Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(3): 816-818
Received: 06-03-2018
Accepted: 10-04-2018

Manoj Kumar
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh, India

VM Praasad
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh, India

Devi Singh
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh, India

Correspondence
Manoj Kumar
Department of Horticulture, Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh, India

Soil properties improvement in developing litchi (*Litchi chinensis* Sonn) orchard through optimum nutrient supply system

Manoj Kumar, VM Praasad and Devi Singh

Abstract
Physico-chemical properties and soil biologia are the life line of soils. It is the microbial population and its role in crop production give soil on adjective of living substance. Application of organic manure either as a full dose or half dose caused CEC (85.25me/100g soil) and organic carbon (0.76%) percentage to increase from the initial values of 0.75me/100g soil and 0.54%, respectively. Available potash content, however, was a bit higher in treatment receiving full dose in inorganic form. Water holding capacity (20.63%) and mean wet diameter (8.46mm) were the highest and electrical conductivity was the lowest (0.31mmhos/dsm) in the treatment receiving 100% nutrition in organic manure form as against corresponding initial values of 17.8%, 4.65mm and 0.34 mmhos/dsm. Microbial population too were the maximum in plots supplicated with 100% nutrition in organic form. In this treatment population of bacteria, fungi and actinomyceties were found $8.53x10^6$, $3.82x10^5$, and $8.03\ X10^5$ against initial value of $69x10^6$, $2.8x10^5$ and $6.2x10^5$.

Keywords: mucilaginous, nutrient supply system, colloid, physical property, chemical property

Introduction
Grower invariably overlook importance of soil management and up keep of nutrients status which entails heavily upon fruiting and quality of fruits, this is true also with litchi orchards. This discrepancy on the part of grower's results into alternate bearing reduced fruiting and undesirable fruit qualities.
Litchi (*Litchi chinensis* Sonn.) primarily a fruit crop of subtropics belong to the family Sapindaceae. It is believed to have originated somewhere to southern China, northern Vietnam and Malaysia. China may be having the maximum acreage under litchi cultivation in the world (5,30000 ha) as against only 56200 ha in India, but the productivity of litchi in India is maximum as reflected in its production of 42,9000 tonnes against that of 95,0000 tonnes in China from almost 10 times acreage (Ghosh, 2000) [1]. In India too both the productivity as well as the quality in the calcareous region of Ganga basin is unparalleled. This is reflected in the fact that most of the export of Litchi from India is to the litchi growing countries itself. The best climatic condition and suitability of soils for litchi cultivation in the world has been to observed in the well-drained calcareous soils of North Bihar. This leaves an unanswered question about calcium requirement of litchi plants for the optimum growth and development as well as fruiting too.
The role of organic manure in augmenting soil health in terms of not only physical and chemical properties of soils part for its impact on soil biologia too. Hence it is not only the fertility which is important for growth and development of plants, but productivity factors which take care of optimum, nutrient supply system is quality important. Thus, it is imperative to work out rate of both organic and inorganic in isolation as well as in their combination. In most of the important litchi growing tracts of the world a litchi plant has to pass varied climatic conditions extending from intense winter to hot desiccating summer season. This amply suggests that the developing plant will need variable nutrition at varied junctions and phases of climatic changes.

Materials and Methods
The experiment was conducted in split plot design having three replications. The two varieties Purvi (V_1) and Early Bedana (V_2) were placed in the main plot while to treatments pertaining to lime supply system C_1 (No slacked lime) and C_2 (2 kg slacked lime per tree per annum) were allocated to sub plot. Nutrition supply system was the most important factor put in to sub- sub plot where in there were three treatments i.e. F_1 (100% organic source through FYM), F_2 (50:50 organo-inorganic ratio) and F_3 (100% inorganic fertilizers). FYM, P_2O_5 and

slacked lime were applied only once in July, whereas, nitrogen and K_2O were applied in two equal doses in July and March. The doses were doubled in the second year. A nutrient supply schedule has been given in Table-1.

Table 1: Fertilizer Schedule 1st Year

Treatments	Dose for plant										
Sources	Organic Source (in kg)		Inorganic source (in g)								
Time of application	July	March	July			March			Total		
Sources	FYM	FYM	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
F_1	20	-	-	-	-	-	-	-	-	-	-
F_2	10	-	25	25	20	25	-	20	50	25	40
F_3	-	-	50	50	40	50	-	40	100	50	80

2nd Year

Treatments	Dose for plant										
Sources	Organic Source (in kg)		Inorganic source (in g)								
Time of application	July	March	July			March			Total		
Sources	FYM	FYM	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
F_1	40	-	-	-	-	-	-	-	-	-	-
F_2	20	-	50	50	40	50	-	40	100	50	80
F_3	-	-	100	100	80	100	-	80	200	100	160

Three samplings were planted in each sub-sub plot thus making a total of 108 plants.

The soil of the experimental plot was sandy loam in texture, with soil reaction in neutral range (pH-7.6). As per initial studies organic carbon was 0.54, CEC-75 me/mg soil, electrical conductivity-0.34 mmhos/dsm, available N-292 kg /ha, available P_2O_5-32.6 kg/ha and available K_2O-196 kg/ha.

The biological studies indicated that the soil had 6.96 x 10^6 bacteria, 2.8 x 10^5 fungi and 6.2 x 10^5 actinomycitis per g of soil.

Results and Discussion

Chemical properties (Table-2) as affected by treatments investigated reflected that varieties (v) and lime application (c) did not affect CEC, OC. (%), and available N, P_2O_5, K_2O significantly. Sources of nutrition however, affected all the characters significantly. CEC and OC. (%) were significantly, the highest (CEC and OC %) in plots getting 100% nutrients in organic farm yard manure (FYM). It had 85.25 me/100 soil CEC and 0.76% organic carbon. The treatment next in order was F_2 (50:50 organo-inorganic combination). The treatment F_3 receiving 100% nutrients in inorganic form had the least (66.75 me/100 g soil CEC and 0.53% OC) values. Nitrogen and P_2O_5 were also not affected significantly by nutritional treatment however, available K_2O was the maximum in F_3 (210.09 kg/ha) while F_1 and F_2 had statistical parity.

Table 2: Chemical properties of soil as affected by varieties, calcium and sources of nutrition (After completion of experiment)

Treatments	Cation Exchange Capacity	Organic Carbon (%)	Available N (kg/ha)	Available P_2O_5 (kg/ha)	Available K_2O (kg/ha)
Main plot (Variety)					
V_1-Purabi	76.00	0.65	2.95	33.08	202.31
V_2-Early Bedana	75.67	0.65	2.92	32.97	201.97
SE M ±	0.79	0.00	0.02	0.33	1.58
CD at 5%	NS	NS	NS	NS	NS
Sub-plot (Calcium)					
C_1-No slacked lime	76.00	64.5	2.93	33.05	202.31
C_2-2 kg slacked lime per plant per yr.	76.17	65.0	2.94	33.00	202.48
SE m ±	0.50	0.00	0.02	0.25	1.62
CD at 5%	NS	NS	NS	NS	NS
Sub-sub plot (Fertilizers)					
F_1-100% organic Source (FYM)	85.25	0.76	2.90	32.88	194.02
F_2-50% Organic + 50% Inorganic	75.50	0.66	2.94	32.88	200.31
F_3-100% Inorganic	66.75	0.53	2.97	33.33	210.09
SE m ±	1.20	0.01	0.05	0.46	4.52
CD at 5%	2.56	0.02	NS	NS	9.58

As regards physical properties of soil (Table-3) the water holding capacity was affected significantly by sources of nutrition but not due to varieties and lime applications. The maximum water holding capacity of 20.63% was in F_1 getting 100% nutrition in organic form. The treatment next in order was F_2 (18.83%) receiving organo -inorganic sources in equal proportion. The least water holding capacity (17.30%) was recorded in soil which 90% full nutrition only in inorganic form F_3 plots getting 2kg slacked lime per plant per annum had 0.35 mmhos/dsm electrical conductivity as against 0.32 mmhos/dsm under control. Electrical conductivity was higher (0.36mmhos/dsm) in plots getting 100% nutrition in inorganic form. Whereas it was the least (0.3 mmhos/dsm) in soils receiving 100% nutrition only in organic form. Mean wet diameter (mm) indicating water stalk soil aggregates were higher in soils receiving slacked lime (6.59mm) as against 4.87mm under control. Amongst the nutritional supply system the soils supplicated with 100% nutrition in organic form the mean wet diameter was significantly highest (8.46mm) followed in descending order by 50:50 organo-inorganic nutrition (7.05mm) and 100% inorganic form (4.13m

Table 3: Physical Properties of soil as affected by Varieties, Calcium and Sources of Nutrition (After completion of experiment)

Treatments	Water holding capacity (%)	Electrical Conductivity	Mean Wet diameter (mm)
Main plot (Variety)			
V_1-Purabi	18.97	0.33	5.62
V_2-Early Bedana	18.87	0.34	5.78
SE M ±	0.01	0.01	0.15
CD at 5%	NS	NS	NS
Sub-plot (Calcium)			
C_1-No slacked lime	19.34	0.32	4.87
C_2-2 kg slacked lime per plant per yr.	19.00	0.35	6.59
SE m ±	0.00	0.01	0.28
CD at 5%	NS	0.02	0.65
Sub-sub plot (Fertilizers)			
F_1-100% organic Source (FYM)	20.63	0.31	8.46
F_2-50% Organic + 50% Inorganic	18.83	0.35	7.05
F_3-100% Inorganic	17.30	0.36	4.13
SE m ±	0.29	0.00	0.45
CD at 5%	0.60	0.01	1.02

Microorganism population (Table-4) was not affected due to varieties. But, lime application and mode of nutrition played significant role in augmenting microbial population. Application of slaked lime caused increase in number of bacteria (8.04×10^6), fungi (3.46×10^5) and actinomycetes (7.05×10^5). The corresponding values for control were 7.40×10^6, 2.96×10^5 and 6.23×10^5, respectively. The application of FYM as nutrition directly appeared responsible for microbial population as reflected in higher values for higher doses of FYM applied F_1 (100% organic sources) had significantly the highest values for population of bacteria (8.53×10^6), Fungi (3.87×10^5) and actinomycetis (8.03×10^5). While the least corresponding values for bacteria (6.45×10^6), fungi (1.58×10^5) and actinemycetes (4.88×10^5) were noted for the treatment receiving 100% nutrients through inorganic sources. The treatment getting organic and inorganic sources in to 50:50 ratio had in between values of microbial populations.

Fine sand particles i.e. colloides flock or group together due to cohesion and form clusters. Sand and Silt particles stick to the clay clusters, thus forming an aggregate, Sand and silt particles with a coating of colloidal clay are bound together in to aggregates due to sticky nature of clay particles (Reddy and Reddy, 2006) [6]. Organic components such as cellulose substances on decomposition release sticky materials resembling mucus or mucilage. The humic and fulvic acids produced during decomposition of organic matter are also sticky in nature and help in aggregate formation colloidal organic matter is more effective in forming aggregates than clay (Biswas and Mukherjee, 2000, Havelin *et al.* 2013) [2, 3]. Population and activities of microflora depend on soil physical and chemical environment. Soil moisture is the most important factor in deciding the type of microorganism present in soil (Bracly and will, 2005 Yawalkar *et al.* 2012 and Havlin *et al*. 2013) [5, 4, 3].

Table 4: Biological Properties of soil as affected by Varieties, Calcium and Sources of Nutrition (After completion of experiment)

Treatments	No. of Bacteria (10^6)	No. of Fungi (10^5)	No. of Actinomycets (10^5)
Main plot (Variety)			
V_1-Purabi	7.48	2.68	6.38
V_2-Early Bedana	7.45	2.75	6.50
SE M ±	0.06	0.02	0.08
CD at 5%	NS	NS	NS
Sub-plot (Calcium)			
C_1-No slacked lime	7.40	2.96	6.23
C_2-2 kg slacked lime per plant per yr.	8.04	3.46	7.05
SE m ±	0.08	0.02	0.06
CD at 5%	0.36	0.07	0.27
Sub-sub plot (Fertilizers)			
F_1-100% organic Source (FYM)	8.53	3.83	8.03
F_2-50% Organic + 50% Inorganic	7.43	2.75	6.43
F_3-100% Inorganic	6.45	1.58	4.88
SE m ±	0.16	0.06	0.15
CD at 5%	0.34	0.12	0.31

References

1. Ghosh SP. world trade in litchi: past, present and future. Abst: 1st international symposium on litchi and longan, Guangzhou, china, 2000, 16.
2. Biswas TD, Mukherjes SK. Text book of soil science, Tata Mc Graw-Hill publishing company limited, New Delhi, 2000.
3. John Havlin L, Samucl Tisdale L, Werner Nelson L, James Beaton D. soil fertility and fertilizers, pearson education dorling kindersly, 2013.
4. Yawalkar KL, Agarwal Bokdes JP. Manures and fertilizers, Agri-horticultural pub. House, 2012.
5. Bracly NC, Ray will. Nature and properties of soils, saurabh printers private Ltd. ND, 2005.
6. Reddy TY, Sankra Reddy GH. Principle of agronomy, Kalyani Publication, 2006.