Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 7 [12] January 2019 : 151-155

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.876
Universal Impact Factor 0.9804
NAAS Rating 4.95

ORIGINAL ARTICLE **OPEN ACCESS**

Residual effect of different organics on OC, DHA and Exchangeable Ca and Mg in soil after harvest of maize in rice fallow maize cropping system

Mohana Rao Puli[1], P.R.K. Prasad[2], P. Ravindra Babu[3], K.L. Narasimha Rao[4]and G.Subbaiah[5] M.Jayalakshmi[6]
1,2,3,4,5 Department of Soil Science and Agricultural Chemistry,
Agricultural College, Bapatla 6.Krishi vigyan Kendra, Banavasi
Acharya NG Ranga Agriculture University

ABSTRACT
A field experiment was conducted for two consecutive years (2011-2012 and 2012-2013) on fine texture soils of Agricultural college farm, Bapatla. The experiment was laidout in a randomized block design in kharif season with four treatments. The treatments consisted of M_1 (RDF - Control), M_2 (10t FYM ha^{-1} + RDF), M_3 (1.5t vermicompost ha^{-1} + RDF), M_4 (Green manuring + RDF).During the immediate rabi, the experiment was laid out in a split-plot design without disturbing the soil for succeeding maize with the four treatments given to kharif rice as main plot treatments and each of these divided into five sub-plots to receive five levels of fertilizer NPK application viz., N_1 - 75%NPK, N_2 - 100% NPK, N_3 - 125% NPK, N_4 - 150% NPK and N_5 - 175% NPK for succeeding maize. Data collected on OC, DHA and Exchangeable Ca and Mg after harvest of maize crop were significantly increasedwith the application of 100%NPK in combination with FYM @10t ha^{-1} to preceding rice crop, irrespective of the NPK levels applied to succeeding maize crop. However, it was on par with that of green manuring together with 100% NPK during both the years of the study.
Key words: FYM, green manuring, vermicompost, available NPK

Received 12.08.2018 Revised 22.10.2018 Accepted 06.11.2018

INTRODUCTION
Rice (*Oryza sativa* L.) and maize (*Zea mays* L.) are the most important food grain crops next only to wheat in world and in India. Among several management practices that affect soil quality, fertilizer application is of paramount importance for its role in growth and development of the crop. In intensive agriculture with high yielding varieties, crop yields have adverse affect on physical properties of soil such as bulk density, water holding capacity [9]. In spite of increased cost of fertilizer and their adverse affect on soil and environment the best alternative sources for plant nutrients to be explored to meet partial or full requirement of crop. Hence, it is time to pay serious attention to nutrient management. The integrated use of organic manures and inorganic fertilizers can help to maintain optimum crop yields and long term soil productivity. There is vast scope for increasing nutrient supply through use of organic manures and adoption of proper cropping system, which together can contribute significantly to the required nutrient pool.

MATERIAL AND METHODS
Experiment was conducted in the field number 49A and 49B of the Agricultural College Farm, Bapatla, during the years 2011-12 and 2012-13, respectively. Prior to preparatory cultivation of the experimental site, soil samples from 0 to 15 cm depth were collected at random and a composite soil sample during both the years was analyzed for different physico-chemical properties. The results of the soil analytical data indicated that the experimental soil is clay and sandy clay during first and second year, respectively in texture, slightly alkaline in reaction, low in organic carbon (0.52 and 0.50% during first and second year, respectively) and available nitrogen (175.6 and 159.8kg ha^{-1} during first and second year, respectively), and high in available phosphorus (95.3 and 93.9 kg P_2O_5 ha^{-1} during first and second year,

respectively) and potassium (960.0 and 925.6 kg K_2O ha^{-1} during first and second year, respectively). The experiment consisted of four treatments *viz.*, M_1 (RDF - Control), M_2 (10t FYM ha^{-1} + RDF), M_3 (1.5t vermicompost ha^{-1} + RDF), M_4 (Green manuring + RDF).

The experiment is laid out in RBD and replicated five times. The recommended fertilizer dose was applied as 160:40:40 kg N, P_2O_5 and K_2O ha^{-1}.During the immediate *rabi,* the experiment was laid out in a split-plot design without disturbing the soil for succeeding maize with the four treatments given to *kharif* rice as main plot treatments and each of these divided into five sub-plots to receive five levels of fertilizer NPK application *viz.*, N_1 - 75%NPK, N_2 - 100% NPK, N_3 - 125% NPK, N_4 - 150% NPK and N_5 - 175% NPK for succeeding maize. The experiment on rice - maize sequence as detailed above was repeated on a separate site but in the same block during *kharif* 2012 and *rabi* 2013, respectively. Popular cultivars of rice and maize, BPT – 5204 and 30 V 92, respectively, were used for the study.

FYM and vermicompost were added 7 days before transplanting of rice on dry weight basis. Dhaincha crop was raised with the seed rate of 60kg ha^{-1} in individual plots and it was incorporated 7 days before transplanting of rice as green manure at flowering stage. Nitrogen was applied in the form of DAP and remaining N was applied in the form of urea, in three equal splits, first split at 10 DAS, second split at knee high stage and third split at tasseling stage. Half dose of K and full dose of P was applied, in the form of MoP and DAP respectively, at 10 days after sowing. Remaining half dose of K was applied at tasseling stage. All fertilizers were applied in pocketing method as per the treatments.

Plot wise surface (0-15) soil sample were collected immediately after harvest of rice. The soil samples were air dried in shade, ground and screened through 2mm sieve and used for laboratory analysis. Soil reaction (pH) was measured by using glass electrode pH meter in 1:2.5 ratio of soil water suspension [6], Conductivity is measured with supernant liquid of 1:2.5 soil water suspensions by using electrical conductivity meter [6]. Organic carbon was estimated by Walkley and Black's method..

Available nitrogen was estimated by alkaline permanganate method by using macro Kjeldahl distillation unit [18]. Available phosphorus was extracted with Olsen's reagent [13], and estimated using spectrophotometer as described by Watanabe and Olsen [20]. Available potassium was extracted with neutral normal ammonium acetate and estimated with the help of flame photometer [6]. Exchangeable Ca and Mg were estimated by using EDTA method in the neutral normal ammonium acetate extract.

RESULTS AND DISCUSSION

Organic carbon

The data on post-harvest status of organic carbon in soil are presented in the table 1. The variations observed in the status of organic carbon after the completion of rice-maize sequence were consistent and significant during both the years of the study.

Irrespective of rate of NPK level applied to maize in the sequence, the organic carbon content of soil after harvest of maize was significantly higher following organic application together with 100% NPK than that of inorganics alone applied to preceding rice crop, during both the years of study. Main plot M_2 showed significantly higher organic carbon content over M_3 during both the years of study. This might be due to the direct incorporation of organic matter, better root growth and more plant residues addition [9, 5]. Singh *et al*. [16] reported buildup of organic carbon in the soil with combination of *Sesbania aculeate* and BGA applied to preceding rice over control.

Irrespective of nutrient management given to preceding rice, the status of organic carbon in soil after harvest of succeeding maize significantly increased with increasing level of NPK from 75 to 125% to succeeding maize during both the years of the study. From 125% NPK onwards it was on par by increasing each level up to 175% NPK. The soil organic carbon and the total nitrogen content of the soil were interrelated [4]. It was reported that the organic matter content of soil increased with increase in the levels of applied N, which in turn caused an increase in the total nitrogen content of the soil [3]. The increase in organic carbon content due to use of fertilizers could be attributed to higher contribution of biomass to the soil in the form of greater root biomass through crop stubbles and residues [5]. These results were in consonance with the findings of Jayaprakash *et al*. [7].

The mean highest OC was recorded in the treatment M_2 with 0.72 and 0.68% followed by M_4 with 0.69 and 0.63% during first and second year of the study. The interaction effect was also found statistically significant. The highest OC was recorded in the treatment M_2N_5 with 0.81 and 0.77% in 2012 and 2013, respectively. The higher residual effect of FYM on wheat yield possibly owed to increase in soil organic carbon and total N content of the soil [17]. Maskina *et al*. [12] reported significant increase in the organic carbon content of soil with the application of FYM. There was increase in soil organic carbon content with green manure or FYM application in rice-wheat cropping system [2, 1].

Dehydrogenase activity (DHA)

All the biological reactions in soil are catalysed by enzymes. Soil enzyme activities are believed to indicate the extent of specific processes in soil fertility evaluation. The activity of dehydrogenase enzyme was strongly affected by application of organics to preceding rice crop. The data on post-harvest status of DHA in soil are presented in the table 2. The data indicated that the variations observed in the status of DHA after the completion of rice-maize sequence were influenced significantly during both the years of the study.

Irrespective of rate of NPK level applied to maize in the sequence, the DHA of soil after harvest of maize was significantly increased with organic application together with 100% NPK than that of inorganic alone applied to preceding rice crop during both the years of study. Similar findings were reported by Kanwar *et al*. [8] and Verma and Mathur [19]. This might be due to increase in microbial growth with addition of organic carbon substrate [10]. Main plot M_2 (44.83 and 44.74μg TPF g^{-1} $24hr^{-1}$) showed significantly higher DHA content over M_3 (41.65 and 41.80μg TPF g^{-1} $24hr^{-1}$) during both the years of study. The FYM was superior in improving DHA as it stimulated microbial population. Being chief carbon source, it provided energy for soil microorganisms, and increased number of pores, which were considered important in soil-water-plant relationships and maintained good soil structure accompanied by better DHA [11].

Irrespective of nutrient management provided to preceding rice, the status of DHA in soil after harvest of succeeding maize progressively increased with increasing level of NPK from 75 to 175% to succeeding maize during both the years of study. These results were in agreement with the findings of Verma and Mathur [19] who reported gradual enhancement in the enzyme activity as fertilizer dosage increased from 100 to 150%. The mean highest DHA was recorded in the treatment N_5 with 44.71 and 44.06μg TPF g^{-1} hr^{-1} followed by N_4 with 44.09 and 43.45μg TPF g^{-1} hr^{-1}, which were on par with each other, during first and second year of the study. The interaction effect was found statistically significant. The highest value of DHA was recorded in the treatment M_2N_5 with 47.34 and 46.69μg TPF g^{-1} hr^{-1} in 2012 and 2013, respectively.

Exchangeable Ca

The data on post-harvest status of exchangeable Ca in soil are presented in the table 3. The variations observed in the status of exchangeable Ca after the completion of rice-maize sequence were consistent during both the years of the study.

Irrespective of rate of NPK level applied to maize in the sequence, the status of exchangeable Ca after harvest of maize was significantly higher following organic application together with 100% NPK than that of inorganic alone given to preceding rice crop during both the years of the study. All these organic treatments were on par with each other which received in preceding rice during both the years of study. The mean highest exchangeable Ca was recorded in the treatment M_4 with 34.00cmol (p+) kg^{-1} followed by M_2 with 33.35cmol (p+) kg^{-1} during first year of the study. During second year of the study it was recorded in the treatment M_2 with 32.04cmol (p+) kg^{-1} followed by M_4 with 31.74cmol (p+) kg^{-1}. These results were in accordance with the findings of Prasad and Singh [15] who reported that the application of FYM increased the levels of exchangeable Ca. Patiram and Singh [14] also reported an increase in the Ca status of the soil due to the continued application of manure.

Irrespective of nutrient management given to preceding rice, the status of exchangeable Ca in soil after harvest of succeeding maize increased with increasing level of NPK from 75 to 150% but not at significant level in 2012 whereas, it was increased significantly with increase every 50% NPK during second year of the study. The interaction effect was found statistically significant. The highest exchangeable Ca was recorded in the treatment M_4N_5 with 35.80cmol (p+) kg^{-1} followed by $M_4N_4$with 34.60cmol (p+) kg^{-1} during first year of the study. During second year of the study it was recorded in the treatment M_2N_5 with 34.07cmol (p+) kg^{-1} followed by $M_2N_4$with 33.73cmol (p+) kg^{-1}.

Exchangeable Mg

Irrespective of rate of NPK level applied to maize in the sequence, the status of exchangeable Mg after harvest of maize was significantly higher following organic application together with 100% NPK than that of inorganic alone given to preceding rice crop during both the years of study. All these organic treatments were on par except the maize grown on plots those received vermicompost @ 1.5t ha^{-1} in combination with 100% NPK in preceding *kharif* season, which was significantly lower to the treatment received 10t FYM ha^{-1} + 100% NPK given to preceding rice crop during first year of the study (Table 4). These results were in accordance with the findings of Prasad and Singh [15] who reported that the application of FYM increased the levels of exchangeable Mg. Patiram and Singh [14] also reported an increase in the Mg status of the soil due to the continued application of manure.

Irrespective of nutrient management given to preceding rice, the status of exchangeable Mg in soil after harvest of succeeding maize increased with increasing level of NPK from 75 to 175% to succeeding maize. The mean highest exchangeable Mg was recorded in the treatment M_2 with 7.34 and 6.25cmol (p+) kg^{-1} followed by M_4 with 6.88 and 6.08cmol (p+) kg^{-1} during first and second year of the study. The interaction effect was found statistically significant. The highest exchangeable Mg was recorded in the treatment M_2N_5 with 8.00 and 6.87cmol (p+) kg^{-1}followed by M_2N_4 with 7.87 and 6.80cmol (p+) kg^{-1} in 2012 and 2013, respectively.

Table 1. Influence of organics applied to preceding rice crop and NPK levels onorganic carbon content (%) of soil after harvest of maize.

NPK levels	2011-2012				Mean	2012-2013				Mean
	Organics applied to preceding rice crop					Organics applied to preceding rice crop				
	M1	M2	M3	M4		M1	M2	M3	M4	
N1-75% RDF	0.47	0.60	0.52	0.56	0.54	0.46	0.51	0.48	0.50	0.49
N2-100% RDF	0.52	0.65	0.62	0.60	0.60	0.52	0.64	0.57	0.60	0.58
N3-125% RDF	0.61	0.75	0.66	0.72	0.68	0.57	0.74	0.63	0.65	0.65
N4-150% RDF	0.64	0.78	0.69	0.76	0.72	0.60	0.76	0.65	0.67	0.67
N5-175% RDF	0.65	0.81	0.71	0.80	0.74	0.62	0.77	0.70	0.74	0.71
Mean	0.58	0.72	0.64	0.69	0.65	0.55	0.68	0.61	0.63	0.62
	SEm ±	CD (p=0.05)	CV (%)			SEm ±	CD (p=0.05)	CV (%)		
M	0.015	0.05	8.6			0.011	0.04	6.7		
N	0.013	0.04	6.9			0.014	0.04	7.8		
M x N Interaction										
N at same M	0.026	0.07				0.028	0.08			
M at same or diff. N level	0.027	0.06				0.027	0.06			

M_1- RDF (Control), M_2- FYM 10t ha^{-1} + RDF, M_3 - Vermicompost 1.5t ha^{-1} + RDF, M_4- Green manuring + RDF
M - Organics applied to preceding rice crop
N - Nutrient levels applied to maize crop

Table 2. Influence of organics applied to preceding rice crop and NPK levels onDHA (µg TPF g^{-1} $24h^{-1}$) of soil after harvest of maize.

NPK levels	2011-2012				Mean	2012-2013				Mean
	Organics applied to preceding rice crop					Organics applied to preceding rice crop				
	M1	M2	M3	M4		M1	M2	M3	M4	
N1-75% RDF	36.47	42.33	39.13	42.00	39.98	35.78	42.01	39.18	40.63	39.40
N2-100% RDF	38.19	43.16	40.98	42.56	41.22	37.00	43.84	40.99	42.52	41.09
N3-125% RDF	40.29	45.71	42.47	44.60	43.27	39.63	45.12	42.14	43.75	42.66
N4-150% RDF	41.90	45.62	42.90	45.94	44.09	41.54	46.06	42.91	43.29	43.45
N5-175% RDF	42.26	47.34	42.77	46.48	44.71	41.60	46.69	43.78	44.16	44.06
Mean	39.82	44.83	41.65	44.32	42.66	39.11	44.74	41.80	42.87	42.13
	SEm ±	CD (p=0.05)	CV (%)			SEm ±	CD (p=0.05)	CV (%)		
M	0.512	1.78	4.7			0.608	2.11	5.6		
N	0.674	1.92	5.4			0.623	1.80	5.1		
M x N Interaction										
N at same M	1.33	3.84				1.247	3.59			
M at same or diff. N level	1.30	2.66				1.270	2.62			

M_1- RDF (Control), M_2- FYM 10t ha^{-1} + RDF, M_3 - Vermicompost 1.5t ha^{-1} + RDF, M_4- Green manuring + RDF
M - Organics applied to preceding rice crop
N - Nutrient levels applied to maize rice crop

Table 3. Influence of organics applied to preceding rice crop and NPK levels on exchangeable calcium (cmol (p+) kg^{-1}) in soil after harvest of maize.

NPK levels	2011-2012				Mean	2012-2013				Mean
	Organics applied to preceding rice crop					Organics applied to preceding rice crop				
	M1	M2	M3	M4		M1	M2	M3	M4	
N1-75% RDF	28.20	32.27	33.27	32.18	31.48	27.87	29.53	29.23	29.80	29.11
N2-100% RDF	28.53	32.67	31.80	33.40	31.60	28.87	30.55	30.20	30.40	30.00
N3-125% RDF	29.17	33.63	32.40	34.00	32.30	29.20	32.33	32.23	31.43	31.30
N4-150% RDF	29.91	34.00	33.00	34.60	32.88	29.90	33.73	33.07	33.67	32.59
N5-175% RDF	30.04	34.17	33.13	35.80	33.28	30.90	34.07	33.30	33.40	32.92
Mean	29.17	33.35	32.72	34.00	32.31	29.35	32.04	31.61	31.74	31.18
	SEm ±	CD (p=0.05)	CV (%)			SEm ±	CD (p=0.05)	CV (%)		
M	0.733	2.53	8.8			0.444	1.54	5.5		
N	0.567	1.63	6.1			0.471	1.36	5.2		
M x N Interaction										
N at same M	1.133	3.26				0.942	2.71			
M at same or diff. N level	1.250	2.61				0.952	1.96			

M_1- RDF (Control), M_2- FYM 10t ha^{-1} + RDF, M_3 - Vermicompost 1.5t ha^{-1} + RDF, M_4- Green manuring + RDF
M - Organics applied to preceding rice crop
N - Nutrient levels applied to maize crop

Table 4.Influence of organics applied to preceding rice crop and NPK levels on exchangeable magnesium (cmol (p+) kg-1) in soil after harvest of maize.

NPK levels	2011-2012				Mean	2012-2013				Mean
	Organics applied to preceding rice crop					Organics applied to preceding rice crop				
	M1	M2	M3	M4		M1	M2	M3	M4	
N1-75% RDF	4.90	6.40	5.80	5.90	5.75	4.80	5.40	5.13	5.33	5.17
N2-100% RDF	5.43	6.60	6.07	6.20	6.08	5.20	5.80	5.67	5.67	5.58
N3-125% RDF	6.34	7.81	7.13	7.25	7.13	5.33	6.40	6.33	6.13	6.05
N4-150% RDF	6.62	7.87	7.23	7.50	7.31	5.73	6.80	6.13	6.60	6.32
N5-175% RDF	7.00	8.00	7.47	7.57	7.51	5.80	6.87	6.40	6.67	6.43
Mean	6.06	7.34	6.74	6.88	6.75	5.37	6.25	5.93	6.08	5.91
	SEm ±	CD (p=0.05)	CV (%)			SEm ±	CD (p=0.05)	CV (%)		
M	0.133	0.46	7.6			0.125	0.43	8.2		
N	0.121	0.35	6.2			0.146	0.42	8.6		
M x N Interaction										
N at same M	0.243	0.70				0.293	0.84			
M at same or diff. N level	0.255	0.53				0.290	0.60			

M_1- RDF (Control), M_2- FYM 10t ha^{-1} + RDF, M_3 - Vermicompost 1.5t ha^{-1} + RDF, M_4- Green manuring + RDF
M - Organics applied to preceding rice crop
N - Nutrient levels applied to maize crop

REFERENCES

1. Balvinderkumar, Gupta, R.K and Bhandari, A.L. (2008). Soil fertility changes after long-term application of organic manures and crop residues under rice-wheat system. *Journal of the Indian Society of Soil Science*, 56: 80-85.
2. Beri, V., Sidhu, B.S., Bahl, G.S and Bhat, A. K. (1995). Nitrogen and phosphorus transformations as affected by crop residue management practices and their influence on crop yield. *Soil Use Manage*, 11: 51-54.
3. Brar, S.P.S., Singh, S and Bembi, D.K. (1989). Effect of long-term application of N and P on crop yields, N uptake and soil N status in maize-wheat. *American Society of Agronomy Inc.*

4. Brownson, K.F., Zobeck, T.M, Chua T.T., Acosta, M.V., Scottvan, P.R and Booker, J.D. (2004). Carbon and Nitrogen Pools of Southern High Plains Cropland and Grassland Soils. *Soil Science Society of American Journal*, 68:1695–1704.
5. Gathala, M.K., Kanthaliya, P.C., Arvind, V and Chahar, M.S. (2007). Effect of integrated nutrient management on soil properties and humus fractions in the long-term fertilizer experiments. *Journal of Indian Society of Soil Science*, 55(3): 360-363.
6. Jackson, M.L. (1973). *Soil chemical analysis*. Prentice Hall of India Private Ltd., New Delhi : 134-182.
7. Jayaprakash, T.C., Nagalikar, V.P., Pujari, B.T and Setty, R.A. (2004). Effect of organics and inorganics on soil properties and available nutrient status of soil after harvest of maize crop under irrigation. *Karnataka Journal of Agricultural Sciences*, 17(2): 327-329.
8. Kanwar, S.S., Sharma, S.P., Mahajan, S., Gupta, M.K and Rajeevkumar. (2006). Long term effects of chemical fertilizers and amendments on soil enzymes in acidic soils of western Himalayas. *Balanced fertilization for sustainable crop production*, 173-174.
9. Kumar, A and Yadav, D.S. (1993). Effect of long-term fertilization on soil fertility and yield under rice-wheat cropping system. *Journal of the Indian Society of Soil Science*, 41: 178-180.
10. Manna, M.C., Kundu, S., Singh, M and Takkar, P.N. (1996). Influence of FYM on dynamics of microbial biomass of its turnover and activity of enzymes under soybean wheat system in a Typic Haplustert. *Journal of Indian Society of soil Science*, 44: 409-412.
11. Marinari, S., Masciandara, G., Ceccanti, B and Grego, S.(2000). Influence of organic and mineral fertilizers on soil biological and physical properties. *Bio resource Technology*, 72: 9-17.
12. Maskina, M.S., Singh, B. Singh, Y and O.P. Meelu. (1988). Fertilizer requirement of rice-wheat and maize-wheat rotations on coarse-textured soils amended with farm yard manure. *Fertilizer Research*, 17:153–164.
13. Olsen, S.R., Code, C.L., Watanable, F.S and Dean, L.A. (1954). Estimation of available phosphorus in soils by extraction with sodium bicarbonate. United States Development Agency Circular Number 939.
14. Patiram and Singh, K.A. (1993). Effect of continuous application of manure and nitrogen fertilizer on some properties of acid Inceptisol. *Journal of the Indian Society of Soil Science*, 41: 430-423.
15. Prasad, B and Singh, R.P. (1981). Accumulation and decline of available nutrients with long-term use of fertilizers, manure and lime on multiple cropped lands. *Indian Journal of Agricultural Sciences*, 51: 108-111.
16. Singh, S., Singh, R.N., Prasad, J and Kumar, B. 2002. Effect of green manuring, FYM and biofertilizer in relation to fertilizer nitrogen on yield and major nutrient uptake by upland rice. *Journal of the Indian Society of Soil Science.* 50(3): 313-314.
17. Singh, Y., Singh, B., Meelu, O.P and Khind, C.S. (2000b). Long-term effects of organic manuring and crop residues on the productivity and sustainability of rice-wheat cropping system in northwest India. Page 149-162 in long-term soil fertility experiments in rice-wheat cropping systems (Abrol, I.P., Bronson, K. F., Duxbury, J. M. and Gupta, R. K. eds.). Rice - Wheat Consortium Paper Series 6. New Delhi, India: Rice-Wheat Consortium for the Indo-Gangetic Plains.
18. Subbiah, B.V and Asija, C.L. (1956). A rapid procedure for the estimation of available nitrogen in soils. *Current Science.* 25: 259-260.
19. Verma, G and Mathur, A.K. (2009). Effect of integrated nutrient management on active pools of soil organic matter under maize-wheat system of a Typic Haplustept. *Journal of Indian Society of soil Science*, 7(3): 317-322.
20. Watanabe, F.S. and Olsen, S.R. (1965). Test of ascorbic acid method fordetermining phosphorous in water and sodium bicarbonate extracts of soil.*Soil Science Society of American Journal*. 29:677-78.

CITATION OF THIS ARTICLE

Mohana Rao Puli, P.R.K. Prasad, P. Ravindra Babu, K.L. Narasimha Rao and G.Subbaiah M.Jayalakshmi. Residual effect of different organics on OC, DHA and Exchangeable Ca and Mg in soil after harvest of maize in rice fallow maize cropping system. Bull. Env. Pharmacol. Life Sci., Vol 7 [12] November 2018: 160-165