Effect of conjoined application of *Sesbania aculeata* along with inorganic fertilizers on the yield and nutrient uptake of rice (*Oryza sativa*)

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Abstract

Field experiment was carried out at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu, India during *rabi* 2013 to 2014 to study the effect of integrated supply of *Sesbania aculeata* with inorganic fertilizers on yield and nutrient uptake of rice. The experiment was laid out in Randomized Block Design with three replications and consisted of seven treatments. Conjoined application of 33% of N through *Sesbania aculeata* + 67% N as chemical fertilizer (T_6) produced the highest grain yield of 5447 kg ha^{-1}. Uptake of nitrogen was observed maximum of 115.91 kg ha^{-1}, 39.73 kg ha^{-1} phosphorus and potassium 134.45 kg ha^{-1}. Application of 50% of N as *Sesbania aculeata* + 50% N as urea to rice recorded the highest post harvest soil available nutrients.

Key words: Rice, Nutrient management, *Sesbania aculeata*, Inorganic Nitrogen, INM Nutrient uptake and post harvest soil available nutrients

Introduction

Rice is one of the most predominant and staple food crop that are being extensively cultivated and consumed all over the world by more than two billion people in Asia. To meet the future food requirements, India has to increase its rice productivity by three per cent per annum. Nitrogen is the key player for any fertilizer management programme in rice cultivation and is the universal key element for realizing the yield potential of high yielding rice varieties. Though use of inorganic fertilizers are beneficial in increasing the crop yields, exclusive use of them causes imbalance of micronutrients and also has the deleterious effect on soil micro flora. Besides, the high cost of fertilizers deters the farmers from using them in recommended doses. Therefore, there is a felt necessity to evaluate suitable agronomic strategies with emphasis on eco friendliness to accomplish the twin objectives of achieving the sustained production and to maintain the soil fertility over a longer period. For sustainability in crop production, it is neither chemical fertilizer nor organic manures alone but their integrated use has been observed to be highly beneficial (Khan *et al.,* 2004).Keeping the aforesaid facts in consideration, the

present investigation was carried out to study the effect of conjoined application of *Sesbania aculeata* with inorganic fertilizers on the grain yield and nutrient uptake of rice.

Materials and methods

Field experimentation was carried out during rabi 2013 to 2014 at Experimental Farm, Department of Agronomy, Faculty of Agriculture, Annamalai University, Annamalainagar, Tamil Nadu, India. The site is situated at 11°24' N latitude and 79°44' E longitude at an altitude of + 5.79 m above mean sea level. The soil is clay, low in available N, medium in available P_2O_5 and high in available K_2O. The experiment was laid out in Randomized Block Design with three replications and consisted of seven treatments *viz.*, Control (T_1), 100% Recommended dose of nitrogen (T_2), 100% of N through *Sesbania aculeata* (T_3), 75% of N through *Sesbania aculeata* + 25% N as chemical fertilizer(T_4), 50 % of N through *Sesbania aculeata* + 50% N as chemical fertilizer(T_5), 33% of N through *Sesbania aculeata* + 67% N as chemical fertilizer(T_6), 25% of N through *Sesbania aculeata* + 75% N as chemical fertilizer(T_7). Recommended dose of 150:50:50 kg ha^{-1} of N, P and K in the form of urea (46% N), single superphosphate (16% P_2O_5) and muriate of potash (60% K_2O) was applied to rice crop. Based on the equal N basis, required quantities of *Sesbania aculeata* was incorporated in the soil one week before transplanting of rice. Observations were recorded on grain yield, N, P and K uptake and post harvest soil available nutrients. The plant samples were grinded and analysed for N, P, and K uptake. Post harvest soil available nutrient status.

Result and discussion

Yield (Table 1)

The data revealed that the grain yield of rice was significantly affected by various treatments. Application of 33% of N through *Sesbania aculeata* + 67% N as chemical fertilizer (T_6) produced the highest grain yield of 5447 kg ha^{-1}.The lowest grain yield. Application of 33% per cent N as *Sesbania aculeata* supplied an additional adequate quantity of phosphorus and potassium. Part of these nutrients would have been released on decomposition and subsequent mineralization of nitrogen might have enhanced the availability in the rhizosphere, reported narrow C: N with *Sesbania aculeata* that resulted in faster decomposition and subsequent mineralization of nitrogen (Surekha, 2007). Better nutrient uptake would naturally lead to favourable manifestation of growth and yield components which ultimately influenced the higher grain yield. This is line with the reference of (Anitha and Jose Mathew (2010).

Nutrient uptake by rice (Table 1)

Uptake of nitrogen was observed maximum of 115.91 kg ha^{-1} in the application of 33% of N as *Sesbania aculeata* + 67% N as urea. The highest phosphorus uptake of 39.73 kg ha^{-1} was observed in T_6 (33% of N as *Sesbania aculeata* + 67% N as urea) with regard to potassium T_6 (33% of N as *Sesbania aculeata* + 67% N as urea) observed maximum of 134.45 kg ha^{-1}. Green manure when combined with inorganic nitrogen resulted in release of higher amount of hydrolysable as well as non – hydrolysable forms of nitrogen and ultimately increased the availability of nutrients to the plant and consequently increased uptake of nitrogen by rice (Palaniappan and Reddy, 1990).

Post harvest soil available nutrient status (Table 2)

The results of soil available N, P, K content was higher under balanced nutrition. Application of 50% of N as *Sesbania aculeata* + 50% N as urea to rice increased to the tune of 230.53, 20.66, 317.20 kg ha^{-1}. The higher N, P and K in post harvest soil in rice could be due to the tendency of *Sesbania aculeata* in amending the soil to retain more of available N, P and K at the end of the study owing to the presence of more organic matter and higher microbial population these results are in concordance with the findings of Sashidar *et al.* (1995) and Bajpai *et al.* (2006).

Table 1. Effect of organic and inorganic N on grain yield and plant nutrient uptake (kg ha^{-1})

Treatments	Grain yield	N	P	K
T_1- control	2466	49.62	17.47	57.30
T_2 -100% RDF	4471	94.62	32.11	107.89
T_3 -100% of N through *Sesbania aculeata*	2800	58.04	20.57	67.69
T_4 - 75% of N through *Sesbania aculeata* + 25% N as chemical fertilizer	3187	67.28	23.23	77.62
T_5 -50 % of N through *Sesbania aculeata* + 50% N as chemical fertilizer	3894	81.99	28.17	94.25
T_6 -33% of N through *Sesbania aculeata* + 67% N as chemical fertilizer	5447	115.91	39.73	134.45
T_7 -25% of N through *Sesbania aculeata* + 75% N as chemical fertilizer	4962	105.19	35.89	118.84
S.Ed	118	2.09	0.31	2.46
CD (P = 0.05)	257	4.56	0.68	5.37

Table 3. Post harvest soil available N, P&K (kg ha^{-1}) in rice.

Treatments	N	P	K
T1- control	187.77	16.48	281.24
T_2 -100% RDF	193.36	17.72	286.54
T_3 -100% of N through *Sesbania aculeata*	216.68	18.74	301.34
T_4 - 75% of N through *Sesbania aculeata* + 25% N as chemical fertilizer	219.87	19.02	303.04
T_5- 50 % of N through *Sesbania aculeata* + 50% N as chemical fertilizer	230.53	20.66	317.20
T_6 -33% of N through *Sesbania aculeata* + 67% N as chemical fertilizer	228.09	20.42	315.96
T_7 -25% of N through *Sesbania aculeata* + 75% N as chemical fertilizer	209.43	17.75	296.42
S.Ed	1.32	0.20	1.64
C.D(P=0.05)	2.87	0.44	3.57

Conclusion

In the light of above facts it can be concluded that the application of 33% of N through *Sesbania aculeata* + 67% N as chemical fertilizer with regard to yield and nutrient uptake. The above finding appears to be more promising and such system would also reduce the cost of farming in addition to maintaining soil productivity and ultimately resulting higher returns to the small and marginal farmers of Cauvery delta region of Tamil Nadu.

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