DEVELOPMENT OF INTEGRATED FERTILIZER PRESCRIPTION BASED ON STCR-IPNS FOR BRINJAL THROUGH INDUCTIVE CUM TARGETED YIELD MODEL IN MANNADIPET SOIL SERIES OF PUDUCHERRY, India

Abstract

The Soil Test Crop Response (STCR) approach, incorporating the Integrated Plant Nutrient System (IPNS) with a focus on targeted yields, aims to balance the need for "fertilizing the crop" and "fertilizing the soil." This balance is essential for meeting the crop's fertilizer requirements, improving yield, enhancing fertilizer efficiency, and maintaining soil health, while also ensuring profitability for farmers. Field trials using the inductive and targeted yield model were conducted on Typic ustropept soils in Puducherry. Fertilizer prescription equations (FPEs) were developed through IPNS, utilizing key parameters such as nutrient requirement (NR) and the contributions from soil (Cs), fertilizers (Cf), and farmyard manure (Cfym). Nomograms were created to set yield targets of 340, 360, and 380 q ha^{-1} for brinjal, based on a range of soil test values. The amount of fertilizer contributed by applying FYM at 12.5 t ha^{-1} was estimated as 50 kg N, 29 kg P_2O_5, and 46 kg K_2O, in conjunction with NPK fertilizers according to soil tests and the desired yield target.

Keywords: Soil Test Crop Response, Integrated Plant Nutrient System, targeted yield model, Fertilizer Prescription Equations, soil test value.

1.Introduction

Soil testing is a globally recognized method for optimizing fertilizer use, ensuring that nutrients are neither under-applied, over-applied, nor improperly proportioned. Balanced nutrition involves not only the right mix of external nutrient sources but also ensures that nutrients are available in adequate amounts and proper ratios in the soil to fulfill the crop's needs for achieving desired yields. Fertilizer recommendations for different crops are typically based on the nutrient status of the soil, which is classified as low, medium, or high. Among various methods of fertilizer recommendations, the Soil Test Crop Response (STCR) approach, using soil test results and targeted yield equations, is one of the most scientific ways to manage crop nutrition. This method considers nutrient contributions from fertilizers, organic manures, and the soil itself.

Brinjal (Solanum melongena L, 2n = 24), a member of the Solanaceae family, is one of India's most important vegetable crops, widely grown for its productivity. Often called the "poor man's crop," brinjal provides moderate levels of essential minerals and vitamins such as phosphorus, calcium, and iron. The unripe fruit is commonly consumed as a vegetable. India ranks second in global eggplant production, after China, accounting for 26% of the world's output. While the nutrient depletion ratio for vegetable crops is typically 2.65:1:3.42 for NPK, India's standard fertilizer recommendation for vegetables uses a 2:1:1 NPK ratio. This highlights the need to tailor fertilization practices to the specific nutrient needs of individual crops. The Inductive cum Targeted Yield Model, based on the work of Truog (1960) and Ramamoorthy et al. (1967), offers a balanced approach that reconciles the need to "fertilize the soil" and "fertilize the crop." This model provides a scientific basis for ensuring balanced fertilization by aligning the nutrients applied with those available in the soil.

2. Materials and Methods

To examine the Soil Test Crop Response (STCR) and Integrated Plant Nutrient System (IPNS) for brinjal, two field experiments were carried out in two stages. The first phase involved a fertility gradient experiment with a maize hybrid (Sakthi), followed by the second phase, which focused on a test crop experiment using the brinjal variety Palur-2. These experiments were conducted on the Mannadipet soil series in the Union Territory of Puducherry, specifically at a farmer's field in Kariamanickam village, Nettapakkam commune, Pondicherry district. The region, which covers 11.01 percent of the area, is classified as fine, mixed, isohyperthermic, Typic Ustropept under the coastal alluvial plain (PC1) classification. According to the agro-climatic zone, the site is located at 11°52' N latitude and 79°36' E longitude.

The initial soil sample analysis revealed a sandy clay loam texture with a bulk density of 1.15 Mg m^{-3}, particle density of 2.20 Mg m^{-3}, and a pore space of 47.7 percent. The soil was found to be moderately alkaline (pH 8.34), non-saline (0.45 dS m^{-1}), with a cation exchange capacity (CEC) of 19.20 Cmol (p^{+}) kg^{-1}. The soil contained total nitrogen, phosphorus, and potassium at 0.216%, 0.097%, and 0.520%, respectively. The soil fertility status showed low levels of $KMnO_4$-N (202 kg ha^{-1}) and organic carbon (0.41%), high levels of Olsen-P (60.50 kg ha^{-1}), and medium levels of NH_4OAc-K (175 kg ha^{-1}).

The goal of the study was to create a broad range of soil fertility variations in the experimental field by controlling fertilizer application while accounting for natural soil fertility differences.

This is not typically achievable in a single location, so a gradient crop experiment was conducted prior to the test crop experiment to establish fertility variations in the same field.

The experimental field was divided into three strips. Pre-sowing soil samples (0-15 cm depth) were collected from each strip before applying fertilizers and sowing the maize hybrid. The first strip ($N_0P_0K_0$) received no fertilizer, while the second and third strips received one ($N_1P_1K_1$) and two ($N_2P_2K_2$) times the recommended dosage of N, P_2O_5, and K_2O, respectively. The maize hybrid (Sakthi) was sown with a spacing of 45 cm x 60 cm, following standard agronomic practices, and the cob yield was recorded strip-wise. Plant samples were collected from each strip for nutrient analysis (N, P_2O_5, and K_2O). Soil samples, taken pre-sowing and post-harvest, were analyzed for available $KMnO_4$-N, Olsen-P, and NH_4OAc-K levels.

After harvesting the maize, each strip was subdivided into 24 plots. Pre-sowing soil samples were taken from each plot and analyzed for the same parameters. Once the fertility gradients were established, the test crop brinjal (Palur-2 variety) was cultivated following recommended practices. Treatments included four levels of nitrogen (0, 50, 100, and 150 kg ha^{-1}), phosphorus (0, 25, 50, and 75 kg ha^{-1}), potassium (0, 25, 50, and 75 kg ha^{-1}), and three levels of farmyard manure (0, 6.25, and 12.5 t ha^{-1}). The IPNS treatments consisted of NPK alone (OM I), NPK plus farmyard manure at 6.25 t ha^{-1} (OM II), and NPK plus farmyard manure at 12.5 t ha^{-1} (OM III), following a fractional factorial design to randomize 21 fertilizer treatments and three controls across all three strips.

Brinjal was planted with 60 cm x 45 cm spacing, and 50% of the nitrogen was applied as top dressing 30 days after planting. Usual agronomic practices were followed during crop growth. Fruit samples were harvested weekly, and total fruit yield was recorded. Both plant and fruit samples were analyzed for N, P_2O_5, and K_2O contents, and nutrient uptake was calculated. Post-harvest soil samples were also analyzed for available N, P_2O_5, and K_2O.

The essential parameters, including nutrient requirements (NR), contributions of nutrients from soil (Cs), fertilizer (Cf), and farmyard manure (Cfym), were calculated using brinjal yield data, total nutrient uptake, initial soil test results, and applied fertilizer doses for N, P_2O_5, and K_2O. These computations were done following the method proposed by Ramamoorthy et al. (1967).

1.Nutrient requirement (NR) kg q^{-1}

$$\text{kg of N/ } P_2O_5\text{/ } K_2O \text{ required per quintal of fruit production} = \frac{\text{Total uptake of N/ } P_2O_5\text{/ } K_2O \text{ (kg ha}^{-1})}{\text{Fruit yield (q ha}^{-1})}$$

2. Per cent contribution of nutrients from soil (Cs) to total nutrient uptake

$$\text{Per cent contribution of N/ } P_2O_5\text{/ } K_2O \text{ from soil} = \frac{\text{Total uptake of N/ } P_2O_5\text{/ } K_2O \text{ in control plot (kg ha}^{-1})}{\text{STV for available N/ } P_2O_5\text{/ } K_2O \text{ in control plot (kg ha}^{-1})} \times 100$$

3. Per cent nutrient contribution of nutrients from fertilizer to total uptake (Cf)

$$\text{Per cent contribution of N/ } P_2O_5\text{/ } K_2O \text{ from fertilizer} = \frac{\text{Total uptake of N/ } P_2O_5\text{/ } K_2O \text{ in treated plot (kg ha}^{-1}) - \left(\text{Soil test value for available N/ } P_2O_5\text{/ } K_2O \text{ in treated plot (kg ha}^{-1}) \times \text{Average Cs}\right)}{\text{Fertilizer N/ } P_2O_5\text{/ } K_2O \text{ applied (kg ha}^{-1})} \times 100$$

4. Percent nutrient contribution of nutrients from organics to total uptake (Co)

$$\text{Cfym} = \frac{\text{Total uptake of N/ } P_2O_5\text{/ } K_2O \text{ in FYM treated plot (kg ha}^{-1}) - \left(\text{STV for available N/ } P_2O_5\text{/ } K_2O \text{ in FYM treated plot (kg ha}^{-1}) \times \text{Average Cs}\right)}{\text{Nutrient N/ } P_2O_5\text{/ } K_2O \text{ added through FYM (kg ha}^{-1})} \times 100$$

With the use of these parameters, fertilizer prescription equations were created to determine the fertilizer doses. The soil test-based fertilizer recommendations were provided in the form of a ready table for the intended yield target of brinjal under both IPNS and NPK alone.

Targeted Yield equations

Making use of the four basic parameters, the fertilizer prescription equations were developed under NPK alone and STCR-IPNS for brinjal as furnished below:

i) Fertilizer nitrogen (FN)

$$FN = \frac{NR}{Cf/100} T - \frac{Cs}{Cf} SN$$

$$FN = \frac{NR}{Cf/100} T - \frac{Cs}{Cf} SN - \frac{Cfym}{Cf} ON$$

ii) Fertilizer phosphorus (FP_2O_5)

$$FP_2O_5 = \frac{NR}{Cf/100} T - \frac{Cs}{Cf} x\ 2.29 \quad x\ SP$$

$$FP_2O_5 = \frac{NR}{Cf/100} T - \frac{Cs}{Cf} x\ 2.29 \quad x\ SP - \frac{Cfym}{Cf} x\ 2.29 \quad x\ OP$$

iii) Fertilizer potassium (FK_2O)

$$FK_2O = \frac{NR}{Cf/100} T - \frac{Cs}{Cf} x\ 1.21 \quad x \quad SK$$

$$FK_2O = \frac{NR}{Cf/100} T - \frac{Cs}{Cf} x\ 1.21 \quad x \quad SK - \frac{Cfym}{Cf} x\ 1.21 \quad x\ OK$$

where,

T is the yield target in q ha^{-1}, NR is Nutrient requirement of N or P_2O_5 or K_2O (kg ha^{-1}), FN, FP_2O_5 and FK_2O are fertilizer N, P_2O_5 and K_2O (kg ha^{-1}), Cs is Per cent contribution of nutrient from soil, Cf is Per cent contribution of nutrient from fertilizer; ON, OP and OK are the quantities of N, P and K supplied through FYM in kg ha^{-1} and SN, SP and SK respectively are Soil test value for available alkaline $KMnO_4$-N, Olsen-P and NH_4OAc-K in kg $ha^{-1}$and.

Based on the afore mentioned formulae, fertilizer doses for different soil available nutrient levels can be predicted for particular brinjal yield targets (T).

3. Result and Discussion

The range and average soil test values, along with the yields for the three strips, are outlined in Table 2. The highest yield, 380.9 q ha^{-1}, was achieved in strip III, while strip I recorded the lowest yield of 168 q ha^{-1} (Fig. 2). Initial soil test results revealed average alkaline $KMnO_4$-N levels of 197.9, 219.0, and 241.6 kg ha^{-1} in strips I, II, and III, respectively. The average Olsen-P levels were 54.1, 61.6, and 65.8 kg ha^{-1} across the three strips, while NH_4Ac-K levels averaged 176.8, 192.2, and 216.4 kg ha^{-1} for strips I, II, and III, respectively (Fig. 3).

In terms of nitrogen uptake, values ranged from 55.7 to 119.1 kg ha^{-1} in strip I, 58.6 to 123.3 kg ha^{-1} in strip II, and 62.7 to 128.1 kg ha^{-1} in strip III, with average uptakes of 93.2, 100.3, and 105.2 kg ha^{-1}, respectively. Phosphorus uptake ranged from 13.6 to 36.8 kg ha^{-1} in strip I (mean: 30.8 kg ha^{-1}), from 14.3 to 39.0 kg ha^{-1} in strip II (mean: 32.8 kg ha^{-1}), and from 15.3 to 39.5 kg ha^{-1} in strip III (mean: 34.5 kg ha^{-1}). Potassium uptake ranged from 41.8 to 98.2 kg ha^{-1} in strip I, 45.7 to 107.7 kg ha^{-1} in strip II, and 49.5 to 108.7 kg ha^{-1} in strip III, with average uptakes of 73.5, 81.0, and 86.3 kg ha^{-1}, respectively (Fig. 4). These findings highlight significant differences in soil test values, crop yields, and nutrient uptake, which are essential for determining the basic parameters and creating fertilizer recommendation equations for specific yield goals.

Basic Parameters (Table 3):

Three essential parameters—nutrient requirement (NR), the percentage of nutrients contributed from soil (Cs), and from fertilizers (Cf)—were calculated using the targeted yield model. These parameters are necessary for calibrating soil test results and providing fertilizer recommendations to achieve the desired brinjal yield (Fig. 5).

Nutrient Requirements for Brinjal:

To produce one quintal of brinjal fruit, 0.33 kg of nitrogen, 0.24 kg of phosphorus (P_2O_5), and 0.32 kg of potassium (K_2O) are needed, with K_2O having the highest demand, followed by nitrogen and phosphorus. This pattern of nutrient requirements is consistent with findings by Natesan et al. (2007) for rice, Coumaravel (2012) for maize-tomato, and studies on brinjal by Muralidharudu et al. (2007 & 2011), Dey and Das (2014), Dhinesh (2015), Kirankumar et al. (2019), and Bhatt et al. (2021).

Percentage Contribution of Soil Nutrients (Cs) to Total Uptake:

Using data from control plots, the contribution of soil nutrients (N, P, and K) to total nutrient uptake by brinjal was calculated. In this study, the soil contributed 27.21% of available nitrogen, 32.20% of phosphorus, and 24.69% of potassium to the total uptake by brinjal. Phosphorus had the highest contribution from soil, followed by nitrogen and potassium. The low contribution of potassium from soil (Cs) can be attributed to the medium K levels in the experimental soil, as brinjal tends to rely more on applied N and K_2O than on native soil sources. These findings are consistent with those reported by Santhi et al. (2011) for beetroot, as well as by Natesan et al. (2007), Coumaravel (2012), Santhi et al. (2017), Karuna Prabu (2018), Beena et al. (2018), Kirankumar et al. (2019), and Bhatt et al. (2021) for other crops, including brinjal.

Percentage Contribution of Fertilizer Nutrients (Cf) to Total Uptake:

For the NPK-applied plots, the contribution of fertilizer nutrients (Cf) to total uptake was calculated. The results showed that fertilizer contributed 43.83%, 73.79%, and 90.31% of the total uptake for nitrogen, phosphorus, and potassium, respectively, with the order of contribution being $K_2O > P_2O_5 > N$. The response yardstick recorded was 70.37 kg kg^{-1}, indicating that potassium's contribution was 2.06 times greater than nitrogen and 1.22 times greater than phosphorus. This trend of higher nutrient contributions from fertilizers aligns with studies by Natesan et al. (2007), Bagavathi Ammal and Sankar (2012), and Karuna Prabu (2018) for various crops, including rice and brinjal. The high potassium contribution may be due to the synergistic effect of higher N and P doses, along with a starter K dose, which likely promoted the release of soil K, enhancing uptake from native sources (Ray et al., 2000; Deshpande et al., 2016).

Contribution of Nutrients from Farmyard Manure (FYM) for Brinjal:

The estimated contributions of nitrogen, phosphorus, and potassium from FYM (Cfym) were 32.58%, 22.95%, and 36.90%, respectively, with potassium showing the highest contribution, followed by nitrogen and phosphorus. Similar findings on Cfym were reported by Natesan et al. (2007), Bagavathi Ammal and Sankar (2012), and Vetrivel (2017) for rice, Coumaravel (2012) for tomato, and Karuna Prabu (2018), Kirankumar et al. (2019), and Bhatt et al. (2020) for brinjal

Fertilizer prescription equation for brinjal under IPNS

Using the basic parameters computed (NR, Cs, Cf and Cfym), fertilizer prescription equations were developed under IPNS and are furnished below.

NPK alone

$$FN = 0.74\ T - 0.61\ SN$$

$$FP_2O_5 = 0.33\ T - 0.97\ SP$$

$$FK_2O = 0.35\ T - 0.33\ SK$$

NPK with FYM

$$FN = 0.74\ T - 0.61\ SN - 0.74\ ON$$

$$FP_2O_5 = 0.33\ T - 0.97\ SP - 0.71\ OP$$

$$FK_2O = 0.35\ T - 0.33\ SK - 0.49\ OK$$

where, T is the yield target in q ha^{-1}; SN, SP and SK respectively are alkaline $KMnO_4$-N, Olsen-P and NH_4OAc-K in kg ha^{-1}; ON, OP and OK are the quantities of N, P and K supplied through FYM in kg ha^{-1} and FN, FP_2O_5 and FK_2O are fertilizer N, P_2O_5 and K_2O in kg ha^{-1} respectively;

Fertilizer prescription under IPNS for desired yield target of brinjal:

Nomograms (ready reckoners) were developed for various soil test values and specific yield targets (Table 4). For comparison purposes, an average soil nutrient availability of 200 kg ha^{-1} for nitrogen, 20 kg ha^{-1} for phosphorus, and 200 kg ha^{-1} for potassium was used to determine fertilizer recommendations. The results indicated that to achieve a yield of 360 q ha^{-1} of brinjal, the required fertilizer doses for N, P_2O_5, and K_2O would be 146.0, 98.0, and 61.0 kg ha^{-1}, respectively, when using only NPK. When NPK was combined with 6.25 t ha^{-1} of FYM, the fertilizer requirements dropped to 121.0, 84.0, and 38.0 kg ha^{-1}, respectively. For a higher application rate of FYM at 12.5 t ha^{-1}, the fertilizer requirements were further reduced to 96.0, 69.0, and 15.0 kg ha^{-1}, respectively.

The percentage reduction in NPK fertilizers under IPNS increased as soil fertility improved with more FYM application, while it decreased as yield targets were raised. These findings align with previous studies such as Balamurugan (2009) for wheat, Coumaravel (2012) for maize and tomato, Bagavathi Ammal and Sankar (2012) for rice, and other works like Santhi et al. (2017), Karuna Prabu (2018) for bhendi, Kirankumar et al. (2019), and Bhatt et al. (2020) for brinjal.

The data clearly demonstrated that fertilizer rates decreased as soil test values and FYM application increased. This is attributed to the nutrient contribution from both soil and FYM, meeting the crop's nutrient needs. Velayutham et al. (1985) also confirmed this observation.

By applying the fertilizer prescription equations within the IPNS framework, the potential savings in inorganic fertilizers for brinjal were calculated. With FYM applied at 6.25 t ha^{-1} (30% moisture content, and nutrient composition of 0.56% N, 0.32% P, and 0.51% K), the savings were 25, 15, and 23 kg ha^{-1} for N, P_2O_5, and K_2O, respectively. If FYM was applied at 12.5 t ha^{-1} with the same quality, the savings increased to 50, 29, and 46 kg ha^{-1} for N, P_2O_5, and K_2O, respectively.

In conclusion, integrated nutrient management using both organic manure and inorganic fertilizers proved superior to using inorganic fertilizers alone, yielding higher brinjal production and nutrient uptake. The IPNS approach enhances soil fertility, supports sustained crop yields, and reduces environmental pollution. Moreover, the STCR-based fertilizer recommendations allow for specific yield targets to be achieved through proper agronomic practices, improving profitability by increasing yields and reducing fertilizer costs. The fertilizer prescription equations developed in this study can be effectively used for targeted brinjal yields in the Mannadipet soil series (Inceptisols) of Puducherry.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript. -

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

Hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

References:

Bagavathi Ammal, U., Sankar, R., Coumaravel, K. and Dey, P., 2020. Fertilizer Prescriptions for Rice Based on STCR–IPNS. *Int. J. Curr. Microbiol. App. Sci*, *9*(10), pp.2517-2522.

BagavathiAmmal, U. and R. Sankar. 2012. Studies on minimizing P fertilizer through STCR IPNS In: Proc. National Seminar on Strategies to rationalize and reduce consumption of water soluble P and K in the country to minimize import held at IISS, Bhopal Dec. 18-20, 2012.

Balamurugan, D. 2009. Soil Test Crop Response studies on wheat under Integrated Plant Nutrient System. Ph.D. Dissertation. Submitted to TNAU, Coimbatore.

Beena, V.I., B. Bastin, R.P. Raji Mol and Dey, P. 2018. Targeted Yield Based Fertilizer Prescriptions for Brinjal (*Solanum melongena* L.) in Ultisols of Kerala, India. Int. J. Curr. Microbiol. App. Sci. 7(10): 1235-1239.

Bhatt, P., S. Singh, L. Bhatt, P.K. Pant and S. Kumar. 2020. Evaluation of Fertilizer Doses for Kharif Brinjal (*Solanum melongena* L.) through Soil Test Crop Response Approach in Mollisols of Uttarakhand. CJAST, 39(19): 8-18.

Coumaravel. K., 2012. Soil test crop response correlation studies through integrated plant nutrition system for maize-tomato sequence. Ph.D. Dissertation, TNAU, Coimbatore.

Deshpande, S.S., Dalavi, S.H. Pandey, V.P. Bhalerao and A.B. Gosavi 2016. Effect of rock phosphate along with organic manures on soil properties, yield and nutrient uptake by wheat and chickpea. J. Indian Society Soil Sci., 63: 93-99.

Dey, P. and D.K. Das. 2014. Progress report of the All India Coordinated Project for Investigations on Soil Test Crop Response. ISSS, Nabi Bagh, Berasi road, Bhopal.

Dhinesh, V. 2015. Soil test crop response based integrated plant nutrition system for brinjal on Alfisol. Ph.D. (Ag.) Thesis, submitted to TNAU, Coimbatore.

Karunaprabhu, G.R.2018.Development of fertilizer prescription equationbased on STCR for Bhendi (*Abelmoschus esculentus* (l.) Monech) in Bahour soil series - U.T. of Puducherry.M.Sc. (Ag.) Thesis, PAJANCOA&RI, Karaikal.

Kirankumar, C., R. Santhi, S. Maragatham, S. Meena, and C.N. Chandrasekhar, Madras Agric. J., 2019

Muralidharudu, Y., A. Rathore and A. Subba Rao. 2007. In: 18th progress report of the All India Coordinated Research project for investigations on Soil Test Crop Response Correlation, IISS, Bhopal. pp. 1-215.

Muralidharudu, Y., B.N. Mandal, K. Sammi Reddy and A. Subba Rao. 2011. In: Progress report of the All India Coordinated Research project for investigations on Soil Test Crop Response Correlation, IISS, Bhopal. pp. 11-61.

Natesan, R., P. MurugesaBoopathi, R. Santhi, S. Thiyageswari, N. Chandra Sekaran, C. Paulraj, S. Natarajan, A. Subba Rao and Y. Muralidharudu. 2007. Technical Bulletin on Soil Test Crop Response based fertilizer prescription for different soils and crops in Tamil Nadu. TNAU, Coimbatore.

Ramamoorthy, B., R.K. Narasimham and R.S. Dinesh. 1967. Fertilizer application for specific yield targets on Sonora 64 (wheat). Indian Fmg 17: 43-45.

Ray, P.K., A.K. Jana, D.N. Maitra, M.N. Saha, J. Chaudhury, S. Saha and A.R.Saha. 2000. Fertilizer prescription on soil test basis for jute, rice and wheat in a typic Ustochrept. J. Indian Soc. Soil Sci., 48 (1): 79-84.

Santhi, R., A. Bhaskaran and R. Natesan. 2011. Integrated fertilizer prescriptions for beetroot through Inductive cum targeted yield model on an Alfisol. Commun. Soil Sci. Pl. Analysis, 42: 1-8.

Santhi, R., Sellamuthu, K.M., Maragatham, S., Natesan, R. Arulmozhiselvan, K., Kumar. K and Dey, P. 2017. Soil test and yield target based fertilizer prescriptions for crops - An overview of outreach activities in tribal villages of Tamil Nadu (in Tamil), AICRP - STCR, Department of Soil Science and Agricultural Chemistry, TNAU Coimbatore.

Troug, E. 1960. Fifty years of soil testing. Trans 7th Intl. Congr. Soil Sci. Vol. III, Commission IV, paper No.7: pp: 46-53.

Velayutham, M., G.R.M. Sankar and K.C.K. Reddy. 1985. In: Annual Report of the All India Co-ordinated Research Project on Soil Test Crop Response correlation (ICAR), Hyderabad, India, pp. 621-642.

Vetrivel, M., 2017. Development of fertilizer prescription equation based on STCR for rice (ADT-45) in Bahour soil series of U.T of Puducherry.M.Sc. (Ag.) Thesis, PAJANCOA&RI, Karaikal.

Fig 1: Layout of the experimental field

OM III	$N_2P_1K_2$	$N_3P_2K_2$		$N_2P_2K_2$	$N_3P_3K_3$		$N_2P_1K_1$	$N_3P_3K_2$	

	$N_1P_1K_1$	$N_3P_1K_1$	$N_2P_0K_2$	$N_3P_2K_3$	$N_1P_2K_2$	$N_3P_2K_1$	OUTS
	$N_0P_2K_2$	$N_2P_3K_3$	$N_1P_2K_2$	$N_3P_3K_2$	$N_1P_1K_2$	$N_2P_3K_2$	
	$N_0P_0K_0$	$N_2P_2K_1$	$N_0P_0K_0$	$N_2P_2K_3$	$N_0P_0K_0$	$N_2P_2K_0$	
OM II	$N_2P_1K_1$	$N_3P_3K_2$	$N_2P_1K_2$	$N_3P_2K_2$	$N_2P_2K_2$	$N_3P_3K_3$	
	$N_1P_2K_2$	$N_3P_2K_1$	$N_1P_1K_1$	$N_3P_2K_1$	$N_2P_0K_2$	$N_3P_2K_3$	
	$N_1P_1K_2$	$N_2P_3K_2$	$N_0P_2K_2$	$N_2P_3K_2$	$N_1P_1K_1$	$N_3P_3K_1$	
	$N_0P_0K_0$	$N_2P_2K_0$	$N_0P_0K_0$	$N_2P_2K_1$	$N_0P_0K_0$	$N_2P_2K_3$	
OM I	$N_2P_2K_3$	$N_0P_0K_0$	$N_2P_2K_0$	$N_0P_0K_0$	$N_2P_2K_1$	$N_0P_0K_0$	
	$N_2P_2K_2$	$N_3P_2K_3$	$N_2P_1K_1$	$N_3P_3K_2$	$N_2P_1K_2$	$N_3P_2K_2$	
	$N_2P_0K_0$	$N_3P_3K_1$	$N_1P_2K_2$	$N_3P_2K_3$	$N_1P_1K_1$	$N_3P_1K_1$	
	$N_2P_2K_1$	$N_3P_2K_2$	$N_1P_2K_2$	$N_2P_3K_2$	$N_0P_2K_1$	$N_2P_3K_3$	
	STRIP III		STRIP II		STRIP 1		

Fig 2: Effect of IPNS on mean fruit yield of brinjal

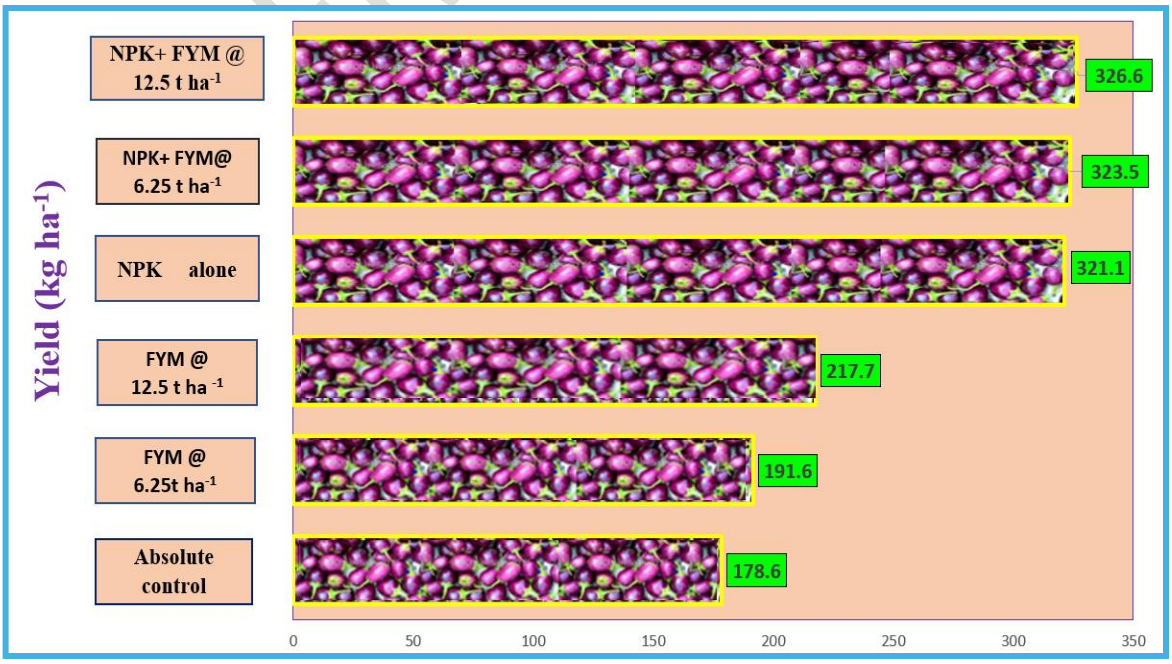

Fig 3: Initial soil fertility in different strips of test crop (Brinjal)

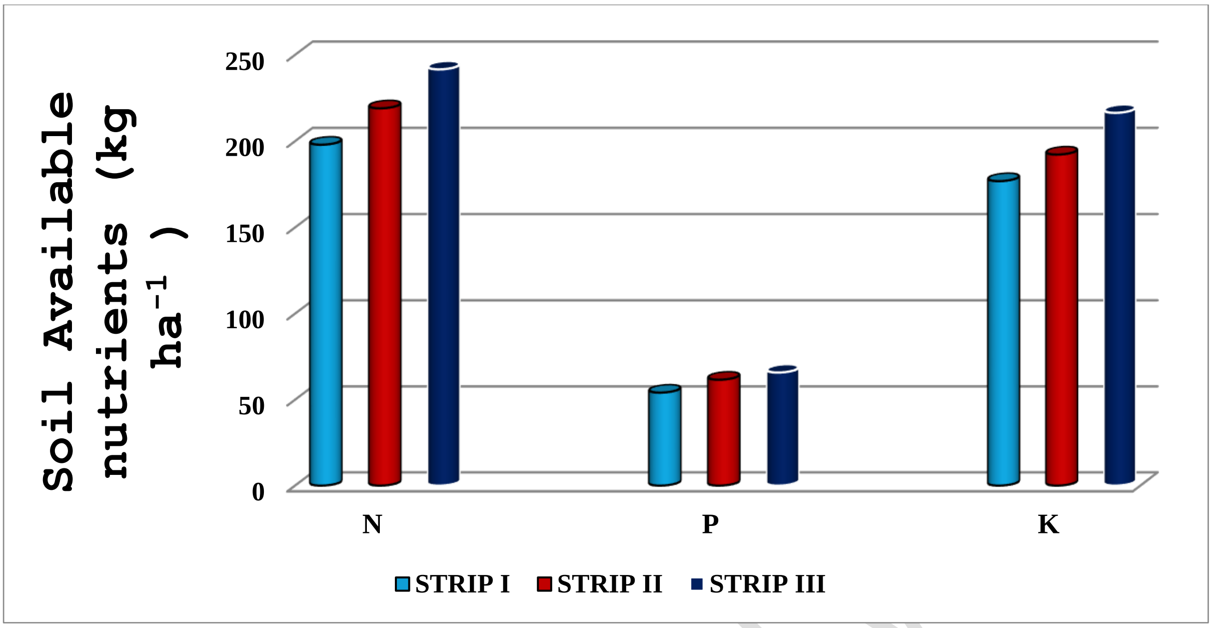

Fig 4: Effect of IPNS on total nutrient uptake by brinjal

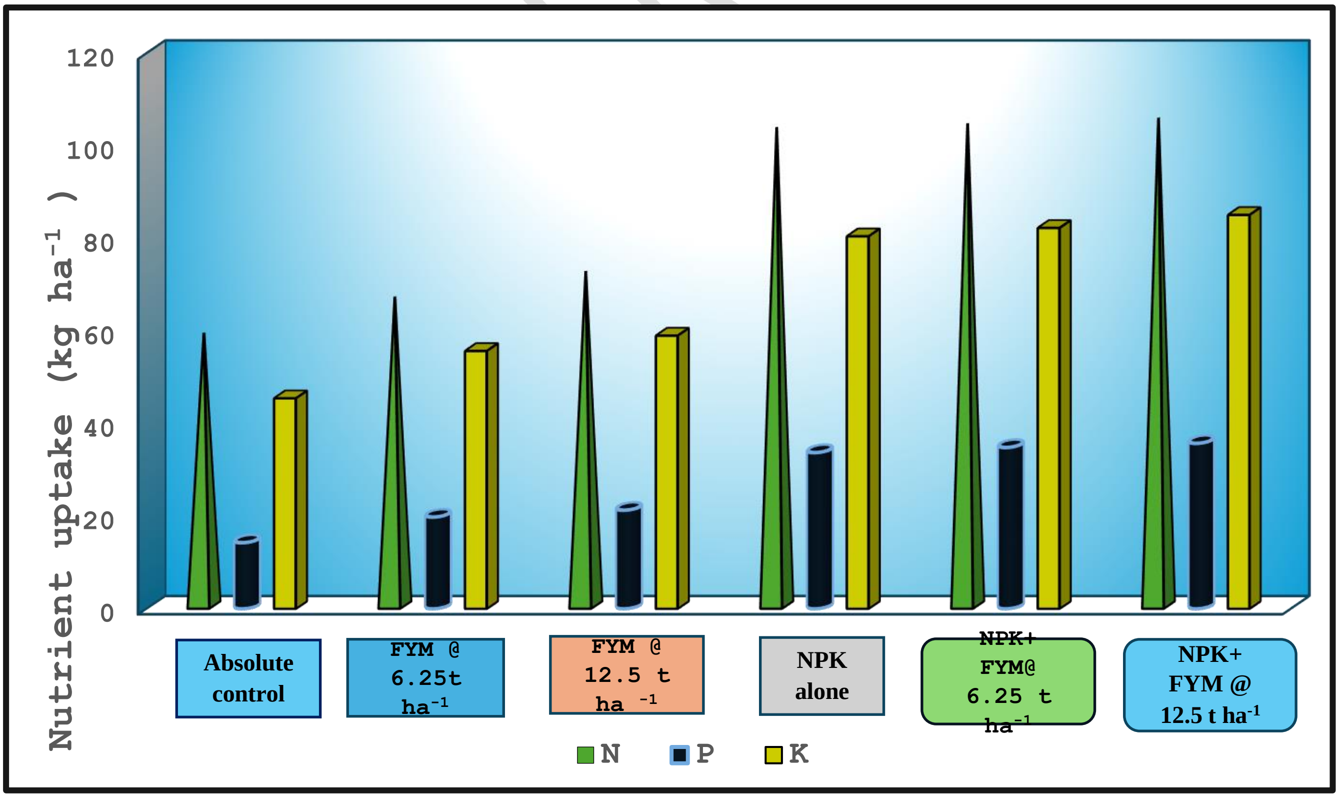

Fig. 5 Per cent contribution of nutrients from soil, fertilizer and FYM

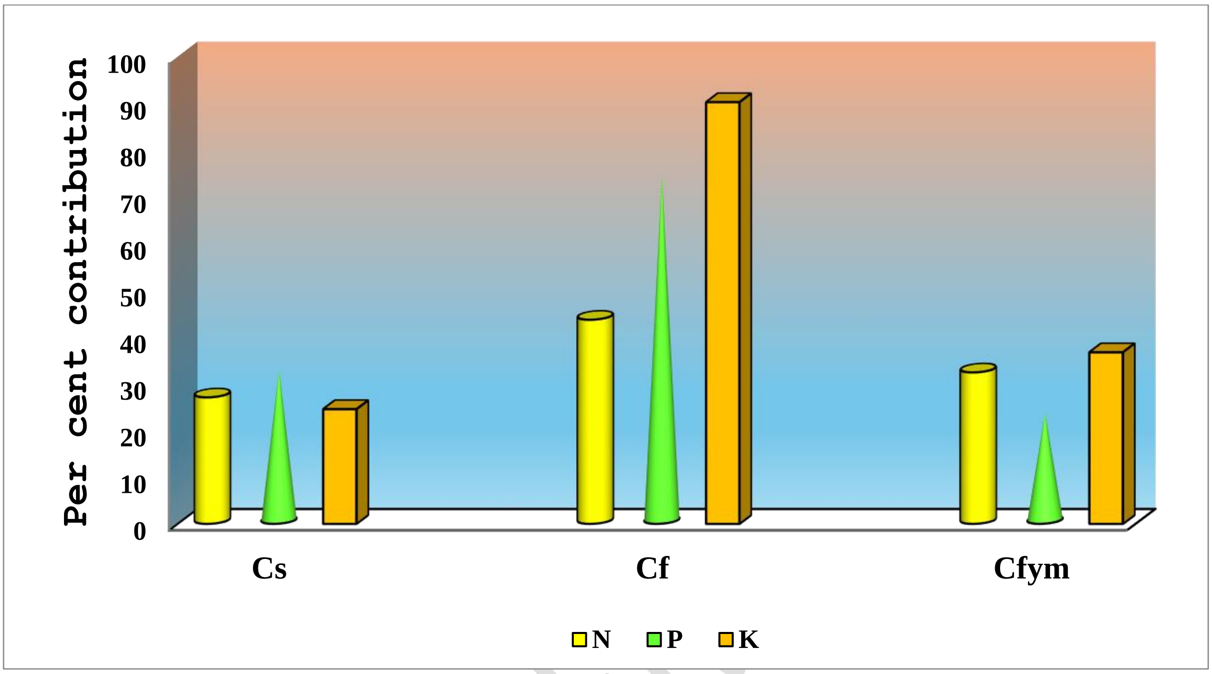

Table 1: Levels of fertilizer nutrients and FYM for brinjal

Level	N (kg ha^{-1})	P_2O_5 (kg ha^{-1})	K_2O (kg ha^{-1})	FYM (t ha^{-1})
0	0	0	0	0
1	50	25	25	6.25
2	100	50	50	12.5
3	150	75	75	-

Table2. Pre-sowing soil available NPK, yield and NPK uptake by brinjal in various strips (kg ha^{-1})

Parameters (kg ha^{-1})	Strip I		Strip II		Strip III		Overall			
							Treated (NPK)		Control (NPK)	
	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
$KMnO_4$ -N	193.2–201.6	197.9	215.6 -224.0	219.0	234.9-251.7	241.6	193.2-251.7	220.0	196.0-221.2	210.6
Olsen–P	40.2-58.6	54.1	45.7-65.9	61.6	48.6-69.2	65.8	53.2-69.2	62.6	40.2-48.6	44.7
NH_4OAc-K	168.0-189.0	176.8	179.0-214.0	192.2	200.0-232.0	216.4	169.0-232.0	196.6	168.0-196.0	182.8

Parameters	Basic Data			Response yard stick (kg kg^{-1})
	N	P_2O_5	K_2O	
Nutrient requirement (kg q^{-1})	0.33	0.24	0.32	70.37
Per cent contribution from soil (Cs)	27.21	32.20	24.69	
Per cent contribution from fertilizers (Cf)	43.83	73.79	90.31	
Per cent contribution from FYM (Cfym)	32.58	22.95	36.90	

Fruit yield (q ha^{-1})	168.4 –344.9	288.1	177.2 -371.0	309.2	189.5 -380.9	324.2	244.8-380.9	326.0	168.4-189.5	178.6
N uptake	55.7-119.1	93.2	58.6-123.3	100.3	62.7-128.1	105.2	75.9-128.1	105.0	55.7-62.7	59.1
P uptake	13.6-36.8	30.8	14.3-39.0	32.8	15.3-39.5	34.5	27.1-39.5	35.2	13.6-15.3	14.4
K uptake	41.8-98.2	73.5	45.7-107.7	81.0	49.5-108.7	86.3	57.8-108.7	84.5	41.8-49.5	45.7

Table 3. Nutrient requirement, per cent contribution of nutrients from soil, fertilizer and FYM for brinjal.

Table 4: Soil test-based fertilizer prescription under IPNS for yield target of 360 q ha^{-1} for brinjal (kg ha^{-1})

Parameter	IPNS						
	NPK alone (kg ha^{-1})	NPK + FYM 6.25 t ha^{-1} (kg ha^{-1})	Per cent reduction over NPK	Fertilizer saving (kg ha^{-1})	NPK + FYM 12.5 t ha^{-1} (kg ha^{-1})	Per cent reduction over NPK	Fertilizer saving (kg ha^{-1})
	$KMnO_4$-N (kg ha^{-1})						
200	146	121	17.1	25	96	32.0	50
220	134	109	18.7	25	84	37.3	50
240	122	97	20.5	25	75	38.5	47
260	110	85	22.7	25	75	31.9	35
280	98	75	23.5	23	75	23.5	23
	Olsen – P (kg ha^{-1})						
10	108	94	13.0	14	79	26.9	29
12	106	92	11.1	14	77	27.4	29
14	104	90	13.5	14	75	27.9	29
16	102	88	13.8	14	73	28.4	29
18	100	86	14.0	14	71	29.0	29
20	98	84	14.3	14	69	29.6	29
22	96	82	14.6	14	68	29.2	28
	NH_4OAc-K (kg ha^{-1})						
100	93	71	23.7	22	41	55.9	52

120	87	64	26.4	23	34	60.9	53
140	80	57	28.8	23	27	66.3	53
160	74	51	31.0	23	21	71.6	53
180	67	44	34.3	23	15	77.6	52
200	61	38	37.7	23	15	75.4	46
220	54	31	42.6	23	15	72.2	39