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

Date	Normal Method		CRA Technique	
	Height of Plant (cm)	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

Dr. K. Satyagopal, I.A.S.,
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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, water mass 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, soil erosion, 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 for watering 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 poor farmers.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.

The Climate Resilient Water Conserving root zone Irrigation 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 corroborated 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 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 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 strengthen 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 emissions as well as enhance carbon sequestration.

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

- Water Use Efficiency
- Water Conservation-
- Irrigation of the Root zone up to 2 to 3 feet
- Enhanced nutrient absorption
- Facilitates full expression of the genetic potential of the seedling
- Results in higher survival rates and accelerated growth –
- Enhanced Carbon sequestration –
- 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 changer for all 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 CO_2 equivalent through additional forest and tree cover by 2030 as part of India's Nationally Determined Contribution. I do hope that over a period of time the technique will be used by farmers in India as well as other countries and reap benefits 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, 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 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.

Trees 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 irrigation around the sapling or through pitcher irrigation/ drip irrigation by which water can percolate up to about half to a maximum of one foot only. Moreover, pitcher irrigation and drip irrigation are expensive and are beyond the reach of poor farmers.

The innovative technique transforms irrigation systems for growing trees/ climbers by quickly transferring the irrigated water to depths of 2 to 3 feet which is not possible even in surface drip irrigation. The technique involves formation of upto 4 sand columns in the pits while planting a seedling to transfer water to the entire root zone 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 yields.

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 corroborated 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 medicinal 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 irrigation as well drip irrigation 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. Irrigation 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 seedling- 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. Agriculture Department Tamil Nadu
3. Horticulture & Plantation Crops Department Tamil Nadu
4. National Bank for Agriculture and Rural Development Tamil Nadu Region in their Tribal Development Programme
5. Srinivasan Services Trust – a Non-Governmental Organisation spread across South India
6. Shri AMM Murugappa Chettiar Research Centre (MCRC)
7. Universities in Tamil Nadu
8. Adoption by Farmers - the success is attracting them to adopt the technique in Tamil Nadu.

INTRODUCTION

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 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 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.

Trees 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.

Recognizing the importance of afforestation in combating the issues of climate change, soil erosion, pollution, and in preserving the biodiversity and ecological balance, 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 agroforestry, which involves increasing tree cover on agricultural land and pastures. 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 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 pitcher irrigation system to take water to depths of two feet so that seedling will establish quickly & grow faster. To overcome the shortcomings of pitcher irrigation, a tubular earthen vessel was designed by me to grow 9,000 seedlings of Bamboo in District Livestock 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 upto 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 irrigation 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 INNOVATION

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 Agricultural and Horticultural 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 innovation addresses 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 climber and creeper species and thus will meet the requirement 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 corners of the pit using augur or crowbar depending on soil type

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

3. Sieved Vermi-compost or Manure is mixed with river sand 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 Vermi-compost or manure, up to the surface ensuring that the PVC pipes are vertically positioned.

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.

5. Each of the PVC pipe is filled up to ½ a foot with Vermi-compost or Manure and then it is filled with river sand up to the surface of the pit.

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

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

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. 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 inturn resulted in additional income to the farmers. The biometric observations are furnished in Table 1-8.

TABLE – 1 : Increase in height - Fruit Bearing Trees

Sr.No.	Name of the Districts	Name of the Plant	Normal Method Measurement		CRA Technique Measurement		Difference in height
			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)	
Difference in 2 Years & 5 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
Difference in 1 Years & 6 Months							
5	Tiruvarur	Guava (Psidium guajava)	30	200	30	345	4.9 ft
6	Tiruchirappalli	Drumstick (Moringa oleifera)	30	308	30	404	3.2 ft
Difference in 1 Years							
7	MCRC-Chennai	Mango (Mangifera indica)	94	118	102	240	4. ft
Difference in 8 Months							
8	Pudukkottai	Cashew (Anacardium occidentale)	30	116	30	218	3.4 ft
9	Madurai	Pappaya (Carica Papaya)	30	240	30	310	2.4 ft

TABLE – 2 : Increase in height - Oil Seed Species

Sr.No	Name of the Districts	Name of the Plant	Normal Methoed Measurement		CRA Technique Measurement		Difference in height
			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)	
Difference in 1 year & 11 months							
1	Tirupur	Pungan (Pongamia glabra)	40	205	40	350	**4.9 ft**
Difference 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	MCRC-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**
Difference in 6 months							
7	Coimbatore	Neem (Azadirachta indica)	60	220	52	334	**4.ft**

TABLE – 3 : Increase in height - Timber Species

Sr.No.	Name of the Districts	Name of the Plant	Normal Method Measurement		CRA Technique Measurement		Difference in height
			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)	
Difference in 2 Years & 2 Months							
1	Tiruvarur	Mahogany (Swietenia mahagoni)	30	230	30	685	14.11 ft
Difference in 1 Years 5 Months to 1 year 11 Months							
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
Difference in 1 Years							
6	MCRC - Chennai	Kumil (Gmelina arborea)	89	240	89	668	14.1 ft

TABLE – 4 : Increase in height - Medicinal Species

Sr.No.	Name of the Districts	Name of the Plant	Normal Method Measurement		CRA Technique Measurement		Difference in height
			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)	
Difference in 2 Years & 2 Months							
1	Tiruvarur	Neermaruthu (Terminalla arjuna)	30	180	30	550	12.2 ft
Difference in 1 Years 1 Months 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
Difference in 8 Months							
6	Madurai	Silk Cotton (Ceiba pentandra)	30	150	30	530	12.6 ft
7	Villupuram	Malaivembu (Melia dubia)	40	267	42	366	3.2 ft

TABLE – 5 : Increase in height - Flowering Species

Sr.No.	Name of the District	Name of the Plant	Normal Method Measurement		CRA Technique Measurement		Difference in height
			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	Height	
Difference in 1 Years 6 Months 1 year 11 months							
1	Coimbatore (Peedampalli)	May flower (Delonix regia)	43	340	43	690	11.6 ft
2	Coimbatore (Sulur)	May flower (Delonix regia)	70	660	70	890	7.7 ft
Difference 8 Months							
3	Madurai	Maiil 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 Measurement	Increase in Length of Leaves (cm)	Age of Tree
			Leaf lenght (cm)	Leaf lenght (cm)		(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	Normal Method Measurement	CRA Technique Measurement	Increase in Number of Branches	Age of Tree
			No of Branches	No of Branches		(Year / Months)
1	Pudukkottai	Cashew (Anacardium occidentale)	7	15	8	8 months
2	MCRC-Chennai	JACK (Artocarpus heterophyllus)	6	12	6	1 Year
3	Tiruchirappalli	Drumstick (Moringa oleifera)	4	10	6	1 Year, 6 nonths
4	MCRC-Chennai	Mango (Mangifera indica)	5	10	5	1 Year
5	MCRC-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 District	Name of the Plant	Normal Method Measurement	CRA Technique Measurement	Difference in GIRTH (cm)	Age of Tree
			Girth (cm)	Girth (cm)		(Year/ Months)
Fruit Bearing Trees						
1	Thanjavur	Naval	11	33	22	2 year, 3 months
2	Thanjavur	Tamarind	10	21	11	2 year, 3 months
3	Thanjavur	Kodukapuli	20	31	11	2 year, 3 months
4	Pudukkottai	Jack	9.5	15.5	6	2 year, 5 months
5	Madurai	Papaya	4	7	3	8 months
Oil Seed Species						
6	Tirupur	Pungan	16	28	12	1 year, 11 months
7	Tirunelveli	Neem	9	17	8	1 year, 1 months
Timber Species						
8	Tiruvarur	Mahogany	14	31	17	2 year, 2 months
9	Tirupur	Arasan	33	42	9	1 year, 11 months
Medicinal Species						
10	Madurai	Silk Cotton	1.8	8	6.2	8 months
11	Tiruvarur	Neermaruthu	11	30	19	2 year, 2 months
12	Villupuram	Malaivembu	11.6	27.1	15.5	11 months
13	Tirupur	Vangai	18	30	12	1 year, 11 months
Flowering Species						
14	Coimbatore (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 over conventional method/drip irrigation

A study was undertaken to document the benefits/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 irrigation with surface drips.

- **Water Conservation-**

  Since the water percolates 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 water conservation. Concomitantly, the frequency of irrigation 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.

- **Water Use Efficiency**

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

- **Enhanced 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 height ranged 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 per conventional 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 sequestration**

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 or more.

❖ **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.

❖ **Easy availability of required materials locally**

❖ **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.

❖ Promotes 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 proper aeration 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 water stress.

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 requirement of water.

e) Root zone moisture in deeper layers aids in faster and healthier tree growth.

f) Fertigation is feasible in deeper layers 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 proper aeration 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 water stress.

Climate Mitigation

The technique is innovative and easily adoptable solution for growing 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 Sequestration-

Trees play a very important role in carbon sequestration. The Innovative technique results in increased bio-mass(increase in height ranged from 4 to 15 feet over a period of 1 to 2 years), increased girth, more branches, more leaves, increased leaf size 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 water use efficiency & water conservation, 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 changer due 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 soil erosion and protect from floods.

Social&Economic Co-Benefits

The smallholder farmer can adopt the technique and derive full benefits 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 bio-metric 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.

Scalability and Replicability

The technique is an innovative 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 currently by following organisations.

1. Rural Development &Panchayat Raj Department, Tamil Nadu
2. Agriculture Department, Tamil Nadu
3. Horticulture & 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 uses locally available materials
- ❖ It is a simple technique and
- ❖ It is a Low Cost Technique

Promotion of Climate Resilience by the CRA Technique through

- ❖ Water Conservation
- ❖ Water use efficiency
- ❖ Enhanced Carbon Sequestration
- ❖ 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 (Goal 1)
- ❖ Poverty reduction (Goal no.2)
- ❖ Action to combat climate change and its impacts (Goal 13)
- ❖ Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss (Goal 15)

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

Cost Analysis :

The State Rural Development has adopted the technique for tree 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 per plant will be Rs.0.60 (for climbers)
- The cost will correspondingly come down if only two sand columns are formed per plant.

b) Cost of River/ Stream Sand or any water absorbing gel

- For 4 numbers of Sand Columns with 4 inch dia PVC pipes, the cost of sand per plant will 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 (for climbers)
- The cost of sand will correspondingly come down if only two sand columns are formed per plant.

c) Additional wage cost due to additional time required for planting Per plant 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/ plant.
Savings in Weeding and Mulching –first year	Rs.4.95/ Plant
Reduction in Wage cost due to reduced watering days –second year	Rs.49/ plant.
Reduction in Wage cost due to reduced watering days –third year	Rs.78.40/ plant.

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

Besides 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 afforestation by adopting CRA Technique.

Table

Activities	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)
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 Manure (*Manure will be supplied at free of cost from SWM site*)	1	5.24	**5.24**	1	5.24	**5.24**
Additional labour cost	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 per Plant			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 per plant for planting & 1st year maintenance			**9.50**			

Activities	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**
Application 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**
Application 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 Conserving Root Zone Irrigation Technique per plant for Three Years						**159.32**

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

Sustainability

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 - METIRIC OBSERVATION OF FRUIT BEARING TREES

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

Date	Normal Method		CRA Technique	
	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

Date	Normal Method		CRA Technique	
	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 Method		CRA Technique
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

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

BIO - METIRIC OBSERVATION OF OILSEED SPECIES

Pongamia pinnata
Pungan

In
2 Years

Increase in Growth over Normal method

4 feet

&

9 inch

Tiruppur District, Palladam

SOIL TYPE
RED SOIL

Date	Normal Method		CRA Technique	
	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

Date	Normal Method		CRA Technique	
	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 - METRIC 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

Date	Normal Method		CRA Technique	
	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

Date	Normal Method		CRA Technique	
	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

Date	Normal Method		CRA Technique	
	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

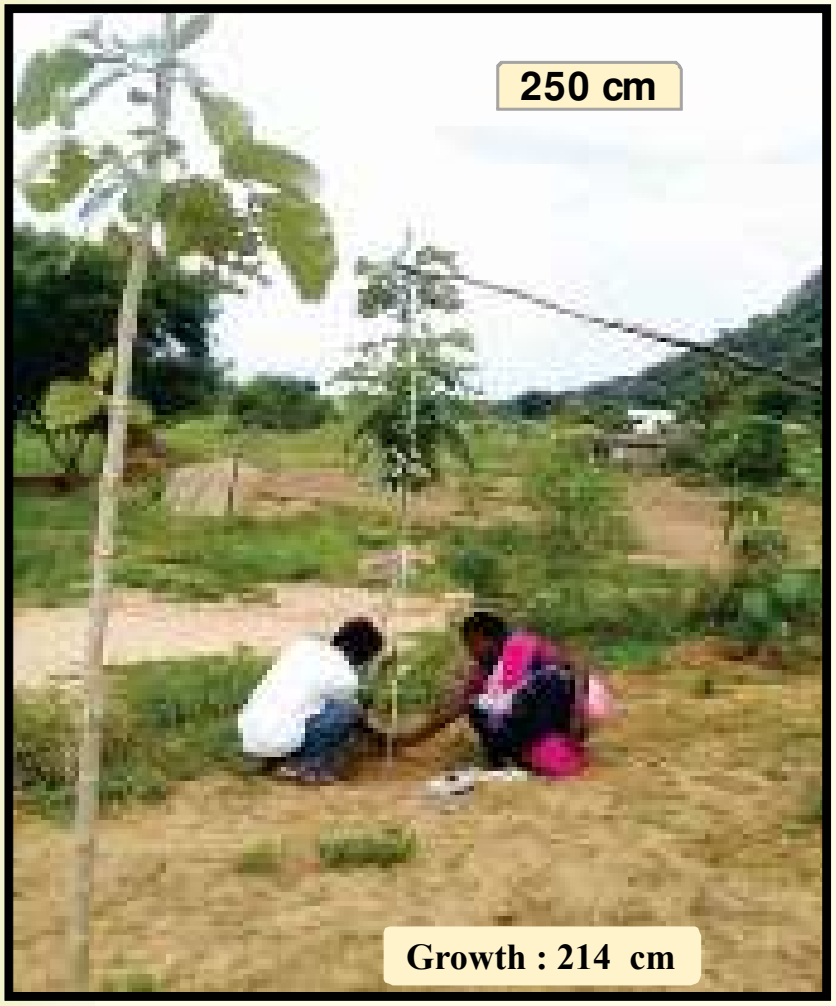
SOIL TYPE
Red sandy

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)



Growth Difference 290 cm
(9 feet 6 inch)

Normal Method		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 - METRIC OBSERVATION OF MEDICINAL PLANTS

Growth : 140 cm

Phyllanthus emblica AMLA

In 6 Months

Increase in Growth over Normal method

6 Feet

Thanjavur Kumbakonam Sub Division Srinivasanallur

SOIL TYPE
SANDY CLAY

Growth : 324 cm

Date	Normal Method		Water Conserving Rootzone Irrigation Technique	
	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)

SOIL TYPE
RED SOIL

Normal Method

CRA Technique

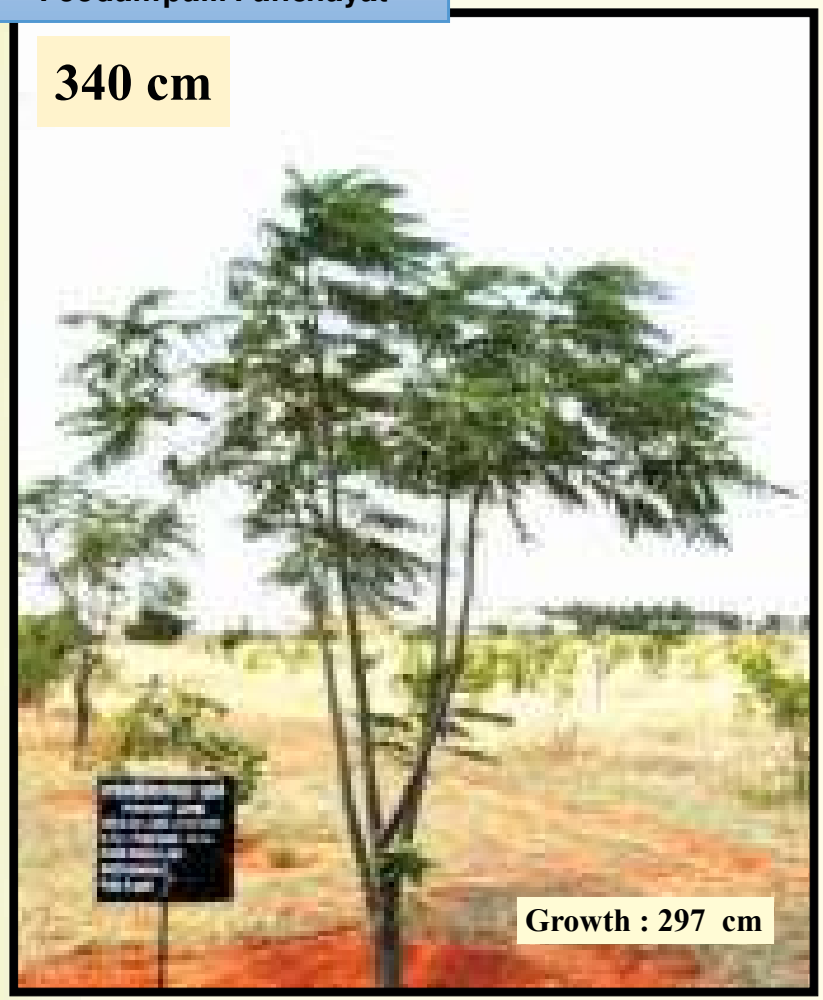
Date	Normal				Root Zone			
	Height of Plant	Circumstance of Girth	Main & Sub Branch of Plant	Avg. Leaf Size (L x B) in mm	Height of Plant	Circumstance of Girth	Main & Sub Branch of Plant	Avg. Leaf Size (L x B) in mm
14.02.2018	30 cm	1 cm	1	10 x 4	30 cm	1 cm	1	10 x 4
15.10.2018	120 cm	1.8 cm	20	80 x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

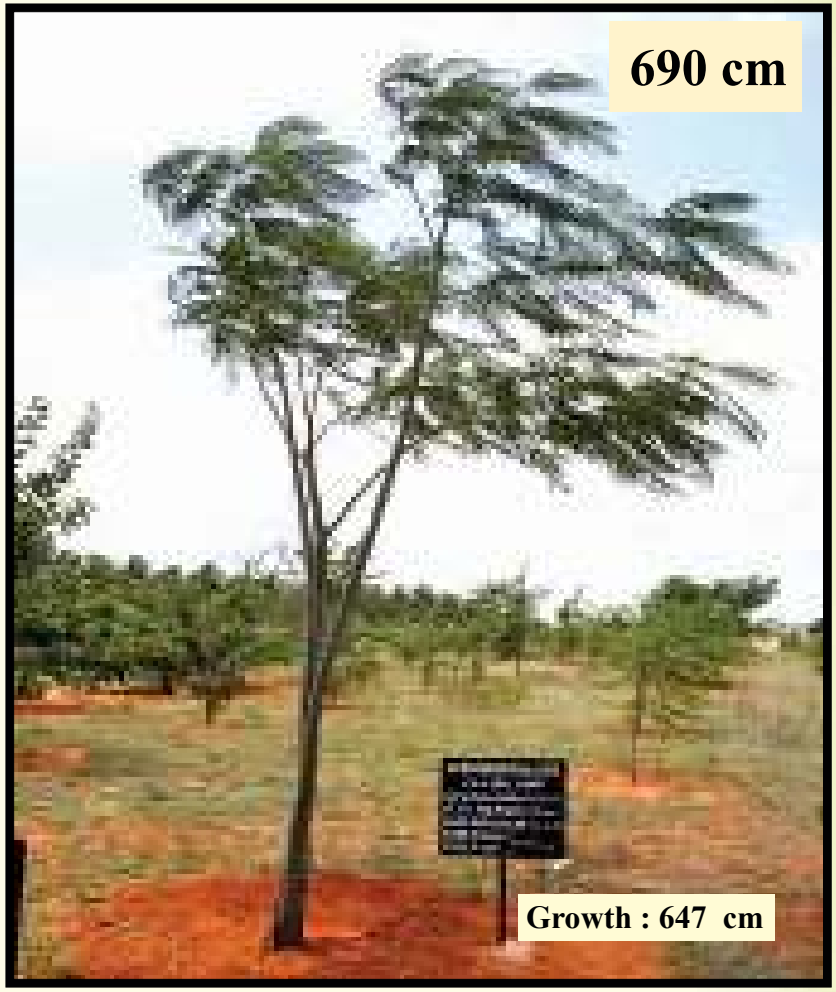
BIO - METIRIC OBSERVATION OF FLOWERING TREES

Coimbatore District,
Peedampalli Panchayat

In 1 year & 6 months

Epigaea repens (May Flower)





Normal Method		CRA Technique
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

Date	Normal Method		CRA Technique	
	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

Madurai, Madurai (E)

SOIL TYPE
SANDY Clay Loam

Date	Normal Method		CRA Technique	
	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

Leaf length : 13 cm

CRA Technique

13-09-2017 Date of Plantation 13-09-2017

Virudhunagar District, Virudhunagar Block, Nursery site

Neem

Leaf length : 26 cm

Normal Method

More leafs,

Height leaf length,

Dark green

Leaf length : 32 cm

CRA Technique

13-09-2017 Date of Plantation 13-09-2017

Biometric Observations- overall Biomass

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

Date	Normal Method		CRA Technique	
	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)

Coimbatore District, Sulur Block

Date	Normal Method		Date	CRA Technique	
	Height of Plant (cm)	Girth (cm)		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)

Coimbatore District, Sulur Block

Date	Normal Method		Date	CRA Technique	
	Height of Plant (cm)	Girth (cm)		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)

Coimbatore District, Sulur Block

Date plantation	Normal Method		Date plantation	CRA Technique	
	Height of Plant (cm)	Girth (cm)		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)

Coimbatore District, Sulur Block

Date plantation	Normal Method		Date plantation	CRA Technique	
	Height of Plant (cm)	Girth (cm)		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)

Coimbatore District, Sulur Block

Date plantation	Normal Method		Date plantation	CRA Technique	
	Height of Plant (cm)	Girth (cm)		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)

Coimbatore District, Sulur Block

Date plantation	Normal Method		Date plantation	CRA Technique	
	Height of Plant (cm)	Girth (cm)		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)

Coimbatore District, Sulur Block

Date plantation	Normal Method		Date plantation	Water Conserving Rootzone Irrigation Technique	
	Height of Plant (cm)	Girth (cm)		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

RESULTS FROM HILL ARES

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	
	Height of Plant (cm)	Breadth (cm)	Height of Plant (cm)	Breadth (cm)
06-01-2018	20	5	20	5
04-06-2019	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 Method		CRA Technique	
	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 Technique

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

60 %

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

48 %

Tiruvarur District, Kottur Block, Thirumakkottai Village

Name of the Farmer: Thiru. Subramanian s/o. Munusamy

Snake Gourd

Yield Difference
3300 Kgs. per Acre

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

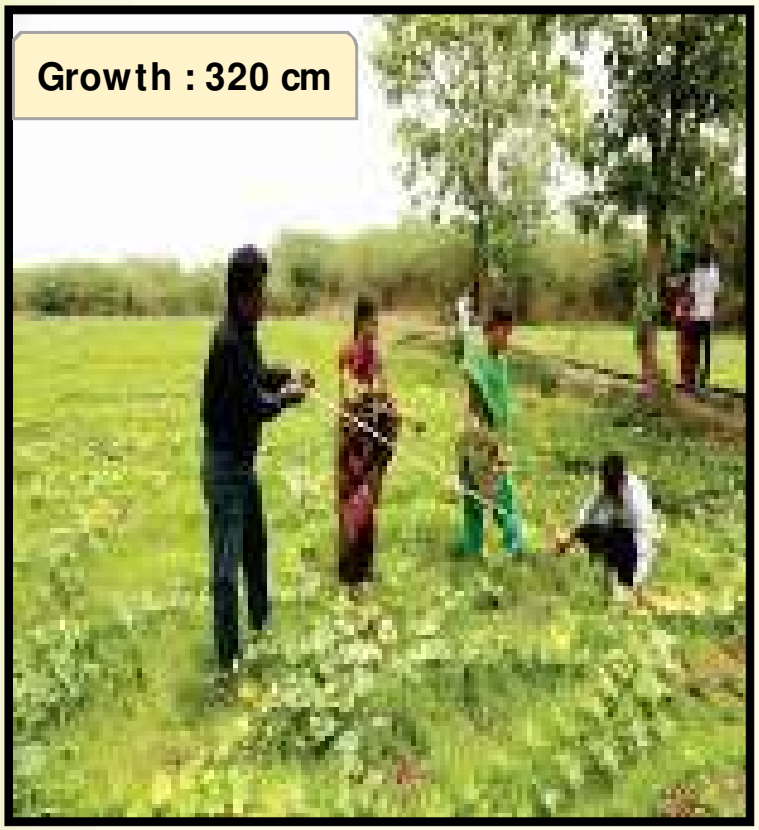
Percentage of increase the yield

44 %

44

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

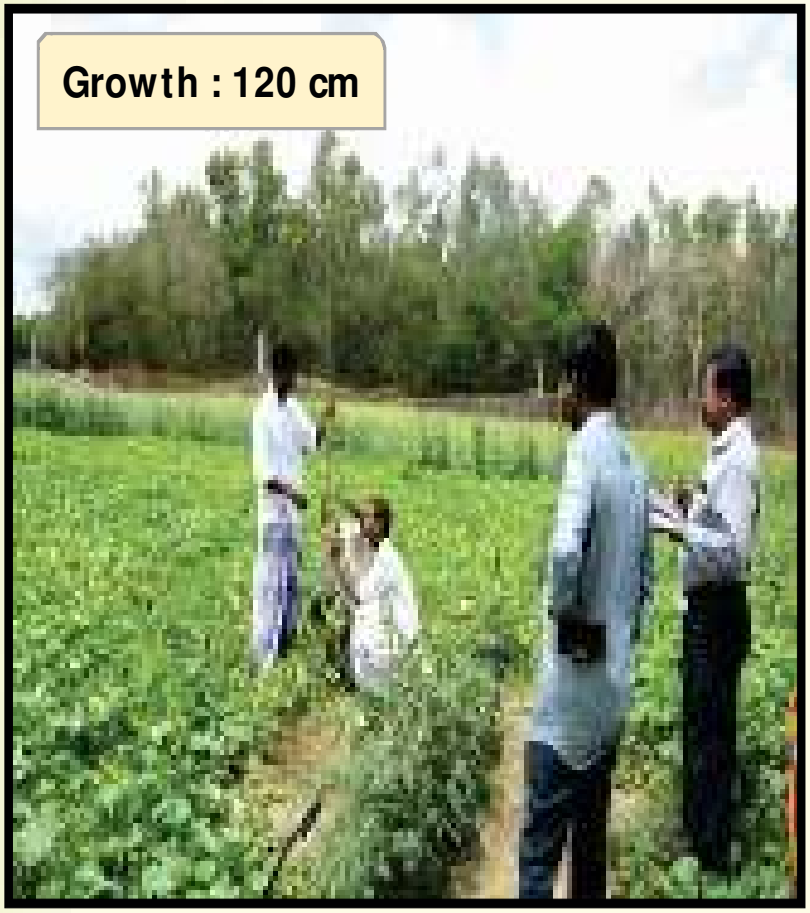
Percentage of increase the yield

38 %

Tiruvarur District, Thiruthuraipoondi Block, Sekal Village

Name of the Farmer: Thiru. R. Balachandran s/o. Ramaiya

Cucumber



Control Method (Drip Irrigation)

Yield Difference
1612 Kgs. per Acre

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

38 %

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

Date	Drip Irrigation		Drip Irrigation and CRA Technique	
	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

Initial plant height (jan 18) - 101 cm
after 1 yr (Jan 19) - 140 cm
No of branches (jan 19) - 5

Mango

In
1 Year

Increase
in Growth
over Normal
method

1 foot
&
3 inch

MCRC
campus,
Taramani,
Chennai

SOIL TYPE
CLAY

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

Gmelina arborea
(KUMIL)

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	
	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	
	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	
	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
	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
	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
	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
	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
	Height of Plant (cm)	Height of Plant (cm)
24.02.2018	120	120
23.08.2018	210	330

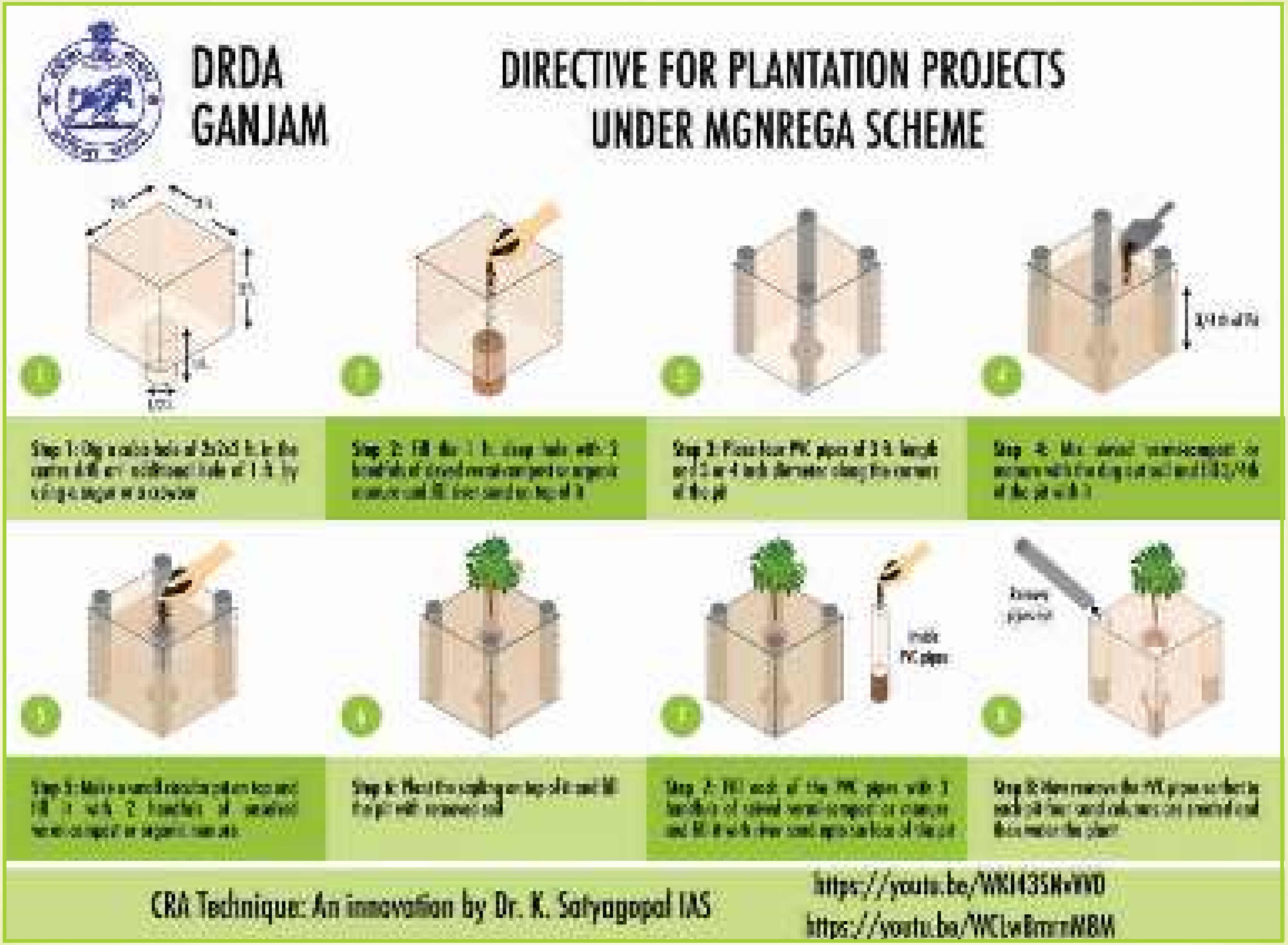
DROUGHT PROOFING EXISTING COCONUT & OTHER TREES

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


DRDA
GANJAM
DIRECTIVE FOR PLANTATION PROJECTS
UNDER MGNREGA SCHEME
CRA Technique: An innovation by Dr. K. Satyagopal IAS

Article on CRA Technique
appeared in
Agroone
Marathi News Paper
Dated : 10.09.2019

'सीआरए' तंत्राने तगली दुष्काळातही फळझाडे

रामिळनाडूत झाले विविध यशस्वी प्रयोग

குறைந்த நீர்... அதிவேக வளர்ச்சி!

கன்றுகளைக் காக்கும் 'ஐ.ஏ.எஸ்.' உத்தி

இந்த முறையில், நீருக்கான செலவு குறைவு. கொட்டுநீர்ப் பாசன முறையில் தண்ணீரை 'பம்ப்' செய்வதற்கான மின்சாரப் பயன்பாடும் இதில் குறைகிறது.

தினமலர்

18-08-2017

வேருக்கு நேரடி நீர் பாசன முறை

ஐ.ஏ.எஸ்., கண்டுபிடிப்புக்கு வரவேற்பு

தினமலர்
18 Aug 2017

ஐ.ஏ.எஸ்., அதிகாரி கண்டுபிடிப்பை செயல்படுத்த அரசு பரிந்துரை

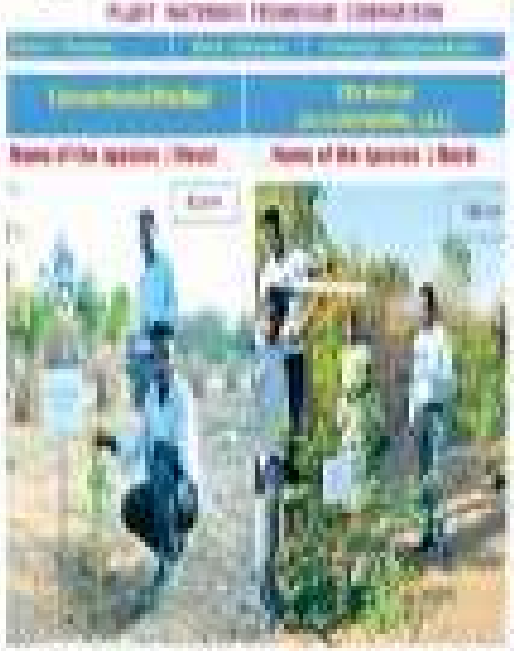
— நமது நிருபர் —

சத்யகோபால்

DECCAN Chronicle

Novel way to grow saplings faster while conserving water

C.S. KOTTESWARAN | DC
CHENNAI AUG. 11



Officials measure the height of saplings planted under the conventional method and the CRA method during experimentation in Thirukarai. -DC

HOW YOU CAN FOLLOW THIS TECHNIQUE AT YOUR GARDEN

K. Satyagopal

To begin with a pit of 2 feet in dug as above in conventional methods and additional holes are drilled further up to 1-foot depth in the corners of the pit using a crowbar (spreading iron rod) type. Four PVC pipes of 3-foot length and 3 to 4 inch diameter are placed vertically in the corners of the pit to create water-absorbing columns filled with river sand and compost. Sieved vermicompost or manure is mixed with river sand or red soil and applied in the bottom of the pit to a height of half a foot. Then the pit is filled with removed soil mixed with vermicompost or manure. The sapling is now planted in the pit after adding some more quantity of sieved vermicompost or manure and the pit is filled fully. PVC pipes are removed creating four sand columns that absorb water faster and is studded with soil nutrients which are fed to the roots below the surface i.e. to the root zone. Once the sand columns is saturated, the moisture spreads laterally and the entire root zone sphere will retain moisture enabling faster growth. The innovative low cost watering technique was implemented by Rural Development and Panchayat Raj Department during 2016.

THE HINDU 17.08.2017

A simple cure to save drought-hit trees

Government official develops innovative technique to rejuvenate roots

[illegible]

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

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

Buoyed by the success of the method in delta, more plants are on to extend it to other districts

SWEET RESULT FROM BITTER GOURD

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

Published: Sep 25,201807:45 AM by CS Kotteswaran Chennai

Farmers in delta region, particularly Tiruvarur district, who tried the Root Zone Irrigation technique designed by senior IAS officer K Sathyagopal, are all smiles as the yield in vegetable and horticulture crops has doubled.

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

Sathyagopal 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.

Last 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 root 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 Thiruthuraipoondi.

"Pumpkin yield using root zone method is encouraging and the water demand 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 Sundarakottai village in Mannargudi said.

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

STATE DROUGHT MONITORING 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 Water Resources, 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