NUTRIENT RICH POTTING MIXTURE FOR TERRACE GARDENING

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Abstract: Terrace gardening is becoming more popular among public to grow their own greens and vegetables free of pesticide residues. The basic requirements for the terrace gardening was good light weight potting medium to support the plants for longer period of time without changing the potting medium. An attempt has been made to prepare nutrient rich potting mixture for terrace gardening by utilizing agro industrial waste material. The agro industrial waste material, viz; press mud, coirdust, vermiculite (mining waste) and vermicompost have been used for preparing the potting medium. Different combination of these materials were tried and the experiment was carried out inthe Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore during 2013-15.The experimental results revealed that the bulk density and particle density of the selected potting mixture was 0.6 and 1.33Mg m^{-3} respectively. It has a pore space of 54.00 per cent with a total N, P and K contents of12.04, 3.71 and 1.50per cent, respectively.The maximum yield attributes of tomato (fruit set, fruit volume, fruit firmness, fruit yield) was evidently found better in the consortium T5 (36.5 percent, 30.83 cm2, 1.55 mm, 920.61 /Plant/bag (g)).

Key words: Tomato, Growing medium, Composted pressmud, Coir dust compost Vermicompost.

Introduction: Terrace gardens are becoming a common feature in today's urban environment. The phenomenon of landscaping on the terraces and rooftops has evolved due to excessive exploitation of the urban land. In such congested environment, rooftops and terraces of buildings provides a valuable potential sources for urban horticulture (Narkhede, 2009).The scope and potential for recycling a variety of agro based industrial wastes as a resource for urban horticulture is vast by any standards. Waste recycling can bring tremendous benefits to urban horticulture and land management in long run. Proper recycling produces a number of gains such as supplying essential plant nutrients, improving physical properties, reducing their accumulation at or near the sites of production and reducing health hazard and enhancing environmental quality (Tandon, 1995). Advantages of using soilless media for terrace gardening in urban horticulture will drain excess water, which greatly reduces the opportunity for soil borne diseases which also reduces the ability to hold onto fertilizer. A mixture of Press mud, Coirpith, Vermiculite, compost or organic fertilizers can provide a suitable environment with sufficient water-holding capacity, nutrient content, and aeration for plant growth and development.

Material and methods: The present investigation was carried out at Department of Environmental Sciences, TNAU, Coimbatore during 2013-15.The potting mixture was prepared by using the substrates like soil, sand, FYM, composted press mud, coir pith compost, vermicompost and vermiculite. The value addition was done with cotton seed cake, groundnut cake, rock phosphate, *Azospirilium* and *Phosphobacteria.*Pressmud compost was collected from Bannari Amman sugars Ltd in Sathyamanalam, Erode district and *Azospirilium, Phosphobacteria* and vermicompost, Farm Yard Manure manure obtained from department of microbiology and central farm in TNAU, Coimatore. Vermiculite was collected from (TAMIN) Tamil Nadu Minerals Limited, Chennai. Coir dust compost collected from local farmer's fieldat Coimbatore. The above materials were collected and mixed in different combinations. The standardized nutrient rich potting mixture has been tested for suitability for improved growth, quality and yield.Tomato is used as test crop for the study. The experiment was laid out in a Completely Randomized design (CRD) with five treatments and four replications.

The details of the treatments are presented below.

T_1. Soil alone

T_2. Soil + sand + compost (2:1:1)

T_3. Press mud : Coir dust: Vermicompost(1:1:2)

T_4. Press mud: Coir dust: Vermicompost : Vermiculite (1:1:2:1)

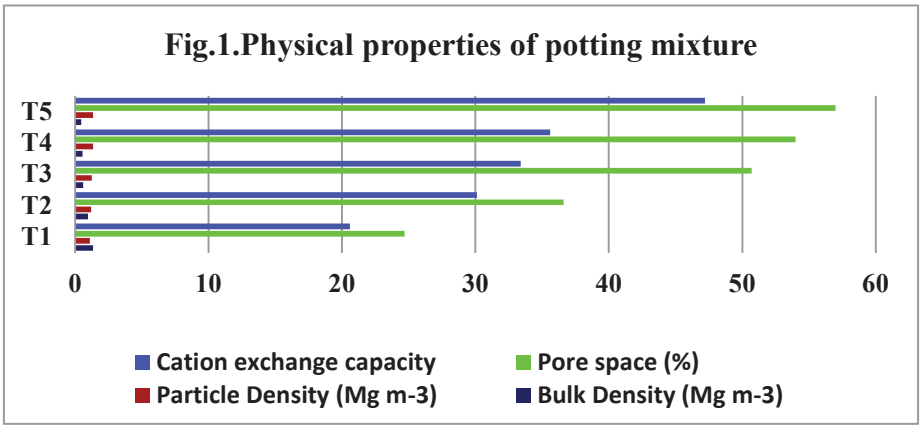
T_5.T_4 + value addition (Value addition of potting mixture with cotton seed cake, groundnut cake, rock phosphate (1.6% w/w basis) together with*Azospirilium* and *Phosphobacterial biofertilizers* @ 0.1% w/w basis)

(T_1 - T_4: Remaining dosage of N, P &K supplied through inorganic fertilizers).

Results and Discussion: Physical and chemical properties such as pH, EC, total organic carbon, total nitrogen, phosphorus, potassium, calcium, magnesium and microbial population were analyzed by standard methods and characteristics ofpotting mixture are presented in Table.1.

Physical Properties of potting mixture: The potting mixture had a bulk density of 0.60 Mg m^{-3}.The per cent increase of bulk density content over the control was 54 (Table.1).Smith (1999) reported that the bulk density and particle density were lowered with the addition of coir pith due to increase in pore space and lighter weight of the particles. The pore

space of potting mixture was 54 percent. The increase in pore space over the control was 50 percent.Percentage of pore space and the proportion and amount of water and air that are present in the pore space in a particular media is an important criterion(Table.1). The total pore space was improved by addition of coir pith in the potting medium and total pore space of coir pith was found to be 80 per cent (Baskar and Saravanan, 1997). Cation exchange capacity of potting mixture is 47.2. About 36 per cent increase was observed under control.CEC is an important chemical property which influences cation movement in soils such as Ca_2^+, Mg_2^+, K^+, NH_4^+, Na^+ and most trace elements (Table.1). Saravanan and Nambisan (1995) reported that the medium with Coirpith: Forest leaf mould: Sand (60:20:20 and 50:25:25 V/V) had high CEC (20-22.7 meq. 100 per g). According to Giaustiniani and Testi (1982), pumice has the influence of Cation exchange capacity.



Chemical Properties of potting mixture: Potting mixture was neutral in pH (7.18) and The pH value of 7.39 was recorded in control (T_1)(Table.1).Baskar and Saravanan (1997) reported that the pH of the medium was considerably reduced by the addition of coirpith. Abad *et al.,* (2002) reported that the pH of coir dust was slightly acidic and found to be 5.60. Most of the foliage plants like a mild acidic pH falling below 5.5 and 6.5 exceptions include the prayer plant (Maranta) and ferns. The electrical conductivity of normal potting mixture was 0.30 and the nutrient rich potting mixture had 0.56 dS m^{-1}.Electrical conductivity is the measure of the soluble salt content in a growing media (Table.1).Goh and Haynes (1977) stated that saw dust medium had the lowest soluble salt concentration. According to Clarkson *et al.,* (1983), addition of coir pith lowered the EC from 3.2 to 0.7 dSm^{-1} in saline alkaline soil.

Nutrient properties of potting mixture: The N,P and Kcontents of the nutrient rich potting mixture were 12.04, 3.71 and 1.50 per cent respectively.The per cent increase of N, P and K content over the control was 92, 81 and 80 per cent respectively (Table.1).

The favourable effects of organic addition on processes such as mineralization and immobilization of nitrogen and its availability has been reported by Purnaik *et al.*, (1978). Lamaire and Dartigues (1985) stated that there was an increase in nitrogen content of the medium when the proportion of spent mushroom was increased in the peat medium. The influence of coir pith both as raw and composed, on the available soil nitrogen was reported by Lavanya (1996).

The phosphorus content of various media (peat, composted cattle manure and their mixtures) were analysed and cattle manure had the highest phosphorus content of 125 mg per g (Chen *et al.*, 1988).Robbins *et al.,* (1986) observed that under pot culture conditions, mushroom spent compost enhanced the potassium content even after three years. A positive influence of organics on potassium availability was reported by Savithri and Hameed Khan (1994). The copper, zinc, iron and manganese contents of nutrient rich potting mixture was 63.50, 115.9, 324.3 and 120.5 mg kg^{-1}, respectively(Table.1). Bunt (1988) used peat, pine, spruce and Hardwood substrates and concluded that peat and pine substrates had high initial ammonium content that was partially nitrificated. According to Baskar and Saravanan (1997), micronutrient content (Fe, Mn, Zn and Cu) of the coirpith based medium were higher than that of the pure soil medium.

Table .1.Initial characteristics of potting mixture						
S.No	**Parameters**	**T1**	**T 2**	**T 3**	**T 4**	**T 4**
a).Physical Properties						
1.	Bulk Density (Mg m^{-3})	1.33	0.95	0.55	0.44	0.60
2.	Particle Density (Mg m^{-3})	1.10	1.20	1.25	1.33	1.33
3.	Pore space (%)	24.70	36.60	50.70	54.00	57.0
4.	Cation exchange capacity	20.6	30.1	33.4	35.6	47.2
b).Chemical Properties						
5.	pH	7.76	7.59	7.34	7.18	7.18
6.	EC (dS m -1)	0.68	0.30	1.06	0.96	0.56
7.	Organic carbon (%)	5.00	7.44	15.59	14.53	24.53
8.	Total N (%)	0.95	1.10	2.95	3.07	12.04
9.	C/N ratio	5.26	6.76	5.28	4.73	2.03
10.	Total P (%)	0.68	0.96	2.32	2.44	3.71
11.	Total K (%)	0.30	0.90	1.58	1.66	1.50
12.	Total Calcium (%)	0.08	0.05	0.29	0.35	0.48
13.	Total Magnesium (%)	0.09	0.04	0.15	0.17	0.25
14.	Sodium (%)	0.06	0.06	0.16	0.19	0.60
15.	Copper (mg kg -1)	11.34	22.42	40.90	39.67	63.50
16.	Zinc (mg kg -1)	40.25	87.50	95.34	89.45	115.9
17.	Iron (mg kg -1)	98.67	253.9	280.9	278.3	324.3
18.	Manganese (mg kg)	40.20	95.20	108.4	105.2	120.5
C). Biological properties						
19.	Bacteri a (x10^6 CFU g-1)	25	21	25	22	32
20.	Fungi (x10^4 CFU g-1)	18	11	14	12	17
21.	Actinomycetes (x10^3 CFU g-1)	9	3	5	4	9

Growth and yield parameters of tomato: Among the different combination of growing medium studied, T_4 + value addition(T5) recorded maximum plant height at all the stages of the crop growth (95.5 cm).The yield attributes of tomato (fruit set, fruit volume, fruit firmness, fruit yield) was evidently found better in the consortium T5 (36.5 percent, 30.83 cm2, 1.55 mm, 920.61 /Plant/bag (g)) Table.2. This can be attributed to the T5 treatment contains composted pressmud, coir dust compost, vermicompost, vermiculite and concentrated manures along with microbial consortia which presents the nutrients in available form to put forth luxuriant growth thereby helping the plants to produce more photosynthates in order to produce higher fruit yields.

Fig.2.Effect of potting mixture under different treatments for growth tomato

Fig .3. Effect of potting mixture on yield of tomato crop

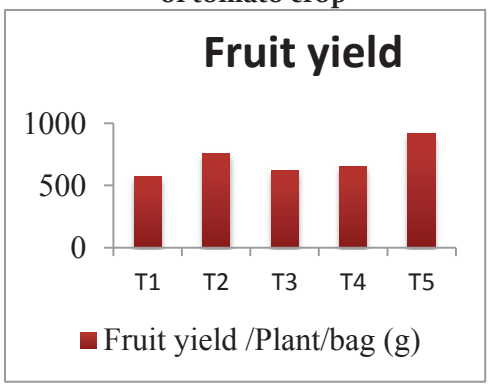


Table .2. Yield parameters of tomato				
Treatments	**Fruit set (percent)**	**Fruit volume(cm^3)**	**Fruit firmness(mm)**	**Fruit yield /Plant/bag (g)**
T_1	20.9	19.13	1.10	575.82
T_2	32.6	23.97	1.33	760.25
T_3	28.3	20.93	1.21	625.34
T_4	30.9	21.77	1.28	656.58
T_5	36.5	30.83	1.55	920.61
Mean	**29.8**	**23.3**	**1.29**	**707.72**

Conclusion: Among various treatments, Composted Pressmud+ Coirdust compost + Vermicompost + Vermiculite+ Concentrated cake and microbial consortia (T5) showed improved plant growth, number of branches and improved fruit yield and quality aspects. It was observed that T5 fulfills the sufficient nutrients i.e., nitrogen, phosphorus and and potassium. The substrate individually did not perform like their mixtures. Thus it is suggested that T5 (Composted Pressmud+ Coirdust compost + Vermicompost + Vermiculite+ Concentrated cake and microbial consortia) may be further exploited as a standard substrate for tomato to maintain best growth and yield under protected conditions.

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