

Long-term Strategies and Programmes for Mechanization of Agriculture in Agro Climatic Zone-X : Southern Plateau and Hills region

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1. NAME OF AGRO CLIMATIC ZONE: Southern Plateau and Hills region
2. STATES UNDER THIS ZONE : Andhra Pradesh, Karnataka and Tamil Nadu



3. SUB-AGRO CLIMATIC ZONES WITH THEIR CHARACTERIZATION

This zone comprising of 35 districts of the States of Andhra Pradesh, Karnataka and Tamil Nadu is large, typically semi-arid with 74% of dryland farming. Only about half the area is cultivated and the cropping intensity is low at about 112%. Under developed irrigation has led to unstable and low agricultural productivity. The zone is divided into six sub-zones as follows:

3.1 Northern Dry Region of Karnataka

This sub-zone covers almost the entire northern Karnataka. It includes, Bidar, Gulbarga, Bijapur, Belgaum, Dharwad, Raichur and Bellary. About 74% of the land is cultivated but only 16 per is irrigated. According to the Agro Planning Unit, there is scope to expand under cultivation. However, groundwater falls low and is the limiting factor for large irrigation development programmes.

The region receives less than 700 mm of rains, the climate is arid to semi-arid and the soil type is black and red clayey.

3.2 Central Region of Karnataka and Rayalaseema

This sub-zone includes four districts from Karnataka—Chitradurga, Tumkur, Bangalore and four districts from the Rayalaseema region of Andhra Pradesh—Chittoor, Cuddapah, Kurnool and Anantapur. The region receives around 700 mm of rains and the climate is semi-arid. The soil types are classified as red and black sandy, clay and red sandy, red loamy, mixed red and black.

In the Central Karnataka region, the proportion of net sown area is about 47%. However, in the Rayalaseema region, the proportion drops to 38%. In this region there are vast stretches of wastelands. The Agro Planning Regional Planning Unit has emphasised the need to develop the region under the integrated watersheds programme.

3.3 South Telengana

This is a dry tract stretching across the districts of Rangareddy, Mahbubnagar, Nalgonda and Hyderabad—all in Andhra Pradesh. The climate is semi-arid with about 820 mm of rainfall. Land productivity is very low. The Agro Planning Regional Planning Unit has suggested the development of wastelands in this region.

3.4 North Telengana

Nearly 31% of the geographical area of this sub-zone

is classified as forests. Only about 35% is cultivated, and only 30% of the cultivated area is irrigated. Rainfall is less than 1,000 mm per annum and the climate is semi-arid. The soil is red sandy. Like in other parts of Rayalaseema and Telengana, there are vast stretches of wastelands. Cropping intensity is particularly low in this region—only 106% as against an average of 138% in Andhra Pradesh. Land productivity is low.

The sub-zone includes the following districts: Adilabad, Nizamabad, Karimnagar, Medak, Warangal and Khammam.

3.5 South Region of Karnataka and North Region of Tamil Nadu

The sub-zone includes the districts of Hassan, Mandya and Mysore in Karnataka and Dharmapuri and Salem in Tamil Nadu. The average annual rainfall in the Karnataka region is around 720 mm, whereas, in Tamil Nadu region, it is around 860 mm. The climate is semi-arid and the soil type is red loamy and sandy loamy. About a fifth of the region is under forest cover and only around 45% of the total area is cultivated.

3.6 Central Plateau of Tamil Nadu

This sub-zone covers six districts of Tamil Nadu, viz. Periyar, Coimbatore, Anna, Madurai, Tiruchchirappalli and Pudukkottai. The area receives 840 mm of rainfall, the climate is semi-arid to dry sub humid and the soil type is classified as red and black deltaic alluvial. About 46% of the land is cultivated and nearly half of the cultivated land is irrigated. Forest cover is only around 18%.

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

This zone is a plateau in the peninsular region and is completely land locked. The plateau corresponding to 150–160 m contours covers about 52% of cultivated area in Andhra Pradesh, 29% of area in Tamil Nadu and most of Karnataka. This zone is mostly a rainfed and drought prone area and agriculture is the backbone of the region.

5. OPERATIONAL LAND HOLDING PATTERN BY MAJOR SIZE GROUPS

The average operational land holdings in Tamil Nadu, Karnataka and Andhra Pradesh in 1995–96 were 0.91, 1.95 and 1.36 ha respectively against the National average of 1.41 ha. The ratio of marginal, small, semi-medium, medium and large category of farmers were

74.28, 15.40, 7.50, 2.50 and 0.32% in Tamil Nadu, 41.95, 27.44, 19.35, 9.55 and 1.70% in Karnataka and 59.42, 21.33, 13.16, 5.31 and 0.78% in Andhra Pradesh respectively. Marginal and small holdings account for more than 68% in this region.

6. IMPORTANT SOIL TYPES AND CROPS

- (a) **Soil types:** The major soil types in Tamil Nadu are red non-calcareous, red calcareous and black soil. In Andhra Pradesh, they are sandy loam, red loam and black soils. In Karnataka, the major soils are shallow to deep black clay in the Northern region, Red loam in Central region and Red sandy loam in the Southern region
- (b) **Important crops:** The important crops grown in this zone are Paddy, Jowar, Bajra, Groundnut, Ragi and other small millets; cash crops like Cotton and Sugarcane and horticultural crops like Turmeric Onion, Chillies, Banana and fodder crops. Wheat is grown in the northern districts of Karnataka during *rabi* season.

7. CLIMATE AND ANNUAL RAINFALL

Tamil Nadu

Annual rainfall varies from 560–1080 mm and the Southwest monsoon, North east monsoon, winter showers and summer remains contribute 45, 37, 10 and 17% to the annual rainfall respectively, though the quantum and distribution may vary between seasons and places.

Andhra Pradesh

- (a) North Telangana : 900–1,500 mm mostly from South-west monsoon.
- (b) Southern Telangana : South west monsoon 700–900 mm
- (c) Scarce rainfall zone : 500–750 mm from both South of Rayalaseema west and North east monsoons

Karnataka

The rainfall is less ranging from 456 mm in Northern region to 1,054 mm in southern region.

8. POPULATION AND POPULATION DENSITY OF THE ZONE

As per Census data 2001, the population density was 447, 275 and 275 per km² in Tamil Nadu, Andhra Pradesh and Karnataka respectively. The decadal growth rate has shown a sharp decline in this zone to 11.19–17.25% compared to all India decadal growth of 21.34% during

1991–2001. The literacy rate has improved to 73.47, 65.38 and 67.07% in Tamil Nadu, Andhra Pradesh and Karnataka respectively as against the national average of 65.38%. The zone has shown downward trend in population growth while the literacy rate has increased.

9. BRIEF SCENARIO OF AGRICULTURE SECTOR

Agriculture is the backbone of the economy of this region, with rainfed farming being the major contributor for agricultural production in this zone. This zone can be classified as moderately draught prone. The crops cultivated in this region are predominantly rainfed, except in the Southern districts of Karnataka, some parts in Rayalaseema of Andhra Pradesh and some parts in Tamil Nadu. 23–40% of total cropped area in the districts coming under this zone in Tamil Nadu and 9–15% of area in Northern Karnataka are irrigated. The major crops grown in this region are paddy, sorghum, bajra, maize, millets, pulses, groundnut, sunflower, safflower, coconut, sugarcane, turmeric, cotton, chillies and vegetables.

The status of mechanization in this zone is only moderate. The density of tractors and power tillers in Karnataka and Andhra Pradesh is low and this requires priority consideration. There is a demand to increase the power availability in this region at least by twice in the next 8–10 years, and to meet this additional demand for power, mechanical prime movers like tractors, power tillers, diesel engines and electric motors are to be adopted in large scale.

The agricultural scenario in this zone in future will be based on ground water availability for irrigation and labour availability for field operations. The State governments in the zone are formulating plans for rain water harvesting, efficient water management as well as alternate crops that may require less water. Plans are being prepared for acceleration of cultivation of hybrid rice through System Rice Intensification method, pulses and vegetable crops.

10. BRIEF SCENARIO OF ANIMAL HUSBANDRY SECTOR

The growth of livestock population in Tamil Nadu has shown a mixed trend. There has been a decline in cattle population by 17% in Tamil Nadu in 1997 compared to 1966. The male cattle, useful in farm operation, constitute about 37.33% and their population has reduced by 9.38% during 1994–97. The population growth of young stock of females is found to be about 6.28%. The increase in the level of female cattle population by 5.18% is an indicator for increase in milk

production. The decrease in draught power animal indicates that the small, marginal farmers and the landless labour want to keep cows in lieu of bullocks. The density of draught animal per thousand ha in the two sub-zones in Tamil Nadu is 160–260 compared to the average density of 332 in Tamil Nadu State. However, the density of bullock carts is more, ranging from 36–96 per 1000 ha, compared to the State average of 28. The population of bullock carts in Tamil Nadu has decreased by 18% during 1994–97.

The sheep population in rural areas has increased by 93%. The goat population has increased by 9.39%. The overall population of goat and sheep in Tamil Nadu is concentrated at more than 90% in the rural areas. The density of livestock population is 200 per 100 ha. Animal operated implements have decreased by 32.29% overall during 1994–97.

In Andhra Pradesh, the density of draught animals per thousand ha of net area sown is 1,497 (ranging from 814–2,062). The average number of draught animals per 1,000 ha of net area sown in the selected districts in Karnataka is 659 (Minimum in Dharwad 94 and maximum Belgaum 3,719). The draught animals are found to be more in Andhra Pradesh area and less in Tamil Nadu region.

11. BRIEF SCENARIO OF FISHERIES SECTOR

Fishing activities in this zone are confined to the rivers, tanks, lakes and reservoirs. The total inland fish production in entire State of Tamil Nadu during 1998–99 was about 119,800 tonnes.

12. IRRIGATED AREA AND SOURCE OF IRRIGATION

In the north and north western Tamil Nadu, 23% of the total cropped area is irrigated. 7% of the irrigated area is by canals and about 70% of the irrigated area is by wells.

In Andhra Pradesh, 12.5, 12.0, 19.5 and 27.3% of the net area irrigated are by canals, tank, tube well and open wells respectively.

Most of the area in this region in Karnataka is rainfed. The net area irrigated is about 9–15%.

13. INFRASTRUCTURAL FACILITIES AVAILABLE IN THE ZONE

13.1 Metalled road connecting villages

In Tamil Nadu the villages are well connected with metal roads. More than 95% of the villages are connected by bus for transport facilities. Most of the villages are

located within 10 kms of the Block headquarters. This indicates that the accessibility for the villages is very good.

In Karnataka, about 47% of the villages are located within 10 kms of the Block head quarters. 79% of the villages are at a distance of 5 kms from the metal roads. All the villages have major transport facilities. The accessibility of the villages is found to be very good.

In Andhra Pradesh, 53% of the villages are located within 10 kms of the Block headquarters. 52% of the villages are connected by metal road and 99% of the villages have transport facilities.

In general, the villages in this zone are having well connected road and accessibility.

13.2 Rural Electrification

Rural electrification in this zone is fairly good with Andhra Pradesh and Tamil Nadu ranking second and third in the country in the number of pumpsets energized with electricity. 100, 100 and 98.88% of the villages in Andhra Pradesh, Tamil Nadu and Karnataka respectively have been electrified. The electric power consumption in rural areas has changed significantly. The preferential supply to rural agricultural sector at free or subsidized tariff has led to rapid increase in use of electricity in agricultural sector. The share of electrical power in energy consumption in agriculture has increased from 17.6 to 32.89% in the country over the past 20 years. However, frequent power shut down in rural areas during summer months is a matter of concern to be addressed to for augmenting availability of electric power for agricultural sector.

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

All manufacturers of agricultural equipment and pumpsets have their showrooms/dealers in major towns/district headquarters in this zone. Kisan markets and regulated markets for agricultural producers are available in the zone.

13.4 Infrastructural facilities available for manufacture of agricultural implements and Machinery

Agricultural machinery manufacturing facilities are well developed and concentrated in a few centres, namely Coimbatore, Hyderabad and Bangalore. The major manufacturing industries in this region are, irrigation pumps, threshers, seed drills/planters/transplanter, power tiller and tractor drawn implements, reapers, hand tools etc. Infrastructural facilities for manufacturing agricultural machinery are very good in this zone

13.5 Infra-structural facilities available for sale/repair and maintenance of tractors and other machinery in the region

There are reasonably good facilities for sale and repair of tractors in almost all towns in this zone. However, the service facilities in far flung areas are inadequate.

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

ICAR INSTITUTES

Tamil Nadu

- (i) Central Institute of Agricultural Engineering, Regional Centre, Coimbatore.
- (ii) Sugarcane Breeding Institute, Coimbatore.
- (iii) Central Institute of Research for Cotton Technology, Field Station, Coimbatore.
- (iv) Central Institute for Cotton Research, Regional Station, Coimbatore.
- (v) Central Reservoir Fisheries Institute, Research Station, Coimbatore.

Karnataka

- (i) Indian Institute of Horticultural Research, Bangalore.
- (ii) National Dairy Research Institute, Regional Station, Bangalore.
- (iii) Indian Veterinary Research Institute, Regional Station, Bangalore.
- (iv) NBSS&LUP Regional Station, Bangalore.
- (v) Project Directorate of Biological Control, Bangalore.
- (vi) Central Tobacco Research Station, Bangalore.
- (vi) National Institute of Animal Nutrition and Physiology, Bangalore.
- (vii) Central Tobacco Research Institute, Hunsur.
- (viii) Indian Grassland and Agro Forestry-Regional Research Centre, Dharwad.
- (ix) Quality Evaluation Unit of CIRCOT, Dharwad.

Andhra Pradesh

- (i) Central Research Institute for Dryland Agriculture, Hyderabad.
- (ii) Directorate of Rice Research, Hyderabad.
- (iii) Directorate of Oilseed Research, Hyderabad.
- (iv) National Research Centre for Sorghum, Hyderabad.

STATE AGRICULTURAL UNIVERSITIES

Tamil Nadu

- Tamil Nadu Agricultural University, Coimbatore
- (a) Agricultural Engineering College and Research Institute, Kumulur, Trichy.
 - (b) Agricultural Engineering College and Research Institute, Coimbatore.

Karnataka

- (i) University of Agricultural Sciences, Dharwad.
 - (a) College of Agricultural Engineering, Raichur.
- (ii) University of Agricultural Sciences, GKVK, Bangalore.

Andhra Pradesh

Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad.

Besides, almost all the districts either have or would soon be having Krishi Vigyan Kendras.

13.7 Facilities for credit

Credit facilities are available from Nationalised Banks, Regional Rural Banks and Co-operative Banks at special interest rates for agricultural purposes. The Kisan Credit Card Scheme introduced by the Govt. of India has also been availed by farmers in the region.

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 inadequate. There are a few positions of Agricultural Engineers in State Department of Agriculture in Karnataka and Andhra Pradesh while there is a separate Directorate of Agricultural Engineering in Tamil Nadu, but this directorate is mainly involved in soil conservation and minor irrigation programmes. There

is very little activity related to promotion of agricultural machinery.

Programmes related to Front Line Demonstration, training and promotion of agricultural machinery in this region are inadequate. The SAUs, KVKs, Centres of AICRP on FIM and PHT and the Industrial Extension Centre of Central Institute of Agricultural Engineering (ICAR) are carrying out transfer of technology (TOT) programmes on agricultural machinery on a limited scale.

14. AGRICULTURAL IMPLEMENTS BEING USED BY THE FARMERS

This is given in the following Table.

Crop	Operation	Tools/ implements presently being used	Improved implements suggested for introduction
Paddy	Puddling	Tractor with cage wheel/ cultivator	
	Transplanting	Manual	Transplanter
	Weeding and interculture	Manual	Cono weeder
	Harvesting	Sickle	Self propelled reaper and thresher/ Combines
Groundnut	Threshing	Paddy thresher	
	Field preparation	Tractor drawn cultivator, Harrow	
	Sowing	Behind country plough	Tractor drawn planter
	Weeding and interculture	Manual hand hoe	Long handle weeder, power weeder
	Harvesting	Manual	3-4 row T.D. Harvester
	Pod separation	Manual	Power thresher
	Grading	Not very common	Grader
	Decortication	Manual Sheller	Power operated decorticator
Sugarcane	Seed bed preparation	Tractor plough, harrow and ridger	Rotavator
	Planting	Manual	Tractor drawn planter
Sorghum and other millet crops	Field preparation		Tractor with cultivator
	Sowing	Broadcasting, seed drill	Tractor drawn seed drill/planter, planter
	Weeding	manual	Power Weeder, long handled weeder
	Harvesting	manual	Fodder harvester
Vegetables	Threshing	Trampling with tractor/bullocks and multi crop thresher	Multi crop Thresher
	Bed preparation	Manual -spade	Tractor drawn-broad bed former
	Transplanting	Manual	Single row self-propelled transplanter
	Plant protection	Power sprayer/ knapsack/ rocker arm sprayer	Improved power sparyers
Banana	Plucking/ harvesting	Manual	Harvesting tools
	Threshing	-	Thresher
	Plant protection	Power sprayer/ knapsack/ rocker arm sprayer	-
	Harvesting	Spade/Pulling	Single row puller
Banana	Field preparation	Country plough cultivator	-
	Sucker removal	Crow bar and Bill hook	Sucker remover

Crop	Operation	Tools/ implements presently being used	Improved implements suggested for introduction
	Pit making	Crow bar and spade	Auger digger
	Weeding/ interculture	Hoe/Spade	Power weeder
	Plant protection pesticide application	Power sprayer/ knapsack/ rocker arm sprayer	Improved power sprayers
	Harvesting	Bill hook	Harvesting equipment
Turmeric	Field preparation	Country plough cultivator	–
	Ridges and furrows	Spade	Ridger
	Dibbling/ Planting	–	Planter
	Weeding/ earthing	Hoe/Spade	Single row weeder
	Plant protection	Power sprayer/ knapsack/ rocker arm sprayer	–
	Detopping Digging/ Harvesting	Sickle Fork/Spade/hoe	Detopper Harvester
Cotton	Field preparation	Tractor with cultivator	–
	Forming ridges and furrows	Manual – Spade, dibbling	Tractor drawn Ridger seeder
	Sowing		
	Weeding	Manual	Single row long handled weeders, power weeders

15. SWOT ANALYSIS OF MECHANIZATION PROGRAMME IN THE REGION

Strengths

1. Manufacturing industry in this region has grown considerably. We have large number of manufacturers in the small scale sector. Village artisans, who are engaged in fabrication, repair

and maintenance of agricultural machinery, mostly traditional are gradually diversifying to improved implements.

2. One tractor manufacturer, one power tiller manufacturer, many pump manufacturers, thresher manufacturers are located in this region.
3. Most of the needs of agricultural machinery is met through indigenous production. The industry in this zone is technically sound and competent.
4. Tradition of custom servicing and custom hire amongst the rural people for field operations is common in this region.
5. With increasing agricultural production and income of people, there has been an upward swing in the demand for processed and high quality foods. Food processing industry has been growing at a reasonable pace and any innovation in PHT and consumer food material or processed product has fair chances to get into the market speedily. There is increasing trend towards quality consciousness in increasing middle classes that have paying capacity.
6. There are many ICAR Institutes and SAUs located in undertaking research and development and KVKs for transfer of technologies. The Research Institutes contribute in generating location specific technologies.
7. Availability of technical personnel, farm machinery and post harvest technology experts will be abundant with 3 Agricultural Engineering Colleges with Post Graduate research facilities located in this region.

Weaknesses

1. Most of the Land holdings in Andhra Pradesh are very small, less than 1 ha. About 60–90% farmers in Andhra Pradesh and Tamil Nadu have less than 2 ha. farm holdings, with associated constraints of being resource poor, low risk abilities, practising mixed farming, thereby, making task of mechanization and post-harvest management difficult.
2. Holdings have become too small to sustain a family, forcing them to seek alternate/ supplemental employment.
3. There is paucity of labour at peak demand period. Tractive power and matching implements continue to be a constraint to farming, resulting in untimeliness in field operations, making jobs arduous and lowering crop yields.
4. There is a vast gender bias in the wages.

5. Ergonomic and safety considerations in design of hand tools, bullock drawn implements and stationary farm machines require consideration.
6. Horticulture is an important thrust area for diversification of farming, but hardly any mechanization has taken place except for tillage, irrigation and transport operations.
7. The after sales service for the farm machinery and sourcing of spare parts are rather slow though the infrastructure facilities are reasonably good.
8. The farm equipment being manufactured by small scale manufacturers need to be looked at from the point of view of quality and standardization. Even the power tillers lack in terms of specific fuel consumption, noise and vibrations, and other safety and ergonomic aspects
9. The manufacturers are in small scale sector and are not quality conscious, which results in frequent break down of machineries in the farms.
10. The State Governments in this region need to focus more on mechanization aspects.
11. The infrastructure for transfer of engineering technologies, through awareness campaigns, demonstrations, trainings; for quality manufacture, supply, and after sales service of agricultural implements are weak and inadequate. The extension activities for mechanization is carried out only by R&D centres, that too, to a limited extent.
12. In the absence of proper plant protection equipment and techniques, for tall crops, plantations and high density orchard crops, there is significant loss of production due to diseases and pests.
13. The farmer is only a producer and not a primary processor of his produce.
14. Though women are involved with various unit operations of agriculture, the farm equipment are mostly designed for operation by men folk.
15. Farmers sell their produce without value addition and thus have low economic returns. There is hardly any incentives for high productivity.

Threats

1. Failure in maintaining desired levels of production, productivity and PHT can lead to food shortages, nutritional insecurity, social in-security and economic collapse in this zone.
2. The globalization of trade gives MNCs an easy access to many industries, import technologies at a higher cost and prevent adoption of low cost

indigenous technologies. Many imported machinery have been introduced in rice farming operations.

3. Failure to mechanise the farming, at least selectively, would result in higher cost of production of food grains, bringing less revenue to farmers.
4. Failure to make agricultural operations labour friendly with improved machinery and tools to reduce human drudgery, would result in rural youth migrating to cities in search of employment, causing delays in agricultural operations.

Opportunities

1. Mechanization can encourage farmers to expand their area under cultivation of crops.
2. India has emerged as number one tractor producing country in the world but the tractor distribution is not adequate. More draught power is required in the farms to meet the demand. About 2.5% of the total 105 million farm holders in the country possess 2.7 million tractors and only about 25% of the total land is estimated to be cultivated by tractors.
3. Drips and sprinklers have great potential to use the available water more efficiently, increasing net irrigated area and providing sustainability in summer months.
4. There is tremendous scope for adoption of many other promising farm equipment.
5. Opportunities also exist for export of agricultural machines and value added agro-products to other Asian and African countries.

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

For preparing long-term strategies for agricultural mechanization till 2020, it is important to visualize the prevailing scenario and the challenges, which are to be overcome, to meet the aspirations from agriculture sector. The productivity of major crops in this zone are 2,560–3,280 kg/ha for rice, 580–990 kg/ha for sorghum, 600–1,200 kg/ha for bajra, 300–500 kg/ha for pulses, 630–1,660 kg/ha for groundnut (in shell) and 2,400–2,900 kg/ha for cotton. The productivity is lower for crops like pulses, sorghum and groundnut in Karnataka and Andhra Pradesh. There is potential for increasing the productivity of rice to 5–6 tonnes/ha which calls for intensified agriculture including mechanization.

16.1 Challenges

The cropping intensity in this region is about 130 in non-tractor farms. 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. The productivity per se has to be increased by 2.5 times in dry farming crops to meet the food demand by 2020. A Second Green Revolution has to be achieved in dry farming crops to boost their productivity. Hence, increasing the mechanization activities in this region should be a major priority programme. By 2020, the available mechanical power has to increase at least by two fold.

16.2 What is Required

- (i) Selective mechanization of rainfed farming areas in the zone to achieve timeliness in tillage and sowing operations to utilise the soil moisture effectively.
- (ii) To increase power availability in the entire zone to meet additional demand for power for increasing production and productivity.
- (iii) The electrical power availability in the rural areas has to be increased tremendously to meet the energy demands for establishing agro processing centres.
- (iv) To provide ergonomically improved tools and gadgets in farming operations to reduce the drudgery of human labour and to provide better environment for agricultural labour for higher work efficiency.
- (v) To fully mechanise the irrigated agriculture with precision equipment and state-of-art technologies for increased productivity through higher yields, reduced field losses and increased income of the farmers.
- (vi) To provide women friendly agricultural tools and equipment for women labour.
- (vii) To introduce mechanization in horticultural crops.
- (viii) To promote surface covered and protected crop cultivation.
- (ix) To modernize rice milling technologies in small and medium mills for higher recovery at reduced cost.
- (x) To introduce straw management technologies.
- (xi) To establish farm mechanization clinics and primary processing centres in rural areas to generate more employment for rural youth and to increase the income of farms.
- (xii) To develop Bio-Energy Parks for utilisation of plant residues, bio-fules.
- (xiii) To encourage entrepreneurs/small industries to take up manufacture of farm equipment suitable for this zone.
- (xiv) To take up massive adoption programmes for mechanization through Front Line Demonstration and other aggressive ToT programmes by through special Mission Mode Projects.

16.3 Strategies

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

16.3.1 Farm Power

1. With no scope of increase in draught animal power and limited human energy, the demand would be on mechanical power to meet the additional requirement of farm power to achieve timeliness in field operations, particularly in dry farming crops. Availability of adequate farm power for mobile and stationary farm operations should be increased from the present level of about 1.60 kW/ha to about 2.5 kW/ha in Andhra Pradesh; from 0.90 kW/ha to 2.5 kW/ha in Karnataka 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 , agro processing and value addition operations. The villages should be provided increased electric power by creating higher grid power connectivity for uninterrupted power supply.

16.3.2 Improved Agricultural Implements and Machinery for Crop Production

2. The productivity of the important crops has to be considerably improved and precision & high tech equipment for handling all the high tech inputs in the field has to be adopted on priority.
3. For achieving timeliness in all the field operations, saving in the cost of operation and energy required, improved tillage equipment like rotavators, moisture conservation tillage tools, precision seed drills and planters for all the major crops in this region would have to be advocated.
4. Draught animal power in the farms will have to be better utilized with ergonomically designed harnesses & yokes and improved implements like seed cum fertilizer drills, planters and multi row interculture implements. The farmers may be provided subsidies for adoption of the improved implements.

5. Emphasis may be given for introducing multi crop equipment like medium range multicrop axial flow thresher for rainfed crops, multicrop reapers, power weeders and roto-tillers suitable for each area by bring about design improvement to suit the crops in that locality.
- (a) **Paddy:** The rice belt in Karnataka region and the western and northwestern zones in Tamil Nadu may be fully mechanized.
- (i) Shallow puddling may be advocated for mechanization of seeding/transplanting and improved puddlers. Power tiller operated rotavators are recommended.
 - (ii) Land levelling equipment may be promoted which would help in maximizing water use efficiency.
 - (iii) Direct seeding of paddy both in low lands and dry uplands with drum seeders may be popularized.
 - (iv) Manual and power operated transplanters may be promoted.
 - (v) Self Help Groups with entrepreneurship goals may be encouraged to run the power-operated transplanters to work on custom hiring basis. Mat type nurseries should be raised on a large scale to cater to the requirements in each village. Enterprising farmers may be encouraged to raise large-scale nursery farms on commercial basis.
 - (vi) Mechanization will be more relevant in hybrid rice cultivation with SRI/Madagascar system of cultivation. The new method of rice cultivation recently introduced, namely, System of Rice Intensification (SRI) from Madagascar, is reported to achieve higher yields with less water requirement. Paddy is grown at wider spacing (25 × 25 cm) with alternate wetting and drying of field rather than flooding of water. The seed requirement is also very less as only one seed is sown at every hill. This requires precision farming and mechanization of critical operations will be very relevant.
 - (vii) Distribution of farm equipment may be further increased under Integrated Cereals Development Programmes of the State Governments.
 - (viii) The small and medium size obsolete rice mills in this zone may be modernized.
- (b) **Sugarcane:** Sugarcane cutter planter (tractor drawn) and sugarcane harvester may be introduced under custom hiring schemes through the sugar mills in this zone. Power weeders for intercultural operations and earthing up equipment may be introduced under subsidy schemes.
- (c) **Groundnut:** Tractor drawn groundnut harvester and groundnut wet pod thresher may be popularized.
 - (d) **Cotton:** Power weeders for intercultural operations and standard/improved spraying equipment for plant protection operations may be popularized for adoption.
6. Dry farming crops: In medium and light soils, chisel plough (tractor drawn) may be introduced for better conservation of water.
 7. Power tillers: Use of power tillers may be introduced for channel forming and trench making, seeding and tillage operations.
 8. Aero blast sprayers, sprayers and electro-static spraying equipment for plantation crops may be introduced.
 9. The harvesting and threshing operations of major crops like paddy sorghum etc are to be mechanized with the introduction of reapers, threshers and combines.
 10. High water requirement crops may be diversified to low water requirement and high return crops.
 11. For increased production and productivity, water conservation, storage and management practices will have to be improvised with appropriate technologies including precision land levelling and micro irrigation methods.
 12. Percolation ponds, soil and water conservation bunds, drainage channels etc. may be made with earth moving machinery.

16.3.3 Mechanization of Horticultural Crops

13. Mechanization in orchard crops for various operations including pruning, spraying for tall tree crops, fruit harvesting etc. need to be identified, developed and popularised.
14. 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.
15. Various garden tools for floriculture have to be promoted.
16. Plasticulture methods for cultivation of ornamental flowers, herbs and medicinal plants may be promoted.

17. 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.

16.3.4 Feed and Fodder handling

18. Fodder harvesting and handling equipment will be required to be introduced and popularized in future.

16.3.5 Crop Residue/Biomass Management

19. Equipment for harvesting, retrieval, densification, fortification, handling and transport of crop residues will be required to be introduced in large numbers for making best utilization of straw and other crop residues for feed, fodder and energy.
20. Equipment for organic farming and manure application in the field may be developed and introduced.

16.3.6 On-farm Post Harvest Technology and value addition

21. Efficient post harvest equipment and technology will be needed for various unit operations like cleaning, grading, drying, cooling, evaporative cooling, storage, cold storage and handling of farm produce to improve their quality and self-life. Efforts should be made to develop suitable mechanism to collect perishable produce from the farmers, store them in cool chambers/cold storage.
22. Farmers may be educated through Awareness and Training programmes about the need to improve the quality of their produce at primary processing stage.
23. Low cost/appropriate storage facilities developed for perishable and semi-perishables may be established on a cooperative/Self Help Group Entrepreneurship basis with technical and financial back up from the concerned government departments. Such facilities should enable farmers for transit storage of their produce even in small quantities, on high charges basis. Govt. may provide subsidy and soft loans for such ventures at viable locations.
24. Primary processing centres may be established at least at each block level to process the local agricultural produce. Women SHGs in that village may run this.
25. Additional electrical power may be made available in all villages for establishing primary processing centres.

16.3.7 Infrastructural Improvements for Promotion of Agricultural Mechanization Programmes

26. 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.
27. 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 certain types of agricultural machinery.
28. Technology Park/Display Centres/Model Mechanization farms may be created in each district headquarters, where the mechanization technologies suitable for that area may be displayed and demonstrated. State Government owned farms may be made as Model farms for mechanization.
29. Bio-energy parks may be created in potential rural areas as a model for processing bio fuels from *Jatropha* and 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.
30. Information Technology Kiosks may be expanded in a big way by establishing them at micro-level in cluster of villages to enable farmer's access for the state-of-art technology in farm mechanization as well as all other production and post production interventions in agriculture.
31. Enumeration of farm mechanization data may be carried out by technical personnel for more accuracy and a district wise computerized data bank may be set up to record all relevant data on sale of different types of agricultural machinery in the district. Such data may be compiled annually and made available for formulation of future strategies and for analyzing impact of mechanization programmes
32. Farm machinery and equipment exhibitions may be organized at important centres every year.
33. Women labour may be provided skill upgradation training to enable them operate the farm machinery with safety and comfort.
34. 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.

35. On farm front line demonstrations of power unit and new equipment should be conducted in farmer's fields
36. Participatory Extension Agencies, both private and NGOs may be encouraged in popularization of agricultural machinery for their commercialization
37. 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.
38. Agricultural Machinery manufacturing facilities are concentrated in Coimbatore, Bangalore and Hyderabad. The service facilities for agricultural machinery are inadequate at far flung areas. The small machinery manufacturers do not have any service network and hence the farmers are put to hardship when the machines break down. There are no effective quality control systems with the manufacturers and this again poses major problems in endurance and reliability of the equipment. Since the manufacturers of medium size/large agricultural machinery are concentrated in a few centres in this zone, common facilities may be created by government for using high precision manufacturing technology on chargeable basis. This would ensure better quality and inter changeability of the components.
39. 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 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.
40. Custom hiring of large equipment in small and marginal farms may be further promoted by providing certain incentives to the custom hire operators.

41. To encourage the farmers, manufacturers and researchers for modernizing the farms, agricultural machinery industry and R&D facilities, visits to other regions, States and other countries may be organized for enriching their knowledge and awareness for appropriate adoption.
42. With the State governments coming up with projects for bio-fuels from Jatropha and other plant products, green bio energy parks may be created in a few potential rural areas as a model for processing the bio-fuels and making them available to the tractors/other machines in the surrounding villages. The projects may be subsidized by government initially. This would create more employment opportunities for rural youth.

16.3.8 Planning, Execution and Monitoring

43. 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 interact with policy makers, manufacturers, research & 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 Board may be established at each district for implementing and monitoring farm mechanization policy at micro level.
44. The agricultural engineering activities in the State Departments of Agriculture/Agril. Engineering in Tamil Nadu are to be strengthened and revived and separate directorate of Agricultural Engineering in Andhra Pradesh and Karnataka may be created with specific mandate for extension of agricultural mechanization at micro level with separate budget allocation for training, demonstrations and other ToT activities in active collaboration with respective SAUs and ICAR units in the State for achieving the targets
45. Establishment of Farm Machinery Clinics coupled with Primary Processing Centres at block

level. The clinics may be run by self-help groups under the supervision/guidance of NGOs or Govt. departments. The farm machinery clinics can offer the custom hiring services for the machinery suitable to the area. The farm machinery clinic should have trained operators/mechanics recruited from local youth and the machinery should be periodically maintained at this centre. The farm machinery clinics should be adequately equipped for servicing and repairing the machinery.

16.3.9 Policy Issues

46. The State Governments should formulate the policy for agricultural mechanization for effective implementation of agricultural mechanization programmes.
47. 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.
48. To achieve a second green revolution in the country, mechanization in dry farming areas has to be given a boost. Incentives/subsidies may be increased for large machinery in dry farming areas. Rapid mechanization by custom hiring and also by encouraging group and contract farming for adoption of larger machinery, wherever required, should be encouraged.
49. Credit policies may be liberalized for farm mechanization programmes.
50. Insurance Schemes for agricultural machinery: Insurance schemes at rationalized premium rates may be introduced for agricultural machinery against accident, fire, theft/loss and damages and loss by non utilisation due to natural calamities. Utilization of agricultural machinery would have set back due to crop failures/drought etc and the insurance schemes may cover such aspects also. □