MANUAL ON CLIMATE RESILIENT AGRICULTURE – WATER CONSERVING ROOT ZONE IRRIGATION TECHNIQUE

(To grow Trees / Climbers faster with less water) (Innovation by Dr.Korlapati Satyagopal I.A.S.,)



Growth Difference 122 cm (4 feet)



Authored by

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Tamarindus indica (Tamarind)

In 2 Years & 3 Months

Increase in Growth over Normal method

> 5 feet & 3 Inch

Thanjavur District, Ammapettai Block

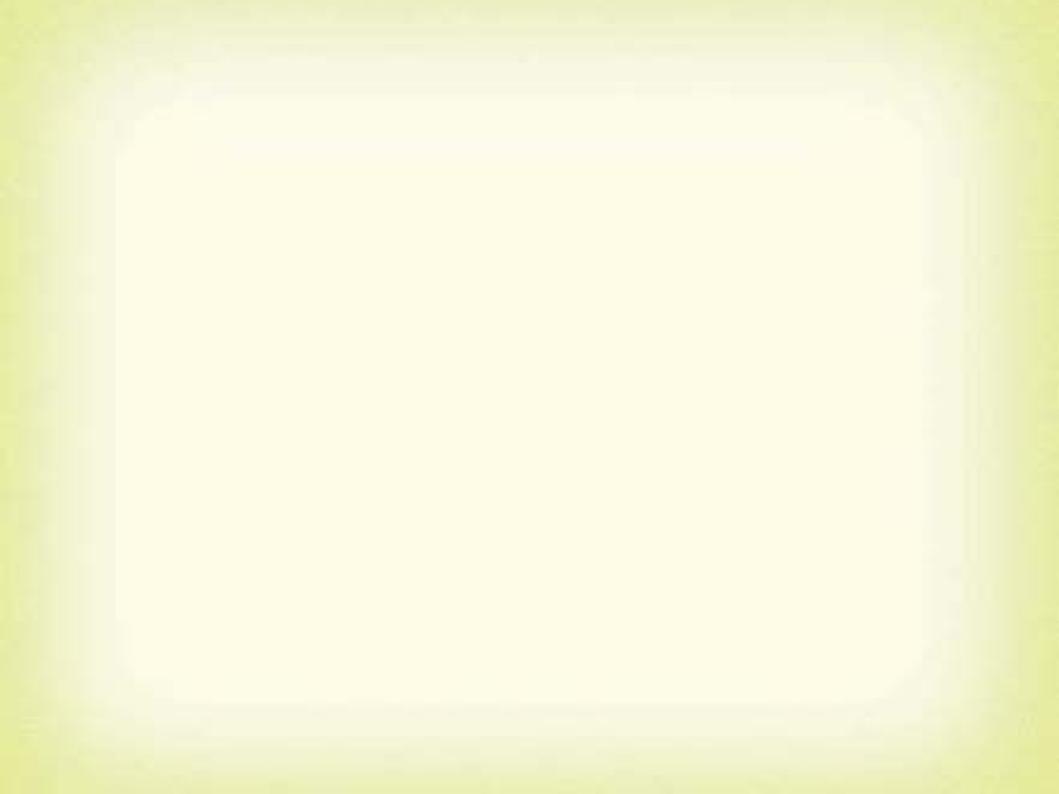
SOIL TYPE
SANDY SOIL



Data	Normal Me	thod	CRA Techniq	ue
Date Height of Plant (cm) Girtl		Girth (cm)	Height of Plant (cm)	Girth (cm)
21-10-2016	20	1	20	1
21-01-2019	138	10	300	21



Dr. Korlapati Satyagopal I.A.S. receiving the Certificate of appreciation awarded by the Government of Tamil Nadu for the special initiative taken in formulating an innovative watering technique useful for tree plantation from the Hon'ble Chief Minister of Tamil Nadu on the Independence Day (15-8-2017) in the presence of the Chief Secretary to Government



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PREFACE

Climate change has become a reality triggering serious imbalances in weather systems across continents and the consequences include inter alia change in precipitation patterns, changes in hydrology, watermass distribution, which affect all biological systems. The adverse impact of these changes have been inducing extreme hardships to the poor and especially the farmers. Due to the climate change induced shortages of water and increased temperatures Agriculture is impacted severely raising serious concerns for the the small and marginal farmers.

Recognizing the importance of afforestation in combating the issues of climate change, soilerosion, pollution, and in preserving the biodiversity and ecological balance, Governments world over have embarked on a massive programme of tree plantation under different schemes. Every year a large number of saplings are planted and their survival depends inter alia on frequent watering during the first few years of plantation.

The current methods adopted forwatering are either the traditional way of watering the area surrounding the sapling or

pitcher irrigation or drip irrigation. However, pitcher irrigation and drip irrigation are adopted only for growing Horticultural fruit trees as they are expensive and are beyond the reach of the poorfarmers. Therefore, the need for developing a low cost but effective watering technique for growing Tree species, and other perennials and seasonal climbers (vegetables/fruits) was constantly engaging my mind.

Imigation Technique was conceived by me in 2016 and it was experimented under the MGNREGS Tree plantation scheme implemented by the Rural Development Department by the Govt of Tamil Nadu. To ascertain the efficacy of the new technique seedlings/saplings were grown compulsorily as per conventional methods along with treated plots. This innovation transforms irrigation systems as it quickly transfers irrigated water to depths of 2 to 3 feet which is not possible even in surface drip systems. The technique enables farmers over come the major impacts of climate change. The bio-metric observations of growth parameters-height, girth, leaf surface area and biomass observed in the field in comparison with the

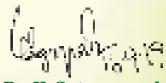
control plots were found to be significantly high. Independent evaluations carried out also comborated the results. Farmers with large holdings can blend the innovation with drip irrigation which reduces water and power consumption and increase the yields.

The yield levels of drumstick, gourd vegetables (bottle, ridge, bitter gourd etc) and fruits (watermelon) was higher ranging from 35% to 60% which in turn resulted in additional income to the farmers. In respect of Thees (including species of medic inal and nutritional value). The increase in height over trees grown adopting conventional methods / drip systems, ranged from 4 feet to 15 feet over a period of 2 years it self. The increase in yield of vegetables and fruits of medicinal and nutritional value resulting in additional income or additional consumption at the farm level will promote the nutritional status and health of pregnant/lactating women and children belonging even to small holder farmers and can streng then the Fruit and Vegetables for Health Initiative of WHO and FAO. The innovation fulfils the objectives of the Paris Agreement to mitigate Climate Change by increasing the ability of farmers including smallholders to reduce carbon e missions as well as enhance carbon seque stration.

The low cost CRA technique is unique due to its ability to grow trees/climbers faster with less water along with otherbenefits when compared to conventional surface irrigation as well drip irrigation systems as listed below.

- ❖ WaterUse Efficiency
- * WaterConservation-
- Irrigation of the Root zone up to 2 to 3 feet
- Enhanced nutrient absorption
- Facilitates full expression of the genetic potential of the seed ling
- Re sults in higher survival rates and accelerated growth -
- ❖ Enhanced Carbon seque stration -
- Climate Resilience -
- ❖ Drought Resistance-

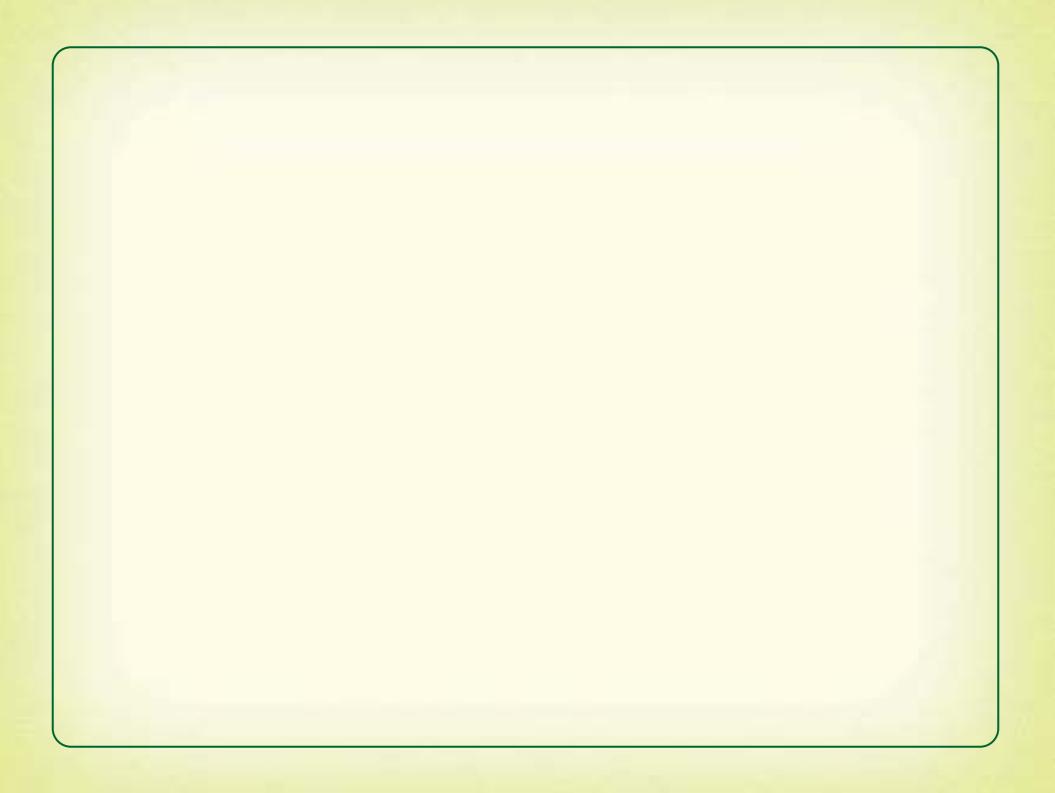
The innovation will reduce vulnerability to climat echange impacts by promoting sustainable development through water conservation, water use efficiency, enhance yields and the innovation can be applied to reduce inequity. This simple technique can also be a game changerforall those Departments, Organizations and farmers as well as Government's efforts to create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree coverby 2030 as part of India's Nationally Determined Contribution. Ido hope that over a period of time the technique will be used by farmers in India as well as other countries and reap be ne fits from this technique.



Dr. K. Satyagopal

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EXECUTIVE SUMMARY

Climate change, a reality, triggers serious imbalances in weather systems resulting in extreme weather events universally. The consequences of climate change include inter alia change in precipitation patterns, changes in hydrology, watermass distribution, which affect all biological systems. The adverse impact of these changes will be more pronounced on Agricultural and Horticultural field crops as well as on Tree Species due to shortages of water and increased temperatures. In respect of crops, the climate change is reported to significantly impact crop yield levels raising serious concerns for the farmers especially the small and marginal farmers.

The Paris Agreement aims to strengthen the response to global climate change by increasing the ability of all, to adapt to adverse impacts of climate change and foster climate resilience. The global goal on adaptation is: to enhance adaptive capacity and resilience to reduce vulnerability, with a view to promote sustainable development.

Thees can play a very significant role in climate change mitigation by acting as carbon sinks. The sun's energy is utilized to capture carbon and converted into trunks, branches, roots and leaves through the process of photosynthesis. Carbon is stored in this "biomass" until being returned back into the atmosphere, whether through natural processes or human interference, thus completing the carbon cycle.

Currently trees/ climbers are grown either through traditional surface imigation around the sapling or through pitcher imigation/drip imigation by which water can percolate up to about half to a maximum of one foot only. Moreover, pitcher imigation and drip imigation are expensive and are beyond the reach of poor farmers.

The innovative technique transforms in gation systems for growing trees/climbers by quickly transferring the irrigated waterto depths of 2 to 3 feet which is not possible even in surface drip irrigation. The technique involves formation of up to 4 sand columns in the pits while planting a seedling to transfer water to the entire rootzone creating appropriate environment in the rhizosphere to facilitate water and nutrient absorption by roots at different levels. The water is transferred through the 4 sand columns thereby minimizing evaporation losses also. The innovation also addresses the need for developing a low cost but effective watering technique for growing trees/climbers. The innovation is an easily adoptable solution for growing trees faster with less water, even under limiting conditions of soil and water. The intervention alters the soil characteristics of the rhizosphere which is beneficial to a wide variety of species (trees & Climbers/Creepers in different soils. The innovation is enabling the plants to express their full genetic potential as evidenced by phenomenal increase in the biomass and enhanced vields.

This simple low cost innovation that can reduce inequity is an original work and first of its kind in India as well as elsewhere. The innovation is an easily adoptable solution for growing trees/climbers faster with less water, even under limiting conditions of soil and water. This innovation transforms irrigation systems as it quickly transfers irrigated water to depths of 2 to 3 feet which is not possible even in surface drip systems. The technique enables farmers overcome the major impacts of climate change. The bio-metric observations of growth parameters - height, girth, leaf surface area and biomass

observed in the field in comparison with the control plots were found to be significantly high. Independent evaluations carried out also comborated the results. Farmers with large holdings can blend the innovation with drip irrigation which reduces water and power consumption and increase yields. The yield levels of drumstick, gourd vegetables (bottle, ridge, bittergourd etc) and fruits (water melon) was higher ranging from 35% to 60% which in turn resulted in additional income to the farmers. In respect of Trees (including species of medicinal and nutritional value) the increase in height over trees grown adopting conventional methods/drip systems, ranged from 4 feet to 15 feet over a period of 2 years itself.

The increase in yield of vegetables and fruits of medic in al and nutritional value resulting in additional income or additional consumption at the farm level will promote the health of pregnant / lactating women and children belonging even to smallholder farmers and can strengthen the Fruit and Vegetable for health initiative of WHO and FAO. The innovation fulfills the objectives of the Paris Agreement to mitigate Climate Change by increasing the ability of farmers including smallholders to reduce carbon emissions as well as enhance carbon sequestration.

The innovation will reduce vulnerability to climate change impacts by promoting sustainable development through water conservation, water use efficiency, enhance yields and the innovation can be applied to reduce inequity.

The unique feature of the low cost CRA technique is its ability to grow trees/climbers faster with less water along with multiple benefits when compared to conventional surface

irrig a tion as well drip irrig a tion systems as listed below.

- 1. Water Use Efficiency The technique promotes faster growth of trees as well as yields with less water.
- 2. Water Conservation- Water requirement is reduced significantly besides minimizing evaporation losses associated with surface irrigation. The frequency of irrigation can also be reduced.
- 3. Imigation of the Root zone up to 2 to 3 feet which is not possible in conventional methods or in drip irrigation with surface drips.
- 4. Enhanced nutrient absorption- the growing roots have access to the nutrients and water even at lower depths and absorb them to facilitate healthy and sturdy growth.
- 5. Facilitates full expression of the genetic potential of the seed ling-Ensures taller and healthier growth of saplings Increased Leaf Surface Area Enhanced Productivity and yields-
- 6. Results in higher survival rates and accelerated growth-
- 7. Enhanced Carbon sequestration Due to increased biomass more carbon will be sequestered than trees grown adopting conventional/drip methods..
- 8. Climate Resilience enhances adaptability and resilience to Climate change impacts
- 9. Drought Resistance- Faster Growth ensures drought resistance during the initial critical growing phase
- 10. Reduced carbon emissions due to reduction in pumping of ground water for conventional or drip irrigation.

The Technique is currently adopted by

- 1. Rural Development &Panchayat Raj Department Tamil Nadu
- 2. Agric ulture Department Tamil Nadu
- 3. Hortic ulture & Plantation Crops Department Tamil Nadu
- 4. National Bank for Agriculture and Rural Development
 Tamil Nadu Region in their Tribal Development
 Programme
- 5. Sriniva san Services Trust a Non-Governmental
 Organisation spread a cross South India
- 6. Shri AMM Murugappa Chettiar Research Centre (MCRC)
- 7. Unive rsitie s in Tamil Nadu
- 8. Adoption by Farmers the success is attracting them to adopt the technique in Tamil Nadu.

INTRO DUCTIO N

Climate change, a reality, triggers serious imbalances in weather systems resulting in extreme weather events universally. The consequences of climate change include inter alia change in precipitation patterns, changes in hydrology, water mass distribution, which affect all biological systems. The adverse impact of these changes will be more pronounced on Agricultural and Horticultural field crops as well as on Tree Species due to shortages of water and increased temperatures. In respect of crops, the climate change is reported to significantly impact crop yield levels raising serious concerns for the farmerse specially the small and marginal farmers.

The Paris Agreement aims to strengthen the response to global climate change by increasing the ability of all, to adapt the adverse impacts of climate change and foster climate resilience. The global goal on adaptation is: to enhance adaptive capacity and resilience to reduce vulnerability, with a view to promote sustainable development.

The escan play a very significant role in climate change mitigation by acting as carbon sinks. The sun's energy is utilized to capture carbonand converted into trunks, branches, roots and leaves through the process of photosynthesis. Carbon is stored in this "biomass" until being returned back into the atmosphere, whether through natural processes or human interference, thus completing the carbon cycle.

Recognizing the importance of afforestation in combating the issues of climatechange, soil erosion, pollution, and in preserving the biodiversity and ecologicalbalance, Governments world over have embarked on a massive programme of tree plantation under different schemes. Trees are also planted as a part of the efforts to restore natural forests as well as in a groforestry, which involves increasing tree cover on a gricultural land and pastures. Every year a large number of saplings are planted and their survival depends inter a lia on frequent watering during the first few years of plantation.

The current surface methods adopted for watering are either the traditional surface watering the area surrounding the sapling or pitcher irrigation or drip irrigation. However, pitcher irrigation and drip irrigation are adopted only for growing Horticultural fruit trees as they are expensive and are beyond

the reach of the poor farmers. The tree planting activities under various programmes face major challenges in areas with limited water availability. This is a major challenge to farmers, who resort to perennial and seasonal vegetable and fruit crops that are climbers/creepers. Therefore, there is a need for developing a low cost but effective watering technique for growing Tree species, other perennials and seasonal climbers (vegetables/fruits).

The Precursor For Invention Of A New Technique

Noticing that the pitcher irrigation adopted under different horticultural programmes will not take water to lower depths due to the shape of the pot, I felt that there is a need to improvise the pitchering ation system to take water to depths of two feet so that seed ling will establish quickly & grow faster. To overcome the shortcomings of pitcher inigation, a tubular earthen vessel was designed by me to grow 9,000 seedlings of Bamboo in District Live stock Farm at Mathagiri, Hosur in the year 1989-90. Mud Tubular Earthen vessels of two feet length designed by me were specially fabricated in local pottery to provide improvised Pitcher Irrigation and to enable speedy movement of water to the root zone easily up to 2 feet and to sustain the Bamboo seedlings. The Mathagiri farm now has fully grown dense Bamboo plantation as a result of the novel pitcher irrig a tion which helped the survival of Bamboo plants. However, this innovation was not pursued further as the cost for each

vessel was quite high and will not be in the reach of the poor farmers. Efforts were also made to use PVC pipes to take water to depths of 2 feet, but had to be given up due to high costs involved.

THE INNO VATION

A very simple, low cost and very effective technique that enhances climate resilience has been developed by me in 2016 and its efficacy tested during the North East Monsoon 2016 in different districts under MGNREGS and formally adopted by Agric ultural and Hortic ultural Departments during 2017. The new technique is being adopted in afforestation programmes and by farmers growing Gourds & other climbers/creepers. The technique is popularly called by the farmers as CRA technique (CRA is the abbreviation of the post Commissioner of Revenue Administration held me). The CRA Technique (Climate Resilient Agriculture-Water Conserving Root Zone Irrigation Technique) helps to grow trees faster with less water. This innovationad dresses the impacts of Climate Change and is emerging as a simple and easily adoptable technique. The technique can be adopted by even poor farmers across the globe to raise agro forestry/horticultural/ silvicultural and c limber and creeperspecies and thus will meet the require ment of some of the Sustainable Development Goals as well as the objective of Paris Agreement.

THE TECHNIQUE



1. To begin with a pit of 2 feet *2 feet *2 feet is dug as done in conventional methods. For horticultural saplings additional holes can be drilled up to 1 foot depth in the comers of the pit using auguror rowbardepending on soil type



2. Now four PVC pipes of 3 feet length and 3 to 4 inch diameter are placed in the comers of the pit.



3. Sie ved Vermi-compost or Manure is mixed with riversand or red soil and applied in the bottom of the pit to a height of ½ foot as prescribed in conventional method.



4. Then the pit is filled with removed soil mixed with Vermicompost or manure, up to the surface ensuring that the PVC pipes are vertically positioned.



5. Each of the PVC pipe is filled up to ½ a foot with Vermicompost or Manure and then it is filled with riversand up to the surface of the pit.



6. The sapling is now planted in the pit after adding some more quantity of unsieved Vermicompost or Manure and the pit is filled fully.



7. Now the PVC pipes are carefully removed so that in each pit, foursand columns are created.

BLENDING OF CLIMATE RESILIENT AGRICULTURE WATER CONSERVING ROOT ZONE IRRIGATION TECHNIQUE & DRIP IRRIGATION SYSTEMS-THE SYNERGIC EFFECT

The new technique can be adopted as standalone technique orcan even be blended with other high cost drip systems to gain additional advantages. The technique can complement Drip Irrigation for cultivating Horticulture Tree Crops as well as Climbers/Creepers. Farmers can adopt the new method while planting and create 2 to 4 sand columns & then drip irrigation system can be installed by placing the drippers above the sand columns. Big farmers and Organizations who can afford drip irrigation can blend the new technique with drip systems since blending with drip systems has shown synergic effects in increasing the benefits over drip systems. Blending also enhances climate resilience and contributes to sustainable development through increased carbon sequestration and results in additional income for the farmers.

Experiments and the Bio-Metric Results from the Field

The technique was experimented while planting trees in several districts in Tamil Nadu by Rural Development Department. Different species were grown to study the efficacy of the technique and it has been found to be very beneficial. Based on the results, the technique was formally adopted in 2017 by Agriculture Department for growing oil seeds and climbers. In all the plots, along with trees grown adopting CRA technique, trees were also grown adopting Conventional methods/Drip systems. The difference in growth parameters such as height, girth, (Perimetre) leaf surface area and biomass were observed in the field in comparison with trees/climbers grown in control plots/rows.

In the case of short duration crops Climbers/Creepers yield of vegetables (ridge gourd, ash gourd etc) & fruits (water melon) was higher and the increase in yield was reported in the range of 35% to 60% which intum resulted in additional income to the farmers. The biometric observations are furnished in Table 1-8.

TABLE - 1: Increase in height - Fruit Bearing Trees

	Name of the		Normal I M easur			echnique urement	Difference in
Sr.No.	Districts	Name of the Plant	at the time of Plantation	on the date of evaluation	at the time of plantation	on the date of evaluation	height
			Height (cm)	Height (cm)	Height (cm)	Height (cm)	
		Diffe	rence in 2	Years & 5 I	Months		
1	Thanjavur	Naval (Syzygium cumini	20	215	20	435	7.3 ft
2	Thanjavur	Tamarind (Tamarindus indicus)	20	138	20	300	5.4 ft
3	Thanjavur	Kodukapuli (Pithecellobium dulce)	30	355	30	473	3.10 ft
4	Pudukottai	Jack (Artocarpus heterophyllus)	25	100	25	215	3.9 ft
		Diffe	erence in 1	Years & 6 N	l onths		
5	Tiruvarur	Guava (Psidium guajava)	30	200	30	345	4.9 ft
6	Tiruchirappalli	Drumstick (M oringa oleifera)	30	308	30	404	3.2 ft
			Differenc	e in 1 Years	S		
7	M CRC-Chennai	M ango (M angifera indica)	94	118	102	240	4. ft
			Difference	in 8 Montl	ns		
8	Pudukkottai	Cashew (Anacardium occidentale)	30	116	30	218	3.4 ft
9	M adurai	Pappaya (Carica Papaya)	30	240	30	310	2.4 ft

TABLE - 2: Increase in height - Oil Seed Species

	Name of the	0		M ethoed rement	CRA Tec M easur	•	Difference in height	
Sr.No	Districts		at the time of plantation	on the date of evaluation	at the time of plantation	on the date of evaluation		
			Height (cm)	Height (cm)	Height (cm)	Height (cm)		
		Di	fference in	1 year & 11	months			
1	Tirupur	Pungan (Pongamia glabra)	40	205	40	350	4.9 ft	
		D	ifference in	1 year & 1	months			
2	Tirunelveli	Neem (Azadirachta indica)	30	200	30	377	5.10 ft	
3	Tirunelveli	Pungan (Pongamia glabra)	30	85	30	220	4.5 ft	
4	M CRC-Chennai	Coconut (Cocos nucifera)	49	208	49	335	4.2 ft	
5	Tirunelveli	Pungan (Pongamia glabra)	30	124	30	249	4.1 ft	
6	Tirunelveli	Neem (Azadirachta indica)	30	185	30	306	4.ft	
			Differen	ce in 6 mon	iths			
7	Coimbatore	Neem (Azadirachta indica)	60	220	52	334	4.ft	

TABLE - 3: Increase in height - Timber Species

	Sr.No. Name of the Districts		Normal Method Measurement		CRA Technique M easurement		Difference in	
Sr.No		Name of the Plant	at the time of Plantation	on the date of evaluation	at the time of Plantation	on the date of evaluation	Difference in height	
			Height (cm)	Height (cm)	Height (cm)	Height (cm)		
		Dif	ference in 2	2 Years & 2	M onths			
1	Tiruvarur	M ahogany (Swietenia mahagoni)	30	230	30	685	14.11 ft	
		Difference in	1 Years 5 l	Monthsto	1 year 11 M	onths		
2	Coimbatore	Etti (Strychnosnux Vomica)	24	250	24	725	14.10 ft	
3	Tiruvannamalai	Teak (Tectona grandis)	36	250	36	540	9.6 ft	
4	Tirupur	Arasan (Ficus religiosa)	30	185	30	287	3.4 ft	
5	Tirupur	Arasan (Ficus religiosa)	50 585		50 685		3.3 ft	
			Differer	ice in 1 Yea	rs			
6	M CRC - Chennai	Kumil (Gmelina arborea)	89	240	89	668	14.1 ft	

TABLE - 4: Increase in height - Medicinal Species

				Method irement	CRA Tec M easur		Difference in
Sr.No.	Name of the Districts	Name of the Plant	at the time of Plantation	on the date of evaluation	at the time of Plantation	on the date of evaluation	height
			Height (cm)	Height (cm)	Height (cm)	Height (cm)	
		Differe	ence in 2 Yea	rs & 2 Mont	hs		
1	Tiruvarur	Neermaruthu (Terminalla arjuna)	30	180	30	550	12.2 ft
		Difference in 1 Y	ears 1 M ont	hs to 1 year	11 Months	'	
2	Tirunelveli	Golden rain tree (Cassia siamea)	30	184	30	399	7.1 ft
3	Tirupur	Vangai (Pterocarpus marsupium)	50	350	50	540	6.3 ft
4	Coimbatore	Vangai (Pterocarpus marsupium)	35	345	35	540	6.5 ft
5	Erode	Soursop (Annona muricata)	20	150	20	230	2.7 ft
		D	ifference in	8 Months			
6	M adurai	Silk Cotton (Ceiba pentandra)	30	150	30	530	12.6 ft
7	Villupuram	M alaivembu (M elia dubia)	40	267	42	366	3.2 ft

TABLE - 5: Increase in height - Flowering Species

	Name of the District	Name of the Plant		M ethod rement		chnique rement	Difference in	
Sr.No.			at the time of Plantation	on the date of evaluation	at the time of plantation	on the date of evaluation	height	
			Height (cm)	Height (cm)	Height	Height		
	Difference in 1 Years 6 M onths 1 year 11 months							
1	Coimbatore (Peedampalli)	M ay flower (Delonix regia)	43	340	43	690	11.6 ft	
2	Coimbatore (Sulur)	M ay flower (Delonix regia)	70	660	70	890	7.7 ft	
			Difference	8 Months				
3	M adurai	M aiil Vagai (Albizia lebbeck)	30	250	30	400	4.11 ft	

TABLE - 6: Increase in Length of leaves

Sr.No.	Name of the District	Name of the Plant	Normal Method Measurement	CRA Technique M easurement	Increase in Length of Leaves (cm)	Age of Tree
			Leaf lenght (cm)	Leaf lenght (cm)	Leaves (GIII)	(Year / Months)
1	Tiruvannamali	Teak (Tectona grandis)	44	55	11	9 months
2	Virudhunagar	Neem (Azadirachta indica)	26	32		3 months
3	Virudhunagar	Pungan (Pongamia glabra)	8	13	5	3 months
4	Virudhunagar	Neem (Azadirachta indica)	14	18	4	3 months
5	Tiruvallur	JACK (Artocarpus heterophyllus)	12.5	15	2.5	1 year 1 month

TABLE - 7: Increase in Number of Branches

Sr.No.	Name of the District	Name of the Plant	No of Branches		Method Measurement Measurement Mo of Measurement Measurement Measurement Measurement Number of Branches		Number of	Age of Tree (Year /
			Branches	No of Branches	2141101100	M onths)		
1	Pudukkottai	Cashew (Anacardium occidentale)	7	15	8	8 months		
2	M CRC-Chennai	JACK (Artocarpus heterophyllus)	6	12	6	1 Year		
3	Tiruchirappalli	Drumstick (M oringa oleifera)	4	10	6	1 Year, 6 nonths		
4	M CRC-Chennai	M ango (M angifera indica)	5	10	5	1 Year		
5	M CRC-Chennai	Guava (Psidium guajava)	8	12	4	1 Year		
6	Tiruvallur	JACK (Artocarpus heterophyllus)	5	8	3	1 Year, 1 months		

TABLE - 8: Increase in Girth

Sr. No	Name of the Distric t	Name of the Plant	Normal Method Measur ement	C RA Technique Measurement	Difference in GIRIH (cm)	Age of Thee
			G irth (c m)	G irth (c m)	(em)	(Year/ Months)
Fruit I	Bearing Trees	,				
1	Thanjavur	Naval	11	33	22	2 year, 3 months
2	Tha nja vur	Ta m a rind	10	21	11	2 year, 3 months
3	Tha nja vur	Kodukapuli	20	31	11	2 year, 3 months
4	Pud ukko tta i	Ja c k	9.5	15.5	6	2 year, 5 months
5	Ma dura i	Papaya	4	7	3	8 months
O il Se	e e d Species					
6	Tirup u r	Pungan	16	28	12	1 year, 11 months
7	Tirune lve li	Neem	9	17	8	1 year, 1 months
Tim b	er Species					
8	Tiruv a rur	Mahogany	14	31	17	2 year, 2 months
9	Tirup u r	A ra sa n	33	42	9	1 year, 11 months
Medi	ic in a l Species					
10	M a d u ra i	Silk C o tto n	1.8	8	6.2	8 months
11	Tiruv a rur	Neermaruthu	11	30	19	2 year, 2 months
12	Villup ura m	Malaivembu	11.6	27.1	15.5	11 months
13	Tirup u r	Vangai	18	30	12	1 year, 11 months
Flow	e ring Species					
14	C o im b a to re (Sulur)	Mayflower	4	5.5	1.5	1 year, 11 months
15	Madurai	Mayilvagai	3.2	5	1.8	8 months

Advantages of the Technique overconventional method/drip irrigation

A study was undertaken to document the bene fits/advantages of the new technique in comparison with trees/climbers grown adopting conventional methods as well as those grown with the aid of surface drip irrigation systems. The study conducted over different areas and on different species revealed phenomenal advantages of the invention. The unique feature of the technique is its ability to grow trees faster with less water at low cost. Adoption of the invention has resulted in flow of the following benefits

❖ Irrigation of the Root zone up to 2 to 3 feet-

Ensures that water is taken up to 2 to 3 feet depth, which is not possible in conventional methods or in drip irrig a tion with surface drips.

* WaterConservation-

Since the waterpercolates up to 2 feet, it is retained in the root zone. Due to retention of soil moisture in the root zone the requirement of water is reduced significantly besides minimizing evaporation losses associated with surface irrigation and thus promotes waterconservation. Concomitantly, the frequency of imigation is reduced, leading to further savings in water requirement. It is observed that water requirement is reduced when compared to conventional surface irrigation as well as in comparison with drip irrigation systems.

❖ WaterUse Efficiency

Inspite of the reduced requirement of water, the technique promotes faster growth of trees and promotes efficiency of water used.

thanced nutrient absorption

Due to moisture retention in the root zone up to 2 to 3 feet, the growing roots have access to the nutrients and water even at lower depths and absorb them to facilitate healthy and sturdy growth.

❖ Facilitates full expression of the genetic potential of the seedling

- ✓ Ensures taller and healthier growth of saplings

 The increase in heightranged from 4 to 14 feet over a period of 1 to 2 years.
- ✓ Increased Leaf Surface Area-

Ensures that the surface area of the leaf and leaf length is more than that of the leaves of trees grown as perconventional method.

✓ Enhanced Productivity and yields-

The technique triggers rapid growth of the seedlings and result in enhanced productivity in biomass and yield. Increase in yield was ranging from 35 to 60 % was recorded in Vegetables & seasonal fruit crops (Climbers/Creepers) when compared with plot with drip irrigation that too with lesser water consumption.

Results in higher survival rates and accelerated growth

The accelerated growth and higher survival rates will increase green cover faster. Ensures faster growth when compared with conventional methods/drip systems.

Enhanced Carbon seque stration

The Innovative technique results in increased biomass as well as in increased leaf size. Due to increased biomass more carbon will be sequestered. Plantations can grow relatively very fast, thus absorbing Co2 at higher rates than trees grown adopting conventional / drip methods. The newly planted trees can continue to absorb carbon for 30-50 years ormore.

Climate Resilience

Retention of moisture in the root zone and the

nutrients provided enhances adaptability and resilience to Climate change impacts

Drought Resistance-

Faster Growth ensures drought resistance during the initial critical growing phase

❖ Low Cost and Easy to Adopt-

The technique is a low cost &easily adoptable even by the poor, small and marginal farmers.

- Ea sy a va ila bility of require d m a te ria ls lo c a lly
- Poverty Reduction-

The low cost technique besides saving water, increases yields and results in generation of additional income for the farmers.

- Reduced Carbon emissions- Reduced power consumption due to reduced hours for pumping water when the technique is used as a stand-alone and also in combination with drip irrigation. This in turn reduces consumption of fossil fuels required for power generation and reduces carbon emissions.
- By this intervention appropriate environment is created in the rhizosphere facilitating water absorption at different levels along with nutrient

supplied at the time of planting. The sand columns also facilitate properaeration and the quick growth of the roots (as evidenced by shoot growth). The intervention also alters the soil characteristics of the rhizosphere which appears to be beneficial in different soils and across a wide variety of species (trees & Climbers/Creepers). The suitable rhizosphere environment is enabling the plant to express its full genetic potential as evidenced by phenomenal increase in the biomass and enhanced yields when compared with the control even though all other facts remained identical except the formation of sand columns for taking water up to a depth of two feet

The technique can be used in all types of soils and can be scaled up to National & Global levels with ease. This innovation will be extremely useful in all areas and a boon in drought prone areas for growing trees and climbers. The principle can be adopted even for existing trees to save them from waterstress.

Advantages of blending of Climate Resilient Agriculture-Water Conserving Root zone Irrigation Technique & Drip Irrigation Systems

The new technique can be adopted as stand-alone technique or can even be blended with other high

cost drip systems to gain additional advantages. The technique can complement Drip Irrigation for cultivating Horticulture Tree Crops as well as Climbers/Creepers. However, while planting climbers in the 2 x 2 x 2 feet pit, 2 inch diameter PVC pipes are sufficient instead of 3 inch diameter (required for Horticultural tree crops) for creating sand columns and there is no need for creating additional holes in the pit. The advantages of blending this new technique with drip irrigation system are:

- a) Significant reduction in electricity consumption and consequent reduction in Co2 emissions.
 (since mostly fossil fuel based power is used for pumping water)
- b) Water from the drip system can be taken up to 2 to 3 feet depth immediately through the four sand columns from surface to the deeper layers of the root zone which is not possible with surface drip irrigation system. This will ensure availability of moisture in the root zone even with lesser quantity of water.
- c) Prevents evaporation losses.
- d) Reduction in require ment of water.

- e) Root zone moisture in deeper layers aids in faster and healthier tree growth.
- f) Fertigation is feasible in deeperlayers also.
- g) Reduction in cost of cultivation due to reduction in irrigation costs

Relevance of CRA Technique in the context of Climate Change

The CRA Technique, though simple is highly versatile and ensures Climate Resilience, Climate Mitigation & Climate Adaptation. It also transforms the irrigation and agronomic practices resulting in socio-economic and national security. Due to its simplicity, scalability, replicability and sustainability attributes it has the potential to be a viable technique for achieving the goals of Paris Agreement on Climate Change and the objectives of Sustainable Development Goals.

Climate Resilience

The CRA technique promotes Climate resilience by enhancing the ability to (1) absorb stresses and facilitate growth of trees/climbers even in the face of external stresses imposed upon it by and (2) adapt to the changes and improve the afforestation and horticultural programmes. Climate resilience is enabled by creating favourable environment in the Rhizosphere. By this intervention appropriate environment is created in the

rhizosphere facilitating water absorption at different levels along with nutrient supplied at the time of planting. The sand columns also facilitate properaeration and the quick growth of the roots (as evidenced by shoot growth). The intervention also alters the soil characteristics of the rhizosphere which appears to be beneficial in different soils and across a wide variety of species (trees & Climbers/Creepers). The suitable rhizosphere environment is enabling the plant to express its full genetic potential as evidenced by phenomenal increase in the biomass and enhanced yields when compared with the control even though all other factors remained identical except the formation of sand columns for taking water up to a depth of two feet.

The innovation will transform existing irrigation systems for growing trees and climbers. The simple, low cost technique can be replicated easily and scaled up quickly to benefit the small holder /women and indigenous farmers. Adoption of the innovation reduces evaporation losses, promotes water conservation and water use efficiency, increases carbon sequestration, reduces carbon emissions and increases yields. The innovation can help in restoring degraded lands and water stressed ecosystems by growing trees besides resulting in socio-economic, nutritional and health benefits to the farmers. The technique can be used in all

types of soils and can be scaled up to National & Global levels with ease. This innovation will be extremely useful in all areas and a boon in drought prone areas for growing trees and climbers. The principle can be adopted even for existing trees to save them from waterstress.

Climate Mitigation

The technique is innovative and easily adoptable solution forgrowing trees faster with less water, even under limiting conditions of soil and water. The technique enables farmers (who resort to cultivation of perennial trees and seasonal vegetable and fruit crops like climbers/creepers) overcome the major climate change impacts.

Enhanced Carbon Seque stration-

The es play a very important role in carbon sequestration. The Innovative technique results in increased bio-mass(increase in heightranged from 4 to 15 feet over a period of 1 to 2 years), increased girth, more branches, more leaves, increased leafsize and enhanced productivity and yields when compared over plots even with drip irrigation that too with lesser water consumption. Due to increased biomass and increased leaf surface area more carbon will be sequestered at higher rates than trees grown adopting conventional / drip methods. The newly planted trees will act as carbon sinks for 30-50 years or more.

Reduction in carbon emissions-

The significant benefits include enhanced wateruse efficiency & waterconservation, reduction in evaporation losses as a result of which the water requirement is significantly less than in plots with drip irrigation systems. Reduction in water consumption reduces power consumption for pumping water resulting in reduced consumption of fossil fuels and in turn lesser carbon emissions. The ease with which the technique can be scaled up and replicated can bring in large scale benefits and it can be a game changerdue to the multiple benefits that accrue to farmers cutting across gender, class and regions.

Climate Adaptation

The innovation can fulfil the objectives of the Paris Agreement to mitigate Climate Change by increasing the ability of farmers including smallholders to reduce carbon emissions as well as enhance carbon sequestration at farm level and when scaled up it can benefit on a large scale. The innovation will also reduce vulnerability to climate change impacts by promoting sustainable development through water conservation, water use efficiency and enhanced carbon sequestration. The innovation can increase the green cover faster and reduce soilerosion and protect from floods.

Social & Economic Co-Bene fits

The smallholder farmer can adopt the technique and derive full be nefits even though he / she cannot afford drip systems. On the other hand the farmers who can afford drip systems can blend it with the innovation and benefit. Due to efficient utilization of scarce water resources. farmers/Organizations can grow trees/Climbers in water stressed areas and derive multiple benefits including increased yields which in turn results in additional wage employment in processing and packaging activities. Farmers can also adopt this technique to grow Drumstick, Papaya and Vegetable climbers and derive additional yields enriching their nutritional and health status. Farmers who adopted the innovation for cultivating vegetables (ridge, bottle, bittergourd, cucumbers etc) and fruits (water melon) have reported additional yields ranging from 30% to 60% over plots with drip irrigation. Moreover the frequency of irrigation in plots with drip was once in To 2 4 days and in the plots that adopted the invention, irrigation was done once in 5 to 10 days.

Farmers/Agencies who are growing fruit bearing trees/ timber/medicinal/oil seeds etc by application of invention have reported phenomenal increase in biometric parameters of trees when compared with trees grown with conventional methods. The height increase

was in the range of 4 to 15 feet within a period of 1 to 2 years, increased girth and increased branches, more leaves and increased leaf surface area. The invention enhances carbon sequestration, reduces carbon emissions, water use efficiency and water conservation benefiting the farmers and the environment.

Sc a la bility a nd Re plic a bility

The technique is an imnovative and easily adoptable solution for growing trees faster with less water, even under limiting conditions of soil and water. The technique overcomes the major climate change impacts faced by farmers, cultivating trees and seasonal vegetable and fruit crops (climbers/creepers). The small holder/indigenous farmers (who cannot afford drip systems) can adopt the new technique to derive full benefits, since the technique is simple, low cost, nature based and relies on local resources.

The initial cost incurred for forming sand columns reduces the cost of cultivation due to reduction in water consumption and power consumption. Moreover the farmers will earn additional income through increased yields (increase of 35 to 60% reported by farmers). The innovation reduces the vulnerability of the poor farmers to climate change. Farmers with limited water resources can also benefit from the innovation.

The farmers having large holdings and agencies (government & Private) adopting drip systems can adopt the innovation to blend it with drip systems and derive benefits besides contributing to the cause of climate mitigation (enhanced carbon sequestration, reduced carbon emissions, water use efficiency and water conservation).

The innovation is being replicated in Tamil Nadu curently by following organisations.

- Rural Development & Panchayat Raj Department,
 Tamil Nadu
- 2. Agriculture Department, Tamil Nadu
- 3. Hortic ulture & Plantation Crops Department, Tamil Nad
- 4. National Bank for Agriculture and Rural Development,
 Tamil Nadu Region in the Tribal Development
 Programme
- 5. Srinivasan Services Trust a Non-Governmental Organisation spread across South India and
- 6. Shri AMM Murugappa Chettiar Research Centre (MCRC)
- 7. Universities in Tamil Nadu

Relevance of the Technique to meet the goals of Paris Agreement

Strengthen the global climate change response by increasing the ability of all farmers to foster climate resilience as well as overcoming the adverse impacts of climate change. The new technique can be adopted by even by small holder farmers across the globe and can reduce their vulnerability and contribute to goals of Paris Agreement due to:

Ease of Adoption of the CRA Technique

The Technique is easily adoptable by all farmers because

- It is a Nature based solution
- ❖ It use s locally a vailable materials
- * It is a simple technique and
- * It is a Low Cost Technique

Promotion of Climate Resilience by the CRA Technique through

- * WaterConservation
- * Wateruse efficiency
- ❖ Enhanced Carbon Seque stration
- ❖ Drought Resistance
- * Reduction of carbon emissions
- * Enhanced Productivity

Relevance of the CRA Technique to meet the Sustainable Development Goals

- * End hunger, achieve food security and improved nutrition and promote sustainable agriculture (Goal1)
- * Poverty reduction (Goalno.2)
- Action to combat climate change and its impacts (Goal13)
- Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss (Goal15)

Relevance of the CRA Technique to meet the Goals of Fruits & Vegetables for Health Initiative of WHO & FAO

The bio -metric results have revealed significant increase in the overall bio mass of fruit bearing trees when compared with the control plots and it has also been recorded that the fruit bearing trees such as Sapota, Pomegranite and Guava started yielding fruits within one and half years when they are grown adopting CRA Technique.

Similarly it has been observed that farmers growing vegetables like Drum Stick, and varieties of Gourds and fruits that grow on Creepers and Climbers have secured additional yields ranging from 35% to 60% compared to control plots. This will enable the farmers to gain additional income as well as consume a portion of the surplus yield which will ensure better nutrition for the farmer's family.

Results of Field Experiments and Independent Evaluations

This technique was experimented by various organisations at field and independently evaluated by Murugappa Chettiar Research Centre, Chennai and Manonmaniam Sundaranar University (MSU), Tirunelveli and Srinivasan Services Trust in Yelagiri Hills, Tribal Development project implemented by National Bank for Agriculture and Rural Development. The results are presented from page 29

CostAnalysis:

The State Rural Development has adopted the technique fortree plantation as part of the MGNREGS since 2017. Wherever the CRA Technique was followed it was ensured that controls as per conventional methods are also laid and concurrently monitored.

The CRA Technique involves additional cost at the time of planting as noted below

- a) Cost towards the PVC pipes for forming sand columns (The pipes are removed immediately after the sand columns are created in each plant and reused number of times, a minimum of 1000 uses are assumed per one set of pipes). The pipes may range from 2 inch dia to 4 inch dia as per site conditions.
- For creating 4 numbers of Sand Columns with 4 inch dia PVC pipes, the pro rata cost of pipe per plant will be Rs. 0.89
- For creating 4 numbers of Sand Columns with 2 inch dia PVC pipes, the pro rata cost of pipes perplant will be Rs.0.60 (for climbers)
- The cost will correspondingly come down if only two sand columns are formed perplant.

- b) Cost of River/Stream Sand or any water absorbing gel
 - For 4 numbers of Sand Columns with 4 inch dia PVC pipes, the costofsand perplantwill be Rs.5.74
 - For 4 numbers of Sand Columns with 2 inch dia PVC pipes, the cost of sand per plant will be Rs.3.00 (forc limbers)
 - The cost of sand will come spondingly come down if only two sand columns are formed perplant.
- c) Additional wage cost due to additional time required forplanting Perplant Rs. 1.71

Savings due to adoption of CRA Technique

Adoption of the CRA technique reduces water consumption and retains moisture for longer time there by reduces the frequency of irrigation and reduces cost of irrigation as noted below:

Reduction in Wage cost due to reduced watering days -first year	Rs.19.60/ pla nt.
Savings in Weeding and Mulching -first year	Rs.4.95/ Pla nt
Reduction in Wage cost due to reduced watering days -second year	Rs.49/ pla nt.
Reduction in Wage cost due to reduced watering days -third year	Rs.78.40/ pla nt.

Though an additional cost of about Rs.10 to 16 has to be incurred at the time of planting/tree, there will be a saving of about Rs 10/ tree in the first year itself. The total saving for three year period will be Rs 159/tree.

The other advantage of CRA Technique over the Conventional Methods of tree Plantation is the higher survival rate of plantations. The average survival rates of trees planted under conventional method is 75% and the CRA Technique 85% as per reports from the Kancheepuram District Administration. Due to increased survival rates there can be further savings of Rs 2698 since replanting is not required for every 100 trees planted

Be sides higher survival rates the biometric observations show enormous difference in bio mass when compared with the plants grown normally resulting in higher carbon sequestration as well as water conservation & reduced consumption of power for pumping water. Difference could be seen in Height, Girth, number of branches and numbers & size of leaf. The cumulative advantage of these benefits, and the greater quantum of carbon sequestration & water conservation when compared to the conventional methods have not been quantified while assessing the economic benefits of affore station by adopting CRA Technique.

Table

Ac tivitie s	Conventional Method in MGNREGS			CRA Technique. (An Innovation by D:KorlapatiSatyagopal IAS)		
	Qty (Cum)	Rate (in Rs)	Amount (in Rs)	Qty (Cum)	Rate (in Rs)	Amount (in Rs)
Earthwork in Hard soil for Plantting for plantation work. (0.60*0.60*0.60)	0.216	344.37	74.38	0.216	344.37	74.38
Planting	0	0	11.32	0	0	11.32
Application of Manue (Manue will be supplied at free of cost from SWM site)	1	5.24	5.24	1	5.24	5.24
Additional la bourcost	0	0	0.00	0	0	1.71
PVC pipe cost for one use	0	0	0.00	4x1.00 m	110.9	0.89
Requirement of Sand to be filled in pipe (with maximum lead of 50 kms)	0	0	0	0.01	574.30	5.74
Cost perPlant			91.94			100.29
First Year: Watering						
(Twice in a week during summer, Once in a week during normal season & No watering during rainy season)	68	2.45	166.60	60	2.45	147.00
Weeding and Mulching	2	4.95	9.89	1	4.95	4.95
Application of Manuring	1	5.24	5.24	0	5.24	0.00

Saving perplant for planting & 1st year maintenance 9.50

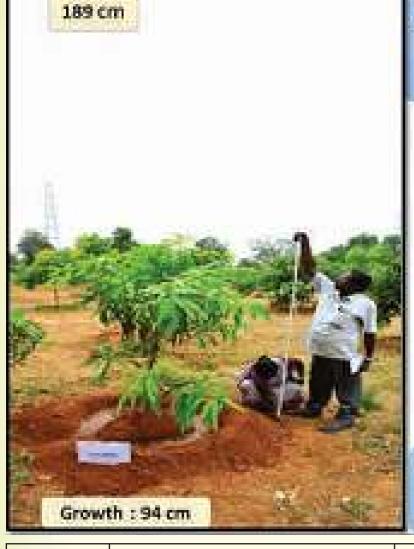
Ac tivitie s	Conventional Method in MGNREGS			CRA Technique. (An Innovation by Dr.KorlapatiSatyagopal IAS)		
	Qty (Cum)	Rate (in Rs)	Amount (in Rs)	Qty (Cum)	Rate (in Rs)	Amount (in Rs)
Second Year Watering	68	2.45	166.60	48	2.45	117.60
Weeding and Mulching	2	4.95	9.90	2	4.95	9.90
Applic a tion of Manuring	2	5.24	10.48	1	5.24	5.24
Total Maintenance cost Second and Third Year			373.96			236.08
Third Year Watering days	68	2.45	166.60	36	2.45	88.20
Weeding and Mulching	2	4.95	9.90	2	4.95	9.90
Applic a tion of Manuring	2	5.24	10.48	1	5.24	5.24
Total Cost including Three Year Maintenance			647.63			488.32
Savings in Water Conservi	ng Root?	Zone Inig	ation Tecl		plant for e Years	159.32

Note: The Department of Rural Development analysed and sent proposals to Government for approval of revised rates.

Susta ina bility

The technique can benefit farmers globally since it is a simple, low cost method providing solution to overcome the likely impacts of climate change. The method helps environmental conservation, water conservation and improves green cover besides enhancing yields and income for the farmers, benefiting the society.

BIO - MEIRIC OBSERVATION OF FRUITBEARING TREES



Mangifera indica, MANGO

> In 2 Years

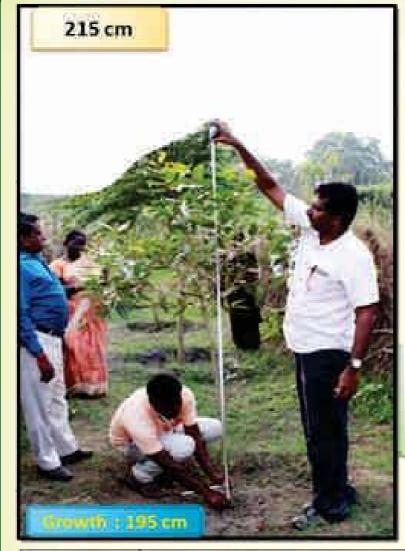
Increase in Growth over Normal method

> 3 feet 7 Inch

Kanchengurem District, Kondrathur Block



Date	Normal Method			CRA Technique		
	Height of Plant (cm)	Girth (cm)	No of Branches	Height of Plant (cm)	Girth (cm)	No of Branches
25-04-2017	95	2	2	105	1	3
28-04-2019	189	13	10	310	21	14



NAVAL

In 2 Years and 3 Months

Increase in Growth over Normal method

> 7 feet & 3 Inch

Thanjavur District, Ammapettai Block

SOIL TYPE SANDY SOIL



1/250200	Normal Met	hod	CRA Technique		
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
21-10-2016	20	1	20	1	
21-01-2019	215	11	435	33	



JACK (Artocarpus heterophyllus)

In 2 Years & 5 Months

Increase in Growth over Normal method

> 3 feet & 9 inch

Pudukottai
District _
Veerapatti _
Thantriswaram

SOIL TYPE CLAY



Data	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
04-08-2016	25	2.5	25	2.6
01-02-2019	100	9.0	215	15.5



Guava (Psidium guajava)

In 1 Year

Increase in Growth over Normal method

4 feet & 3 inch

Tiruvarur District, Ammaiyappan Panchayat



Normal	Wethod CRA Tec	hnique
14.10.2016	Date of Plantation	14.10.2016
30 cm	Height (cm) of the plant at the time of plantation	30 cm
24.10.2017	Date on which current height of both plants are measured	24.10.2017



Manilkara Zapota (Sappotta)

In 2 Years

Increase
in Growth
over
Normal
method

4 feet 7 inch

Kancheepuram
District,
Madurantakam
Block



D	Date Normal Method				CRA Technique				
D.	Jaic	Height of Plant (cm)	Girth (cm)	No of Branches	No. of Leaves	Height of Plant (cm)	Girth (cm)	No of Branches	No. of Leaves
25-04	4-2017	30		3	3	30		3	3
28-04	4-2019	90		14	13	230		22	19

BIO - MEIRIC OBSERVATION OF OIL SEED SPECIES



Pongamia pinnata Pungan

In 2 Years

Increase in Growth over Normal method

4 feet

&

9 inch

Tiruppur District, Palladam

SOIL TYPE RED SOIL



Data	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
15-11-2016	40	2	40	2
15-10-2018	205	16	350	28



Azadirachta indica (NEEM)

In 2 Years & 8 Months

Increase in Growth over Normal method

7 feet & 2 inch

Perambalur District – Alathur Block Melamathur Village



Doto	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
23.01.2017	75		75	
17.09.2019	430	30	650	34

BIO - MEIRIC OBSERVATION OF TIMBER SPECIES



Tectona grandis (Teak)

In 2 Years & 6 Months

Increase in Growth over Normal method

10 feet & 2 inch

Tiruvannamalai District, Vnnankulam Village



Data	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
April - 2017	36		36	
20.09.2019	440	20.3	750	30.3



Tectona grandis (Teak)

In 2 Years & 6 Months

Increase in Growth over Normal method

7 feet & 4 inch

Tiruvannamalai District, Vnnankulam Village



Doto	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
April - 2017	36		36	
20.09.2019	345	14.1	570	25.2



Tectona grandis (Teak)

In 2 Years & 6 Months

Increase in Growth over Normal method

6 feet & 6 inch

Tiruvannamalai District, Vnnankulam Village



Data	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
April - 2017	36		36	
20.09.2019	160	10	360	17.5



Swietenia Mahaghany

> In 2 Years & 2 Months

Increase in Growth over Normal method

14 feet & 11 inch

Tiruvarur District -Ammaiyappan

SOIL TYPE
Red sandy



Date	Normal Method		CRA Technique	
	Height of Plant (cm) Girth (cm)		Height of Plant (cm)	Girth (cm)
14-10-2016	30		30	
04 01 2019	250	14	685	31

Tiruvannamalai District, Vnnankulam Village

In 1 year & 6 months

Tectona grandis (Teak)



290 cm Growth Difference



Normal N	Method CRA Tech	CRA Technique	
April-2017	Date of Plantation	April-2017	
36 cm	Height (cm) of the plant at the time of plantation	36 cm	
05-09-2018	Date on which current height of both plants are measured	05-09-2018	

BIO - MEIRIC OBSERVATION OF MEDIC INAL PLANTS



Phyllanthus emblica AMLA

In 6 Months

Increase in Growth over Normal method

6 Feet

Thanjavur Kumbakonam Sub Division Srinivasanallur

SOIL TYPE
SANDY CLAY



Data	Normal Method		Water Conserving Rootzone Irrigation Technique		
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
12-02-2018	20	1	20	1	
25-02-2019	160	9.5	344	18.4	



Neermaruthu (**Terminalia** arjuna)

> In 2 Years & 2 Months

Increase in Growth over Normal method

12 feet & 1 inch

Tiruvarur District -Sithanvalur

SOIL TYPE
Sandy Clay



Date	Normal Method		CRA Technique		
	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
14-10-2016	30		30		
04-01-2019	180	11	550	30	



Albizia Lebbeck Vagai

Black Shirish

In 1 Year, 11 Months

Increase in Growth over Normal method

> 6 feet & 3 inch

Tiruppur District, Uthukuli Block

> SOIL TYPE RED SOIL

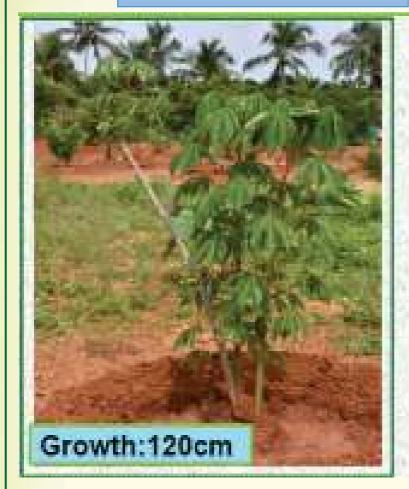


Date	Normal Method		CRA Technique		
	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
15-11-2016	50	1	50	1	
15-10-2018	350	18	540	30	

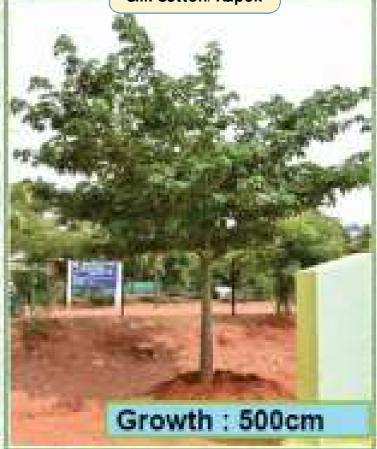
Madurai District – Madurai East Block

In 8 months

Bombax ceiba Silk Cotton/ Kapok



Growth Difference: 380 cm (12 feet 6 inch)



Normal Method

CRA Technique

	Normal				Root Zone			
Date	Height of Plant	Circumstance of Girth	Main & Sub Branch of Plant	Avg. Leaf Size (L x B) in mm	Height of Plant	Circumstance of Girth	Main & Sub Branch of Plant	Avg. Leaf Size (L x B) in mm
14.02.2018	30 cm	1 cm	1	10 x 4	30 cm	1 cm	1	10 x 4
15.10.2018	120 cm	1.8 cm	20	80 x 30	500 cm	8.0 cm	33	250 x 100

SOIL TYPE

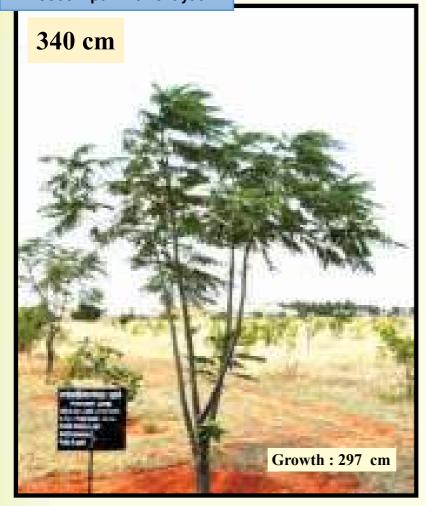
RED SOIL

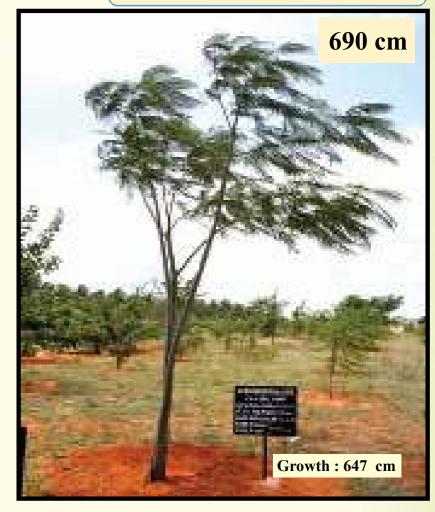
BIO - MEIRIC OBSERVATION OF FLOWERING TREES

Coimbatore District, Peedampalli Panchayat

In 1 year & 6 months

Epigaea repens (M ay Flower)





Normal I	Method CRA Tecl	hnique
14-02-2017	Date of Plantation	14-02-2017
43 cm	Height (cm) of the plant at the time of plantation	43 cm
25-08-2018	Date on which current height of both plants are measured	25-08-2018



Cassia fistula (Sarakondrai)

In 2 Years & 8 Months

Increase in Growth over Normal method

7 feet & 7 inch

Perambalur District – Alathur Block – Melamathur Village



Data	Normal Method		CRA Technique		
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
23.01.2017	75		75		
17.09.2019	405	30	640	47	



Mimosa speciose (Mayil vagai)

In 8 Months

Increase in Growth over Normal method

> 4 feet & 11 Inch

M adurai, M adurai (E)

SOIL TYPE
SANDY Clay
Loam



Data	Normal Method		CRA Technique		
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
14-02-2018	30	1	30	1	
15-10-2018	250	3.2	400	5	

Biometric Observations-Leaf size

In 3 months

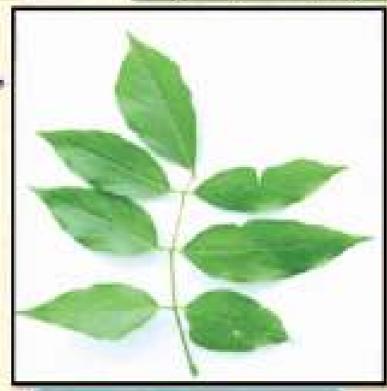
Virudhunagar District, Virudhunagar Block, Nursery site

Pongamia pinnata (Pungam)



More leaves,

Leaf size is bigger Dark green



Leaf length: 8 cm

Normal Method

Date of Plantation

CRA Technique

Leaf length: 13 cm

13-09-2017

13-09-2017

Virudhunagar District, Virudhunagar Block, Nursery site

Neem



More leafs,

Height leaf length,

Dark green



Leaf length: 26 cm

Normal Method

Leaf length: 32 cm

CRA Technique

13-09-2017

Date of Plantation

13-09-2017



Biometric Observations- overall Biomass

355 cm

Pithecellobium dulce (KODUKKAPULI)

In 2 Years and 3 Months

Increase in Growth over Normal method

> 3 feet & 10 inch

Thanjavur District, Ammapettai Block

SOIL TYPE
SANDY SOIL



Dete	Normal Method		CRA Technique		
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
21-10-2016	30	1	30	1	
21-01-2019	355	20	473	31	



Punica granatum (POMOGRANITE)

In 1 Year 11 Months

Increase in Growth over Normal method

> 3 feet & 7 Inch

Coimbatore
District,
Sulur Block

SOIL TYPE RED SOIL



Date	Normal Method		Water Conserving Rootzone Irrigation Technique		
	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)	
15-11-2016	50	1.7	50	1.7	
15-10-2018	385	17	480	26	

COMPARISON BETWEEN
NORMAL METHOD (3 YEARS)
&
CRA TECHNIQUE (2 YEARS)



Terminalia catappa (BADAM)

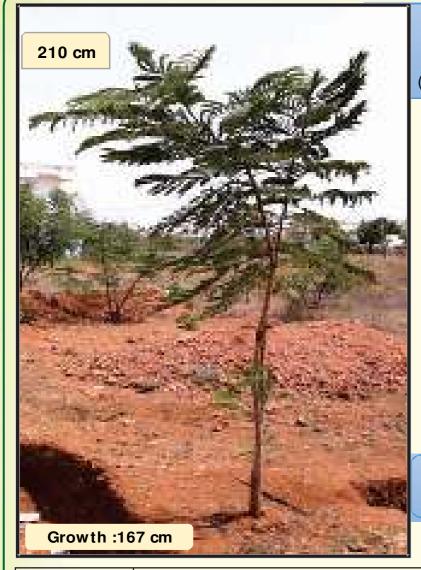
Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

> 5 feet & 4 inch

(162 cm)



Date	Normal Method		Date	CRA Technique	
	Height of Plant (cm)	Girth (cm)	Date	Height of Plant (cm)	Girth (cm)
27-06-2016	32	9	29-06-2017	40	11
13-05-2019	270	25	13-05-2019	440	35



Epigaea repens (MAY FLOWER)

Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

> 14 Feet & 4 inch (438 cm)



Date	Normal Method		Date	CRA Technique	
	Height of Plant (cm)	Girth (cm)	Date	Height of Plant (cm)	Girth (cm)
27-06-2016	43	3	29-06-2017	65	14
13-05-2019	210	12	13-05-2019	670	50



Ficus religiosa ROYAL WOOD (ARASA MARAM)

Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

> 5 Feet & 10 inch (177 cm)



Date Normal Method		Date	CRA Technique		
plantation	Height of Plant (cm)	Girth (cm)	plantation	Height of Plant (cm)	Girth (cm)
27-06-2016	42	4	29-06-2017	45	9
13-05-2019	305	12	13-05-2019	485	25



Strychnos nux-vomica (ETTI)

Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

> 18 Feet & 10 Inch (575 cm)



Date Normal Method		Date	CRA Technique		
plantation	Height of Plant (cm)	Girth (cm)	plantation	Height of Plant (cm)	Girth (cm)
27-06-2016	24	2	29-06-2017	54	10
13-05-2019	125	8	13-05-2019	730	40



Syzygium cumini (NAVAL)

Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

> 11 Feet & 2 inch (340 cm)



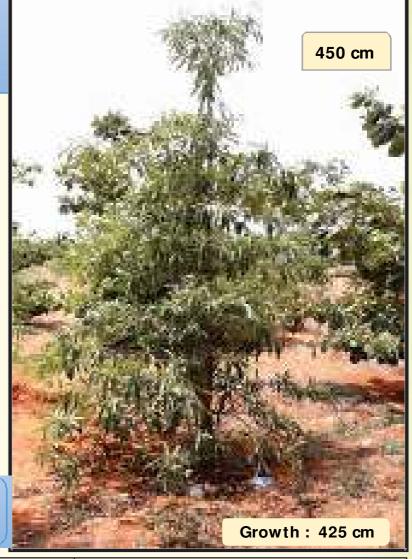
Date Normal Method		Date	CRA Technique		
plantation	Height of Plant (cm)	Girth (cm)	plantation	Height of Plant (cm)	Girth (cm)
27-06-2016	50	2	29-06-2017	30	
13-05-2019	180	7	13-05-2019	500	40



Madhuca longifolia (ILUPPAI)

Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

11 Feet (335 cm)



Date	Normal Method		Date	CRA Technique	
plantation	Height of Plant (cm)	Girth (cm)	plantation	Height of Plant (cm)	Girth (cm)
27-06-2016	30	2	29-06-2017	25	8
13-05-2019	120	8	13-05-2019	450	30



Thespesia populnea (POOVARASU)

Increase in Growth over Normal method in 3 Years (CRA Technique 2 years)

3 Feet & 6 inch (107 cm)



Date	Normal Method		Date	Water Conserving Rootzone Irrigation Technique	
plantation	Height of Plant (cm)	Girth (cm)	plantation	Height of Plant (cm)	Girth (cm)
27-06-2016	27	3	29-06-2017	35	12
13-05-2019	200	9	13-05-2019	315	45





Avacado

In 17 Months

Increase in Growth over Normal method

54cm height 32cm breadth& 1cm girth

Nilgiri District, Kotagiri Block

SOIL TYPE
LATERITE SOIL



Date	Normal Method			CRA Technique			
	Height of Plant (cm)	Breadth (cm)	Girth (cm)	Height of Plant (cm)	Breadth (cm)	Girth (cm)	
06-01-2018	30	10	0.5	30	10	0.5	
04-06-2019	96	92	2.0	150	125	3.0	



Acid Lime (Bush plant)

In 17 Months

Increase in Growth over Normal method

> 95cm height & 34cm breadth

Nilgiri District, Kotagiri Block

SOIL TYPE
LATERITE SOIL



Date	Normal Method		CRA Technique		
Date		Height of Plant (cm)	Breadth (cm)	Height of Plant (cm)	Breadth (cm)
06	6-01-2018	20	5	20	5
04	<mark>1-06-</mark> 2019	70	109	165	143



Peaches (Bush plant)

In 17 Months

Increase in Growth over Normal method

57cm height & 63cm breadth

Nilgiri District, Kotagiri Block

SOIL TYPE
LATERITE SOIL



Date	Normal M et l	hod	CRA Technique	
Bate	Height of Plant (cm)	Breadth (cm)	Height of Plant (cm)	Breadth (cm)
06-01-2018	45	15	45	15
04-06-2019	186	127	235	190

CRA TECHNIQUE IN COMPARISON WITH DRIP IRRIGATION

Tiruvarur District, Nannilam Block, Kothavasal Village Name of the Farmer: Thiru. Kaliyamoorthi s/ o. Thandavarayan

Watermelon



Yield Difference 7300 Kgs. per Acre

SOIL TYPE
Sandy Clay



Control Method (Drip Irrigation)

CRA	3 M I M	
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	 -	

21.05.2018	Date of Observation	21.05.2018
5 days	Irrigation Interval	9 days
5	Inter Nodal No. of Flowers	7
0.05	Cultivated Area (in Acre)	0.25
610	Total Yield (in Kgs.)	4875
12200	Yield Per Acre (in Kgs.)	19500

Percentage of increase the yield

Tiruvarur District, Nannilam Block, Kurungulam Village Name of the Farmer: Thiru. U. Pakkirisamy s/ o. Ulaganathan

Pumpkin



Yield Difference 4000 Kgs. per Acre

SOIL TYPE
Sandy Clay



Control Method (Drip Irrigation)

CRA Technique

20.05.2018	Date of Observation	20.05.2018
2 days	Irrigation Interval	6 days
4	Inter Nodal No. of Flowers	6
0.05	Cultivated Area (in Acre)	0.10
420	Total Yield (in Kgs.)	1240
8400	Yield Per Acre (in Kgs.)	12400

Percentage of increase the yield

Tiruvarur District, Kottur Block, Thirumakkottai Village Name of the Farmer: Thiru. Subramanian s/o. M unusamy

Snake Gourd



Yield Difference 3300 Kgs. per Acre Growth: 380 cm

SOIL TYPE Sandy Clay

Control Method (Drip Irrigation)

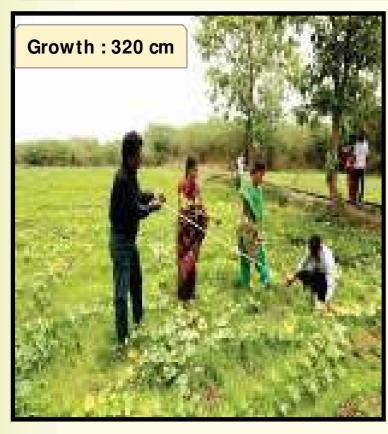
	_	
20.05.2018	Date of Observation	20.05.2018
3 days	Irrigation Interval	6 days
3	Inter Nodal No. of Flowers	6
0.10	Cultivated Area (in Acre)	0.10
750	Total Yield (in Kgs.)	1080
7500	Yield Per Acre (in Kgs.)	10800

CRA Technique

Percentage of increase the yield

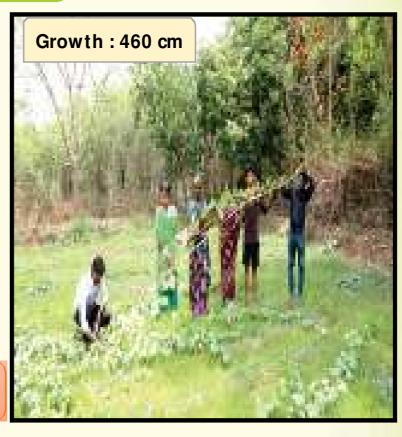
Tiruvarur District, Tiruvarur Block, Pallivaramangalam Village Name of the Farmer: Thiru. S. Sekar s/o. Subramaniyan

Ash gourd



Yield Difference 3100 Kgs. per Acre

SOIL TYPE
Sandy Clay



Control Method (Drip Irrigation)

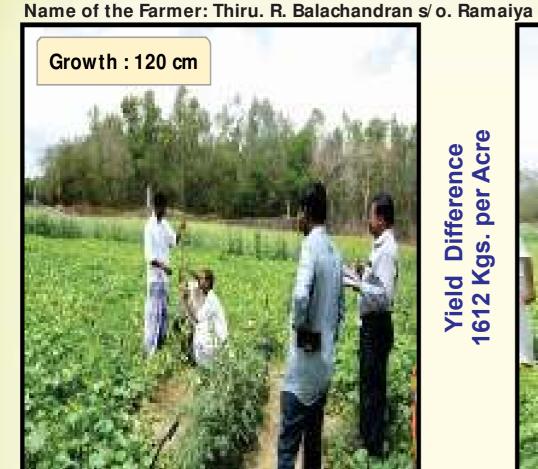
13.06.2018	Date of Observation	13.06.2018
2 days	Irrigation Interval	7 – 10 days
6	Inter Nodal No. of Flowers	11
0.20	Cultivated Area (in Acre)	0.60
1620	Total Yield (in Kgs.)	6720
8100	Yield Per Acre (in Kgs.)	11200

CRA Technique

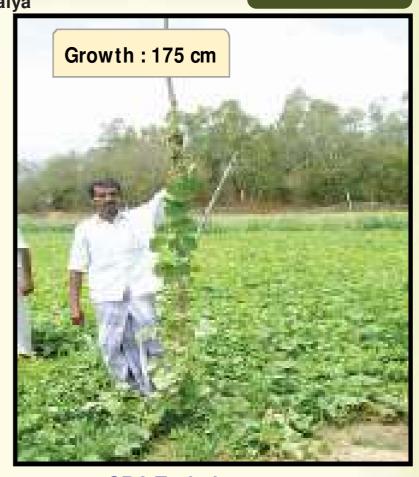
Percentage of increase the yield

Tiruvarur District, Thiruthuraipoondi Block, Sekal Village

Cucumber



Yield Difference 1612 Kgs. per Acre



Control Method (Drip Irrigation)

CRA Technique

26.05.2018	Date of Observation	26.05.2018
2 days	Irrigation Interval	7 days
5	Inter Nodal No. of Flowers	8
0.01	Cultivated Area (in Acre)	0.33
4200	Yield Per Acre (in Kgs.)	5812

Percentage of increase the yield

BLENDING CRA TECHNIQUE – WITH DRIP IRRIGATION

CRA Technique with Drip Irrigation



Anacardium occidentale (Cashew)

In 17 Months

Increase in Growth over Normal method

5 feet

State Horticulture Farm, Vallathirakkottai. Pudukkottai,

SOIL TYPE
Red Laterite



Data	Drip Irrigation		Drip Irrigation and CRA Technique	
Date	Height of Plant (cm)	Branches	Height of Plant (cm)	Branches
22-03-2018	30		30	
14-09-2019	195	7	244	16

RESULTS OF INDEPENDENT EVALUATION DONE BY SHRI A.M.M. MURUGAPPA CHETTIAR RESEARCH CENTRE (MCRC), A NON-GOVERNMENTAL VOLUNTARY RESEARCH ORGANIZATION, CHENNAI.



Mangifera indica (Mango)

In 1 Year

Increase in Growth over Normal method

4 feet

MCRC campus, Taramani, Chennai

SOIL TYPE CLAY



Normal Method

Initial plant height (jan 18) - 94 cm after 1 yr (Jan 19) - 118 cm No of branches (jan 19) - 5

CRA Technique

Initial plant height (jan 18) - 102 cm
After 1 yr (Jan 19) - 240 cm
No of branches - 8



Mango

In 1 Year

Increase in Growth over Normal method

> 1 foot & 3 Inch

MCRC campus, Taramani, Chennai

SOIL TYPE

Initial plant height (jan 18) - 123 cm
After 1 yr (Jan 19) - 178 cm
No of branches -10

Initial plant height (jan 18) - 101 cm after 1 yr (Jan 19) - 140 cm

No of branches (jan 19) - 5





Gmelina arborea (KUM IL)

In 1 Year

Increase in Growth over Normal method

14 feet

MCRC campus, Taramani, Chennai

SOIL TYPE CLAY



Initial plant height (jan 18) - 89 cm after 1 yr (Jan 19) - 240 cm No of branches (jan 19) - less Initial plant height (jan 18)- 98 cm
After 1 yr (Jan 19) - 668 cm
No of branches - more

RESULTS OF INDEPENDENT EVALUATION DONE BY MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI



Golden rain tree

(Cassia siamea)

In

1 Year &

1 Month

Increase in Growth over Normal method

> 7 feet & 1 Inch

Manonmaniam Sundaranar University, Tirunelveli



Date	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
20-12-2017		5		13
26-01-2019	184	10	399	21



NEEM

(Azadirachta indica)

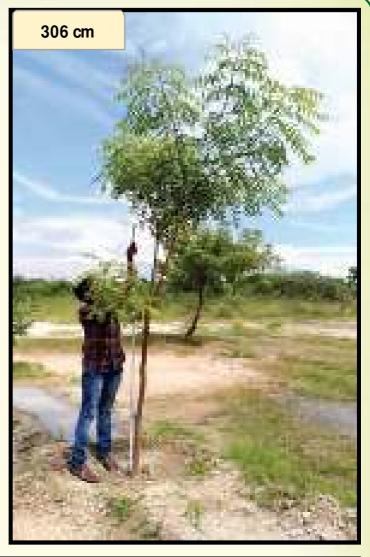
In

- 1 Year &
- 1 Month

Increase in Growth over Normal method

4 feet

Manonmaniam Sundaranar University, Tirunelveli



Date	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
20-12-2017		7		12
26-01-2019	185	9	306	17



PUNGAN

(Pongamia pinnata)

In

1 Year &

1 Month

Increase in Growth over Normal method

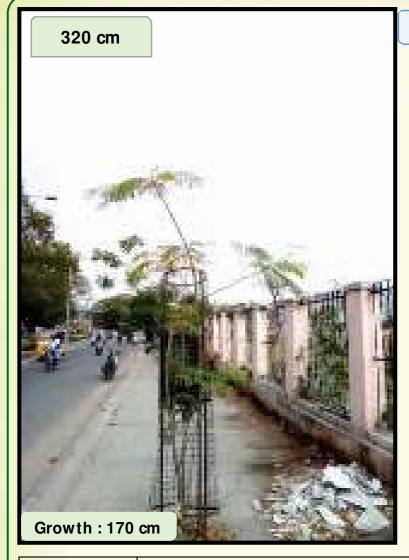
> 4 feet & 1 Inch

Manonmaniam Sundaranar University, Tirunelveli



Date	Normal Method		CRA Technique	
Date	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
20-12-2017		6		12
26-01-2019	124	8	249	18

RESULTS OF INDEPENDENT EVALUATION DONE BY GREATER CHENNAI CORPORATION, GOVERNMENT OF TAMILNADU



Peltophorum

In 1 Year

Increase in Growth over Normal method

> 9 feet & 2 Inch

Greater Chennai Corporation, Greams Road (Zone-9)



Date	Normal Method	CRA Technique	
Date	Height of Plant (cm)	Height of Plant (cm)	
2018	150	150	
2019	320	600	



Tapepuia rossea

In 1 Year

Increase in Growth over Normal method

3 feet & 3 Inch

Greater Chennai Corporation, Greams Road (Zone-9)



Date	Normal Method	CRA Technique	
Date	Height of Plant (cm)	Height of Plant (cm)	
24.02.2018	120	120	
15.02.2019	450	550	



Peltophorum

In 8 Months

Increase in Growth over Normal method

8 feet & 10 Inch

Greater
Chennai
Corporation,
Dr. Natesan
Park
(Zone-10)



Date	Normal Method	CRA Technique	
Date	Height of Plant (cm)	Height of Plant (cm)	
19.01.2018	120	120	
19.09.2018	180	450	



Spathodea campanulata

In 6 Months

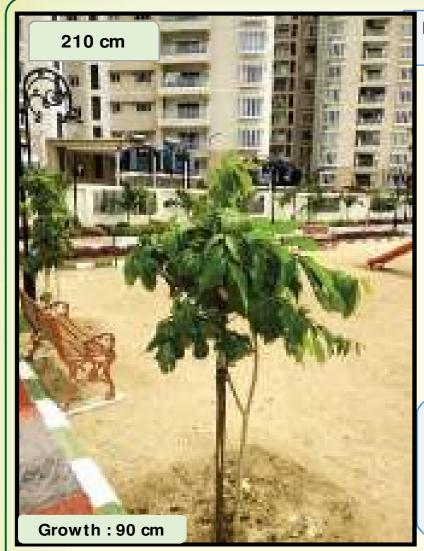
Increase in Growth over Normal method

4 feet & 11 inch

Greater
Chennai
Corporation,
Dr.
Visveswaraya
Tower Park
(Zone-8)



Date	Normal Method	CRA Technique	
Date	Height of Plant (cm)	Height of Plant (cm)	
24.02.2018	90	90	
23.08.2018	150	300	



Lagcrstromia florcginca

In 5 Months

Increase in Growth over Normal method

3 feet & 11 inch

Greater Chennai Corporation, TNHB Quarters Park (Zone-11)



Date	Normal Method	CRA Technique	
Date	Height of Plant (cm)	Height of Plant (cm)	
24.02.2018	120	120	
23.08.2018	210	330	

DROUGHT PROOFING EXISTING COCONUT & OTHER TREES

DROUGHTPROOFING EXISTING COCONUT& OTHER TREES

Famers Who adopted the CRA CRA Tecnique in existing Coconut Pantations in Tiruppur District observed that;

- Premature Button Shedding has reduced
- > The Plants looked Greenish even during Drought
- > 30 40 % water Saving was reported
- > The technique is found to be suitable to well grown up trees under water stress.
- More trees can be saved with limited quantity of water under extreme moisture stress & drought conditions



NEWS COVERAGE ON CRA TECHNIQUE



DIRECTIVE FOR PLANTATION PROJECTS UNDER MGNREGA SCHEME









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Step 4: Min street promise report or recover with the display sell and \$3,7% of the 60 with 1









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CRA Technique: An innovation by Dr. K. Satyagopal IAS

https://youtu.be/WKI435MvWD https://youtu.be/WCbwBmrnMBM **Article on CRA Technique** appeared in **Agroone Marathi News Paper** Dated: 10.09.2019

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المعروضة شوية كمو ويها والمستخور

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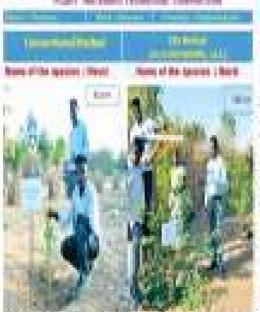
Chronicle

Novel way to grow saplings faster while conserving water

C.S. KOTTESVAMA DO D49WH #05.15

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HOW YOU CAN FOLLOW THIS TECHNIQUE AT YOUR GARDEN

begin with a sit of 2 feet is dog as done in conventional methods and additional holes are critical further so to I -1 fact eight in the corners of the pit using a crowbor depending an soil type. Four PWC pipes of 1-foot length and 3 to 4 inch diameter are placed vertically in the corners of the pit to create water-absorbing columns filled with rise; sand and compact. Sevel versionsport or minure is mixed with river same or red sail and applied in the bettom of the pilt to a height of half a feet. Then the pit is filled with removed soil mixed with vernicompost or manuse. The sapileo is now planted in the pit after addingsome more quantity of an eleved vernicompost or manuse and the pit is filled. fully. PVC pipes are removed creating four rand columns that absorb water faster and is studied with sail matrierts which are two feet below the surface i.e. to the cost date. Give the speciations is saturated, the weighter specials. Internally and the entire ract zone sphere will retain meisture enabling figiter growth. The enoughye low cost autoring technique was implemented by -bC Rural Sevelopment and Punchsyst Rai Department during 20%.



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THE MACHINDII 17.08.2017

A simple cure to save drought-hit trees

Covernment official develops impositive technique to rejuvenate mots:

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The technique problets displantage plus abound each tree. and filling them with ever ther smeaked and a tree in each a way that the pits shooththe water which in turn procedures (for releasing)

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https://www.thehindu.com/news/cities/chennai/a-simple-cure-to-savedrought-hit-trees/article19505430.ece

Farmers rejoice as Root Zone Irrigation proves a roaring success in Tiruvarur

Buoged by the success of the method to delta, now plans are on to extend it to other districts

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FARMERS REJOICE AS ROOT ZONE IRRIGATION PROVES A ROARING SUCCESS IN TIRUVARUR

Published: Sep 25,201807:45 AM by CS Kotte swaran Chennai

Farmers in de Itaregion, particularly Tiruvarur district, who tried the Root Zone Irrigation technique designed by senior IAS officer KSathyagopal, are all smiles as the yield invege table and horticulture crops has doubled.

The cost-effective technique is set to go global as the officer, also the State commissioner of disastermanagement, is scheduled to spread this me thod in Africa, where the farmers are exploring cost effective techniques.

Sa thy a gopal was recently invited by RIMES (Regional Integrated Multi Hazard Early Warning System for Africa and Asia), an organisation that works with UN on subjects like climate change.



"The basic concept of the technique is to ensure that saplings are grown by providing water and nourishment directly to the roots using sand manure. Under this system, the water will reach the roots faster and the manure and coconut pith kept near the roots sustain the moisture," explains Sathyagopal.

"After the success in delta, the project will now be extended to other districts of the state. It will help farmers to save big on maintenance costs. A few collectors in TN are also popularising the technique among farmers as it saves water by more than 50 percent and when coupled with the drip irrigation method, the maintenance will come down by 60 percent," says Sathyagopal.

Iast year, the technique was experimented in Tiruvarur where saplings of Pongamia Pinnata and timber showed good results. This year, vegetables were grown using the same technique and the results were encouraging, said a revenue official in the delta region.

According to the one-year observation, the plants raised under root zone method grew faster and with better girth. In the case of timber, the results were encouraging with the regular plant growing 130 cm in height, whereas those grown through root zone measured 570 cm.

"This year, we tried the mot zone method with cucumber, ash gourd, snake gourd,

pumpkin and the yield has doubled," adds a revenue official. "Last year, I lost two harvests as my vegetable crops died due to inundation and water shortage. This year, I tried cucumber using the root zone irrigation and it produced excellent results," said Singaram, a farmer from Thiruthura ipoondi.

"Pumpkin yield using root zone method is encouraging and the waterdemand through the new method is minimal. Earlier we will water the crops once in four or five days. Under the new method, we water the plants only once in 10 days," M Balakrishnan of Sundara kottaivillage in Mannargudisaid.

https://www.dtnext.in/News/TopNews/2018/09/25071625/1089788/Farmers-rejoice-as-Root-Zone-Irrigation-proves-a-roaring-.vpf

CRA Technique - Climate Resilient Agriculture Water Conserving Rootzone Irrigation Technique

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Link of videos available www.youtube.com

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STATE DROUGHTMONITORING CENTRE

The State Drought Monitoring Centre established in the Commissionerate of Revenue administration is engaged in the scientific assessment of situations that lead to Drought on a dynamic basis with the use of inputs from Indian Meteorological Department, National Remote Sensing Centre, National Crop Forecasting Centre State WaterResources, Agriculture, Horticulture, Animal Husbandry.

The The primary objective of the State Drought Monitoring Centre is to assist the state by providing scientific analysis and early warning information on drought.

The centre will provide analytical reports and suggest the short-term and long-term drought mitigation measures to be initiated periodically to the Commissioner of Revenue Administration for placing it to the Tamil Nadu State Disaster Management Authority.

The recent efforts are directed towards "Capacity Building of farmers and field level functionaries" in understanding, managing drought and adopting Climate resilient best practices.

The current publication brings out an innovation that received Certificate of Appreciation from Govt of Tamil Nadu will help small and marginal farmers to grow tree crops and vegetables grown on climbers / creepers with less water.



Punica granatum (POMOGRANITE)

In 1 Year 11 Months

Increase in Growth over Normal method

> 3 feet & 7 Inch

Coimbatore District, Sulur Block

SOIL TYPE RED SOIL



Date	Normal Method		Water Conserving Rootzone Irrigation Technique	
	Height of Plant (cm)	Girth (cm)	Height of Plant (cm)	Girth (cm)
15-11-2016	50	1.7	50	1.7
15-10-2018	385	17	480	26