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Review on effect of conjunctive use of organic manures and inorganic phosphorus on growth, yield attributes, yield and economics of rice

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Abstract
Among several management practices that affect soil quality, fertilizer application is of paramount importance for its role in growth and development of the crop. In intensive agriculture with high yielding varieties, crop yields have adverse effect on physical properties of soil such as bulk density, water holding capacity. In spite of increased cost of fertilizer and their adverse effect on soil and environment the best alternative sources for plant nutrients to be explored to meet partial or full requirement of crop. Hence, it is time to pay serious attention to nutrient management. The integrated use of organic manures and inorganic fertilizers can help to maintain optimum crop yields and long term soil productivity.

Keywords: organic manures, phosphorus fertilizers, growth and yield

Introduction
Rice (*Oryza sativa* L.) is the staple food crop for the world billions of people. It plays a vital role in our national food security, hence, the slogan 'Rice is Life' is most appropriate. Rice stands second in the world after wheat in area and production. India occupies a pride place in rice production among the food crops cultivated in the world. About 90 per cent of rice grown in the world is produced and consumed in Asian countries, China and India accounting for more than half of the world's acreage. In India, it is grown in an area of 43.9 m.ha with a production of 99.24 m t and productivity of 2494 kg ha^{-1}. In Andhra Pradesh, it is grown in an area of 2.152 m.ha with a production of 8.05 m.t and productivity of 3741 kg ha^{-1}. (Ministry of Agriculture, Govt of India, 2018-19). Although the fertilizers are very effective in increasing yield, they may deteriorate the soil health and pollute the ground water. In addition, chemical fertilizers are expensive due to the energy crisis and are unavailable to many farmers, particularly in developing countries like India. There is vast scope for increasing nutrient supply through use of organic manures and adoption of proper cropping system, which together can contribute significantly to the required nutrient pool. In this situation, conjunctive use of organic manures and inorganic source of phosphorus fertilizers can improved the source of plant nutrition, it results in increased soil fertility.

Phosphorus is the second essential plant nutrient required by plant in large quantity next to nitrogen by rice crop is more compared to other crops. Phosphorus not only enhances the yield, it is the primary constituent of plant and animal life. P always plays a vital role in several metabolic processes. It has structural function in macromolecules, metabolic pathways and degradation. It is involved in a wide range of plant processes starting from permitting cell division to the development of a good root system, ensuring timely and uniform ripening of the crop. It is needed mostly by young, fast growing tissues and performs a number of functions related to growth, development, photosynthesis and utilization of carbohydrates. It is a constituent of ADP and ATP, two of the most important substances in life processes. But the main problem concerning phosphatic fertilizers is its fixation with soil complex within a short period of application rendering more than two thirds unavailable. So, it is necessary to know the optimum dose of phosphorus fertilizer for maximum yield. Phosphorus fertilization is required to sustain optimum crop yields (Pypers *et al*., 2005; Nachimuthu *et al*., 2009) [20, 18].

Growth
Indrani *et al.* (2008) [7] found that incorporation of green manure through *Gmelina arborea* with inorganic fertilizer recorded higher plant height (71.1 cm) and tillers m^{-2} (85) than fertilizer applied alone on sandy loam soils of Jorhat, Assam. Karmakar *et al.* (2011) [12] stated that application of 50% NPK through inorganic fertilizer along with 25% N FYM + green

manure+ BGA recorded the highest plant height (81.48 cm) on sandy loam soil of Ranchi. The highest plant height (77.60 cm) and root biomass (826.77 kg ha^{-1}) was recorded with combined application of NPK + chromolaena compost at Mandya, Karnataka (Krishna Murthy, 2012) [13]. Islam *et al.* (2014) [8] reported that the tallest plant (94.21 cm), maximum number of effective tillers $hill^{-1}$ (14.73), longest panicle (24.42 cm), maximum grains $panicle^{-1}$ (84.80), maximum 1000 grain weight (23.08 g) and maximum grain yield (5752 kg ha^{-1}) and straw yield (6654 kg ha^{-1}) were recorded by incorporation of green manure at 50 days after sowing with 75% RDN (180:120:70 kg ha^{-1}). The highest plant height (128.4 cm) and more number of tillers (521) were recorded by combined application of NPKS & Zn @ 120:60:60:40 &5 kg ha^{-1} with FYM at Kanpur (Manoj Parihar *et al*., 2015) [15]. Venkata lakshmi and Veeraraghavaiah (2015) [31] reported that incorporation of Glyricidia with 240 Kg N ha^{-1} recorded the highest plant height (93.2 and 86.2 cm), maximum number of tillers (490 and 470) and highest drymatter accumulation (4257 and 3976 kg ha^{-1}) during 2008 and 2009 on sandy clay loam soil at Agricultural college Farm, Bapatla. Geetha and Balasubramaniyan (2016) [6] observed that combined application of 50% RDF+6.25 t of green manure (*Sesbania aculeate*) recorded the highest plant height both in panicle initiation stage (116.7 cm) and harvesting stage (130.3 cm) on sandy loam soils of Madurai, Tamilnadu. Application of green manure in combination with 120 kg ha^{-1} recorded the highest plant height (84.30 cm) and maximum number of tillers m^{-2} (733) at Agricultural College Farm, Bapatla, Andhra Pradesh (Sujatha *et al*., 2016) [28]. Kyaw Lin Thu *et al*. (2017) [14] reported that the highest plant height (89.3 and 77.26 cm) was recorded during 2015 and 2016 by the combined application of NPK @ 43:15:26 with poultry manure were recorded Letkhoke Pin village in Myanmar.

Yield attributes and yield

Ashutosh Shrivastava *et al*. (2006) [2] conducted an experiment on clay loam soils of Indira Gandhi Agricultural University, Raipur and reported that combined application of 50% RDF+50% N through sunnhemp significantly recorded the higher number of grains/ panicle (122), maximum number of fertile grains $panicle^{-1}$ (112.4), highest panicle length (23.2 cm), highest grain yield (6.5 t ha^{-1}) and straw yield (7.6 t ha^{-1}) of rice. Bajpai *et al.* (2006) [3] found that the highest grain yield (60.51 q ha^{-1}) was recorded with 50% N through *Sesbania aculeata* and 25% N through fertilizer (80:60:40) at Raipur. Stalin *et al.* (2006) [27] recorded higher grain yield (5403 kg ha^{-1}) of rice by combined application of inorganic fertilizer along with green manure over NPK alone (5018 kg ha^{-1}). Balwinder Kumar *et al*. (2008) [4] reported that highest grain yield of rice (6.71 t ha^{-1}) was recorded by the combined application of 100% NPK+FYM at Punjab Agricultural University, Ludhiana. The highest grain yield of rice (4.48 t ha^{-1}) was recorded when rice was grown after green manuring of *dhaincha* in situ along with 60:13:37 kg of NPK fertilizer ha^{-1} (Fatesh Singh *et al.,* 2008) [5]. Rakesh Sahu *et al.* (2009) [21] reported that the highest grain yield (3833 kg ha^{-1}) was recorded with the combined application of N, P, K, S and Zn @ 80, 12.5, 40, 93 and 7 with three irrigations at Jabalpur. Karmakar *et al*. (2011) [12] stated that the significantly maximum panicle length (23 cm) and more number of grains $panicle^{-1}$ (113), highest grain yield (4.33 t ha^{-1}) and straw yield (5.99 t ha^{-1}) of rice were obtained in 50% RDF+25% N FYM + green manure + BGA on sandy loam soil of Ranchi. Singh and Dolly Dhar, (2011) [26] reported significant enhancement in grain yield of rice over absolute control (N0 P0 K0) due to application of different organic sources of nutrients applied in combination with fertilizers in sandy clay loam soil of New Delhi. Rice crop grown after green manuring with *Glyricidia* (10 t ha^{-1}) along with 100% of the recommended dose of N, P and K also improved the grain, straw and biological yields of rice at Parbhani, Maharashtra (Yadav and Raskar, 2011) [33]. Krishna Murthy (2012) [13] observed that the highest number of grains/panicle (131), 1000 grain weight (24.88 g), grain yield (48.66 q ha^{-1}) and straw yield 55.63 q ha^{-1}) of rice were recorded with combined application of NPK +chromolaena compost at Mandya, Karnataka. Mukesh kumar *et al*. (2012) [17] noticed that incorporation of *Sesbania aculeata* in sandy loam soil of Karnal in combination with 120 kg N and 26 kg P_2O_5 increased the number of tillers per m^2, test weight, grain and straw yields of rice. Titab Das *et al*. (2012) [29] on silty clay loam soil of Panthnagar noticed that combined application of FYM @ 15 t ha^{-1}+ NPK @120:26:33 kg ha^{-1} recorded highest grain (44.83 q ha^{-1}) and straw yield (48.76 q ha^{-1}) of rice. The highest grain yield (6.26 t ha^{-1}) of rice was recorded due to the application of NPK @ 120:26:42 along with green manure on sandy loam soil of Karnal (Yaduvanshi *et al.,* 2013) [34]. Upadhyay and Vishwakarma (2014) [30] conducted an experiment at Jabalpur and reported that the application of 50% NPK with green leaf manure recorded the highest grain yield of rice. Manoj Parihar *et al*. (2015) [15] noticed that the highest grain (60.32 kg ha^{-1}) and straw yield (73.69 kg ha^{-1}) was recorded by combined application of NPKS & Zn @ 120:60:60:40 &5 kg ha^{-1} with FYM at Kanpur. Venkata lakshmi and Veeraraghavaiah (2015) [31] conducted an experiment on sandy clay loam soil at Agricultural College Farm, Bapatla stated that incorporation of *Glyricidia* with 240 kg N ha^{-1} significantly increased all the yield attributes like number of effective tillers, number of grains/ panicle, test weight, grain and straw yields of rice. Geetha and Balasubramaniyan (2016) [6] found that combined application of green manure (*Sesbania aculeate*) @6.25 t ha^{-1} + leaf colour chart based N management recorded the highest panicle length (26.1 cm), number of panicles m^{-2} (465), test weight (13.88 g) and grain yield (2100 kg ha^{-1}) of rice on sandy loam soil of Madurai, Tamil Nadu. Jana *et al*. (2016) [10] stated that incorporation of *dhaincha* @ 6 t ha^{-1} + FYM @ 5 t ha^{-1} along with NPK @ 50:25:25 kg ha^{-1} significantly recorded the highest grain and straw yields (3.19 and 5.39 kg ha^{-1}) of rice on clayey soil of West Bengal. Sujatha *et al*. (2016) [28] conducted an experiment at Agricultural College Farm, Bapatla, Andhra Pradesh, reported that the highest number of tillers m^{-2}, maximum number of grains $panicle^{-1}$, highest number of filled grains $panicle^{-1}$, maximum test weight, maximum grain yield and straw yield of rice. Jaffar Basha *et al.* (2017) [9] found that significantly highest grain yield (4262 kg ha^{-}) and straw yield (6033 kg ha^{-1}) was observed with the combined application of 100:50:50 kg NPK ha^{-1}+FYM+microbial consortium on clay soil of Dharwad, Karnataka. Similarly, Kyaw Lin Thu *et al*. (2017) [14] reported that the maximum number of panicles $hill^{-1}$ (10.4 and 12.7), maximum number of spikelets $panicle^{-1}$ (118.5 and 99.8), maximum test weight (22.6 and 22.3 g) and the highest grain yield (5.9and 6.3 t ha^{-1}) by the combined application of NPK @ 43:15:26 with poultry manure were recorded at Letkhoke Pin village in Myanmar.

Economics

Parasuraman *et al*. (2004) [19] reported that maximum net

returns and B:C ratio of Rs.5095 and 1.5 1 were obtained with 40 kg P_2O_5 ha^{-1} as DAP against Rs.2508 and 1.00 in control and Rs.3686 and 1.23 with the existing blanket recommendation of 20 kg P_2O_5 ha^{-1} as SSP. It is brought out that by applying 40 kg P_2O_5 ha^{-1} as DAP paves the way for an additional income of Rs.1409 ha^{-1} in rainfed sorghum in the red loamy sandy soil. Bajpai *et al.* (2006) [3] found that the highest net returns (28,076 Rs. ha^{-1}) were recorded with 50% N through *Sesbania aculeata* and 25% N through fertilizer (80:60:40) at Raipur. Sing *et al*., (2006) [25] reported that green manuring with NPK fertilizer gave the highest net return and benefit cost: ratio and produce significant higher biomass in returns of rice-equivalent yield. The highest net return (34582 Rs. ha^{-1}) of rice was recorded by the combined application of 100% NPK @ 120:60:60 kg $ha^{-1}$with FYM at Bichpuri, Agra (Vinay Singh, 2006) [32]. Jayadeva (2008) [11] reported that in-situ incorporation of green manure (Sunnhemp) + recommended NPK (125:62.5:62.5 kg ha^{-1}) recorded higher net income (Rs.42, 636 ha^{-1}) and B:C ratio. Roy *et al*. (2008) [24] studied that application of 50% RDF (60-30-30 kg N-P_2O_5-K_2O ha^{-1})+*dhaincha* @10 t ha^{-1} in rice provided highest gross return and net return in comparison to rice-oats, rice-fenugreek and rice-lathyrus systems. Ramesh Babu *et al*. (2009) [22] noticed the highest benefit cost ratio with the application of phosphate rich organic manure made of recommended dose of P_2O_5 in 1:4 ratio followed by phosphate rich organic manure made of double recommended dose of P_2O_5 in 1:4 ratios. Rani *et al*. (2009) [23] reported that net returns over variable cost from rice were Rs. 32.745 and 33.963 in cowpea green manuring and chemical fertilizers, respectively. The benefit/Rupees invested was highest in chemical fertilizer (Rs. 12.84) compared to cowpea green manure (Rs.8.22 to 8.60). Anitha and Jose Mathew (2010) [1] stated that green manuring with inter cropped *dhaincha* enhanced rice yield by 544 kg ha^{-1} and returns by Rs.10, 220 ha^{-1} in sandy loam soil of Thrissur, Kerala. Karmakar *et al*. (2011) [12] revealed that the highest gross returns (40108 Rs. ha^{-1}), net returns (22,160 Rs. ha^{-1}) and benefit cost ratio (2.23) of rice with the application of 50% NPK through inorganic fertilizer along with 25% N FYM + green manure + BGA at Ranchi. On the other hand, Krishna Murthy (2012) [13] noted that the highest gross returns (56,662 Rs. ha^{-1}) and net returns (39,957Rs. ha^{-1}) of rice were recorded with combined application of NPK +chromolaena compost at Mandya, Karnataka. However, Sujatha *et al*. (2016) [28] noted that application of green manure in combination with 120 kg K_2O ha^{-1} recorded the highest gross returns (1,51,992 Rs. ha^{-1}), net returns (1,08,076 Rs. ha^{-1}) and benefit cost ratio (2.44) of rice at Agricultural College farm, Bapatla, Andhra Pradesh.

References

1. Anitha S, Jose Mathew. In situ green manuring with Dhaincha (*Sesbania aculeata*): a cost effective management alternative for wet seeded rice (*Oryza sativa*). Journal of Tropical Agriculture. 2010; 48(1-2):34-39.
2. Ashutosh Shrivastava BS, Joshi S, Gayen K, Mohanty A. Effect of integrated nutrient management on yield and yield attributes of lowland rice. Madras Agricultural Journal. 2006; 93(1-6):122-124.
3. Bajpai RK, Chitale S, Upadhyay SK, Urkurkar JS. Long-term studies on soil physico-chemical properties and productivity of rice-wheat system as influenced by integrated nutrient management in Inceptisol of Chhattisgarh. Journal of Indian Society of Soil Science. 2006; 54:24-29.
4. Balwinder Kumar, Gupta RK, Bhandari AL. Soil fertility changes after long-term application of organic manures and crop residues under rice-wheat system. Journal of the Indian Society of Soil Science. 2008; 56:80-85.
5. Fatesh Singh, Ravindra Kumar, Samir Pal. Integrated nutrient management in rice-wheat cropping system for sustainable productivity. Journal of the Indian Society of Soil Science. 2008; 56(2):205-208.
6. Geetha P, Balasubramaniyan P. Effect of integrated nutrient management quality rice cultivars. Annals of Agri-Bio Research. 2016; 21(1):29-31.
7. Indrani PB, Arundathi B, Singh J. Integrated use of legume green manure and inorganic fertilizer on soil health, nutrient uptake and productivity of rice (*Oryza sativa*) in shifting cultivation of Assam. Indian Journal of Research. 2008; 42(4):260-265.
8. Islam MR, Hossain MB, Siddique AB, Rahman MT, Malika M. Contribution of green manure incorporation in combination with nitrogen fertilizers in rice production. SAARC Journal of Agriculture. 2014; 12(2):134-142.
9. Jaffar Basha S, Basavarajappa R, Hebsur NS. Nutrient uptake as influenced by organic and inorganic sources of nutrient under aerobic rice cultivation. 2017; 35(1):474-479.
10. Jana TK, Bhomick MK, Surekha. Nutrient management for improving grai yield, nutrient uptake and quality of aromatic rice varieties. SATSA Mukhapatra-Annual Technical, 2016, 20.
11. Jayadeva HM, Shetty TK, Prabhakara. Influence of crop establishment techniques and sources of nutrients on productivity, energetics and economics of rice. Oryza. 2008; 45:166-168.
12. Karmakar S, Surya Prakesh Kumar B, Agrawal B, Devkant Prasad and Rajeev. Effect of green manuring and biofertilizers on rice production. Oryza. 2011; 48(4):339-342.
13. Krishna Murthy R. Productivity and Economics of Rainfed Rice as Influenced by Integrated Nutrient Management. Madras Agriculture Journal. 2012; 99(4-6):266-270.
14. Kyaw Lin Thu, Aung Naing OO, Kyaw Ngwe, Pan Ei Ei Kyaw, Soe Paing OO. Effect of manure and chemical fertilizers an growth and yield of the Thee Htet Yin rice variety in Maubin Township. International Journal of Agricultual Research. 2017; 4(1):74-80.
15. Manoj Parihar, Ravi Kumar, Meens LK, Jat Suryakant, Jatav HS. Effect of inorganic fertilizers with and without FYM on yield, nutrient uptake and quality parameters of rice (*Oryza sativa* L.). Environment & ecology. 2015; 33(4):1480-1484.
16. Ministry of Agriculture, Government of India. 2018-19. www.indiastat.com.
17. Mukesh Kumar NPS, Yaduvanshi and Singh YV. Effects of integrated nutrient management on rice yield, nutrient uptake and soil fertility status in reclaimed sodic soils. Journal of the Indian Society of Soil Science. 2012; 60(2):132-137.
18. Nachimuthu G, Guppy C, Kristiansen P, Lockwood P. Isotopic tracing of phosphorus uptake in corn from 33P labelled legume residues and 32P labelled fertilisers applied to a sandy loam soil. Plant and Soil. 2009; 314:303-310.

19. Parasuraman P, Mani AK, Duraisamy VP, Suresh M. Effect of Phosphorus on yield and economics of rainfed sorghum. Madras Agricultural Journal. 2004; 91(7-12):503-505.
20. Pypers P, Verstraete S, Thi CP, Merckx R. Changes in mineral nitrogen, phosphorus availability and salt-extractable aluminum following the application of green manure residues in two weathered soils of South Vietnam. Soil Biology and Biochemistry. 2005; 37:163-172.
21. Rakesh Sahu, DL Kauraw, Rishikesh Thakur. Impact of integrated resource management on production and nutrients uptake by rice crop. Journal of Soils and Crops. 2009; 19(2):205-209.
22. Ramesh Babu PV, Chandrasekhar K, Veeraraghavaiah R. Effect of phosphate rich organic manure on growth, nutrient uptake, quality and economics in soyabean. The Andhra Agricultural Journal. 2009; 56(4):399-402.
23. Rani N, Sidhu BS, Beri V. Organic rice (*Oryza sativa*) and wheat (*Triticum aestivum)* production, quality and economics in irrigated agriculture. Indian Journal of Agricultural Science. 2009; 79(1):20-24.
24. Roy DP, Barik AK, De GC. Studies on productivity, nutrient uptake and economics of wet season rice under IPNS in rice-based fodder cropping systems. Oryza. 2008; 45(2):27-29.
25. Sing S, Singh RN, Prashed J, Singh BP. Effect of INM on yield and uptake of nutrients by rice and soil fertility in rainfed upland. Journal of Indian Society of Soil Science. 2006; 54(3):327-330.
26. Singh YV, Dolly Dhar W. Influence of organic farming on soil microbial diversity and grain yield under rice-wheat-greengram cropping sequence. Oryza. 2011; 45(1):40-46.
27. Stalin P, Ramanathan S, Nagarajan R, Natarajan K. Long-term effect of continuous manorial practices on grain yield and some soil chemical properties in rice based cropping system. Journal of the Indian Society of Soil Science. 2006; 54(1):30-37.
28. Sujatha DV, Kavitha P, MVS Naidu, Uma Maheswari. Influence of green manure and potassium on growth, yield and economics of rice *(Oryza sativa. L*). Journal of Research ANGRAU. 2016; 44(3&4):43-49.
29. Titab Das, Shri Ram, Pradeep Sirari. Effect of long term application of inorganic fertilizers and manure on yields, nutrients uptake and grain quality of wheat under rice – wheat cropping system on Mollisol. Pantnagar Journal of Research. 2012; 10(2):174-180.
30. Upadhyay VB, Vishwakarma SK. Long-term effect of integrated nutrient management in rice *(Oryza sativa*) - wheat (*Triticum aestivum*) cropping system. Indian Journal of Agronomy. 2014; 59(2):209-214.
31. Venkata Lakshmi N, Veeraraghavaiah R. Productive performance of rice as affected by Glyricidia leaf manuring in conjunction with fertilizer nitrogen. Oryza. 2015; 51(1):41-45.
32. Vinay Singh. Productivity and economics of rice (Oryza sativa) - wheat (*Triticum aestivum*) cropping system under integrated nutrient –supply system in recently reclaimed sodic soil. Indian Journal of Agronomy. 2006; 51(2):81-84.
33. Yadav OM, Raskar SK. Effect of organic and inorganic nutrient management on productivity of rice (*Oryza sativa*) under upland ecosystem. Current Advances in Agricultural Sciences. 2011; 3(2):143-145.
34. Yaduvanshi NPS, Sharma DR, Swarup. Impact of integrated nutrient management on soil properties and yield of rice and wheat in a long term experiment on a reclaimed sodic soil. Journal of the Indian Society of Soil Science. 2013; 61(3):188-194.