

Long-term Strategies and Programmes for Mechanization of Agriculture in Agro Climatic Zone–XII : Western Plains and Ghat regions

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1. NAME OF AGRO CLIMATIC ZONE : Western Plains and Ghat region
2. STATES UNDER THIS ZONE : Goa, Karnataka, Kerala, Maharashtra and Tamil Nadu



3. SUB-AGRO CLIMATIC ZONES WITH THEIR CHARACTERIZATION

This is an important zone for plantation crops and spices. It runs along the west coast covering parts of Tamil Nadu, Kerala, Karnataka, Maharashtra and Goa with a variety of soil types and rainfall patterns. There are four sub-zones. The coastal hilly region covers the north coastal areas of Konkan, Goa and Uttar Kannad. The coastal midland extends along the Kerala State coast. The third sub-zone comprises of Palakkad and Kottayam belt of Kerala. Finally, the hilly region has six districts from Karnataka, Kerala and Tamil Nadu.

3.1 Coastal Hilly Sub-Region

This region, more famous for its industrial activities in the Bombay Thane belt and Financial markets inn; Bombay is poor in agricultural development. Only 20% of the land is cultivated and only four per cent of the cultivated area is irrigated. Agricultural activities depend almost, entirely upon rainfall. The sub-zone receives about 3,640 mm of rains annually. Its climate is semi-arid to dry sub-humid. The soil is red, laterite and coastal alluvial soil with loam and clay loam soil texture and acidic reaction.

In spite of the low irrigation support, land productivity is quite high. The sub-zone covers the districts of Thane, Greater Bombay, Raigarh, Ratnagiri and Sindhudurg from Maharashtra, Uttar Kannad from Karnataka and Goa.

3.2 Coastal Midland Region

This region is essentially based in Kerala. It also includes Dakshin Kannad in the north from Karnataka and Kanniyakumari from Tamil Nadu in the south. The districts from Kerala are Thiruvananthapuram, Kollam, Alappuzha, Ernakulam, Thrissur, Malappuram, Kozhikode, Kinnaur and Kasaragod. The area produces high value crops. More than 60% of the land is sown and about 22% of the net sown area is irrigated. Forests cover about a quarter of the land. The area receives about 3,000 mm of rains, the climate is humid to perhumid. The soil type is classified as coastal alluvium sandy loam.

3.3 Midland Sub Region

This sub-zone spans across Kottayam and Pathanamthitta, and Palakkad. In many respects this region is similar to the coastal midland region. However, it receives much lesser rainfall—around 2,400 mm. The climate is humid to perhumid and the soil type is classified as clay to clay loam and lateritic.

3.4 Hilly Sub Region

Availability of land for agricultural purposes in these hilly areas is low. Only around a third of the area is available for agricultural purposes. Nearly half of the area is under forest cover. Land productivity is high since the cultivation here is mostly of high value crops.

The region includes the districts of Shimoga, Chikmagalur and Kodagu of Karnataka, Idukki and Wayanad of Kerala and Nilgiri from Tamil Nadu. It receives about 2,500 mm of rainfall per annum and the climate is mostly humid to perhumid.

4. GENERAL TOPOGRAPHY OF THE ZONE WITH BRIEF HISTORICAL BACKGROUND OF AGRICULTURAL DEVELOPMENT OF THE ZONE

This zone is a high rainfall zone with undulating terrain and the rainfall in this zone is ranging from 3,000–4,500 mm in coastal plains and from 900–2,000 mm in the hilly regions. There are two distinct sub zones, namely, coastal low land and up lands. The major crops in the coastal low lands are coconuts, paddy, arecanut, tapioca, cashew nut, ginger and turmeric and other cereals and pulses and in the uplands and hilly region, plantation crops like tea, coffee, rubber and spices like cardamom, pepper etc are grown. Agriculture contributes most to the income in primary sector in this zone. Export earning crops like tea, coffee, spices, cashew and some marine products from this zone also contribute considerably for our country's foreign exchange revenue. The soils in this zone are generally laterite, coastal alluvial and loamy types. There are some specific problem areas in Kerala where flooding and inundation takes place frequently during heavy monsoon, damaging standing crops. Kerala has typical hills and valleys intercepted by streams and rivers and back waters providing inland water transport. Irrigation potential in the southern parts of the zone is found to be exploited well but in the northern parts, namely Goa and Konkan regions, the irrigated area is much less. Though the rainfall has been abundant in this region, most of it flows to the Arabian Sea and rain water storage systems are inadequate. Marine fisheries is well developed in this zone and there are many marine fish processing industries located in this zone.

Tourism is another industry which has grown very well in this zone. The labour wages are high in this zone compared to other zones and the labour for doing hard agricultural work is not available sufficiently, causing slackness and lack of interest for agriculture among farmers. Most of the farmers in Kerala are part-time

farmers. The zone is well developed in terms of infrastructure facilities and cash flow. In spite of this, the stage of agricultural mechanization is still to be developed to the desired level.

There are a few success stories of mechanization also in this zone. The self propelled transplanter for paddy introduced under special scheme to farming groups in Palakkad and Thrissur districts of Kerala has become very successful that the farmers are able to realize 10–15% more yield in rice crop. The simplified mat type nursery for paddy has been well adopted and even women are raising the nursery and operating the rice transplanter on custom hiring basis.

During peak season, combine harvesters owned by operators in Tamil Nadu are brought to Palakkad district in Kerala and are found to be performing successfully on custom hiring basis.

5. OPERATIONAL LAND HOLDING PATTERN BY MAJOR SIZE GROUP

The holdings in this zone are highly fragmented. 93.96 and 81.43% of number of holdings are found to be marginal with average marginal holding size at 0.15 and 0.35 ha respectively in Kerala and Goa. In the hilly districts of Tamil Nadu, 77.39% of holdings are marginal and small. The highly fragmented land holdings and the undulating topography of this zone has restricted the adoption of agricultural machinery.

6. IMPORTANT SOIL TYPES AND CROPS

(a) Soil types

Kerala

Red loam, laterite, coastal alluvial, riverine alluvium, onatukara alluvium, brown hydro morphic, saline hydro morphic, kutatnnad, black soils and forest loam are major soil types in Kerala.

Tamil Nadu

In Nilgiris district, three types of soil such as laterite, dark brown and red soils exists whereas hydrological soil group 'B' with moderate infiltration and moderate runoff potential covers 52% of the district in Kanyakumari district. The remaining area of 48% is constituted by soil group 'C' with slow infiltration and moderate run off potential.

Karnataka

In the hilly zone of Karnataka, Red clay, loamy soils occur whereas the coastal zone is occupied by the red laterite and coastal alluvial soil types.

Maharashtra

Laterite soil is widely found in southern Konkan coastal zone of Maharashtra. Along the sea coast in a narrow belt, coastal saline and coastal alluvial soil occurs. The predominant type of soils occurs in the Thane district and the northern part of Raigad district is coarse and shallow. Medium black type soils occurs in patches in the northern part of the zone. Southern part of Raigad district has laterite soil.

(b) Important crops

The important crops grown in this zone are Paddy, Tapioca, Sugarcane, tree crops like Coconut, Arecanut and Cashewnut, Spices and Plantation crops, viz. Pepper, Small cardamom, Ginger, Turmeric, Tea, Coffee, Rubber and . Mango are important Orchard crops of Konkan region.

7. CLIMATE AND ANNUAL RAINFALL

Goa

Normal annual rainfall 3,149 mm

Kerala

Rainfall distribution in Kerala is bimodal. July is the most rainy month in the northern districts and southern parts receive both South West and North East monsoon. Highest annual rainfall of the region is around 5,883.8 mm is recorded at Neriamangalam (Ernakulam district) and lowest (1,651.3 mm) at Chinnar (Idukki district).

Tamil Nadu

The maximum annual rainfall received had been 2,189 mm and minimum of 1,118 mm in the hilly region of Nilgiris. Rainfall is well distributed in high rainfall zone of Tamil Nadu throughout the year with January and February as the lean months. Summer shower begins during March and continue in April, May and accompany by the south west monsoon in June–July.

Karnataka

The hilly zone of Karnataka receives only 904–1,695 mm annual rainfall whereas the coastal zone of western ghat region receives about 3,011–4,694 mm annual rainfall.

8. POPULATION AND POPULATION DENSITY OF THE ZONE

Kerala has a higher population density of 819 per sq.km. while it is 363 in Goa, 275 in Karnataka and 314 in Maharashtra. The literacy rate in Kerala is the highest

in the country at 90.92%, and 82.32% in Goa, 77.27% in Maharashtra and 73.04% in Karnataka. The population growth has slipped to 9.42% in Kerala.

9. BRIEF SCENARIO OF AGRICULTURE SECTOR

Goa

Agriculture contributes most to the State's income in the primary sector. Out of the total geographical area of 3,885 thousand ha., the net area sown is 2,206 thousand ha and the gross cropped area is 3,022 thousand ha. Rice is the main crop and staple food crop. Other important crops are coconut, arecanut, cashew, pepper, pulses, cotton, groundnut, ragi, tobacco, mango, banana, pineapple and jack fruit.

Kerala

Homestead farming is most common in Kerala. Coconut constitutes the base crop in almost every homestead, intermixed with other seasonal, annual and perennial crops. Vegetables and tuber crops are important mixtures in homestead farming. Kerala's major sources of exports are agro based. In spices, pepper is the single most important product, with Kerala being the largest producer and exporter of black pepper.

Tamil Nadu

Kanyakumari and Nilgiris districts are coming under this zone. Despite high rainfall, irrigation facilities available in the districts are poor. Irrigated area constitutes only 7.8% of the total cultivated area. Tea is grown in about 66% of the cropped area and it is in the mainstay of the economy of the Nilgiris district. The area under tea has been increased by nearly 6,000 ha during the last 15 years owing to crop diversification. Coffee comes next to tea in terms of area coverage. Potato is the third major crop after tea and coffee and the Nilgiris accounts for three fourth of the total potato production in the State. Paddy and cereals are grown on a limited scale mainly in Gudalur area, which is the only terrain suitable for such crops. Major vegetable crops grown in the district include potato, cabbage, carrot, beans, radish, cauliflower etc., orange, jackfruit, plum, peach, apple and mango are the major fruits cultivated in the district. Apart from these, spices like cardamom, garlic, pepper and ginger are grown in a limited scale. In Kanyakumari district, 63.1% of the area, i.e. 1,06,260 ha cultivated. The district has a unique advantage of rainfall during both the southwest and northeast monsoons. Agriculture is the major activity in the district. Dairy development is an important subsidiary activity. Fishery is a traditional

activity. Rice is the only annual crop grown extensively. Tapioca is grown as the main rainfed crop. Coconut, rubber and tamarind are other important crops of Kanyakumari district. Pepper, clove, nutmeg, cardamom and coffee are important crops of this zone. High value crops are grown for export purpose.

Karnataka

Much of Karnataka's land resources are assigned to agriculture and forests. A key feature of the land use system in Karnataka is the control on the conversion of agricultural land to non-agriculture use. Agriculture and allied activities in 2000 accounted for about 37% of the State income and 69% of employment. Rice and sugarcane are cultivated on the coastal plain and coffee, tea & cardamom are grown in the hill region. The hilly zone of Karnataka has mountains and deep valleys. It also represents very wide variety of ecological conditions.

Maharashtra

About 70% population in the State depends on agriculture. The principal crops grown in this zone of State are coconut, rice, oilseeds, vegetables, banana, mango and other fruit crops. The State is an important producer of oilseeds. The region has a substantial area of orchards of orange, banana, mango, grapes, cashew nut, sweet lime etc.

10. BRIEF SCENARIO OF ANIMAL HUSBANDRY SECTOR

Brief scenario of animal husbandary sector is given in Table 1.

Table 1. Number of Live stock population in the zone

| State | Livestock Population | Number |
|-------------|--------------------------|-----------|
| Goa | Cattle | 87,978 |
| | Buffaloes | 40,222 |
| | Pigs | 1,05,402 |
| | Other Animals | 92,113 |
| | Poultry | 7,89,504 |
| Kerala | Cattle | 33,96,335 |
| | Buffaloes | 1,65,125 |
| | Goats | 18,60,501 |
| | Sheep | 6,058 |
| | Pigs | 1,42,784 |
| Tamil Nadu | Plough animals | 16,421 |
| | White Cattle (Cow) | 1,92,781 |
| | Black cattle (buffaloes) | 22,827 |
| | Sheep | 15,350 |
| | Goat | 1,13,411 |
| Maharashtra | Poultry | 7,69,616 |
| | Livestock | 27,95,000 |
| | Poultry | 22,80,000 |

11. BRIEF SCENARIO OF FISHERIES SECTOR

| State | Marine (tonnes) | Inland (tonnes) |
|--------------------------|-----------------|-----------------|
| Goa | 66,550 | 3,368 |
| Kerala | | |
| Fish landings (tonnes) | 5,93,783 | 78,039 |
| Fish value (Rs in lakhs) | 1,46,342.69 | 28,867 |

Tamil Nadu

There are 3,000 ponds for fish seed and fingerling rearing and supply to the farmers. Duck-cum-fish culture is important in Thirupatisaram. Integrated systems with co positive fish culture with catla, labia rohita are popularised in high rainfall region of Tamil Nadu.

| | | |
|-------------|----------|---|
| Karnataka | 1,28,415 | — |
| Maharashtra | 4,14,268 | — |

12. IRRIGATED AREA AND SOURCE OF IRRIGATION**Goa**

| | |
|-------------------|---------------------------------------|
| Rice | 27.4% of total area under rice |
| Total cereals | 26.1% of total area under cereals |
| Total pulses | 23.3% of total area under pulses |
| Total food grains | 25.7% of total area under food grains |
| Sugarcane | 100% of total area under sugarcane |
| Total oilseeds | 16.8% of total area under oilseeds |

Kerala

Net area irrigated is 3,81,000 ha. About 15.7% of the area under various crops is irrigated.

| | |
|------------------|--------------------------------------|
| Rice | 59.7% of total area under rice |
| Total cereals | 58.8% of total area under cereals |
| Total food grain | 53.1% of total area under food grain |
| Total oilseeds | 18.1% of total area under oilseeds |

Tamil Nadu

| | |
|--------------------|-----------|
| Net area irrigated | 33,745 ha |
| By Canals | 11,439 ha |
| Shallow tube wells | 1,643 ha |
| By Other sources | 20,663 ha |

Maharashtra

| | |
|----------------------|-----------|
| Net area irrigated | 42,000 ha |
| Total area irrigated | 74,000 ha |

13. INFRASTRUCTURAL FACILITIES AVAILABLE IN THE ZONE**13.1 Connecting of villages by roads to nearest towns and markets**

Villages in Kerala are well connected to towns by roads and transport facilities are good. Villages in hilly regions and sloppy terrains are to be provided better roads. The coastal areas in the entire zone has well connected roads.

13.2 Rural Electrification

All the villages in Kerala, Karnataka, Goa and Tamil Nadu are electrified and 92.3% of villages in Maharashtra have been electrified.

Rural electrification in this zone is satisfactory but the availability of the electric power for irrigation purposes during summer months is to be improved since the electricity generation is mainly by hydro power plants.

There are about 4 lakh and 3700 electric pumpsets that have been energized in Kerala and Goa respectively.

13.3 Important markets for sale of farm implements and machinery/grain mandies

The markets are available in major towns in this zone. Tea auction centres are available in Coonoor (Tamil Nadu) and Kochi (Kerala). Major export markets for spices are also available at Kochi and Kozhikode.

13.4 Infrastructural facilities available for manufacture of agricultural implements and Machinery

Small manufacturing units are located at Palakkad, Thrissur (Shoranur) and Trivandrum districts in Kerala. A leading manufacturer of power tiller is also located in Central Kerala. A few agricultural implements manufacturing units are available in Mangalore and Manipal areas.

Manufacturing activities need to be promoted by extending soft loans, subsidies and special incentives to entrepreneurs in this zone.

Sustainability of small manufacturers of agricultural machinery/implements may be ensured by strengthening their marketing system.

13.5 Infrastructural facilities available for sale/repair and maintenance of tractors and other machinery in the region**Kerala**

Few tractor and power tiller dealers are available in few major districts.

Tamil Nadu

Power tiller dealers are available in the two districts of in this zone. Tractor dealers are located in the neighbouring districts.

Karnataka

Tractor and power tiller dealers are available in the coastal region.

Maharashtra

Tractor dealers are available in Thane district.

13.6 Facilities available for extension/training of farmers, artisans/farm women entrepreneurs etc.

ICAR INSTITUTES**Goa**

ICAR Research Complex for Goa.

Kerala

- (i) Central Plantation Crops Research Institute, Kasargod.
- (ii) Central Tuber Crops Research Institute, Trivandrum.
- (iii) Central Institute of Fisheries Technology, Kochi.
- (iv) Central Marine Fisheries Research Institute, Kochi.
- (v) Indian Institute of Spices Research, Kozhikode.
- (vi) National Research Centre for Oilpalm, Regional Centre, Palode.

Karnataka

- (i) National Research Centre for Cashew, Pattur.
- (ii) CPCRI Research Station, Vittal.

Tamil Nadu

IARI Regional Station, Wellington.

Central Potato Research Institute, Regional Centre, Udagamandalam.

Central Soil Conservation and Training Institute, Southern Station, Udagamandalam.

State Agricultural Universities**Kerala**

- (i) Kerala Agricultural University, Vellanikkara, Trichur.
- (ii) KCAET, Tavanur of KAU and Other research stations of KAU, Agricultural Engineering wing of Department of Agriculture.

Zonal Research Stations

- | | |
|--------------------|---|
| Northern Zone | – Pilicode, Panniayar. |
| Central Zone | – Pattambi, Mannuthy, Eruthampathy, Kannara, Chalakudy. |
| Southern Zone | – Vellayani, Kottarakkara. |
| Problem area Zone | – Kumarakom, Monocompu, Kayamkulam, Vyttila, Tiruvalla. |
| High Altitude Zone | – Ambalvayal, Pampadumpara |

Karnataka

- | | |
|-------------------------------------|--------------------------------|
| University of Agricultural Sciences | – Fisheries College, Mangalore |
|-------------------------------------|--------------------------------|

Maharashtra

- Konkan Krishi Vidyapeeth, Dapoli
Regional Centres
Southern Konkan – Vengurla, Pondaghat,
Coastal Zone – Mulde, Girya, Bhatye
North Konkan Coastal – Panvel, Palghar, Repoli
Zone

Tamil Nadu

- TNAU Centres in the zone:
High Rainfall Zone – Pechiparai, Thirupathisaram
Hilly Region – Horticultural Research Station, Udagamandalam
Deptt. of Horticulture and Agriculture extension agencies.

Other Institutions in the Region

- Coconut Development Board, Kochi.
- Spices Board, Kochi.
- Directorate of Arecanut and Spices, Govt. of India, Kozhikode.
- Rubber Board, Kottayam.
- Rubber Research Institute of India, Kottayam.
- Cardamom Research Institute, Myladumpara.
- Upasi Tea Research Institute, Cinchona, Tamil Nadu.
- Central Coffee Research Institute, Balehannur, Karnataka.

Along with these, each district in the zone has/would soon be having a Krishi Vigyan Kendra for training and extension activities.

13.7 Facilities for credit

The credit facilities are available to farmers through Nationalised Banks and Co-operative Banks.

13.8 Incentives, concessions, subsidies available to farmers/manufacturers of agricultural implements

The provision of subsidy/loan for agricultural purposes is quite satisfactory as from Bank and from co-operative society loan is available in almost all the villages of the region. Subsidies for agricultural machinery are also given by State Governments through centrally sponsored schemes.

13.9 Infrastructure for Execution and Monitoring of Agricultural Engineering Extension Programmes

There is adequate infrastructure available for extension of agricultural technologies to the farmers but the infrastructure for execution and monitoring of agricultural engineering extension programme is highly inadequate. There are a few positions of Agricultural Engineers in State Department of Agriculture in Kerala and Karnataka while there is a separate Directorate of Agricultural Engineering in Tamil Nadu, with a network of Agricultural Engineers posted in the Nilgiris and Kanyakumari districts. But practically the extension activities on Front Line Demonstration, promotion and manufacturing of agricultural mechanization programmes in this zone are inadequate. The KVKs under SAUs, the SAU Centres of AICRP on FIM and PHT are carrying out extension and ToT programmes.

14. Agricultural implements being used by the Farmers

These are given in Table 2.

Table 2. Agricultural implements

| Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction |
|---------------|--------------------------|--|--|
| Kerala | | | |
| Paddy | Puddling | Wetland puddler | Power tiller operated rotavator |
| | Transplanting | Manual transplanter | Power operated transplanters, direct seeder |
| | Weeding and interculture | Manual | Cono weeders |
| | Harvesting | Manual | Vertical conveyor reaper, combines |

| Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction |
|----------|--------------------------|--|--|
| Coconut | Threshing | Manual, hold on threshers | Threshers, combines |
| | Plant protection | Foot operated sprayers | Tall tree power sprayers |
| | Weeding and interculture | Long spades, manual | Power tiller operated implements |
| | Harvesting | Manual | Tree climber, hydraulic operated harvesting ladder |
| | Dehusking | Manual, foot operated dehusking tool | Improved dehusking Machine |
| Arecanut | Drying | Sun drying | Dryers for copra making |
| | Weeding and interculture | Manual | Improved tools and weeders |
| | Earthing up | Manual | Power tiller mounted implement |
| | Plant protection | Foot operated sprayer | Tall tree sprayer |
| | Harvesting | Manual | — |
| Tapioca | Drying and dehusking | Open sun, manual with knife, arecanut nut dehusker | Dryers, power operated dehusker |
| | Ploughing | Bullock drawn plough | Tractor ploughing |
| | Planting | Manual | |
| | Interculture | Manual | Power weeders |
| | Harvesting | Manual digging | Tractor operated harvesters |
| Tapioca | Peeling | Manual | Tapioca peeling machine |

| Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction | Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction | |
|-----------|------------------------------|--|--|---|---------------------|--|--|----------------------------------|
| Sugarcane | Ploughing, secondary tillage | Bullock, Power tiller and tractor | Tractor drawn rotavators | Tea and Coffee | Interculture | Manual | Small power weeders | |
| | Planting | Manual | Tractor drawn planter | | Spraying | Power sprayers | High efficiency sprayers | |
| | Weeding and interculture | Manual | Small power weeders | | Plucking (Tea) | Manual | Tea plucking machine | |
| | Harvesting | Manual | Improved harvesters | | GOA Paddy | Tillage | Bullock drawn implement | Power tiller operated rotavator |
| Cashew | Interculture | Manual | Power tiller mounted implements | Levelling | | Bullock drawn | Improved levellers | |
| | Spraying | Foot operated sprayers | Power sprayers and dusters, tree crop sprayers | Sowing | | Manual broadcasting | Direct seeders (manual) | |
| | Harvesting | Manual | Fruit picker(manual) | Weeding and interculture | | Manual | Cono weeders | |
| | Post harvest management | Traditional | Improved technologies to be introduced | Harvesting | | Manual | Vertical conveyor reaper, combines | |
| Pepper | Planting | Manual | Auger digger | Coconut | | Threshing | Manual | Threshers, combines |
| | Interculture | Manual | Improved tools and rakes | | | Plant protection | Foot operated sprayers | Tall tree power sprayers |
| | Plant protection | Foot operated sprayers | Tree crop sprayers | | | Weeding and interculture | Manual | Power tiller operated implements |
| | Harvesting | Manual or ladder | Plucking tools | | | Harvesting | Manual | Tree climber |
| Cardamom | Post harvest management | Drying under sun grading manual | Dryers for retaining quality pepper graders | Dehusking | | Manual | Hand operated degusting tool | |
| | Interculture | Manual | Small power weeders | Drying | Sun drying | Dryers for copra making | | |
| | | Post harvest management | Drying – curing houses | Electrical-cum-solar powered dryers, high efficiency curing kilns | Arecanut | Weeding and interculture | Manual | Improved hoe and weeders |
| | | | Earthing up | Manual | | Power tiller mounted implement | | |

| Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction | Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction |
|---------------------|--------------------------|--|--|------------------------|--------------------------|--|--|
| | Plant protection | Foot operated sprayer | Tall tree sprayer | Plantation crops | | | |
| | Harvesting | Manual | – | Tea, Coffee and Rubber | All operations | Traditional methods | Improved equipment and gadgets to be introduced |
| | Drying and dehusking | Open sun, manual with knife | Arecanut nut dehusker | | | | |
| Cashew | | | | KARNATAKA | | | |
| | Interculture | Manual | Power tiller mounted implements | Paddy | Puddling | Wetland puddler | Power tiller operated rotavator |
| | Spraying | Foot operated sprayers | Power sprayers and dusters, tree crop sprayers | | Transplanting | Manual transplanter | Power operated transplanters, direct seeder |
| | Harvesting | Manual | Fruit picker (manual) | | Weeding and interculture | Manual | Cono weeders |
| | Post harvest management | Traditional | Improved technologies to be introduced | | Harvesting | Manual | Vertical conveyor reaper, combines |
| | | | | | Threshing | Manual, hold on threshers | Threshers, combines |
| Vegetables | Field preparation | Manual | Power tillers | Coconut | Plant protector | Foot operated sprayers | Tall tree power sprayers |
| | Planting | Manual | Vegetable planter | | Weeding and interculture | Long spades, manual | Power tiller operated implements |
| Garden crops | All operations | Manual | Improved horticultural tools | | Harvesting | Manual | Tree climber, hydraulic operated harvesting ladder |
| TAMIL NADU | | | | | Dehusking | Manual, foot operated dehusking tool | Improved dehusking Machine |
| Paddy | Puddling | Wetland puddler | Power tiller operated rotavator | | Drying | Sun drying | Dryers for copra making |
| | Transplanting | Manual transplanter | Power operated transplanters, direct seeder | Arecanut | Weeding and interculture | Manual | Improved tools and weeders |
| | Weeding and interculture | Manual | Cono weeders | | Earthing up | Manual | Power tiller mounted implement |
| | Harvesting | Manual | Vertical conveyor reaper, combines | | | | |
| | Threshing | Manual, hold on threshers | Threshers, combines | | | | |

| Crop | Operation | Tools/ implements presently being used | Improved implements suggested for introduction |
|----------|-------------------------|--|---|
| | Plant protection | Foot operated sprayer | Tall tree sprayer |
| | Harvesting | Manual | – |
| | Drying and dehusking | Open sun, manual with knife, arecanut nut dehusker | Dryer, power operated dehusking Machine |
| Cardamom | Interculture | Manual | Small power weeders |
| | Post harvest management | Drying–curing houses | Electrical-cum-solar powered dryers, high efficiency curing kilns |
| Coffee | Interculture | Manual | Small power weeders |
| | Spraying | Power sprayers | High efficiency sprayers |
| | Plucking | Manual | Tea plucking machine |

15. SWOT ANALYSIS OF MECHANIZATION PROGRAMME IN THE REGION

Strengths

1. Most of the farmers are literate and hence educating them and convincing them about the importance of mechanization would be easier. The socio-economic conditions of the farmers favour a congenial situation
2. The country is a leading manufacturer of tractors in the world and hence introduction of more tractors would pose no problems and there are tractor dealers in the zone to cater to the additional requirement of tractors.
3. A leading manufacturer of power tiller is located in this zone itself and another leading manufacturer of power tiller is located very closely adjacent to this zone.
4. There are many ICAR Research Institutes and SAU centres in almost all areas in this zone to attend to location specific problems.

5. This zone is more developed compared to other zones in terms of basic amenities, education, transport, roads, communication etc and hence mechanization with appropriate and viable technologies would be readily acceptable.
6. The flow of funds from NRI citizens of this zone and a few processing industries in this zone have been very good and surplus funds are available in the National Banks and these resources may be diverted to provide easy credit facilities to farming sector in the zone.
7. This zone is located in a high rain fall zone and hence the agriculture can be taken up round the year with bare water management/conservation methods. The scope of increasing cropping intensity is very high.
8. This zone is the major producer of many export oriented produces like tea, coffee, pepper, cardamom, cashew etc and therefore mechanization with appropriate technologies in hill agriculture/plantations would be a promising and successful proposition.
9. Post Harvest Management Technology and Value Addition Technologies have very great potential in this zone.

Weaknesses

1. The State governments in this zone are lacking in their policy towards mechanization for this zone.
2. The State government machinery for implementation of the schemes are not fully involving themselves.
3. The extension wings for agricultural engineering is either very weak or absent in this zone.
4. Infrastructure for agricultural machinery manufacturing for small tools/machinery is very limited. Repair/service facilities available are inadequate.
5. Concept of custom hiring of machinery has to be promoted among small farmers.
6. Gender bias is observed in wages for women labour.
7. Co-operative Societies in many States in this zone are not functioning efficiently. Politicization of the societies is creating conflicts among members.
8. The lands are highly fragmented and holdings are marginal in size
9. Farmers in Goa and Kerala are mostly having other avenues for livelihood and hence are showing less interest in promoting their agricultural lands. Many farmers are practicing agriculture only as a part time vocation.

10. The land holdings in Kerala are mostly homestead type gardens.

Threats

1. Failure to promote mechanization aggressively in this zone may lead to further reduction of agricultural activities and cropping intensity, thus affecting the agricultural economy of the States in the zone.
2. Failure to develop and promote the activities of improved and modern post harvest management practices in plantation and spice crops would greatly affect the dominance of Indian products in foreign market as there would be stiff competition from other countries with better quality products.

Opportunities

1. If mechanization of agriculture including horticulture is aggressively introduced in this zone, the agricultural economy of the States in the zone can grow tremendously.
2. Quality improved and value added products of plantation and horticultural crops would become spinners of foreign exchange earnings for our country.
3. Harvest and post harvest losses of food grains and horticultural crops would be further reduced and there would be more scope for increasing productivity.

16. LONG-TERM PROGRAMMES AND STRATEGIES FOR AGRICULTURAL MECHANIZATION IN THE ZONE

Present Level of Mechanization

Growth of agricultural mechanization in this zone is very limited except in a few pockets. Agriculture in hilly region is under plantation sector which are well organised as an industry. The status of mechanization in this zone from various indicators shows that the level and extent of mechanization is very low and with very high labour wages and low income group of farmers, with most of them having marginal land holdings, there is need for introducing labour friendly, more efficient equipment, to be available on hire basis for field operations for bringing down the cost of cultivation and increasing productivity. Special emphasis and thrust has to be given for Goa where there are very few tractors and power tillers and for Kerala, which has very low mechanization in spite of plenty of resources.

Kerala

In Kerala, the problem area zones comprising Alleppey, Trichur, Malappuram and Quilon districts have low lying lands and have inundation of water during monsoon months. The central zone comprising Palakkad, Thrissur and Ernakulam districts are industrialized and have favourable conditions for mechanization. The fact that there are only about 20000 tractors and power tillers in the entire State of Kerala speaks for itself the low extent of mechanization. In the recent years, group farming system called “patasekaram” was introduced by Govt. of Kerala, which has been an instant success in Palakkad and Thrissur districts. But the concept of custom hiring has not picked up much in these groups. They are mostly found to use these machines within themselves only. During harvest season, combine harvesters are brought from neighbouring States and operated on hire basis. The central zone in Kerala requires further boost in mechanization with provision of tractors under group farming system to farmers groups with higher subsidy/grant by the Government. Palakkad and Thrissur being major rice producing districts may be given a special thrust in this area. The agricultural machinery workshop facilities are to be created and better involvement of credit/financing agencies in distribution of subsidies/loans would be required.

Goa

The scenario in Goa is slightly different and this State requires more emphasis for supply of power tillers and labour friendly tools.

The rice in this State is grown mostly as rainfed crop in low lands and seeds are broadcasted manually before the rains. There is a priority need to introduce manually operated drum seeders and cono weeders in this State.

Karnataka

In the coastal belt of Karnataka, where rice, coconut and arecanut are major crops, introduction of power tillers will be able to boost the mechanization and beneficial to horticultural farmers.

Maharashtra

The Co-operative system is found to be lacking in the Konkan area and the government may initiate steps to strengthen and revitalize the co-operative societies and introduce machinery through them. Industries of Post Harvest Processing and value addition of fruits is to be promoted in this area.

16.1 Challenges

Despite being a high rainfall zone, this zone requires a thrust in improving the water conservation methods, increasing production and productivity and in post harvest processing and value addition of horticultural products.

16.2 What is Required

- (i) Selective mechanization of rainfed farming areas to achieve higher productivity may be implemented.
- (ii) Mechanization of irrigated agriculture of cash and food crops with precision equipment and state-of-art technologies for increased productivity through higher yields and reduced field losses may be promoted.
- (iii) As half of the agricultural workforce is women, it is essential that women friendly tools and equipment may be developed and promoted, keeping their ergonomical considerations to improve their efficiency, reduce drudgery and also minimize the occupational health problems.
- (iv) Women labour may be provided skill upgradation training to enable them operate the farm machinery with safety and comfort.
- (v) To introduce labour friendly, ergonomically improved and more efficient machinery and equipment, to be available on custom hire basis for field operations to achieve precision in farming and to bring down the cost of cultivation and increasing productivity.
- (vi) To increase power availability in the zone and to meet the additional demand for power in agriculture.
- (vii) To develop and introduce appropriate mechanization technology for flood inundated low lying problem areas.
- (viii) To propagate the group farming system among marginal farmers for adoption of mechanization.
- (ix) To mechanise cultivation of horticultural crops like coconut, arecanut, cashew and plantation crops to achieve higher production at lower costs.
- (x) To promote surface covered and protected crop cultivation for ornamental and high value crops.
- (xi) To promote improved post harvest management practices through On-Farm primary processing by scientific methods in horticultural crops.
- (xii) To promote value addition of agricultural produces by establishing industries.
- (xiii) To strengthen by-product utilisation units to achieve better performance.

- (xiv) To tap renewable energy sources like wind energy, solar energy etc for supplementing power requirement in farms.

16.3 Strategies

Mechanization Package

The mechanization package for different crops in this zone includes improved, ergonomically designed hand tools for both genders, power tiller and tractor operated implements for field preparation like roto tilling, puddling, levelling, seed planting, seedling transplanting, weeding, intercultural operations, power spraying and tall tree spraying, reapers, threshers and combines, diggers for root crops, improved dryers and other post harvest equipment for coconut, arecanut and spice crops etc.

The mechanization package shall have three components

- (i) Small farms equipment and tools on ownership basis for small farms.
- (ii) Sharing of farm equipment through group farming
- (iii) Custom hiring service

Based on the various mechanization needs, the strategies for agricultural mechanization in this zone are summarized below:

16.3.1 Farm Power

The mechanical power source in Kerala is very less and there is ample scope for increasing power sources with mechanical power through introducing more tractors and power tillers. In the Konkan region of Maharashtra and coastal and hilly regions of Karnataka, the available power sources are only meagre, indicating the need for improving the power availability.

1. For a increasing the agricultural productivity, the cropping intensity has to be increased for which farm power available in the farms has to be improved. Efficient use of the agricultural inputs like seed, fertilizer, plant protection chemicals, water and farm machinery should be promoted
2. Availability of adequate farm power for mobile and stationary farm operations should be increased from the present level of about 0.90 kW/ha to 3.0 kW/ha in Karnataka; from 0.80 kW/ha to 2.50 kW/ha in Kerala; from 0.70 kW/ha to 2.5 kW/ha in Maharashtra and Goa and from 0.90 kW/ha to 2.5 kW/ha in Tamil Nadu, by 2020. The power scenario in villages is highly inadequate to meet the demand for electrical energy for irrigation, threshing and agro processing and value addition operations. The villages should be provided increased electric power by creating

higher grid power connectivity for uninterrupted power supply

3. Tractors, power tillers and other machinery for rice farming may be introduced in appropriate areas depending on the potential.
4. Energy towers—small windmills may be established in hilly regions to tap the wind energy for generation of power to supplement the energy needs in the plantations.

16.3.2 Improved Agricultural Implements and Machinery for field and horticultural crops

5. Mechanization of irrigated agriculture of cash and food crops with precision equipment and state-of-art technologies for increased productivity through higher yields and reduced field losses may be promoted.
6. Ergonomically improved tools and gadgets for farming operations may be advocated to reduce the drudgery and to provide better environment for agricultural labour for higher work efficiency, especially for women labour.
7. For problem areas in Kerala, namely low lying locations like Kole and Kuttanad areas, low head, high discharge, low cost improved energy efficient axial flow pumps may be provided at subsidized cost to farmers to pump out the flood waters from the fields to save their crop during heavy monsoon rains.
8. Tractors and rotavator attachments may be provided in Central and Northern Kerala, Coastal Karnataka and Konkan Maharashtra on a massive scale to increase power availability in the zone.
9. Shallow puddling with rotavators and mechanized levelling the fields may be propagated for mechanized transplantation.
10. Power tillers with attachment implements may be further promoted in Goa, coconut and mango orchards in Konkan Maharashtra, Coastal Karnataka and southern parts of Kerala.
11. Improved drum seeder for direct sowing of paddy in Goa, Coastal Karnataka and Kerala may be aggressively popularized.
12. Manual transplanters/power operated transplanters may be supplied with subsidy to farmers in Kerala, Coastal Karnataka and Konkan region of Maharashtra.
13. The State Governments may subsidise supply inputs for mat type rice seedling nursery raising at village level to enterprising nursery farmers in the villages.

14. Introduction of combine harvesters may be suggested in Konkan region, Coastal Karnataka and Central and Northern Kerala.
15. Tall tree sprayers and orchard sprayers for coconut, arecanut, mango and cashew nut may be advocated. Mechanization in orchard crops for various operations like pruning, fruit harvesting etc. need to be identified, developed and popularized.
16. Chisel plough may be introduced in upland areas of Goa, middle upland areas in Kerala and upland areas in Konkan Maharashtra for retention of rainwater in the subsurface by reducing surface run off from the fields.
17. Power operated weeders for narrow and wider row crops will have to be introduced and popularized.
18. Harvesting equipment for tall tree crops like coconut, arecanut and vine crops like pepper and diggers for turmeric may be developed and introduced.
19. Drip irrigation system may be introduced for the plantation crops and horticultural crops like coconut, arecanut for providing life irrigation in summer months to the plants. Sprinkler irrigation is being used in tea and coffee plantations and to some extent in cardamom and coconut. The water management programmes may be strengthened and State Government may take concrete measures to reduce the wastage of water and to prevent run off for augmenting the ground water potential. Drainage equipment in water stagnation areas may be promoted.
20. Production and post production tools and equipment for vegetable crops are to be developed/modified for adoption. Broad bed forming equipment and vegetable planters may be introduced.
21. Various garden tools for raising of seedlings for fruits, vegetables and floriculture have to be promoted.
22. Plasticulture methods for cultivation of ornamental flowers, herbs and medicinal plants may be promoted.
23. Green house technology for high value of seasonable vegetables needs greater promotion. Equipment for mechanization of cultivation in green houses will be required to be introduced and popularized.

16.3.3 Biomass Management

24. Equipment for handling and processing for value addition of biomass from husks of coconut and

arecanut and cashew nut shells are to be modernized.

25. Equipment for organic farming and manure application in the field may be developed and introduced.

16.3.4 On-farm Post Harvest Technology

26. Post harvest technology equipment for On-Farm/Village level processing may be given greater thrust during the next 10 years for drying of copra, arecanut, pepper, etc. Special dryers for cardamom to obtain best quality produce with retention of green colour and aroma may be introduced in a big way for the benefit of small growers. There are no proper facilities available in this zone for collection, storage and marketing of perishable produce. There is an urgent need to develop suitable mechanism to collect perishable produce from the farmers, store them in cool chambers/cold storage to hold the produce for a short period when there is a glut in the market. There are cold storage facilities for fisheries products. The cold storage facilities for perishable crop produce are to be established in common places among the cluster of villages. Cooperatives/Self Help Group Entrepreneurs may be provided technical and financial back up to create such facilities for providing storage service to farmers on hire basis, to store even small quantities. The Govt. may support such programmes with subsidy and soft credit in viable locations. Emphasis may also be given for On-Farm storage systems for perishables (fruits and vegetables).
27. Value addition industries like coconut water bottling plant, snowball coconut, coconut chips etc. and by product utilisation industries for coconut, cashew and other horticultural crops may be established by encouraging entrepreneurs/Self Help Groups. Coconut processing complexes may be established in Konkan Maharashtra for value added products from coconut and their by products. Coconut husk utilization units may be established in the Konkan region.
28. There are only a few rice-processing mills in Kerala and coastal belt of Karnataka and Goa and more modern rice processing mills may be established. The by-product industries for coconut, cashew nut shell liquid etc in Kerala and Karnataka may be improved with modernization. Processing industries for mango and cashew may

be set up in Konkan region of Maharashtra. Non-destructive qualitative analytical equipment for assessing quality of export grade mango may be developed for Konkan region. Mechanized cashew nut shellers may be developed for avoiding the manual handling of the CNSL oozing from cashew shells.

16.3.5 On-farm Post Harvest Technology

29. Testing facilities for agricultural machinery and agro-products for quality control should be developed in the region for the benefit of manufacturers, processors and exporters for improving the quality of their products.
30. Testing facilities are to be adequately created in the Agricultural Engineering Colleges located in this region and they should be empowered for testing and certifying of certain types of agricultural machinery.
31. Technology park/display centres may be established in each district headquarters where the mechanization technologies suitable for that area may be displayed with details of sources of availability etc. State Government owned farms may be made as Model Farms for Mechanization.
32. Bio-energy parks may be created in potential rural areas as a model for processing bio fuels other plant products and making these bio-fuels available for use in agricultural prime movers in the same areas. These projects may be subsidized initially.
33. The plantations in high ranges may be equipped with Wind Energy Towers for tapping wind energy for supplementing the power grid.
34. For providing information to the farmers, information centers have been established by Department of Agriculture at some important places. These centers are computerized and provide information on soil, crop, variety, fertilizer, chemicals, diseases and pest, irrigation requirements, loans, subsidies etc. Adequate information on the availability farm equipment, sources of supply, costs etc. are not available at these information centers. Farm machinery being a costly input to agriculture, farmers should be provided information and properly guided in selection of appropriate equipment for them by using information technology.
35. Farm machinery and equipment exhibitions may be organized at important centres every year.
36. Agricultural Mechanization Training Centres may

be established in each SAU/State to provide continuous training to extension engineers, farmers, manufacturers, artisans, entrepreneurs in manufacture/running of custom service centres/ Farm machinery clinics/repair and maintenance of workshops and providing contract services for different farm operations etc with emphasis for on-farm trainings at block level.

37. Incentives/support and awards are to be given to manufacturers to manufacture good quality equipment at competitive prices. Manufacturers/ Entrepreneurs should be given assistance through Directorates of Agriculture/Agricultural Engineering.
38. For creating awareness amongst the farmers and extension workers, regular programmes should be broadcasted/telecasted on radio and TV networks. Video films on the working of different equipment should be prepared and shown to the farmers.
39. The network of IT Kiosks established/being established for providing information to farmers, may also be updated with state-of-art technologies in mechanization, sources of availability, cost etc. Many farmers face the problem of locating a suitable supplier/manufacturer of a particular farm equipment. This network would help even the farmer in a remote area in one State to have access to information on machinery of his requirement and choice manufactured in another State.
40. To take the advantage of use of improved high capacity agricultural machinery by all categories of farmers, custom services of agricultural machinery by private entrepreneurs should be encouraged and promoted. They should be given incentives and long-term loans on concessional rate of interests. This will boost use of efficient agricultural machinery for timely farm operations at reduced cost.
41. To encourage the farmers, manufacturers and researchers for modernizing the farms, agricultural machinery industry and R&D facilities, visits to other States, other countries and regions may be organized for enriching their knowledge and awareness for appropriate adoption
42. Manufacturers may be encouraged to start agricultural machinery industries in this zone by providing them special incentives.
43. Agricultural machinery repairing and servicing facilities should be created in block level, to be

maintained by enterprising, trained village youth, supported and supervised by government.

44. NGOs and participatory extension agencies may be encouraged to take part in creating awareness and sensitizing farmers to adopt mechanization technologies.
45. Front line demonstrations of new equipment should be conducted in farmer's fields and large number of farmers should be invited to see the demonstration The fund allocations for Front Line Demonstration of agricultural machinery may be increased as the cost involved in such programmes are quite high. Effective FLD programmes on mechanization will have great impact with farmers motivating them to adopt the technology.
46. Generally, the agricultural mechanization data is based from the Livestock Surveys conducted in every State and these data are unreliable and unrealistic due to possible human errors in enumeration of technical details of machinery by non-technical personnel. It is suggested that enumeration of mechanization data may be done by technical personnel for more accuracy. Computerized data bank district-wise may be set up to record all relevant data on production and sale of different types of agricultural machinery district-wise and such information should be published annually for updating of the data for formulating future strategies as well for analyzing the impact of the mechanization programmes.

16.3.6 Infrastructural Improvements

47. Agricultural Mechanization Boards may be set up at State level with State Government Agriculture Minister as Chairman with adequate powers. The State Mechanization Board would serve as a nodal agency for implementation of mechanization policy by establishing linkages with all development/financial/HRD/Technology/ Insurance Institutions and shall constantly monitor the progress of mechanization in the State and shall also interact with policy makers, manufacturers, research and extension agencies for eliciting feedback, for correction in problem pockets as well as for future R&D development based on farmers' need. A special Agricultural Mechanization Development Agency similar to DRDA, under the State Mechanization may be established at each district for implementing and monitoring farm mechanization policy at micro level.

48. The existing infrastructure and manpower for identification, planning, execution, guidance and monitoring of agricultural mechanization and agro-processing activities in the State is poor and inadequate. There is a strong need for creating a separate Directorate of Agricultural Engineering in the States to plan, execute, review, and monitor various programmes related to agricultural mechanization and post harvest activities in the State. A Monitoring Cell should also be established in the Directorate of agriculture/ Agricultural Engineering for this purpose. This Cell should maintain computerized databases and progress reports of all the programmes.
49. Agricultural Extension agencies under State Governments may be activated to play a major role in popularising the mechanization.
50. Farm Machinery Clinics coupled with primary processing centres may be established at Block level, which may be run by SHGs or youth entrepreneurs from the village.
51. The State Governments should formulate the policy for agricultural mechanization for effective implementation of agricultural mechanization programmes.
52. Some States have provided free electricity to the farmers and this has no check on indiscriminate use of inefficient equipment by farmers causing heavy energy losses. This policy requires reconsideration and the farmers may be provided electricity at subsidized rates with more incentives on other aspects.
53. Custom hiring of equipment may be encouraged by providing incentives and subsidies to entrepreneurs/custom hiring equipment operators with a view to reduce the custom hire charges for machines in high cost areas, to attract small farmers to go for hiring of the machinery.
54. Co-operative system of farming may be promoted like group farming system of Kerala in other States in the zone.
55. The State Governments may subsidise supply inputs for mat type rice seedling nursery raising at village level to enterprising nursery farmers in the villages.
56. Banks may liberalise credit policies to attract more farmers to avail loans for purchasing machinery. Manufacturing activities may be promoted by extending soft loans, subsidies and special incentives to entrepreneurs in this zone.
57. Special insurance schemes for agricultural machinery and equipment at reduced premium rates covering risks against accidents, fire, theft/ losses and damages and loss by non utilization due to natural calamities may be introduced.

16.3.7 Policy Issues

51. The gaps in mechanization namely, lack of State governments policy, slackness of government machinery towards mechanization, lack of cooperative team work among small farmers, need for location specific equipment/machinery, active role of financing agencies and promoting farmers to be participating partners in mechanization rather than being passive observers, may be bridged by aggressive focusing of strong policies by all concerned to provide a concerted effort to achieve the future goals for future.

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