Asian Journal of Soil Science and Plant Nutrition

Volume 10, Issue 4, Page 698-704, 2024; Article no.AJSSPN.128429
ISSN: 2456-9682

Impact of STCR Based Fertilizer Application on Soil Chemical Properties of Rabi Onion in Inceptisols

Margal P. B. [a++], Thakare Ritu S. [a#*], Kamble B.M. [a†], Patil V.S. [a#], Bhakare B.D. [a#], Patil Kranti B. [a#], Gaikwad A.S. [a++] and Titirmare, N.S. [a++]

[a] *Department of Soil Science, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: https://doi.org/10.9734/ajsspn/2024/v10i4440

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/128429

Original Research Article

Received: 15/10/2024
Accepted: 18/12/2024
Published: 21/12/2024

ABSTRACT

A field experiment for fertilizer equation validation was conducted during the Rabi season of 2022–23 under the AICRP on STCR farm, PGI farm, and AICRP on IWM farm, MPKV, Rahuri, to evaluate the effect of STCR-based fertilizer application on the soil chemical properties of Rabi onion. The experiment was laid out in a randomized block design with ten treatment combinations: Absolute Control, GRDF, As per Soil Test, STCRC target for 250 q ha^{-1} without vermicompost, STCRC target for 300 q ha^{-1} without vermicompost, STCRC target for 350 q ha^{-1} without vermicompost +

[++] *PHD Scholar;*
[#] *Professor;*
[†] *Head;*
**Corresponding author: Email: ritu.thakre@gmail.com;*

Cite as: *P. B., Margal, Thakare Ritu S., Kamble B.M., Patil V.S., Bhakare B.D., Patil Kranti B., Gaikwad A.S., and Titirmare, N.S. 2024. "Impact of STCR Based Fertilizer Application on Soil Chemical Properties of Rabi Onion in Inceptisols". Asian Journal of Soil Science and Plant Nutrition 10 (4):698-704. https://doi.org/10.9734/ajsspn/2024/v10i4440.*

Biofertilizer, STCRC target for 250 q ha^{-1} with vermicompost, STCRC target for 300 q ha^{-1} with vermicompost, STCRC target for 300 q ha^{-1} with vermicompost + Biofertilizer, and only 5 t ha^{-1} vermicompost. The research findings indicated that treatment T_9 significantly increased electrical conductivity (0.24 dS m^{-1}) and soil organic carbon content (0.59%). Similarly, treatment T_9 resulted in the highest residual soil available nitrogen and phosphorus levels, measuring 199.21 kg ha^{-1} and 16.12 kg ha^{-1}, respectively. On the other hand, the highest soil available potassium level (475.29 kg ha^{-1}) was recorded in treatment T_6, which was comparable to treatment T_9 (471.76 kg ha^{-1}). Combining vermicompost with biofertilizers (*Azospirillum* and *PSB*) boosts nutrient use efficiency, reduces losses, and improves residual nutrient content compared to treatments without them.

Keywords: STCR; chemical properties; vermicompost; biofertilizer.

1. INTRODUCTION

The 'targeted yield model' is one of the practical approaches for efficient use of fertilizers. The theory of formulating optimum fertilizer recommendations for targeted yields was first given by [1]. Troug and later modified by [2] Ramamoorthy as 'Inductive-cum targeted yield model'. Incorporating the Integrated Plant Nutrition System (IPNS) into this concept ensures balanced fertilization through the application of both inorganic and organic nutrient sources.

Balanced fertilization essentially involves the rational use of fertilizers and organic manures to supply plant nutrients for agricultural production. This approach aims to ensure efficient fertilization, maximize positive and synergistic interactions among various production factors, minimize adverse environmental effects and reduce nutrient losses [3].

Vermicompost, produced through the digestion of organic waste by earthworms, is a nutrient-rich resource packed with essential macro and micronutrients, plant growth regulators, vitamins and beneficial microflora. It is widely celebrated for its ability to enhance soil fertility in an environmentally sustainable way, making it a key player in promoting eco-friendly agricultural practices [4]. Compared to inorganic fertilizers, vermicompost stands out as a superior alternative due to its diverse microbial populations and high levels of enzyme activity, which significantly boost plant growth [5,6].

Similarly, biofertilizers offer a sustainable and cost-effective solution. These products contain live microorganisms that improve soil fertility by increasing organic matter, enhancing nutrient availability and mobilizing essential nutrients within the soil [7]. Recognized for their affordability and eco-friendliness, biofertilizers are gaining momentum in modern crop production. They work in tandem with organic matter to transform insoluble nutrients into forms that plants can readily absorb, supporting healthy growth [8].

While organic manures typically provide nutrients in smaller quantities than chemical fertilizers, they also supply growth-promoting compounds such as enzymes and hormones. These contribute not only to improved soil health and productivity but also to enhanced overall plant growth. Looking ahead, the adoption of organic manures and biofertilizers will become a cornerstone of sustainable agriculture, ensuring that crop nutrient needs are met in an environmentally responsible way.

2. MATERIAL AND METHOD

The present STCR validation experiments were carried out in STCR farm, PGI field and AICRP on IWM field, MPKV Rahuri during the *rabi* season 2022-23. The experiment was laid out in uniform and nearly levelled land with medium deep black soil belongs to order Inceptisols. The soil is slightly alkaline, low in nitrogen and phosphorus and high in potassium which described in Table 1.

The STCR equation on *rabi* onion (Variety- N: 2-4-1) was derived by test crop trial and given below;

i) STCR yield target equation without vermicompost

$FN = (0.83 \times T) – (0.65 \times SN)$

$FP_0O_5 = (0.41 \times T) – (3.21 \times SP)$

$FK_2O = (0.45 \times T) – (0.18 \times SK)$

ii) STCR yield target equation with vermicompost (5 t ha^{-1})

$FN = (0.65 \times T) – (0.51 \times SN – 5.05\ VC)$

$FP_0O_5 = (0.39 \times T) – (3.06 \times SP – 5.22\ VC)$

$FK_2O = (0.38 \times T) – (0.15 \times SK – 4.04\ VC)$

Table 1. Initial soil properties of all three locations

Sr.No.	Particulars	AICRP on STCR	PGI	AICRP on IWM
1	pH (1:2.5)	8.03	7.92	7.87
2	EC (1:2.5) (d S m^{-1})	0.19	0.17	0.20
3	Organic Carbon (%)	0.56	0.50	0.53
4	Available N (kg ha^{-1})	169	158	201
5	Available P (kg ha^{-1})	14	10	14
6	Available K (kg ha^{-1})	437	414	426

iii) STCR yield target equation with vermicompost (5 t ha^{-1}) and Biofertilizer (*Azospirullum* and *PSB*)

FN= (0.63 x T) – (0.49 x SN – 6.57 VC)

FP_0O_5 = (0.27 x T) – (2.13 SP – 5.00 VC)

FK_2O = (0.36 x T) – (0.15 x SK – 5.49 VC)

Where, F and S indicate fertilizer and soil nutrients, respectively (kg ha^{-1}), t indicates yield target (t ha^{-1}), VC indicates vermicompost (t ha^{-1}), VC + BF indicates vermicompost (t ha^{-1}) + Biofertilizer.

These relationships were further used to compute fertilizer dose for different yield targets of *rabi* onion and varying soil test values.

The experiment was laid out in randomized block design with three replications. The treatments comprised with ten treatments such as T_1- Absolute Control, T_2- GRDF, T_3- As per Soil Test, T_4 -STCRC target for 250 qt ha^{-1} without vermicompost, T_5-STCRC target for 300 qt ha^{-1} without vermicompost, T_6-STCRC target for 350 qt ha^{-1} without vermicompost + Biofertilizer, T_7-STCRC target for 250 qt ha^{-1} with vermicompost, T_8- STCRC target for 300 qt ha^{-1} with vermicompost, T_9- STCRC target for 300 qt ha^{-1} with vermicompost + Biofertilizer, T_{10}- Only 5 t ha^{-1} vermicompost. For assessment of chemical properties of soil, surface representative and composite soil samples from each treatment were collected replication wise and dried in shade, pounded in wooden mortar and pestle and passed through 2 mm sieve and used for chemical analysis. Soil pH (1:2.5) was determined by potentiometric method and electrical conductivity (1:2.5) was determined by conductometric method [9]. Organic carbon in soil was determined by wet oxidation method [10]. Available N in soil was determined by alkaline permanganate method [10]. Available P in soil was determined by $NaHCO_3$ (0.5 M) method [11]. Available K in soil was determined by N N NH_4OAc method [12]. The data were analyzed statistically and results were interpreted by using methods suggested by Panse and Sukhatme [13].

3. RESULT AND DISCUSSION

3.1 Impact of STCR Based Fertilizer Application on Soil pH, Electrical Conductivity (dS m^{-1}) and Organic Carbon (%)

Soil pH measures the acidity or alkalinity of soil, reflecting the concentration of hydrogen ions (H^+) in the soil solution. It is a critical soil property that influences various chemical, biological and physical processes within soil ecosystems. Soil pH plays a key role in plant growth, nutrient availability, microbial activity and overall soil health. In the verification trials conducted across three locations (AICRP on STCR, PGI, and AICRP on IWM) no significant differences in soil pH were observed (Table 2). However, the soil pH values showed slight numerical variations, ranging from 7.98 to 8.03 in the AICRP on STCR trial, 7.80 to 8.00 at the PGI farm, and 7.57 to 7.89 at the AICRP on IWM location.

Soil electrical conductivity (EC) measures the soil's ability to conduct electrical current, offering insights into the concentration of soluble salts and ions in the soil solution. These factors play a crucial role in plant growth and soil fertility. Pooled data on electrical conductivity (Table 2) revealed higher values in treatment T_9 (STCR target 350 q ha^{-1} with 5 t ha^{-1} vermicompost + biofertilizer) and treatment T_4 (STCR target 250 q ha^{-1} without vermicompost), both recording 0.24 dS m^{-1}. Treatments T_5, T_6, T_7, and T_8 showed similar results to T_9 and T_4. In contrast, the lowest pooled electrical conductivity was observed in treatment T_1 (Absolute Control), with a value of 0.18 dS m^{-1}. The application of fertilizers and organic manures increases the concentration of soluble salts in the soil, resulting in elevated electrical conductivity, as noted by Singh et al. [14]. Studies by Goyal et al. [15] and Rajamani et al. [16] also highlight the influence of STCR-based fertilizer application on soil pH and electrical conductivity.

Soil organic carbon (SOC) represents the carbon stored in soil organic matter, including plant and animal residues at various stages of decomposition. It is a critical component of soil fertility, structure and overall ecosystem functioning. SOC plays a vital role in nutrient cycling, water retention, soil aggregation, microbial activity and crop productivity. Pooled data (Table 2) showed that the highest soil organic carbon content was recorded in treatment T_9 (STCR target 350 q ha^{-1} with 5 t ha^{-1} vermicompost + biofertilizer) at 0.59%, while the lowest was observed in treatment T_1 (Control) at 0.47%. The results indicated that all treatments performed on par with T_9. The combined use of organic manures and fertilizers enhances soil organic carbon, primarily due to the increased organic inputs from biomass, as highlighted by Pandey and Srivastava (2021) [17]. Similar findings on the positive effects of STCR-based fertilizer application on soil organic carbon have been reported by Goyal et al. [15] and Venkatesh et al. [18].

3.2 Impact of STCR Approach on Soil Available Nitrogen (kg ha^{-1}), Soil Available Phosphorous (kg ha^{-1}) and Soil Available Potassium (kg ha^{-1})

Soil available nitrogen refers to the portion of nitrogen (N) in the soil that is readily accessible for plant uptake and use. As a critical nutrient for plant growth, nitrogen plays an essential role in the formation of amino acids, proteins, nucleic acids and chlorophyll. Understanding soil nitrogen levels is vital for optimizing crop nutrition, maximizing yields and managing nutrient inputs efficiently. The pooled data on soil available nitrogen (Table 3) ranged from 149.91 to 199.21 kg ha^{-1}. Treatment T_9 (STCR target 350 q ha^{-1} with 5 t ha^{-1} vermicompost + biofertilizer) was significantly superior to the absolute control treatment (T_1). Treatments T_8 (STCR target 300 q ha^{-1} with 5 t ha^{-1} vermicompost) and T_6 (STCR target 350 q ha^{-1} without vermicompost + biofertilizer) were statistically on par with T_9. The higher doses of fertilizer applied to achieve elevated yield targets likely contributed to the increased nitrogen availability in the soil. This effect was further amplified by the inclusion of organic sources like vermicompost, which not only enhanced nutrient accumulation but also improved the soil's long-term fertility. Reddy et al. [19] highlighted this synergistic impact, attributing it to the combined use of farmyard manure (FYM) and inorganic fertilizers. The addition of FYM stimulated microbial growth and activity, further enhancing soil fertility, as noted by Udayakumar et al. [20] and Sekaran et al. [21].

Soil available phosphorus (P) refers to the portion of phosphorus in the soil that is readily accessible for plant uptake and use. As a vital nutrient, phosphorus plays a key role in energy transfer, photosynthesis, root development, flowering and fruiting. Understanding soil available phosphorus levels is essential for optimizing crop nutrition, maximizing yields and effectively managing nutrient inputs. The verification trials revealed that different nutrient management approaches did not significantly influence soil available phosphorus levels, except at the AICRP on IWM location (Table 3). At the AICRP on STCR and PGI farms, soil available phosphorus levels ranged from 12.15 to 16.19 kg ha^{-1} and 11.29 to 15.67 kg ha^{-1}, respectively. However, at the AICRP on IWM location, treatment T_9 (STCR target 350 q ha^{-1} with 5 t ha^{-1} vermicompost + biofertilizer) showed a significantly higher phosphorus availability (17.65 kg ha^{-1}) compared to the control treatment T_1 (12.21 kg ha^{-1}). The integrated application of organic manures and fertilizers in treatment T_9 likely enhanced phosphorus availability by minimizing nutrient losses, even after meeting crop nutrient demands. This is in line with the principles of the Integrated Plant Nutrient System (IPNS), as highlighted by Rajamani et al. [16]. Similar findings on the positive effects of STCR-based fertilizer applications on soil phosphorus levels were reported by Chari et al. [22] and Eunice et al. [23].

Soil available potassium (K) refers to the portion of potassium in the soil that is readily accessible for plant uptake and utilization. Potassium is a vital nutrient for plant growth and development, playing critical roles in enzyme activation, photosynthesis, water and nutrient uptake, osmoregulation and stress tolerance. Understanding soil available potassium levels is essential for optimizing crop nutrition, maximizing yields and managing nutrient inputs effectively. In the follow-up trials conducted at the AICRP on STCR and PGI locations, no significant differences were observed among treatments (Table 3). At the AICRP on STCR site, soil available potassium levels ranged from 424.67 to 459.99 kg ha^{-1}, while the PGI trial reported levels between 410.50 and 434.00 kg ha^{-1}. However, at the AICRP on IWM location, treatment T_6 (STCR target 350 q ha^{-1} without vermicompost + biofertilizer) recorded significantly higher soil

Table 2. Impact of stcr based fertilizer application on soil ph, electrical conductivity (dS m^{-1}) and organic carbon (%)

Tr. No	Soil pH				Electrical Conductivity (dS m^{-1})				Organic Carbon (%)			
	AICRP on STCR	PG Farm	AICRP on IWM	Pooled	AICRP on STCR	PG Farm	AICRP on IWM	Pooled	AICRP on STCR	PG Farm	AICRP on IWM	Pooled
T_1	8.02	7.90	7.85	7.92	0.18	0.16	0.19	0.18	0.49	0.45	0.47	0.47
T_2	8.03	7.89	7.67	7.86	0.21	0.18	0.18	0.19	0.60	0.53	0.48	0.54
T_3	8.02	7.82	7.57	7.80	0.22	0.19	0.19	0.20	0.58	0.51	0.49	0.53
T_4	8.03	7.90	7.83	7.92	0.25	0.23	0.23	0.24	0.54	0.49	0.48	0.50
T_5	8.03	8.00	7.89	7.97	0.25	0.22	0.22	0.23	0.56	0.52	0.49	0.52
T_6	8.01	8.00	7.81	7.94	0.28	0.21	0.21	0.23	0.58	0.53	0.52	0.54
T_7	8.01	7.86	7.80	7.89	0.23	0.22	0.23	0.23	0.60	0.54	0.49	0.54
T_8	8.00	7.89	7.74	7.88	0.24	0.21	0.24	0.23	0.61	0.56	0.57	0.58
T_9	7.98	7.83	7.76	7.86	0.23	0.23	0.25	0.24	0.62	0.57	0.57	0.59
T_{10}	8.01	7.80	7.76	7.86	0.22	0.21	0.21	0.21	0.54	0.50	0.48	0.51
S.E. (m) $\pm$	0.04	0.07	0.08	0.06	0.01	0.01	0.005	0.01	0.03	0.01	0.02	5.60
CD@5%	NS	NS	NS	NS	0.03	0.02	0.014	0.02	0.08	0.04	0.06	0.16

Table 3. Impact of STCR approach on soil available nitrogen (kg ha^{-1}), soil available phosphorous (kg ha^{-1}) and soil available potassium (kg ha^{-1})

Tr.No	Soil Available Nitrogen (kg ha^{-1})				Soil Available Phosphorous (kg ha^{-1})				Soil Available Potassium (kg ha^{-1})			
	AICRP on STCR	PG Farm	AICRP on IWM	Pooled	AICRP on STCR	PG Farm	AICRP on IWM	Pooled	AICRP on STCR	PG Farm	AICRP on IWM	Pooled
T_1	143.46	141.38	164.89	149.91	12.15	11.29	12.21	11.88	424.67	410.50	420.73	418.63
T_2	164.74	166.71	203.84	178.43	15.13	14.84	14.52	14.83	439.27	419.14	439.47	432.63
T_3	153.86	151.29	180.84	162.00	14.45	13.39	13.61	13.82	447.57	424.37	429.90	433.95
T_4	160.43	154.01	181.69	165.38	13.85	14.37	14.40	14.21	443.47	427.02	427.87	432.79
T_5	169.34	168.35	200.70	179.46	15.01	14.35	14.97	14.78	452.82	422.17	526.19	467.06
T_6	173.53	169.57	208.02	183.71	14.68	15.67	15.69	15.35	459.99	427.81	538.07	475.29
T_7	162.11	157.16	197.28	172.18	16.04	12.57	14.51	14.37	446.08	423.85	532.49	467.47
T_8	183.98	177.13	213.09	191.40	15.85	13.30	16.17	15.11	451.51	420.33	530.00	467.28
T_9	190.25	183.67	223.70	199.21	16.19	14.51	17.65	16.12	444.93	434.00	536.36	471.76
T_{10}	146.82	144.15	168.22	153.06	12.70	12.64	16.45	13.93	427.96	405.82	423.67	419.15
S.E. (m) $\pm$	6.02	6.45	6.45	3.67	3.24	1.20	0.87	0.89	14.94	15.60	15.87	17.92
CD@5%	17.89	19.16	19.42	10.32	NS	NS	2.59	2.64	NS	NS	47.16	53.26

available potassium levels (538.07 kg ha^{-1}). The elevated potassium levels in this treatment may be attributed to the interaction between higher doses of nitrogen, phosphorus and the priming effect of the initial potassium application. This interaction likely enhanced the release of potassium from native soil sources, increasing its availability for plant uptake, as suggested by Vijayakumar et al. [24]. Similar results on the efficiency of potassic fertilizers have been reported by Ahmed et al. [25] for rice in alluvial soils and by Kadu and Bulbule [26] for finger millet.

4. CONCLUSION

The soil chemical parameters, such as soil electrical conductivity, soil organic carbon and soil available nitrogen, phosphorus and potassium were found to be significantly higher in the treatment T_9, which used vermicompost and biofertilizer. The use of vermicompost with biofertilizers (*Azospirillum* and *PSB*) increases nutrient use efficiency by reducing nutrient losses, ultimately enhancing the residual nutrient content compared to treatments without vermicompost and biofertilizers. The results indicate that the use of vermicompost and biofertilizers plays a crucial role in the IPNS-based STCR based fertilizer application.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Authors hereby declare that NO generative AI technologies such as Large Language Models and text-to-image generators have been used during the writing or editing of manuscripts.

ACKNOWLEDGEMENT

We are thankfull to MAHAJYOTI, Nagpur gave the financial support and AICRP on STCR, MPKV, Rahuri for technical assistance during research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Truog E. Fifty years of soil testing, Proc. Trans 7th Intl. Congr. Soil Sci. Commission IV paper No.7. 1960;III:46-53.
2. Ramamoorthy B, Narasimhan RL, Dinesh RS. Fertilizer application for specific yield targets of Sonara-64. Indian Farming. 1967;17(5):43-45.
3. Jadhav AB, Kadlag AD, Deshpande AN, Patil VS, Durgude AG. Soil test crop respose correlatin studies for targeting yield of tomato on Entisol. Indian Journal of Horticulture. 2013;70:60-64.
4. Pathma J, Sakthivel N. Microbial diversity of vermicompost bacteria that exhibit useful agricultural traits and waste management potential. Springer Plus. 2012;1:1-19.
5. Joshi R, Vig AP, Singh J. Vermicompost as soil supplement to enhance growth, yield and quality of *Triticum aestivum* L. A field study. International Journal of Recycle Organic Waste Agriculture. 2013;2:1-7.
6. Atiyeh RM, Lee CA. Edwards, Arancon N.Q. and Metzger, J.D. The influence of humic acids derived from earthworms-processed organic wastes on plant growth. Bioresource Technology. 2002;84:7-14.
7. Kawalekar SJ. Role of biofertilizers and biopesticides for sustainable agriculture. Journal of Biological Innovation. 2013;2: 73–78.
8. Karchoo D, Razdan R. Growth, nutrient uptake and yield of wheat as influenced by biofertilizers and nitrogen. Indian Journal of Agronomy. 2006;51:37- 39.
9. Jackson ML. Soil Chemical Analysis. Prentice Hall Pvt. Ltd., New Delhi. 1973;pp69-182.
10. Nelson DW, Sommers LE. Total carbon, organic carbon and organic matter. In: Methods of Soil Analysis, Part-II, Page, A.L. (Ed.). American Society of Agronomy. Inc. Soil Science Society of America Inc. Madison, Wisconsin, USA. 1982;539-579.
11. Watanabe FS, Olsen SR. Test of ascorbic acid method for determining phosphorous in water and sodium bicarbonate extract of soils process. Soil Science Society of America. 1965;21:677-678.
12. Knudsen D, Peterson GA, Pratt PF. Lithium, sodium and potassium. In: Methods of Soil Analysis Part 2: Chemical and microbiological properties (A.L. Page, R.H. Miller and D.R. Keeney Eds.), 2nd Edition Agronomy Monograph No.9, American Society of Agronomy and Soil Science Society of America, Madison, Wisconsin, USA. 1982;225-246.
13. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. IVEd. ICAR, New Delhi; 1995.

14. Singh M, Singh YV, Singh SK, Dey P, Jat LK, Ram RL. Validation of soil test and yield target based fertilizer prescription model for rice on Inceptisol of Eastern Zone of Uttar Pradesh, India. International Journal of Current Microbiology and Applied Sciences. 2017;6:406-415.
15. Goyal V, Bhardwaj KK, Dey P. Validation of soil test-based fertilizer prescription models for specific yield target of wheat on an Inceptisols of Haryana. Journal of Pharmacognosy and Phytochemistry. 2020;9:1914-1920.
16. Rajamani K, Madhavi A, Srijaya T, Babu PS, Dey P. Validation of Target Yield based Fertilizer Prescription for Rabi Castor in Alfisol. International Research Journal of Pure and Applied Chemistry. 2020;21:166-173.
17. Pandey V, Srivastava A. Effect of integrated use of organic manures and chemical fertilizers under soil test crop response approach on soil properties and yield of maize (*Zea mays* L.). International Journal of Plant Soil Science. 2021;33:40-77.
18. Venkatesh I, Anantha KC, Raju B, Revathi P. Unveiling the impact of integrated nutrient management on soil health and microbial dynamics in mustard cultivation. International Journal of Environment and Climate Change. 2023;13:2544-2551.
19. Reddy TP, Srijaya T, Madhavi A, Sahana F, Lakshmi DV, Ravindhar K. Validation of soil test and yield target based fertilizer prescription equation for sugarcane on Vertisols of Northern Telangana Zone. Biological Forum - An International Journal. 2022;14:385-389.
20. Udayakumar S, Santhi R. Soil test based integrated plant nutrition system for pearl millet on an Inceptisol. Research on Crops. 2017;18:21-28.
21. Sekaran U, Santhi R, Dey P, Meena S, Maragatham S. Validation of soil test and yield target-based fertilizer prescription model developed for pearl millet on Inceptisol. Research on Crops. 2019;20(2):266-274.
22. Chari MS, Madhavi A, Srijaya T, Dey P. Validation of soil test and yield target-based fertilizer prescription equations developed for groundnut in Alfisols. International Journal of Chemical Studies. 2020;8:1252-1256.
23. Eunice DH, Visveswaran S, Rani B, Reji Rani OP, Gopinath PP. Evaluation of STCR based targeted yield equations of amaranthus (*Amaranthus tricolor* L.) in Southern Laterite Soils (AEU-8) of Kerala. International Journal of Plant and Soil Science. 2023;35:53-58.
24. Vijayakumar M, Santhi R, Jalaluddin SM. Refinement of fertilizer recommendation based on Soil Test Crop Response technology for rice under System of Rice Intensification. Journal of Applied and Natural Science. 2017;9:855-859.
25. Ahmed SR, Reddy PVK. Optimizing fertilizer doses for rice in alluvial soils through chemical fertilizers, farm yard manure and green manure using soil test values. Agropedology. 2002;12:133-140.
26. Kadu PP, Bulbule AV. Nutrient requirements of finger millet based on soil test crop response correlation approach. Asian Journal of Soil Science. 2007;2:51-3.

Peer-review history:
The peer review history for this paper can be accessed here:
https://www.sdiarticle5.com/review-history/128429