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S Natarajan

Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

## Effect of organic and inorganic sources of nutrients on NPK uptake by transplanted rice at different growth stages

S Natarajan

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### Abstract

A field experiment was conducted at Tamil Nadu agricultural university, Coimbatore during kharif and rabi 2011-12 and 2012-13 to find out the effect of different sources of nutrients on NPK uptake by rice at different growth stages. The experiment was laid out in randomized block design in kharif and rabi season with fourteen treatments and three replications. The treatments consists of T6 50% as *Sesbania aculeata* + 50% as inorganic fertilizer maximum NPK uptake by rice in different growth stages. However, it was on par with that of 50% N through FYM + 50% N as inorganic fertilizer.

**Keywords:** Press mud, *Sesbania aculeata*, poultry manure, FYM, 'N' fertilizer (Urea), NPK Uptake, Growth Period

### Introduction

The land available for cultivation in our country is limited while our population continues to increase. The need therefore is to intensity agriculture production through increasing the cropping intensity which can be achieved through rice-rice cropping system, as the rice being the main crop of the India, rice crop utilizes nitrogen in efficiently under tropical condition, efficiency of fertilizer N was usually 30-40 percent. The nitrogen is subjected to different loses which causes depletion of nutrients in the post-harvest soil. The supply of fertilizer N along with the other organic sources in known to stimulate the mineralization and then immobilization of organic sources in combination with the fertilizer and their management for efficient as well as economic use of fertilizer and maintenance of soil fertility and productivity is very essential for tropical countries keeping these facts in perspective, the present investigation was taken up to study the Effect of Organic and Inorganic Sources of nutrients on NPK uptake by transplanted rice crop at different growth stages.

### Materials and Methods

Field experiment were conducted at the wetland farm of Tamil Nadu agricultural university, Coimbatore during kharif and rabi season 2011-12 and 2012-13. The soil was clay loam with ph 8.1, low in available N (270.0 kg ha<sup>-1</sup>), medium in available p (17.8 kg ha<sup>-1</sup>), high in available K (585.0 kg ha<sup>-1</sup>). Different organic source viz., green manure, FYM, Press mud and composted poultry manure were tried alone and in combination with 50, 75 and 100% in organic 'N' (area). These were compared with 100 recommended N and one absolute control treatments. The treatments details are as follows.

T1 - 100% N as press mud alone

T2 - 75% N as press mud + 25% N as inorganic

T3 - 50% N as press mud + 50% N as inorganic

T4 - 100% N as *Sesbania aculeata* aloneT5 - 75% N as *Sesbania aculeata* + 25% N as inorganicT6 - 50% N as *Sesbania aculeata* + 50% N as inorganic

T7 - 100% N as Composted poultry manure alone alone

T8 - 75% N as Composted poultry manure + 25% N as inorganic

T9 - 50% N as Composted poultry manure + 50% N as inorganic

Corresponding Author:

S Natarajan

Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

- T10 – 100% N as FYM alone  
 T11 - 75% N as FYM + 25% N as inorganic  
 T12 – 50% N as FYM + 50% N as inorganic  
 T13 - 100% of the recommended dose of N as inorganic  
 T14 – Absolute control (No organic and Inorganic)

Rice variety Co47 and ADT38 was grown as test crop in kharif and rabi seasons respectively. All the treatments except T14 received the recommended dose of N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O for kharif and rabi seasons are 120:38:38 kg ha<sup>-1</sup> and 150:50:50 kg ha<sup>-1</sup> respectively. The N content in different organic materials was determined and the amount of these materials required for substituting a specified amount of N as per the treatment was calculated. These materials were incorporated in the soil N and K were applied in four equal split at basal, active tillering, panicle initiation and flowering stages. The entire dose of P was applied basally before transplanting. Weeding and plant protection measures were done as and when necessary. Rice grain and straw yield were recorded at harvest, the plant samples collected harvest time and analyzed for nutrient uptake N, P and K was estimate by micro kjeldahl method (Humphries, 1956) <sup>[1]</sup> photometry as suggested by Jackson (1973) <sup>[2]</sup>.

### Results and Discussion

The chemical fertilizer composition of plants is an translations of the conditions under which they complete their lifecycle fully as a part of its their chemical composition is a net summary of all the changes either positive and negative which are faced by the plants. The nutrients. Uptake is directly and indirectly affected by many factors like total concentration as well as available quantity of different nutrients, root developments, aeration, water potential, climatic condition and other related soil parameters. Beside all these, the presense of a nutrient in available form for the plant has to play deciding role. Application of nutrients in readily available forms rapidly enhance the availability of the nutrient in the soil but all is neither taken up by plants nor remain permanently is available form. The dynamic processes are always in operation in the soil or accelerate and a major part of the applied nutrients are rapid converted in the available forms. Some fraction of it may be permantely fixed but when organic materials are applied, the over all fertility status of the soil is buildup the total reserve of nutrients is increased and a stage for enhanced availability is set up. Ayalew and Dejen (2012) <sup>[3]</sup> stated that integrated nutrient management is the best approach to supply adequate and balanced nutrients and increased crop productivity in an efficient and environmentally benign manner, without sacrificing soil productivity of future generations Mithun *et al.* (2007) <sup>[4]</sup>, Srinivasan and Angayarkanni (2000) <sup>[5]</sup> reported that uptake of nutrients was improved by the application of integrated use of organic manures and inorganic fertilizers compared to recommended fertilizers alone.

### N uptake by rice

The nitrogen uptake was influenced by manuring in conjunction with fertilizing at all the stages of crop growth in kharif season. The N uptake progressively increased with advancement in the growth stages i.e from active tillering to harvest stage. The N accumulation was comparatively faster between active tillering and panicle initiation stages, while it was slower between panicle initiation and flowering stages and later increased considerable from flowering at harvest stage.

There was uptake indicated that in absolute control treatment it was the least (12.40, 35.12, 42.70 and 69.50 kg ha<sup>-1</sup> in respective stages) while it was the maximum when plant of N (50% N) was applied as *Sesani aculeate* along with 50% N as inorganic *viz.*, T6 (30.65, 568.70, 65.97 and 117.25 kg ha<sup>-1</sup> respectively). This was on par with the application of 50% N through FYM + 50% N as inorganic (T12) but superior to other organics (Poultry manure and press mud to supply 50% N) along with 50% N as inorganic *viz.*, T9 and T3 and Panicle initiation., Flowering and harvest stages while it was on par with T12, T9 and T3 at active tillering stage. The application of 100% N as inorganic (T13) being on par with other combinations of organic and inorganic (75% + 25% and 100% + 0%) was inferior to the above treatments T6, T12, T9 and T3 but superior to absolute control (T14). in respect of N uptake by CO47 rice the uptake of nitrogen in rabi season 2012 was also influenced by the application of organic conjointly with inorganics in different proportions. The uptake of N varied from 15.96 to 36.88, 33.60 to 65.31, 39.92 to 76.91 and 56.28 to 119.51 kg ha<sup>-1</sup> active tillering, panicle initiation, flowering and harvest stages respectively. The N uptake at each growth stages was the lower in absolute control (T14) while it was the maximum with the application of 50% N as *Sesbania aculeata* + 50% N as inorganic (T6).

The results were in consonance with the findings of sharma and mithun (1990) <sup>[6]</sup> with FYM, Bhandari *et al.* (1992) <sup>[7]</sup> with green manuring and kale *et al.* (1991) <sup>[8]</sup> with vermi compost. Hossain *et al.* (2010) <sup>[9]</sup> also reported higher N uptake in rice with FYM application over no fertilizer and inorganic fertilizers application. The higher N Uptake was associated with treatments of NPK applied through organics + 100% NPK. This might be due to added fertilizers FYM, green manuring.

These results were in accordance with findings of singh *et al.* (2004) <sup>[10]</sup>. The favourable effect of green manuring and FYM in soil and there by removal of NPK through plant uptake by upland rice was earlier reported by Gupta *et al.* (2006) <sup>[11]</sup>.

### Phosphorus Uptake

The Phosphorus Uptake by CO47 rice was also influenced by the application of organics in conjunction with inorganic. The 50% N as through *Sesbania aculeata* + 50% N as inorganic (7.68, 15.65, 17.50 and 39.28) recorded the highest N uptake at active tillering, panicle initiation, flowering and harvest stages respectively. It was however at on par with 50 % N as through FYM

+ 50% N as inorganic (T13) but superior to 50% N as through poultry manure + 50% N as inorganic (T9) and 50% N through Press mud + 50% N as inorganic (T3) at all the stages of crop growth except at harvest where it was superior even to T12 during kharif season.

The Uptake of Phosphorus by ADT 38 rice varied from 3.10 to 7.53, 7.97 to 16.98, 9.47 to 19.30 and 22.81 to 37.50 kg ha<sup>-1</sup> for the active tillering, panicle initiation, flowering and harvest stages respectively. The treatments effects were similar to that observed for kharif seasons.

Hossain *et al.* (2010) <sup>[9]</sup> also reported higher P uptake in rice with FYM application over no fertilizer and inorganic fertilizer application. Available P in soil significantly enhanced due to application of organic manures. The increased availability of P resulted in more uptake of P by the plant. The pH of the soil also indicated a positive change i.e a shift towards neutrality. This positive change enhanced the solubility of different nutrients especially phosphorus in the soil. The form of orthophosphate ion might have converted

from  $\text{Po}_4^{3-}$  to  $\text{Hpo}_4^{2-}$  on even  $\text{H}_2\text{po}_4^-$  for short periods, which resulted in increased concentration of P in the plants. These results are in accordance to the observation of Tilahur *et al.* (2013) [12]. The higher P uptake attributed to the increased P availability and increased growth of the crop (Tilahur *et al.* 2013) [12]. According to Aziz *et al.* (2010) root growth in plants receiving FYM was higher and hence would increased nutrient uptake. Yassen *et al.* (2010) further suggested that FYM application increased the transfer of elements between the solid phase and soil solution which again could be a reason for the higher nutrient uptake. It was also indicated that the activity of soil micro-organisms under higher FYM applications might had led to increased nutrient uptake. (Yassen *et al.* 2010). Yadav *et al.* (2005) also reported maximum P uptake when 25% N was substituted by green leaf (*Sesbania aculeata*) Manure.

### Potassium Uptake

During Kharif the positive influence of treatments on K uptake by CO47 rice was evidenced. Higher potassium uptake was associated with 50% N as through *Sesbania aculeata* + 50% N as inorganic (50.60, 94.15, 105.60 and 134.20) T6 at active tillering, panicle initiation, flowering and harvest stages respectively and it was on par with 50% N through FYM + 50% N as inorganic (T12) but superior to 50% N through poultry manure + 50% N as inorganic (T9) and 50% N through pressmud + 50% N as inorganic (T3). The above treatments (T6, T12 and T3) were superior to 100% N as inorganic (T13), 75% N through *Sesbania aculeata* + 25% N as inorganic (T5), in enhance K uptake by rice lower uptake of K was observed under absolute control (T14).

The uptake of k by ADT38 rice extended from 41.03 to 60.00, 80.68 to 109.50 and 86.41 to 112.62 during Rabi season respectively for active tillering, Panicle initiation, flowering and harvest stages. Here again the application of 50% N through *Sesbania aculeata* + 50% N as inorganic was found to be the best in enhancing K uptake. Among the organics *Sesbania aculeata* followed by FYM, Poultry manure and pressmud along with inorganic improved the K uptake when compared to inorganic N alone. Duhan *et al.* (2001) [13] observed that application of green manure, in general increased the k uptake in rice grain and straw. In barley, the highest K uptake was found due to an addition of vermicompost @ 4.5+ ha-1 along with 60kg N ha-1 (Kurmawat and jat 2005) which supported these findings. Tiwari *et al.* 2002 [15] noticed fast rate of mineralization and greater utilization of nutrients through the use of green manuring to combination with chemical fertilizer FYM, green manuring and compost were applied to the soil. Similarly the findings of Pattanayak *et al.* (2001) [16], Yaduvanshi (2001) [17] were again in the same direction of enhanced N, P and K uptake by different crops. Sharma and Sharma (2002) [18] Studied the effect of nutrient management of sustainability of rice-wheat cropping system and revealed that FYM @ 10+ ha-1 increased N uptake by 38 to 45kg ha-1, P uptake by 7 to 10kg ha-1 K uptake by 25 to 42 kg ha-1. The Uptake of NPK rice plant was highest when fertilizer was applied in combinations with vermicompost. Jadhva *et al.* (1997) [19] Mohana rao puli reported that the NPK uptake by rice at various growth period was significantly increased with the application 100% recommended fertilizers with farm yard manure 10+ ha-1.

**Table 1:** Influence of organic and inorganic N on Nitrogen Uptake (kg ha-1) at different growth stages

Treatments	Kharif 2011-12				Rabi 2012-13			
	Active Tillering	Panicle initiation	Flowering	Harvest	Active Tillering	Panicle initiation	Flowering	Harvest
T1	19.25	41.52	51.07	95.37	21.72	47.30	54.12	91.04
T2	19.50	42.50	53.79	96.62	21.98	18.13	55.19	93.10
T3	26.25	48.97	59.60	108.72	29.17	59.11	68.68	109.90
T4	21.50	44.50	56.13	99.93	23.84	53.68	60.10	99.30
T5	21.75	44.84	56.88	101.19	24.86	54.08	61.30	100.52
T6	30.65	58.70	65.91	117.25	36.88	65.31	76.91	119.51
T7	20.50	43.07	53.81	36.88	22.21	49.19	56.18	94.10
T8	20.75	43.57	54.55	98.15	22.60	49.80	57.21	95.36
T9	27.50	51.50	59.68	109.23	30.44	59.80	70.61	110.53
T10	21.80	44.02	53.81	98.43	23.01	51.69	58.40	96.23
T11	21.0	46.22	54.55	99.67	23.56	52.14	59.69	97.50
T12	28.80	56.88	65.48	115.75	35.60	64.82	76.62	116.85
T13	22.50	45.49	54.98	101.53	25.00	54.33	60.00	103.51
T14	12.40	35.12	42.70	69.50	15.96	33.60	39.92	56.25
SE2	2.284	2.379	2.105	1.096	2.393	2.174	2.578	2.925
CD(P = 0.05)	4.695	4.892	4.328	6.364	4.919	4.469	5.300	6.013

**Table 2:** Influence of organic and inorganic N on Phosphorus Uptake (kg ha-1) at different growth stages

Treatments	Kharif 2011-12				Rabi 2012-13			
	Active Tillering	Panicle initiation	Flowering	Harvest	Active Tillering	Panicle initiation	Flowering	Harvest
T1	3.37	9.42	12.32	24.90	4.10	11.34	12.53	26.52
T2	3.48	9.96	12.43	25.52	4.26	11.53	13.0	27.01
T3	5.85	11.92	14.92	32.79	5.89	13.45	15.87	31.25
T4	3.98	10.02	12.74	26.92	4.58	11.98	13.44	27.30
T5	4.03	10.40	12.85	27.72	4.65	12.15	13.74	28.55
T6	7.68	15.65	17.50	39.28	4.65	16.98	19.30	37.50
T7	3.75	9.80	12.47	26.10	7.53	11.33	12.97	27.92
T8	3.82	9.97	12.58	27.32	4.32	11.74	13.20	28.09
T9	5.98	12.08	15.11	33.51	4.39	13.80	16.25	32.98
T10	3.82	10.12	12.64	26.59	6.10	11.68	13.07	28.01

T11	3.90	10.18	12.75	26.80	4.55	11.94	13.43	28.33
T12	6.93	14.53	16.82	35.55	4.52	15.78	18.75	36.62
T13	4.92	10.73	13.50	29.61	6.93	12.11	13.50	28.00
T14	2.70	6.72	10.50	21.17	5.10	7.97	9.47	22.81
SE2	0.397	0.545	0.631	1.747	0.303	0.613	0.790	1.418
CD(P = 0.05)	0.817	1.121	1.292	3.592	0.624	1.260	1.625	2.915

**Table 3:** Influence of organic and inorganic N on Pottasium Uptake (kg ha<sup>-1</sup>) at different growth stages

Treatments	Kharif 2011-12				Rabi 2012-13			
	Active Tillering	Panicle initiation	Flowering	Harvest	Active Tillering	Panicle initiation	Flowering	Harvest
T1	39.55	82.17	91.23	119.82	40.89	84.23	92.50	121.50
T2	39.02	83.39	91.94	120.69	41.09	85.40	93.72	122.64
T3	45.25	88.43	98.02	126.47	46.30	88.80	98.80	129.63
T4	40.90	83.90	92.93	121.98	42.24	85.95	94.94	123.50
T5	41.41	84.17	93.51	122.29	42.73	86.18	95.18	124.12
T6	50.60	94.15	105.60	134.20	51.50	94.50	106.70	138.51
T7	40.62	83.17	92.01	120.97	41.99	85.09	93.98	122.50
T8	40.91	83.65	92.46	121.22	42.20	85.67	94.23	123.14
T9	45.80	88.90	98.95	127.50	47.60	90.20	94.77	130.50
T10	40.83	83.29	91.58	120.33	41.96	85.50	102.00	123.09
T11	41.16	83.91	92.99	121.75	42.46	83.93	94.27	123.65
T12	49.50	93.22	103.85	132.55	50.20	93.62	104.80	136.68
T13	41.48	84.00	93.98	122.00	42.98	87.00	96.00	12.59
T14	34.33	71.39	81.74	101.62	35.42	74.53	84.69	104.83
SE2	1.696	7.913	1.948	2.124	1.194	0.719	0.970	2.565
CD(P = 0.05)	3.486	3.932	4.005	4.367	2.454	1.477	0.994	5.260

## References

- Humphries EC, Mineral Components and ash analysis in modern methods of plant analysis. Springer Verlag Berlin. 1956; 1:468-502.
- Jackson MV. Soil chemical analysis. Prentice hall of Indian Pvt.Ltd., New Delhi, 1973.
- Ayalew A, Dejene T. combined application of organic and inorganic fertilizers to increase yield of barley and improve soil properties of fereze in southern Ethiopia. Innovative Systems Design and Engineering. 2012; 3(1):25:35
- Mithun S, Mondal SS, Acharya D, Sanjoy S. Effect of integrated nutrient management on productivity and quality of basmati rice (*Oryza sativa*) oryza. 2007; 44(2):125-129.
- Srinivasan S, Angayarkanni A. Effect of INM on yield and nutrient uptake by rice in STCR experiment. Agricultural Science Digest. 2000; 28(2):130-132.
- Sharma AR, Mithra N. In rice based cropping system in eastern India, Organic manure should be combined with chemical fertilizer. Indian Farming. 1990; 40(9):40-42.
- Bhandari AL, Sood Anil, Sharma KN, Rana DS. Integrated nutrient management in rice-wheat system. Journal of indian society of soil science. 1992; 40(4):742:747
- Kale RD, Bano K, Satyavati GP. Influence of Vermicopost application on growth and yield of cereals, Vegetables and Ornamental plants. Final report of KSCST project No.67- 04/Verm/34b(3478), Bangalore, 1991, 87.
- Hossain AT, Rahman F, Saha PK, Solaiman AR. Effect of different aged poultry litter on the yield and nutrient balance in boro rice cultivation. Prentice Hall of India Pvt Ltd., New Delhi, 2010, 134-182.
- Singh SK, Verma SC, Singh RP. Residual effect of organic and inorganic sources of nutrients in lowland rice on succeeding lentil. Indian Journal of agricultural Research. 2004; 38(2):121-125.
- Gupta V, Sharma RS, Vishwakarma SK. Longterm effect of integrated nutrient management on yield sustainability and soil fertility of rice (*Oryza sativa*) Wheat (*Triticum aestivum*) Cropping system, Indian Journal of Agronomy. 2006; 51(3):160-164
- Tilahun TF, Nigissie DR, Wondimu B, Setegn G. Effect of farm yard manure and inorganic fertilizers on the growth yield and moisture stress tolerance of rainfed lowland rice. American journal research communication. 2013; 1(4):274-301
- Duhan BS, Kumar V, Singh N, Khera AP, Kumar V, Singh N *et al.* Effect of Manuring on the yield and uptake of potassium in rice crop research. 2001; 22(3):330-334.
- Kumawat PD, Jat NI. Effect of organic manure and nitrogen fertilization on productivity of barely (*Hordeum vulgare*). Indian Journal of Agronomy. 2005; 50:200-202
- Tiwari A, Dwivedi AK, Dikshit PK. Long-term influence of organic and inorganic fertilization on soil fertility and productivity of soybean. Wheat system in a vertisol. Journal of Indian Society of soil science. 2002; 50:472-475.
- Pattnayak SK, Mishra KN, Jener MK, Nayak RK. Evaluation of green manure crops fertilized with various phosphorus sources and their effect on subsequent rice crop. Journal of the Indian society of soil science. 2001; 49(2):285-291.
- Yaduvanshi NPS. Effect of five years of rice wheat cropping and NPK fertilizers use with and without organic and green manures on soil properties and crop yield in a reclaimed sodic soil. Journal of the Indian Society of soil science. 2001; 49(4):714-719.
- Sharma SK, Sharma SN. Integrated nutrient management for sustainability of rice (*Oryza sativa*) – wheat(*triticum aestivum*) cropping system. The Indian journal of Agricultural sciences. 2002; 72(10):573-576.
- Jadhava AD, Talashilkar SC, Powar AG. Influence of conjunctive use of F7M, Vermicom post and urea on growth and nutrient uptake in rice, Journal of

Maharashtra Agricultural University. 1997; 22(2):249-250.

20. Mohana Rao Puli, PRK Prasad, M Jaya Lakshmi, B Srihari Rao. Effect of organic and inorganic sources of nutrients on NPK uptake of rice crop at various growth periods, Research Journal of Agricultural sciences. 2017; 8(1):64-69.