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National Research Priorities in Crop Improvement

2017-2021

National Committee on Crop Improvement & Agronomy

Sri Lanka Council for Agricultural Research Policy
Ministry of Agriculture

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Ministry of Agriculture

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Message from the Chairman of
Sri Lanka Council for Agricultural Research Policy

Sri Lanka Council for Agricultural Research Policy (SLCARP) is the apex body for formulating Agricultural Research Policies and Priorities of Agricultural Research in Sri Lanka. It also prepares the National Agricultural Research Plan for the country and recommends to the government for funding. Council identifies Research Priority Areas based on the current needs of the country and appoints National Committees accordingly. Crop Improvement is one such priority area identified by the Council. The National Committee on Crop Improvement consisting of expertise in various sectors in Crop Improvement makes its contributions for better utilization of crop improvement for the enhancement of the agriculture sector.

The responsibility of setting priorities for Crop Improvement was assigned to the National Committee on Crop Improvement by the Council. The research priorities of crop improvement for each crop sector of the country were identified based on the information derived at the Workshop on " Current Status and Future Directions in Crop Improvement Research in Sri Lanka" held in October 2016 with the participation of most senor Plant Breeders and other senior scientist from different disciplines and Private Sector organizations. Research Priorities for the future were identified after reviewing the programmes and advancements of the previous priorities and taking into consideration the future emerging challenges, particularly the impact of climate change on Agriculture and need recently

On behalf of the Council, I am pleased to thank the members of the National Committee on Crop Improvement for their valuable contributions to develop this priority document which will shape the agricultural research in this country. I am particularly thankful to Dr Padmini Girihagama, Secretary/Coordinator of the Committee representing the Council for documenting this information and making it available to the scientists of this country.

Dr S D G Jayawardena
Chairman
Sri Lanka Council for Agricultural Research Policy

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 is one such committee working on the research issues related to Crop Improvement 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 Crop Improvement was assigned to the National Committee on Crop Improvement by the Council. The research priorities of crop improvement for each crop sector of the country and the objectives for each priority with strategies and activities for achieving those objectives were identified based on the information gathered at the Workshop on "Current Status and Future Directions in Crop Improvement Research in Sri Lanka" held in October 2016 with relevant stakeholders.

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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. 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.

Dr J D H Wijewardena
Secretary
Sri Lanka Council for Agricultural Research Policy

Message from the Chairman
National Committee on Crop Improvement

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 is one such committees working on the research issues related to the enrichment and conservation of crop genetic resources and their utilization for the genetic improvement of crop plants to achieve desired goals according to the needs of the country.

Crop genetic improvement or simply the crop improvement is the back bone of enhancing crop productivity. This is because history has taught us crop productivity enhancement without crop improvement is very marginal. The research thrust areas of crop improvement 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 and validated with relevant stakeholders. The National Committee on Crop Improvement hopes that the present document will be useful to guide researchers/scientists in the NARS to undertake crop improvement 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 crop improvement research to achieve the government targets with maximally utilizing the available resources at a minimum cost.

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Dr J M Senevirathne
Chairman
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.

Application of Crop Improvement in Agriculture is the base of the crop productivity improvement. Thus, Sri Lanka Council for Agricultural Research Policy (SLCARP) has identified Crop Improvement as a thrust area for agricultural research and development.

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 Crop Improvement Research were formulated based on the information gathered at the Workshop on "Current Status and Future Directions in Crop Improvement Research in Sri Lanka" held in October 2016.

On behalf of the National Committee on Crop Improvement, I am pleased to thank the members of the National Committee on Crop Improvement in assisting to develop the present priority document. The special thank should go to Dr. S Abeysiriwardene, Senior Consultant (Research), CIC Agribusinesses, for taking part in reviewing and editing the present document with valuable suggestions. 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 Crop Improvement 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

Abbreviations

DNA	Deoxyribo Nucleic Acid
DUS	Distinctness, Uniformity and Stability
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
MAS	Marker – Assisted Selection
NARS	National Agricultural Research System
NCCI	National Committee on Crop Improvement
NCCIA	National Committee on Crop Improvement & Agronomy
NCPBB	National Committee on Plant Breeding and Biotechnology
QTL	Quantitative Trait Loci
R & D	Research and Development
SLCARP	Sri Lanka Council for Agricultural Research Policy
TCP	Technical Cooperation Project

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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 8% to the total Gross Domestic Product (GDP), nearly 24% to total exports and nearly 33% to the employment (Annual Report of Finance Ministry of Sri Lanka, 2015). At present, more than 33% of the population living in Sri Lanka depends on agriculture for their livelihood (Central Bank of Sri Lanka, 2010). Therefore, agriculture plays an important role either directly or indirectly for improving livelihoods of the Sri Lankans.

A considerable amount of foreign exchange is drained out annually on importing a vast array of food items which could be produced locally. In 2010, nearly Rs. 214 billion which accounts for 14% of the total import expenditure (Central Bank of Sri Lanka, 2010) 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 following are 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 R&D

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.Crop improvement is the back bone of increasing crop productivity and production so that it has been identified as one of the major thrust areas by the SLCARP to address the key challenges in agriculture sector.

A National Committee on Plant Breeding and Bio Technology (NCPBB) was appointed by the SLCARP in 1998, and later in mid- 2009, two separate national committees; one for Plant Breeding and the other for Agricultural Biotechnology were established. However, the term 'Crop Improvement' is more meaningful representing a wider subject area than the term 'Plant Breeding' in dealing with the subject of genetic improvement of crop plants. Thus, hereafter the term 'Crop Improvement' will be used in place of the term 'Plant Breeding'.

National Committee on Crop Improvement & Agronomy

The National Committee on Crop Improvement (NCCI) was established on 31st July 2009 and mandated to identify and formulate policies and strategies related to Crop Improvement 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 of the discipline.

2. Identification and documentation of National Research Priorities of the discipline, request for research proposals, subject them to evaluation and submit them for consideration by the Council.

3. Reviewing and evaluation of research proposals for funding.

4. Assisting in Monitoring and Evaluation of such research, looking for tangible outputs for the public.

5. Conducting workshops, seminars, training programs and to upgrade and update data base 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 at all levels.

Identification of National Research Priorities

The crop improvement R&D programs conducted by public R&D institutions have made a significant contribution to the development of improved crop cultivars to raise both crop productivity and production in the country. At present, the priorities in crop improvement activities have been identified by relevant R&D institutions based on the national agricultural policies. However, national priorities in crop improvement 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 crop improvement R&D programs efficiently and effectively at national level. Therefore, there is a need for identification and prioritisation of Crop Improvement Research thrusts in consultation with relevant stakeholders and end users. The following steps were followed in identifying national crop improvement research priorities;

Step 1: Analyze the Current Status of Crop Improvement in Sri Lanka

In depth analysis on the current status of Crop Improvement in the following relevant areas was performed by responsible representatives of the National Agricultural Research

System (NARS), National University System (NUS) and Private Sector and the results were presented in a workshop to make the Stakeholders aware of the current status;

- Policies related to Plant Breeding Research in Sri Lanka
- Rice Breeding Research in Sri Lanka
- Vegetable Breeding Research in Sri Lanka
- Other Field Crops Breeding Research in Sri Lanka
- Tea Breeding Research in Sri Lanka
- Rubber Breeding Research in Sri Lanka
- Coconut Breeding Research in Sri Lanka
- Sugarcane Breeding Research in Sri Lanka
- Fruit Breeding Research in Sri Lanka
- Importance of Plant Genetic Resources for Plant Breeding Research in Sri Lanka
- Export Agricultural Crops Breeding Research in Sri Lanka
- Floriculture Breeding Research in Sri Lanka
- Cashew Breeding Research in Sri Lanka
- Private- Public Partnership and role of Plant Breeding Research in Private Sector
- Involvements of Universities in Plant Breeding Research in Sri Lanka
- Forestry Breeding Research in Sri Lanka (Information were provided but not presented at the Workshop)
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Step 2: Analysis on Current Status of Crop Improvement

The information derived from the presentations was further analyzed by the break-out groups at the same workshop. Based on this analysis, future priorities were identified and the existing priorities were revised with these newly identified priorities.

Step 3: Improvements to the Revised Document

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

Major Priority Areas of Crop Improvement Research in Sri Lanka

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

i. Plant Genetic Resource Management and Utilization

Genetic variation is the back bone of crop genetic improvement. Preservation of existing natural genetic variation, introduction of genetic variation from other countries and creation of new genetic variation are important for future development of improved crop varieties.

ii. Productivity and Production Enhancement through Genetic Improvement

Crop productivity enhancement through genetic improvement increases the actually realized yield of crop plants in farmers' fields in the most economical way. Increases in potential yield through genetic improvement and reducing the gap between potential yield and realized yield at farmer level by improving variety adaptability over diverse environments are important in this aspect. For successful improvement of adaptability and stability of crop varieties over diverse environments, incorporation of tolerance/resistance for biotic and abiotic stresses into them and improving their phenotypic plasticity which is under genetic control are important.

iii. Product Quality Improvement to Meet the Requirements of the End-Users

At present the end users are more concerned about the quality of the crop produce. Therefore, there is a demand for different product quality attributes depending on the crop. It is further lead to fetch a comparatively higher price for the end product that will in turn lead to higher income of the producer.

iv. Making Sure the Continuous Availability of Quality Breeder Seed and/or basic Planting Materials in Adequate Quantities

This is one of the major responsibilities of any crop improvement program. Maintenance of variety genetic purity and making continuous availability of adequate quantities of breeder seed / basic planting material are important for achieving high and sustainable yields at farmer level.

Objectives, strategies and activities under each priority or thrust area (Goal) across all crops in general are summarized in Table 1.

Objectives, strategies and activities under each priority or thrust area (Goal) for the crop categories listed in Annexure 2 are summarized in Table 2. Table 3 summarizes the priorities for each crop.

Objectives, Strategies and Activities for Major Priority (Thrust) Areas in Crop Improvement

Table 1.Objectives, Strategies and Activities for Major Priority (Thrust) Areas in Crop Improvement

Thrusts	Objectives	Strategies	Activities
1. Plant genetic resource management and utilization	• To conserve and utilize available germplasm. • To widen the existing genetic base. • Creation of new genetic variation wherever possible • Characterization of available germplasm as far as possible • Prevention of genetic vulnerability	• Exploration and preservation of the natural genetic variation • Introduction of exotic germplasm safely • Improve collaboration between plant breeders and Plant Genetic Resource Centre in utilisation of plant genetic material • Utilization of relevant genetic tools to create new genetic variation	• Exploration and introduction of germplasm • *In-situ* and *ex-situ* conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm • Utilization of germplasm
2. Productivity and production enhancement through genetic improvement	• To increase productivity per unit land area/unit quantity of inputs and reduce cost of cultivation and production • To expand cultivable area wherever possible • To improve multiple resistance to biotic and abiotic stresses and adaptability of crop varieties	• Use of conventional plant breeding tools. Use of backcross breeding to incorporate multiple resistance to biotic and abiotic stresses • Use of hybrid crop technology to explore hybrid vigour or heterosis as much as possible • Application of biotechnological and mutation breeding tools wherever possible • Testing improved varieties in multi-locational yield trials and use of efficient analysis methodologies to select better varieties • Development of region specific videotapes	• Establishment of seed gardens • Maintenance of parental stocks • Hybridization and selection • Heterosis breeding • Wide hybridization • Mutation breeding • Molecular breeding • Quantitative Trait Loci (QTL) Mapping • Marker-assisted selection (MAS) • Gene pyramiding for multiple

		• Development of climate smart varieties • Development of efficient variety screening methodologies for biotic and abiotic stresses	resistance • Conducting multi-locational yield trials over diverse environments • Development of efficient and effective methodologies for testing variety adaptability • Screening breeding lines against biotic and abiotic stresses in collaboration with respective disciplines
3. Product quality improvement to meet the requirements of the end-users	• To develop varieties to meet the local and export demand for high-quality products • To increase diversity of quality products • To enhance keeping, processing, physical, sensory, nutritional, medicinal, cooking & eating and marketing qualities	• Same as in productivity and production enhancement	• Same as in productivity and production enhancement • In addition varieties are screened for keeping, processing, physical, sensory, nutritional, medicinal, cooking & eating and marketing qualities
4. Assurance of the continuous availability of quality breeder seed and basic planting materials in adequate quantities	• To continuously supply genetically purified breeder seeds and/or basic planting material of the recommended varieties	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother plants

Objectives, Strategies and Activities for Major Priority (Thrust) Areas for Improvement in each Crop Category

Table 2. Objectives, Strategies and Activities for Major Priority (Thrust) Areas for improvement in each Crop Category.

Rice

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To conserve and utilize available germplasm • To widen the existing genetic base • Creation of new genetic variation wherever possible • Characterization of available germplasm as far as possible • Prevention of genetic vulnerability • To identify novel genes for useful traits • To introduce novel exotic germplasm	• Continue exploration and preservation of the natural genetic variation • Continue introduction of exotic germplasm safely • Improve collaboration between plant breeders and Plant Genetic Resource Centre in utilisation of plant genetic resources • Mutation breeding and make use of soma clonal variation • phenotyping of genetic resources for useful traits (yield, other agronomic traits, reaction to biotic and abiotic stresses).	• Exploration of germplasm • *In-situ* and *ex-situ* conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm • Utilization of germplasm • Use of sequence data from IRRI or other genomic studies • Gene mapping and Tagging • Marker identification and MAS. • Plan and implement introduction of exotic germplasm
2. Productivity and production enhancement through genetic improvement	• To develop rice varieties with desirable characteristics for favorable environments • To improve the potential yield of improved varieties of different maturity groups (2½,3,3½ and 4months) based on farmer demand • To improve 5-6 month rice varieties for flood prone areas in LCWZ • To develop widely adaptable rice varieties to reduce the gap between	• Use of conventional breeding techniques • Use of hybrid rice technology • Application of biotechnological tools • Gene pyramiding • Development of New Plant Type • Use of super rice technology (Hybrid on New plant) • Use of mutation breeding and wide	• Wide hybridization, screening, hybridization followed by selection and evaluation • Use of mutational breeding techniques to improve traditional varieties • Heterosis breeding • Use of MAS, MABB and tissue culture techniques such as anther culture and embryo rescue

	actual farmer-level and potential yields • To improve horizontal resistance for pests and diseases (GM, BPH, Sheath mite, Blast, BLB& Brown Spot) • To develop rice varieties suitable for unfavorable environments • To raise the potential yield of the improved varieties at least by about 20% of the present level under stress conditions • To develop different ideotypes with tolerance to abiotic stresses (heat, cold, drought, flood, iron toxicity, salinity, acidity and anaerobic condition) for different regions • To incorporate multiple/horizontal resistances for pests and diseases to new improved rice varieties	hybridization • Testing improved varieties in multi-locational yield trials and use of efficient analysis methodologies to select better varieties • Development of region specific videotapes • Development of climate smart varieties	• Pyramiding genes for biotic stresses • Evaluation and maintenance of parental stock including traditional, existing, and exotic germplasms • Conducting multi-locational yield trials and use latest methodologies to analyze G X E interaction
3. Development of suitable varieties with high grain quality for the local rice industry and for the export market	• To fulfill the local industrial and export market demands • To improve varieties with high grain quality attributes (milling, keeping, sensory, nutritional and medicinal properties) • To minimize the post- harvest losses	• As same as in productivity and production enhancement • Local (eg. Suduru Samba, Suwanda samba, Puwak mal eta samba, Unakola samba) and exotic varieties with high grain quality attributes will be used as parents for hybridization • Identification of varieties having lower damages from storage pest and incorporate these characteristics to improved varieties	• Wide hybridization, screening for grain quality attributes, hybridization followed by selection and evaluation • Use of mutational breeding techniques to improve traditional varieties • Use of MAS, MABB and tissue culture techniques such as anther culture and embryo rescue • Pyramiding genes for grain quality characteristics

4. Assurance of the continuous availability of quality breeder seed of recommended varieties	• To continuously supply genetically purified breeder seeds of the recommended varieties in adequate quantities	• Conventional methods • Hybrid seed production technology	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of parental lines of hybrids

Table 2. Continued

Maize

Thrusts	Objectives	Strategies	Activities
• Productivity and production enhancement through genetic improvement • Development of suitable varieties with high grain quality	• Development of maize varieties with desirable agronomic traits for irrigated and rain fed conditions • To increase the potential yield under ▪ favorable conditions- 8 t/ha ▪ moisture stressed conditions-5-6 t/ha • To develop early maturing varieties (less than 3 months) and short plant type resistant to mechanical damages • To improve existing Open Pollinated varieties • To incorporate multiple resistance genes for biotic (Stem borer, Sheath blight) and abiotic (extreme moisture stress & heat tolerance)stresses • To improve nutrient use efficiency, lodging resistance and plant type. • To incorporate desirable grain and nutritional quality (quality protein and oil content)	• Use of conventional breeding techniques • Use of hybrid technology • Application of molecular and mutation breeding techniques. • Testing improved varieties in multi-locational yield trials and use of efficient analysis methodologies to select better varieties • Development of climate smart varieties	• Conventional breeding techniques; viz. screening for desirable traits, hybridization followed by selection and evaluation • Heterosis breeding • Development of inbred lines and making crosses among them to produce hybrid combinations • MAS for biotic & abiotic stresses • Evaluation and maintenance of parental stock including traditional, existing, and exotic germplasms • Screening available germplasm for desirable traits • Conducting multi-location yield trials and use latest methodologies to analyze G X E interaction

• Assurance of the continuous availability of quality breeder seed of recommended varieties	• To continuously supply genetically purified high-quality breeder and nucleus seed in sufficient quantities	• Conventional methods • Hybrid seed production technology	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of parental lines of hybrids

Table 2. Continued

Finger Millet

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and grain quality enhancement through genetic improvement	• Development of Finger millet varieties with desirable characteristics suitable for irrigated and rain fed conditions. • To increase the potential yield under ▪ favorable conditions - 4 t/ha ▪ moisture stressed conditions - 2 t/ha • To develop varieties with short maturity duration (less than three months) • To develop varieties with synchronized maturity • To incorporate multiple resistant genes for biotic and abiotic stresses • To incorporate desirable grain quality characteristics and nutritional quality	• Use of conventional breeding techniques • Mutation breeding approaches • Gene pyramiding • Testing improved varieties in multi-location yield trials and use of efficient analysis methodologies to select better varieties • Development of climate smart varieties	• Conventional breeding techniques; viz. pure line selection, hybridization and selection • Evaluation and maintenance of parental stock including traditional, existing and exotic germplasms • Screening available germplasm for desirable traits • Conducting multi-location yield trials and use latest methodologies to analyze G X E interaction
2. Assurance of the continuous availability of quality breeder seed of recommended varieties	• To continuously supply genetically purified high-quality breeder seed in sufficient quantities	• Conventional techniques	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection

Table 2. Continued

Grain Legumes (Green gram, Black gram, Soybean, Cowpea)

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and grain quality enhancement through genetic improvement	• Development of grain legumes (Mung bean, black gram, Soy Bean, Cowpea) varieties with desirable characteristics for favorable and unfavorable environments. • To increase the yield potential ▪ Mung bean- above 2.5 t/ha ▪ Black gram-above2.5t/ha ▪ Soy bean-above4 t/ha ▪ Cowpea-above2.5 t/ha • To develop early/medium/long maturing varieties ▪ Mung bean- <60 days ▪ Blackgram <60 days ▪ Soybean </= 90 days ▪ Cowpea <60 days, 90 days • To develop grain quality (seed size, color and appearance, hard seed<1%/ synchronized maturity for Mung bean) • To develop widely adaptable	• Use of conventional breeding techniques • Application of biotechnological tools • Application of mutation breeding techniques • Introduction of useful exotic germplasms for varietal improvement • Gene pyramiding • Defining idiotypes for different environments • Testing improved varieties in multi-locational yield trials and use of efficient analysis methodologies to select better varieties	• Conventional breeding techniques; viz. screening for desirable traits, hybridization followed by selection, evaluation and backcross breeding • Molecular marker assisted selection and mutation techniques • Maintenance of existing germplasm including traditional cultivars • Conducting multi-locational yield trials and use latest methodologies to analyze G × E interaction

	varieties over diverse environments • To incorporate multiple resistance genes for pest and disease resistance ▪ Cowpea – Collar rot, YMV, Bruchids ▪ Mung bean – YMV, BND, Bruchids, ▪ Black gram – YMV ▪ Soybean - Purple Stain • To develop varieties for value addition		
2. Maintenance of genetic purity and making availability of breeder seeds of recommended varieties	• To continuously supply genetically purified breeder seed in adequate quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection

Table 2. Continued

Condiments

Chilies

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and pod quality enhancement through genetic improvement	• Development of chili varieties with desirable traits suitable for irrigated and rain fed conditions **Irrigated** ▪ Hybrids: >40 t/ha–(Green chili) and above 4 t/ha (Dry Chili) ▪ OPV:- 25 t/ha - (Green chili) and above 2.5 t/ha-(Dry Chili) **Rain fed** ▪ Hybrids:->20 t/ha - (Green chili) and above 2 t/ha-(Dry Chili) ▪ OPV:- 10 t/ha - (Green chili) and above 1 t/ha-(Dry Chili) • To develop resistance /tolerance to major diseases in chili; ▪ Chili Leaf Curl Virus ▪ Cucumber Mosaic Virus ▪ Tomato Spotted Wilt Virus ▪ Anthracnose ▪ *Cercospora* Leaf Spot ▪ Fungal Wilt • To develop chili varieties for unfavorable eco-systems; ▪ Moisture stress ▪ High temperature	• Use of conventional breeding techniques • Use of hybrid variety technology • Application of biotech. Tools & mutation breeding techniques • Introduction of useful exotic germplasm for varietal improvement • Enhancing hybrid seed yield • Gene pyramiding • Defining idiotypes for different environments • Testing improved varieties in multi-location yield trials and use of efficient analysis methodologies to select better varieties	• Conventional breeding techniques; viz. screening for desirable traits, hybridization followed by selection and evaluation and backcross breeding • Heterosis breeding • Molecular marker assisted selection and mutation technique • Maintenance of parental stock including existing germplasm and traditional cultivars • Application of new emasculation and pollination techniques • Conducting multi-location yield trials and use latest methodologies to analyze G X E interaction

	• To develop Chili varieties suitable for green chili/dry chili/industrial purposes (Capsaicin, oleoresins, pigments)		
2. Maintenance of genetic purity and making availability of Breeder seed of recommended varieties	• To continuously supply genetically purified breeder seed in adequate quantities	• Conventional methods • Hybrid seed production technology	• Maintenance of parental lines of hybrids • Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection

Table 2. Continued

Onion (Red and Big Onion)

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and bulb quality enhancement through genetic improvement	• Development of Cluster and Big onion varieties with desirable agronomic and bulb quality characteristics • To increase the yield potential up to 20t/ha for Cluster onion and 40 t/ha for Big onion • To develop early maturing (< 3 Months) varieties in both types • To develop bulb quality (Size, long storability, less sprouting / rotting, pungent, and high dry matter content) in both types • To develop well adapted varieties suitable for diverse environments and management conditions to reduce the gap between farmer and potential yield • To incorporate multiple resistance genes for pests (Thrips, Bulb mites) and diseases (Anthracnose, Purple blotch,) • To develop varieties. with high true seed production ability	• Use of conventional breeding techniques • Use of hybrid technology • Application of biotechnological tools • Application of mutation breeding techniques • Gene pyramiding • Testing improved varieties in yield trials over varying environmental and management conditions in farmers' fields and use of efficient analysis methodologies to select better varieties	• Conventional breeding techniques • Development of F1 hybrids for Heterosis breeding and clonal propagation of improved varieties of Cluster and Big onions • Maintenance of existing germplasms including local and introduced germplasm l • Introduction of useful exotic germplasm for varietal improvement • Screening available germplasm for desirable traits • Conducting multi-location yield trials in farmers' fields and use latest methodologies to analyze G× E interaction

2. Maintenance of genetic purity and making availability of breeder seeds of recommended varieties	• To continuously supply genetically purified breeder seeds in adequate quantities	• Conventional methods • Hybrid seed production technology	• Maintenance of parental lines of hybrids • Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection

Table 2. Continued

Oil Crops (Groundnut, Sesame, Sunflower)

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and seed quality (oil quality) enhancement through genetic improvement	• Development of oil crops(Ground nut, Sesame) varieties with high yield potential & well adapted to local cropping systems • To increase the yield potential of: ▪ Ground nut- >5 t/ha ▪ Sesamme->2t/ha • To develop early maturing (3 Months) Ground nut varieties well adapted to rain-fed condition • To develop early maturing (<3 Months) white / black seeded sesame varieties with determinate growth habit • To develop varieties tolerant to biotic (Groundnut- Collar rot, BND, *Aflatoxin* and Sesame-Foot rot, Phyllody) and abiotic (drought for both crops) stresses • To improve the seed, oil content and quality characteristics for various industrial needs • To develop seed quality characteristics -Seed size, shape, oil content etc.	• Use of conventional breeding techniques • Application of biotechnological tools • Introduction of useful exotic germplasm for varietal improvement • Application of mutation breeding techniques • Gene pyramiding • Testing improved varieties in multi-vocational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Conventional breeding techniques; viz. screening, hybridization followed by selection using phenotypic and molecular markers and evaluation& backcross breeding • Application of mutation technique • Maintenance of existing parental stock including introduced and traditional cultivars • Screening available germplasm for desirable traits • Conducting multi-location yield trials and use latest methodologies to analyze G ×E interaction

3. Maintenance of genetic purity and making availability of breeder seeds of recommended varieties	• To continuously supply genetically purified breeder seeds in adequate quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection

Table 2. Continued

Fruit Crops

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and fruit quality enhancement through genetic improvement.	• Development of major and underutilized fruit varieties with desirable characteristics • To achieve the potential Annual yield of ▪ Mango: >35 t/ha ▪ Papaya (OP): >35t/ha ▪ Papaya (Hybrid): >55t/ha ▪ Banana: 30t/ha ▪ Passion fruit: >20t/ha ▪ Orange: >17t/ha ▪ Mandarin: ▪ Guava: >40 t/ha ▪ Sour sap: >16t/ha ▪ Durian: 200 – 220 fruits/tree ▪ Rambutan: >35t/ha ▪ Grapes: >111t/ha • To develop resistant varieties to biotic and abiotic stresses • To improve quality (keeping, eating and nutritional) of the fruits depending on the crop	• Use of conventional breeding techniques • Creation of new genetic variation through mutation and wide hybridization • Use of biotechnology • Gene pyramiding • Testing improved varieties in multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Introduction • Hybridization and selection • Evaluation & selection of germplasm for improved characteristics • Mutation breeding /tissue culture techniques • Finger printing and MAS • Screening of germplasm for pest and disease resistance; ▪ Panama disease of Banana ▪ PRSV of Papaya ▪ Mottle virus of Passion fruit ▪ Powdery Mildew Disease of Rambutan and other major pest and diseases • Screening of germplasm for quality characteristics; appearance, keeping quality, transportability, nutritional and medicinal properties, processing qualities and taste • Conducting multi-location yield trials and use latest methodologies to analyze G × E interaction

2. Maintenance of genetic purity and making availability of breeder seeds and basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seed and basic planting materials in sufficient quantities	• Conventional techniques • Hybrid seed production technology	• Confirmation of variety characteristics • Maintenance of parental lines of hybrids • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Fruit Crop priorities for Genetic Improvement

Priority 1. Papaya, Pineapple, Mango, Orange/ Mandarin, Banana, Guava, passion fruit, Pomegranate,

Priority 2. Melon, Strawberry, Sour sop, Avacado, Rambutan, Pear, Grapes, Durian

Priority 3. Mangoosteen, Longon, Woodapple, Beli, Lime, Jack Fruit, Apple and Other Underutilized Crops

Table 2. Continued.

Root and Tuber crops (Sweet Potato and Cassava)

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and tuber quality enhancement through genetic improvement	• Development of varieties with high yield and other desirable characteristics • To increase the potential yields of; ▪ Sweet potato:- > 30t/ha ▪ Cassava:- >50t/ha ▪ Yams :- >50t/ha • To develop resistant varieties to biotic and abiotic (heat and drought) stresses • To improve quality of tubers (appearance, keeping quality, transportability, composition, taste, nutritional quality and functional properties)	• Use of conventional breeding techniques • Creation of new genetic variation through mutation and somaclonal variation • Use of biotechnological tools • Testing improved varieties in multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Introduction • Evaluation & selection of germplasm for improved characteristics (yield and yield attributes/plant architecture, tuber quality, biotic and abiotic stresses) • Mutation breeding /tissue culture techniques • Finger printing and MAS • Screening varieties/lines for resistance to biotic stresses: ▪ Sweet Potato- weevil ▪ Innala- Nematodes ▪ Cassava- Cassava Mosaic virus • Screening verities/lines for resistance to abiotic stresses • Screening for Salinity tolerance in Sweet Potato and Innala • Nutrient use efficiency and low heavy metal uptake ability • Screening varieties/lines for tuber quality characteristics (appearance, keeping quality, transportability, nutritional and medicinal qualities,

			processing qualities and taste) • Conducting multi-location yield trials and use latest methodologies to analyze G × E interaction
2. Maintenance of genetic purity and making availability of basic planting materials of recommended varieties	• To continuously supply high-quality genetically purified basic planting materials in sufficient quantities	• Conventional techniques/Tissue culture techniques	• Confirmation of variety characteristics • Maintenance of mother stocks

Table 2. Continued.

Root and Tuber crops: Potato

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and potato quality enhancement through genetic improvement	• Development of varieties with high yields and other desirable characteristics • To increase the potential yields above 25 t/ha • To develop resistant varieties to biotic and abiotic stresses • To improve potato quality (appearance, keeping quality, transportability, composition, taste, nutritional and functional properties)	• Use of conventional breeding techniques • Creation of new genetic variation through mutation and wide hybridization • Use of biotechnological tools • Testing improved varieties in multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Introduction • Evaluation & selection of germplasm for improved characteristics (yield and yield attributes/plant architecture, tuber quality, biotic and abiotic stresses) • Mutation breeding /tissue culture techniques • Finger printing and MAS • Screening of varieties/lines for resistant to biotic stresses; ▪ *Late Blight* ▪ *Bacterial wilt* ▪ *Powdery scab* ▪ *Potato cyst nematode* • Screening of verities/lines for tolerance to heat stress, nutrient use efficiency and low heavy metal up taking ability • Screening of varieties/lines for tuber quality characteristics; appearance, keeping quality, transportability, nutritional qualities, and taste • Conducting multi-location yield trials and use latest methodologies to analyze G × E interaction

2. Maintenance of genetic purity and making availability of basic planting materials of recommended varieties	• To continuously supply high-quality pre basic and basic planting materials in sufficient quantities	• Conventional and tissue culture techniques	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Table 2. Continued

Vegetables

Thrusts	Objectives	Strategies	Activities
1. Productivity, production and product quality enhancement through genetic improvement	• Development of vegetable varieties with desirable characteristics • To increase the potential yield of; ▪ Bean:- >25 t/ha ▪ Tomato:- >40 t/ha ▪ Pumpkin:->35 t/ha ▪ Okra ->25t/ha ▪ Urinal: >40 t/ha ▪ Yard long bean:- >25 t/ha ▪ Life: >25 t/ha ▪ Bitter gourd:- >25 t/ha ▪ Cucumber:- >30 t/ha ▪ Snake gourd:- >25t/ha ▪ Wing Bean -: >30t/ha ▪ Mushroom >300g/bag ▪ Leafy vegetables:- >25 t/ha ▪ Carrots: >25 t/ha ▪ Radish: >20 t/ha ▪ Other Traditional Vegetables at least 20% above the present level	• Use of conventional breeding techniques • Creation of new genetic variation through mutation and wide hybridization • Use of hybrid variety development technology • Use of biotechnological tools • Testing improved varieties in multi-locational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Introduction of exotic germplasm • Hybridization and selection (Open Pollinated varieties and pure lines) • Heterosis breeding • Evaluation & selection of germplasm for improved characteristics (yield and yield attributes/plant Architecture, product quality, biotic and abiotic stresses) • Mutation breeding • Tissue culture techniques • Finger printing and MAS • Screening of varieties/lines for resistance to biotic stresses; ▪ Bean: -Yellowing ▪ Tomato:- Bacterial wilt, Blight and Viruses ▪ Pumpkin and Okra:- Virus ▪ Urinal: Little leaf, Bacterial wilt and Shoot and Pod borer ▪ Yard Long bean:- Collar rot ▪ Luffa/ Bitter gourd:-Yellowing and Downy mildew

	• To develop resistant varieties to biotic and abiotic (heat and drought) stresses • To improve product quality of vegetables (appearance, keeping quality, transportability, composition, taste, and nutritional and functional properties)		▪ Leafy vegetable (Gotukola and Mukunuvanna):- Nematodes ▪ Other common major pest and diseases • Screening of varieties/lines for resistance to abiotic stresses; ▪ Heat tolerance for brinjal, beans, tomato, okra, luffa, yard long bean and Thumbakarawila ▪ Drought tolerance for brinjal, capcicum and Thumbakarawila • Testing for Nutrient use efficiency • Development of varieties/lines for product quality characteristics; appearance, keeping quality, transportability, nutritional and medicinal properties, taste and low heavy metal content • Conducting multi-location yield trials and use latest methodologies to analyze G × E interaction
2. Maintenance of genetic purity, making availability of breeder seeds & basic planting materials of recommended varieties	• To continuously supply genetically purified high-quality breeder seeds and basic planting materials in sufficient quantities	• Conventional and tissue culture techniques • Hybrid seed production techniques	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Vegetable Crop priorities for Genetic Improvement

Priority 1: Bean, Tomato Pumpkin, Okra Capsicum, Brinjal, Yard long bean,

Priority 2: Luffa, Bitter gourd, Thumbakarawila, Cucumber, Snake gourd, Wing Bean, Mushroom, Leafy vegetables

Priority 3: Carrots, Radish and other Traditional Vegetables (Murunga, Thibbatu, Elabatu, Cluster bean,)

Table 2. Continued

Ornamentals and Flowers

Thrusts	Objectives	Strategies	Activities
1. Productivity and Product quality enhancement through genetic improvement .	• Development of ornamental flower varieties with enhanced flower productivity and desirable flower quality characteristics (appearance, keeping quality, transportability) • To develop varieties with diverse floral characteristics (Anthurium, Orchids and other Ornamentals) • To develop Foliage varieties in diverse color, shape, size, novelties etc., • To develop varieties, resistant to biotic and abiotic stresses	• Use of conventional breeding techniques • Creation of new genetic variation through mutation breeding, Ploidy manipulation, somaclonal variation and wide hybridization • Use of biotechnological tools	• Introduction of exotic varieties • Hybridization and selection • Evaluation & selection of germplasm for improved characteristics (/plant architecture, product quality, tolerance to biotic and abiotic stresses) • Mutation breeding /tissue culture techniques • Screening of varieties/lines for resistance to biotic stresses • Development of varieties/lines for resistance to abiotic stresses; ▪ Heat tolerance ▪ Drought tolerance • Screening varieties for nutrient use efficiency • Screening of varieties/lines for product quality characteristics; appearance, keeping quality, transportability • Finger printing and MAS

2. Maintenance of genetic purity and making availability of breeder seeds and basic planting materials of recommended varieties	2. To continuously supply genetically purified high-quality breeder seeds and basic planting materials in sufficient quantities	• Conventional techniques/Tissue culture techniques • Hybrid seed production techniques	• Confirmation of variety characteristics • Maintenance of parental lines of hybrids • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Table 2. Continued

Export Agricultural Crops

Spice and Beverage Crops

Cinnamon

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purposes • To expand genetic diversity	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation to prevent genetic vulnerability for crop improvement	• Exploration, conservation and characterisation of germplasm • Introduction • Mutaion breeding
2. Productivity and production enhancement through genetic improvement	• Increasing variety yield potential, product quality and reduction of cost of cultivation To increase productivity: Dry quills> 1000 kg/ha/annum and oil content > 3%) • To develop varieties with resistance/ tolerance to biotic (stem borer, root borer, Leaf Gall, Rough bark) and abiotic (drought) stresses • To develop varieties with desirable agronomic traits • To develop varieties suitable for mechanical peeling and synchronized harvesting	• Use of conventional plant breeding technologies • Development of region specific idiotypes • Testing improved varieties in multi-locational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Selection from open pollinated populations • Hybridization and selection • MAS and QTL • Screening of varieties/lines for resistance to biotic and abiotic stresses • Conducting multi-locational yield trials and use latest methodologies to analyze G × E interaction

	• To Improve yield stability over locations and seasons		
3. Maintenance of genetic purity and making availability of breeder seeds and basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seeds/basic planting materials in sufficient quantities	• Conventional methods • Tissue culture techniques if available	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Table 2. Continued

Black Pepper

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purpose • To expand genetic diversity	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation to prevent genetic vulnerability for crop improvement	• Exploration, conservation and characterization of germplasm • Introduction of exotic germplasm • In-situ and ex-situ conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm
2. Productivity, production and product quality enhancement through genetic improvement	• Increasing varietal yield potential, and product quality and reduction of cost of cultivation • To increase productivity; ▪ Dry pepper:- > 2500 kg/ ha per annum ▪ Oil content:-> 3% and ▪ Oleoresin content:- >15% • To develop varieties with resistance / tolerance to biotic and abiotic stresses(viral diseases and drought, Slow & quick yellowing disease and little leaf disease) • To develop varieties with desirable agronomic traits(yield stability and seasonal bearing) • To develop varieties with synchronized flowering	• Use of conventional plant breeding technologies • Application of biotechnological tools and tissue culture techniques • Mutation breeding • Development of region specific idiotypes • Testing improved varieties in multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties • Area wise quality testing for Black Pepper	• Hybridization and selection • MAS and QTL • Conducting multi-locational yield trials and use latest methodologies to analyze G X E • Adopting mutation and innovative breeding methods • Screening of germplasm for Oil, Oleorasin, Piperin and bulk density • GC – MSMS

	• To develop varieties without alternative bearing • To develop varieties with wider adaptability • Identification of area specific variation of the quality of Black pepper • Fixing Geographical Index (GI) for specific qualities		
3. Maintenance of genetic purity and making availability of breeder seeds and basic planting materials of recommended varieties	• To continuously supply genetically-purified breeder seed/basic planting materials in sufficient quantities	• Establishment of mother vines gardens • Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Table 2. Continued

Cardamom

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purpose • To expand genetic diversity	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation to prevent genetic vulnerability for crop improvement	• Exploration, conservation and characterization of germplasm • Introduction of germplasm • In-situ and ex-situ conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm
2. Productivity, production and product quality enhancement through genetic improvement	• Increasing variety yield potential and product quality and reduction of cost of cultivation • To increase productivity; ▪ Yield:- > 750 kg/ha/annum ▪ Oil content > 2.5% • To develop varieties with resistance/ tolerance to biotic and abiotic stresses • To develop varieties with desirable agronomic traits(adaptability to low elevations, synchronized harvesting)	• Use of conventional plant breeding technologies • Application of biotechnological tools and tissue culture techniques • Mutation breeding • Development of region specific idiotypes • Testing improved varieties in multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Selection from existing natural populations • Hybridization and selection • MAS and QTL • Conducting multi-location yield trials and use latest methodologies to analyze G X E • Screening germplasms for Oil, Oleoresin, Piper in and bulk density

3. Maintenance of genetic purity and making availability of breeder seeds/basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seeds/ basic planting materials in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Table 2. Continued

Coffee

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purpose • To expand genetic diversity	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation to prevent genetic vulnerability for crop improvement	• Exploration, and conservation of germplasm • Introduction of germplasm • In-situ and ex-situ conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm
2 Productivity, production and product quality enhancement through genetic improvement	• Increasing variety yield potential, improving product quality and reduction of cost of cultivation • To increase productivity; ▪ yield > 3000 kg/ha/annum • To develop varieties with resistance/ tolerance to biotic and abiotic stresses • To develop varieties with desirable agronomic traits (adaptability to different climates, synchronized harvesting and crop stability over seasons)	• Use of conventional plant breeding technologies • Application of biotechnological tools and tissue culture techniques • Mutation breeding • Development of region specific idiotypes • Testing improved varieties in multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties • Area wise quality testing for Arabica coffee	• Hybridization and selection • MAS and QTL mapping • Evaluation of varieties for general and specific adaptability over diverse environments by analysing G × E interaction • Quality testing for aroma and cup taste • Screening of germplasm for biotic and abiotic stresses

	• Identification of area specific variation of the quality of Arabica coffee • Fixing Geographical Index (GI) for specific qualities		
2. Maintenance of genetic purity and making availability of breeder seeds/basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seeds/basic planting material in sufficient quantities	• Conventional breeding methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother stocks

Table 2. Continued

Cocoa

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purposes • To expand genetic diversity	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation to prevent genetic vulnerability for crop improvement	• Exploration and, conservation of germplasm • Introduction of germplasm • In-situ and ex-situ conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm •
2. Productivity, production and product quality enhancement through genetic improvement	• Increasing variety yield potential, improving product quality and reduction of cost of cultivation • To increase productivity; ▪ Yield:- >2500 kg/ha/annum ▪ Butter fat content :-> 50%) • To develop varieties with resistance/ tolerance to biotic and abiotic stresses • To develop varieties with desirable agronomic traits (synchronized harvesting and yield stability)	• Use of conventional plant breeding technologies • Application of biotechnological tools and tissue culture techniques • Mutation breeding • Development of region specific idiotypes • Testing improved varieties in multi-locational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Hybridization and selection • MAS and QTL mapping • Evaluation of varieties for general and specific adaptability over diverse environments by analysing G × E interaction • Variety screening for reaction to biotic and abiotic stresses • Variety screening for product quality parameters

3. Maintenance of genetic purity and making availability of breeder seeds/basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seeds/basic planting material in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother plants

Table 2. Continued

Betel

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purpose • To expand genetic diversity	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation to prevent genetic vulnerability for crop improvement	• Exploration and conservation of germplasm • Introduction of germplasm • In-situ and ex-situ conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm
2. Productivity, production and product quality enhancement through genetic improvement	• Increasing variety yield potential, improving product quality and reduction of cost of cultivation • To increase productivity; ▪ Yield > 3000 kg/ha/annum • To develop varieties with resistance/ tolerance to biotic and abiotic stresses • To develop varieties with desirable agronomic traits(adaptability to different climates, synchronized harvesting and crop stability)	• Use of conventional plant breeding technologies • Application of biotechnological tools and tissue culture techniques • Mutation breeding • Development of region specific idiotypes • Testing improved varieties in multi-locational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Hybridization and selection • MAS and QTL mapping • Evaluation of varieties for general and specific adaptability over diverse environments by analysing G × E interaction • Variety screening for reaction to biotic and abiotic stresses

3. Maintenance of genetic purity and making availability of breeder seeds/basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seeds/basic planting material in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother plants

Table 2. Continued

Other Export Agricultural crops

Clove, Nutmeg, Citronella, Vanilla, Lemongrass, Turmeric, Ginger, Garcenia, Areca & Kitul

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purposes • To expand genetic diversity.	• Conservation of the natural genetic variation and make it accessible for utilization • Creation of genetic variation	• Exploration and conservation of germplasm • Introduction of exotic germplasm • In-situ and ex-situ conservation of germplasm • Evaluation, characterisation and cataloguing of germplasm
2. Maintenance of genetic purity and making availability of breeder seeds/basic planting materials of recommended varieties	• To continuously supply genetically purified breeder seeds/basic planting material in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant and progeny selection • Maintenance of mother plants

Export Agricultural crop priorities

Priority 1: Black Pepper, Cinnamon, Coffee, Cocoa, Cardamom

Priority 2: Betel, Citronella, Ginger, Areca nut, Clove, Nutmeg, Garcenia

Priority 3: Lommon Grass, Kithul, Vanilla, Turmeric

Table 2. Continued

Plantation Crops

Tea

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purposes • To expand genetic diversity	• Conservation of the existing genetic variation and make it accessible for utilization • Introduction/multiplication of exotic germplasm • Assembling of core collection to facilitate managerial aspects of *ex-situ* germplasm	• Exploration and In-situ and ex-situ conservation of germplasm • Field establishment and maintenance of germplasm • Morphological, Biochemical & molecular characterization of germplasm • Evaluation of germplasm for utilization of conserved material in the breeding programs
2. Productivity, production and product quality enhancement through genetic improvement	• Development of tea cultivars with desirable characteristics for different agro-climatic regions • To increase the potential yield (kg made tea /ha/annum); - above 4500 -Up country - above 5000 -Mid country - above 4000 -Uva - above 6000 –Low country - • To develop cultivars for diverse agro-ecological zones with high general	• Use of conventional breeding techniques • Use of in-vitro techniques to supplement the conventional breeding program • Use of Molecular breeding techniques • Use of early screening methods • Identification of segregating pattern of biochemical compounds • Identification of region specific cultivars • Testing improved clones in multi-locational	• Utilization of characterized and evaluated germplasm in varietal development • Hybridization and selection • Embryo culture, Embryo rescue • Micro propagation, Cryopreservation • DNA fingerprinting, MAS and QTL mapping, gene expressions • Use of biotechnological, biochemical

	adaptability within zones • To develop cultivars tolerant to major biotic and abiotic stresses • To shorten the breeding cycle • To identify bi- and ploy clonal seeds having commercial yields of 2500 kg made tea/ha/annum for drought prone and low productive areas in different tea growing regions • To develop cultivars giving high quality end-product that meet the demand of the end-user locally and internationally	yield trials over diverse environments and use of efficient analysis methodologies to select better varieties • Establishment of Bi and Poly clonal seed gardens	&molecular techniques • Genotyping and Gene Mapping Isotope signature, DNA barcode • Screening germplasm for desirable characteristics • Conducting multi-locational yield trials and use latest methodologies to analyze G X E • Evaluation of bi and polyclonal seeds for desirable traits • Evaluation for biochemical compounds, organoleptic and health promoting properties • Genotyping and Transcriptome analysis
3. Maintenance of genetic purity and making availability of basic planting materials/breeder seed of recommended varieties	• To continuously supply genetically purified basic planting material/breeder seed in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant selection • Maintenance of mother plants

Table 2. Continued

Rubber

Thrusts	Objective	Strategy	Activities
1. Genetic resource management and utilisation	• To make availability of germplasm for breeding purposes • To expand genetic diversity	• Conservation of the existing genetic variation and make it accessible for utilization • Introduction/multiplication of exotic germplasm • Assembling of core collection to facilitate managerial aspects of *ex-situ* germplasm	• Exploration and In-situ and ex-situ conservation of germplasm • Field establishment and maintenance of germplasm • Morphological & molecular characterization of germplasm • Evaluation of germplasm for utilization of conserved material in the breeding programs • Multilateral and bi lateral clone exchange
2. Productivity, production and product quality enhancement through genetic improvement	• Development , of high yielding *Hevea* clones with desirable secondary characteristics for commercial cultivation • To increase the productivity (above 3500 kg /ha/year of latex yield) and reduce the cost of cultivation and production • To develop clones for non-traditional *Hevea* growing areas (climate-smart *Hevea* cultivations) • To shorten the breeding cycle • To develop clones tolerance to foliar	• Use of conventional breeding techniques • To develop clones for diverse agro-ecological zones • Strengthen of early selection procedure • Use of Molecular breeding techniques • Identification of region specific cultivars • Testing improved clones in multi-locational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Utilization of characterized and evaluated germplasm in varietal development • Hybridization and selection • DNA fingerprinting, MAS and QTL mapping, gene expressions • Screening germplasm for desirable characteristics • Conducting multi-location yield trials and use latest methodologies to analyze G X E interaction • Identification of parameters for early selection through conventional and

	diseases and tapping panel dryness • To develop clones with improved latex properties		biotechnological approaches
3. Maintenance of genetic purity and making availability of basic planting materials/breeder seed of recommended varieties	• To continuously supply genetically purified basic planting material/breeder seed in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant selection • Maintenance of mother plants

Table 2. Continued

Coconut

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilisation	▪ Widening, Conservation and maintenance of coconut genetic resources • To utilize the conserved genetic materials in coconut improvement programme	Conservation of the existing genetic variation and make it accessible for utilization Introduction/multiplication of exotic germplasm	• Exploration and in-situ and ex-situ conservation of germplasm • Field establishment and maintenance of germplasm • Morphological, Biochemical & molecular characterization of germplasm • Evaluation of germplasm for utilization of conserved material in the breeding programmes
2. Productivity and production enhancement through genetic improvement	• Development of coconut cultivars with desirable characteristics for commercial cultivation • To increase the yield potential (above 22,000 nuts /ha/Yr and /or above 3000 million nuts per year) • To develop early-maturing cultivars (<3 yrs) • To develop cultivars for diverse agro-ecological zones. • To develop cultivars tolerant to *Aceria* mite	• Use of conventional breeding techniques • Use of Biotechnological tools • Testing improved clones in multi-locational yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Utilization of characterized and evaluated germplasm in varietal development • Hybridization and selection • Screening of conserved material for desirable traits • MAS and QTL mapping • Anther culture, Embryo culture • Evaluate/improve cultivars for beverage purposes • Genotyping and Transcriptome

	• To develop cultivars resistant to Weligama Coconut Leaf Wilt Disease • To develop cultivars tolerant to moisture/heat stress • To develop cultivars for short stature and limited space • To develop new cultivars for beverage purposes		analysis • DNA fingerprinting, MAS and QTL mapping, gene expressions • Conducting multi-locational yield trials and use latest methodologies to analyze G X E interaction
3. Maintenance of genetic purity and making availability of breeder seed of recommended varieties	• To continuously supply genetically purified breeder seed in sufficient quantities • Increasing the capacity of seed gardens to meet the demand for genetically improved high quality seed-nuts of coconut	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant selection • Maintenance of mother plants • Seed production in "Isolated seed gardens" by directed natural pollination • Artificial hand pollinations

Table 2. Continued

Sugarcane

Thrusts	Objectives	Strategies	Activities
a. Genetic resource management and utilisation	• Conservation of crop biodiversity • To enrich and utilize genetic diversity • Development of improved new sugarcane varieties for commercial cultivation	• Introduction/multiplication of exotic germplasm • Preservation of the natural genetic variation • Creation of genetic variation to prevent genetic vulnerability in crop improvement	• Exploration and in-situ and ex-situ conservation of germplasm • Field establishment and maintenance of germplasm • Evaluation of germplasm for cane yield components, sugar and fiber contents and with resistance to smut, leaf scald and white leaf diseases for development of core-collections for directional breeding • Characterization of germplasm (morphologically and molecular biologically for development of germplasm catalogue)
2. Productivity and production enhancement through genetic improvement including reduction in cost of cultivation	• High cane and sugar yields (to improve cane potential yield up to 150 t/ha and sugar potential yield up to 18 t/ha in the irrigated sector and cane potential yield up to 80 t/ha and sugar potential yield up to 10 t/ha in the rain-fed area) • To develop varieties with good ratoonability • To develop varieties with good milling qualities • To develop varieties with high fibre (17%) content for power co-generation	• Use of conventional breeding • Nobilisation of wild cane species • Tissue culture and mutation breeding • Biotechnological approaches • Increasing yield stability • Increasing fertilizer use efficiency • Testing improved clones in	• Hybridization and selection, Evaluation of Introductions and Local collection • Development of core-collections for inbreeding, population improvement, directional breeding and recurrent selection • Family and progeny selection • Screening for pest and disease resistance • Conducting multi-location yield trials and use latest methodologies to analyze G x E interaction Exploitation of somaclonal variation and mutants

	• To develop varieties with good morphology (ideotype for mechanized farming) • To develop varieties with suitability for growing under different agro-ecological regions(rain-fed and irrigated farming) • To develop varieties with resistant / tolerant to biotic and abiotic stresses • To develop varieties with desirable agronomic traits • To develop varieties suitable for mechanized farming	multi-location yield trials over diverse environments and use of efficient analysis methodologies to select better varieties	• Marker-aided selection (Transcriptomics)
3. Quality improvements to fit the purpose of end-users	• To increase nutritional quality of jaggery and sugar produced from open pan boiling, syrup and sugarcane-juice based beverages • To enhance keeping, processing and marketing qualities of sugar cane • To increase the potential of power co-generation	• Use of conventional breeding • Tissue culture and mutation breeding • Biotechnological approaches	• QTL mapping for sucrose content • Hybridization and selection • MAS and QTL • Selection of suitable varieties from pure *Saccharum officinarum* population • Exploitation of somaclonal variation and mutants • Screening varieties for quality parameters
4. Maintenance of genetic purity and making availability of basic planting materials/breeder seed of recommended varieties.	• To continuously supply genetically purified breeder seed/basic planting materials in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant selection • Maintenance of mother plants

Table 2. Continued

Other Plantation Crops: Cashew

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilization	• widening, Conservation and maintenance of cashew genetic resources • To utilize the conserved genetic materials in cashew improvement program	• Preservation of the natural genetic variation • Introduction/multiplication of exotic germplasm	• Exploration and in-situ and ex-situ conservation of germplasm • Field establishment and maintenance of germplasm • Morphological characterization of germplasm • Evaluation of germplasm for utilization of conserved material in breeding programs • Introduction of germplasm
2. Productivity and production enhancement through genetic improvement	• Development of cashew cultivars with desirable characteristics for commercial cultivation • To increase the yield potential (above 10 kg tree/Yr of nut yield) • To improve the juice content and quality in cashew apple • To develop cultivars tolerance to major pests and diseases (*Helopeltis*, Root & Stem borer & Inflorescence blight) • To develop cultivars having open branching habit	• Use of conventional breeding methods	• Germplasm screening for nut yield and other desirable traits (high nut quality, Juice content & content of the cashew apple, resistance to pest and diseases,) • Hybridization and selection • Production of authentic materials of superior cultivars

3. Maintenance of genetic purity and making availability of basic planting material of recommended varieties	• To supply genetically purified basic planting material in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant selection • Maintenance of mother plants

Table 2. Continued

Forest Crops

Thrusts	Objectives	Strategies	Activities
1. Genetic resource management and utilization	• Conservation and maintenance of Forest Crops genetic resources	• Preservation of the natural genetic variation	• Conservation, characterization and evaluation of the germplasm
2. Productivity and production enhancement through genetic improvement	• Increase the timber productivity of main commercial timber species: ▪ Teak *(T. grandis)* ▪ Mahogany *(S. macrophylla, K. senagalensis)* ▪ Pinus species • To develop improved seed/clonal sources of commercial tree species • To identify clones resistant to pest and diseases (i.e. eucalypts – eucalypt gall wasp, cancer disease) • Improvement of bio fuel tree species: Jatropha and Gliricidia	• Conventional breeding and selection • Inter- and intra-specific hybridization	• Provenance, progeny and genetic gain trials • Development of seedling seed orchards • Development of clonal seed orchards • Identification of high-yielding clones for teak, eucalypts and mahogany species • Macro and micro propagation
3. Domestication of potential native species for timber and other forest products	• To identify adaptable native tree species for different ecological zones	• Domestication	• Progeny trials • Seed orchard development • Propagation studies

4. Maintenance of genetic purity and making availability of basic planting materials of recommended varieties	• To supply genetically purified basic planting materials in sufficient quantities	• Conventional methods	• Confirmation of variety characteristics • Maintenance of genetic purity through plant selection • Maintenance of mother plants

A Summary of

National Research Priorities in Crop Improvement

Table 3. A Summary of Crop Improvement Research Priorities

Priority Research Area	Crop
1. Plant Genetic Resource Management and Utilization	Rice, Maize, Finger Millet, Grain Legumes (Green gram, black gram, Soybean, Cowpea), Onion (Red, Big), Oil Crops (Groundnut, sesame, Sun Flower), Chillie, Fruit Crops (Banana, Papaw, Pineapple etc.) Vegetables (Brinjal, Okra, Tomato, Capsicum etc.)Roots and Tuber Crops, Cinnamon, Black Pepper, Cardamom, Coffee, Cocoa, Betel, Clove, Nutmeg, Citronella, Vanilla, Lemongrass, Turmeric, Ginger, Garcenia, Areca, Kitul, Tea, Rubber, Coconut, Sugarcane,, Cashew, Forest crops
2. Development and Recommendation of Varieties with Desirable Characteristics for Irrigated and Rain-Fed Conditions	Rice, Maize, Finger Millet, Chili, Sugarcane, legumes, oil crops
3. Development and Recommendation of Varieties for Unfavorable Conditions in Irrigated and Rain-Fed Cultivation	Rice
4. Development and Recommendation of Varieties with Desirable Characteristics	Rice, Maize, Finger Millet, Grain Legumes (Green gram, black gram, Soybean, Cowpea), Onion (Red, Big), Oil Crops (Groundnut, sesame, Sun Flower), Chili, Fruit Crops (Banana, Papaw, Pineapple etc.) Vegetables (Brinjal, Okra, Tomato, Capsicum etc.) Roots and Tuber Crops, Cinnamon, Black Pepper, Cardamom, Coffee, Cocoa, Betel, Clove, Nutmeg, Citronella, Vanilla, Lemongrass, Turmeric, Ginger, Garcenia, Areca, Kitul, Tea, Rubber, Coconut, Sugarcane,, Cashew, Forest crops
5. Increasing Availability of Genetically Purified Breeder Seeds and Basic Planting Materials	Rice, Maize, Finger Millet, Grain Legumes (Green gram, black gram, Soybean, Cowpea), Onion (Red, Big), Oil Crops (Groundnut, sesame, Sun Flower), Chili, Fruit Crops (Banana, Papaw, Pineapple etc.) Vegetables (Brinjal, Okra, Tomato, Capsicum etc.) Roots and Tuber Crops,

	Cinnamon, Black Pepper, Cardamom, Coffee, Cocoa, Betel, Clove, Nutmeg, Citronella, Vanilla, Lemongrass, Turmeric, Ginger, Garcenia, Areca, Kitul, Tea, Rubber, Coconut, Sugarcane,, Cashew, Forest crops
6. Development of Varieties for Food / Beverage Industries	Rice, Tea, Coffee, Cinnamon, Sugarcane, Soy Bean, Vanilla, Ginger, Kitul, Coconut
7. Reduction of Cost of Cultivation	Rice, Maize, Finger Millet, Grain Legumes (Green gram, black gram, Soybean, Cowpea), Onion (Red, Big), Oil Crops(Ground nut, sesame, Sun Flower), Chili, Fruit Crops, Vegetables, roots and tuber crops, Cinnamon, Black Pepper, Cardamom, Coffee, Cocoa, Betel, Tea, Rubber, Coconut, Sugarcane, Cashew, Forest crops
8. Improvement of Product Quality Characteristics	Rice, Grain Legumes (Green gram, black gram, Soy Bean, Cowpea), Onion (Red, Big), Oil Crops(Groundnut, sesame, Sunflower), Chili, Fruits, Vegetables, root and tuber crops, Tea, Rubber, Coconut, Sugarcane
9. Development of Bi- and Poly Clonal Seeds for Drought Prone and Low Productive Areas in Different Growing Regions	Tea
10. Increasing Timber Productivity	Teak, Eucalypts, Mahogany, Pinus, Rubber
11. Improvement of Bio Fuel Tree Species	*Jatropha, Gliricidia*

Annexure: 1

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Annexure 2

Crop List

1. **Rice**

2. **Other Field Crops**:

   Maize

   Finger Millet

   Red Onion

   Big Onion

   Chilli

3. **Grain Legumes**:

   Green gram

   Black gram

   Soybean

   Cowpea

4. **Oil Crops**:

   Groundnut

   Sesame

   Sun flower

5. Fruits:

Priority 1	Priority 2	Priority 3
Mango	Beli	Mangosteen
Papaya	Durian	Avocado
Banana	grape	
Citrus	Passion fruit	
Pineapple	Anona	
	Rambutan	
	Guava	

6. Vegetables

Priority 1	Priority 2	Priority 3
Bean,	Luffa	Carrots
Tomato,	Bitter gourd	Radish
Pumpkin,	Thumbakarawila	Murunga
Okra	Cucumber,	Thibbatu
Capsicum,	Snake gourd	Elabatu
Brinjal,	Wing Bean	Cluster bean
Yard long bean	Mushroom	
	Leafy vegetables	

7. Root &Tuber crops:

Potato

Sweet potato

Cassava

Other local yams

8. Export Agricultural Crops:

Priority 1.	**Priority 2**.	**Priority 3.**
Black Pepper,	Betel	Lommon grass
Cinnamon,	Citronella	Kithul
Coffee,	Ginger	Vanila
Cocoa,	Areca nut	Turmeric
Cardamom	Clove	
	Nutmeg	
	Garcenia	

9. Plantation Crops

Tea

Rubber

Coconut

Sugarcane

Cashew

10. Forest Crops

Teak *(T. grandis*)

Eucalypts species

Mahogany (*S. macrophylla, K. senagalensis*)

Annexure: 3

Speakers of the Workshop on "Current Status & Future Directions in Plant Breeding Research in Sri Lanka" Organize by National Committee on Plant Breeding, Sri Lanka Council for Agricultural Research Policy

- Introduction/Opening Remarks by Dr J M Senevirathne, Chairman, National Committee on Plant Breeding & Deputy. Director, Department of Export Agriculture.
- Keynote Address by Dr M P Dhanapala, Former Director, *Rice Research & Development Institute*, Department of Agriculture, Affiliated Scientist, IRRI, Technical Adviser, JICA & NCPB Committee Member.
- Policies related to Plant Breeding Research in Sri Lanka BY Dr K Hettiarchchi, SCPPC.
- Current Status & Future Directions in Rice Breeding Research in Sri Lanka by Dr Amitha P. Bentota, Member, National Committee on Agricultural Biotechnology & Director, Rice Research & Development Institute.
- Current Status & Future Directions in Vegetable Breeding Research in Sri Lanka by Ms M P Malathi, Assistant Director (Research), Horticultural Crops Research & Development Institute, Department of Agriculture.
- Current Status & Future Directions in Other Field Crops Breeding Research in Sri Lanka by Dr Malima Perera, Addl. Director (Research), Field Crops Research & Development Institute, and Department of Agriculture.
- Private- Public Partnership and role of Plant Breeding Research in Private Sector, by Mr. W. Madawanaarachchi, CIC
- Involvements of Universities in Plant Breeding Research in Sri Lanka by Prof. V A Sumanasinghe, Principal Scientist, Faculty of Agriculture, University of Peradeniya.
- Current Status & Future Directions in Tea Breeding Research in Sri Lanka by Mr. J D K Arachchi, Research Officer, Tea Research Institute.
- Current Status & Future Directions in Rubber Breeding Research in Sri Lanka by Dr S P Withanage, Principal Scientist, Rubber Research Institute.
- Current Status & Future Directions in Coconut Breeding Research in Sri Lanka by Dr S A C N Perera, Principal Scientist, Coconut Research Institute.
- Current Status & Future Directions in Sugarcane Breeding Research in Sri Lanka by Dr Aruna Wijesuriya, Principal Scientist, Sugarcane Research Institute.
- Current Status & Future Directions in Fruit Breeding Research in Sri Lanka by Ms I Kalubowila, Assistant .Director, (Research), Fruit Research & Development Institute, Department of Agriculture.
- importance of Plant Genetic Resources for Plant Breeding Research in Sri Lanka by Dr S K Wasala, Assistant Director, Plant Genetic Resources Centre, Department of Agriculture.

- Current Status & Future Directions in Export Agricultural Crops Breeding Research in Sri Lanka by Dr J M Senevirathne, Chairman, National Committee on Plant Breeding &Deputy. Director, Department of Export Agriculture.
- Current Status & Future Directions in Floriculture Breeding Research in Sri Lanka by Dr S. A. Krishnarajah, Director (Research & Technology Transfer), Department of National Botanic Gardens
- Current Status & Future Directions in Cashew Breeding Research in Sri Lanka by Mr P. M. A. P. K. Wijethunga, Assistant General Manager (Plantation), Sri Lanka Cashew Corporation.

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