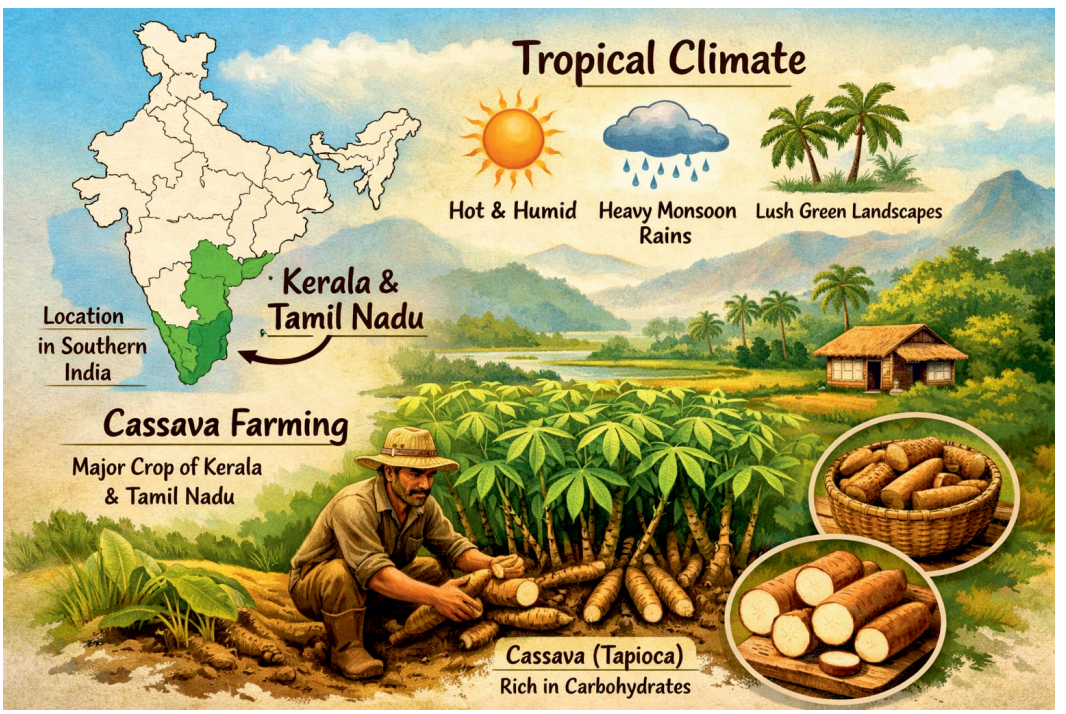
CLIMATE CONTINGENCY PLAN FOR MAJOR CASSAVA GROWING DISTRICTS OF KERALA AND TAMIL NADU



भाकृअनुप
ICAR

भाकृअनुप– केंद्रीय कंद फसल अनुसंधान संस्थान
श्रीकार्यम, तिरुवनंतपुरम 695017, केरल, भारत
(भारतीय कृषि अनुसंधान परिषद)

ICAR-CENTRAL TUBER CROPS RESEARCH INSTITUTE
Sreekariyam, Thiruvananthapuram - 695 017, Kerala, India
(Indian Council of Agricultural Research)

CLIMATE CONTINGENCY PLAN FOR MAJOR CASSAVA GROWING DISTRICTS OF KERALA AND TAMIL NADU

भाकृअनुप
ICAR

भाकृअनुप– केंद्रीय कंद फसल अनुसंधान संस्थान
श्रीकार्यम, तिरुवनंतपुरम 695017, केरल, भारत
(भारतीय कृषि अनुसंधान परिषद)

ICAR-CENTRAL TUBER CROPS RESEARCH INSTITUTE
Sreekariyam, Thiruvananthapuram - 695 017, Kerala, India
(Indian Council of Agricultural Research)

ICAR-Central Tuber Crops Research Institute
(Indian Council of Agricultural Research)
Sreekariyam, Thiruvananthapuram 695 017, Kerala, India
Tel: 0471 2598551 to 2598554
E-mail: director.ctcri@icar.org.in
Website: https://www.ctcri.org

Published by
Dr. G. Byju
Director

Editors
V. Ramesh
Saravanan Raju
P. Prakash

Correct citation
Ramesh V., Saravanan Raju. and Prakash, P. 2025. Climate contingency plan for major cassava growing districts of Kerala and Tamil Nadu, Technical Bulletin Series No. 117/2025, ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram 695017, Kerala, India, p 34

July 2025

Design, Layout & Printing
Aden Digital Signage, Thiruvanathapuram
Mob: +91 9605206323, Email: adentvm2018@gmail.com

Contents

ICAR-Central Tuber Crops Research Institute
Sreekariyam 695 017, Thiruvananthapuram, Kerala, India

Dr. G. Byju
Director

Phone: 0471- 2598431
Email: director.ctcri@icar.org.in

From the Director

Agriculture is not only sensitive to climate change but is also one of the major drivers of climate change. Climate variability and extreme weather events have become a great threat to agricultural production in India. The projected increase in droughts, floods, heat and cold waves, cyclones, extreme precipitation events will result in greater instability in food production. Provision of accurate weather forecast and dissemination of timely agromet advisories can greatly mitigate the negative impact of extreme weather events in agriculture. Scientific evidence about the seriousness of the climate threat to agriculture is now unambiguous, but the exact magnitude is uncertain because of the complex interactions and feedback processes in the ecosystem and the economy.

Studies so far suggest that following five main climate related factors would affect agricultural productivity in the coming decades: changes in temperature, precipitation, carbon dioxide (CO_2), fertilization, short-term weather variability and erosion/surface water run-off. Adaptation strategies to address the climate change impacts on agriculture are needed under different agro-climatic conditions. Long˘term strategic approaches are also needed to efficiently conserve and utilize rain water on the one hand and season tactical approaches to mitigate the adverse effects of weather aberrations on the other. Sectors such as horticulture are perennial in nature and are affected more severely than field crops, as it takes longer period to recoup the losses.

Contingency planning in agriculture is one of the major strategies of preparedness for tackling aberrant weather events that cannot be prevented. Existing agricultural plans available at the state level or agro–climatic zone level (a cluster of 3–5 districts) are generic in nature and geared to drive agricultural growth by often assuming the occurrence of a normal monsoon in the ensuing season. On the other hand, district agricultural contingency plans consider the vulnerability of a given district to various weather–related risks coupled with a critical analysis of the forecast for the forthcoming season, so as to enable to plan for various probable contingencies.

The bulletin highlights significant contingency plan details exclusively for cassava in the major growing districts of Kerala and Tamil Nadu. The information presented will be useful for cassava growing farmers, extension officials to adopt for the required strategies.

G. Byju
Director

July 2025

1. INTRODUCTION

Cassava (*Manihot esculenta* Crantz), a tropical root crop of global significance, plays a pivotal role in ensuring food and livelihood security for millions of resource-poor farmers across southern India, especially in the states of Kerala and Tamil Nadu. In India, it is grown in an area of 1.77 lakh ha with a production of 62.83 lakh tones (GoI, 2024). With its high calorific value, flexibility in intercropping systems, and suitability for cultivation under diverse agro-ecological conditions, cassava is well-positioned to contribute to sustainable agricultural development in rainfed and marginal lands. However, recent climatic trends—including delayed monsoons, prolonged dry spells, intense rainfall events, and the increased incidence of pests such as the cassava mealy bug pose significant threats to its stable productivity and cultivation viability.

In light of these challenges, the preparation of district-level Agricultural Contingency Plans (ACPs) for cassava is both timely and critical. These plans aim to provide location-specific, actionable strategies to mitigate the adverse effects of climatic aberrations, improve adaptive capacity at the farm level, and ensure continuity in cassava production even under erratic weather patterns. The current document focuses on the vulnerable districts of Kerala and Tamil Nadu, which represent some of the key cassava-producing belts in India.

Decades of research undertaken by ICAR-Central Tuber Crops Research Institute (ICAR-CTCRI), Thiruvananthapuram, have significantly contributed to understanding the physiological basis of stress tolerance in cassava and other tropical tuber crops. Studies at ICAR-CTCRI have identified critical growth stages particularly the early bulking phase (3-5 months after planting) as highly sensitive to drought and heat stress. Experimental results have demonstrated that cassava exhibits up to 48% reduction in photosynthetic efficiency and nearly 50% decrease in tuber yield under early-season drought. These findings highlights the importance of temporal alignment of planting windows, varietal selection, and water-saving agronomic interventions in climate-resilient cassava cultivation.

To address these vulnerabilities, climate-resilient practices such as mulching, intercropping with legumes, and timely life-saving irrigation have been developed and validated under field conditions. Furthermore, ICAR-CTCRI has screened and recommended drought-tolerant varieties such as 'Sree Reksha', 'Sree Athulya', and 'Sree Apoorva', which have shown stable performance across varied stress environments.

The district-specific ACPs presented herein have been prepared with inputs from agro-climatic assessments, soil fertility mapping, cropping patterns, and contingency issues

observed over recent years. Each plan details the normal rainfall patterns, major soil types, crop coverage, and critical vulnerabilities (e.g., drought, pest outbreaks, floods). Tailored strategies are suggested for different climatic contingencies including early and mid-season droughts, prolonged dry spells, unseasonal rains, and pest outbreaks-drawing on the extensive empirical findings and physiological research generated at ICAR-CTCRI.

This document also aligns with broader climate adaptation frameworks such as the National Innovations in Climate Resilient Agriculture (NICRA) and complements ongoing efforts to mainstream climate-smart agricultural technologies in India. By integrating scientific evidence with field-based observations, these district-level plans aim to empower local farming communities with practical tools for risk management and sustainable cassava production.

As the threats posed by climate variability continue to evolve, strengthening regional preparedness through dynamic, research-backed contingency planning will be essential. This document is envisioned as a living resource to support adaptive decision-making by farmers, extension personnel, and policy stakeholders alike, reinforcing the role of cassava as a climate-resilient crop of strategic national importance.

2. AGRICULTURAL CONTINGENCY PLAN FOR MAJOR CASSAVA GROWING DISTRICTS OF KERALA

I. Thiruvananthapuram

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Central and south Sahyadris, hot moist, subhumid to humid eco-subregion (19.2) Konkan, Karnataka and Kerala Coastal plain, hot humid to per humid eco-sub region (19.3)

Agro Climatic Zone (NARP): Southern Zone (KE-2)

Districts or part thereof falling under this NARP Zone: Thiruvananthapuram, Kollam, Pathanamthitta, Kottayam

Geographic coordinates of district: 8° 29' N (Latitude)
76°59' E (Longitude)
5 m amsl (Altitude)

2. Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	806.8	June 1st week	September 1st week
NE Monsoon (October-December)	559.1	October 2nd week	November 3rd week
Winter (January-February)	120.2		
Summer (March-May)	193.4		
Annual	**1679.5**		

3. Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Sandy soils	8.5	3.8
Gravelly sandy loam soils	11.1	5.1
Gravelly sandy clay loam soils	155.9	71.3
Gravelly clay loam soils	12.0	5.5

4. Agriculture cultivation details

- Net irrigated area: 7842 ha
- Gross irrigated area: 12848 ha
- Rainfed area: 126800 ha

- Total cassava area: 13,243.8 ha
- Total cassava production: 473603.9 tons
- Cassava productivity: 35760 kg ha^{-1}
- Major contingency issues: Drought (regular); Sea water intrusion (regular); Cassava mealy bug infestation (regular); Attack of wild animals nearby forest areas (regular)

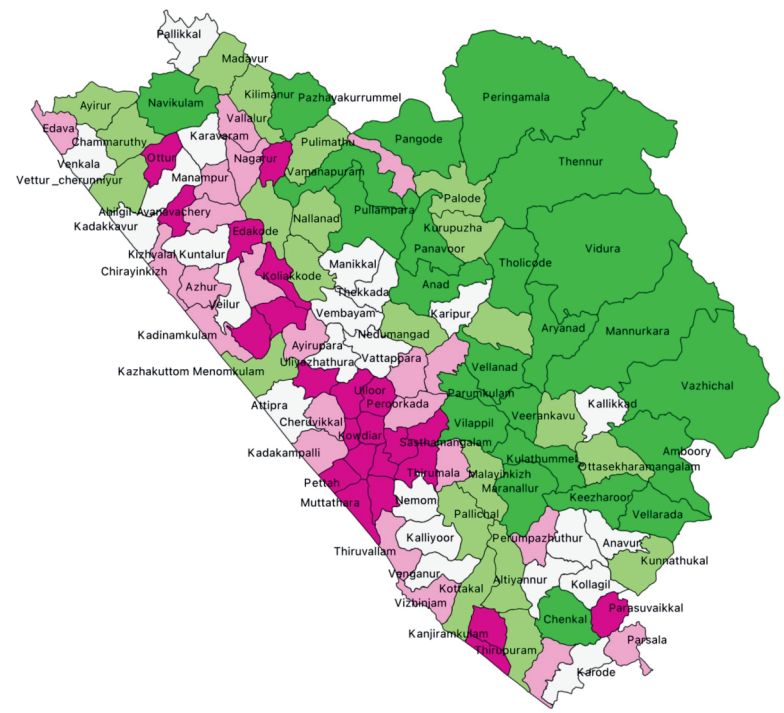


Fig. 1. Location map of Thiruvananthapuram district

Soil fertility status of Thiruvanthapuram district

- Majority of soils (74 %) are strongly acid to slightly acid with overall pH ranging from 5.1 to 6.5 (pH class 4 to 6).
- Organic carbon is low in 36 per cent and medium in 49 per cent of soil samples
- Available phosphorus is high in 53 per cent of samples
- Available potassium is low in 32 per cent and medium in 38 per cent of samples
- Calcium is adequate in 73 per cent of samples

- Magnesium is deficient in 98 per cent of samples
- Sulphur is adequate in 96 per cent of samples
- Copper is adequate in 82 per cent of samples
- Zinc is adequate in 86 per cent of samples
- Boron is deficient in 62 per cent of samples

Strategies for weather related contingencies

Drought

Rainfed situation

1. Mixing of soil with crop residues in the surface 0-10 cm
2. Intercropping of cassava with pulses at 2:1 ratio
3. Adoption of mulching (organic or plastic)
4. Application of farmyard manure under minimum soil moisture conditions

Early season drought (delayed onset)

Delay by 2 weeks, June 3rd week

1. Coconut + cassava / other tubers / banana / pepper
2. Homestead cultivation of tuber crops
3. Adjust planting time of tubers in order to avoid drought during crop period

Delay by 4 weeks, July 1st week

1. Coconut + cassava / other tubers / banana / pepper
2. Homestead cultivation of tuber crops
3. Adjust planting time of tubers in order to avoid drought during crop period

Delay by 6 weeks, July 3rd week

1. Coconut + cassava / other tubers / banana / pepper
2. Homestead cultivation of tuber crops
3. Production of more drought tolerant planting materials by minisett technique
4. Adjust planting time of tubers in order to avoid drought during crop period critical crop stages

Delay by 8 weeks, August 1st week

1. Coconut + cassava / other tubers / banana / pepper
2. Homestead cultivation of tuber crops

3. Selection of tuber crops which can tolerate drought
4. Adjust planting time of tubers in order to avoid drought during crop period.

Early season drought (normal onset)

Normal onset followed by 15 – 20 days dry spell after sowing leading to poor germination/ crop stand etc

1. Coconut + cassava / other tubers / banana / pepper
2. Homestead cultivation of tuber crops
3. Adopt measures to protect the plants from direct sunlight

Mid season drought (Long dry spell, consecutive two weeks rainless (<2.5 mm) period

1. Production of buffer stock planting materials by minisett technique
2. Providing life saving irrigation
3. Mulching with available organic matter
4. Adjust planting time of tubers in order to avoid drought during crop period

Terminal drought

1. Life saving irrigation
2. Harvest the crop at physiological maturity
3. Mulching
4. Shelter belts
5. Establishment of cover crops

II. Kollam

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Western Ghats and Coastal Plain, Hot Humid Zone (19.2)

Agro Climatic Zone (NARP): Southern zone

Districts or part thereof falling under this NARP Zone: Thiruvananthapuram, Kollam, Pathanamthitta

Geographic coordinates of district: 8° 54' 53.717"N (Latitude)
76°37'15.79" E (Longitude)
3m amsl (Altitude)

2. Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	1395.3	Last week of May	
NE Monsoon (October-December)	599.8		
Winter (January-March)	265.9		
Summer (April-May)	258.4		
Annual	**2494.8**		

3. Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Laterite soils	199082	81.4
Sandy soils	13907	5.6
Sandy loams	4233	1.7
Others	27658	-
Problem soils	1730	11.3

4. Agriculture cultivation details

- Net irrigated area: 8132.59 ha
- Gross irrigated area: 10003.5 ha
- Rainfed area: 124045 ha
- Total cassava area:12233 ha

- Total cassava production: 530584 tons
- Productivity: 43373 kg ha^{-1}
- Major contingency issues: Drought (occasional); Papaya mealy bug infestation (occasional)

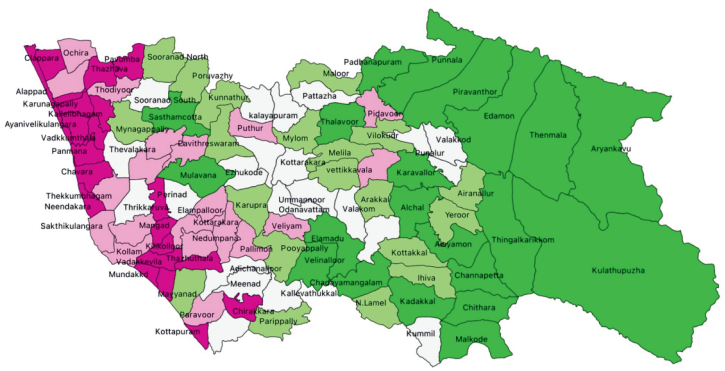


Fig. 2. Location map of Kollam district

Strategies for weather related contingencies

Drought

Rainfed situation

Early season drought , Delayed onset (delay by 2 weeks (second week of June) :

For coconut + cassava cropping system

1. Spray 0.5% KCl solution
2. Soil application of *Azotobacter* @ 2 kg ha^{-1} after receipt of showers along with 20 kg FYM and 20 kg soil

Early season drought (delayed by 4 weeks, fourth week of June)

1. Growing drought tolerant cassava varieties (var. Sree Reksha, Sree Swarna)
2. Soil application of *Azotobacter* @ 2 kg ha^{-1} after receipt of showers along with 20 kg FYM and 20 kg soil
3. Mulching with polythene or crop mulch

Outbreak of pests and diseases due to unseasonal rains

a. Cassava mealy bug

1. Spray chemicals like imidocloprid/thiomethoxan , minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare
2. Planting resistant cassava varieties with high starch content like Sree Kaveri

III. Kottayam

1.Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Western Ghats and Coastal Plain, Hot Humid region (19.2)

Agro Climatic Zone (NARP): Southern Zone (KE 2)

Districts or part thereof falling under this NARP Zone: Kollam, Kottayam, Alappuzha, Pathanamthitta, Thiruvananthapuram

Geographic coordinates of district: 9° 35' 42" N, (Latitude)
76°31' 51.6" E (Longitude)
3 m amsl (Altitude)

2. Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	1706	June 1st week	September 2nd week
NE Monsoon (October-December)	474	October 1st week	November 2nd week
Winter (January-March)	84		
Summer (April-May)	348		
Annual	**2612**		

3. Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Clay Loam soils	33.7	15.3
Alluvial soils	44.0	20.0
Laterite soils	69.9	31.7
Gravelly clay soils	56.0	25.4
Gravelly Loam soils	10.1	4.6
Others (specify): Forest soil	4.8	2.2

4. Agriculture cultivation details

- Net irrigated area: 18449 ha
- Gross irrigated area: 22801 ha
- Rainfed area: 200830 ha
- Total cassava area: 6640.41 ha

- Total cassava production: 336522.7 tons
- Cassava productivity: 50680 kg ha^{-1}
- Major contingency issues: Sea water intrusion, mealy bug attack

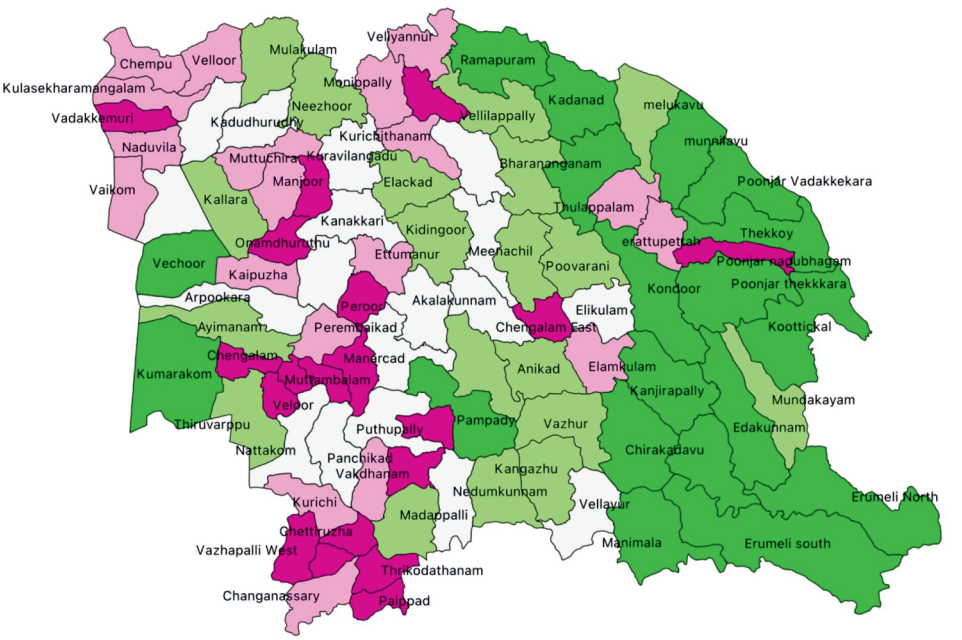


Fig. 3. Location map of Kottayam district

Strategies for weather related contingencies

Drought

Early season drought (delayed onset)

Delay by 2 weeks, June 3rd week

1. No Change
2. Short duration var, cover crops

Delay by 4 weeks, July 1st week

1. No Change
2. Short duration var, cover crops
3. Life saving irrigation

Unusual rains

Continuous high rainfall in a short span leading to water logging

1. Improve drainage facilities, cover crops, strip cropping with fodder grass, water harvesting structures

Outbreak of pests and diseases due

1. Use healthy planting material
2. Prophylactic spraying of biocontrol agents
3. Use resistant varieties

Floods

Continuous submergence for more than 2 days

1. Providing adequate drainage for draining excessive stagnating water around the root system
2. Timely cleaning, de-silting and deepening of natural water reservoir and drainage channels
3. Construction and protection of all the flood protection embankments, ring bunds and other bunds
4. Crop insurance, increase the storage capacity of reservoir

Outbreak of pests and diseases due to unseasonal rains

a. Cassava mealy bug

1. Spray chemicals like Imidachloprid/thiomethoxam , minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare

IV. Ernakulam

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Western Ghats and Coastal Plain, Hot Humid region (19.2)

Agro Climatic Zone (NARP): Central Zone (KE-3)

Districts or part thereof falling under this NARP Zone: Thrissur, Palakkad, Malappuram, Wayanad, Ernakulam

Geographic coordinates of district: 10° 0' 0" N (Latitude)
76°19' 48" E (Longitude)
22 m above MSL (Altitude)

2. Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	2035.4	June 1st week	September 2nd week
NE Monsoon (October-December)	378.6	October 1st week	November 2nd week
Winter (January-March)	19.6		
Summer (April-May)	405.2		
Annual	**2838.8**		

3. Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Alluvial soil	52.1	17.5
Hilly soils	36.0	12.1
Pokkali soils	8.0	2.7
Sandy loam	26.2	8.8
Laterite soil with well defined B horizon	105.3	35.4
Others (specify): Forest soil	69.0	23.2

4. Agriculture cultivation details

- Net irrigated area: 23351 ha
- Gross irrigated area: 31662 ha
- Rainfed area: 110100 ha
- Total cassava area: 5475.47 ha

- Total cassava production: 273914.8 tons
- Cassava productivity: 50030 kg ha^{-1}
- Major contingency issues: Drought (occasional to none);Cassava mealy bug infestation (regular)

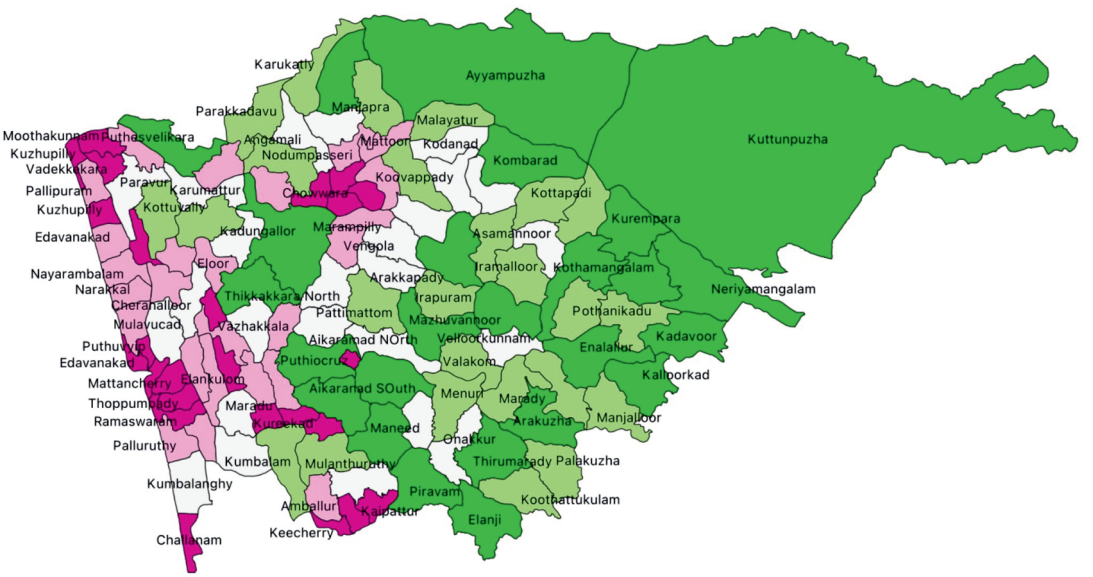


Fig. 4. Location map of Ernakulam district

Strategies for weather related contingencies

Drought

Rainfed situation

Early season drought (delayed onset)

Delay by 2 weeks, June 3rd week

1. Coconut based cropping system in garden lands with tuber crops and vegetables as inter crops
2. Short duration varieties of tuber crops like Sree Jaya and Sree Vijaya and pulses as inter crops

Delay by 4 weeks, July 1st week

1. Coconut based cropping system in garden lands with tuber crops and vegetables as inter crops

2. Short duration varieties of tuber crops like Sree Jaya and Sree Vijaya and pulses as inter crops
3. Provide life saving irrigation

Mid season drought (long dry spell, consecutive 2 weeks rainless (>2.5 mm) period)

At vegetative stage

1. Coconut based cropping system in garden lands with tuber crops and vegetables as inter crops
2. Provide life saving irrigation

Unusual rains

Continuous high rainfall in a short span leading to water logging

1. Provide drainage at crop maturity stage

Diseases due to unseasonal rains

1. Use healthy planting material, prophylactic spraying of bio control agents, use resistant varieties

Floods

Transient water logging/ partial inundation

1. Providing adequate drainage for draining excessive stagnating water around the root system, Foliar spray of 2% DAP + 1% KCl (MOP)

Continuous submergence for more than 2 days

1. Providing adequate drainage for draining excessive stagnating water around the root system, Timely cleaning, de-silting and deepening of natural water reservoir and drainage channels, Construction and protection of all the flood protection embankments, ring bunds and other bunds. Crop insurance, Increase the storage capacity of reservoir.

Outbreak of pests and diseases due to unseasonal rains

a. Cassava mealy bug
   1. Spray chemicals like Imidachloprid/thiomethoxam , minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare

V. Idukki

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Western Ghats and Coastal Plain, Hot Humid region (19.2)

Agro Climatic Zone (NARP): High altitude zone (KE-4)

Districts or part thereof falling under this NARP Zone: Idukki and Wayanad

Geographic coordinates of district: 9° 51' 0" N (Latitude)
76°56' 24" E (Longitude)
1200 m amsl (Altitude)

2.Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (July-September)	987.6	June 1st week	September 1st week
NE Monsoon (October-December)	506.57	October 1st week	November 3rd week
Winter (January-March)	85.54		
Summer (April-May)	203.6		
Annual	**1783.31**		

3.Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Forest loam	210.280	48.19
Laterite	N.A	
Brown hydromorphic	N.A	
Alluvial	N.A	

4. Agriculture cultivation details

- Net irrigated area: 44648 ha
- Gross irrigated area: 44843 ha
- Rainfed area: 57000 ha
- Total cassava area: 6998 ha
- Total cassava production: 297870 tons
- Cassava productivity: 42565 kg ha^{-1}

- Major contingency issues: Drought (occasional to none)

Fig. 5. Location map of Idukki district

Strategies for weather related contingencies

Drought

Rainfed situation

Early season drought (delayed onset)

Delay by 2weeks, June 3rd week

1. Coconut based mixed cropping with pepper, pineapple, cassava and rubber
2. Adoption of mulching
3. Bulk organic manuring
4. Micro irrigation: Sprinkler irrigation/drip irrigation

Delay by 4 weeks, July 1st week

1. Coconut based mixed cropping with pepper, pineapple, cassava and rubber
2. Mulching
3. Bulk organic manuring

4. Micro irrigation: Sprinkler irrigation/drip irrigation
5. Collection and conservation of rainwater, de silting, repairing and renovation of irrigation channels

Mid season drought (long dry spell, consecutive 2 weeks rainless (>2.5 mm) period)

At vegetative stage

1. Coconut based mixed cropping with pepper, pineapple, cassava and rubber

Terminal drought

1. Coconut based mixed cropping with pepper, pineapple, cassava and rubber

Outbreak of pests and diseases due to unseasonal rains

Cassava mealy bug

1. Spray chemicals like imidacloprid/thiomethoxam, minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare

3. AGRICULTURAL CONTINGENCY PLAN FOR MAJOR CASSAVA GROWING DISTRICTS OF TAMIL NADU

I. Salem

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Eastern Ghats and Tamil Nadu Uplands and Dry Region (8.3)

Agro Climatic Zone (NARP): North Western Zone (TN-2)

Districts or part thereof falling under this NARP Zone: Salem district, Dharmapuri district excluding hilly areas, Namakkal district excluding Thiruchengodu and Perambalur taluks

Geographic coordinates of district: 11° 38'36.86"N (Latitude)
78°09'26.35" E (Longitude)
309 m amsl (Altitude)

2.Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	493	June 1st week	October 1st week
NE Monsoon (October-December)	301	October 2nd week	December 1st week
Winter (January-February)	28		
Summer (March-May)	161		
Annual	**983**		

3.Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Shallow red soils	98.8	19.0
Moderately shallow red soils	94.3	18.1
Very deep black soils	62.3	12.0
Moderately deep red soils	46.0	8.9
Deep black soils	43.1	8.3

4. Agriculture cultivation details

- Net irrigated area: 118948 ha
- Gross irrigated area: 175914 ha

- Rainfed area: 1,06,003 ha
- Total cassava area: 13117 ha
- Total cassava production: 538936 tons
- Cassava productivity: 41090 kg ha^{-1}
- Major contingency issues: Drought (occasional to none);Cassava mealy bug infestation (regular)

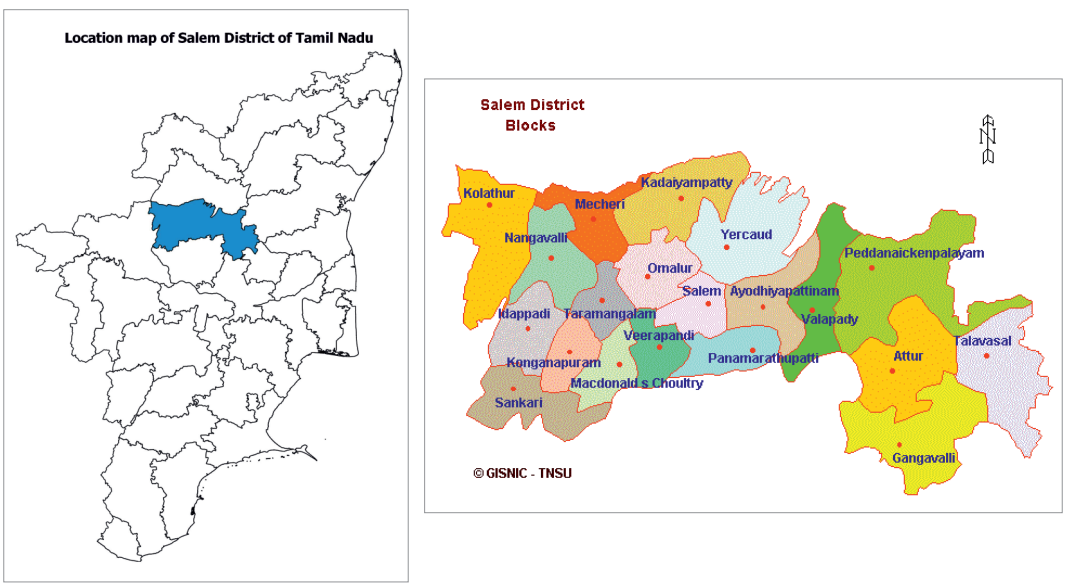


Fig. 1. Location map of Salem district (left) and blocks (right)

Strategies for weather related contingencies

Drought

A. Rainfed situation

1. Mixing of soil with crop residues in the surface 0-10 cm
2. Intercropping of cassava with pulses at 2:1 ratio
3. Adoption of mulching (organic or plastic)
4. Application of farmyard manure under minimum soil moisture conditions
5. Providing a top dressing of nitrogen spray immediately after stress period when rainfall is received

6. Keep the crop in weed free condition

Rabi season (October 4th week)

1. Growing short-duration varieties like Sree Vijaya, Sree Jaya
2. Mulching (soil and water conservation)
3. Spray with 0.5% potassium chloride (KCl) solution
4. Soil application of pusagel @ 2 g plant^{-1}

Early season drought (delayed onset) November second week

1. *In situ* moisture conservation
2. Opening of conservation furrows
3. Spray with 0.5% KCl solution
4. Drought tolerant varieties like Sree Reksha, Sree Kaveri
5. Inter cultivation
6. Cropping system with black gram like VBN-1, VBN-2, VBN-3

Early season drought (delayed onset) November fourth week

1. *In situ* moisture conservation
2. Opening of conservation furrows
3. Spray with 0.5% KCl solution
4. Inter cultivation

Early season drought (Normal onset, followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.

1. Inter cultivation
2. Conservation furrows
3. Split application of fertilizers after receipt of rainfall
4. Application of organic manures like FYM/Vermi compost to improve soil physical condition
5. Water spraying

B. Irrigated Conditions

Delayed/ limited release of water in canals due to low rainfall/ insufficient groundwater recharge due to low rainfall

1. Conservation furrows

2. Mulching
3. Practice of drip irrigation

Outbreak of pests and diseases due to unseasonal rains

a. Cassava mealy bug

1. Spray chemicals like Imidachloprid/Thiomethoxam, minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare
2. Planting resistant cassava varieties with high starch content like Sree Athulya

ll. Namakkal

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Eastern Ghats and Tamil Nadu Uplands and Dry Region (8.3)

Agro Climatic Zone (NARP): North Western Zone (TN-2)

Districts or part thereof falling under this NARP Zone: Western Zone (AZ 123) except Thiruchengodu taluk. Remaining taluk falling under North western zone.

Geographic coordinates of district: 11° 13'27.77"N (Latitude)
78°10'15.29" E (Longitude)
209 m amsl (Altitude)

2.Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	310.3	June 1st week	October 1st week
NE Monsoon (October-December)	314.9	October 2nd week	December 3rd week
Winter (January-February)	10.2		
Summer (March-May)	140.6		
Annual	**776**		

3.Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Red soils	206.7	60.6
Black soils	30.9	9.0
Brown soils	12.9	3.8
Alluvial soils	17.2	5.0

4. Agriculture cultivation details

- Net irrigated area: 72,829 ha
- Gross irrigated area: 102,036 ha
- Rainfed area: 1,00,800 ha
- Total cassava area: 17,755 ha

- Total cassava production: 656937 tons
- Productivity: 37000 kg ha^{-1}
- Major contingency issues: Drought (occasional);Papaya mealy bug infestation (occasional)

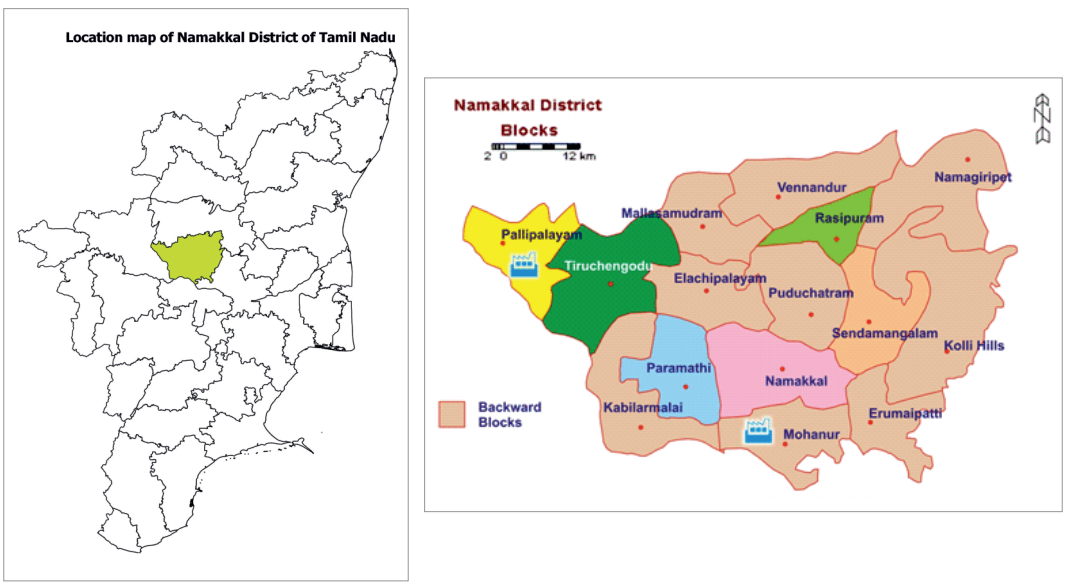


Fig. 2. Location map of Namakkal district (left) and blocks (right)

Strategies for weather related contingencies

Drought

Rainfed situation in black soils

1. Watershed approach in conservation of soil and water
2. Adoption of short duration cassava varieties like Sree Jaya, Sree Vijaya
3. Preparation of land in advance of monsoon
4. Maximum use of farm yard manure
5. Weed free conditions of the field
6. Adoption of intercropping to reduce the risk

Early season drought , Delayed onset (delay by 2 weeks (third week of June) :

1. Spray with 0.5% KCl solution

2. Soil application of pusagel @ 2 g plant^{-1}
3. Soil application of Azotobacter, 2 kg ha^{-1} after receipt of showers along with 20 kg FYM and 20 kg soil
4. Raising polybag nursery

Early season drought (delayed by 4 weeks, first week of July)

1. Growing drought tolerant cassava varieties
2. Soil application of Azotobacter, 2 kg ha^{-1} after receipt of showers along with 20 kg FYM and 20 kg soil
3. Mulching with polythene or crop mulch

Early season drought (delayed onset by 6 weeks) Third week of July or (by 8 weeks, first week of August, in black soils)

1. Change in cropping systems with minor millets with pulses/castor/fodder/ragi (CO14, Paiyur 1), black gram (VBN 3, 4) etc.
2. Raising polybag nursery
3. Soil application of Azotobacter, 2 kg ha^{-1} after receipt of showers along with 20 kg FYM and 20 kg soil
4. Mulching with polythene or crop mulch

B. Irrigated Conditions under deep black soils

Delayed/ limited release of water in canals due to low rainfall/ Insufficient groundwater recharge due to low rainfall

1. Change in cropping system to fodder maize or sorghum

C. Unusual rains (Untimely, unseasonal etc.)

Rainfed condition

1. Provide drainage at early stage
2. Soil drenching with biopesticides/systemic fungicides
3. Provide drainage and do early harvest
4. Tubers should be used for milling purpose immediately

Heavy rainfall with high wind speed in a short span

1. Provide drainage at early stage
2. Soil drenching with biopesticides/systemic fungicides
3. Provide drainage and early harvest at physiological stage

4. Use the produce for starch preparation/consumption purpose

Irrigated condition/Floods/Continuous submergence for more than 2 days

1. Provide drainage
2. Soil drenching with biopesticides/systemic fungicides
3. Provide drainage and early harvest at maturity stage
4. Use the produce for starch preparation/consumption purpose

Outbreak of pests and diseases due to unseasonal rains

a. Cassava mealy bug

1. Spray chemicals like Imidachloprid/Thiomethoxam , minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare
2. Planting resistant cassava varieties with high starch content like Sree Athulya

lll. Erode

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Eastern Ghats and Tamil Nadu Uplands (8.2, 8.3)

Agro Climatic Zone (NARP): North-Western Zone (TN-2), Western zone (TN-3)

Districts or part thereof falling under this NARP Zone: Erode, Thirupur, Coimbatore, Dindugal, Madurai, Trichy, Salem district

Geographic coordinates of district: 11° 20' N (Latitude)
77°.43 E (Longitude)
175.3 m amsl (Altitude)

2. Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	270	June 1st week	September 4th week
NE Monsoon (October-December)	319	October 1st week	December 4th week
Winter (January-February)	44		
Summer (March-May)	139		
Annual	**772**		

3.Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Red clayey soils	142.0	17
Lateritic soils	114.2	14
Alluvial soils	145.2	17
Other soil types	414.8	52

4. Agriculture cultivation details

- Net irrigated area: 117758 ha
- Gross irrigated area: 132368 ha
- Rainfed area: 128600 ha
- Total cassava area: 6021 ha
- Total cassava production: 190318 tons

- Cassava productivity: 31610 kg ha^{-1}
- Major contingency issues: Drought (occasional); Papaya/cassava mealy bug infestation (occasional)

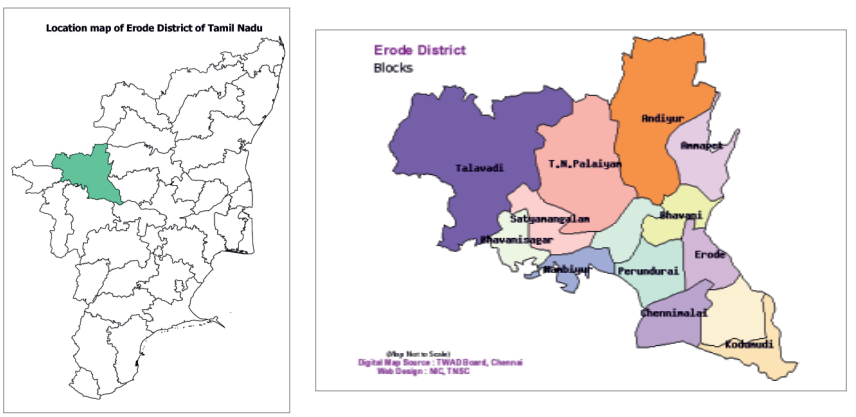


Fig. 3. Location map of Erode district (left) and blocks (right)

Strategies for weather related contingencies

Drought

A.Rainfed situation

1. Mixing of soil with crop residues in the surface 0-10 cm
2. Intercropping of cassava with pulses at 2:1 ratio
3. Adoption of mulching (organic or plastic)
4. Application of farmyard manure under minimum soil moisture conditions
5. Providing a top dressing of nitrogen spray immediately after stress period when rainfall is received.
6. Keep the crop in weed free condition

Rabi season (October 4th week)

1. Growing short-duration varieties like Sree Vijaya, Sree Jaya
2. Mulching (soil and water conservation)
3. Spray with 0.5% potassium chloride (KCl) solution
4. Soil application of pusagel @ 2 g $plant^{-1}$

Early season drought (delayed onset) November second week

1. In situ moisture conservation

2. Opening of conservation furrows
3. Spray with 0.5% KCl solution
4. Drought tolerant varieties like Sree Reksha, Sree Kaveri
5. Inter cultivation
6. Cropping system with black gram like VBN-1, VBN-2, VBN-3

Early season drought (delayed onset) November fourth week

1. In situ moisture conservation
2. Opening of conservation furrows
3. Spray with 0.5% KCl solution
4. Inter cultivation

Early season drought (Normal onset, followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.

1. Inter cultivation
2. Conservation furrows
3. Split application of fertilizers after receipt of rainfall
4. Applications of organic manures like FYM/Vermi compost to improve soil physical condition
5. Water spraying

B. Irrigated Conditions

Delayed/ limited release of water in canals due to low rainfall/ insufficient groundwater recharge due to low rainfall

1. Conservation furrows
2. Mulching
3. Practice of drip irrigation

Outbreak of pests and diseases due to unseasonal rains

Cassava mealy bug

1. Spray chemicals like Imidachloprid/Thiomethoxam , minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare
2. Planting resistant cassava varieties with high starch content like Sree Athulya

IV. Dharmapuri

1. Agro-Climatic/Ecological Zone

Agro Ecological Region /Sub Region (ICAR): Tamil Nadu uplands and plains, hot moist semiarid eco-subregion (8.3)

Agro Climatic Zone (NARP): High Altitude and Hilly Zone, western zone (TN-7, TN-3)

Districts or part thereof falling under this NARP Zone: Dharmapuri excluding hilly areas, Salem, excluding Thiruchengodu, Perambalur taluk of Tiruchirapalli district

Geographic coordinates of district: 12° 07'49.42"N (Latitude)
78°09'26.35" E (Longitude)
507 m amsl (Altitude)

2.Rainfall Pattern

Rainfall	Average (mm)	Normal onset	Normal cessation
SW monsoon (June-September)	361.0	June 1st week	September 4th week
NE Monsoon (October-December)	316.7	October 1st week	December 3rd week
Winter (January-February)	18.5		
Summer (March-May)	156.9		
Annual	**853.1**		

3.Major Soil types

Major Soils	Area ('000 ha)	Per cent (%) of total
Deep black soils	71.1	15.8
Deep red soils	101.5	22.6
Moderately deep black soils	39.8	8.9
Moderately shallow red soils	38.5	8.6
Very deep black soils	63.2	14.1

4. Agriculture cultivation details

- Net irrigated area: 57512 ha
- Gross irrigated area: 106306 ha
- Rainfed area: 93400 ha
- Total cassava area: 13860 ha
- Total cassava production: 405052 tons
- Cassava productivity: 29220 kg ha^{-1}

- Major contingency issues: Drought (occasional to none); Phoma leaf spot and Cassava mealy bug infestation (regular)

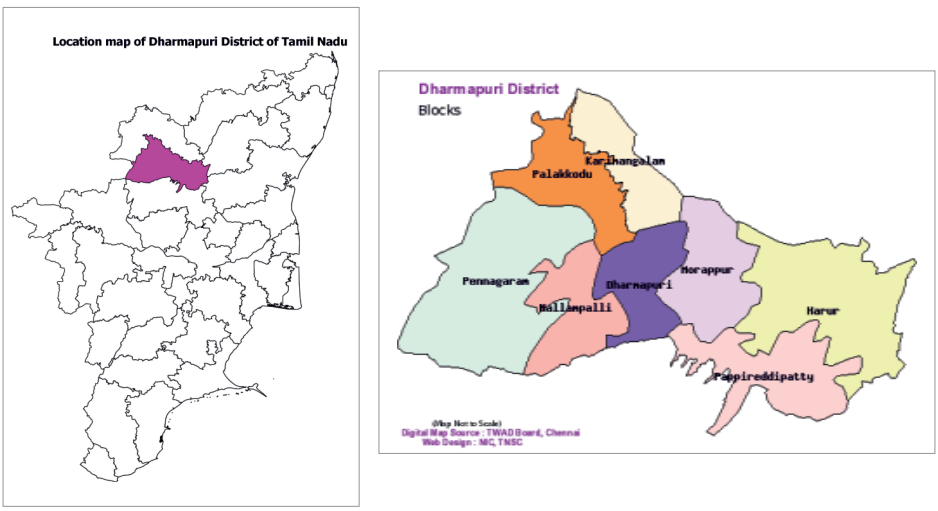


Fig. 4. Location map of Dharmapuri district with blocks

Strategies for weather related contingencies

Drought

Rainfed situation

Delay by 4 weeks (July 1st week)

1. Sett treatment with 0.5% KCl+ $FeSO_4$+ $ZnSO_4$ solutions
2. Mixing of soil with crop residues in the surface 0-10 cm
3. Intercropping of cassava with pulses at 2:1 ratio
4. Adoption of mulching (organic or plastic)
5. Application of farmyard manure and recommended fertilizers under minimum soil moisture conditions

Delay by 6 weeks (July 3rd week)

No change

Delay by 8 weeks (Aug 1st week)

Fallow / vegetables like tomato, brinjal, okra

Early season drought October fourth week

Nil

Early season drought, delay by four weeks (November second week)

1. Sett treatment with 0.5% KCl+ $FeSO_4$+ $ZnSO_4$

Early season drought delay by 6 weeks (November 4th week)

No change

Early season drought delay by 8 weeks (December 2nd week)

1. Fallow/vegetables like tomato, brinjal, okra

Early season drought (Normal onset, followed by 15-20 days dry spell after sowing leading to poor germination/crop stand etc.

Optimum population maintenance by

- Gap filling
- Thinning
- Resowing

In case of intercropping sequential sowing may be followed

- Forming ridges and furrows to conserve the expected rain
- Blade harrowing
- Soil mulching

Mid season drought **long dry spell, consecutive 2 weeks rainless (>2.5 mm) period At vegetative stage**

- Reduction of green leaves
- Providing life irrigation
- Forming ridges and furrows for *in situ* rainwater conservation

Mid season drought **long dry spell, consecutive 2 weeks rainless (>2.5 mm) period At reproductive stage**

- Reduction of green leaves
- Life saving irrigation

Terminal drought

- Harvest at physiological maturity
- Forming ridges and furrows to conserve the expected rainwater

Irrigated situation Delayed/ limited release of water in canals due to low rainfall

- Give protective irrigation

Non release of water in canals under delayed onset of monsoon in catchment

- Finger millet / Pulses

- Deep ploughing

Insufficient Groundwater recharge due to low rainfall

- Fallow

Unusual rains Continuous high rainfall in a short span leading to water logging

- Drain excess water at vegetative stage, flowering stage, crop maturity stage and post harvest stage

Heavy rainfall with high speed winds in a short span

Not applicable for Dharmapuri district

Outbreak of pests and diseases due to unseasonal rains

- Phomopsis wilt – Spray with SAAF at 0.2% concentration or Bavistin at 0.1 % concentration
- Tuber rot – Drain excess water
- Cassava mealy bug
  - Spray chemicals like Imidachloprid/Thiomethoxam , minimum 0.5 ml per liter of water or release of parasitoids for both papaya and cassava mealy bug @ 500 adult per hectare
  - Planting resistant cassava varieties with high starch content like Sree Athulya

Floods Transient water logging/ partial inundation

Not applicable for Dharmapuri district

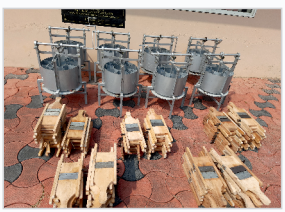
References

1. GoI. 2024. Agricultural Statistics at a Glance 2024. Ministery of Agriculture and Farmers Welfare, Government of India.
2. Department of Agriculture & Farmers Welfare, Government of India, Agriculture Contingency Plan [Online]. Available at https://www.agriwelfare.gov.in/en/DocAgriContPlan
3. Venkateshwarlu B., Singh A.K., Prasad Y.G., Ravindra Chary G, Ch. Srinivasa Rao, Rao K.V., Ramana D.B.V and Rao V.U.M (2011). District level contingency plans for weather aberrations in India. Central Research Institute for Dry land Agriculture, Natural Resource Management Division, Indian Council of agricultural research, Hyderabad - 500059, India. p-135
4. F. H. Rahman, R. Bhattacharya and S. Nandi (2021). Annual Report of National Innovations on Climate Resilient Agriculture- TDC, ICAR-ATARI Kolkata, India, pp 1-58
5. Technical Program of NICRA-AICRPDA (2016-17). National Innovations on Climate Resilient Agriculture - All India Coordinated Research Project for Dryland Agriculture, Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad-500059, India. 190 p.2.

Tuber crops for.....

Food, Health, Wealth and Prosperity






ICAR-Central Tuber Crops Research Institute

Sreekariyam, Thiruvananthapuram 695 017, Kerala, India

Phone: (91) (471) 2598551 to 2598554

E-mail: director.ctcri@icar.org.in

Website: https://www.ctcri.org

Social Media

Facebook Twitter Whatsapp Instagram You Tube