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National Research Priorities in Agronomy

2020-2024

National Committee on Crop Improvement & Agronomy

Sri Lanka Council for Agricultural Research Policy
Ministry of Agriculture

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National Committee on
Crop Improvement & Agronomy

Sri Lanka Council for Agricultural Research Policy
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Ministry of Agriculture

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Message from the Secretary
Sri Lanka Council for Agricultural Research Policy

The Sri Lanka Council for Agricultural Research Policy (SLCARP), the umbrella organization of the National Agricultural Research System (NARS) in the country, has formed a number of National Committees with the experts in relevant subjects, to look into the matters related to agricultural research of national and current importance. The National Committee on Crop Improvement & Agronomy is one such committee working on the research issues related to Crop Improvement and Agronomy to achieve desired goals according to the needs of the country.

Agricultural research plays an important role in achieving food security and ensuring higher and sustainable income for farmers. Identification and prioritization of national-level agricultural research thrusts are important steps in the process of agricultural research policy formulation to cater to the needs of the development of the agriculture sector in the country while ensuring rational allocation of human, physical and financial resources for agricultural research.

The setting of priorities for Agronomy was assigned to the National Committee on Crop Improvement & Agronomy by the Council. The research priorities of Agronomy for each crop sector of the country and the strategies for each priority with research needs were identified based on the information gathered at the Workshop on "Current Status and Future Directions in Agronomy Research in Sri Lanka" held in March 2019 with relevant stakeholders.

On behalf of the Council, I take this opportunity to thank the members of the National Committee on Crop Improvement for their tireless efforts in developing this priority document. This will be very useful to the National Agricultural Research System and other stakeholders, particularly the emerging private sector investors. My sincere appreciation to Dr. D T Kingsley Bernard, Former Chairman of the Sri Lanka Council for Agriculture Research Policy for his guidance and support towards formulation of this document. I am particularly thankful to Dr Padmini Girihagama, Secretary/Coordinator of the Committee representing the Council for documenting these research priorities and making those available to the scientists of this country.

Prabath Wimal Kumara

Secretary/Director

Sri Lanka Council for Agricultural Research Policy

Message from the Chairman
National Committee on Crop Improvement & Agronomy

The agricultural policy direction of the government policy framework targets at realising the policy goals, inter-alia, achieving food security and ensuring high and sustainable income for farmers. Agricultural research plays an important role in this regard. The Sri Lanka Council for Agricultural Research Policy (SLCARP) has formed various National Committees representing various disciplines and the National Committee on Crop Improvement and Agronomy is one such committees working on the research issues related to crop improvement and agronomic research of economically important plantation and non-plantation crops and to achieve desired goals according to the needs of the country.

Agronomy is one of the most crucial factors for ensuring successful agriculture product which that knowledge required to manipulate the growing conditions to optimize the economical yield. The research thrust areas of agronomy for each crop sector of the country and the objectives for each thrust with strategies and activities for achieving those objectives were identified based on the information gathered by the committee by two day workshop with relevant stakeholders. The National Committee on Crop Improvement & Agronomy hopes that the present document will be useful to guide researchers/scientists in the NARS to prioritize the agronomic research in a well-coordinated manner to come out with desired results and the policy makers and research managers to make decisions in rational allocation of resources for agronomic research to achieve the government targets with maximally utilizing the available resources.

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Dr S K Wasala

Chairperson

National Committee on Crop Improvement & Agronomy

Sri Lanka Council for Agricultural Research Policy

Preface

Research is the main source of technological innovations and is, thus, very important in strengthening the country's agricultural potential. It is only through continued agricultural technological breakthroughs that sustainable growth in agricultural productivity and hence the competitiveness of Sri Lanka's agricultural capability can be achieved or improved.

Genetic improvement alone does not support to increase the crop productivity and production but good varieties should be accompanied with appropriate agronomic management packages to realize potential yields. Thus, SLCARP has identified Agronomy as one of the major thrust areas to address the key challenges in agriculture sector and added the discipline of Agronomy to National Committee on Crop Improvement in 2017.

In times of tightening national budgets as a result of structural adjustment requirements especially due to the impacts of the 30 years period of war, the need to make choices in Sri Lanka's publicly funded research is heightened. Prioritization of agricultural research activities results in the selection of the optimal research portfolio given the resource constraints. Thus, resources allocation based on identified research priorities will be more efficient, effective and responsive to the research system Objectives than when allocation of resources is not based on research priorities. The National Priorities in Agronomy Research were formulated based on the information gathered at the Workshop on "Current Status and Future Directions in Agronomy Research in Sri Lanka" held in March 2019.

As the Secretary/Coordinator of National Committee on Crop Improvement & Agronomy, I am pleased to thank the members of the National Committee on Crop Improvement & Agronomy in assisting to develop the present priority document. The special thank should go to Dr. M.A.P.W. K. Malaviarachchi, Principal Agriculture Scientist (Agronomy), Field Crop Research & Development Institute, Mahailluppallama, for taking part in reviewing and editing the present document with valuable suggestions. My sincere thank should go to Mr. L G Hettiarchchi, Research Officer, SLCARP for his support given to me for the preparation of this Priority Book. The information produced in the present document will be very useful to the National Agricultural Research System and other stakeholders, particularly the emerging private sector investors to focus attention on priority research areas in Agronomy and allocation of funds by the government and other funding agencies as well.

Dr. Padmini C Girihagama

Secretary/Coordinator

National Committee on Crop Improvement & Agronomy

Sri Lanka Council for Agricultural Research Policy

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Introduction

Agriculture Sector in the Economy of Sri Lanka

Agriculture sector which consists of several sub sectors, such as, food crops, plantation crops, livestock, forestry, fisheries and aquaculture, is the cornerstone of the Sri Lanka's economy contributing nearly 7% to the total Gross Domestic Product (GDP), nearly 25.5% to total exports (Central Bank of Sri Lanka, 2018) and nearly 31% to the employment (Economic & Social Statistics in Sri Lanka 2018). Therefore, agriculture plays an important role either directly or indirectly for improving livelihoods of the Sri Lankans.

A considerable amount of foreign exchange is spent annually on importing a vast array of food items which could be produced locally. In 2018, nearly Rs. 281.6 billion which accounts for 7.2% of the total import expenditure (https://www.export.gov/article?id=Sri-Lanka-Agricultural-Sector, 7/22/2019) has been spent for importing agricultural food commodities. A rapid growth of the domestic food crop sector is essential to achieve food security, increase farmers' income and living standards and to reduce rural poverty. On the other hand, development of the plantation sector contributes to increased foreign exchange earnings. Therefore, assistance of the government to enhance agricultural production in the country is significant. Various policies, plans, and programs are being implemented for sustainable increase in agricultural production, both in food crop and plantation crop sectors.

Challenges of the Agriculture Sector

The development of the agriculture sector in the country is vital for its economic development. The followings are the major challenges that have to be addressed in this regard;

- Continuous increase in demand for food due to increasing population growth
- Shrinking of cultivable land due to urbanisation and population growth
- Low crop productivity and production
- Increasing biotic and abiotic stresses due to anticipated climate changes
- High cost of cultivation due to escalating cost of inputs
- Declining overall soil fertility status
- Increasing demand for high-quality agricultural products
- Impact on environment due to indiscriminate use of agrochemicals/chemical fertilizers

- Inadequacy of improved varieties /other appropriate technologies
- Inadequacy of quality seed and planting materials of improved varieties
- Inadequate supply of spice and beverage crops to meet the increasing demand in the export market.
- Lack of stable government policies towards agriculture
- Limited allocation of government funds for agricultural Research and Development

Research and Development in the Agriculture Sector

Research and development (R&D) activities of the different sub sectors of agriculture play a significant role in addressing the above-mentioned challenges.The R&D institutions in food crops, plantation crops, livestock, forestry, fisheries and aquaculture sub-sectors are functioning under several Cabinet Ministries. These R & D institutes are coordinated by the Sri Lanka Council for Agricultural Research Policy (SLCARP), the apex body of the National Agricultural Research System (NARS) of Sri Lanka.

National Committee on Crop Improvement & Agronomy

Genetic improvement alone does not support to increase the crop productivity and production but good varieties should be accompanied with appropriate agronomic management packages to realize potential yields. Thus, SLCARP has identified Agronomy as one of the major thrust areas to address the key challenges in agriculture sector and added the discipline of Agronomy to National Committee on Crop Improvement in 2017. The name of National Committee on Crop Improvement rename as National Committee on Crop Improvement and Agronomy (NCCIA). It is mandated to identify and formulate policies & strategies related to Crop Improvement & Agronomy and set national research priorities considering agricultural development policies of the government.

The committee is responsible for the following;

1. Identification and formulation of national policies and strategies required for development in the disciplines of Crop Improvement & Agronomy.

2. Identification and documentation of National Research Priorities in the disciplines of Crop Improvement & Agronomy.

3. Reviewing and evaluation of research proposals for funding relevant to the disciplines, Crop Improvement & Agronomy.

4. Assisting in monitoring and evaluation of such research, looking for tangible outputs for the public.

5. Conducting workshops, seminars, training programs to upgrade and update data bases for the scientists and policy makers with the latest advances in crop improvement and publish relevant information for wider use by the clients and other interested groups.

6. Acting as the main contact person/representative of main and sub organizations involved in agricultural research.

7. Identification of the training needs of crop improvement and agronomy at all levels.

Identification of National Research Priorities

The Agronomy R&D programs conducted by public R&D institutions have made a significant contribution to raise both crop productivity and production in the country. At present, the priorities in agronomy activities have been identified by relevant R&D institutions based on the national agricultural policies. However, national priorities in agronomy R&D activities have not been identified in a well-coordinated and coherent manner. This has hindered the allocation of resources, both physical and human, in carrying out agronomy R&D programs efficiently and effectively at national level. Therefore, there is a need for identification and prioritisation of agronomy research thrusts in consultation with relevant stakeholders and end users. The following steps were followed in identifying national crop improvement research priorities.

Step 1: Analysis of the Current Status of Agronomy in Sri Lanka

In depth analysis on the current status of agronomy in the following relevant areas was performed by responsible representatives of the National Agricultural Research System (NARS) and the results were presented in a workshop to make the stakeholders aware of the current status of the agronomy research in Sri Lanka;

- Agronomy research in Rice in Sri Lanka
- Agronomy research in Vegetables in Sri Lanka
- Agronomy research in Other Field Crops (OFC) in Sri Lanka
- Agronomy research in Fruit Crops in Sri Lanka
- Agronomy research relevant to Seed Certification Activities in Sri Lanka
- Agronomy research in Export Agricultural Crops in Sri Lanka
- Agronomy research in Coconut in Sri Lanka
- Agronomy research in Rubber in Sri Lanka
- Agronomy research in Sugarcane in Sri Lanka
- Agronomy research in Tea in Sri Lanka
- Agronomy research in Floriculture in Sri Lanka
- Agronomy research in Forestry in Sri Lanka
- Agronomy research in Palmyrah in Sri Lanka
- Agronomy research in Cashew in Sri Lanka

Step 2: Analysis on Current Status of Agronomy

The information derived from the presentations was further analyzed by the break-out groups at the same workshop and thereafter future priorities were identified.

Step 3: Improvements to the Revised Document

The draft document was further improved by the National Committee on Crop Improvement & Agronomy after lengthy discussions.

Major Priority Areas of Agronomy Research in Sri Lanka

The major priority/thrust areas identified for the crops listed in annexure 2 are:

1. Increasing production, productivity and quality of produce
2. Increased availability of quality seed and planting materials
3. Crop production in controlled environments
4. Adaptation to climate change
5. Increased profitability in farming
6. Year-round availability and reduction of price fluctuations
7. Increased food availability and accessibility

Issues, strategies and research activities under each priority or thrust area (Goal) across all crops in general are summarized in Table 1. Issues, strategies and research needs under each priority or thrust area (Goal) for the crop categories listed in Annexure 2 are summarized in Table 2.

Thrust Area, Issues, Strategies and Research Needs for Major Priority (Thrust) Areas in Agronomy

Table 1. Thrust area, Issues, Strategies and Research Needs for Major Priority (Thrust) Areas in Agronomy

Thrust area	Issue	Strategy	Research needs
1. Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Identification of optimum time of harvesting (maturity/time of day/time of the year)
			Identification of appropriate harvesting intervals
			Identification of suitable harvesting methods
			Development of agronomic packages for novel crops
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advance land preparation techniques (Mechanization)
			Development of novel moisture conservation techniques
			Development of technologies for soil fertility improvement
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of appropriate technologies on flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on abiotic stress management	Research on improvement of micro climatic condition	
			Research on development of abiotic stress management technologies	
		Development of appropriate technologies on weed management	Research on novel weed management approaches	
2. Increased availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on Seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
				Planting material treatment
3. Crop production in controlled environments	Adverse effects of growing environment	Development of technologies for protected agriculture	Research on novel techniques for crop production under controlled environments	

Thrust area	Issue	Strategy	Research needs
4. Adaptation to climate change	Adverse effects due to Climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses
			Weather forecasting, crop modeling and simulation approaches
			Protected agriculture
			Introduction of climate smart cropping patterns
			Research on climate change and carbon sequestration
5. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable crop combinations
			Integrated farming approaches
6. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas
7. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Thrust Area, Issues, Strategies and Research Needs for Major Priority (Thrust) Areas for Agronomy in each Crop Category

Table 2. Thrust area, Issues, Strategies and Research Needs for Major Priority (Thrust) Areas for Agronomy in each Crop Category

Rice

Thrust area	Issue	Strategy	Research need
1. Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advance land preparation techniques (Mechanization)
			Development of novel moisture conservation techniques
			Development of technologies for soil fertility improvement
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of appropriate technologies on abiotic stress management	Research on improvement of micro climatic condition
			Research on development of abiotic stress management technologies

Thrust area	Issue	Strategy	Research need	
		Development of appropriate technologies on weed management	Research on novel weed management approaches	
2. Increased availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Seed production techniques
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
3. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Introduction of climate smart cropping patterns	
			Research on climate change and Carbon sequestration	
4. Increased profitability in farming	High cost of production	Development of low cost and efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production	
			Introduction of integrated crop management packages	
			Introduction of energy efficient technologies	
			Integrated farming approaches	

Thrust area	Issue	Strategy	Research need
5. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of potentials of rice cultivation on different marginal lands" (saline/marshy lands)
6. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification

Table 2. Continued

Other Field Crops

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advance land preparation techniques (Mechanization)
			Development of novel moisture conservation techniques
			Development of technologies for soil fertility Improvement
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production
		Development of appropriate technologies on abiotic stress management	Research on improvement of micro climatic condition
			Research on development of abiotic stress management technologies

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on weed management	Research on novel weed management approaches	
2. Increased availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (tissue culture/micro propagation)
				Seed production techniques
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
3.Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Protected agriculture	
			Introduction of climate smart cropping patterns	
			Introduction of integrated crop management packages	
			Introduction of energy efficient technologies	
			Suitable cropping combination	
			Integrated farming approaches	

Thrust area	Issue	Strategy	Research needs
4.Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas
5. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Fruit Crops

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Identification of optimum time of harvesting (maturity/time of day/time of the year)
			Identification of suitable harvesting methods
			Development of agronomic packages for novel crops
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advanced land preparation techniques (Mechanization)
			Development of novel moisture conservation techniques
			Development of minimum soil tillage techniques
			Development of technologies for soil fertility Improvement
		Development of appropriate establishment technologies	Research on planting systems
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Adaptability research on modern irrigation techniques
			Research on water and moisture conservation techniques
			Research on soil health management through novel technologies

Thrust area	Issue	Strategy	Research needs	
			Research on modification of crop micro environment	
		Development of technologies on Plant canopy management	Research on plant canopy management (Training, Pruning and Thinning research)	
		Development of appropriate technologies on flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production	
		Development of appropriate technologies on abiotic stress management	Research on improvement of micro climatic condition	
			Research on development of abiotic stress management technologies	
		Development of appropriate technologies on weed management	Research on novel weed management approaches	
2. Increased availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (Tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques

Thrust area	Issue	Strategy	Research needs
			Planting material treatment
3. Crop production in controlled environment	Adverse effects of growing environment	Development of technologies for protected agriculture	Research on novel techniques for crop production in controlled environment
4.Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses
			Weather forecasting, crop modeling and simulation approaches
			Protected agriculture
			Introduction of climate smart cropping patterns
			Research on climate change and carbon sequestration
5. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
6.Year-round availability and reduction of	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas

Thrust area	Issue	Strategy	Research needs
price fluctuations			
7. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Vegetable Crops

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Development of novel moisture conservation techniques
			Development of minimum soil tillage techniques
			Development of technologies for soil fertility Improvement
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of appropriate technologies on flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production
		Development of appropriate technologies on abiotic stress management	Research on improvement of micro climatic condition
			Research on development of abiotic stress management technologies

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on weed management	Research on novel approaches on weed management	
2. Increased availability of quality seed and planting material	Inadequate quality seed and planting materials	Development of technologies to Improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
				Planting material treatment
3. Crop production in controlled environment	Adverse effects of growing environment	Development of technologies for protected agriculture	Research on novel techniques for crop production in controlled environments	
4. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Protected agriculture	

Thrust area	Issue	Strategy	Research needs
			Introduction of climate smart cropping patterns
			Research on climate change and carbon sequestration
5. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
6. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas
7.Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Export Agricultural Crops

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Identification of optimum time of harvesting (Maturity/Time of day/Time of year)
			Identification of appropriate harvesting intervals
			Development of agronomic packages for novel crops
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advance land preparation techniques (Mechanization)
			Development of novel moisture conservation techniques
			Development of minimum soil tillage techniques
			Development of technologies for soil fertility Improvement
		Development of appropriate establishment technologies	Research on planting systems
			Production of high quality planting material
	Sub-optimum crop		Adaptability research on modern irrigation techniques
			Research on water and moisture conservation techniques

Thrust area	Issue	Strategy	Research needs	
	management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on soil health management through novel technologies	
			Research on modification of crop micro environment	
		Development of technologies on plant canopy management	Research on plant canopy management (Training, Pruning and Thinning research)	
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production	
		Development of appropriate technologies on abiotic stress management	Research on micro climatic condition improvement	
			Agronomic Research on improvement for abiotic stress management	
		Development of appropriate technologies on weed management	Research on novel approaches on weed management	
2. Increased availability of quality seed and planting material	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (Tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement

Thrust area	Issue	Strategy	Research needs	
				Seed pre treatment
				Seed priming techniques
				Planting material treatment
3. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Research on management of heat and water stress on crop yield	
			Introduction of climate smart cropping patterns	
			Research on climate change and carbon sequestration	
4.Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production	
			Introduction of integrated crop management packages	
			Introduction of energy efficient technologies	
			Suitable cropping combination	
			Integrated farming approaches	
5. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation	
			Development and modifications of cropping calendars	
			Exploration of non-conventional cultivation areas	

Thrust area	Issue	Strategy	Research needs
6. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Coconut

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identification of prime agricultural lands based on soil and climatic conditions.
			Development of techniques to maximize the resource utilization in cropping lands
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Development of novel soil and moisture conservation techniques
			Development of technologies for soil fertility Improvement
		Development of appropriate establishment technologies	Research on different planting systems and methods
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Adaptability research on modern irrigation techniques
			Water management and moisture conservation techniques
			Soil health management through novel technologies
			Modification of micro environment of the crop
		Development of appropriate technologies on flowering and fruiting	Flowering, fruiting physiology and seasonality of the production

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on abiotic stress management	Improvement of micro climatic conditions	
			Reduction of abiotic stress and management technologies	
		Development of appropriate technologies on weed management	Novel weed management approaches	
2.Increased availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (tissue culture/micro propagation)
				Potting media (Alternative potting media)
3.Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop varieties and specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Introduction of climate smart cropping technologies	
			Climate change and carbon sequestration potential of different cropping systems	
4.Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production	
			Introduction of integrated crop management packages	
			Introduction of energy efficient farming technologies	
			Identification of suitable cropping combinations	
			Technologies for off season production / cultivation in mixed cropping systems	

Thrust area	Issue	Strategy	Research needs
5.Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Exploration of non-conventional cultivation areas
6.Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification technologies
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Rubber

Thrust area	Issue	Strategy	Research needs
1. Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Identification of optimum time of harvesting (maturity/Time of day/Time of the year)
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Development of novel moisture conservation techniques
			Development of technologies for soil fertility improvement
		Development of appropriate establishment technologies	Technologies for developing smart planting materials
			Research on planting systems
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of technologies on plant canopy management	Research on plant canopy management (Training, Pruning and Thinning research)

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting Physiology and seasonality of production	
		Development of appropriate technologies on abiotic stress management	Research on micro climatic condition improvement	
			Agronomic research on improvement for abiotic stress management	
		Development of appropriate technologies on weed management	Research on novel approaches on weed management	
2. Increase availability of quality Seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to Improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (Tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
				Planting material treatment

Thrust area	Issue	Strategy	Research needs
3. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses
			Weather forecasting, crop modeling and simulation approaches
			Introduction of climate smart cropping patterns
			Research on climate change and Carbon sequestration
4. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
5. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas

Table 2. Continued

Sugarcane

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advanced land preparation techniques (Mechanization)
			Development of novel moisture conservation techniques
			Development of technologies for Soil fertility Improvement
		Development of appropriate establishment technologies	Research on planting systems
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Adaptability research on modern irrigation techniques
			Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of appropriate technologies on abiotic stress management	Research on micro climatic condition improvement
			Agronomic research on development of abiotic stress management technologies

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on weed management	Research on novel weed management approaches	
2.Increase availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
			Research on seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
				Planting material treatment
3. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Introduction of climate smart cropping patterns	
			Research on climate change and carbon sequestration	

Thrust area	Issue	Strategy	Research needs
4. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
5. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas
6. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems

Table 2. Continued

Tea

Thrust area	Issue	Strategy	Research needs
1. Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advance land preparation techniques
			Development of novel moisture conservation techniques
			Development of technologies for soil fertility Improvement
		Development of appropriate establishment technologies	Research on planting systems
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Adaptability research on modern irrigation techniques
			Research on soil and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of technologies on plant canopy management	Research on plant canopy management (Training, Pruning and Thinning research)

Thrust area	Issue	Strategy	Research needs	
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting Physiology and seasonality of tea seed production	
		Development of appropriate technologies on abiotic stress management	Research on micro climatic condition improvement	
			Research on development of abiotic stress management technologies	
		Development of appropriate technologies on weed management	Research on novel weed management approaches	
2. Increased availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Mass propagation (Tissue culture/micro propagation) & novel nursery techniques
				Seed production techniques
				Potting media (Alternative potting media)
				Novel grafting techniques
			Research on Seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Planting material treatment

Thrust area	Issue	Strategy	Research needs
3. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses
			Weather forecasting, crop modeling and simulation approaches
			Introduction of climate smart cropping patterns
			Research on climate change and carbon sequestration
4. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combinations
			Integrated farming approaches
6. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Cashew

Thrust area	Issue	Strategy	Research need
1.Increase production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advanced land preparation techniques (Mechanization)
			Development of novel Moisture conservation techniques
			Development of technologies for Soil fertility Improvement
		Development of appropriate establishment technologies	Research on planting systems
	Sub-optimum crop management strategies	Development of technologies on water, Nutrient, Soil Management and crop environment	Adaptability research on modern irrigation techniques
			Research on water and moisture conservation techniques
			Research on Soil health management through novel technologies
			Research on Modification of crop micro environment
		Development of technologies on Plant canopy management	Research on Plant canopy management (Training, Pruning and Thinning research)

Thrust area	Issue	Strategy	Research need	
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting Physiology and seasonality of production	
		Development of appropriate technologies on abiotic stress management	Research on Micro climatic condition improvement	
			Agronomic Research on improvement for abiotic stress management	
		Development of appropriate technologies on weed management	Research on novel approaches on weed management	
2. Increase availability of quality Seed and Planting Material	Inadequate quality seed and planting materials	Development of technologies to Improve seed/ planting material production and quality	Research on Seed and planting material production technologies	Mass propagation (Tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on Seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
				Planting material treatment

Thrust area	Issue	Strategy	Research need
3. Adaptation to climate change	Adverse effects due to Climate change	Development of climate resilient technologies	Identification of Crop and variety specific management practices against abiotic stresses
			Weather forecasting, crop modeling and simulation approaches
			Introduction of climate smart cropping patterns
			Research on climate change and Carbon sequestration
4. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
5. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas
6. Increase food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems

Table 2. Continued

Palmyrah

Thrust area	Issue	Strategy	Research need
1. Increase production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Identification of optimum time of harvesting (maturity/Time of day/Time of the year
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Development of novel Moisture conservation techniques
			Development of technologies for Soil fertility Improvement
		Development of appropriate establishment technologies	Research on planting systems
	Sub-optimum crop management strategies	Development of technologies on water, Nutrient, Soil Management and crop environment	Research on water and moisture conservation techniques
			Research on Soil health management through novel technologies
			Research on Modification of crop micro environment
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting Physiology and seasonality of production

Thrust area	Issue	Strategy	Research need	
		Development of appropriate technologies on abiotic stress management	Research on Micro climatic condition improvement	
			Agronomic Research on improvement for abiotic stress management	
		Development of appropriate technologies on weed management	Research on novel approaches on weed management	
2. Increase availability of quality Seed and Planting Material	Inadequate quality seed and planting materials	Development of technologies to Improve quality seed / planting material production	Research on Seed and planting material production technologies	Mass propagation (Tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
			Research on Seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
3. Adaptation to climate change	Adverse effects due to Climate change	Development of climate resilient technologies	Identification of Crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Protected agriculture	
			Introduction of climate smart cropping patterns	
			Research on climate change and carbon sequestration	

Thrust area	Issue	Strategy	Research need
4. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques to improve crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
5. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
6. Increase food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification
			Improvement of home gardening systems
			Development and introduction of technologies for urban agriculture

Table 2. Continued

Ornamental Crops

Thrust area	Issue	Strategy	Research need
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability
			Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Identification of appropriate harvesting intervals
			Development of agronomic packages for novel crops
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Development of novel Moisture conservation techniques
			Development of technologies for Soil fertility Improvement
	Sub-optimum crop management strategies	Development of technologies on water, Nutrient, Soil Management and crop environment	Adaptability research on modern irrigation techniques
			Research on water and moisture conservation techniques
			Research on Soil health management through novel technologies
			Research on Modification of crop micro environment
		Development of technologies on Plant canopy management	Research on Plant canopy management (Training, Pruning and Thinning research)

Thrust area	Issue	Strategy	Research need	
		Development of appropriate technologies on Flowering and fruiting	Research on flowering and fruiting Physiology and seasonality of production	
		Development of appropriate technologies on abiotic stress management	Research on Micro climatic condition improvement	
			Agronomic Research on improvement for abiotic stress management	
		Development of appropriate technologies on weed management	Research on novel approaches on weed management	Research on Seed and planting material production technologies
				Mass propagation (Tissue culture/micro propagation)
				Seed production techniques
				Potting media (Alternative potting media)
				Novel bud grafting techniques
2. Increase availability of quality Seed and Planting Material	Inadequate quality seed and planting materials	Development of technologies to Improve seed/ planting material production and quality	Research on Seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
				Planting material treatment
3 Crop Production in controlled environment	Adverse effects of growing environment	Development of technologies for protected agriculture	Research on novel techniques for crop production in controlled environment	

Thrust area	Issue	Strategy	Research need
4. Adaptation to climate change	Adverse effects due to Climate change	Development of climate resilient technologies	Identification of Crop and variety specific management practices against abiotic stresses
			Weather forecasting, crop modeling and simulation approaches
			Protected agriculture
			Introduction of climate smart cropping patterns
			Research on climate change and Carbon sequestration
5. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production
			Introduction of integrated crop management packages
			Introduction of energy efficient technologies
			Suitable cropping combination
			Integrated farming approaches
6. Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation
			Development and modifications of cropping calendars
			Exploration of non-conventional cultivation areas

Table 2. Continued

Forestry Crops

Thrust area	Issue	Strategy	Research needs
1.Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Development of techniques for optimum resource utilization
			Development of eco system-based crop management packages
			Development of technologies to improve quality aspects of agricultural products
			Development of silvicultural packages for less utilized tree species
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Development of novel moisture conservation techniques
			Development of technologies for soil fertility Improvement
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Research on water and moisture conservation techniques
			Research on soil health management through novel technologies
			Research on modification of crop micro environment
		Development of appropriate technologies on flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production
		Development of appropriate technologies on abiotic stress management	Research on micro climatic condition improvement
			Research on development of abiotic stress management technologies
2. Increased availability of	Inadequate quality seed		Mass propagation (tissue culture/micro propagation)
			Seed production techniques

Thrust area	Issue	Strategy	Research needs	
quality seed and planting materials	and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on seed and planting material production technologies	Potting media (Alternative potting media)
				Novel bud grafting techniques
			Research on Seed quality improvement technologies	Seed storage/preservation
				Seed viability
				Seed vigor improvement
				Seed pre treatment
				Seed priming techniques
3. Adaptation to climate change	Adverse effects due to climate change	Development of climate resilient technologies	Identification of crop and variety specific management practices against abiotic stresses	
			Weather forecasting, crop modeling and simulation approaches	
			Invasive species management and control	
			Introduction of climate smart cropping patterns	
			Research on climate change and carbon sequestration	
4. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production	
			Introduction of integrated crop management packages	
			Introduction of energy efficient technologies	
			Suitable species combination	
			Integrated farming approaches	

Summary of agronomy research priorities for crops

Thrust area	Issue	Strategy	Research need	Crops /Crop Groups
1. Increasing production, productivity and quality of produce	Low crop productivity & quality	Development of technologies to improve crop productivity and quality	Identifying prime agricultural lands based on crop suitability	All
			Development of techniques for optimum resource utilization	All
			Development of eco system-based crop management packages	All
			Development of technologies to improve quality aspects of agricultural products	All
			Identification of optimum time of harvesting (maturity/time of day/time of the year	Rubber, Export crops/ palmyrah /Fruit Crops
			Identification of appropriate harvesting intervals	Ornamentals/ EAC
			Identification of suitable harvesting methods	Fruit crops/Tea
			Development of agronomic packages for novel crops	Ornamentals/ Forestry /Fruit Crops /EAC
	Poor crop establishment	Development of appropriate technologies for land and soil improvement	Identification of advanced land preparation techniques (Mechanization)	Tea/Fruit crops/ EAC/Rice/OFC
			Development of novel moisture conservation techniques	All
			Development of minimum soil tillage techniques	Tea/Fruit crops / EAC/Vegetables
			Development of technologies for soil fertility Improvement	All
			Technologies for developing smart planting materials	Rubber

Thrust area	Issue	Strategy	Research need	Crops /Crop Groups
		Development of appropriate establishment technologies	Research on planting systems	Plantation/EAC/Fruits
	Sub-optimum crop management strategies	Development of technologies on water, nutrient, soil management and crop environment	Adaptability research on modern irrigation techniques	Coconut/Tea/Fruit crops EAC
			Research on water and moisture conservation techniques	All
			Research on soil health management through novel technologies	All
			Research on modification of crop micro environment	All
		Development of technologies on Plant canopy management	Research on plant canopy management (Training, Pruning and Thinning research)	Cashew/Rubber/ Ornamentals/Fruit Crop/EAC
		Development of appropriate technologies on flowering and fruiting	Research on flowering and fruiting physiology and seasonality of production	All
		Development of appropriate technologies on abiotic stress management	Research on micro climatic condition improvement	All
			Research on development of abiotic stress management technologies	All

Thrust area	Issue	Strategy	Research need		Crops /Crop Groups
		Development of appropriate technologies on weed management	Research on novel approaches on weed management		
2. Increase availability of quality seed and planting materials	Inadequate quality seed and planting materials	Development of technologies to improve seed/ planting material production and quality	Research on Seed and planting material production technologies	Mass propagation (tissue culture/micro propagation)	All
				Seed production techniques	
				Potting media (Alternative potting media)	
				Novel bud grafting techniques	Rubber
			Research on seed quality improvement technologies	Seed storage/preservation	All
				Seed viability	All
				Seed vigor improvement	
				Seed pre treatment	
				Seed priming techniques	
				Cane or Planting material treatment	
3 Crop production in controlled environment	Adverse effects of growing environment	Development of technologies for protected agriculture	Research on novel techniques for crop production in controlled environment		Vegetables/Ornamentals /Fruits
4. Adaptation to climate change			Identification of crop and variety specific management practices against abiotic stresses		All

Thrust area	Issue	Strategy	Research need	Crops /Crop Groups
	Adverse effects due to climate change	Development of climate resilient technologies	Weather forecasting, crop modeling and simulation approaches	
			Protected agriculture	
			Introduction of climate smart cropping patterns	
			Research on climate change and carbon sequestration	
5. Increased profitability in farming	High cost of production	Development of low cost & efficient production technologies	Novel simple or high-tech machineries / tools & techniques for crop production	All
			Introduction of integrated crop management packages	
			Introduction of energy efficient technologies	
			Suitable cropping combination	
			Integrated farming approaches	
6.Year-round availability and reduction of price fluctuations	Seasonality of crop production	Development of technologies for year-round production	Technologies for off season production / cultivation	All
			Development and modifications of cropping calendars	
			Exploration of non-conventional cultivation areas	
7. Increased food availability and accessibility	Limited availability of lands	Development of technologies for efficient land utilization	Crop intensification and diversification	All food & Beverages crops
			Improvement of home gardening systems	
			Development and introduction of technologies for urban agriculture	

Annexure 1: Members of the National Committee on Crop Improvement and Agronomy (NCCIA)

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Annexure 2: Speakers of the Workshop on "Current Status & Future Directions in Agronomy Research in Sri Lanka" Organized by National Committee on Crop Improvement & Agronomy, Sri Lanka Council for Agricultural Research Policy, 28-29 March 2019, Rice Research & Development Institute, Batalagoda

1. Introduction to the Workshop by Dr. S K Wasala, Addl. Director, HORDI & Chairperson, National Committee on Crop Improvement & Agronomy of SLCARP

2. Current Status & Future Directions in Agronomy research in Rice in Sri Lanka by Ms T K Illangakoon, ADA (Res), Rice Research & Development Institute

3. Current Status & Future Directions in Agronomy research in Field Crops in Sri Lanka by Dr. MAPWK Malaviarachchi, Principal Agronomist, Field Crops Research & Development Institute and Ms D A Shirani, Principal Agronomist, Grain Legumes & Oil crop Research & Development Centre

4. Current Status & Future Directions in Agronomy research in Horticultural Crops in Sri Lanka by Ms. D. Karunananda, Principal Agronomist Horticultural Crops Research & Development Institute

5. Current Status & Future Directions in Agronomy research in Fruit Crops in Sri Lanka by Ms. A J Warusawitharana, ADA (Research), Fruit Crops Research & Development Institute

6. Current Status & Future Directions in Agronomy research in Seed Sector in Sri Lanka by Dr. M G D L Priyantha, Principal Agricultural Scientist, Seed Protection & Plant Protection Centre

7. Current Status & Future Directions in Agronomy research in Tea in Sri Lanka. Dr. M A Wijerathne, Head, Agronomy, Tea Research Institute

8. Current Status & Future Directions in Agronomy research in Sugarcane in Sri Lanka. Mr. A L C de Silva, Research Officer, Sugarcane Research Institute

9. Current Status & Future Directions in Agronomy research in Rubber in Sri Lanka. Dr.Wasana Wijesuriya, Head, Biometry Division, Rubber Research Institute

10. Current Status & Future Directions in Agronomy research in Coconut in Sri Lanka\. Mr.Thilina Raveendra, Research Officer, Coconut Research Institute

11. Current Status & Future Directions in Agronomy research in Export Agricultural Crops in Sri Lanka .Dr. Ananda Subasinghe, Director, IBRS, Department of Export Agriculture

12. Current Status & Future Directions in Agronomy research in Palmyrah in Sri Lanka. Mr. S Vinujan, Research Officer, Palmyrah Research & Development Board

13. Current Status & Future Directions in Agronomy research in Cashew in Sri Lanka Sri Lanka .Mr. Saman Herath, Research Officer Cashew Cooperation

14. Current Status & Future Directions in Agronomy research in Floriculture Crops in Sri Lanka. Ms M C Wickramasinghe, Deputy Director, Department of National Botanical Garden, Gampaha.