Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2020; 9(1): 1140-1143
Received: 08-11-2019
Accepted: 12-12-2019

Effect of different resource conservation practices on soil chemical properties under cotton cultivation

Sushma R Ingle, Hanumant Singh, MD Sarware Alam, VK Kharche and SG Wankhade

Sushma R Ingle
Soil and Land Use Survey of India Ahmedabad, Gujarat, India

Hanumant Singh
Soil and Land Use Survey of India Ahmedabad, Gujarat, India

MD Sarware Alam
Assistant Professor, Department of Soil Science and Agricultural Chemistry, Starex University, Gurugram, India

VK Kharche
Professor, Department of Soil Science and Agricultural Chemistry, Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

SG Wankhade
Professor, Department of Soil Science and Agricultural Chemistry, Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Corresponding Author:
Sushma R Ingle
Soil and Land Use Survey of India Ahmedabad, Gujarat, India

Abstract
The present investigation was conducted at Research Farm of Department of Soil Science and Agricultural Chemistry, Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola. The field experiment consisting of nine treatments with three replications in the Randomized Block Design. The treatments comprised of recommended dose only through chemical fertilizers, 25% N through *Sesbania aculeata* (Dhaincha), cotton stalk, wheat straw, Biomulch and neemcake with remaining dose through chemical fertilizers, 100% N - FYM + compensation of P - Phosphocompost, 50% N - FYM + compensation of P - Phosphocompost + Urea and 50% N – leucaena loppings + compensation of P - Phosphocompost + Urea. The results of the present study indicated that, application of 100% N - FYM + Compensation of P-Phosphocompost significantly.

Keywords: Resource, conservation, soil, physico, chemical, properties, cotton, cultivation

Introduction
The key features which characterize conservation agriculture include: a) Minimum soil disturbance by adopting no-tillage and minimum traffic for agricultural operations, b) Leave and manage the crop residues on the soil surface, and c) Adopt spatial and temporal crop sequencing/crop rotation to derive maximum benefits from inputs and minimize adverse environmental impacts (Sangar, 2004) [2].
The conservation Technology Information Centre in India, USA has defined conservation tillage as tillage and planting system in which at least 30% of the soil surface is covered by plant residue after planting to reduce erosion by water.
The term 'Conservation Agriculture' refers to the system of raising crops without tilling the soil while retaining crop residues on the soil surface. Land preparation through precision land leveling and (Ghuman and Sur 2006) [6] bed furrow configuration for planting crops further enables improved resource management.
Resource conservation technologies is gaining acceptance in many parts of the world as an alternative to both conventional agriculture and organic agriculture. Conservation agriculture is based on the principles of rebuilding soil, optimizes the crop production input, including labor, and optimizing the profit. Conservation Agriculture has emerged as a new way forward to achieve the goals of sustainable agriculture.
The primary factor having influence on soil health is organic matter fractions, which are under constant threat of depletion due to inadequate replenishment under rainfed farming system. The organic matter build up in tropical soil is not feasible, but its maintenance at a desirable level is essential. Use of organics, crop residues, green manures, agricultural wastes, biofertilizers as the components of conservation agriculture improve soil health by changing rhizosphere environment. The organic matter in crop residues serves as a major source for replenishing various fractions of soil organic matter and subsequently influences aggregation, porosity and other soil properties. Organic manures ameliorate this problem as organic matters helps in increasing adsorptive power of soil for cations and anions particularly phosphorus and nitrates. These absorbed nutrient ions are released slowly for the benefit of crop during entire growth period (Naguib, 2011) [16]. It helps to improve the soil physical and chemical properties (Tiwari *et al*., 1998) [25]. Organic manures also improve the organic carbon status, available primary and secondary nutrients (Pratibha, *et al*. 2011) [18].
The systematic study of soil physical, chemical and biological properties of soil under different resource conservation technologies is necessary to create an evidence for evaluating the impact of these management measures on soil quality.

In recent years conservation agriculture concept has come in vogue, as a means of reducing time, labour and machine operation as well as conserving moisture and reducing soil erosion and nutrient loss. Conservation agriculture is more appropriate strategy for rainfed production system. Conservation agriculture is generic term encompassing many different soil management practices. It is generally defined as "Conservation agriculture is minimal disturbance of the soil by tillage (zero tillage), balanced application of chemical inputs (only as required for improved soil quality and healthy crop and animal production), and careful management of residues and wastes" (Dumanski *et al*. 2006) [5].

Materials and Methods

The experiment was conducted at Research Farm of Department of Soil Science and Agricultural Chemistry, Dr. Panjab Rao Deshmukh Krishi Vidyapeeth, Akola. The experiment was consisting of nine (9) treatment *viz*., T_1 (100% RDF), T_2 (Dhaincha 25% N +Compensation of RDF), T_3 (Cotton Stalk 25% N +Compensation of RDF), T_4 (Wheat Straw 25% N +Compensation of RDF), T_5 (Bio mulch 25% N + Compensation of RDF), T_6 (Neemcake 25% N + Compensation of RDF), T_7 (100% N-FYM +Compensation of P-Phosphocompost), T_8 (50% N-FYM +Compensation of P-Phosphocompost +Urea), T_9 (50% N – leucaena loppings +Compensation of P – Phosphocompost +Urea). These treatments were evaluated in Randomized Block Design having three replications. Soil samples collected from sites from each plot at a depth of 0- 15 cm before sown of cotton crop and after harvest of cotton crop, After preparing soil samples, several parameters were measured separately from soil samples like pH and Electrical conductivity (Jackson, 1973) [8], Organic Carbon (Walkley and Black's, 1934), Nitrogen (Subbiah and Asija, 1956) [23], Phosphorus (Olsen *et al*., 1954), Potassium, Calcium, Magnesium and Sodium (Jackson, 1973) [8], Sulphate (Chensin and Yien, 1950) [2], micronutrients *viz*., Iron (Fe), Magnesium (Mn), Copper (Cu) and Zinc (Zn) were determined by using atomic absorption spectrophotometer (Lindsay and Norvell, 1978) [14] by their standard methods.

Soil pH is most important chemical characteristics of soil that influences all (physical, chemical and biological) properties of soil and also important factors for nutrient availability to the plants. The pH of soil ranged from 8.29 to 8.34 under cotton, which could be attributed to the buffering effect caused due to organic matter and secondly due to pH the high buffering capacity of the clayey soil. There was no significant variation among treatment due to addition of amendments. However, Ismail *et al.* (1998) [7] observed a significant reduction in pH value of Vertisol with application of FYM @ 30 Mg ha^{-1} over control within one year. Masto *et al.* (2007) [15] and Sujata *et al*. (2007) [24] studied the effect of various levels of FYM and NPK fertilizers alone and in combination for 15 years on black soils and found that the long term use of FYM and fertilizers caused slight decrease in pH due to FYM. Similar observations were also reported earlier by Katkar *et al*. (2006) [10], Kumar *et al*. (2008) [13] and Rao and Janawade (2009) [19] who has reported that soil pH and electrical conductivity reduced slightly with the application of FYM, crop residue and green manure.

Electrical conductivity was also observed that, the differences of EC among the different treatments were non significant, electrical conductivity varied from 0.14 to 0.17 dSm^{-1} under cotton cultivation. The application of organic materials also increases the release of salts into soil solution as result of mineral dissolution due to increase in partial pressure of carbon dioxide and organic acids which leads to very slight increase in electrical conductivity Choudhary *et al.* (2011) [4]. Lowering the electrical conductivity under all resource conservation treatments is attributed to the increased permeability and consequently the leaching of salts (Srikanth *et al*. 2000) [2].

The effect of different resource conservation practices on organic carbon content under cotton cultivation varied from 5.79 to 6.20 g $kg^{-1}$and result was found to be significant. The higher organic carbon content of soil (6.20 g kg^{-1}) was observed with the application of RDF (based on soil test) i.e 100% N - FYM + compensation of P - Phosphocompost (T_7) followed by other treatment combinations. The organic carbon in the soil under cotton crop increased as compared to other cereals which may be due to legume crop like soybean which adds more crop residues than other crops. The organic carbon content of soil increased slightly due to cultivation of leguminous crop (90.41%) as compared to soil under cereal (0.38%) and fallow (0.36%) (Sharma *et al.* 1986) [21]. Soil organic carbon dynamics is of paramount importance for sustaining long term soil quality and productivity under intensive cropping. Organic matter is an indication of organic carbon fraction of soil formed due to microbial decomposition of organic residues.

The soil available nitrogen varied from 209.20 to 225.90 kg ha^{-1} after cotton cultivation. The data showed significant difference in all treatments. It was observed that gain of nitrogen after harvest of cotton crop in all treatments over initial. The maximum available nitrogen (225.90 kg ha^{-1}) was observed in treatment (T_1) and (224.10 kg ha^{-1}) in treatment (T_7). There was significant increase in available nitrogen due to addition of FYM and Phosphocompost (T_7) over use of other treatments. The regular application of FYM is highly essential to maintain the sustainability of soil in respect of available nitrogen. It was observed that considerable improvement in available nitrogen status was observed in all the treatments which involve combined application of crop residues and inorganic fertilizer over initial status. Organic matter helps in increasing adsorptive power of soil for cations and anions which released slowly particularly nutrients Katkar *et al.* (2005) [11] and Babhulkar *et al.* (2000) [1].

Effect of different resource conservation practices on available phosphorous after harvest of cotton was significantly influenced by various treatments. It varied from 14.92 to 16.80 kg ha^{-1} after harvest of cotton. The highest available phosphorous (16.80 kg ha^{-1}) was observed in RDF (based on soil test) i.e. 100% N - FYM + compensation of P-Phosphocompost (T_7) which was significantly superior over all the other treatments. Significant increase in available phosphorus by addition of chemical fertilizer with organic manures as compared to only chemical fertilizers was also reported by Kanwar and Paliyal, (2002) [9] and Chitale *et al.* (2003) [3]. The decomposition of leaf litter is useful for slight reduction in pH which favours availability of phosphorous in these soils. The appreciable build up in available phosphorous may also be due to influence of organic matter in increasing the labile phosphorous in soil through complexing of cations like Ca^{2+} which is mainly responsible for fixation in swell shrink soils. The conjunctive use of organics with chemical fertilizers is beneficial for improving available P which is also evidenced by the reduced calcium carbonate content of the soil there by reducing phosphorous fixations. Similar results were reported by Kharche *et al*. (2011) [12].

The highest amount of available potassium in soil recorded in treatment T7 (100% N-FYM+Compensation of P-Phosphocompost) 373.10 Kgha^{-1}. Which was significant superior with followed by rest of all treatments, while recorded minimum available nitrogen, phosphorus and potassium are varies between *viz*. treatments T8 (50% N-FYM +Compensation of P-Phosphocompost +Urea) 209.20 Kg ha^{-1}, T4 Wheat Straw 25% N +Compensation of RDF) 14.92 Kg ha^{-1} and T9 (50% N – leucaena loppings + Compensation of P – Phosphocompost +Urea) 348.20 kg ha^{-1}. Effect of different resource conservation practices on available sulphur after harvest of cotton was significantly influenced by various treatments. the highest available sulphur (11.73 mg kg^{-1}) was observed in the treatment i.e.100% RDF (T_1) and remaining treatments were at par with (T_1). Available sulphur in the cotton and has shown increase over initial values which may be due to addition of biomass from previous year soybean crop. The highest available sulphur (11.73 mg kg^{-1}) was observed in the treatment i.e.100% RDF (T_1) due to applied of single super phosphate fertilizer because single super phosphate can help to convert unavailable nutrient in available form in the soil. Single super phosphate is the cheapest source of sulphur for the soil.

Table 1: Effect of different resource conservation practices on soil properties under cotton cultivation

T. No.	pH (1:2.5)		EC (dSm^{-1})		OC(g kg^{-1})		Avai. N (kg ha^{-1})		Avai. P (kg ha^{-1})		Avai. K (kg ha^{-1})		Avai. S (mgkg^{-1})	
	Initial	Cotton	Initial	Cotton	Initial	Cotton	Initial	Cotton	Initial	Cotton	Initial	Cotton	Initial	Cotton
T1	8.32	8.30	0.16	0.16	5.83	5.84	203.00	225.90	11.46	16.06	330.10	366.60	10.13	11.73
T2	8.36	8.34	0.18	0.16	5.83	5.86	193.08	216.10	11.38	15.01	328.30	360.30	9.77	11.49
T3	8.30	8.31	0.18	0.17	5.79	5.82	199.00	211.00	11.36	14.98	325.70	354.40	9.78	11.37
T4	8.31	8.31	0.17	0.16	5.78	5.79	190.20	213.30	11.36	14.92	323.20	352.70	9.79	11.38
T5	8.34	8.32	0.16	0.14	5.79	5.81	191.30	214.90	11.36	14.93	322.10	350.30	9.82	11.55
T6	8.34	8.33	0.18	0.17	5.80	5.82	194.10	218.60	11.38	15.00	326.70	356.40	9.51	11.41
T7	8.32	8.29	0.18	0.16	6.01	6.20	208.80	224.10	11.63	16.80	345.30	373.10	9.96	11.68
T8	8.33	8.32	0.18	0.17	6.00	6.14	198.80	209.20	11.41	15.02	340.10	370.80	9.92	11.64
T9	8.34	8.33	0.17	0.16	5.82	6.09	195.03	215.60	11.37	14.97	320.30	348.20	9.67	11.42
SE(m)±	0.047	0.033	-	0.009	-	0.04	-	2.70	-	0.41	-	3.72	-	0.38
CD at 5%	-	-	-	- -	-	0.12	-	8.11	-	1.24	-	11.16	-	1.13

Table 2: Effect of different resource conservation practices on soil micro nutrients status under soybean cultivation

Tr. No.	Avai. Fe (mg kg^{-1})		Avai. Mn (mg kg^{-1})		Avai. Zn (mg kg^{-1})		Avai. Cu(mg kg^{-1})	
	Initial	At harvest	Initial	At harvest	Initial	At harvest	Initial	At harvest
T_1	9.60	9.62	8.99	9.05	0.57	0.58	2.85	2.92
T_2	9.77	9.84	9.83	9.90	0.59	0.63	3.00	3.10
T_3	9.76	9.82	9.21	9.24	0.57	0.60	2.95	2.98
T_4	9.75	9.82	9.17	9.28	0.56	0.59	2.91	2.97
T_5	9.76	9.86	9.19	9.51	0.57	0.61	2.95	3.08
T_6	10.13	10.23	9.14	9.21	0.61	0.62	2.97	3.01
T_7	10.24	10.33	10.00	10.14	0.64	0.69	3.22	3.33
T_8	10.23	10.29	9.96	10.08	0.62	0.67	3.16	3.28
T_9	10.22	10.28	9.87	10.03	0.61	0.65	3.13	3.18
SE(m)±	-	0.032	-	0.041	-	0.014	-	0.024
CD at 5%	-	0.096	-	0.124	-	0.044	-	0.072

The highest amount of available iron, manganese, zinc and copper in soil recorded in treatment T7 (100% N-FYM+Compensation of P-Phosphocompost) 10.33, 10.14, 0.69 and 3.33 mg kg^{-1} respectively. Which was significant superior with followed by rest of all treatments, while minimum in treatment T1 (100% RDF) 9.62, 9.05, 0.58 and 2.92 mg kg^{-1} respectively.

Conclusion

The results from the sites under study where application of farm yard manure and phospho- compost, along with chemical fertilizers is useful for improving the chemical properties of soil resulting into enhancement in soil quality under cotton crop cultivation.

References

1. Babhulkar PS, Wandile RM, Badole WP, Balpande SS. Residual effect of long term application of FYM and fertilizers on soil properties (Vertisols) and yield of soybean. J Indian Soc. Soil Sci. 2000; 48(1):89-92.
2. Chesnin L, Yien CH. Turbidimetric determination of available sulphur. Soil Science Society of America proceedings. 1950; 15:149-151.
3. Chitale Shrikant R, Bajapai RK, Upadhyay SK, Joshi BS. Influence of cereal legume, legume-cereal and cereal sequence on productivity, economics and soil fertility status. Madras Agric J. 2003; 90(10-12):733-736.
4. Choudhary BR, Gupta AK, Parihar CM, Jat SL, Singh DK. Effect of integrated nutrient management on fenugreek and its residual effect on fodder Pearlmillet. Indian J Agronomy. 2011; 56(3):189-195. International Journal of Chemical Studies
5. Dumanski J, Peiretti R, Benetis J, McGarry D, Pieri C. The paradigm of conservation tillage. Proc. World Assoc. Soil and Water Conserv. 2006; P1:58-64.
6. Ghuman BS, Sur HS. Effect of manuring in soil properties and yield of rainfed Wheat. J. Indian Soc. Soil Sci. 2006; 54(1):6-11.
7. Ismail S, Malewar GU, Rege VS, Yelvikar NV. Influence of FYM and gypsum on soil properties and yield of groundnut grown in Vertisol. Agropedology, 1998; 8:73-75.
8. Jackson ML. Soil chemical Analysis, Prentice Hall India Pvt. Ltd., New Delhi, 1973.
9. Kanwar, Kamla, Paliyal SS. Influence of phosphorus management and organic manuring on uptake and yield

of chickpea (*Cicer arientinum*), Ann. Agric. Res, New Series. 2002; 23(4):642-645.

10. Katkar RN, Turkhede AB, Wankhade ST. Residual effect of manures and inorganic fertilizers on soil properties and yield of cotton. PKV Res. J. 2006; 30(1):36-41.
11. Katkar RN, Wankhade ST, Turkhede AB, Lambe SP. Effect of integrated nutrient management in cotton grown on shallow soil on growth, seed cotton yield and physicochemical properties. PKV Res. J. 2005; 29(2):210-211.
12. Kharche VK, Kulkarni AA, Patil SR, Katkar RN. Long term integrated nutrient management for securing soil quality under intensive cropping system on vertisols of Maharashtra. Proceedings of national seminar on soil security for sustainable agriculture held at collage of agriculture, Nagpur, Dr. PDKV., Akola (M.S.) on 2010-2011, 127-148.
13. Kumar B, Gupta RK, Bhandari AL. Soil fertility changes after long term application of organic manure and crop residues under Rice-wheat system. J Indian Soc. Soil Sci. 2008; 56(1):80-85.
14. Lindsay WL, Norvell WA. Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Science Society of America Journal. 1978; 42:421-448.
15. Masto, Reginald Ebhin, Chhonkar PK, Singh D, Patra AK. Soil quality response to long-term nutrient crop management on semi-arid Inceptisol, 2007, 130-142.
16. Naguib NYM. Organic Vs chemical fertilization of medicinal plants: concise review researches. Adv. Environ. Biol. 2011; 5(2):394-400.
17. Olsen SR, Cole CW, Watenable FS, Dean LA. Estimation of available phosphorus in soil by extraction with NaHCO3 USDA. Circular 1954, 939.
18. Pratibha G, Korwar GR, Ch. Rao S, Venkateswarlu B, Yadav SK, Rao KS. Nutrient management strategies in Medicinal, Aromatic and Dye yielding crops in rainfed regions. Indian J Fert. 2011; 7(4):118-133.
19. Rao S, Janawade AD. Nutrient uptake and fibre quality parameters as influenced by integrated nutrient management practices in irrigated hybrid cotton. J Cotton Res. Dev. 2009a; 23(2):237-239.
20. Sangar S, Abrol IP, Gupta RK. Conservation Agriculture: conserving resources, enhancing Productivity. Centrefor Advancement of Sustainable Agriculture, 2004, 1-2.
21. Sharma CP, Gupta HS, Bajpai PD. Residual Effect of leguminous crop on some chemical and Microbiological properties of soil. J Indian Soc. Soil Sci. 1986; 346:206-208.
22. Srikanth K, Srinivasamurthy CA, Siddaramappa R, Ramakrishna Parama VR. Direct and residual effect of enriched composts, FYM, vermicompost and fertilizers on properties of an Alfisols. J Indian Soc. Soil Sci. 2000; 48(3):496-499.
23. Subbiah BV, Asija GL. A rapid procedure for determination of available nitrogen in soil. Curr. Sci., 1956; 25:259-260.
24. Sujata Pothare, Rathod PK, Ravankar HN, Patil YG, Yewale AC, Dhammadina Pothare. Effect of long term fertilization in Vertisols on soil properties and yield of sorghum-wheat sequence. Asian J Soil Sci. 2007; 2(1):74-78.
25. Tiwari A, Tembhare BR, Nema HR. Effect of continuous use of fertilizer and manure on soil aggregates in vertisols. PKV, Res. J. 1998; 29(2):215-217.
26. Walkley A, Black CA. An Examination of the method for determining soil organic matter and a proposed modification of the chromic acid titration method. Soil sci. 1934; 37:29-38.