The Pharma Innovation Journal 2022; 11(11): 2680-2686

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(11): 2680-2686

www.thepharmajournal.com
Received: 04-09-2022
Accepted: 06-10-2022

Carbon pool assessment in mango orchard at regional fruit research station, Ganeshkhind, Pune

Marella Rahul Reddy, Abhay Vijay Patil, Deepak Dulaji Sawale, Marella Nikhileshwar Reddy, Sumayya, Sonunkar Chandrakant Dattarao, Murodiye Kishor Ramchandra and Pagare Supriya Gopa

Marella Rahul Reddy
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Abhay Vijay Patil
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Deepak Dulaji Sawale
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Marella Nikhileshwar Reddy
Ramkrishna Bajaj College of Agriculture, Pipri, Wardha, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra, India

Sumayya
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Sonunkar Chandrakant Dattarao
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Murodiye Kishor Ramchandra
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Pagare Supriya Gopa
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Corresponding Author:
Marella Rahul Reddy
Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

Abstract
A present investigation was conducted at Regional Fruit Research Station, Ganeshkhind, Pune and Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune during 2020-2021. The experiment was conducted on existing mango orchard of age 13 years planted in the year 2006, from that, eight alternate bearing exotic mango genotypes were identified for study along with conventionally cultivated soil (Without mango tree). The soil samples collected beneath the mango genotype Hy-13/3 was recorded ssignificantly higher active carbon pools *viz*., water soluble carbon (79.50 and 54.00 mg kg^{-1}), soil microbial biomass carbon (544.00 and 413.00 mg kg^{-1}), permanganate oxidizable soil carbon (1531.00 and 812.00 mg kg^{-1}) and passive carbon pool like particulate organic carbon (1180.50 and 552.00 mg kg^{-1}) at 0-30 and 30-60 cm depth as compared to conventionally cultivated soil. Similarly Hy-13/3 was reported higher total organic carbon content (0.94 and 0.88%) as compared to conventionally cultivated soil (0.76 and 0.65%) at 0-30 and 30-60cm depth respectively. Significantly higher soil organic carbon stock was recorded with Hy-13/3 (36.24 and 34.32 Mg ha^{-1}) followed by Lily (36.05 and 33.74 Mg ha^{-1}) while lower soil organic carbon stock was observed in Kent (34.85 and 31.12 Mg ha^{-1}) mango genotypes at both depths. However least soil organic carbon stock was recorded in conventionally cultivated soil (30.35 and 26.22 Mg ha^{-1}) at 0-30 and 30-60 cm depth respectively. Significantly higher values of all soil carbon fractions under study were found in upper depth (0-30 cm) than the lower depth (30-60 cm).In case of carbon sequestration per plant after thirteen years of mango orchard age, Hy-13/3 genotype was superior (90.60 and 85.80 kg $tree^{-1}$) among all the genotype studied which was closely followed by Lily (90.13 and 84.35 kg $tree^{-1}$) at both depths.

Keywords: Mango genotypes, soil carbon stock, Carbon sequestration, carbon pools, soil carbon sequestration per tree, WSC, SMBC, POSC, POMC, TOC, SOC

Introduction
Carbon dioxide is required for plant and animal existence. Too much, however, can cause all life on Earth to die. Carbon dioxide is naturally occurring greenhouse gas, others include water vapour, methane and nitrous oxide. These gases helps to keep the Earth warm by absorbing the sun's energy and by redirecting energy back to the Earth's surface. An increase in the amount of carbon dioxide creates an over abundance of greenhouse gases that trap additional heat and causes global warming (Reddy M.R., *et al*., 2022) [21]. This trapped heat leads to melting ice caps and rising oceans levels, which cause flooding. To minimize the risks of global warming, there is a considerable interest in stabilizing CO_2 and other GHG abundance in the atmosphere (Kerr, 2007) [8] To tackle climate change, there are three techniques for reducing CO_2 emissions (Schrag, 2007) [22] (i) lowering global energy consumption, (ii) producing low-carbon or carbon-free fuels, and (iii) CO_2 sequestration from point sources or the atmosphere using natural and artificial methods. Hence, naturally sequestration of carbon in terrestrial ecosystem is referred as absorption of CO_2 from the atmosphere by photosynthesis. Carbon sequestration is a built-in mechanism in plants that allows them to capture carbon dioxide from the environment and convert it into a variety of goods such as flowers, fruit, and seeds (Reddy M.R., *et al*., 2022) [21]. In order to keep the soil carbon pool and soil fertility high, carbon sequestration is crucial. India is the largest producer of Fruits in the world and is known as the fruit basket of the world. Mango has the highest area under cultivation of any fruit crop in India. In order to compare the carbon sequestration in soil between eight exotic mango genotypes and conventionally cultivated soil (Without mango tree), a study was conducted.

Material and Methods
The study was conducted at Regional Fruit Research Station, Ganeshkhind, Pune,

Maharashtra, on an eight genotypes of 13-year-old existing mango orchard, between 2020 and 2021. The region experiences 763 mm of average annual precipitation, with temperature ranging from 15.1 to 16.8 °C in the winter, 35.5 to 37 °C in the summer. Argo-climatically, the Regional Fruit Research Station is located in Zone VIII, also known as the Western Maharashtra Plain Zone.

A total thirty-six soil samples were collected from eight exotic mango genotypes and one conventionally cultivated soil at two depths (0-30 and 30-60 cm) (Table.1). The carbon pools of soil is estimated by standard methods (Table.2). Soil carbon sequestration (kg tree^{-1}) is estimated by using formula (Soil carbon sequestration(kg tree^{-1}) = SOC / Number of plants per hector (spacing 5x5 m)). Soil chemical properties (Reddy M.R., *et al.*, 2022) [21], physical properties of soil beneath the genotypes and conventionally cultivated soil i.e., BD (g cm^{-3}) 1.29-1.31 and 1.35 respectively, Texture Sandy Clay Loam and Colour at 0-30 and 30-60 cm depth has Very Dark Gray (10 YR 3/1), Very dark Gray Brown (10 YR 3/2) respectively.

Table 1: Details of Treatments

Sr. no.	Genotype	Sr. no.	Genotype
1.	Kent	6.	Lily
2.	Austin	7.	Kitt
3.	Tony Atkins	8.	Palmer
4.	Maya	9.	Conventionally cultivated soil (without mango tree)
5.	Hy-13/3		

Table 2: Methods adopted for soil analysis

Sr. No.	Parameter	Method Used	Reference
1.	WSC	Water extraction method	Mc Gill *et al.* (1986) [13]
2.	SMBC	Chloroform fumigation extraction method	Brooks *et al.* (1985) [2]
3.	POSC	Permanganate oxidation method	Blair *et al.* (1995) [1]
4.	POMC	Wet sieving method	Camberdella *et al.* (1992)
5.	Total organic carbon	Dry ashing / TOC analyzer	Nelson and Sommer (1982) [16]
6.	Soil carbon stock	TOC X BD X Depth	Jasmine *et al.* (2021) [7]

Results and discussion

In the given study the effect of different mango genotypes and depth on soil carbon content after thirteen years of plantation grown on Inceptisol was observed. The results are discussed below.

Effect of Different Mango Genotypes on Active Carbon Pool at 0-30 and 30-60 cm Depth.

Water Soluble Carbon

Water soluble carbon in soil is influenced significantly by exotic mango alternate bearing genotypes and with two depths (0-30 and 30-60 cm). However, the interaction effect among mango genotypes and soil depth was found non-significant is presented in Table.3 and Fig.1.

Significantly higher WSC content was recorded in the soil at two depths collected beneath the mango genotype Hy-13/3 (79.50 and 54.00 mg kg^{-1}) which was at par with Lily (78.50 and 52.50 mg kg^{-1}), Kitt (75.50 and 50.00 mg kg^{-1}) and Palmer (76.50 and 52.00 mg kg^{-1}) at 0-30 and 30-60 cm depth respectively. However in case of conventionally cultivated soil (without mango tree) lower WSC was reported (52.00 and 34.00 mg kg^{-1}) at 0-30 cm and 30-60 cm soil depth. Overall increased in water soluble carbon content under mango genotypes (0-30 cm) varies from 28.85 to 52.88% as compared to conventionally cultivated soil after thirteen years of plantation.

Interaction effect of WSC per cent contribution in total organic carbon in soil was found non-significant for mango genotypes and soil depth.

Higher WSC at 0-30 cm soil depth was observed which might be due to accumulation of leaf fall litter over the period of thirteen years. The oxidation of organic matter from the surface and remaining WSC may have accumulated at lower depths. In case of conventionally cultivated soil which does not have any leaf litter fall hence WSC content was reported lover at both the depth than mango genotypes.

Horticultural (mango) land use systems have higher water soluble carbon than agricultural land use systems, due to the greater SOC concentration (Pramod Jha *et al.*, 2012) [18]. Similarly Massaccesi L. *et al.* (2018) [12] was also observed that the amount of water soluble carbon in the upper layer of the orchard was found to be higher than in the conventionally cultivated soil.

Table 3: Effect of mango genotype and depth on soil Water Soluble Carbon after thirteen years of plantation

Sr. No.	Genotype	WSC (mg kg^{-1}) Depth (cm)		
		0-30	30-60	Mean
1.	Kent	67.00	46.00	56.50
2.	Austin	72.50	48.00	60.25
3.	Tony Atkins	70.50	48.00	59.25
4.	Maya	75.00	49.50	62.25
5.	Hy-13/3	79.50	54.00	66.75
6.	Lily	78.50	52.50	65.50
7.	Kitt	75.50	50.00	62.75
8.	Palmer	76.50	52.00	64.25
9.	Conventionally cultivated soil	52.00	34.00	43.00
	Mean	71.89	48.22	
		Genotype	Depth	G X D
	S.E.(m) ±	2.02	0.95	2.85
	CD at 5%	6.02	2.84	NS

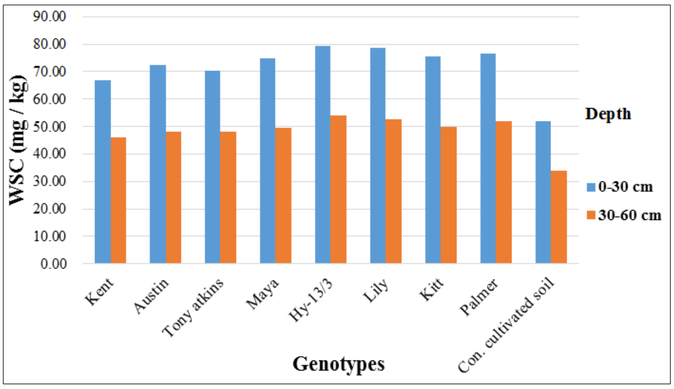

Fig 1: Effect of mango genotype and depth on soil water soluble carbon after thirteen years of plantation

Soil Microbial Biomass Carbon

The influence of different mango genotype on soil microbial biomass carbon was significant at 0-30 and 30-60 cm depth (Table.4 and Fig.2).

Soil beneath the mango genotype Hy-13/3 recorded significantly higher soil microbial biomass carbon (544.00 and 413.00 mg kg^{-1}) which was at par with Lily (529.50 and 408.00 mg kg^{-1}) at 0-30 and 30-60 cm depth respectively. All mango genotypes recorded higher soil microbial biomass carbon as compared to conventionally cultivated soil (without mango tree) (415.00 and 257.50 mg kg^{-1}) at 0-30 and 30-60 cm depth respectively. Significant increased in soil microbial biomass carbon under all mango genotypes at 0-30 cm varies from 20.24 to 31.09 % as compared to conventionally cultivated soil after thirteen years of plantation. The same trend was observed in 30-60 cm depth of soil but it is numerically lower than 0-30 cm depth.

Soil microbial biomass carbon is the most active and labile part of SOC, and incorporating organic manures and residues boosts the labile pools of carbon significantly. (Moussa *et al*., 2007) [14]. Zhang Y. *et al*. (2019) [24] also reported that the dominating plant species influenced the soil microbial biomass carbon content in the 0-10 and 10-20 cm soil layers, and not in the lower soil layer. Similarly, Fortuna *et al*. (2003) [5] and Manna *et al*. (2008) [11] were observed that the active pools carbon, such as SMBC, is maintained in soil as a result of the coordinated application of organic wastes and inorganic fertilizers.

Permanganate Oxidizable Soil Carbon

The effect of the different mango genotypes on permanganate oxidizable soil carbon in 0-30 and 30-60 cm soil depth after thirteen years of plantation grown on Inceptisol is presented in Table.5 and Fig.3.

Soil beneath the mango genotype Hy-13/3 recorded significantly higher permanganate oxidizable soil carbon (1531.00 and 812.00 mg kg^{-1}) in soil which was at par with Lily genotype (1519.00 and 797.50 mg kg^{-1}) at 0-30 and 30-60 cm depth respectively. However in case of conventionally cultivated soil (with out mango tree) lower POSC (1256.00 and 634.00 mg kg^{-1}) was reported at 0-30 cm and 30-60 cm soil depth. Significant permanganate oxidizable soil carbon content under mango genotypes at 0-30 cm depth varies from 13.13 to 21.90 % as compared to conventionally cultivated soil after thirteen years of plantation. The same trend was observed in 30-60 cm depth of soil but it is numerically lower than 0-30 cm depth.

The increase in permanganate oxidizable soil carbon in mango orchard system was attributable to a considerable increase in carbon input from organic manure and higher fall of leaf litter. Similar results were also be recorded by (Purakayastha *et al*., 2008) [20]. The POSC of the mango orchard was significantly higher than that of the conventionally cultivated soil (Naik *et al*., 2016) [15]. Long-term experiments at Rothamsted (UK) found a similar increase in SOC after manure application (Powlson *et al*., 1998) [17].

Table 4: Effect of mango genotype and depth on Soil Microbial Biomass Carbon after thirteen years of plantation

Sr. No.	Genotype	SMBC (mg kg^{-1}) Depth (cm)		
		0-30	30-60	Mean
1.	Kent	490.00	380.50	435.25
2.	Austin	499.50	393.00	446.25
3.	Tony Atkins	492.50	383.00	437.75
4.	Maya	510.00	395.00	452.50
5.	Hy-13/3	544.00	413.00	478.50
6.	Lily	529.50	408.00	468.75
7.	Kitt	518.50	396.00	457.25
8.	Palmer	521.50	403.50	462.50
9.	Conventionally cultivated soil	415.00	257.50	336.25
	Mean	502.28	381.06	
		Genotype	Depth	G X D
	S.E.(m) ±	6.15	2.90	8.69
	CD at 5%	18.34	8.65	NS

Table 5: Effect of mango genotype and depth on soil Permanganate Oxidizable Soil Carbon after thirteen years of plantation

Sr. No.	Genotype	POSC (mg kg^{-1}) Depth (cm)		
		0-30	30-60	Mean
1.	Kent	1421.00	748.50	1084.75
2.	Austin	1459.00	771.00	1115.00
3.	Tony Atkins	1443.00	752.00	1097.50
4.	Maya	1468.50	774.50	1121.50
5.	Hy-13/3	1531.00	812.00	1171.50
6.	Lily	1519.00	797.50	1158.25
7.	Kitt	1474.00	787.00	1130.50
8.	Palmer	1487.50	795.50	1141.50
9.	Conventionally cultivated soil	1256.00	634.00	945.00
	Mean	1451.00	763.56	
		Genotype	Depth	G X D
	S.E.(m) ±	6.05	2.85	8.55
	CD at 5%	18.04	8.51	25.52

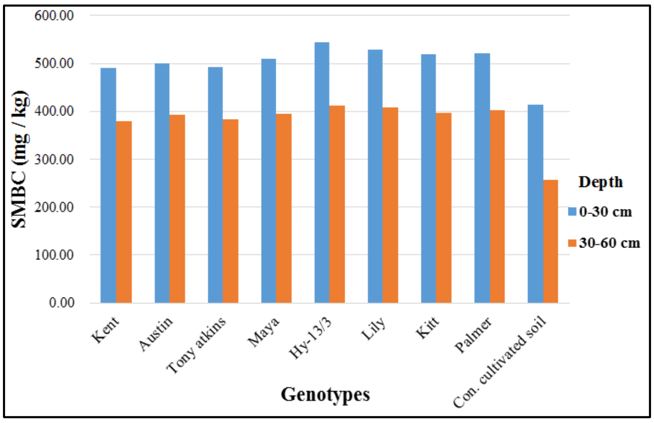

Fig 2: Effect of mango genotype and depth on soil microbial biomass carbon after thirteen years of plantation

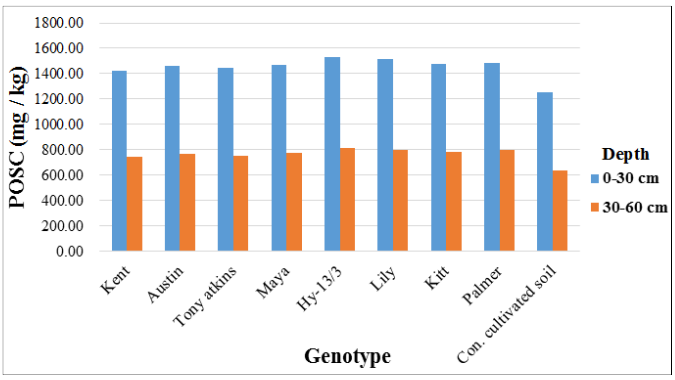

Fig 3: Effect of mango genotype and depth on soil permanganate oxidizable soil carbon after thirteen years of plantation

Effect of Different Mango Genotypes on Passive Carbon Pool at 0-30 and 30-60 cm Depth

Particulate Organic Matter Carbon

Particulate organic matter carbon in soil was influenced significantly by exotic mango alternate bearing genotypes and with two depths (0-30 and 30-60 cm). However, the interaction effect among mango genotypes and soil depth was found non significant is depicted in Table.6 and Fig.4.

Soil beneath the mango genotype Hy-13/3 recorded significantly higher POMC (1181 and 552 mg kg^{-1}) followed by Lily (1139 and 547 mg kg^{-1}) and Palmer (1137 and 541 mg kg^{-1}) as compared to conventionally cultivated soil (1013 and 467 mg kg^{-1}) at 0-30 and 30-60 cm depth respectively. Among the depth, higher POMC content was observed at 30-60 cm depth than 30-60 cm depth. Significant increase in POMC content in soil beneath the mango genotypes at 0-30 cm depth varies from 9.04 to 15.59 % as compared to conventionally cultivated soil after thirteen years of plantation. The same trend was observed in 30-60 cm depth but it is numerically lower than 0-30 cm soil depth.

The higher increase of POMC in mango orchard as compared to conventionally cultivated soil is due to an increase in organic matter in soil through the litter and above plant components of mango plants (Purakayastha *et al*., 2008) [20]. According to similar studies N fertilizer increased POMC content in a loamy soil but not in a sandy soil (Malhi *et al*., 2003) [10]. In this investigation, the main sources of POMC were leftover root biomass and increased microbial biomass waste in mango orchard. According to the root biomass produced, the larger biochemical recalcitrance of root litter may have also raised POMC concentrations in soil (Puget and Drinkwater, 2001) [19]. POMC was also the superior, which can be attributable to higher litter deposits containing more labile carbon (Laik R. *et al*., 2009) [9].

Table 6: Effect of mango genotype and depth on soil particulate organic matter carbon after thirteen years of plantation

Sr. No.	Genotype	POMC(mg kg^{-1}) Depth (cm) 0-30	30-60	Mean
1.	Kent	1104	515	809
2.	Austin	1113	522	818
3.	Tony Atkins	1107	519	813
4.	Maya	1121	534	827
5.	Hy-13/3	1181	552	866
6.	Lily	1139	547	843
7.	Kitt	1128	536	832
8.	Palmer	1137	541	839
9.	Conventionally cultivated soil	1013	467	740
	Mean	1116	526	
		Genotype	Depth	G X D
	S.E.(m) ±	7.27	3.43	10.28
	CD at 5%	21.69	10.22	NS

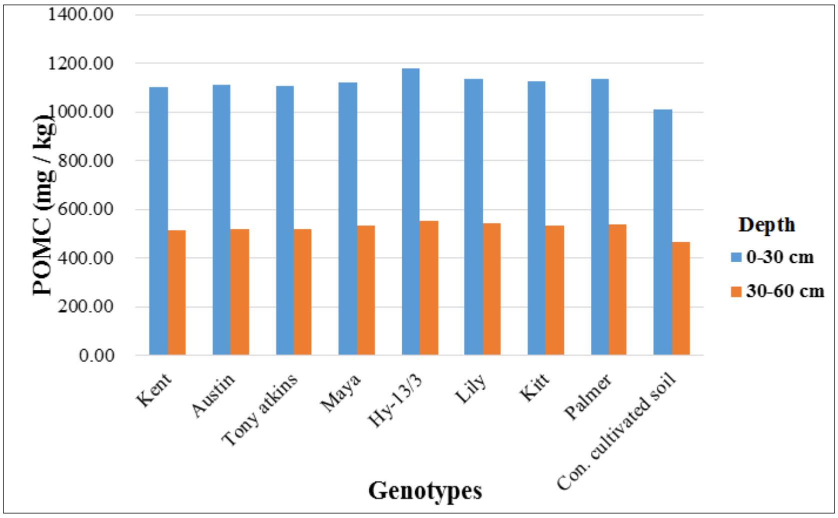

Fig 4: Effect of mango genotype and depth on soil particulate organic matter carbon after thirteen years of plantation

Effect of Different Mango Genotypes and Soil Depth on Total Organic Carbon (TOC) after Thirteen Years of Plantation

Total organic carbon in soil was significantly influenced by mango genotypes and with two depth (0-30 and 30-60 cm) after thirteen years of plantation grown on Inceptisol is presented in Table.7 and Fig.5.

The soil beneath mango genotype Hy-13/3 recorded significantly higher total organic carbon content (0.94 and 0.88 %) which was closely followed by Lily (0.94 and 0.87 %) at 0-30 and 30-60 cm depth. However, conventionally cultivated soil (0.76 and 0.65 %) recorded lowest TOC as compared to mango genotypes. In case of soil depth, significantly higher total organic carbon was found at 0-30 cm soil depth than the 30-60 cm depth in all the genotypes including conventionally cultivated soil (without mango tree). However, interaction effect of TOC content in soil was found non-significant for mango genotypes and soil depth.

The increased total organic carbon in mango orchard can be linked to the various quantities and types of organic matter supply via fresh litter, living micro-organisms, and root activity (eg. turnover and exudates) (Vesterdal *et al*., 2008) [23]. Due to the addition of roots and plant biomass at the surface layer and a lack of nutrient and biological activity in the 30-60 cm layer, the maximum TOC was reported in the surface soils as compared to lower depths (Ingram and Fernandes, 2001) [6]. Similarly, it was assumed that the bare soil surface and breaking of aggregates due to a lack of vegetation, which enhances erosion activities with high precipitation, were the reasons for the lowest total organic carbon content in the conventional control soil (Conant and Paustian, 2002) [4].

Table 7: Effect of mango genotype and depth on soil total organic carbon after thirteen years of plantation

Sr. No.	Genotype	TOC (%)		
		Depth (cm)		
		0-30	30-60	Mean
1.	Kent	0.89	0.80	0.84
2.	Austin	0.91	0.81	0.86
3.	Tony Atkins	0.90	0.80	0.85
4.	Maya	0.91	0.81	0.86
5.	Hy-13/3	0.94	0.88	0.91
6.	Lily	0.94	0.87	0.90
7.	Kitt	0.92	0.82	0.87
8.	Palmer	0.92	0.84	0.88
9.	Conventionally cultivated soil	0.76	0.65	0.70
	Mean	0.90	0.81	
		Genotype	Depth	G X D
	S.E.(m) ±	0.02	0.01	0.03
	CD at 5%	0.06	0.03	NS

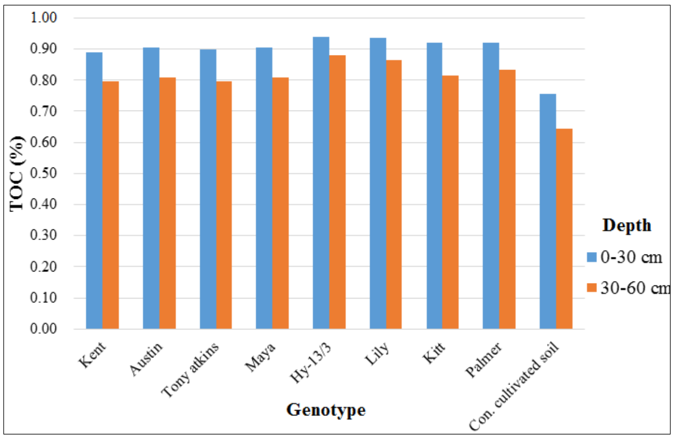

Fig 5: Effect of mango genotype and depth on soil total organic carbon after thirteen years of plantation

Effect of Different Mango Genotypes and Depth on Soil Organic Carbon Stock and Carbon Sequestration after Thirteen Years of Plantation

Soil organic carbon stock in soil was influenced significantly by exotic mango alternate bearing genotypes and with two depths (0-30 and 30-60 cm). However, the interaction effect among mango genotypes and soil depth was found non-significant is presented in Table.8 and Fig.6 and 7.

The mango genotype Hy-13/3 recorded higher soil organic carbon stock in soil (36.24 and 34.32 Mg ha^{-1}) fallowed by Lily (36.05 and 33.74Mg ha^{-1}) and Palmer (35.47 and 32.44 Mg ha^{-1}) whereas lower soil organic carbon stock was observed in conventionally cultivated soil (30.35 and 26.22 Mg ha^{-1}) at 0-30 and 30-60 cm depth. Significant increase in soil organic carbon stock under mango genotypes at 0-30 cm varies from 14.82 to 19.40 % as compared to conventionally cultivated soil after thirteen years of plantation. The same trend was observed in 30-60 cm depth of soil but it is numerically lower than 0-30 cm depth.

Among the mango genotypes, higher carbon sequestration per tree were recorded in Hy-13/3 (90.60 and 85.80 kg $tree^{-1}$) fallowed by Lily (90.13 and 84.35 kg $tree^{-1}$) and Palmer (88.68 and 81.10 kg $tree^{-1}$) where as lower carbon sequestration were observed in Kent (87.13 and 77.80 kg $tree^{-1}$) at 0-30 and 30-60 cm depth. Further, carbon sequestration observed higher in upper layer (0-30 cm) as compared to lower layer (30-60 cm) irrespective of genotypes.

The higher soil organic carbon stock and carbon sequestration was recorded in the surface soil (0-30 cm) as compared to lower depth (30-60 cm) in mango orchard is due to the addition of leaf fall or leaf litter and plant biomass in surface layers and lack of nutrient and biological activity in deeper layers, which ultimately constraints the rooting depth. Similar results were also recorded by Ingram and Fernandes (2001) [6].

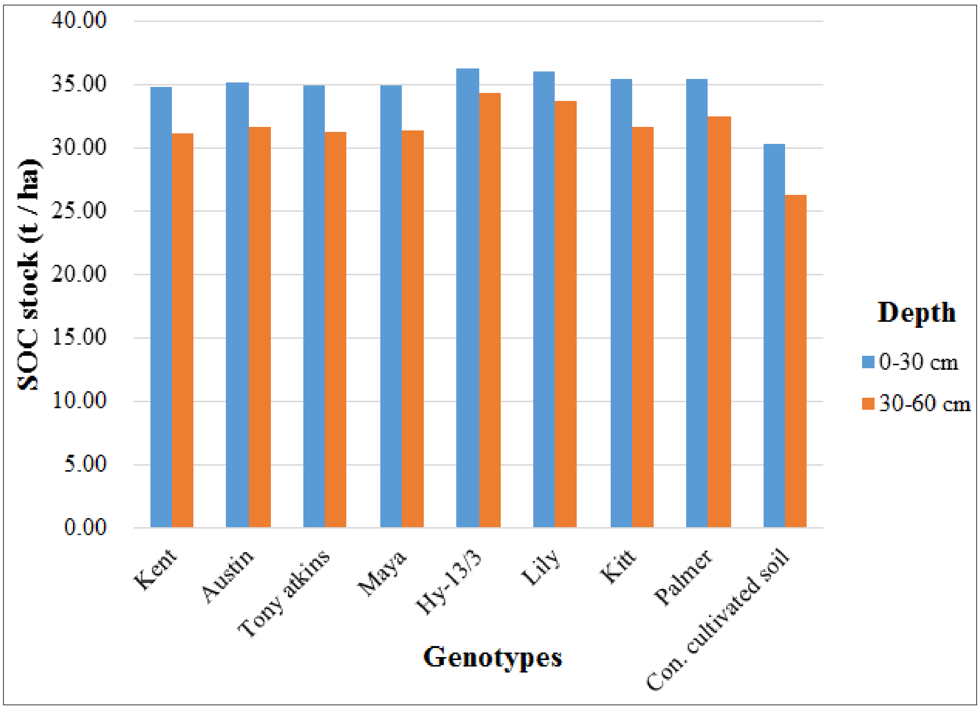

Fig 6: Effect of mango genotype and depth on soil organic carbon stock after thirteen years of plantation

Table 8: Effect of mango genotype and depth on soil organic carbon stock and carbon sequestration for the period of thirteen years

Sr. No.	Genotype	SOC Stock (Mg ha^{-1})			Carbon Sequestration per tree (kg tree^{-1})	
		Depth (cm)			Depth (cm)	
		0-30	30-60	Mean	0-30	30-60
1.	Kent	34.85	31.12	32.99	87.13	77.80
2.	Austin	35.15	31.60	33.37	87.86	79.00
3.	Tony Atkins	34.97	31.24	33.11	87.43	78.10
4.	Maya	34.88	31.46	33.17	87.20	78.65
5.	Hy-13/3	36.24	34.32	35.28	90.60	85.80
6.	Lily	36.05	33.74	34.89	90.13	84.35
7.	Kitt	35.47	31.66	33.57	88.68	79.15
8.	Palmer	35.47	32.44	33.96	88.68	81.10
9.	Con. cultivated soil	30.35	26.22	28.28	--	--
	Mean	34.83	31.53		--	--
		Genotype	Depth	G X D	--	--
	S.E.(m) ±	0.78	0.37	1.10	--	--
	CD at 5%	2.33	1.10	NS	--	--

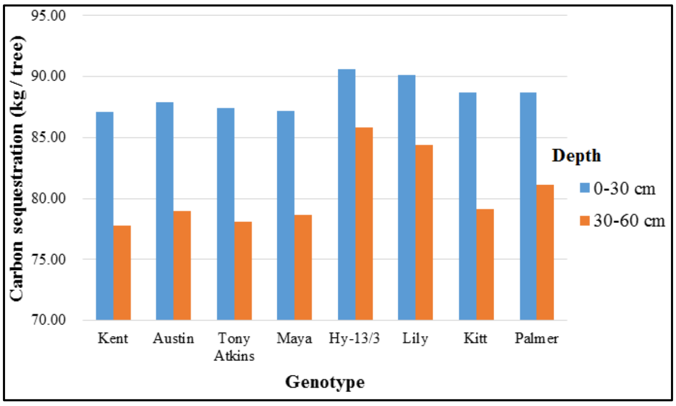

Fig 7: Effect of mango genotype and soil depth on carbon sequestration per tree after thirteen years of plantation

Conclusion
It is concluded that the Hy-13/3 mango exotic genotype was found suitable followed by Lily and Palmer for improving soil carbon pools and fertility status of soil at 0-30 and 30-60 cm depth respectively after 13 years of mango plantation in Inceptisol.

Application of research
The study was undertaken to assess the carbon sequestration in soil after thirteenth year with eight exotic mango genotypes in relation to conventionally cultivated soil (Without mango tree).

Research Category
Agricultural Chemistry

Abbreviation
WSC- Water soluble carbon, POMC- Particulate organic matter carbon, POSC- permanganate oxidizable soil carbon, SMBC- Soil Microbial Biomass Carbon, TOC- Total organic carbon, SOC- soil organic carbon

Acknowledgement/Funding
Authors are thankful to Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, 411005, Mahatma Phule Krishi Vidyapeeth, Rahuri, 413722, Maharashtra, India.

Author Contributions
All authors equally contributed

Study area/Sample Collection
NARP (Plain Zone), Ganeshkhind, Pune.

Cultivar/Variety/Breed name
Mango

Research Guide
Abhay Vijay Patil University: Mahatma Phule Krishi Vidyapeeth, Rahuri, 413722, Maharashtra, India Research project name or number: MSc Thesis.

References
1. Blair GJ, Lefroy RDB, Lisle L. Soil carbon fraction based on there degree of oxidation and development of carbon management index for agricultural system. Australian Journal of Agricultural Research. 1995;46:1459-1466.
2. Brooks PC, Landman A Pruden, Jenkinson G. Chloroform fumigation and release of nitrogen, a rapid direct extraction method to measure microbial biomass nitrogen in soil. Soil Biology and Biochemistry. 1985;17:837-842.
3. Cambardella CA, Eliott ET. Particulate soil organic matter changes acroos a grassland cultivation sequence. Soil Science Society of America Journal. 1992;56:777-783.
4. Conant RT, Paustian K. Potential soil carbon sequestration in overgrazed grassland ecosystems. Global Biogeochemical Cycles. 2002;16(4):1143.
5. Fortuna A, Hardwood RR, Paul EA. The effect of compost and crop rotations on carbon turnover and the particulate organic matter fraction. Soil Science. 2003;168:434-444.
6. Ingram JSI, Fernandes ECM. Managing carbon sequestration in soils concept and terminology. Agricultural Economics and Environment. 2001;87:111–117.
7. Jasmine E, Black Thomas, Wagner, Geoffrey D. Abbott Assessing Lignin Decomposition and Soil Organic Carbon Contents Across a Tropical Savannah-Rainforest Boundary in Guyana. Frontiers in Forests and Global Change. 2021;(4):600-629.
8. Kerr RA. Scientists tell policy makers we're all warming

the world. Science. 2007;315:754–757.
9. Laik R, Kumar K, Das DK, Chaturvedi OP. Labile soil organic matter pools in a calciorthent after 18 years of afforestation by different plantations. Applied Soil Ecology. 2009;42(2):71-78.
10. Malhi SS, Harapiak JT, Noyborg M, Gill KS, Monreal CM, Gregorich EG. Total and light fraction organic C in a thick black Chernozemic grassland soil as affected by 27 annual applications of six rates of fertilizer. N. Nutrient Cycling in Agroecosystems. 2003;66:33–41.
11. Manna MC, Wani SP, Rego TJ, Sahrawat KL, Bhattacharyya T, Ramesh V. Influence of different land use management on soil biological properties and other C-fractions under semi-arid benchmark soils of India. Global Theme on Argoecosystems. 2008;41:1-54.
12. Massaccesi M, Feudis De Agnelli AE, Nasini L, Regni L, Ascoli R, Castaldi Proiettia P. Organic carbon pools and storage in the soil of olive groves of different age. European Journal of Soil Science. 2018. doi: 10.1111/ejss.12677.
13. Mc Gill WB, Cannon KR, Rebertson JA, Cook FD. Dynamics of Soil Microbial Biomass and Water - Soluble carbon in Breton L after 50 years of cropping two rotations. Canadian Journal of Soil Science. 1986;66:1-19.
14. Moussa AS, Rensburg LV, Kellner K, Bationo A. Soil microbial biomass in semi-arid communal sandy rangelands in the western Bophirima district, South Africa. Applied Ecology and Environmental Research. 2007;5:43-5.
15. Naik SK, Maurya S, Bhatt BP. Soil organic carbon stocks and fractions in different orchards of eastern plateau and hill region of India. Agroforestry Systems. 2016;91(3):541–552.
16. Nelson DW, Sommer LE. Total carbon, organic carbon and organic matter. In A. L. Page (Ed.). Methods of analysis part II Agronomy. American Society Agronomy, Madison, Wisconsin, USA. 1982;9:539-579.
17. Powlson DS, Smith P, Cloeman K, Smith JU, Glendining MJ, Korshens M. A European net work of long-term sites for studies on soil organic matter. Soil and Tillage Research. 1998;47:263–274.
18. Pramod Jha, Arpan De, Brij Lal Lakaria, Biswas AK, Singh M. Soil Carbon Pools, Mineralization and Fluxes Associated with Land Use Change in Vertisols of Central India, National Academy Science Letters. 2012;35:475-483.
19. Puget P, Drinkwater LE. Short-term dynamics of root- and shoot-derived carbon from a leguminous green manure. Soil Science Society of America Journal. 2001;65:771–779.
20. Purakayastha TJ, Rudrappa L, Singh D, Swarup A, Bhadraray S. Long-term impact of fertilizers on soil organic carbon pools and sequestration rates in maize-wheat cowpea cropping system. Geoderma. 2008;144:370–378.
21. Reddy MR, Patil AV, Sawale DD, Jadhav AB, Gosavi AB, Phalke DH. Carbon Sequestration Assessment in Mango Orchard at Regional Fruit Research Station, Ganeshkhind, Pune, Maharashtra. International Journal of Agriculture Sciences. 2022;14(3):11196-11198.
22. Schrag DP. Preparing to capture carbon. Science. 2007;315:812–813.
23. Vesterdal L, Schmidt IK, Callesen I, Nilsson LO, Gundersen P. Carbon and nitrogen in forest floor and mineral soil under six common European tree species. Forest Ecology and Management. 2008;255:35–48.
24. Zhang Y, Tang S, Xie S, Liu K, Li J, Chen Q. Effects of species-dominated patches on soil organic carbon and total nitrogen storage in a degraded grassland in China. PeerJ. 2019;7:e6897. DOI 10.7717/peerj.6897.