International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(6): 388-390

Received: 20-09-2020
Accepted: 25-10-2020

S Sheeba
Horticultural College and Research Institute, Trichy, Tamil Nadu, Tamil Nadu Agricultural University, Tamil Nadu, India

Akshara Rakesh
Horticultural College and Research Institute, Trichy, Tamil Nadu, Tamil Nadu Agricultural University, Tamil Nadu, India

Corresponding Author:
S Sheeba
Horticultural College and Research Institute, Trichy, Tamil Nadu, Tamil Nadu Agricultural University, Tamil Nadu, India

Evaluation of fly ash as a constituent of pot mixture

S Sheeba and Akshara Rakesh

DOI: https://doi.org/10.22271/chemi.2020.v8.i6f.10798

Abstract
Fly ash mixed with farmyard manure, vermicompost, sand and red soil in different ratios on a w/w basis was used for growing tomato, chilli, marigold, celosia and papaya. The response of pot mixture on germination, growth and development of these crops. The results indicated that the fly ash based pot mix showed positive influence in enhancing different growth parameters. In generalthe treatment T_{11} 1:3 fly ash: vermicompost and treatment T_6 fly ash: farmyard manure in 1:3 ratio recorded the highest germination percentage, maximum plant height and vigour index. Fly ash based organic substrate pot mixtures benefits increase in plant growth which in turn attains significance from the point of view of production of cost efficient pot mix.

Keywords: Pot mixture, Fly, sand and red

Introduction
Fly ash has been found to be good soil ameliorant as well as a source of nutrients. The fly ash contains higher concentration of essential plant nutrients like Ca, K Mo, Zn and B but a low content of available N; therefore, flyash can be applied to agriculture or forestry fields accompanied with supply of nitrogen. In general fly ash particles are spherical and have a size distribution with medium around 4 µm (Srivastav *et al.* 20007). Fly ash has usually high surface area and light texture due to presence of large, porous and carbonaceous particles. Chemically, 90-99% of flyash is comprised of Si, Al, Fe, Ca, Mg and Na & K with Si & Al forming the major matrix identified in fly ash and oxidation of C & N during combustion drastically reduces their quantity in ash. Fly ash application to sandy soil could permanently alter soil texture, increase micro porosity and improve the water holding capacity.Flyash may be used in forestry and agricultural lands as a soil stabilizer; because of presence of several natural elements and being alkaline, application of flyash on lands has a marked effect on physico-chemical properties of soil from the point of view of crop production. It is easily available and lesser in cost compared to usual components (Red soil: Sand: FYM) of pot mixture. Cost involved in buying raw material can be reduced to a greater extend if soil is replaced by fly ash as cost of red soil is twenty times that of fly ash. Thus fly ash can be utilized in potting mixture by replacing soil.

Materials and methods
Fly ash was collected from Neyveli Lignite Corporation India Limited, Neyveli, Tamil Nadu. The Ph of fly ash and soil used in the study was 7.5 and 5.02 respectively. The chemical properties of fly ash and soil used in the study are presented in the Table 1. pot mixtures were prepared with fly ash, sand, red soil, FYM and VC. The fly ash was mixed with FYM, VC, red soil and sand on w/w basis in different proportions FA+FYM and FA+VC in 1:1, 1:1,1:2,1:2,1:3,1:3, 2:1,2:1, 3:1, 3:1 ratios FA+S and +FYM, FA+S and +VC and Soil+S and +FYM in 1:1:1 ratio. Germination was recorded on 7th day after sowing of Tomato, 14th day after sowing ofChilli, 15th day after sowing of Marigold,15th days after sowing of Celosia and 18th day after sowing of Papaya. Shoot length and root length were recorded during 28thdays after sowing of Tomato,32th days after sowing ofChilli,30th day after sowing of Marigold,30th day after sowing of Celosia and 60th day after sowing of Papaya. Thereafter the plants were dried in hot air oven at 60^{0}C and weighed for dry weight.

Results and discussion

Effect of pot mixture on germination percentage of tomato, chilli marigold celosia, papaya

The results showed that there was significant effect on germination percentage due to treatment effect containing different combination pot mixtures containing fly ash+farmyard manure and fly ash+vermi compost in different proportions. Higher germination percentage of 90%in tomato,95% in chilli, 80% in marigold, 55% in celosia and 85% in papaya was observed in T11 treatment receiving fly ash and vermicompost in 1:3 ratio and least germination percentage was observed in T13 treatment receiving fly ash and vermicompost in3:1 ratio. The germination percentage enhanced with decreasing the proportion of fly ash in the pot mixture. Germination percentage increased with replacement of soil in normal potting mixture with fly ash in all the five crops. The combination of fly ash with vermicompost in the ratio1:3 recorded better results when compared to the combination of fly ash with farm yard manure in the ratio 1:3in tomato and chilli while celosia and marigold showed better germination percentage in the combination of fly ash with farm yard manure in the ratio 1:3 when compared to the combination of fly ash with farm yard manure in the ratio 1:3. Papaya showed higher germination percentage in both the above treatments.

Effect of pot mixture on shoot length of tomato, chilli, marigold, celosia, papaya

The results showed that fly ash based pot mixture containing farm yard manure and vermicompost influenced the growth of the seedlings in terms of shoot length. Higher shoot length was recorded in seedlings grown in T11 treatment comprising of fly ash and vermicompost in the ratio 3:1 with shoot length of 15.46cm in tomato, 9.52cm in chilli, 11.85cm in marigold, 11.25cm in celosia and 30.65cm in papaya. Least shoot length was recorded in T13 treatment comprising of fly ash and vermicompost in the ratio 3:1. All five crop seedlings performed better in pot mixture in which soil was replaced by fly ash when compared to the seedlings in T1 treatment which is the normal pot mixture. Shoot length recorded showed an increasing trend with decrease in the proportion of fly ash in the pot mixture. Better growth was recorded in fly ash with vermicompost mixture in the ratio 1:3 when compared to fly ash with farm yard manure mixture in the ratio 1:3

Effect of pot mixture on root length of tomato, chilli, marigold, celosia, papaya

The result indicates that there is an increase in root length when soil from the normal potting mixture is replaced with fly ash. This deference is more prominent when vermicompost is used in place of farm yard manure. Higher root length was observed in seedlings grown in T11 treatment comprising of fly ash and vermicompost in the ratio 1:3 with root lengths recording 8.41cm in tomato, 4.2cm in chilli, 4.45cm in marigold, 8.75cm in celosia, 16.15cm in papaya.T6 treatment comprising fly ash and farm yard manure in the ratio 1:3 also showed significantly better root length. All five crop seedlings performed better in pot mixture in which soil was replaced by fly ash when compared to the seedlings in T1 treatment which is the normal pot mixture except T13 treatment comprising of fly ash and vermicompost in the ratio 3:1. Root length of seedlings grown in pot mixture containing lower proportion of fly ash showed better growth when compared to the treatments containing higher proportion of fly ash.

Effect of pot mixture on vigour index 1 of tomato, chilli, marigold, celosia, papaya

The results indicates that there is a significant influence of fly ash based pot mixture containing farmyard manure and vermicompost on the vigour index of the seedlings. The plants grown in T13 treatment receiving fly ash and vermicompost in the ratio 1:3recorded highest vigour index of 21.996 in tomato, 13.097 in chilli, 13.04 in marigold, 11.005 in celosia and 39.88 in papaya.T6 treatment comprising of fly ash and farmyard manure in the ratio 1:3 also recorded significantly high vigour index. Vigour index of all the seedlings grown in the pot mixture replacing soil performed better than the normal pot mixture except T13 treatment comprising of fly ash and vermicompost in the ratio 3:1which recorded the lowest vigour index.

Table 1: Effect of Fly ash, FYM and VC pot mixtures on germination percentage of tomato, chilli, marigold, celosia, papaya.

Treatment	Tomato	Chilli	Marigold	Celosia	Papaya
T1	55	45	55	35	55
T2	85	45	55	55	90
T3	90	60	75	45	90
T4	95	75	35	15	75
T5	85	45	40	35	75
T6	85	75	85	35	85
T7	95	50	25	35	85
T8	65	65	35	25	65
T9	90	55	65	30	85
T10	95	75	55	25	75
T11	90	95	80	35	85
T12	65	65	25	15	65
T13	55	60	90	25	60
MEAN	80.77	62.31	55.38	31.54	74.62
SEd	0.73	0.73	0.73	0.78	0.73
CD(P=0.01)	2.21	2.21	2.21	2.36	2.21

Table 2: Effect of Fly ash, FYM and VC pot mixtures on shoot length (cm) of tomato, chilli, marigold, celosia, papaya.

Treatment	Tomato	Chilli	Marigold	Celosia	Papaya
T1	6.22	6.33	13.2	8.25	22.85
T2	9.8	6.88	11.65	11.5	24.4
T3	12.2	6.85	14.35	9.55	22.3
T4	9.35	5.07	12.8	9.95	27.1
T5	11.9	5.6	13.45	7.15	31.15
T6	12.68	6	12.2	7.05	29.25
T7	9.25	5.34	8.95	5.8	19.85
T8	9	5.23	8.7	5	17.25
T9	11.42	5.36	13.7	8	22.4
T10	12.85	7.85	13	7.35	30.15
T11	15.46	9.52	11.85	11.25	30.65
T12	8.9	5.63	10.5	8.75	15.35
T13	6.4	4.29	5.5	5.05	12.75
MEAN	10.39	6.09	11.3	8.18	23.5
SEd	0.9491	0.69	1.32	0.39	2.26
CD(P=0.01)	2.86	2.07	3.98	1.18	6.80

Table 3: Effect of Fly ash, FYM and VC pot mixtures on root length (cm) of tomato, chilli, marigold, celosia, papaya.

Treatment	Tomato	Chilli	Marigold	Celosia	Papaya
T1	3.55	2.35	4.7	8	8.8
T2	5.84	3.25	4.6	5.7	10.05
T3	5.9	3.35	2.5	6.05	10.6
T4	6.36	2.88	3.1	4.65	12.5
T5	6.9	3.38	5.3	3.65	15.35
T6	7.5	3.75	2.8	3.05	14.65
T7	5.3	2.85	2.2	4.95	9.45
T8	4.82	2.65	1.4	5	8.7
T9	8.05	3.19	3.85	3.8	12.2
T10	8.29	3.65	3.9	5.2	12.15
T11	8.41	4.2	4.45	8.75	16.15
T12	4.16	3	3.8	5.15	8.55
T13	4.13	2.25	3	2.3	7.5
MEAN	6.15	3.15	3.82	5.1	11.28
SEd	0.61	0.43	0.36	0.42	0.5
CD(P=0.01)	1.85	1.3	1.08	1.27	1.5

Table 4: Effect of Fly ash, FYM and VC pot mixtures on vigour index of tomato, chilli, marigold, celosia, papaya.

Treatment	Tomato	Chilli	Marigold	Celosia	Papaya
T1	4.907	3.875	10.115	5.67	17.42
T2	13.627	4.547	8.75	9.495	31.01
T3	16.29	6.12	13.51	6.995	29.61
T4	15.471	5.99	5.68	2.19	29.76
T5	15.97	4.05	7.015	3.78	34.79
T6	17.079	7.41	13.26	3.575	37.495
T7	13.77	3.88	2.81	3.785	24.96
T8	9.149	5.12	4.57	2.485	16.845
T9	17.604	4.67	11.31	3.57	29.275
T10	20.116	8.6	9.515	3.13	31.625
T11	21.996	13.09	13.04	11.005	39.88
T12	8.4665	5.6	3.485	2.105	15.47
T13	5.725	4.15	6.975	1.835	12.125
MEAN	13.86	5.93	8.41	4.59	26.95
Sed	1.56	1.17	1.17	1.12	3.43
CD(P=0.01)	4.7	3.54	3.52	3.39	10.33

Conclusion

The study indicates the positive role of fly ash as on alternative to soil for pot mixture and when mixed with farmyard manure or vermicompost improves the growth of the plants. The germination percentage was enhanced by pot mixture with fly ash and vermicompost. It was maximum in the treatment T_{11} receiving fly ash and vermicompost in the ratio 1:3 and fly ash and farmyard manure in the ratio of 1:3. Fly ash based pot mixture containing farmyard manure and vermicompost influenced the plant height of tomato, chilli, marigold, celosia and papaya positively. The plant height was maximum in the treatment T_{11} receiving 1:3 fly ash and vermicompost. The vigour index was maximum in the treatment T_{11} comprising of fly ash and vermicompost in the ratio 1:3 in tomato, chilli, marigold, celosia and papaya.

A relative plant growth and development was observed when compared to standard pot mix (red soil: sand: FYM in the ratio 1:1:1) in the pot mix with soil replaced by fly ash. Thus tomato, chilli, marigold, celosia and papaya seedlings could be raised effectively in fly ash based pot mix.

The treatment T6 containing fly ash and farmyard manure in the ratio 1:3 gave the best results following T_{11} for all the parameters. The cost of farmyard manure is lesser than that of vermicompost which makes it more economical.

References

1. CB Raju PP. Fly Ash as Supplement of Nutrients for Better Productivity of Vegetables. Journal of environmental research and development 2007;2(1):41-44.
2. Deepa Katiyar *et al*. Impact of Fly-Ash-Ammended Soil on Growth And Yield of Crop Plants. Int. J. Environment and waste management 2012;10(2/3):151-162.
3. Goyal SJ. ESP Fly Ash Application Effects on Plant Biomass and Boiconcentration of Micronutrients In Nursery Seedlings of Populus deltoids 2010,53-56.
4. Jha VK. Use Of Fly Ash In Agriculture: Indian scenario. International Workshop on Agriculture: Coal Ash Uses 2014,1-10.
5. Khan MR. The Effect of Fla Ash on Plant Growth and Yield of Tomato. Environmental Pollution 1996;92(2):105-111.
6. NW Menzies RA. Evaluation of Fly Ash As A Component of Potting Substrates. Scientia horticulture 1996;67:87-99.
7. Pani *et al*. Effects of Fly Ash on Growth and Yield of Sunflower (Helianthus annus L,). International journal of Agronomy and Agricultural research (IJAAR) 2015;7(2):64-74.
8. Pawan *et al*. Growth of Chilli Plants (Capsicum Annum) In Fly Ash Blended Soil. African journal of basic & applied sciences 2013;5(5):237-241.
9. Pradhan *et al*,. Potential Use Of Fly Ash In Floriculture:Aa Case Study On The Photosynthetic Pigments Content And Vegetative Growth Of Tagetes erecta (Marigold). Eco. Env. &Cons 2015,369-376.
10. Prasad AB. Analysis of Marigold Plant Growth on Flyash Amended Soil: A Research. International journal of engineering and technical research (IJETR) 2014;2(9):192-195.
11. Prem Kishor AG. Use Of Flyash In Agriculture:A Way To Improve Soil Fertility And Its Productivity. Asian journal of Agricultural research 2010;4(1):1-14.
12. Rajashekhar LMC. Effect of Fly Ash Added Pot Mixture on Growth and Development of Nursery Seedlings Of Simarouba glauca. Journal of Pharmacognosy and Phytochemistry 2017,1616-1621.
13. SNC Ray *et al*. Potential Use of A Mix of Fly Ash and Diluted Distillery Effulent In Agriculture: Acase Study on The Vegetative Growth And Photosynthetic Pigments of The Ornamental Plant, Calendula officinalis. International journal of engineering research and applicatins (IJERA) 2012;2(5):193-203.
14. Seema Raj SM. Effect Of Low Concentration of Fla Ash on The Plant Growth Performence: A Review. Intrenational journal of recent advances in engineering & technology (IJRAET) 2016;41(1):91-96.
15. Sett R. Flyash: Characteristics, Problems And Possible Utilization. Pelagia research library 2017;8(3):32-50.
16. Sheng-Fu J, Chou *et al*. Plant Growth In Sandy Soil/Compost Mixture And Commercial Peat Moss Both Amended With Illinois Coal Fly Ash. World of coal ash (WOCA) 2005.
17. Shweta Sao PK. Influence of Fly Ash Growth Regulator With Soil for Determination of Chlorophyll In Arachis hypogaea L. American journal of plant sciences 2013;4:1744-1749.
18. Trlica DB. Mixtures of Bottom Ash and Soil As A Growth Medium for Three Range Species. Journal of range management 1977;30(5):391-394.
19. Zimmerman BL. Mixtures of Coal Ash and Compost As Substrates for Highbush Blueberry. J Amer. Soc. Hort Sci 2002;125(5):869-877.