International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2017; 5(2): 106-109

Received: 25-01-2017
Accepted: 26-02-2017

VD Kapse
Department of Soil Science and Agril. Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

UY Puranik
Department of Soil Science and Agril. Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

AR Bhosale
Department of Soil Science and Agril. Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

NB Gokhale
Department of Soil Science and Agril. Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

MC Kasture
Department of Soil Science and Agril. Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

Correspondence
VD Kapse
Department of Soil Science and Agril. Chemistry, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra, India

Effect of integrated nutrient management on yield of chilli (*Capsicum annum* L.) and physico-chemical properties of soil in Konkan region of Maharashtra (India)

VD Kapse, UY Puranik, AR Bhosale, NB Gokhale and MC Kasture

Abstract
The present study was carried out during 2014 and 2015 *rabi* season at Vegetable Improvement Scheme, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra state (India). The field experiment was laid out in Randomized Block Design comprising of thirteen treatments replicated thrice. Treatments comprised of T_1 [25% N through FYM + 75% N through Urea], T_2 [50% N through FYM + 50% N through Urea], T_3 [75% N through FYM + 25% N through Urea], T_4 [25% N through Vermicompost + 75% N Urea], T_5 [50% N through Vermicompost + 50% N through Urea], T_6 [75% N through Vermicompost + 25% N through Urea], T_7 [25% through N Poultry manure + 75% N through Urea], T_8 [50% through N Poultry manure + 50% N through Urea], T_9 [75% N through Poultry manure + 75% N through Urea], T_{10} [25% N through Groundnut cake + 75% N through Urea], T_{11} [50% N through Groundnut cake + 50% N through Urea], T_{12} [75% N through Groundnut cake + 25% N through Urea] and T_{13} [Absolute control]. Among the treatments, application of 50 % N through Poultry manure and 50 per cent N through urea was recorded highest yield and yield contributing character such as green pod yield of chilli (128.01 q ha^{-1}), dry matter of green pod yield (11.22 q ha^{-1}), stover yield (15.28 q ha^{-1}) and weight of fresh fruit/ plant (345.63 g $plant^{-1}$). The different sources of organic manures and their combination with of inorganic fertilizer (urea) do not showed any significant effect on physico-chemical properties (pH, Electrical conductivity and Organic carbon) of soil.

Keywords: Chilli, Organic and inorganic fertilizers, Yield, pH, Electrical conductivity and Organic carbon

1. Introduction
Chilli is one of the commercial high value crops in our country. It is called as the universal spice of India, since it is cultivated in almost all the states and union territories. In India, area under chilli is about 774.87 thousand hectare and production 1492.14 thousand MT with productivity of 1.9 thousand MT per hectare (Anonymous, 2015) [2]. The crop is very important for agricultural economy and is used in processing industries. India is the largest producer, consumer and exporter of chilli, which contributes to 25% of total world's production. In India the most important chilli growing states are Karnataka, Tamil Nadu, Odisha, Maharashtra, Rajasthan and West Bengal.
Chillies are excellent source of vitamin A, C and E with minerals like molybdenum, magnesium, potassium and copper. It is an essential ingredient of Indian curry, which is characterized by tempting colour and exciting pungency. It is predominantly popular for its green pungent fruits, which is used for culinary purpose. It is commercially important for the two qualities, the red colour due to the pigment capsanthin and the biting taste due to the chemical constituent capsaicin.
Adequate and balanced fertilizer management in association with manures is very much essential to exploit the full yield potential of Chilli. After the green revolution, increase in production was achieved at the cost of soil health. It has been proved that indiscriminate use of inorganic fertilizers results in decrease in soil fertility and increase in soil acidity with depletion of organic humus content in addition to poor crop quality. Use of organic manures to meet the nutrient requirements of crop would be an inevitable practice in the years to come for sustainable agriculture since organic manures not only improve the physical, chemical and biological properties of soil

(Heitkamp *et al*., 2011) [8]. but also improves the moisture holding capacity of soil, Chilli crop requires a balanced fertilizer management without which growth and development of the crop will be impaired leading to substantial reduction in yield of the chilli. Organic matter like farm yard manure, vermicompost, poultry manure and crop residues are considered as a store house of various nutrients which are essential for the plant growth. Use of organic manures alone cannot fulfil the crop nutrients requirement. Mixture of organic manures and inorganic fertilizers gave better results than organic manure alone (Chinnaswami, 1967) [6]. The integrated supply and use of plant nutrients from chemical fertilizers and organic manures has shown to produce higher crop yields than when they are applied alone (Chinnaswami, 1967) [6]. Inclusion of organic manures with inorganic sources of nutrient is essential. It is found that integrated nutrient management with FYM, vermicompost, poultry manures and oil cakes showed a significant positive response on chillies (Pariari and Khan, 2013) [17]. Particularly chilli needs heavy manuring for better plant growth and high yield. Use of judicious combinations of organic and inorganic fertilizer sources is essential not only to maintain the soil health but also sustain the productivity (Malewar *et al*., 1998) [14]. Hence, the present investigation was carried out to find out the effect of Integrated Nutrient Management on yield of chilli (*Capsicum annum* L.) and chemical properties of soil in Konkan region of Maharashtra (India).

Materials and methods

The present investigation pertaining to the effect of Integrated Nutrient Management on yield of chilli (*Capsicum annum* L.) and physico-chemical properties of soil in Konkan region of Maharashtra (India). Was conducted during 2014-2015 at Vegetable Improvement Scheme, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri. The analytical work was done in the research laboratory of the Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dapoli. The selection of site was done on the basis of suitability of land for the cultivation of chilli where, the facilities of irrigation water and protection from cattle's were available. Chilli (*Capsicum annuum* L.) var. Konkan Kirti was taken as a test crop during *Rabi* season of the year 2014 -2015 with a spacing 60 X 45 cm. There were thirteen treatment combinations in three replications and the details are as follows: Treatments comprised of T_1 [25% N through FYM + 75% N through Urea], T_2 [50% N through FYM + 50% N through Urea], T_3 [75% N through FYM + 25% N through Urea], T_4 [25% N through Vermicompost + 75% N Urea], T_5 [50% N through Vermicompost + 50% N through Urea], T_6 [75% N through Vermicompost + 25% N through Urea], T_7 [25% through N Poultry manure + 75% N through Urea], T_8 [50% through N Poultry manure + 50% N through Urea], T_9 [75% N through Poultry manure + 75% N through Urea], T_{10} [25% N through Groundnut cake + 75% N through Urea], T_{11} [50% N through Groundnut cake + 50% N through Urea], T_{12} [75% N through Groundnut cake + 25% N through Urea] and T_{13} [Absolute control]. Organic manures, viz. Farm yard manure, Vermicompost, Poultry manure and groundnut cake was applied on the basis of nitrogen content only, and applied at the time of field preparation. Half dose of N and recommended dose of P and K was applied at the time of transplanting and half dose of N was applied at 30 days after transplanting. The required amount of N, P and K fertilizers was applied through urea, SSP and muriate of potash, respectively. Other cultural operations and plant protection measures were followed as per the recommendations. Observation was recorded from five selected plants in the plot area at each picking time and average was workout. Multiple pickings were taken from green chilli for six times. Immediately after harvesting their fresh yield was recorded. The weight of each picking was added to get the total green chilli yield. Pods were harvested at maturity i.e. green matured chilli and the pod yield obtained after each harvesting and stover yield after uprooting of crop was recorded with fresh as well as dry stover yield.

The initial experimental soil was sandy clay loam in texture, slightly acidic in reaction (5.29) and low in electrical conductivity (0.33dSm^{-1}). The soil was to be found very high in organic carbon (1.68%). The soil samples were collected by proper method from each treatment plot at different stages (30 DAT, 60 DAT and At harvest of crop) for different analysis. The pH of soil was determined using pH meter having glass and calomel electrode using 1:2.5 soil: water suspension ratio (Jackson, 1973) [10] Electrical conductivity of soil was determined with the help of Systronic Conductivity Meter-306 using 1: 2.5 soil: water suspension ratio (Jackson, 1973) [10]. Organic carbon was determined by Walkley and Black wet digestion method (Black, 1965) [5]. The collected data during experiment was analyzed as per the procedure given by Panse and Sukhatme (1967).

Results and discussion

Table 1: Effect of different sources of organic manures and their combination with inorganic fertilizer (urea) on yield of chilli.

Tr. No.	Treatment Details	Yield (q ha^{-1})		
		Green pod yield	Dry matter yield of green pods	Stover yield
T_1	25% N(FYM) + 75% N(Urea)	99.05	8.88	15.03
T_2	50% N(FYM) + 50% N(Urea)	100.56	9.81	10.96
T_3	75% N(FYM) + 25% N(Urea)	114.27	9.71	12.13
T_4	25% N(VC) + 75% N(Urea)	101.91	8.72	12.36
T_5	50% N(VC) + 50% N(Urea)	110.42	10.16	11.23
T_6	75% N(VC) + 25% N(Urea)	110.86	10.27	9.25
T_7	25% N(PM) + 75% N(Urea)	114.10	10.40	11.86
T_8	50% N(PM) + 50% N(Urea)	128.01	11.22	15.28
T_9	75% N(PM) + 25% N(Urea)	111.28	9.24	12.99
T_{10}	25% N(GC) + 75% N(Urea)	107.30	9.49	10.91
T_{11}	50% N(GC) + 50% N(Urea)	105.48	9.68	12.15
T_{12}	75% N(GC) + 25% N(Urea)	109.53	11.08	9.50
T_{13}	Absolute control	73.65	5.73	8.13
	SE ±	6.14	0.86	1.23
	C.D.(P=0.05)	17.91	2.52	3.60

FYM- Farm yard manure. VC- Vermicompost. PM- Poultry manure GC- Groundnut cake

Effect on chilli pod and Stover yield

The data pertaining pod and stover yield of chilli as influenced by different treatments are presented in Table 1. The application of different sources of organic manures and their combination on chilli significantly influenced the yield of green chilli as well as stover. Highest green pod yield of chilli (128.01 q ha^{-1}) was recorded in the treatment T_8 receiving 50 % N through Poultry manure and 50 per cent N through urea. Maximum dry matter of green pod yield (11.22 q ha^{-1}) was recorded in treatment T_8 receiving 50 % N through poultry manure and 50 per cent N through urea. Numerically higher stover yield (15.28 q ha^{-1}) was obtained by treatment T_8 receiving 50 % N through Poultry manure and 50 per cent N through urea. The treatment not receiving any fertilizer or manure T_{13} i.e. control was less effective by recording minimum green pod yield, dry matter of green pod yield and stover yield. Range of the yield recorded here was similar with the results obtained by Mujumdar *et al*. (2000) [15], Kasture (2001) [11] and Kokare (2013) [12]

Effect on chemical properties of soil

Effect on soil pH

The data pertaining to pH of soil is given in Table. 2. It was observed that at 30 DAT there were no significant differences due to various treatments. The highest pH (5.39) was recorded in treatment T_1 (25% N through FYM + 75% N through Urea) and the lowest pH (5.12) was recorded in treatment T_5 (50% N through Vermicompost + 50% N Urea). Similar results was found in Maheswari *et al*. (2015). At 60 DAT, the pH was significantly affected due to different treatments, the highest pH (6.22) was recorded in treatment T_9 receiving 75% N through poultry manures and 25% N through urea and this treatment was at par with remaining all treatments except treatment T8. It might be due to the Ca present in the poultry manure as well as other complex materials including high amount of organic matter which helps to increase the pH of soil. At harvest, the pH of soil was not significantly influenced due to various treatments, and highest pH (5.44) was recorded in treatment T_{13} (Control). It is observed that the pH of soil was increasing up to 60 DAT stage, it might be due to mining of the nutrients responsible for increasing pH of soil, later at harvest it declined slightly, it might be due to the acidifying effect of urea and organic acid produced during the course of decomposition of organic amendments. Similar results were obtained by Saravanan and Baskar (1996) [18] and Tambe *et. al.* (2015) [20].

Effect on soil EC

The data pertaining to EC of soil is given in Table. 2. It can be observed that at 30, 60 DAT and at harvest there were no significant variations due to the different treatments. The values were ranged between 0.13 to 0.18 dSm^{-1}, 0.12 to 0.23 dSm^{-1} and 0.11 to 0.17 dSm^{-1} at 30, 60 DAT and at harvest respectively. At 30 DAT (0.18 dSm^{-1}), 60 (0.23 dSm^{-1}) and at harvest (0.17 dSm^{-1}) were the highest values of electrical conductivity recorded in treatment T_9 receiving 75 per cent N through poultry manure and 25 per cent N through urea. At 30, 60 DAT and at harvest, values of EC of soil ranged in between 0.11 to 0.23 dSm^{-1} indicating that these soils are containing least soluble salts. The lateritic soils devoid of soluble salts; as reported by number of workers (Anonymous 1990 and Shende 2010) [1]. Similar results were found in Tambe *et. al.* (2015) [20]. Basak *et al.* (1990) [4] observed that application of vermicompost decreased EC value in presence of earthworms.

Table 2: Effect of different sources of organic manures and their combination with inorganic fertilizer (urea) on pH, EC and organic carbon content of soil

Tr. No.	Treatment Details	pH of soil			E C of soil (dSm^{-1})			Organic Carbon g kg-1		
		30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest
T1	25% N(FYM) + 75% N(Urea)	5.39	5.46	5.33	0.14	0.14	0.12	16.77	14.69	14.82
T2	50% N(FYM) + 50% N(Urea)	5.24	5.61	5.15	0.15	0.12	0.15	14.43	13.65	14.56
T3	75% N(FYM) + 25% N(Urea)	5.32	5.62	5.29	0.15	0.12	0.14	15.08	17.03	15.60
T4	25% N(VC) + 75% N(Urea)	5.24	5.44	5.18	0.13	0.18	0.11	9.75	17.16	15.34
T5	50% N(VC) + 50% N(Urea)	5.12	5.52	5.37	0.13	0.15	0.14	10.53	23.66	16.90
T6	75% N(VC) + 25% N(Urea)	5.26	5.68	5.20	0.13	0.16	0.15	9.10	16.51	15.60
T7	25% N(PM) + 75% N(Urea)	5.23	5.49	5.32	0.14	0.19	0.14	11.16	16.25	14.95
T8	50% N(PM) + 50% N(Urea)	5.23	5.75	5.33	0.15	0.18	0.15	16.64	15.60	15.60
T9	75% N(PM) + 25% N(Urea)	5.22	6.22	5.32	0.18	0.23	0.17	12.48	17.94	17.68
T10	25% N(GC) + 75% N(Urea)	5.17	5.60	5.23	0.14	0.19	0.11	12.61	14.82	14.69
T11	50% N(GC) + 50% N(Urea)	5.19	5.53	5.08	0.18	0.20	0.15	12.35	15.21	15.47
T12	75% N(GC) + 25% N(Urea)	5.13	5.51	5.23	0.18	0.16	0.11	10.14	14.30	15.21
T13	Absolute control	5.26	5.75	5.44	0.16	0.15	0.12	12.02	12.35	14.30
	SE ±	0.07	0.14	0.13	0.01	0.03	0.01	1.64	2.08	0.82
	C.D.(P=0.05)	NS	0.40	NS	NS	NS	NS	4.80	NS	NS

FYM- Farm yard manure. VC- Vermicompost. PM- Poultry manure, GC- Groundnut cake DAT- Days after transplanting.

Effect on soil Organic carbon

The data pertaining to OC of soil is given in Table 2. It was observed that at 30 DAT exhibits significant differences. Highest OC of soil (16.77g kg^{-1}) was recorded in treatment T_1 receiving 25 per cent N through FYM and 75 per cent N through urea. This can be attributed to the addition of organic manures, which increases organic carbon content of soil. At 60 DAT and at harvest, the OC of soil was not significantly affected due to the different treatment. Highest OC in soil (23.66 g kg^{-1}) was recorded in treatment T_5 receiving 50 per cent N through vermicompost and 50 per cent N through urea and T_9 receiving 75 per cent N through poultry manure and 25 per cent N through urea at 60 DAT and at harvest stage of crop respectively. Tambe *et. al.* (2015) [20], observed that the organic carbon content in soil was significantly increased when vermicompost was applied in combination with chemical fertilizer, cow-dung, urine slurry and other organic. Gupta *et al*. (1988) [7] observed that organic carbon content of soil increased up to 52 days at all levels of FYM application. Badole and More (2000) [3] and Islam *et al.* (2013) [9] observed that the organic carbon content was relatively higher with treatment receiving organic nutrient sources whereas lower

OC content was found with treatment receiving no organic sources. This might be due to the non-addition of organic matter with inorganic sources.

Conclusion

From the above investigation it could be proved that the application of 100 % RDN through different combination of poultry manure with urea (50 per cent through poultry manure and 50 per cent N through urea) was found to be the best treatments along with recommended dose of phosphorus and potassium in increasing yield (Stover and pod) of chilli, Var. Konkan Kirti as well as improving the soil chemical properties. Thus, it may be concluded that integrated nutrient management practice was found beneficial for sustaining soil health in terms of buildup of organic carbon and enhancing the crop yield.

References

1. Anonymous. Soils Research Bulletin-2. Konkan Krishi Vidyapeeth, Dapoli. 1990, 2.
2. Anonymous. Report of Indian Horticulture Database, crop-wise area, production and productivity of major spice crops in India during. 2013-2015; 14: 6-7.
3. Badole SB, More SD. Soil organic carbon status as influenced by organic and inorganic nutrient sources in Vertisol. *J.Maha. agric. Univ.* 2000; 25(2):220-222.
4. Basak RK, Lascar B, Goutam KD, Debnath NC. Effect of earthworm in soil fertility, Enviorn. Econ. 1990; 8(3):1065-1066.
5. Black CA. Method of Soil Analysis Part-II. *Am. Agron. Inc. Madison* Wisconsin, U.S.A. 1965; 1040-41:1374-75.
6. Chinnaswami KN. Madras Agric. J. 1967; 54:144-146.
7. Gupta AP, Anil RS, Narwal RP. Effect of FYM on organic carbon, N and P content of soil during different periods of wheat growth. J. Indian Soc, Soil. 1988; 36(2):269-273.
8. Heitkamp F, Raupp J, Ludwig B. Soil organic matter pools and crop yields as affected by the rate of farmyard manure and use of biodynamic preparations in a sandy soil. *Organic Agriculture* 2011; 1:11-124.
9. Islam MR, Chowdhury MAH, Saha BK, Hasan MM. Integrated nutrient management on soil fertility, growth and yield of Tomato. J. Bangladesh Agril. Univ. 2013; 11(1):33-40.
10. Jackson ML. Soil chemical analysis. Prentice Hall of India Pvt. Ltd., New Delhi. 1973, 134-182.
11. Kasture. Effect of phosphorous and sulphur on yield and uptake of nutrient by chilli (*Capsicum annuum* L.) on lateritic soils of Konkan. M. Sc. (Agri.) Thesis submitted to Dr. B. S. K. K. V., Dapoli. India (M. S). (Unpublished) 2001.
12. Kokare. Comparative efficacy of different fertilizer briquettes and organic manures on chilli (*Capsicum annuum* L. cv. Pusa Jwala) in lateritic soils of Konkan. M.Sc. (Agri.) Thesis submitted to D. B. S. K. K. V. Dapoli, Maharashtra, India. (Unpublished) 2013.
13. Maheswari TU, Haripriya K, Sivasakthivelan P. Studies on the efficacy of combined inoculation of different organic manures and azospirillum bio inoculant in solarized hot pepper nursery. Life Science Archives (LSA), 2015; 1(4):246-249.
14. Malewar GU, Syed I, Rudraksha GB. Integrated Nitrogen Management in chilli (*Capsicum annuum* L.). Bulletin of Indian Institute of Soil Science. 1998; 2:156-163.
15. Mujumdar SP, Meena RL, Baghel GDS. Effect of levels of compaction and Potassium on yield and quality of tomato and Chilli crops grown on highly permeable soils. J. Indian Soc. Soil Sci. 2000; 48(2):215-220.
16. Panse VG, Sukhatme PV. Statistical Methods of Agricultural Workers, ICAR Pub., New Delhi, 1961.
17. Pariari A, khan S. Integrated nutrient management of chilli (*Capsicum annuum* L.) in Gangetic alluvial plains. Journal of Crop and Weed. 2013; 9(2):128-130.
18. Saravanan A, Baskar M. Utilization of coirpith as potting medium for container grown tomato.Tamil Nadu Agril. Univ., Coimbatore, Personal Communication. 1996.
19. Shende SV. Response of gypsum and lime to Kharif groundnut (Arachis hypogaea L.) in lateritic soil of Konkan region. M.Sc. (Agri.) Thesis submitted to Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli. India (M. S). (Unpublished) 2010.
20. Tambe AJ, Dhawan AS, Gourkhede PH. Effect of Integrated Nutrient Management on Yield, Quality Improvement and Nutrient Uptake of Chilli. International Journal of Tropical Agriculture. 2015; 33(4):3777-3781.