International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2018; 6(3): 723-726

Received: 17-03-2018
Accepted: 19-04-2018

Gandu Ranjith Kumar
Department of Soil Science and Agricultural Chemistry, Post graduate Institute, Dr. PDKV, Akola, Maharastra, India

NM Konde
Department of Soil Science and Agricultural Chemistry, Post graduate Institute, Dr. PDKV, Akola, Maharastra, India

DB Tamgadge
Department of Soil Science and Agricultural Chemistry, Post graduate Institute, Dr. PDKV, Akola, Maharastra, India

SD Jadhao
Department of Soil Science and Agricultural Chemistry, Post graduate Institute, Dr. PDKV, Akola, Maharastra, India

AN Paslawar
Department of Soil Science and Agricultural Chemistry, Post graduate Institute, Dr. PDKV, Akola, Maharastra, India

Correspondence
Gandu Ranjith Kumar
Department of Soil Science and Agricultural Chemistry, Post graduate Institute, Dr. PDKV, Akola, Maharastra, India

Effect of STCR equation on soil characters and nutrient availability in cotton under Rainfed conditions in Vertisols

Gandu Ranjith Kumar, NM Konde, DB Tamgadge, SD Jadhao and AN Paslawar

Abstract
To study the effect of soil test crop response equation on soil properties and nutrient availability in cotton under rainfed cultivation was conducted at Integrated Farming Systems Research Field, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during *kharif* season 2016-17. The experiment was laid out in RBD with eight treatments replicated thrice. Organic sources used FYM, along with chemical fertilizers. The results shown that highest organic carbon content (4.75 g kg^{-1}) lowest values of soil pH (7.81) and lowest values of EC (0.30 dSm^{-1}) and $Caco_3$ (6.30 %) as well as significantly highest available nitrogen (187.67 kg ha^{-1}), phosphorus (24.20 kg ha^{-1}), potassium (329.33 kg ha^{-1}) were reported in the treatment of FYM @5 t ha^{-1} than other treatments. The experiment can be concluded that, application of chemical fertilizers along with FYM significantly improves the properties of soli and available of nutrients in Vertisols under rainfed cotton

Keywords: STCR, available nutrients, cotton, FYM

Introduction

Cotton (*Gossypium sp.*), most important fiber crop plays a dominant role in its agrarian and industrial economy. It is backbone of our textile industry, accounting for 70 per cent of total fiber consumption in textile sector, 11 per cent to industrial production, 14 per cent to the manufacturing sector, 4 per cent to the GDP and 38 per cent of the country export, fetching over Rs. 214918.45 crores. [1]

In India it's grown over an area of 116.14 lakh hectares with production of 334 lakh bales and productivity of 571 kg ha^{-1}. Among the major state in India, Maharashtra having area of 41.46 lakh hectare with production of 74 lakh bales and the productivity is 303 kg ha^{-1}. Vidarbha which is famous specially for cotton crop which occupies area 14.9 production of 27.4 lakh bales and the productivity of 312 kg ha^{-1}. It indicates that the productivity of cotton in Maharashtra is lower than the cotton productivity in Vidarbha (The cotton corp. of India ltd 2013).

Nutrient availability in the soil after the harvest of a crop is much influenced by the initial soil nutrient status, the amount of fertilizer nutrient added and the nature of the crop raise. In the recent years, the concept of integrated nutrient supply involving combining use of organic and chemical fertilizers is being developed. The use of adequate dose of organic manures coupled with chemical fertilizers will ensure optimum growth conditions under intensive cropping system using high yielding varieties. Besides N, P and K organic manures are the potential source of micro nutrients and their judicious application significantly enhances the micro-nutrients [2]. The combined use of organic and inorganic fertilizers increases the physical condition of the soil more effectively than continuous addition of chemical fertilizers (N P K) alone [3].

The fertilizer consumption in India is grossly imbalanced since beginning. It is titled more towards Nitrogen followed by Phosphorus. Further the decontrol of the phosphatic and potassic fertilizers resulted in more than doubling the prices of phosphatic and potassic fertilizers. thus, the fertilizer consumption ratio of 4:2:1 implying thereby that farmers started adding more nitrogen and proportionately less phosphatic and potassic fertilizers. even till today, the situation is grim as far as fertilizers application by farmers is concerned.in many areas the imbalanced fertilization is the root cause for poor crop yields and soil fertility status,

in nutrient consumptions to prevent further deterioration in soil quality and to break the yield [4].

Material and methods

The experiment was conducted during *kharif* season of 2016-17 at Integrated Farming Systems Research Field, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, and Akola. The soils of the experimental area were medium deep black, clay loam texture with typical swell-shrink, high water holding capacity.

The initial soil data is presented in table 1 revealed that, the soil of the experimental field was clay loam in texture and slightly alkaline in reaction. The result of the chemical analysis indicated that, the soils have pH 7.84 with electrical conductivity 0.33 dSm^{-1} and organic carbon content was 4.6 g kg^{-1} calcium carbonate (6.75 %). The available nitrogen, potash and phosphorus content of soil were 164, 310 and 14.20 kg ha^{-1} respectively. The treatment details are presented in Table no 2.

Table1: Properties of experimental soil before start experiment

Sr. No.	Soil characteristics	Values
1	Soil order	Vertisol
2	Texture	Clay loam
3	pH (1: 2.5)	7.84
4	EC (dSm^{-1})	0.33
5	Organic carbon (g kg^{-1})	4.6
6	Calcium carbonate (%)	6.75
7	Available Nitrogen (kg ha^{-1})	164
8	Available Phosphorus (kg ha^{-1})	14.20
9	Available Potassium (kg ha^{-1})	310

Table 2: Treatments Details

S. No.	Treatment
1	T_1- Absolute control
2	T_2- RDF (recommended dose of fertilizer)
3	T_3- Fertilizer Application as per soil test
4	T_4- Farmers practices
5	T_5- 12 q ha^{-1} target (without FYM)
6	T_6- 12 q ha^{-1} target (with FYM)
7	T_7- 15 q ha^{-1} target (without FYM)
8	T_8- 15 q ha^{-1} target (with FYM)

Chemical used along with FYM for this experimentation. All the cultural and plant protection measures were adopted as and when required.

The data obtained various parameters were analysed in RBD statistical procedure (Panse and Sukhatme, 1984). The appropriate standard error of mean (S.E. m±) and the critical difference (C.D.) were calculated at 5% level of probability.

Fertilizer prescription equations for yield targeting in BT cotton

1**. Without FYM (use of chemical fertilizers alone)**

$$FN = 9.53\ T - 0.38\ SN$$
$$FP_2O_5 = 6.26\ T - 2.66\ SP$$
$$FK_2O = 3.89\ T - 0.07\ SK$$

2. With FYM (Conjoint use of chemical fertilizers and FYM)

$$FN = 9.67\ T - 0.51\ SN - 0.73\ FYM$$
$$FP_2O_5 = 6.83\ T - 3.89\ SP - 0.30\ FYM$$
$$FK_2O = 3.29\ T - 0.06\ SK - 0.11\ FYM$$

Where, F and S indicate the fertilizer and soil nutrients respectively (kg ha^{-1}) and T indicates yield target (q ha^{-1})

Results and Discussion

Influence of STCR equation on soil properties in Vertisols under Rainfed cotton cultivation.

Soil pH, electrical conductivity, organic carbon and calcium carbonate status of the soil after harvest of rainfed cotton was studied and data obtained are presented in Table 3.

Soil pH

The pH of the experimental soil ranged from 7.81 to 7.85. The highest pH value was observed in the T_5 & T_7 and it was decrease as the doses of organic nutrient sources increases and lowest value of pH (7.81) was observed in the treatment received well decompose FYM @5 t ha^{-1} (T_8).Various treatments have showed non significant influence of H^+ concentration of soil and it was reduced towards neutrality as there was increment in doses of organic manures. [6, 7, 8].

Electrical Conductivity

The electrical conductivity of the experimental soil ranged from 0.30 to 0.34 dSm^{-1}. The highest electrical conductivity value was recorded in the T_5 & T_7 treatment and it was decrease as the doses of organic nutrient sources increase and lowest value (0.30 dSm^{-1}) of electrical conductivity was observed in the treatment received well decompose FYM @ 5 t ha^{-1} followed by FYM and RDF (T_2).

Halemani *et al.* (2004) He noted that, organics alone and their combination had no significant influence on EC of soil. Similar results were reported by [10, 11].

Table 3: Effect of STCR equation on pH, Electrical conductivity, organic carbon and calcium carbon content in Vertisols under cotton

Treatment	Ph (1:2.5)	EC (dS m^{-1})	Org.c. (g kg^{-1})	CaCo3 (%)
T_1- Absolute control	7.84	0.33	4.55	6.50
T_2- RDF (recommended dose of fertilizer)	7.83	0.31	4.66	6.46
T_3- Fertilizer application as per soil test	7.83	0.32	4.70	6.48
T_4- Farmers practices	7.84	0.33	4.63	6.45
T_5- 12 q ha^{-1} target (without FYM)	7.85	0.34	4.67	6.42
T_6- 12 q ha^{-1} target (with FYM)	7.82	0.31	4.70	6.32
T_7- 15 q ha^{-1} target (without FYM)	7.85	0.34	4.68	6.40
T_8- 15 q ha^{-1} target (with FYM)	7.81	0.30	4.75	6.30
SE (m)±	0.01	0.008	0.02	0.07
CD at 5%	NS	NS	0.05	NS

Organic carbon

The results showed that superior build up of organic carbon content (5.95 g kg^{-1}) of soil at application of FYM @ 5 t ha^{-1}. The highest organic carbon (4.75 g kg^{-1}) was noted in treatment T8 where 5 tonnes FYM ha^{-1} was applied along with inorganic fertilizers followed by treatments T6 (4.70 g kg^{-1}) where 12 q ha^{-1} yield was targeted. The organic carbon content in treatment T8 was (4.75 g kg^{-1}) more over absolute

control. The addition of FYM has remarkable role in built up of organic carbon in soil.

Tadesse *et al.* (2013) reported that, organic carbon content of soil increased due to highest (15 t·ha^{-1}) FYM application. Similar results were also reported by [13, 14].

Calcium carbonate

The values of Calcium carbonate of soil were non-significant in various treatments. The treatments, where FYM was applied showed the lower values of $CaC0_3$ was noticed in treatments T_8 and T_6 while the highest content of $CaCO_3$ was found in T1 (control).

Nehra and Hooda (2002) found slight reduction in $CaCO_3$ content in vertisol with the organic manure in combination with inorganic fertilizer over control.

Influence of STCR equation on nutrient availability of Vertisols under rainfed cotton

The effect of STCR equation on available Nitrogen, available P_2O_5, and available K_2O was studied and discussed under the following heads and presented in Table 4.

Available Nitrogen

The available nitrogen was significantly increased with the co-joint application of chemical fertilizers and FYM calculated based on the equation developed. The highest amount of available nitrogen was noticed in treatment T8, where 15 q ha^{-1} seed yield of cotton was targeted and also the integration of chemical fertilizers and FYM was made. The lowest values of available nitrogen were noticed in treatment T1 (control). The availability increased as the fertilizer doses were increased, similarly the available nitrogen content in absolute control (161.33 kg ha^{-1}) was little bit lower than farmers practice (162.67 kg ha^{-1}). The increasing pattern of residual nitrogen indicates the validity of the developed equation.

Halemani *et al*. (2004) also noticed that, application of FYM @ 10 t ha^{-1} to cotton increases soil available nitrogen (254.36 kg ha^{-1}), as compared to control. Similar results were also reported by [15, 16].

Available Phosphorus

The available phosphorus was significantly increased with the co-joint application of chemical fertilizers and FYM calculated based on the equation developed. The highest amount of available phosphorus was noticed in treatment T8, where 15 q ha^{-1} seed yield of cotton was targeted and also the integration of chemical fertilizers and FYM was made. The lowest value of available phosphorus was noticed in treatment T1 (control). The availability increased as the fertilizer doses were increased similarly, the available phosphorus in absolute control (13.13 kg ha^{-1}) little bit lower than farmers practice (14.70 kg ha^{-1}). The increasing pattern of residual phosphorus, indicates the validity of the equation developed.

Bonde *et al.* (2004) reported that the available phosphorus on soil as affected due to organic Residue treatment revealed that the availability of phosphorus was increased up to 90 days only. FYM applied @ 5 t ha^{-1} recorded greater values (27.21 kg ha^{-1}) of available phosphorus in soil over control (17.84 kg ha^{-1}).

Table 4: Effect of STCR equation on available N, P, K and S content in Vertisols under rainfed cotton

Treatment	Available N (Kg ha^{-1})	Available P_2O_5 (Kg ha^{-1})	Available K_2O (Kg ha^{-1})
T_1- Absolute control	161.33	13.13	293.67
T_2- RDF (recommended dose of fertilizer)	170.67	17.33	315.00
T_3- Fertilizer application as per soil test	172.00	18.50	318.33
T_4- Farmers practices	162.67	14.70	294.33
T_5- 12 q ha^{-1} target (without FYM)	175.67	19.95	320.33
T_6- 12 q ha^{-1} target (with FYM)	183.67	21.43	325.00
T_7- 15 q ha^{-1} target (without FYM)	181.00	22.90	324.00
T_8- 15 q ha^{-1} target (with FYM)	187.67	24.20	329.33
SE (m)±	2.54	0.68	1.49
CD at 5%	7.39	2.00	4.34

Available Potassium

Data revealed that, available K of soil ranged from 293.67 to 329.33 kg ha^{-1}. It was observed that, available K status of soil increases with the increase in doses of FYM. The highest amount of available potassium was noticed in treatment T8, where 15 q ha^{-1} seed yield of cotton was targeted and also the integration of chemical fertilizers and FYM was made. The lowest value of available potassium was noticed in treatment T1 (control). The availability increased as the fertilizer doses were increased similarly, the available potassium content in absolute control (293.67 kg ha^{-1}) was little bit lower than farmers practice (294.33 kg ha^{-1}). The increasing pattern of residual potassium indicates the validity of the equation developed.

These results are conformity with findings of Das *et al*. (2003) reported that, soil available K was increased with the application of FYM over control. Similar results were also reported by Halemani *et al*. (2004) also noticed that, application of FYM @ 10 t ha^{-1} to cotton increases soil available K_2O (373.23 kg ha^{-1}), Liu *et al*. (2010) and Shankar *et al.* (2012) [9,15, 16].

Conclusions

Impact of combined use of chemical fertilizers with FYM on soil properties the results revealed that, there was significant influence on soil characters such as soil pH, EC organic carbon and calcium carbonate. It can be concluded that the use of FYM in combination with chemical fertilizers helps in building up the fertility status of N, P and K which indicate the validity of fertilizer prescription equation.

References

1. Anonymous. Evaluation of new Bt hybrids of fertilizer levels. Annual Progess Report of Cotton Research. Agronomy and Soil Science, 2007, 24.

2. Mann JS, L Singh, OP Srivastava. The forms of phosphorus In a sierozem soil as affected by nitrogen fertilizer and cropping. Pattern. Agrichimica. 1977; 21:147-152.
3. Alok Kumar, HP Tripati, DS Das. Correcting nutrient imbalances for sustainable crop production. Indian J of ferti. 2007; 2(11):37- 44, 60.
4. Muralidharudu Y, K Sammi Reddy, A Subba Rao. Balanced and integrated nutrient management for sustaining higher crop productivity and better soil health. State Level Seminar on Soi Resource Management for Sustainable Agriculture, Akola Chapter of ISSS, Dr. PDKV., Akola, 2010, 56-77.
5. Panse VG, PV Sukhatme. Statistical Methods for agricultural workers. ICAR, New Delhi, 1985.
6. Patil PV, SD Nafade, RM Patel, UG Patel. Effect of organic soil amendments on the incidence of root rot of cotton. J Cotton Res. Dev. 2003; 17(1):48-51.
7. Katkar RN, ST Wankhade, AB Turkhede, SP Lambe. Effect of integrated nutrient management in cotton growth on shallow soil on growth, seed cotton yield and physico-chemical properties. PKV Res. J 2005; 29(2):210-214.
8. Ojha RB, Shah SC, Pande KR, Dhakal DD. Residual effects of farm yard manure on soil properties in spring season, chitwan, Nepal. Int J of Sci. Res. in Agric. Sci. 2014; 1(8):165-171.
9. Halemani HL, Hallikeri SS, Nooli SS, Nandagavi RA. Harish Kumar HS. Effect of organics on cotton productivity and physico-chemical properties of soil. In: International symposium on “Strategies for sustainable cotton production-A global vision”. 2. Crop production, 23-25., VAS, Darwad. 2004, 123-129.
10. Badanur VP, Poleshi CM, Naik BK. Effect of organic matter on crop yield and physical and chemical properties of Vertisol. J Indian Soc. Soil Sci. 1990; 38(3):426-429.
11. Nehra AS, Hooda IS. Influence of integrated use of organic manures and inorganic fertilizers on wheat yield and soil properties. Res. on Crops. 2002; 3(1):11-16.
12. Tadesse T, N Dechassa, W Bayu, S Gebeyehu. Effects of Farmyard Manure and Inorganic Fertilizer Application on Soil Physico-Chemical Properties and Nutrient Balance in Rain-Fed Lowland Rice Ecosystem. Am. J of Plant Sci. 2013; 4:309-316.
13. Badole SB, SD More. Organic carbon status as influenced by organic and inorganic nutrient sources Vertisol. J Maharashtra Agric. Univ. 2000; 25(2):220-222.
14. Sonune BA, KB Tayade, VV Gabhane, RB Puranik. Long term effect of manuring and fertilization on ***fertility*** and crop productivity of Vertisols under sorghum-wheat sequence. Crop Res. 2003; 25(3):460-467.
15. Liu E, Yan C, Mei X, He W, Bing SH, Ding L. *et al*. Long term effect of chemical fertilizer, straw and manure on soil chemical and biological properties in north-west China. Geoderma. 2010; 158:173-80.
16. Shankar Lal Golada, Sharma GL, Arvind Verma, Jain HK. Effect of FYM, Nitrogen and Azospirillum on yield, economics and soil nutrient status of forage Pearl Millet, Madras Agric. J 2012; 99(4, 6):308-310.
17. Bonde AN, BG Karie, MS Deshmukh. KU Tekale, NP Patil. Effect of different organic residues on physic-chemical properties of soil in cotton- soybean intercropping in Vertisol. J Solis and Crops. 2004; 14(1):112-115.

Das A, M Prasad, YS Shivay, KM Subha. Productivity and sustainability of cotton (*Gossypium hirsutum* L)-Wheat (*Triticumaestivum* L.) cropping system as influenced by FYM and Azotobacter. J Agron and Crop Sci. 2003; 190:298-304.