cm between the spacing the plants between the Citrus trees. There were a total of 9 rows of Rice within the alley of two rows of citrus The gross area 193.6 and net plot area 108 size was 2 x 2 m respectively. The distance between the citrus and Rice row was 1 m on both sides.

Cultural practices and observations

Organic manure were applied as per treatments 5 days before sowing respectively. FYM 10t/h vermicompost 5 t/h, and poultry manure 5 t/h elemental respectively. The recommended dose 120N, 60P, 60K. The organic manure was applying the furrows at 5 cm below the seedling depth before sowing at the recommended seed rate Rice was 5 to 6 kg/ha and at 2.5 cm soil depth. The seeds were covered with the soil from the other side of furrow. Eleven days after Transplanting (DAT) was done to maintain the desired plant population. Periodic hand weeding was done as and when needed. Rice was harvested from each plot when 95 per cent of panicles turned brownish-yellow and started harvesting after drying. The border rows were harvested and kept aside and the yield was measured by manually harvesting the net plot area. Grain and stalk yields were recorded after proper sun-drying and tagged in bundles. Each bundle was weighed, threshed and cleaned separately and seed yield per plot was calculated from net plot. Grain and straw yields were recorded separately. Moisture in the seed was 10 per cent at the time of harvesting. Randomly selected ten plants were taken from each plot for agronomic observations of yield and yield parameters. Test weight of 1000 seeds from each plot was recorded with the seed yield.

Results and Discussion

Significantly higher values of Growth and Yield parameters in 2017 under citrus were obtained the Vermicompost 5 t/h. FYM (Farm Yard Manure) 10 t/h and Poultry manure 5 t/h in comparison to T1: 100% RDN through Vermicompost. T2:75% RDN through vermicompost + 25% RDN through FYM. T3:50% RDN VM+ 25% RDN FYM + 25% RDN through PM. T4:100% RDN through FYM. T5: 75% RDN through FYM+ 25% RDN through PM. T6:50% RDN through FYM + 25% RDN PM + 25% RDN through VC. T7:100% RDN through Poultry manure. T8:75% RDN through Poultry manure + 25% RDN through VC T9:50% RDN through PM + 25% RDN VC + 25% RDN through FYM.

Growth Parameters

Plant height (cm): Significantly taller plant height of At 60 DAT interval, the highest plant height (90.93 cm) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) Significant whereas, at 120DAT interval, highest plant height (119.53 cm) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) whereas, plant height was significant. (Table 1). Plant height increased and. Number of tillers $hill^{-1}$: Significantly tiller of at 60DAT interval, highest Number of tillers $hill^{-1}$ (10.33cm) was observed in treatment (T_5 75% RDN through FYM+ 25%

RDN through PM), at 90DAT interval, highest Number of tillers hill^{-1} (25.00 cm) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) Number of tillers hill^{-1} was significant. (Table 1). Number of tillers hill^{-} increased and. leaf (flag) length (cm) Significantly taller At 60 DAT interval, the highest leaf flag length (54.06 cm) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) whereas, at 120DAT interval, highest leaf flag length (72.73 cm) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) Leaf flag length was significant. (Table1). Leaf flag length (cm) increased and. Plant dry weight (g hill^{-1}) Significantly taller At 60 DAT interval, the highest Plant dry weight (47.90gm hill^{-1}) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) whereas, at 120DAT interval, highest Plant dry weight (137.60gm hill^{-1}) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) Plant dry weight (g hill-1)was significant. (Table1). Plant dry weight (g hill-1) increased. and, Leaf Area Index (LAI) Significantly taller At 60 DAT interval, the highest Leaf Area Index (LAI) (7.93 cm) was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM) whereas, at 120DAT interval, highest Leaf Area Index (14.20 cm) was observed in (T_5 75% RDN through FYM+ 25% RDN through PM) Leaf Area Index was significant. (Table1). Leaf Area Index (LAI) increased respectively

Generally in treatments with SRI method of transplanting component, which may have allowed greater potential for increase rooting. Further, due to shade plant height, no tillers, leaf length, dry weight and leaf area during the initial growth stages, the stimulating effect on shade but increased soil moister may have caused more soil moisture elongation and increased These findings corroborate with Dhananchezhiya (2013) [5] Chaudhary (2014) [3]. subashbabu (2015). This parameter is of importance, perhaps due to the fact that SRI organic rice is getting acclimatized to under citrus based agroforestry system

Table 1: Application of Organic manure for Growth and Yield of Rice using SRI) method under Citrus based agroforestry system Growth parameters of Kharif rice data of 2017

Treatment	Treatment Combinations	Plant Height (cm)		Number of tillers hill-1		leaf length (cm)		Plant dry weight (g hill-1)		Leaf Area Index (LAI)	
		60DAT	120DAT	60DAT	120DAT	60DAT	120DAT	60DAT	120DAT	60DAT	120DAT
T_1	100% RDN through Vermicompost.	83.40	118.33	9.86	20.26	47.40	66.53	44.40	135.33	7.86	13.60
T_2	75% RDN through vermicompost + 25% RDN through FYM.	88.20	118.00	9.26	20.20	39.20	67.46	43.70	129.06	7.26	13.00
T_3	50% RDN VM+ 25% RDN FYM + 25% RDN through PM.	85.60	115.60	9.13	22.60	47.73	72.53	46.26	132.06	7.80	13.66
T_4	100% RDN through FYM.	77.27	116.53	9.66	24.93	44.46	66.06	45.53	124.66	7.13	12.40
T_5	75% RDN through FYM+ 25% RDN through PM.	90.93	119.53	10.33	25.00	54.06	72.73	47.90	137.60	7.93	14.20
T_6	50% RDN through FYM + 25% RDN PM + 25% RDN through VC.	85.47	117.53	10.20	22.66	46.53	72.46	44.90	122.66	7.13	11.73
T_7	100% RDN through Poultry manure.	77.07	114.73	7.33	19.00	36.00	63.50	39.80	121.73	6.06	10.13
T_8	75% RDN through Poultry manure + 25% RDN through VC.	81.67	119.33	9.33	22.60	34.46	72.46	43.80	126.13	7.80	13.06
T_9	50% RDN through PM + 25% RDN VC + 25% RDN through FYM.	84.60	117.73	8.00	22.60	46.40	66.40	44.73	129.00	7.93	11.80
	F test	**S**	**S**	S	S	**S**	**S**	**S**	**S**	**S**	**S**
	C.D. (0.05%)	8.462	2.441	1.15	1.21	4.58	1.78	2.24	1.32	1.10	2.22
	S Ed(±)	1.82	0.64	0.34	0.34	1.27	0.60	0.79	0.40	0.36	0.92

NOTE: VC: Vermicompost FYM: Farm Yard Manure- PM: Poultry manure - RDN: Recommended dose of nitrogen (100% = 120 kg ha-1)
DAT: Days After Transplanting S: Significant SN: Non-significant

Table 2: Application of Organic manure for Growth and Yield of Rice using SRI) method under Citrus based agroforestry system Economic analysis of Kharif rice data of 2017

	Treatment Combinations	Gross return (□ ha-1)	Cost of cultivation (□ ha-1)	Net return (□ ha-1)	Benefit cost ratio
		After harvesting		After harvesting	
T_1	100% RDN through Vermicompost.	52.936	37.833	15.102	1:3.9
T_2	75% RDN through vermicompost + 25% RDN through FYM.	66.400	52.111	14.288	1:2.7
T_3	50% RDN VM+ 25% RDN FYM + 25% RDN through PM.	68.271	51.238	17.031	1:3.3
T_4	100% RDN through FYM.	78.190	52.958	25.231	1:4.7
T_5	75% RDN through FYM+ 25% RDN through PM.	87.092	56.390	30.701	1:5.4
T_6	50% RDN through FYM + 25% RDN PM + 25% RDN through VC.	54.958	38.446	16.511	1:4.2
T_7	100% RDN through Poultry manure.	56.950	37.273	19.678	1:5.2
T_8	75% RDN through Poultry manure + 25% RDN through VC.	51.280	36.752	14.527	1:3.9
T_9	50% RDN through PM + 25% RDN VC + 25% RDN through FYM.	59.150	39.745	19.404	1:4.8

Economic analysis

Cost of cultivation significantly taller At harvesting time the highest Cost of cultivation (□/ha^{-1}) ≠ 56.390.10/ha^{-1}.was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM.) Cost of cultivation was significant. Gross return Significantly taller At harvesting time the highest Gross return (□/ha^{-1}) □ 87.092.00 /ha^{-1}.was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM.), Gross return was significant. Net return significantly taller At harvesting time the highest Net return (□/ha^{-1}) □ 30.701.00/ha^{-1}.was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM.), Net return was significant. B.C. ratio significantly taller At harvesting time the highest Benefit cost ratio (B.C. ratio). 1:5.4 was observed in treatment (T_5 75% RDN through FYM+ 25% RDN through PM.), B.C. ratio) was significant.

Generally in treatments with SRI method of Economic component, which may have allowed greater potential for increased economicas. Further, due to shade Cost of cultivation. Gross return Net return B.C. ratio during the initial Economic analysis Attributes, the stimulating effect on shade but increased soil moister may have caused more soil moisture elongation and increased These findings corroborate with Mamtameena (2014) [9] Leelarani (2012), Sureshkumar (2016) chaudhary (2014) [3] Amarsingh (2014). This parameter is of importance, perhaps due to the fact that SRI organic rice is getting acclimatized to under citrus based agroforestry system see (table no 2)

Conclusion: From the above experiment results, it can be concluded that the maximum growth parameters significant and Economics significant The result recorded the higher Gross return (ha-1) 87.092, Cost of cultivation (ha-1) 56.390, Net return (ha-1) 30.701, and Benefit cost ratio (B.C. ratio). 1:5.4 was in the treatment T_5 75% RDN through FYM+ 25% RDN through PM.), significantly. Rice under Citrus based agroforestry system, respectively.

References

1. Abraham T. Organic farming: the ultimate strategy to combat antimicrobial resistance. (In:) Proceedings of National Conference on Antimicrobial Resistance: From Emerging Threat To Reality; Rubina Lawrence (Ed.). Narosa Publishing House Pvt. Ltd., New Delhi, (1st ed,), 2009, 174-181.
2. Bhatt KN. System of rice intensification for increased productivity and ecological security: A report. Journal of Rice Research. 2015; 3(4):1-3.
3. Chaudhary SK, Singh SP, Singh Y. Dharminder. Influence of integrated use of fertilizers and manures on SRI grown rice (*Oryza sativa*) and their residual effect on succeeding wheat (*Triticum aestivum*) in calcareous soil Indian Journal of Agronomy. 2014; 59(4):527-533.
4. Chaudhary SK, Singh JP, Jha S. Effect of integrated nitrogen management on yield, quality and nutrient uptake of rice (*Oryza sativa*) under different dates of planting. Indian Journal of Agronomy. 2011; 56(3):228-31.
5. Dhananchezhiya P, Divaker CD, Parveen S. Development of nursery raising technique for system of rice intensification machine transplanting. African Journal of Agricultural Research. 2013; 8(29):3873-3882.
6. Dhewa Jaiveer Singh, Sameer Daniel and Sulochana. Effect of Different Levels of Phosphorus and Sulphur on Yield and Quality of Green Gram (*Vigna Radiata* L.) Under Teak (*Tectona Grandis* L.)-Based Agroforestry System, International Journal of Farm Sciences. 2017; 7(3):95-100.
7. Leela Rani, Rao P, Ramachandra A. Effect Of Organic And Inorganic Sources Of Nitrogen On Growth, Yield, Economics And Nutrient Status In Ricegreengram Cropping System. Journal. Res. ANGRAU. 2012; 40(4):24-28,
8. Mohapatra S, Mohanty AK, Tripathy SK, Nayak BR. Integrated weed management under modified water regimes in System of Rice Intensification Indian Journal of Weed Science. 2016; 48(1):17-20.
9. MamtaMeena Patel, Das MV, Tania Verma HP. Effect Of Organic Sources And Nitrogen Levels On Growth And Yield Of *Kharif* Rice (*Oryza Sativa* L.) Under Sri Technique Agriculture for Sustainable Development, 2014. ISSN 2347-5358 2(1):39-42.
10. Mohanty TR, Maity SK, Roul PK, Sahoo KC. Studies on yield, economics and energetics of rice (*Oryza sativa* L.) in relation to crop establishment methods and nutrient management practices. International Journal of Bio-resource and Stress Management. 2014; 5(4):495-501.
11. MamtaMeena Patel, Verma MV, HP, Das Tania. Effect Organic Manuares and Nitrogen fertiliger On Growth and Yield Of paddy grown in Rice (*Oryza Sativa* L.) Under SRI Technique Under middle gujrath condition. Annals of agri-bio research. 2013; 18(2):141-145.
12. Nair PKR. An Introduction to Agroforestry: The Netherlands: Kluwer Academic publishers, 1993.
13. Pal PP, Tarai RK. Viable vegetable based inter croping system in Sweet orange cv. Mosambi International Journal of Advanced Research in Biological Sciences. Int. J Adv. Res. Biol. Sci. 2015; 2(12):126-129.
14. Rahul Yadav, Thomas Abraham. Agronomic Performance of Rice (*Oryza sativa* L.) As Affected By planting System, Date of Transplanting, Source and Dose of Nitrogen. International Journal of Current Microbiology and Applied Sciences. 2017; 6(8):387-394. ISSN: 2319-7706.
15. Suresh Kumar, Tiwari SK, Alok Kumar. Effect of Nutrient Mangmt on Soil Fertility and Productivity under SRI Method of Cultivation. Journal of the Indian Society of Soil Science. 2016; 64(2):157-162.
16. Subhash B, Singh R, Avasthe RK, Yadav GS, Tirtha KC. Effect of organic nitrogen sources on growth, yield, quality, water productivity and economics of rice (*Oryza sativa* L.) under different planting methods in mid-hills of Sikkim Himalayas Res. on Crops. 2015; 16(3):389-400.
17. Singh SS, Singh R. Crop Management (Under irrigated and rainfed conditions). Kalyani Publishers, New Delhi, 2011, 54-98.
18. Srivastava VK, Singh JK, Bohra JS. Effect of fertilizer levels and organic sources of nitrogen on production potential of hybrid rice (*Oryza sativa*) and soil properties under system of rice intensification. Indian Journal of Agronomy. 2014; 59(4):607-612.
19. Srivastava AK, Huchche AD, Singh LRS. Yield prediction in intercropped versus mono cropped citrus orchards. Scientia Horticulturae. 2007; 114:67-70.
20. Vijayakumar M, Ramesh S, Chandrasekaran and B. Effect of System of Rice Intensification (SRI) Practices on Yield Attributes, Yield and Water Productivity of Rice (*Oryza Sativa* L.). Research Journal of Agriculture and Biological Sciences. 2006; 2(6):236-242,
21. Yadav SK, Subhash Babu, Yadav MK, Kalyan Singh, Suresh Pal. Farming for ustainable Agriculture in Northern India. International Journal of Agronomy, 2013.