Int.J.Curr.Microbiol.App.Sci (2020) *9*(5): 1485-1498

International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 9 Number 5 (2020)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2020.905.169

Validation and Refinement of Soil Test Based Derieved Fertilizer Equation for SRI Rice in *Vertisol*

Krishna*, L. K. Srivatsava, V. N. Mishra, Neha Padhi, Neeta Rathia and Susma

College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh, India

**Corresponding author*

Keywords

STCR, Rice, SRI, FYM, *Vertisol*

Article Info

Accepted:
10 April 2020
Available Online:
10 May 2020

ABSTRACT

The fertilizer adjustment equations evolved during previous season for the Swarna variety of rice was tested and fertilizer application with organic source (FYM). It was also noticed that fertilizer dose applied based on STCR prescription derived previously to achieve a definite yield target could not be obtained. This may be due to differences in various input use efficiency, nutritional requirement. However, further refinement of the equations was tried using nutrients omission plot technique and basic parameters required for the formulation of the fertilizer equations were confirmed. The amount of nutrient required to produce one quintal of rice grain yield was found to be 1.57 kg N, 0.30 kg P and 1.71 kg K. The contribution of fertilizer N, P and K were estimated as 41.83, 28.37 and 116.21 per cent. Similarly, the contribution of soil test N, P and K were recorded as 33.55, 81.28 and 19.10 percent. The contribution of organic source (FYM) was observed as 13.8 % N, 6.67 % P and 11.64 % K. After refinement of the fertilizer prescription equations, it was observed that by calculation with new equation, N and P fertilizer requirement at various soil test levels increased over existing equations developed previously. However, the dose of K fertilizer was lower than existing one. Hence, a new set of N P K doses at different soil test levels were evolved and need to be tested for its suitability under similar soil and crop situation.

Introduction

Fertilizer is one of the costliest inputs in agriculture and the use of right elements in right amount of fertilizer at right time is fundamental for farm profitability and environmental protection. Soil testing as a diagnostic tool, the value of soil testing both in general and specific terms is to identify soil fertility problems and constraints in an area and to give specific fertilizer recommendation based on soil testing results of a farm holding.

At the same time a balanced fertilization has to be considered for maintaining soil health for sustainable use because indiscriminate and imbalanced use of fertilizers has already distorted soil fertility and deteriorated soil health in India (Santhi *et al.*, 2011). Soil test based fertilizer recommendations result in efficient fertilizer use and maintenance of soil fertility.

Several approaches have been used for fertilizer recommendation based on chemical soil test so as to attain maximum yield per unit of fertilizer use. Among the various approaches, the soil test crop response (STCR) studies help to generate fertilizer adjustment equations and calibration charts for recommending fertilizers on the basis of soil tests and achieving targeted yield of crops (Ramamoorthy *et al.*, 1967, Singh and Biswas, 2000). The formulation of soil test based fertilizer equations generated for a particular soil type and climatic conditions requires validation for their suitability in similar soil and climatic conditions. If validation is differed more than ±10 % then certain refinement can be done in constant values used in fertilizer equations by adjusting efficiencies of fertilizer, Fertilizer application and yield target chosen can be so manipulated that both high profit from fertilizer investment and maintenance of soil fertility can be achieved (Velayutham, 1979). Targeted yield concept is based on quantitative idea of the fertilizer needs based on yield and nutritional requirement of the crop, per cent contribution of the soil available nutrient and fertilizer applied. This method not only estimates soil test based fertilizer dose but also the level of yield the farmer can achieve with that particular dose. Targeted yield approach also provides scientific basis for balanced fertilization not only between the nutrients from the external sources but also from the external sources. Target yield approach has to be used to formulate fertilizer recommendations across the country (Santhi *et al.*, 2004).

In India rice (*Oryza sativa*) is the staple food crop for more than two thirds of the population. The slogan “RICE is life” is most appropriate for India as this crop plays a vital role in our national food security and is a means of livelihood for millions of rural households. Over 50 % of the world’s population depends on rice as their primary source of energy while the demand for rice keeps growing. It is estimated that rice production should be increased by about 40 % to meet the growing demand by 2030 due to population growth and changing food habits (Khush, 2005). Latest statistics by FAO (2017b) show that global paddy production has grown from around 690 million tons in 2008 to over 750 million tons in 2016and the global area under rice production has grown from around 160 million hectares in 2008 to around 165 million hectares as of 2017.

India produces rice in a large quantity with a production of 104.4 million tonnes and productivity of 2367 kg ha^{-1} in 2015-16, grown in an area of 44.1 million hectares. Rice is grown in Chhattisgarh in an area of 37.18 lakh hectares with a production of 66.20 lakh tonnes and productivity of 1780 kg ha^{-1} in 2015-16.

Materials and Methods

A field experiment was conducted at the farm of Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) The soil of the experimental field comes under the soil order of Vertisol. This soil is locally known as Kanhar. It is clayey in texture with 25.0 % Sand, 26.0% silt and 49.0% clay, dark brown to black in color. Some physico-chemical properties of experimental soil were analyzed which found 7.6 pH (1:2.5), 0.18 EC (dSm-1), 35.40 CEC (c mol(p+) kg-1),0. 58 Organic C (g kg-1), 198 Available N (kg ha-1), 16 Available P (kg ha-1) and 390 Available K (kg ha-1).The fertilizer materials were used as urea, single supper phosphate and muriate of potash for the source of N P and K nutrient, respectively. Full dose of P_2O_5 and K_2O and 1/3rd of N were applied as basal, remaining 2/3rd of N applied in two equal splits as top dressing at tillering and panicle initiation stages. Grain and straw samples were analyzed for N, P and K content (Piper, 1966) and total nutrient uptake was computed using grain and straw yield data. Using the data on grain yield, nutrient uptake, pre-sowing soil available nutrients and fertilizer doses applied the basic parameter, viz. nutrient requirement (kg q-1), contribution of nutrients from soil and fertilizer sources were calculated as described by Ramamoorthy *et al.*, (1967). The contribution of nutrients from applied FYM was estimated by relating the yield with fertilizer nutrients and FYM. These parameters were used for the formulation of fertilizer adjustment equations for deriving fertilizer doses and the soil test based fertilizer prescription in the form of ready reckoners for desired yield target of rice.

Experiment design

The Experimental details are as follows:-

Location	:	Instructional Farm, I.G.K.V. Raipur (C.G.)
Season	:	Kharif, 2017
Soil type	:	*Vertisol*
Crop	:	Rice
Plot Size	:	$16m^2$ (4m x 4m)
Row spacing	:	25 x25 cm^2
Date of transplanting	:	15/07/17
Date of harvesting	:	20/11/17
Treatment	:	Fourteen
Replications	:	Three
Design	:	Factorial RBD

Treatment details

S.No.	Treatment	Fertilizer Application
1.	T1	Control (N_0 P_0 K_0)
2.	T2	Control (N_0 P_0 K_0) + FYM
3.	T3	N_{120} P_{60} K_0
4.	T4	N_{120} P_{60} K_0 + FYM
5.	T5	N_{120} P_0 K_{40}
6.	T6	N_{120} P_0 K_{40} + FYM
7.	T7	N_0 P_{60} K_{40}
8.	T8	N_0 P_{60} K_{40} + FYM
9.	T9	N_{120} P_{60} K_{40}
10.	T10	N_{120} P_{60} K_{40} + FYM
11.	T11	Yield Target 8 t/ha
12.	T12	Yield Target 8t/ha + FYM
13.	T13	Yield Target 10 t/ha
14.	T14	Yield Target 10 t/ha + FYM

Statistical analysis

The data collected from field observations and those recorded in laboratory were subjected to statistical analysis by standard analysis of variance technique. For significant treatment effects, critical differences were calculated at 5 per cent level of significance.

Results and Discussion

Results presented in Table.1 and depicted in Fig.1 show the mean grain yields of rice differed significantly with main effects of treatment (T) however, FYM application (F) and interaction effect (FT) did not show significant variations. Significantly higher grain yield was recorded with the treatment T_7 (YT 10 t/ha) followed by T_5 (N_{120} P_{60} K_{40}), T_6

(YT 8 t/ha) and T_2 (N_{120} P_{60} K_0). STCR based fertilizer dose for yield target of 10 t/ha received highest yield among all other treatments. Yield performance severely affected when N and P were omitted. The grain yield of N omitted plot showed statistically at par result with that of absolute control thereby indicating that N is most important limiting nutrient and yield reduced considerably if treatment did not received N application. Higher yield of rice (84.50 q/ha) was obtained with the treatment that received higher amount chemical fertilizer coupled with 5 tons of FYM although yield was not as per the yield goal.

It was also noticed that fertilizer dose applied based on STCR prescription derived previously to achieve a definite yield target could not be obtained. This may be due to differences in various input use efficiency, nutritional requirement etc. Application of FYM with chemical fertilizer enhanced the grain yields as compared to chemical fertilizer only. Singh *et al.,* (2009) also concluded that significantly higher grain yield of rice was recorded in the treatment 75% RDF + 25% N through FYM, followed by the treatment 50% RDF + 50% N through FYM.

The mean straw yield of rice (Table.2 and Fig.2) showed the similar trend with that of grain yields. Straw yields affected significantly with main effects of treatment (T),while FYM application (F) and Interaction (TxF) had no significant effect on straw yields. As observed in case of straw yields, higher straw yield was recorded with the treatment T_7 (YT 10 t/ha) followed by T_5 (N_{120} P_{60} K_{40}), T_2($N_{120}P_{60}K_0$), T_6 (YT 8 t/ha). Among the nutrient omission treatments (T_1 to T_5), application of RDF (T_5) performed higher straw yield than that of T_2 treatment where K application was omitted indicating in spite of more accumulation of applied fertilizer K in its application resulting increase in straw yield but did not contribute to increase in grain yield. Application of FYM also showed higher straw yields over sole application of inorganic fertilizers alone. Straw yield of rice increased with increasing level of fertilizers up to 100% NPK as reported by Pandey *et al.,* (2009).

Nitrogen uptake by rice (Table.3 and Fig 3) affected significantly with main effects of treatment, FYM application and Interaction of treatment with FYM (TxF). Significantly higher N uptake was recorded with the treatment T_7 (YT 10 t/ha) followed by T_6 (YT 8 t/ha), T_5 (N_{120} P_{60} K_{40}), T_2 (N_{120} P_{60} K_0). STCR based fertilizer dose for yield target of 10 t/ha received significantly highest N uptake among all other treatments. Among the nutrient omission treatments (T_1 – T_5), application of RDF (T5) performed significantly higher N uptake as compared to the treatment T_4 where N was omitted. Total N uptake was significantly increased with the application of FYM as compared to without FYM. N uptake is the product of content and dry matter yield (grain & straw). Hence, N uptake performed identical with that of grain yields.

The total N uptake was significantly increased with increasing doses of N fertilizer. The N uptake was increased due to the better availability of nitrogen in soil and their transport to the plant from the soil and availability of nitrogen enhanced by application of higher doses of fertilizer. The per cent increase in N uptake by different fertilizer and manurial treatment was 93 to 195% in rice as reported by Bhandari *et al.,* (1992).

Phosphorus uptake by rice (Table.4 and Fig.4) affected significantly with main effects of treatment while FYM application and their interaction effect did not show significant result. Significantly higher P uptake was recorded with the treatment T_5 (N_{120} P_{60} K_{40}), followed by T_7 (YT 10 t/ha),T_6 (YT 8 t/ha), T_2 (N_{120} P_{60} K_0). Application of RDF (T_5) performed significantly higher P uptake and was at par with that of T_7 (YT 10 t/ha). P uptake severely affected when P was omitted. Total P uptake was significantly increased with the application of FYM as compared to without FYM.

The phosphorus uptake being a function of biomass production, it was significantly increased due to increase in grain and straw yields along with their concentration in plant and with increasing N and P application levels in soil. Plants absorb proportionately more nitrogen and phosphorus from the pool of available with higher dose of application. The uptake of N, P and K in rice was highest when the crop was fertilized with 100% RDF of NPK (120:60:50 kg N, P2O5 and K2O ha-1) on the basis of soil test. These findings corroborate that of Pal *et al.*, (2009).

Table.1 Average grain yield (q/ha) of rice in relation to different fertilizer treatments with and without FYM application

Treatments (T)	Grain yield (q/ha)		
	Without FYM	With FYM	Mean
$N_0P_0K_0$ T_1	38.00	42.44	40.22
$N_{120}P_{60}K_0T_2$	65.67	66.96	66.31
$N_{120}P_0K_{40}T_3$	58.60	62.44	60.52
$N_0P_{60}K_{40}T_4$	45.50	47.27	46.38
$N_{120}P_{60}K_{40}T_5$	75.96	78.63	77.29
YT 8 t/ha T_6	68.71	70.73	69.72
YT 10 t/ha T_7	83.79	85.21	84.50
Mean	62.31	64.81	63.56
CD at 5% level	T* = 6.99 , F = NS , FT = NS		

Table.2 Average straw yield (q/ha) of rice in relation to different fertilizer treatments with and without FYM application

Treatment (T)	Straw yield (q/ha)		
	Without FYM	With FYM	Mean
$N_0P_0K_0$ T_1	39.11	42.93	41.02
$N_{120}P_{60}K_0$ T_2	66.23	68.10	67.16
$N_{120}P_0K_{40}T_3$	60.15	61.07	60.61
$N_0P_{60}K_{40}$ T_4	46.40	48.57	47.48
$N_{120}P_{60}K_{40}T_5$	77.02	80.92	78.97
YT 8 t/ha T_6	66.01	66.97	66.49
YT 10 t/ha T_7	86.18	88.56	87.37
Mean	63.35	64.96	64.15
CD at 5% level	T* = 6.73 , F=NS , FT = NS		

Table.3 Total N uptake (kg/ha) by rice (Swarna) in relation to different fertilizer treatments with and without FYM application

Treatment (T)	Total Nitrogen Uptake (kg/ha)		
	Without FYM	**With FYM**	**Mean**
$N_0P_0K_0$ T_1	66.440	67.790	67.110
$N_{120}P_{60}K_0$ T_2	101.10	105.35	103.22
$N_{120}P_0K_{40}T_3$	94.690	99.860	97.270
$N_0P_{60}K_{40}$ T_4	67.100	71.770	69.430
$N_{120}P_{60}K_{40}T_5$	114.83	116.63	115.73
YT 8 t/ha T_6	116.55	115.88	116.21
YT 10 t/ha T_7	141.49	149.09	145.29
Mean	100.31	103.76	102.03
CD at 5% level	**T*=2.22 , F*=1.19 , FT= 3.13**		

Table.4 Total P uptake (kg/ha) by rice (Swarna) in relation to different fertilizer treatments with and without FYM application

Treatment (T)	Total Phosphorus uptake (Kg/ha)		
	Without FYM	**With FYM**	**Mean**
$N_0P_0K_0$ T_1	13.00	13.30	13.15
$N_{120}P_{60}K_0$ T_2	16.86	18.23	17.54
$N_{120}P_0K_{40}T_3$	16.20	17.07	16.63
$N_0P_{60}K_{40}$ T_4	11.62	12.51	12.06
$N_{120}P_{60}K_{40}T_5$	28.14	30.03	29.08
YT 8 t/ha T_6	24.21	25.55	24.88
YT 10 t/ha T_7	27.71	28.55	28.13
Mean	19.79	20.62	20.21
CD at 5% level	**T*= 0.6 , F=NS , FT= NS**		

Table.5 Total K uptake (kg/ha) by rice (Swarna) in relation to different fertilizer treatments with and without FYM application

Treatment (T)	Total K Uptake (kg/ha)		
	Without FYM	**With FYM**	**Mean**
$N_0P_0K_0$ T_1	74.490	75.330	74.910
$N_{120}P_{60}K_0$ T_2	106.87	112.53	109.70
$N_{120}P_0K_{40}T_3$	96.180	104.02	100.10
$N_0P_{60}K_{40}$ T_4	82.620	87.120	84.870
$N_{120}P_{60}K_{40}T_5$	114.75	120.92	117.83
YT 8 t/ha T_6	116.90	127.22	122.06
YT 10 t/ha T_7	142.39	148.10	145.24
Mean	107.17	108.45	116.38
CD at 5% level	**T*=1.77 , F*=0.95 , FT=2.50**		

Estimation of basic parameters based on the nutrient omission plot technique

Table.6 Nutrient requirement of rice

Nutrient	Nutrient requirement (kg q^{-1}) of rice (Swarna)	
	2016	2017
N	1.54	1.57
P	0.28	0.30
K	1.70	1.71

Table.7 Efficiencies of fertilizer, soil test and FYM

Nutrient	Fertilizer efficiency (%)		Soil test Efficiency (%)		FYM Efficiency (%)	
	2016	**2017**	**2016**	**2017**	**2016**	**2017**
N	40.17	41.83	35.02	33.55	18.41	13.8
P	28.17	28.37	82.55	81.28	6.27	7.07
K	102.2	116.1	17.24	19.10	10.79	12.5

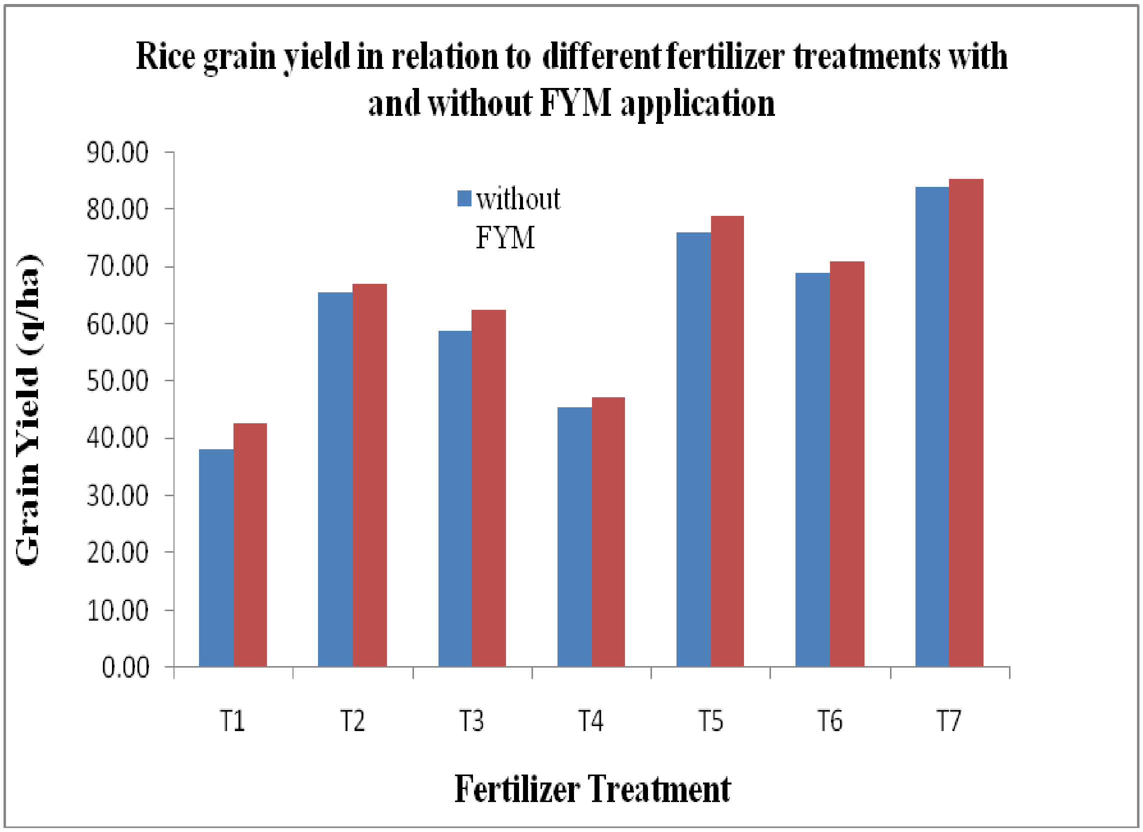
Table.8 Fertilizer adjustment equation derived for rice cv. Swarna

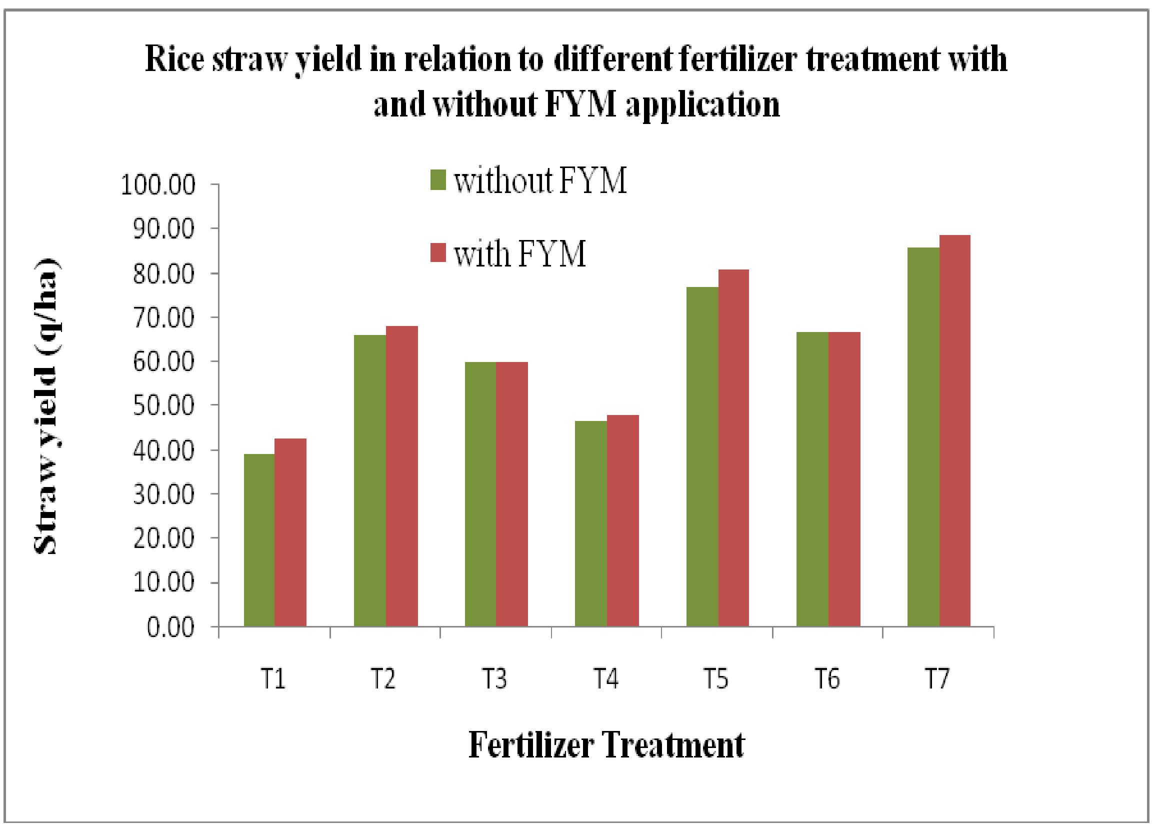
Nutrient management strategy	Fertilizer adjustment equation
STCR-IPNS	FN = 3.74 Y - 0.80 SN - 0.33 FYM
	FP = 1.06 Y – 2.86 SP – 0.25 FYM
	FK = 1.47 Y – 0.16SK – 0.11 FYM

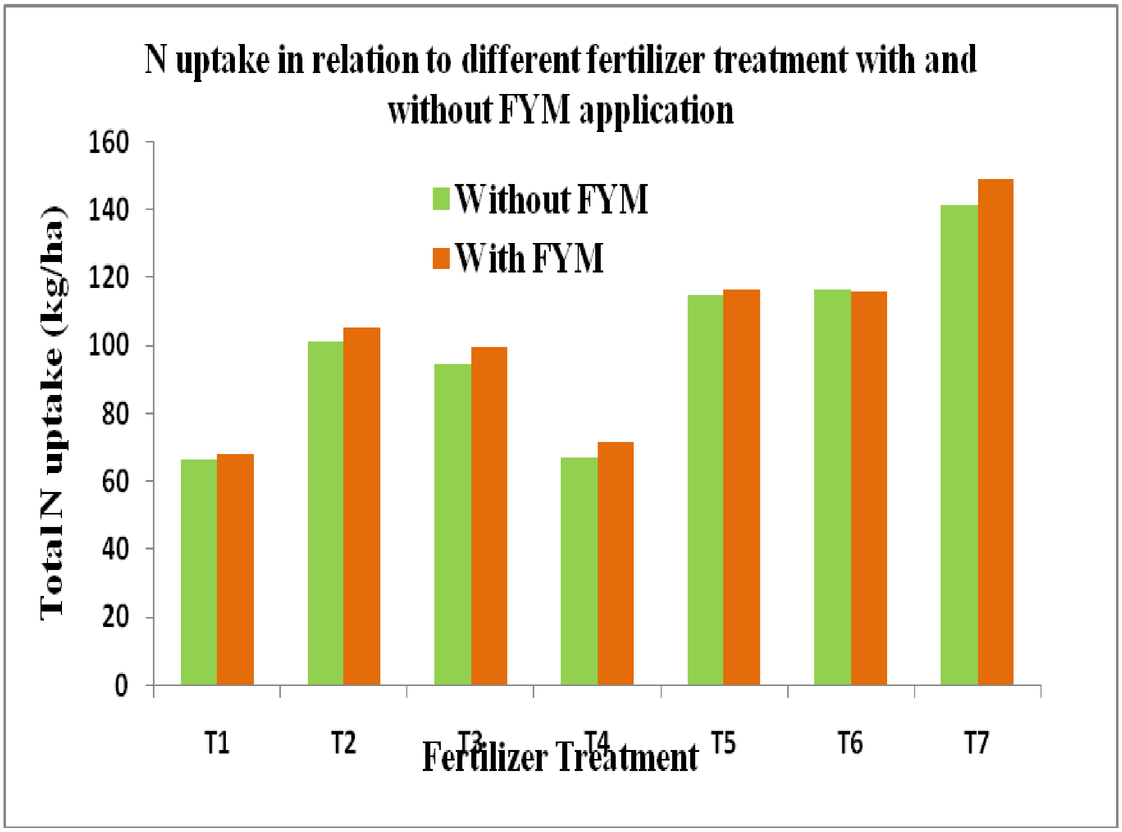
Table.9 Comparison of soil test based fertilizer recommendations by existing equation and new developed equation for rice to achieve 8 t yield target in *Vertisols* with 5 t of FYM

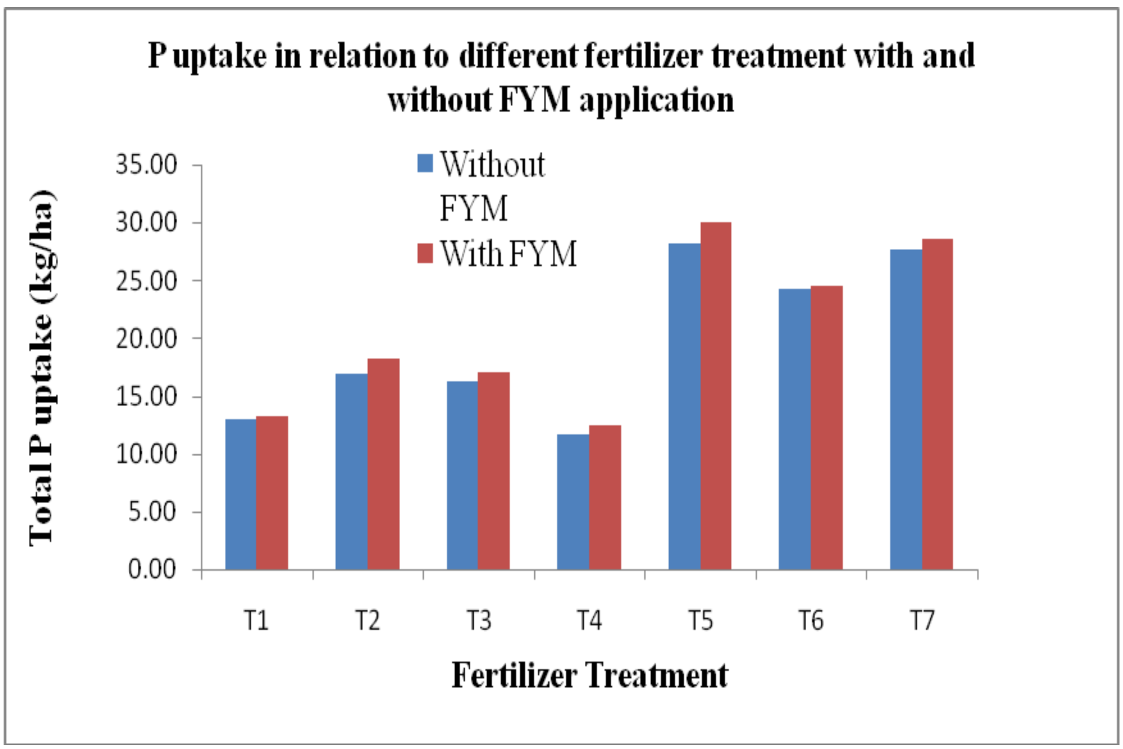
Soil test value (kg/ha)			Yield target of rice (q/ha)					
			Existing equation			New equation		
N	**P**	**K**	**FN**	**FP**	**FK**	**FN**	**FP**	**FK**
150	4	200	169	67	93	178	72	85
175	6	225	147	61	88	158	66	81
200	8	250	124	55	84	138	61	77
225	10	275	102	49	80	118	55	73
250	12	300	80	43	76	98	49	69
275	14	325	58	37	71	78	44	65
300	16	350	35	31	67	58	38	61
325	18	375	13	25	63	38	32	57
350	20	400	13	19	59	18	26	53
375	22	425	13	13	54	18	21	49
400	24	450	13	7	50	18	15	45

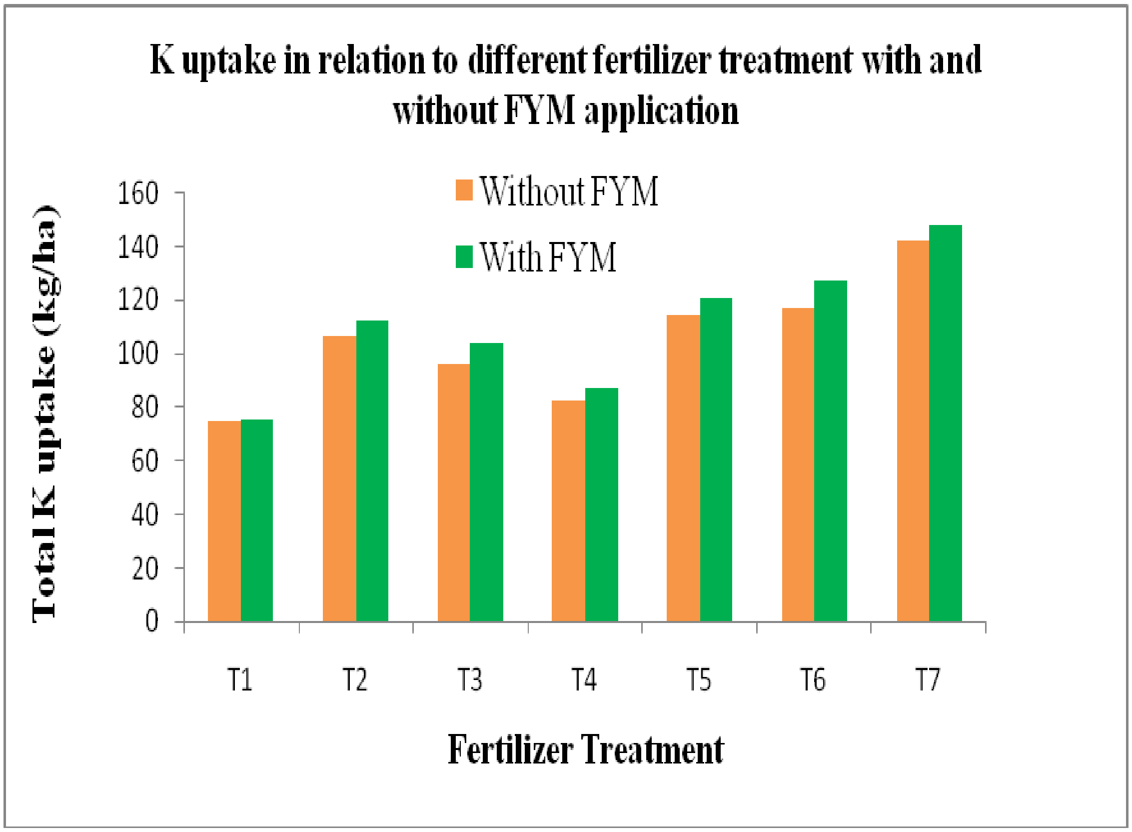
Where, FN, FP and FK are fertilizer N, P_2O_5 and K_2O (Kg ha^{-1}) respectively. SN, SP and SK are soil test values (kg ha^{-1}) for $KMnO_4$- N, Olsen's P and ammonium acetate extractable K


Rice grain yield in relation to different fertilizer treatments with and without FYM application
Grain Yield (q/ha)
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
without FYM
T1
T2
T3
T4
T5
T6
T7
Fertilizer Treatment

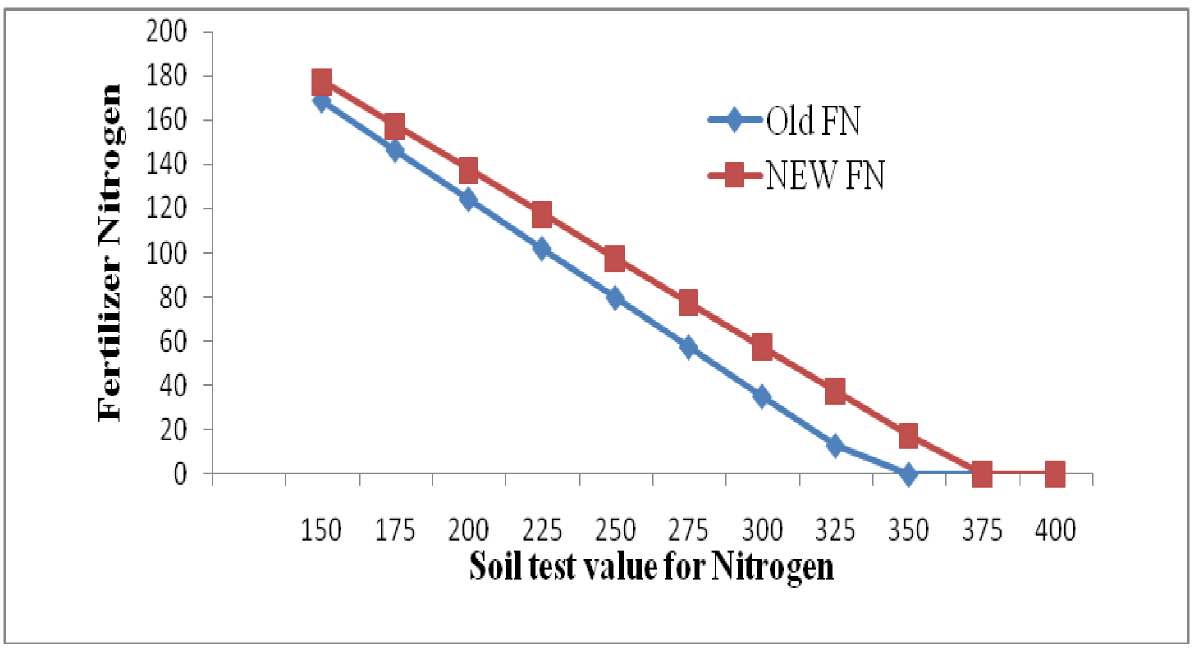

Rice straw yield in relation to different fertilizer treatment with and without FYM application
Straw yield (q/ha)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
without FYM
with FYM
T1
T2
T3
T4
T5
T6
T7
Fertilizer Treatment

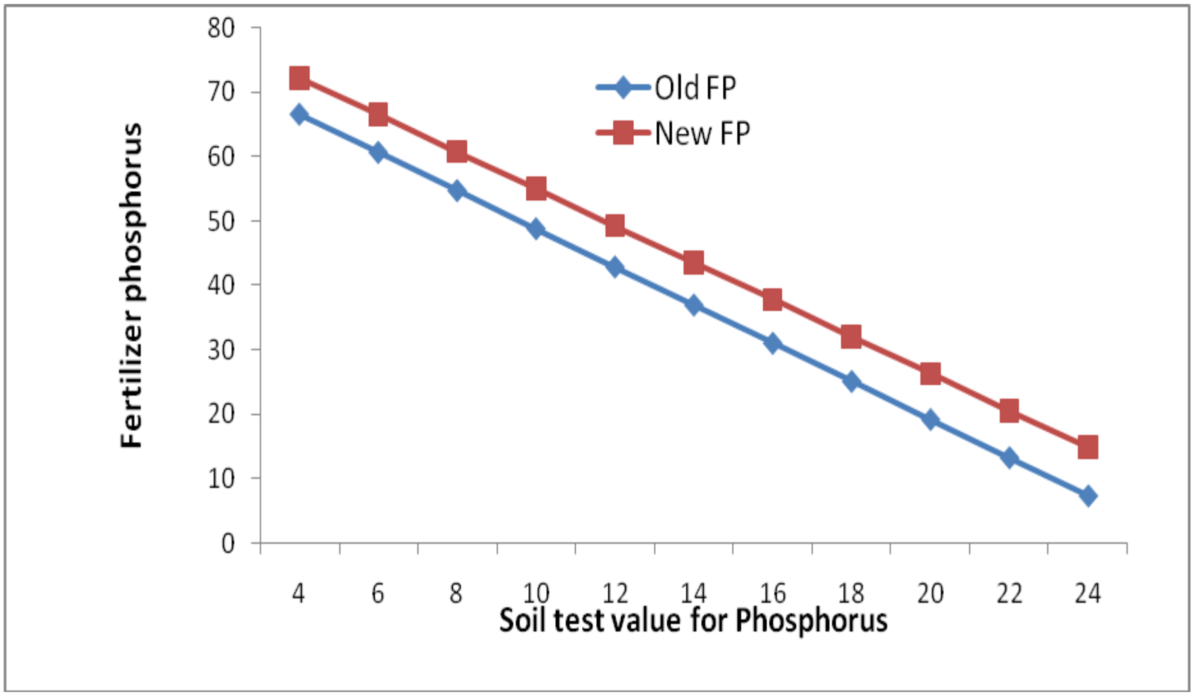

N uptake in relation to different fertilizer treatment with and without FYM application
Total N uptake (kg/ha)
160
140
120
100
80
60
40
20
0
Without FYM
With FYM
T1
T2
T3
T4
T5
T6
T7
Fertilizer Treatment

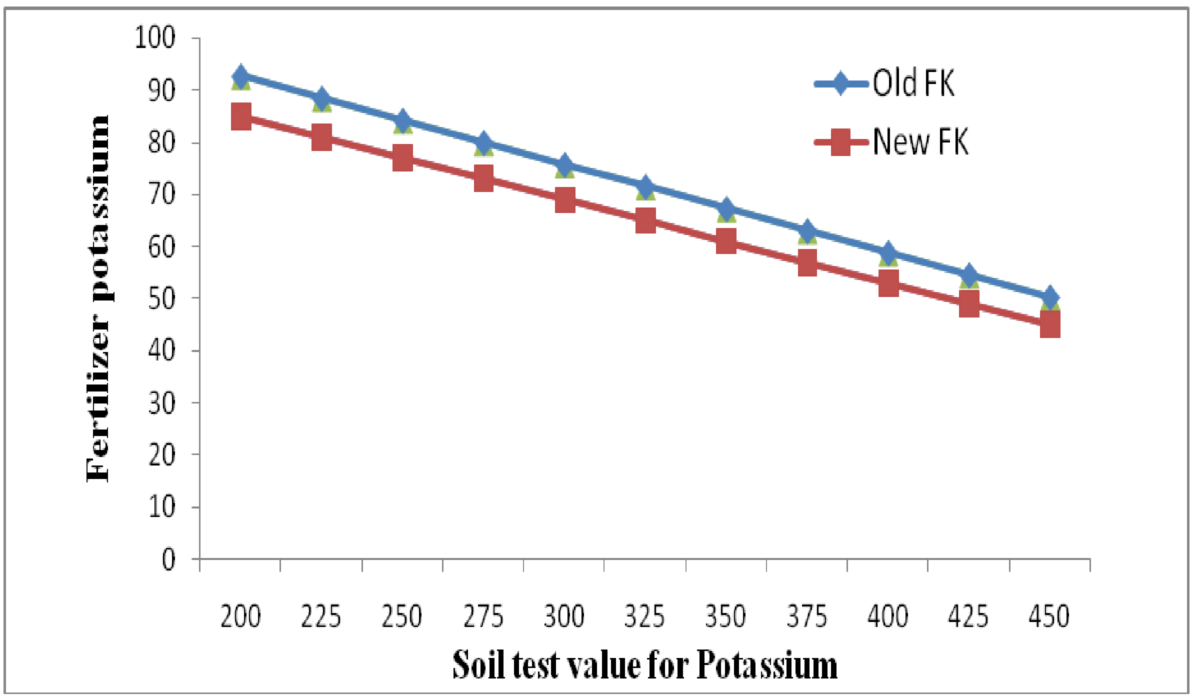

P uptake in relation to different fertilizer treatment with and without FYM application
Total P uptake (kg/ha)
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Without FYM
With FYM
T1
T2
T3
T4
T5
T6
T7
Fertilizer Treatment



Comparison of soil test based fertilizer recommendations by existing equation and new developed equation for rice to achieve 8.0 Ton yield target in Vertisol







Potassium uptake by rice (Table.5 and Fig.5) affected significantly with main effects of treatment and FYM application. Interaction of treatment with FYM (TxF) had significant effect on K uptake. Significantly higher K uptake was recorded with the treatment T_7 (YT 10 t/ha) followed by T_6 (YT 8 t/ha), T_5 ($N_{120}P_{60}K_{40}$) and T_2 (N_{120} P_{60} K_0) and T_3 (N_{120} P_0 K_{40}). STCR based fertilizer dose for yield target of 10 t/ha received significantly highest K uptake.

Total K uptake was significantly increased with the application of FYM over its no application. Pandey *et al.,* (2009) reported that potassium uptake from 49.7 82.6 kg ha-1 by rice increased with increasing levels of NPK from 0 to 150%. Similarly, Datta and Singh (2010) also reported that with the application of 10 tonnes cattle manure ha-1, nutrient uptake exhibited 1.38-2.36 and 1.76-2.60 times increased in rice-green gram and rice-field pea cropping systems, respectively.

Derivation of fertilizer prescriptions equation based on basic parameters evolved during current season experiment

The derivation of new fertilizer equations using the basic parameters like nutrient requirement, efficiencies of fertilizer, soil and organic source were developed for rice as elaborated below

$$\mathbf{FN = \frac{NR}{CF/100}\, Y - \frac{CS}{CF}\, STVN - \frac{CFYM}{CFYM}\, FYMN}$$

Where, FN is fertilizer nutrients (N, P and K kg/ha), NR – nutrient requirement of N, P and K (kg/q); CS, CF and CFYM – percentage contributions (efficiency) of N P & K nutrients from soil, fertilizer and farmyard manure, respectively; STVN is soil test value for available N, P and K (kg/ha); FYM is Farm Yard Manure, Y – yield (q/ha) of the test crop.

Ready reckoners for fertilizer recommendations of rice

The comparative ready reckoners table was prepared based on the equations derived previously for rice with existing equation and new currently developed equations with five tonnes of FYM application (Table.6).It was noticed that by calculation with new equation, N and P fertilizer requirement at various soil test levels increased over existing equations developed previously. However, the doses of K fertilizer were lower than existing one. Hence, a new set of N P K doses at different soil test levels were evolved and need to be tested for its suitability under similar soil and crop situation. It was remarkably noticed that yield targets of 8 and 10 t/ha were not achieved with existing equation derived during previous season with SRI rice. However, fertilizer doses with new equations have estimated higher amount of N and P which might fulfill the nutrient requirement for higher yield target although this needs field validation in the next crop season. It is evident that the fertilizer requirements decreased with increase in soil test values and differences between two equations resulted higher at increasing soil test levels particularly for N fertilizer. This may be due to lower contribution of N from soil and FYM sources.

Thus the targeted yield approach of fertilizer recommendation ensures nutrient balancing to suit the situations involving different yield goals, soil fertility and resources of the farmer (Dev *et al.,* 1985). The existing equations derived during 2016 for Swarnavariety of rice were refined by the estimation of new basic parameters as mentioned above. The new equations have been compared with that of existing one and can be said superior over existing after validation.

References

Bhandari, A. L., Sood. A., Sharma, K. N. and Rana, D. S. 1992. Integrated nutrient management in a rice-wheat system. J. Indian Soc. Soil. Sci. 40 (4): 742-747.

Datta, M. and Singh, N. P. 2010. Nutrient management in rice-based cropping systems as influenced by applying Cattle Manure alone or in combination with fertilizers in upland acid soils of Tripura. J. Indian Soc. Soil. Sci. 58 (1) 94-98.

Dev, G., Dillion, N. S., Brar, J. S. and Vig, A.C. 1985. Soil test based yield targets for wheat and rice-cropping system. Fert. News. 30 (5): 42-50.

FAO.2017b.Rice Market Moniter (RMM) [online]. Available http://www.fao.org/economic/est/publications/rice-publications/rice-market-monitorrmm/en/ [Accessed 8.6.2017].

Khush, G. S. 2005. What it will take to Feed 5.0 Billion Rice consumers in 2030. An International Journal on Molecular Biology, Molecular Genetics and Biochemistry, 59, 1-6.

Pal, S.; Banerjee, H., Basu, B. and Maiti, S. 2009. Studies on nutrient management practice in rice-rice crop sequence under new alluvial zone of West Bengal. Oryza. 45 (10): 125-128.

Pandey, A. K., Kumar Vipin and Kumar Rajesh 2009. Effect of long-term organic and inorganic nutrients on transplanted rice under rice-wheat cropping system. J. Oryza. 46: (3): 209-212.

Ramamoorthy, B., Narasimhan, R. L. and Dinesh, R.S. 1967. Fertilizer application for specific yield targets of Sonara-64. Indian Farming,17 (5): 43-45.

Santhi, R., Natesan, R., Andi, K. and Selvakumari, G. 2004. Soil test based fertilizer recommendation for sunflower. (*Heliathus annus* L). in Inceptisols of Tamilnadu. J. Oil Seed Res. 21 (1): 78-81.

Santhi *et al.*, 2011. Targeted yield based fertilizer prescriptions for autumn rice (*Oryza sativa* L.) in inceptisols of Assam, India. Indian J. Agric. Res., 49 (5): 437-441.

Velayutham, M. 1979. Fertilizer recommendation based on targeted yield concept: problem and prospects. Fert News. 24 (9): 12-17.

How to cite this article:

Krishna, L. K. Srivatsava, V. N. Mishra, Neha Padhi, Neeta Rathia and Susma. 2020. Validation and Refinement of Soil Test Based Derieved Fertilizer Equation for SRI Rice in Vertisol. *Int.J.Curr.Microbiol.App.Sci.* 9(05): 1485-1498.
doi: https://doi.org/10.20546/ijcmas.2020.905.169