

Long-term Strategies and Programmes for Mechanization of Agriculture in Agro Climatic Zone-III: Lower Gangetic Plains region

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1. NAME OF AGRO CLIMATIC ZONE : Lower Gangetic Plains region
2. STATES UNDER THIS ZONE : West Bengal



3. SUB-AGROCLIMATIC ZONE WITH THEIR CHARACTERIZATION

This zone covers the entire State of West Bengal, except four districts namely Darjeeling, Cooch Behar, Jalpaiguri and Purulia out of its 18 districts. The State of West Bengal occupies an area of 88,752 sq km, out of which 62.85% is arable and 13.38% is forest. The Ganges and its numerous distributaries have resulted in highly fertile soils, which also form the world's largest deltaic zone and mangrove forest, known as Sunderbans. The State has international borders with Bangladesh, Nepal and Bhutan while it shares national States boundaries with Sikkim, Assam, Bihar, Jharkhand and Orissa. In its south lies the Bay of Bengal. Agriculture plays a vital role in State's economy and about 70% of the population derives livelihood from it. Major tributaries of the Ganga flow through this zone which is also in the high rainfall area with an annual rainfall ranging between 1,200 mm and 1,700 mm. Silt deposition has increased the frequency of floods in this zone. Flooding of vast areas during the end of September or October and drought spells during November–June have become a normal feature, rendering crop cultivation very risky.

The zone is divided in four sub-zones as follows:

3.1 Barind Plains

This is a high relatively rainfall region covering two districts—West Dinajpur and Maldah. The annual precipitation is 1,587 mm. The climate is per humid to humid and the soil is brown hilly. The sub-zone has a high net sown area and low irrigation development. Nearly 71% of the land is sown but only nine per cent of the sown area is under irrigation.

3.2 Central Alluvial Plains

This is the largest sub-zone in the Lower Gangetic Plains covering 3.5 million hectares, or about 40% of the total land in the zone. It covers the districts of Murshidabad, Nadia, Burdhaman, Hugli, Haora and Medinipur. About 68% of the land is cultivated. Over 60% of the cultivated land is irrigated. The sub-zone receives 1,460 mm of rains; the soil is deltaic alluvial and the climate is per humid to humid. Cropping intensity is reasonably high at 139 given that the main crop is rice. The Agro-Climatic Regional Planning Unit has identified this region as having the most potential of the State, showing promise of growth.

3.3 Alluvial Coastal Saline Plains

This covers the North and South 24 Parganas districts and also the metropolitan city of Calcutta. Population

density is high and cropping intensity is low. Only about 26% of the net sown area is irrigated. The region receives 1,607 mm rainfall, the climate is per humid to humid and the soil is deltaic alluvial.

3.4 Rarh Plains

The Rarh Plains are mostly rural and poorly developed. They include Birbhum and Bankura districts of West Bengal. About two-thirds of the land is cultivated and 23% is under forest cover. About 12% of the land is available for cultivation but not cultivated. Irrigation development is poor. Cropping intensity is low at around 110.

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

The topography of the entire zone is nearly level to gently sloping. West Bengal has nearly 3% of the nation's cultivable land and about 8% of the country's population. It produces more than 8% of the food of the country. Agriculture plays a pivotal role in the State's GDP and nearly 75% population is directly or indirectly involved in agriculture. The agricultural sector is characterized by the predominance of small and marginal farmers tilling more than 68% of the total operated area of the State. The average size of holding here is less than one hectare. Since the scope for bringing more area under cultivation is limited, emphasis has been laid mainly on increasing the productivity of different crops by using quality seeds, fertilizers, plant protection measures as well as improved packages of practice and distribution of surplus and vested land, to the actual tillers, through land reforms.

The cropping intensity in the State has also been increased from 131% to 162% during the last two decades. The State has achieved remarkable progress during the last one decade in the production of oilseeds which increased from 0.24 million tones to 0.55 million tones during the last decade. The State is the leading producer of paddy and second largest producer of potato giving 30% of total potato production of the country. More than 60% of the country's raw jute fiber is also produced here.

In addition, wheat, pulses, mustard, groundnut, sugarcane, fruits, vegetables and flowers are cultivated. Main cropping systems are paddy–paddy, paddy–jute, paddy–mustard, paddy–potato, and paddy–wheat.

Total generation of electric power in the State during the year 2000–01 was 12,208.96 MU. However,

consumption of electricity for agricultural purposes during the same year was only 999 MU, which was 12.2% of the total consumption. Farm power availability in the State during the year 2001 was 1.25 kW/ha and food grain productivity was 2,006 kg/ha. Irrigation potential created through major and medium irrigation projects in 1999–2000 was 1,429.70 thousand ha. Till 1999–2000, 33.64 lakh hectare of minor irrigation potential was created in the State.

5. OPERATIONAL LAND HOLDING PATTERN BY MAJOR SIZE GROUPS

More than 70% land holdings in the State are less than one hectare. Only 7% holdings were greater than 2 hectares. The average size of land holding in the State is 0.8 hectare. Distribution of land holdings is given in Table 1.

Table 2. Types of soils in different sub-zones

Sub-zone	Districts included	Type of soil
Barind Plains	West Dinajpur and Malda and North of Ganga and Bardman, Birbhum, Bankura, Midnapore, Howrah and Hoogly South of Ganga	Soil textures are sandy loam to silty clay loam on the top that become heavier downwards. Yellowish to reddish yellow in colour and moderately well drained to somewhat poorly drained. The pH is around 5.5 to 7.5.
Central Alluvial Plains	Murshidabad, Bardman, Birbhum, Hooghly North of Ganga, Nadia and parts of 24 Parganas.	Texture from loams to heavy clay possessing high water retention capacity, good porosity and generally a higher permeability for the surface soils. The soils are generally deficient in nitrogen (0.02–0.06%) and low in available P ₂ O ₅ (0.03 to 0.15%) and K ₂ (0.1 to 1.0%). The pH of the soil ranges from 6.0 to 7.8 having high calcium status. Most of the soils are also low in organic matter (0.3 to 0.6%).
Rarh Plains	Parts of the districts of Birbhum, Bankura, Bardman, Midnapore	Two major group of soils, viz. laterite and red are found that vary in depth and in many cases are gravelly in nature and shallow. Due to undulating terrain the soils are highly eroded. Soil fertility level is very poor with nitrogen and phosphorus contents varying between 0.01 to 0.05%. Ca and K ₂ O contents of the soils vary from 0.01 to 0.04%. The cation exchange capacity is very low and the soils are of high degree of aggregate stability and well drained. The pH of laterite varies from 5.5 to 6.6 and that of red soils from 6.2 to 6.6.
Alluvial Coastal saline plains	Alipore Sadar and Diamond Harbour sub-division of 24 Parganas (South) district, and Midnapore Sadar, south divisions of Midnapore district	The soils are of the tidal origin, silty clay in nature with low infiltration capacity and poor by soil conductivity leading to poor drainage and restricted leaching of soluble salts. They are rich in plant nutrients and when reclaimed support a good crop of rice. But the problem of high salinity of the soils and water coupled with poor drainage stand in the way of profitable cultivation of crops. Soil pH ranges from 6.4 to 7.6.

Table 1. Status of land holdings in the zone

Category	Size of land holding	% of total holdings
Marginal	< 1 ha	76.42
Small	1–2 ha	16.82
Semi-medium	2–4 ha	5.83
Medium	4–10 ha	0.92
Large	> 10 ha	0.01

6. IMPORTANT SOIL TYPES

All the 4 sub-zones of the State have distinct characteristics in terms of soil types. Description of soil types in different sub-zones is given in Table 2.

7. CLIMATE AND ANNUAL RAINFALL

The zone has a tropical climate with a short spell of

winter season. The hot season lasts from mid-March to mid-June, with the day temperature ranging from 38°C to 45°C in different parts of the State. The monsoon arrives by the middle of June. Its scouts start arriving about two weeks before its normal onset. This is called the *Chhota monsoon* which breaks the hot spell of summer. The monsoon rains in region are caused solely by the current of wind from the Bay of Bengal. Winter, which lasts about three months, is mild over the plains, the average minimum temperature not falling below 15°C.

Average rainfall in the zone is 1,435.8 mm. Month-wise distribution of rainfall is given in Table 3. More

Table 3. Distribution of rainfall in the zone

Month	Normal rainfall (mm)	% of total rainfall
January	13.7	0.95
February	22.8	1.58
March	27.2	1.89
April	44.0	3.06
May	103.6	7.21
June	245.7	17.11
July	310.4	21.61
August	305.5	21.27
September	227.2	15.82
October	114.1	7.94
November	18.8	1.31
December	2.8	0.19
Annual	1,435.8	100

than 75% rainfall occurs during the 4 months from June to September. December and January are almost dry months.

8. POPULATION AND POPULATION DENSITY OF THE ZONE

As per 2001 census, the male and female population in West Bengal State was 41,465,985 and 38,710,212

respectively. The ratio of females to males was 934 to 1,000. Population density was 904 per sq km. Literacy rates of male and female were 77.58 and 60.22% (Table 4).

9. BRIEF SCENARIO OF AGRICULTURE SECTOR

The gross cropped area of the Lower Gangetic Plains is 6.96 m ha, out of which 1.19 m ha is irrigated. Main source of irrigation is wells/tubewells. The State of West Bengal, which falls under the zone, is the leading producer of paddy and second largest producer of potato (30% of total potato production of the country). Rice is the most important *kharif* crop, which presently accounts for 77% of the total rice area and 68% of total area under food grains in the State. In addition, wheat, pulses, mustard, groundnut, jute, sugarcane, fruits, vegetables and flowers are cultivated. Main cropping systems are paddy–paddy, paddy–jute, paddy–mustard, paddy–potato, and paddy–wheat. The overall cropping intensity of the zone is 162%. Table 5 and 6 show area, production and yield of principal crops grown in the State.

The State of West Bengal now holds the third position after Punjab and Haryana in terms of per capita rural income from agriculture. During the years 1970–1990, in spite of decline in net sown area in the State at the rate of 0.16% per annum, and cropping intensity increasing marginally at the annual rate of 0.58%, agricultural production increased at a compounded annual growth rate of 3.66%. The food grain productivity of the State is around 2006 kg/ha, which is third highest in the country, after Punjab and Haryana, and 32% higher than the national average.

10. BRIEF SCENARIO OF ANIMAL HUSBANDRY SECTOR

According to Basic Animal Husbandry Statistics 2004, total population of livestock in the State of West Bengal was about 40.54 million, consisting 18.91 million cattle, 1.01 million buffalo, 1.5 million sheep and 18.77 million goat and some others. Poultry sector is also strong with a population of more than 60.6 million birds.

Table 4. Distribution of population, sex ratio, density, % decadal growth rate—2001

	Total population			Sex ratio (females/ 1,000 males)	Density/km ²	% Decadal growth	
	Persons	Males	Females			1981–91	1991–01
West Bengal	8,01,76,197	4,14,65,985	3,87,10,212	934	904	24.73	17.77
India*	1,02,88,30,774	53,22,63,021	49,65,67,753	933	324	23.86	21.56

Source: Census of India, 2001, Series-1, Registrar General and Census Commissioner, New Delhi.

Table 5. Area, production, yield of principal crops (2000–01)

Principal crops	Area ('000 ha)	Production ('000 tonnes)	Yield (kg/ha)	National yield (kg/ha)
Rice	5,435.2	12,428.1	2,287	1,901
Wheat	426.0	1,058.6	2,485	2,708
Maize	35.3	88.3	2,501	1,822
Ragi	12.7	15.2	1,197	
Total cereals	5,918.3	13,595.7	2,297	
Gram	54.7	50.2	918	744
Tur (Arhar)	8.9	5.9	663	618
Total Pulses	322.3	238.8	741	544
Total food grains	6,240.6	13,834.5	2,217	1,626
Groundnut	36.3	53.4	1471	977
Sugarcane	21.6	1,465.6	67,852	68,577
Cotton	1.2	#2.7	383	190
Jute and Mesta	613.9	##7,428.4	2,181	1,867
Tea	107.48	181.536	1,686	
Coarse cereal	60.0	110.0	1,909	1,027
Lentil	80.0	70.0	901	619
Rape seed/mustard	440.0	420.0	956	935
Potato	299.70	76,73,100.0	25,603	18,404
Coconut	20.0	3.31 (million nuts)	13,490 (nuts/ha)	6,951 (nuts/ha)
Cashew nut	8.0	6.0	900 (nuts/ha)	710 (nuts/ha)

Note: #- thousand bales of 170 kg each; ##- thousand bales of 180 kg each.

Source: (1) *Agricultural Statistics at a Glance, 2003*, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India; (2) *Fertiliser Statistics, 2002–03*, The Fertiliser Association of India, New Delhi.

11. BRIEF SCENARIO OF FISHERIES SECTOR

West Bengal has a large share of brackish-water as well as inland fishery resources. It has 2.10 lakh hectare of brackish water with a productivity of 953 kg/ha/annum. The State is one of the largest exporters of frozen fish, which is about 10% of the total exports of India. Inland fishery is spread along 2,526 km length of its rivers and canals and nearly 3.0 lakh hectares of reservoirs, tanks and reservoirs. As per 2001 census, total production of marine and inland fish in the State was 9,95,000 tonnes.

12. IRRIGATED AREA AND SOURCE OF IRRIGATION

Till 1999–2000, 33.64 lakh hectare of minor irrigation

Table 6. Area, production and productivity of fruits/vegetables (2000–01)

Fruits/vegetables	Area ('000 ha)	Production ('000 tonnes)	Productivity (tonnes/ha)
Banana	18.9	335.2	17.7
Orange	8.5	33.2	9.5
Litchi	4.2	42.0	10.0
Mango	62.5	380.3	6.1
Papaya	6.7	220.5	32.9
Pineapple	10.4	279.5	26.9
Sapota	2.3	27.5	12.0
Brinjal	140.6	2,388.5	17.0
Cabbage	65.2	1,929.9	29.6
Cauliflower	57.0	1,670.0	29.3
Okara	58.4	662.2	11.3
Tomato	43.6	588.6	13.5
Potato	299.7	7,673.1	25.6

Source: (1) *Agricultural Statistics at a Glance, 2003*, Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India; (2) *Fertiliser Statistics, 2002–03*, The Fertiliser Association of India, New Delhi.

potential was created in the State of West Bengal. Another 14.30 lakh of hectares were added through major and medium irrigation projects during the year 1999–2000. As such, the State is well endowed with water resources. Shallow wells and lift irrigation are the major means of irrigation as the water table in most part of the zone is high. As per Central Electricity Authority data, about 113,468 pump sets were electrified and there was an ultimate potential for energization to the tune of 6.5 lakh pump sets.

13. INFRASTRUCTURAL FACILITIES AVAILABLE IN THE ZONE

The rural infrastructure in the zone is fairly good with connectivity of villages to towns and cities, network of telephones etc. The State has a good set up of panchayats. In addition, the government is in the process of strengthening the marketing infrastructure of agricultural commodities. Special zones for the export of horticultural produce and establishment of 134 new agro-industries with an investment of Rs 757 crores have been recently added to the existing infrastructure.

13.1 Metalled roads and rail network

The State has a vast network of roads and rail. Most of the villages are connected by some kind of road for

transport. Details of different types of surface transport network are as follows:

- National highways : 1,651 km
- State highways : 3,418 km
- State road (PWD) : 12,288 km
- Zila Parishad roads : 31,064 km
- Municipal roads : 18,632 km
- Railway network : 3,867 km

13.2 Rural electrification

Out of 37,910 inhabited villages of West Bengal, 32,271 (84%) are electrified. The State has surplus power with an installed capacity of 6,877 MW and generation of 16,770 MU. It has been supplying power to the neighbouring States. Despite surplus power production, electric supply is not adequate and assured in rural sector.

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

Kolkata, Bankura, Bardhman, Hooghly, and Midnapore are major markets for the sale/marketing of agro-equipment and grain.

13.4 Infrastructural facilities available for manufacture of agricultural implements and machinery

There are no major manufacturing centers for farm equipment in the State. Bardhman has a few units manufacturing some farm equipment. Most of the equipment is bought from other States.

13.5 Infrastructural facilities available for sale/repair and maintenance of tractors and other machinery

These facilities are not adequate. Most servicing facilities are extended through dealers of power tillers and tractors. The zone has the highest population and annual sale of power tillers. However, like any other States, there are plenty of roadside shops catering to the general maintenance of tractors/power tillers etc.

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

The State has three agricultural/allied sector universities and several other institutes including prestigious Indian Institute of Technology at Kharagpur. The IIT has a Department of Agricultural and Food Engineering and a Rice Processing Centre, which are credited with numerous path-breaking useful agro-technologies to their credit. There are 9 Krishi Vigyan

Kendras located at Midnapore, Kakdwip- South 24-Paraganas, Nimpith- South 24-Paraganas, Bankura, Jalpaiguri, Purulia, Kalimpong (Darjeeling), Burdhan and Birbhum which impart trainings to farmers and other groups. Besides, there are several NGOs that serve for socio-economic upliftment of rural masses. To serve the large population of rural sector, these facilities are highly inadequate. There should be more training centres to provide hands-on training on the use of farm equipment, power tillers and tractors. Besides, there is a need to establish specialized centres for imparting training on post-harvest technologies for on-farm value addition. Establishment of a full fledged Directorate of Agricultural Engineering at the State level would greatly help to achieve the above-mentioned activities.

14. Agricultural implements being used by the farmers

Most of the tools and implements being used by farmers are either manual or animal drawn. Since majority of farms are marginal (< 1 ha), use of high capacity tools is not feasible. Use of tractors is suggested on custom-hiring basis. Power tillers are being adopted at a fast pace in the region. There are a number of small tools and implements, which need to be introduced for higher output and reduced drudgery. A list of traditional and improved tools and equipment suggested for adoption/introduction for different operations/crops in the zone is given in Table 7 & Table 8.

15. SWOT ANALYSIS FOR AGRICULTURAL MECHANIZATION PROGRAMME IN THE REGION

Strengths

- (i) Paddy, potato and wheat are main crops for which a wide range of equipment for all the operations are available in the country. Introduction of these equipment will ensure timeliness of operations and enhance the productivity of crops.
- (ii) Most of the soils are alluvial with sandy loam to loam texture, which are suitable for the use of improved soil working equipment with available power sources.
- (iii) Although, more than 90% holdings belong to marginal and small farmers but in so far as operational holdings are concerned, nearly 40% of holdings are semi-medium, medium and large. In fact, there seems to be a tendency for large operational holdings to keep increasing which will favour farm mechanization.

Table 7. Traditional implements being used and improved tools and equipment suggested for adoption for different operations/crops

Crop	Operation	Traditional implements/practices			Improved implements/practices		
		Name	Power source	Size	Name	Power source	Size
Paddy	Puddling	Desi plough Bose plough	Pair of bullocks	12–15 cm	Puddler	Pair of bullocks	70 cm
	Transplanting	–	Human labour	–	Drum seeder	Human labour	8 × 20 cm
	Weeding	–	Human labour	–	Wet land weeder	Human labour	14 cm
	Harvesting	Sickle	Human labour	32 mm × 1.5 mm blade	Vertical conveyor reaper	3.5 hp engine	120 cm
Wheat	Sowing	Desi plough	Pair of bullocks and human	12–15 cm	Seed drill	Pair of bullocks	3 × 20 cm
	Weeding	Khurpi	Human labour	35 mm × 2 mm flat blade	Dry land weeder	Human labour	14 cm
	Harvesting	Sickle	Human labour	35 mm × 1.5 mm blade	Vertical Conveyor Reaper	3.5 hp engine	120 cm
	Threshing	–	Pair of bullocks	–	Thresher	5 hp engine	–
Mustard	Sowing	Broadcasting	Human labour	–	Seed drill	Pair of bullocks	3 × 20 cm
	Weeding	Khurpi	Human labour	35 mm × 2 mm flat blade	Dry land weeder	Human labour	14 cm
Groundnut	Sowing	Row marker	Human labour	3 × 30 cm	Ground nut planter	Pair of bullocks	2 × 30 cm
	Earthing	Spade	Human labour	10–15 cm wide 12–18 cm long blade	Leveller	Power tiller	–
	Digging	Spade	Human labour	12–20 cm wide, 15–20 cm long blade	Groundnut digger	Power tiller	30 cm
	Stripping	Pedal thresher	Human labour	60 cm long cylinder	Groundnut pod stripper	Power tiller	27 cm dia × 125 cm long cylinder
	Decorticating	–	Human labour	–	Decorticator	Human labour	21 × 5 cm shoes (3 nos.)
Potato	Sowing	Row marker	Human labour	3 × 30 cm	Potato planter	Pair of bullocks	Single row
	Earthing	Spade	Human labour	10–15 cm wide 12–18 cm long blade	Leveller	Power tiller	–
	Digging	Spade	Human labour	12–20 cm wide 12–18 cm long blade	Potato digger	Power tiller	30 cm
Jute	Sowing	–	Human labour	–	Jute seed drill	Human labour	Single row

- (iv) Although, there is a slight decline in the population of draft animal, the use of animate power for farm operations is going to remain for long time to come. Introduction of improved animal operated equipment will enhance the efficiency and capacity of draft animal power.
- (v) There are abundant water resources and rainfall distribution available in most part of the State. The government has been making concerted efforts to bring more and more area under irrigation. Increase in irrigated area will require farm equipment to enhance capacity of operations.
- (vi) There is a big potential to enhance the yield levels of paddy and horticultural crops. Mechanization of different farm operations will greatly assist in achieving these levels.
- (vii) Although electricity availability in rural areas is low, a steady increase of inanimate power sources, especially power tillers (more than 15,000 units a year), is positive indicator for higher levels of mechanization.
- (viii) The State has a very strong industrial base which can be used to develop farm equipment manufacturing activities for supply to different

Table 8. Improved farm equipment suggested for introduction in the zone

Operation	Equipment
Seed bed preparation	Laser leveller, cultivators, power tiller rotavator, ridger
Puddling	Helical blade puddler
Sowing	Seed drills for wheat, mustard, groundnut and jute, zero till drill
Transplanting	Drum seeder, manual transplanters, self-propelled transplanters
Planting	Potato planter (animal/tractor drawn), raised bed transplanters
Weeding	Wet and dry land weeders, power weeders
Plant protection	Sprayers, mist blowers, air blast sprayer, electrostatic sprayers
Harvesting	Vertical conveyor reapers, diggers, vegetable and fruit harvesters, paddy combines
Threshing	Wire loop thresher, multi-crop threshers
Decorticating/shelling	Decorticator, maize sheller
Grading	Manual/power operated graders
Transport	Pneumatic wheel animal cart, trolleys

parts of the country. There are several R&D centers, like IIT, SAUs and ICAR institutes which can act as technology providers.

- (ix) The State envisages Rs 983 crores for term loan investment for agriculture from NABARD. Out of this, Rs 266 crores is projected for farm mechanization. This will give necessary impetus for farm mechanization.

Weaknesses

- (i) Government policy on farm mechanization is lacking. A large population of unemployed persons provides cheap that discourages mechanization.
- (ii) The economic conditions of the farmer do not favour investment on high value equipment. Besides, there is a lack of credit facilities available to the farmers.
- (iii) Fragmented small land holdings limit the use of large capacity machines and tractors, except for custom hiring. Ownership of most machines becomes economically unsustainable, especially when labour availability is abundant.
- (iv) The State Department of Agriculture is short of well-trained manpower to plan and execute farm mechanization programs.

Opportunities

- (i) More and more area is being covered by assured irrigation facility. This will enhance the cropping intensity and resultant farm mechanization.
- (ii) An increase in the size of operational holdings has been observed in recent past, which is a good indicator for higher levels of farm mechanization.
- (iii) The government has firm plans to make the State self sufficient in food grains. At present, there is substantial gap between the demand and production of wheat, pulses and oilseeds. Farm mechanization will be necessary to increase the production to achieve the targets.
- (iv) New developments in jute technology are promising to enhance production of jute in the State. This is likely to provide avenues for jute based agro-industries to establish for gainful employment in rural sector.
- (v) The agro-climatic conditions are favourable to promote aggressive diversification in horticultural crops, fisheries and poultry.

Threats

- (i) Although the State government has been laying

high emphasis in agriculture, the farm mechanization is not on the listed priority.

- (ii) There is abundant and cheap labour available for farm operations in the State. The government has the priority of engaging more persons in agriculture that will discourage farm mechanization.
- (iii) The State has poor infrastructure for the fabrication and maintenance of farm equipment.
- (iv) Post harvest losses are very high, which must be reduced by way of developing processing sector.

16. LONG-TERM MECHANIZATION STRATEGIES FOR THE ZONE

16.1 Farm power

1. Although majority of land holdings are small and fragmented, use of manual power for some of the farm operations needs to be reduced to enhance timeliness and also to reduce drudgery. Manual operations of paddy transplanting and potato sowing need to be mechanized with suitable power source and equipment.
2. The existing level of available farm power is about 1.2 kW/ha which is inadequate to enhance the cropping intensity and output of the farm sector. This level needs to be raised to 3.0 kW/ha by 2020 by introducing power sources like, power tiller, tractors (preferably custom hiring), electric motors, and engines.
3. The State of West Bengal has sufficient installed and generating capacity of electric power, but its availability in rural sector is not adequate. Emphasis on rural electrification is necessary to give boost to agro-based rural industries that would, in turn, enhance farm outputs and incomes.

16.2 Improved implements and machinery for crop production

4. It would be appropriate to introduce a mix of power-operated and animal operated improved tools and equipment that would enhance the output and quality of work at reduced drudgery levels. All such equipment have already been developed at different places and are being commercially manufactured. A list of selected tools and equipment is given in Table 7.
5. Paddy is the major crop grown in 58 m ha of area of the State. At present, most of the operations are done with manual or animal power. In order to increase productivity, intensity, timeliness of

operations and also reduce human drudgery, improved implements and machinery must be introduced. Animal-operated helical blade puddlers, drum type pre-germinated paddy seeders, manually-operated 6-row transplanters, manual/motorized threshers must be introduced on large scale. These will be useful to enhance the quality and output of work.

6. The State ranks second in the production of potato in the country. It is an important crop not only for nutrition but also for the income of farmers. Equipment for all the operations of potato production are commercially available and should be selectively introduced for higher productivity. Animal-drawn and tractor drawn potato planters, diggers and graders need to given priority for large scale adoption.
7. Wheat production during the year 2001–02 was 8.87 lakh tons which was 44% of the State's requirement. The government plans to achieve self-sufficiency of wheat to produce 20 lakh tons. This will require additional area under wheat and more importantly mechanization of critical operations. Introduction of cultivators, harrows, rotavators, seed drills, harvesters and threshers is required on large scale.

16.3 Mechanization of horticultural crops

8. The State of West Bengal is a major producer of all kinds of horticultural crops. However, the level of mechanization in these crops is negligible. In order to compete in quality and productivity in future, it is necessary to introduce different tools and equipment, which are commercially available.
9. For orchards, pit makers, pruning tools, air-assisted sprayers for tall trees are required.
10. Rotavators, precision seeders/planters, efficient sprayers, weeders, and diggers/harvesters are required or vegetable crops.
11. Some parts in the region especially near big cities can be developed for introducing greenhouse technology for growing high quality vegetables and flowers for which niche markets are available in these cities. In fact, climatic advantages in some parts of the region favour use of greenhouse technology for producing export-oriented flowers and vegetables.

16.4 Feeds and fodders

12. Equipment for harvesting fodder crops, silage making, compressed feed blocks will be required

for introduction and popularization. This technology is useful in producing the transport costs of shifting fodder and feed from surplus areas to deficit areas.

16.5 Biomass management

13. Equipment for harvesting, densification and transport of crop residues will be required for feed, fodder and energy.
14. Since paddy is grown on large area, management of paddy crop residue is necessary to generate additional income from the farm.

16.6 On-farm post harvest technology

15. In order to increase the farm income and reduce losses, it would be necessary to introduce technologies for on-farm value addition of different produces. This would go a long way in developing catchments based agro-industries for enhanced incomes of rural sector.
16. The region has huge potential of producing horticultural crops which can be realized by developing agro and food processing industries in the production catchments.

16.7 Infrastructural improvements

17. Agricultural engineering college in the University at Kalyani should be adequately strengthened for designing and testing suitable equipment for the region. Also, the State of West Bengal should create a directorate of agricultural engineering to introduce and popularize equipment and on-farm processing technologies.
18. All the KVKs in the region must have an agricultural engineer to impart trainings and conduct demonstrations on farm machinery for the benefit of farmers.
19. The region has good industrial climate which should be used to develop agro-based manufacturing activities. Good manufacturers should be given incentives to manufacture quality equipment at competitive prices not only for use in the State but also to supply these to entire north-east region, which is a big market for hand tools.
20. Customized services of tractors and high capacity farm machinery by private entrepreneurs should

be encouraged and promoted by providing soft loans and other incentives. This will cut down substantially on the cost of various farm operations which are done by owning machines on individual basis.

21. Department of Agriculture/Horticulture should organize periodical exposure visits of farmers to other States where they can see modern farm technologies and use of efficient farm machinery. The State department of agriculture should also organize annual exhibitions of new technologies at different places for the benefit of farmers.

16.8 Institutional frame work

22. The State of West Bengal should create a Directorate of Agricultural Engineering, which should be responsible to plan, promote and monitor the programs related to farm mechanization including post-harvest technologies in the State. It should also maintain a database on all aspects of farm mechanization.
23. Agro-Industries Corporation should be revitalized/reorganized to manufacture prototypes of improved farm equipment and popularize them in the region.

16.9 Policy issues

24. Mechanization of selected operations must be promoted to enhance productivity and produce operational drudgery. The government should not, as a policy matter, discourage farm mechanization with a false pre-conceived notion of labour displacement.
25. To encourage the use of farm machinery, a policy of insurance for users and credit facilities for farmers and entrepreneurs need to be introduced at low premium and interest rates.
26. Policies are needed for accelerated development of high quality processing industries with quality testing laboratories for horticultural produces to derive maximum profits from this sector.
27. A Farm Mechanization Development Council should be created at the State level which should be headed by the Minister of Agriculture. This will provide necessary guidance and policy framework on various aspects of farm mechanization.

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