EXTERNAL REVIEW

OF THE

FIELD CROPS RESEARCH AND DEVELOPMENT INSTITUTE (FCRDI), MAHAILUPPALLAMA

&

SATELLITE STATIONS

A review report submitted to the

Sri Lanka Council for Agricultural Research Policy (SLCARP)

30 November 2018

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Acknowledgements

The review team thank Dr. S.S.B.D.G. Jayawardena (Chairman), Dr. J.D.H. Wijewardena (Secretary) and the members of the Sri Lanka Council for Agricultural Research Policy (SLCARP) for appointing us to review the Field Crops Research and Development Institute (FCRDI) at Mahailuppallama and its satellite stations under the External Review of the Research Institutions Programme of the National Agricultural Research System (NARS) of Sri Lanka. The support provided Dr. Frank Niranjan (Deputy Director – Research) of the SLCARP,in particular, during the review process is highly appreciated.

The review team would also like to express their gratitude to the Director General of Department of Agriculture, Dr. W.M.W. Weerakoon for his assistance provided during the review process. A special word of thanks should go to Dr. (Mrs) A. Malima Perera, the Director of the FCRDI at Mahailuppallama for her whole-hearted support extended and timely submission to information to the review team. Her enthusiasm and dedication greatly facilitated the review. The cooperation of Additional Directors, Deputy Directors and other staff of the FCRDI and all satellite stations namely, Aralanganwila, Angunakolapelessa and Kilinochchi is hereby acknowledged. We appreciate the hospitality extended to us by all staff at the stations visited.

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30th November 2018

Executive Summary

The Field Crops Research and Development Institute (FCRDI) and its satellite stations at Aralaganwila, Angunakolapelessa and Kilinochchi were reviewed by a four-member committee appointed by the Sri Lanka Council for Agricultural Research Policy (SLCARP) of Sri Lanka. The review covered the period 2013-2017, in consistent with the objectives of the External Review of the Research Institutes in the National Agricultural Research System (NARS) of Sri Lanka as per Terms of Reference provided by the SLCARP. The review consisted of desk study of the documents provided by the FCRDI and available literature, site visits to FCRDI and all satellite stations, meeting of the stakeholders at Mahailluppallama at a session to review activities and a final meeting with the staff of the FCRDI to discuss the outcome of the review process. The recommendation of the review was presented to the members of the SLCARP and the proposed future research plan based on the review was submitted as a document in advance to the submission of the final report. All four members participated at the three visits made to the FCRDI while 2-3 members visited the other sites depending on their availability.

The review team was content with the overall progress made by the FCRDI and the satellite research stations during past five years (2013-2017) despite limitations in the human and physical resources. Satisfactory outreach programmes, linking with other DoA institutes and Universities were evident, though the external linkages should be strengthened further. The well-equipped and laboratories and field facilities at FCRDI is a strength that has immensely supported the research programmes, However, the regional centres are under-equipped, and plagued with lack of physical and trained human resources. As there are many issues concerning the recruitment of staff and retaining the available staff in remote stations, the FCRDI should re-prioritize its activities and re-assign scientists and staff based on the resource availability and the needs of the country. The review team is happy to learn that the research and development programs have focused on the National Agricultural Research Plan (NARP) and have played a supporting role to achieve targets of the National Food Production Programme of Sri Lanka 2016-2018. However, the weak research-extension dialogue is the major impediment hindering the dissemination of technology, which require urgent attention of the authorities for remedial action.

In addition to the recognition of outstanding researchers/scientists by the SLCARP at its bi-annual awards ceremony and by the DoA at its annual symposium (ASDA), we recommend further strengthening of the promotion schemes by introducing a merit-based system similar to that adopted by the Universities in Sri Lanka. We are of the view that performance (60%) should supersede service/seniority whereas at present seniority overwhelmingly supersedes performance. This should encourage sound, well-planned scientific research, publications in high

quality journals in the international arena and recognition of scientists based on their performance.

Recent initiatives taken by the SLCARP to provide scholarship opportunities for the scientists/officers to obtain higher degrees from foreign universities is commendable. The opportunity has been granted by the SLCARP through Treasury funding at three selected Universities in Thailand, Malaysia and the Philippines. This would strengthen the operations at the FCRDI and its satellite stations in the future. At present, the operations at the research centres have been badly affected due to young staff being on overseas leave. Given the persistent difficulty of retaining qualified especially in the peripheral R & D stations, we strongly propose confining disciplinary research to the FCRDI at Mahailuppallama and the sub-stations essentially for adaptive or farmer participatory research or highly site specific research.

Lack of incentives (monetary and physical, including residential facilities) have always been an issue with respect staff at remote locations in Sri Lanka. Stations located away from the major cities of Sri Lanka have not only affected the work efficiency of the officers/scientists and workers, but also the other personal operations as well. Hence, remunerating the services of those in remote work stations by means of a "hardship allowance" in addition to the personal emoluments is strongly recommended. Several recommendations are provided in this report to this effect.

The varietal development programme carried out by the FCRDI, especially focusing on the hybrids of maize and chilli, has to be commended. The cost effectiveness of the research being carried out, however, need an in-depth analysis of the beneficial impacts. The services provided by the institutes are satisfactory but should be strengthened further by providing adequate trained man power. The limited access to germplasm due to inadequate international linkages is one of the major drawbacks in the varietal development programmes. The FCRDI has already entered into agreements with SVRDC, CIMMYT, IAEA, KPIA and USDA, however, further strengthening of the international linkages is a need to support achieving the long term breeding objectives of the centre and also to provide international exposure to the scientists.

It is encouraging to note the initiatives taken by the FCRDI, and the DoA as a whole, to establish public-private partnerships thus allowing the private sector to access breeding material for seed production programmes and marketing. This has opened up a new avenues in the seed industry in Sri Lanka. The agreements are currently limited to chilli with the involvement of six private companies, but should be further expanded to other crop hybrids to provide the seed requirement of the farming community in Sri Lanka.

The Ministry of Agriculture is currently in the process of developing a new National Agriculture Policy while the department of National Planning is currently preparing an Overarching Agriculture Policy covering all major fields in the agriculture sector of the country (food crops, plantation and export agricultural crops, livestock and poultry, inland fisheries and aquaculture, irrigation, and environment). Further, the SLCARP has already prepared the National Agricultural Research Policy for the period 2016-2027. These hopefully have a tangible impact enabling the FCRDI and other institutes in the DoA to focus their activities in a coherent manner to overcome some of the threats identified in the SWOT analysis. The brain drain of experienced DoA officials to other state (especially Universities) and private sector institutions due to high financial perks and elevated retirement age (*e.g.* 65 years in Universities) have become long-standing problems to retain staff at DoA-institutions in additions to other constraints identified. This has further aggravated by the undue delays in recruitment of staff to scientists cadre. The section on recommendations in report suggest viable options to, to mitigate this trend. However, the delays in recruitment is beyond the control as at present the matter is in courts pending judgment.

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1. REVIEW OF FIELD CROPS RESEARCH AND DEVELOPMENT INSTITUTE (FCRDI), MAHAILUPPALLAMA

1.1. The Review Team and Mandate

On a directive of the Sri Lanka Council for Agricultural Research Policy (SLCARP), which has been mandated to carry out regular External Reviews of institutes under the National Agricultural Research System (NARS), a review team comprising the following four members were appointed:

- Professor Buddhi Marambe – a specialist in the field of Agriculture from the academia as the Chairperson
- Dr. Parakrama Waidyanatha – a specialist in the field of agriculture
- Professor L.H.P. Gunaratne – a specialist in the field of Agricultural Economics from the academia
- Mr. Suranimala Wirasinghe – a specialist in Agricultural Extension

1.2. Terms of Reference

The objectives of the review and the detailed terms of reference are given in annexure 1.

1.3. Review Methodology

The team adopted the following strategy to complete the review process

(a) Visits to FCRDI at Mahailuppallama for an Inception Meeting, Research Planning Meeting of the institute, and the Final Meeting to discuss the Recommendations of this Review.
(b) Site visits each to the main regional stations at Aralaganwila, Kilinochchi and Angunakolapelessa
(c) Perusal of submission made by the Director, Additional Directors and Officers-in-charge of stations and the review of available literature
(d) Discussion with staff of the respective research stations
(e) Visit to FCRDI at Mahailuppallama to attend the stakeholder workshop to identify the research agenda on Other Field Crops (OFCs) for future
(f) Perusal of other documents made available to the team by the Director of the FCRDI
(g) Preparation of the draft recommendations to be presented to the Sri Lanka Council for Agricultural Research Policy (SLCARP)
(h) Preparation and discussion of the draft report-by the members of the review team.
(i) Meeting of the Review team to finalize the report

Technology generation and furtherance of knowledge, technology transfer and other support services are integral components of agricultural research and development. Hence, the Review Team, whilst emphasizing on research, also considered these aspects in the review.

2. INTRODUCTION

The agricultural sector of Sri Lanka, which has the characteristics of a dualistic economy, consists of two sub sectors; (a) the non-plantation or domestic food crop sub sector and (b) the plantation sub sector. The non-plantation sector mainly consists of paddy, other cereal crops, grain legumes (pulses), oil crops, vegetables, fruits, floriculture and spices and accounts for 80% of the total agricultural lands while the plantation sector mainly consists of tea, rubber, and coconut and accounts for 20% of the agricultural land. The agricultural sector-accounts for about 6.9%[1] of the Gross Domestic Product, 24-25% of total exports and about 26.1% of employed labour force. About 80% of Sri Lankans live in rural areas and a high proportion of there is income generated from agriculture. Therefore, agriculture plays an important role in the economy of the country.

The share of agricultural and food imports out of total imports to Sri Lanka has varied between 8.7% to 10.5%, over the past five years[2]. A rapid growth of the domestic other food crop sector (OFCs) is vital to enhance food security, increase farmers' income and living standard and ~~to~~ reduce rural poverty, now that the country is self-sufficient in rice. This is especially important under a variable climate where the agriculture sector showed a negative growth in 2016 (-4.2%) and 2017 (-0.8%) mainly owing to vagaries in the climate. Therefore, enhanced assistance of the government for agricultural production in the country is critical.

The institutional structure of DOA consisting of three research institutes; Rice Research and Development Institute (RRDI), Field Crops Research and Development Institute (FCRDI), Horticultural Crops Research and Development Institute (HORDI) and six technical service centers; Seed Certification and Plant Protection Centre (SCPPC), Seed and Planting Material Development Center (SPMDC), Extension and Training Centre (ETC), Socio Economics and Planning Center (SEPC), Natural Resource Management Center (NRMC), Progress Monitoring and Evaluation Unit (PMEU) together with three support services; Engineering Division, Finance Division and Administration Division. Of these, FCRDI plays an important role in the national agricultural development. The vision of the Department of Agriculture and its mission statement to achieve the vision are given below:

2.1. Vision of the Department of Agriculture

Achieve excellence in agriculture for national prosperity

[1] Department of Census and Statistics (2017)
[2] Central Bank of Sri Lanka – monthly bulletins

2.2. Mission of the Department of Agriculture

Achieve an equitable and sustainable agriculture development ensuring food and nutritional security through development and dissemination of improved agricultural technology, and providing related services

This review report is on the Field Crops Research and Development Institute (FCRDI). The following sections thus, will focus on the history, and the analysis of activities and role play of FCRDI in the overall agricultural sector of the country and, relevant recommendations emanating out of the review process.

2.3. History of Field Crops Research and Development Institute (FCRDI) at Mahailuppallama

The British Colonial rulers, considering the importance of food crop production in the Dry Zone of Sri Lanka, established a research station at Mahailuppallama (Low Country Dry Zone; DL_1) in 1903 to identify and develop crops suitable for the Dry Zone of the country. The station ceased to function in 1919 owing to the remoteness and other difficulties. The research programs, however, continued at locations in Vavuniya and Anuradhapura (1926), Kurundankulama (1938), and Relapanawa, Olukanda and Makalanagama (1949).

Following independence (1948), the facilities at the Mahailuppallama station were uplifted, activities were revitalized and the centre was re-named as the Dry Zone Agricultural Research Center in 1950. These initiatives paved the way to conduct research on crop improvement, crop husbandry, natural resource management and crop protection. Simultaneously a seed production facility, In-Service Training Institute and Farm Mechanization Research Center were established. The station was responsible to ensure sustainable highland settled-farming in the Dry Zone with emphasis on conserving the soil fertility, and enhancing crop productivity and farmer income. The "research station complex" gradually became a centre of excellence with the establishment of Sub-campus of the Faculty of Agriculture of University of Peradeniya and the Farm Broadcasting Service Center in 1968.

With the development of the *Mahaweli Ganga* diversion program in 1970's, the focus of research was broadened to both rainfed and irrigated agriculture. To strengthen the capacity and mandate of the research centre, the Field Crops Research and Development Institute (FCRDI) was established in 1994 aiming at developing new varieties of OFCs and associated production technologies and strategies for dissemination of technologies.

The FCRDI at Mahailuppallama has three main satellite stations located in Angunukolapallessa, Aralaganwila and Kilinochchi and the sub-research stations in Karandiyanaru, Thirunelveli and Vavuniya to undertake the relevant adaptive research. At present, the FCRDI is located in an agricultural complex covering 650 ha comprising the Farm Mechanization Research Center (FMRC), Government Seed Farm, Provincial In-service Training Institute, Field Meteorology Unit and Faculty of Agriculture sub campus of University of Peradeniya and bordering two large tanks (*wewas*) Mahaillupallama and Divulwewe. The FCRDI alone occupies a 425 ha of cultivable land and necessary basic infrastructure for R & D.

The FCRDI has the mandate for all research and development of field crops other than rice; they are - condiments (onion and chilli), grain legumes (mungbean, black gram, cowpea, soybean, pigeon pea), coarse grains (maize, sorghum, finger millet and minor millets), oilseed crops (groundnut, sunflower and sesame). The FCRDI also has a regional mandate for rice, vegetables (okra, tomato, brinjal, long bean, cucumber, soybean, etc.) and fruits (grape, watermelon, papaya, banana, pineapple, mango, etc.) grown in the Dry Zone of Sri Lanka. The technology generated is disseminated to stakeholders through the extension arm of the DOA and the Provincial Departments of Agriculture.

2.4. Vision and Mission of the FCRDI

The FCRDI has developed its own vision and mission as given below, in relation to the development of the Other Field Crops (OFC) Sector.

2.4.1. Vision of the FCRDI

"National prosperity through Excellence in the Field Crops Production"[3]

2.4.2. Mission Statement of the FCRDI

"To achieve economic revitalization of the farmers in the field crops sector and to assure national food security through generation and facilitating the dissemination of technology necessary for priority field crops to cater for sustainable field crops production in Sri Lanka."[4]

[3] https://www.doa.gov.lk/FCRDI/index.php/en/
[4] https://www.doa.gov.lk/FCRDI/index.php/en/

2.5. Objectives of FCRDI

i. To increase availability of OFC's in the island through increase production by developing and cultivating improved OFC varieties and associated technologies and reducing dependency on imports of OFCS.

ii. To ensure adequate supply seeds and planting materials of improved OFC varieties for farmers.

iii. To ensure the sustainability of crop production through developing efficient and effective pest and disease and nutrient management strategies giving emphasis on integrated nutrient, pests and diseases management packages.

iv. To develop appropriate varieties and technologies to meet the future changes in weather pattern due to climate change

v. To conserve germplasm of perennial crops available in the dry zone and expand the available field gene bank to all crops.

vi. To improve income and livelihood of dry zone farmer by increasing their knowledge through effective technology transfer

vii. To develop all necessary field, laboratory, infrastructure facilities and trained man power at FCRDI and satellite stations to achieve the above objectives

2.6. Current Status of Production and Imports of OFCs

Despite the efforts made by FCRDI to boost the production of OFC's in Sri Lanka, the country still imports a wide range of OFCs such as maize, onion, chilli, finger millet, soybean and groundnut, annually (Table 2.1).

Table 2.1. Production and imports of major OFCs

Crop	2015				2016			
	Cultivated Extent (ha)	Production (t)	Import (consumption)		Cultivated Extent (ha)	Production (t)	Import (consumption)	
			Quantity (t)	Value (Rs '000)			Quantity (t)	Value (Rs '000)
Dry chilli	13,029	42,866*	49,928	10,542,764	15,267	72,311	51,018	13,477,137
B'onion	5,618	89,323	210,253	11,619,303	3,983	65,223	215,593	6,796,127
Red onion	4,873	61,202	15,168	1,279,746	4,994	64,675	19,542	1,306,678
Potato	5,496	97,391	142,182	4,801.442	5,753	95,805	148,081	4,596,036

Maize	69,971	261,115	67,237	2,347,531	67,629	243,960	41,496	1,571,524
Kurakkan	6,950	8,916	765	33,865	6,151	8,565	2,178	123,328
Gingelly	17,841	13,285	95	13,559	14,044	12,414	129	18,930
Soya bean	6,383	11,254	7,293	495,148	6,301	7,946	7,126	433,880
Green gram	11,346	15,058	11,513	2,038,887	11,301	14,546	13,862	2,265,007
Cowpea	9,200	12,276	5,678	596,632	8,220	13,740	6,055	649,695
Ground nut	17,716	28,503	3,479	610,854	19,975	24,200	3,095	552,955
Black gram	12,305	1,901	7,081	1,437,197	11,158	11,197	11,991	3,265,393

Source: AgStat (2017); *local production is categorized as chilli

The demand for OFCs has continued to increase with the increase in population and change in food habits. Therefore, it is necessary to further increase the OFC production in the country by improving the productivity and expanding the cultivated extent, and also the quality of produce. The productivity of OFCs grown in Sri Lanka has been identified as low when compared to other countries (Table 2.2).

Table 2.2. Potential and average yield of OFCs grown in Sri Lanka compared to other countries

Crop	Potential yield (t/ha)		Average yield (t/ha)	
	National	World	National	World
Maize	8 (Local Hybrid)	12	3.74	7.8 (USA)
Finger millet	3.5	3.5 (Kenya)	1.28	2.53 (India)
Chilli (Green)	40 (hybrid)	70 (hybrid)	5.13	20 (hybrid)
Big onion	37.9	65 (Korea)	16.0	19.0
Mungbean	2.2	2.5 (Australia)	1.0	0.8
Blackgram	1.8	2.5	0.9	0.5-0.8 (India)
Soybean	4.0	8.2 (USA)	1.7	2.5 (USA, 2014)
Cowpea	2.5	3.0	1.3	1.3 (Ghana. 2011)

Interventions to increase the productivity are thus key to enhance the total production of OFCs and meet the national requirement. Achieving these objective requires an enhanced R & D input and also due consideration to the vagaries in climate and socio-political environment of the country.

2.6.1. *Constraints for OFC cultivation in Sri Lanka*

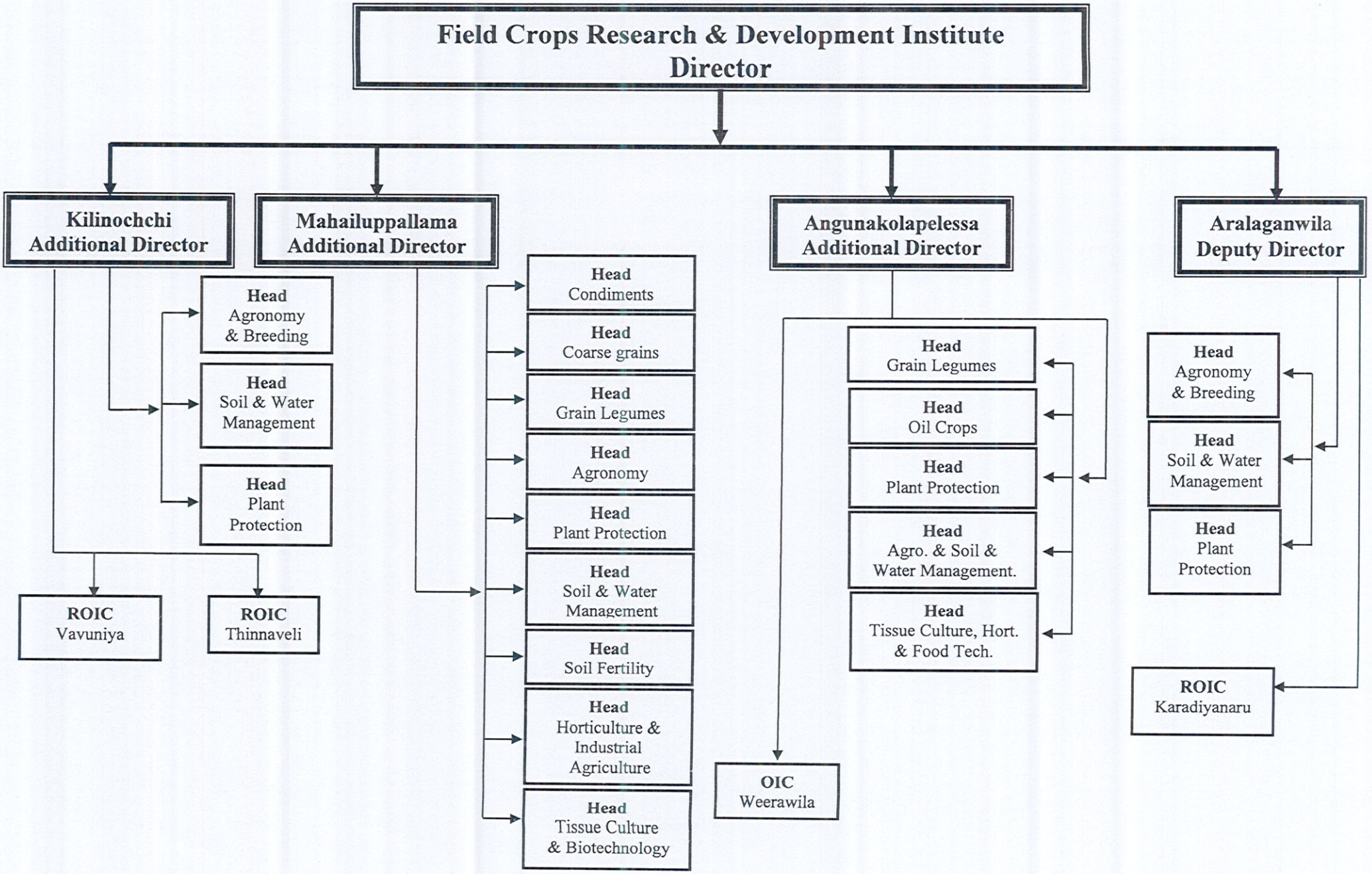
The stakeholder consultation carried out during the review identified following constraints for OFC cultivation in Sri Lanka

- Increasing yield gap between potential and realized by farmers
- Lack of awareness among farmers on improved varieties/technologies

- Variable weather patterns / climate change
- Moisture stress (excess and deficit) and high temperature
- Diminishing soil fertility, and natural and other resources
- Increasing impact of weeds, insect pests and diseases
- Diminishing labour availability and increasing cost of labour
- Variable market status - gluts and scarcities
- No specialized varieties for specific food items - Changing food habits
- Increased concerns on the environmental issues
- Variable income from crops
- Changing world trends in food production
- Changing attitudes and policies

Dry Zone agriculture being primarily rainfed with or without supplementary irrigation, has experienced erratic weather pattern thus, exposing crop production to both biotic and abiotic stresses over the years. Furthermore, concerns have also been raised on the misuse of agro-chemicals with potential negative impacts on human, animal and environmental health. Thus, the need has arisen to generate new technologies for rainfed and irrigated farming in the Dry Zone of Sri Lanka with a view to achieving sustained food security of the country.

2.7. ORGANOGRAM



3. SWOT Analysis of FCRDI

The results of the SWOT analysis conducted are given below

3.1. Strengths

- Government commitment and support
    - To make the country self-sufficient in OFC
    - Favorable policies
- Availability of a separate institute for field crop research
- Dedicated and committed technical and supporting staff
- Availability of a network of research stations
- Fairly well-equipped research laboratories and sufficient office space
- Adequate land availability for research and other facilities
- Availability of residential facilities with electricity and water
- Job security of scientists (irrespective of their contribution)

3.2. Weaknesses

- Limited opportunities for foreign training
- Uneven supply of funds
- Inadequate number of qualified scientific staff and supporting technical staff
- Lack of recognition for outstanding scientists
- Lack of merit based promotional prospects
- Lack of incentives to retain qualified staff
- No recognition of staff for the duration of service
- Poor access to latest research information / literature
- Inadequate infrastructure facilities for research
- Limited access to exotic germplasm
- Lack of formal links with other international institute such as IITA, AVRDC, ICRISAT, CIMMYT, ICARDA etc and even with local universities.
- No formal way of receiving support from qualified scientists from other departments and foreign and local universities.
- Inadequate short term training opportunities
- Lack of official encouragement for obtaining foreign training by individual scientists.
- Poor conditions of residential and transport facilities
- Poor quality of drinking water

- Poor and limited facilities in public services such as schools, hospitals etc.
- Frequently interrupted electricity supply etc.

3.3. Opportunities

- Commitment of the Government of Sri Lanka to become self-sufficient in OFCs
- Increasing demand for OFC-based industries
- Increasing demand for healthy and nutritional foods
- Expanding demand from animal feed industries
- Un assured supply from international market

3.4. Threats

- Lack of a strong national agriculture policy
- Inadequate investments in agriculture research and development
- Brain drain of qualified personals due to remoteness and poor living conditions
- Delays in man power recruitment procedure
- Procedural weaknesses in recruiting and retaining outstanding scientists

4. PROGRESS REVIEW OF THE FIELD CROPS RESEARCH AND DEVELOPMENT INSTITUE (FCRDI) AND SATELLITE STATIONS

The review was conducted and reported as per TOR given by the SLCARP. The report presents the observations and analysis accordingly.

4.1. Mission of the FCRDI

The mission of the FCRDI (see section 2.4) includes the research and development focus on immediate and long term needs in Sri Lanka an includes reference to Transferring technological recommendations/research outcomes to relevant stakeholders, reflect national policies and programmes on food security, and infers the environmental sustainability through "sustainable field crops production". The mission statement of the FCRDI has been endorsed by the stakeholders as appropriate to achieve the goals and objectives of the institute.

4.2. Objectives of the FCRDI

The objectives of the FCRDI (see section 2.5) aligns with the mandate of the institute as given below;

"To conduct research and development programs on field crops aiming at developing new technology, and facilitating the technology dissemination for enhancement of production and productivity in the field crop sector. Field crops include condiments (chilli and onions), grain legumes (mungbean, cowpea, blackgram, pigeon pea and chickpea), oil seed crops (groundnut, soybean, sesame and sunflower) and non-rice cereals (maize, sorghum, finger millet and other minor millets).

At regional level responsibility extends to crops such as fruits, vegetables, rice, etc., to deal with problems specific to the region. Programs are conducted under various disciplines such as crop improvement, agronomy, plant pathology, entomology, weed science, cropping systems, soil and water management, horticulture and technology adoption research (economics, adaptive research, participatory research, etc.)."[5]

Further, the objective aligns with the FCRDI's criteria of allocation of resources and planning procedures adopted and the mechanisms of their formulation. Though the objectives are in line with the rationale of the FCRDI for its present allocation of resources among research,

[5] https://www.doa.gov.lk/FCRDI/index.php/en/

extension information exchange and other activities, appropriate changes to the operational procures may be necessary (see the section on recommendations).

4.3. Planning and Mode of Conduct of Research and Development Programmes

The FCRDI has continued to carry out its core functions, i.e. research & development, extension, analytical services, consultancy services and science popularization. The activities of FCRDI over the past five year period were mainly funded by an annual allocation by the Government of Sri Lanka. Additionally, research grants from the National Research Council (NRC), the National Science Foundation (NSF), the Rural Development Administration of Korea (KOPIA), CIMMYT (Mexico and India), ICRISAT (India), and NIAES (Japan). A large extent of research fields, well-equipped laboratories, poly houses and rain shelters, irrigation infrastructure, solar powered electricity supply, etc., facilitates the activities of the institute.

The FCRDI has a well-established process for planning R&D projects as described below.

4.3.1. *Research Planning:*

(a) The Research Planning Committee (RPC) of the FCRDI identifies the national priorities based on the short, medium and long-term national economic goals through a broad stakeholder consultation involving officers of the FCRDI, private sector, community-based organization and the farming community. The planning process considers the outcome of Provincial Technical Working Groups (PTWGs), discussion with extensions officers, and global trends and forecasts.

(b) The recommendations will then be discussed with experts from other institutions such as Universities and other state institutions, through formal and informal meetings, to identify the possible interventions needed based on the institutional capacity (human, physical and financial resources).

(c) A detailed research programme will then be developed by the relevant technical group meetings of the DoA.

(d) Project proposals prepared by the scientists of the institute for soliciting financial assistance from national and international organizations

The research programme planned for 2017/2018 *Maha* and 2018 *Yala* seasons is given in Annexure 2 as a sample. Several milestones achieved by the FCRDI and its satellite stations during the period of review are summarized in Annexure 3.

4.3.2. *Planning of Research and Development Projects*

(a) Identification of the national needs by the officers of the institute considering the national policies, and discussions with the representatives of the stakeholders

(b) Development of proposals by the scientists for large scale interventions for commercialization of research outputs

The Technical Action Plans prepared accordingly by the FCRDI Complex from 2014-2017. The action plan prepared for 2018 is given in the Annexure 4. The plans have been done comprehensively and include the area of study (*e.g.* breeding), the crop (*e.g.* chilli), activities, the annual target, expected output and responsible officers from the FCRDI system. The overall analysis clearly indicates the priority given for breeding of chilli, onion, mungbean, soybean and maize, in collaboration with national and international organizations. General agronomy, entomology, pathology, weed management, soil & water conservation, and biotechnology sections have developed plans based on the needs. Weed management programmes are highlighted in the 2018 research pan mainly owing to the ban imposed on importation and use of several alternative time-tested herbicides. The FCRDI complex has also supported the national Coordinated Varietal Testing Programmes (NVCT) for vegetables, breeder seed production programmes for OFCs.

The FCRDI complex, keeping in line with the policies of the Department of Agriculture, has initiated private-public partnership (PPP) programmes, initially focusing on the hybrid seed production of maize and chilli, evaluation of imported/introduced hybrid varieties (seeds) and evaluation of agrochemicals for final recommendations.

4.3.3. *Operational Mechanism of Research*

The research in the FCRDI complex has been carried out through inter-departmental (involving researchers/scientists from different sections of DoA), inter-institutional (involving researchers/scientists from Universities, and other state or private sector organizations), and international collaborations.

4.3.4. *Research Infrastructure*

Field facilities have been improved to support research activities such as provision of irrigation infrastructure (surface and micro irrigation), new lands developed for specific purposes such as in situ gene banks for germplasm conservation, organic farming (including low-input farming), and grazing. Further, green houses and poly tunnels to support year-round cultivation, insect proof net houses to support varietal development and hybrid seed production, rain shelters and temperature-gradient tunnels for climate-related research, renovated laboratories for modern equipment for agronomy, physiology, soils science and molecular/biotechnological research, library facilities, provision of internet and computer facilities for staff are the other infrastructure development that has taken place over the past five years. Providing transport facilities for official events and required consumables for research activities are the other supporting activities. The physical facilities available at the FCRDI complex for R&D are shown in Table 4.1.

Table 4.1. Physical facilities and Major Equipment available at FCRDI at Mahailuppallama

Physical Facility	Use
Plant Houses	
Insect Proof net house (3 Nos)	For Chilli - development of hybrids and open-pollinated varieties, seed production,
Glass house	For Mungbean - Hybridization
Glass house	For Soybean and Cowpea – hybridization
Plant House	Pathology – plant resistance
Rain shelters	For Onion - variety development and seed production
Cold room	All crops – medium term seed storage, vernalization
Rain-out shelter	All crops – drought screening
Temperature- gradient Tunnel	All crops – screening for high temperature
Specialized Laboratories	
Molecular and Tissue Culture Laboratory (1 Nos)	All Crops
Sol Laboratory (1 Nos)	All Crops
Water Management Laboratory (1 Nos)	All Crops
Agronomy laboratory (1 Nos)	All Crops
Breeding Laboratory (1 Nos)	All Crops
Entomology Laboratory (1 Nos)	All Crops
Pathology laboratory (1 Nos)	All Crops
Special Equipment	
Canopy analyzer	All crops*
Leaf area meter	
Porometer	
Stereo microscope	

Osmometer	
Pressure chamber	
Incubator	
Laminar flow	
High purity water system	
Atomic Absorption Spectrophotometer	
Digester	
Kjeldhal distillation Units	
Flame photometer	
Muffle furnace	
Ovens	
Fume cupboard	
Conductivity meter	
Lab Weighing scales	
Electric shaker	
Laminar flow	
Hot air sterilizer (Dry oven)	
Centrifuge	
Microwave oven	
Orbital Shaker	
Orbital Shaker Incubator	
pH meter	
Thermal Cycle System (PCR)	
Gel image system	
Gel running Apparatus (Horizontal)	
Ultra Low Temperature Freezers	
ELISA reader	
Refrigerated centrifuge	
Spectrophotometer	
Autoclave	
Vertical Gel Apparatus	

*These facilities are mostly underutilized due to absence of trained staff (researchers and skilled workers)

The facilities available at the FCRDI Complex require skilled staff for their use and maintenance. While the importance of having trained scientists is highlighted, it is also important to have competent support staff who can assist the researchers to operate attend to the day-to-day maintenance of the specialized equipment. Further, given the importance of continuous upgrading of the facilities available at this national level institute, efforts towards gaining accreditation for several service-oriented laboratories will be important. It is encouraging to note that the FCRDI complex used solar-powered electricity generation to cut down the public expenditure and have entered into service agreements with equipment suppliers. However, many researchers claim that the

maintenance services provided by the equipment suppliers are not satisfactory (see the section on Recommendations). This matter should be taken up for discussion at the Directorate's Meeting of the DoA at which a decision to reach firm agreements with service providers to provide an effective services is recommended.

4.4. Other Science and Technology (S&T) and Development Activities

The officers of the FCRDI and its satellite stations have been actively involved in providing analytical services, extension/advisory services, training programmes, attending conferences/workshops/seminars as resource persons and participants, and other S&T work. The FCRDI and satellite centres are also actively involved in the breeder seed and commercial seed production of OFCs to be supplied to the Seeds and Planting Materials Development Centre (SPMDC) of the Department of Agriculture and other relevant organizations. The quantities of breeder and certified seeds produced in year 2017 are shown in Table 4.2

Table 4.2. Breeder/registered/certified and commercial seed production at FCRDI in 2017

Crop	Variety	Breeder seed production (kg)	Registered/Certified/Commercial seed production (kg)
Maize	Ruwan	39	-
	Bhadra	55	-
	CML 161	755	-
	CML 194	164	-
	CML 451	70	-
	CLO 2450	55	-
	MI Maize HY 1		350
Finger millet	Rawana	37	-
	Oshada	38	-
Pop Corn	MI pop Corn		64
Sweet Sorghum			100
Chilli	Galkiriyagama inbred line	1.44	-
	MI Waraniya Inbred line	1.85	-
	MICH 3	3.59	-
	MI 2	2	-
	MI Waraniya	1	-
Mungbean	Ari	11	-
	MI 6	72.5	-
Big onion	MIBO 1	7 (true seeds)	-
Black gram	MI 1	29	-
	Anuradha	44	-
Soybean	Pb 1	185	-

Cowpea	Dhawala	16	-
	MICP 1	37	-
	Waruni	27	-
	Bombay	22	-
Snake Gourd	MI Short	2	-

Source: FCRDI

4.5. Human Resources

Similar to the situation experienced by many government institutions, the FCRDI is also plagued with lack of trained man power at all levels. The strength of human resources at the institute and the educational qualifications of S&T staff are shown in Tables 4.3 and 4.4.

Table 4.3. Staff strength at the FCRDI Complex (numbers)

Category	2013	2014	2015	2016	2017
S&T personnel	28 (41)	30 (41)	26 (41)	22 (41)	19 (41)
Administrative staff	14 (18	16 (18)	16 (18)	15 (18)	12 (18)
Technical Staff	27 (45)	28 (45)	26 (45)	25 (45)	24 (62)
Supporting staff	393 (345(	375 (344)	356 (344)	277 (344)	329 (344)

Values in parenthesis are total cadre position available under different categories

It is important to note that the FCRDI Complex have failed to recruit required staff in almost all categories, except for the supporting staff category. This is mainly due to the on-going legal battle among different categories of staff in terms of recruitment to the position of scientist, which needs to be resolved quickly if the FCRDI to recruit the requisite research staff (see the section on Recommendations). Further, there is a dearth of S&T officials with PhD level training serving the institute at present, thus, affecting the research output.

Table 4.4. Education qualifications of S&T staff

Qualification	2013	2014	2015	2016	2017
PhD	5	5	4	2+1*	2
MPhil	4	4	4	3	2
M.Sc (or equivalent)	16	18	17	15	14
Basic degree (or equivalent)	4	2	0	0	0
Postgraduate diploma	1	1	1	1	1
Total	30	30	24	22	19

*one officer serves on a part-time basis

4.6. Financial Management

As stated previously, the activities of the FCRDI Complex have been financially supported by various entities. The details of funds received the period reviewed are presented in Table 4.5.

Table 4.5. Expenditure at FCRDI

Vote	2013	2014	2015	2016	2017
Capital	22,341,567 (85)	8,615,569 (92)	16,023,652 (57)	11,119,424 (89)	12,796,026 (76)
Recurrent	30,341,903(98)	30,211,324 (86)	11,630,748 (96)	13,278,277 (92)	12,757,786 (72)
Projects	39,720,469 (61)	53,401,969 (89)	44,243,000 (92)	35,396,133 (103)	22,960,000 (53)
NARP	3,587,081 (97)	2,392,132 (82)	1,626,045 (61)	2,742.342 (81)	2,367,251 (88)
KOPIA	1,113,759 (35)	3,655,784 ((37)	4,086,175 (31)	4,460,461 (46)	7,107,649 (49)
Ministry Projects	-	983,844 (26)	2,372,321 (26)	8,513,309 (81)	1,152,422 (92)
Crop Leader projects	-	-	-	1,524,030 (15)	-
Total	97,104,779 (75)	99,260,621 (82)	79,981,944 (71)	77,033,680 (84)	59,141,127 (62)

Values within parenthesis are % expenditure of the allocation

The expenditure at FCRDI complex out of the total has exceeded 70% during the period of review except in 2017. The low expenditure of money received through KOPIA annually (31-49%) is noteworthy, though this has shown an increase during the2016 and 2017. The KOPIA project has mainly funded mung bean and onion programs, which is supplementary to the funding from the government. The finances received through special Ministry Projects have not being spent adequately. This is probably due to the late receipt of funds and delayed planning. Only 15% expenditure was observed of the total funds received from the government for the Crop Leader Projects on black gram, finger millet and cowpea in 2016. This highlights the needs for proper planning and implementation of the plans according to the schedule to mitigate fund underuse.

4.7. Research Output – FCRDI, Mahailupallama

4.7.1. *Crop Improvement Programmes*

Chilli: The current crop improvement program of chilli is focused on the development of high yielding hybrids (> 35 t/ha of green chilli) and open pollinated varieties (> 20 t/ha of green chilli). The centre has released a chilli hybrid with the potential green chilli yield of 35 t/ha, and identified six high yielding exotic varieties (18-25 t/ ha of green chilli). Further, an appropriate pollen collection method and an emasculation method have been identified to cut down the F1 seed production cost by 50%.

In studies leading to genetic diversity, 38 chilli genotypes have been assessed, and 14 morphological characters have been scored and analyzed. Significant differences among genotypes for the most of tested traits have been identified through analysis of variance and more than 75 % of the total variation among the genotypes have been identified using principal component analysis. Plant breath, leaf characters, pod length, pod width, pericarp thickness, pod weight, secondary branches per plant and yield can be used to identify the breeding materials for chilli. Further, studies leading to conservation and evaluation of local chilli landraces have resulted in development of around 10,000 – 15,000 plants of Jaffna Selection and *Hene miris* land races, which will be useful in future breeding programmes.

Onion: Onion crop improvement programme is aimed at developing high yielding short duration big onion varieties (40 t/ha by 2020) with longer storability (losses <25% in 4 month storage). The development of high yielding (25 t/ha) seed setting cluster onion varieties with large sets to substitute big onion during off-season is a major objective in cluster onion breeding programme. After the completion of NCVT, the seed setting cluster onion line MICIO 09 – 01 (Rose) has been conditionally released for cultivation.

In the latest efforts by FCRDI, 26 big onion accessions have been collected from farmers to evaluate their diversity with a view to identifying suitable accessions useful for breeding programmes. The Nationally Coordinated Varietal Testing programmes (NCVTs), conducted at the FCRDI at Mahailluppallama, Grain Legumes and Oil Crops Research and Development Institute (GLOCRDI) at Angunakolapelessa, Regional Agriculture Research and Development Institute (RARDI at Aralaganwila and the Agriculture Research Station (ARS) at Thirunevelly to test the adaptability of the seed setting of cluster onion lines under different climatic conditions have selected the line MICIO 09-01 for the variety adaptability trials (VATs) in the farmer fields. The FCRDI has also initiated a breeding programme to develop cluster onion varieties with large set size. This could be used as a substitute for big onion during the off-seasons to reduce the big onion importation. For this purpose, 24 lines have been selected from F2 generation of the crosses between big onion and cluster onion. Studies on germplasm exploration, and development of crosses between local and exotic lines are continued at the FCRDI to create genetic variability among the varieties produced. Consequently, six F1 generations were created and two F2 generations have been selected for further evaluation.

Maize and other Coarse Grains: Maize breeding programme is set to develop maize hybrid varieties having target yield of 8 t/ha in favorable ecosystems. 'MI Maize Hybrid 02' has been released in 2016 for cultivation, giving an average yield of 5.5 - 6.5 t/ha (potential yield = 8 t/ha). This hybrid yields about 3 - 4 t/ha higher when compared to most of the commercially available hybrids, under drought conditions. Further, two hybrids, namely, 'CLYQ220/ CL02450Q' and 'CLYQ203/ CLYQ221' evaluated in VAT have shown average yields of about 5 - 6 t/ha. Five of the 12 drought-resistant maize hybrids received from CIMMYT in India have shown higher yields (6 -7/ ha) under farmer field conditions and have been selected for further evaluation in VAT, while promising locally hybrids out of 64 single crossed maize hybrids and their parent lines have been selected for further evaluation and crossing programs. The FCRDI has also evaluated maize hybrids imported by the private sector for yield performance, and Champ 5555, Var 153, Tech 153 and Tech 188 Tabimdang have been permitted for importation for general cultivation.

A Back cross breeding programme of popcorn has been initiated to develop a high yielding popcorn population. Currently, the 3rd back cross generation was established in the field and the experiments are continuing.

The finger millet breeding programme aims at developing short-aged (75-85 days) and medium aged (100-110 days) varieties having a potential yield of 3.5 t/ha. The FCRDI has selected one promising finger millet line showing average yields around 3.0 - 3.75 t/ha for VAT, while eight accessions received from ICRISAT in India have shown an average grain yields around 2.5 - 3 t/ha. One promising line among six finger millet lines showing an average grain yield around 3.5 - 3.75 t/ha in both *Yala* and *Maha* seasons has been selected for NCVT. The FCRDI has also developed one bulk population of finger millet through successful crosses in the previous season. Further, M1 generation of two mutated finger millet varieties produced from gamma rays-treatment of seeds have been established in the field for further evaluation.

In the VAT conducted to evaluate and popularize other coarse grains, two sorghum accessions giving an average grain yield of 3.5-4.0 t/ha and two promising foxtail millet accessions with an average grain yields of 2.5-3.0 t/ha have been identified. Field studies are on-going to confirm the results.

Pulses: The objective of the pulse breeding programme–is to develop high yielding varieties, *i.e.* mungbean >2.5 t/ha, cowpea 3.0 t/ha, back gram >2.5 t/ha and soya bean 3.0 t/ ha. The FCRDI has continued research to evaluate local and foreign accessions of mungbean germplasm for drought tolerance, short-duration and high yielding characteristics. Accessions received from PGRC and foreign countries are being characterized, purified and multiplied to obtain sufficient seed quantities. Hybridization and generation advancement of mungbean has been initiated to develop high yielding varieties with desirable traits. Two lines have been selected from the NCVT conducted to test their adaptability and stability of different accessions in the different agro-ecological regions and are being evaluated further for their yield traits. One promising cowpea line out of four selected from the hybridization program, through the NCVT and being further assessed for its yield under field conditions, while hybridization and generation advancement of black gram have been continued to develop high yielding varieties with desirable traits. The FCRDI has evaluated the 107 soybean lines received from the Michigan State University (MSU) in USA with the check varieties MISB 1 and Pb 1. The objective was to identify high yielding, large cream-seeded soybean varieties/ lines. Several lines with better yields and 100 seed weights than the variety Pb 1 have now being selected for further evaluation.

The researchers at MI have also been successful in gamma-radiating the seeds of Pb 1 to identify mutant plants with better characters than Pb 1 to produce M5 generation.

The achievements in the varietal development programmes with the above stated objectives/targets during the review period are highlighted in Table 4.6.

Table 4.6. Crop varieties developed by the FCRDI at Mahailuppallama and its satellite centres during 2013-2017 period

Crop	Variety	Year of release
Maize	MI Maize H-1	2013
	MI Maize H-2	2015
	MI Maize popcorn	2015
Mungbean	MIMB-7	2016
Cowpea	ANK CP-1	2015
Kollu	ANK Black	2014
	ANK Brown	2014
Soybean	MISB-1	2013

Groundnut	ANKG-2	2015
Big onion	MIBO-1	2014
Cluster onion	MICLO-1	2017
Thumba karawila	Chandu (female)	2015
	Vishma (male)	2015

Fruits and vegetables: Okra breeding programme is continuing to develop new okra varieties having a high yielding ability (> 15 t/ha), resistant/tolerant to Yellow Vein Mosaic Virus (YVMV) and having desirable fruit characters. In this effort, six F4 generations of okra were established in the field for generation advancement. Establishment and maintenance of mango, guava, dwarf drumstick, dragon fruit and grapes germplasm has been done as a Dry Zone Field Gene Bank to conserve genetic resources of important perennial crop species.

4.7.2. *Agronomy and Water Management*:

Maize: A study found that the density of hybrids of maize can be increased up to 74,074 plants/ha at 45 cm x 30 cm spacing from the present plant density of 55,555 at a spacing of 60 cm x 30 cm, with a proportionate increasing of N application. The resultant yield advantage was 20-25%. However, economics benefit of the outcome should be calculated to ascertain the overall benefits of the research outcome.

Application of Nano Nitrogen fertilizer and Urea has shown similar effects on growth and yield of maize while Zinc Sulphate applied at two weeks after planting and at the flower initiation stage had a positive impact on the yield of green gram. Use of micronutrients require further research for all OFCs (see the section on Recommendations).

Mungbean: The mungbean accession MIMB 1011 has shown promise among the 99 accessions tested with more than 81% plant survival with an average seed yield of 8.2 g per plant, under excess soil moisture conditions at vegetative and flowering stages. Researchers have also found that the canopy temperature of mungbean increases with moisture stress thus, affecting pollen and the spikelet fertility and grain yield.

Research results have revealed that the alley cropping systems including sprinkler irrigation and lopping increased seed yield of green gram by 38 - 45% while alley cropping with sprinkler irrigation but without lopping increased only

by 25 - 26 % compared to the control (no alleys) with sprinkler irrigation. It was found that the average temperature could be reduced by 1.5 °C and 1 °C in *Yala* and *Maha*, respectively, with the treatment combination of alley and sprinkler irrigation without lopping.

Rice: Screening of 16 recommended and five traditional rice varieties showed that the variety *Suwandal* had a lower canopy cooling ability in moisture-stressed condition compared to Bg 300, while At 308, Bg 304, Bg 369, *Kaluheenati* and *Pokkali*, which had a higher canopy cooling ability in no water stressed condition. Studies are also on-going using 11 rice varieties with different morphological characters to identify the phenotypic markers for reducing temperature stress on pollen sterility.

Big onion: In organic mulching trials with big onion, gliricidia leaf mulch has recorded an average yield of 34 t/ha with smaller bulb size. Paddy straw mulch recorded the highest yield (38 t/ ha) with dark coloured bulbs compared to that recorded in plots without mulch (30 t/ha). A study has also found that though the chilli plant growth was higher when seeds were treated with GA3 and Nappgibb (a commercial product having 10 % GA3 and 90 % Boron), their yields were comparatively lower than that of the control. Further, Alberts' solution had no effect on the green chilli yields.

General: Mungbean, chilli and maize genotypes have been screened for their adaptability to low soil moisture regimes in the dry season and 3 maize lines and 4 chilli parental lines have been selected for further studies based on their yield performances.

A method for inhibiting the recalcitrant nature of chilli was tested and successful results were obtained. Further studies are being conducted on this aspect and also on methods for the tissue culture generation of chilli plants.

Research has also revealed that fertigation with drip irrigation can be used to increase the productivity of big onion, green chilli and mungbean yields up to 40 t/ha, 45 t/ha and 2.5 t/ha, respectively, under the micro-irrigation systems while reducing the irrigation water consumption by around 30-50% compared to the surface irrigation. Some of the experiments will be repeated to confirm the results.

The Biotechnology Division has also been able to develop a tissue culture protocol for regeneration of tobacco and grape vine (Sonaca seedless grape variety), which is of practical use for the industry and for supply of high quality planting materials.

4.7.2. *Plant Protection*

Maize: Studies have revealed that stem borer damage was lower in the maize plots intercropped with cowpea compared to the control (maize sole crop) plots. Further, the stem borer damage was reported to be low (below 10 %) in all the exotic hybrids under unsprayed conditions when compared to local varieties. Different herbicides have been evaluated against weeds under maize crop where Tembotrione 420 SC 350 ml/ ha (post immergence herbicide) and Pendimathalene 33 % EC 3.5 L/ ha (pre immergence herbicide) can be recommended to control weeds in Maize cultivation in the absence of glyphosate in the market.

Finger millet: Among the finger millet lines, I_{6-2} and IE 6337 lines have shown comparable results with the variety Oshada, which was moderately-resistant to the Finger Millet Blast disease.

Chilli: Management of Chilli Leaf Curl Virus (CLCV) was evaluated by varying micro environments under different shade levels on CLCV and pest population dynamics. No significant reduction of CLCV has been recorded with increasing artificial shade levels, with the highest White fly population being recorded under 70% shade level. The chilli yield was reduced with the increased shade levels. Further studies on CLCV have revealed that MICH PL 42 is resistant while MICH PL 08 and MICH PL 09 are moderately resistant to CLCV. The Local hybrid 1 and 2 have also shown moderate-resistance whereas, local hybrid 3 and 4 were moderately susceptible. The exotic varieties were highly susceptible to the disease.

A study has been initiated to evaluate chilli accessions along with the recommended varieties available in Sri Lanka to detect anthracnose resistance using biotechnological tools. Chilli varieties *Arunalu* and MI Hot have shown the lowest susceptibility. These findings can be used in developing Anthracnose tolerant varieties. The Polymerase Chain Reaction using resistance gene analog

with the primers is being simultaneously executed to detect the resistant genes in chilli.

Studies have also revealed that the severity of Thrips damage was low in all the tested chilli hybrids in the Sri Lanka hybrids. However, virus incidence was higher in the exotic hybrid "*Wijaya*" (85%) compared to the local hybrids (49-55%). Mites damage in chilli has increased with the increase of shade levels while the highest White fly population has been recorded under the 70% shade level. The research results have also revealed that the local chilli hybrids has virus incidence of 12%, the Galkiriyagama Selection had 20% while all exotic hybrids have been more susceptible with a virus incidence ranging from 27-71% indicating that the local hybrids are better performers.

Mungbean: The mungbean lines 14-156 and14-254 have shown low infection of Mungbean Yellow Mosaic Virus (MYMV) and high infections to both Anthracnose and Powdery Mildew diseases. In studies carried out for insect pest resistance, results have revealed that both the varieties MI6 and MI5 are marginally susceptible to pod borers (1-2%) and pod sucking bugs (27-38 %).

The Biotechnology Division has developed protocols that can be used to screen the mungbean lines/varieties with bruchid resistance gene (B_{r1}).

Big onion: Antagonism studies showed that the *Trichoderma* effectively controlled the *Aspergillus* spp. Pilot scale trial was conducted in *Maha* season 2016/17 in farmers' fields in Dambulla to test the efficacy of Azoxystrobin 250 g/ 1 SC in controlling Anthracnose and purple blotch of onion. Studies are in progress.

Sulfoxaflor 24 SC/ 50 WG and Pymetroxine 50 WG have been identified as effective insecticides in controlling thrips in big onion.

Biotechnology: A study has been done to finger print 18 chilli accessions using six Simple Sequence Repeat (SSR) primers. Data analysis has shown that chilli varieties MICH 3 and *Waraniya* Purple can be used as genetically diverse parents for the future hybridization programs. The primer set M1 (JS 108 F and JS 109 R primers) can be recommended to obtain the highest Polymorphic Information Content (PIC) in the future studies.

A study has been initiated to accelerate the breeding cycle of Quality Protein Maize (QPM) where Marker Assisted Selection has been incorporated.

Overall, research focusing mainly on development of new high yielding varieties has that been carried out at the FCRDI is impressive.

4.8. Grain Legume and Oil Crops Research and Development Centre (GLORDC), Angunakolapelessa

Grain Legumes and Oil Crops Research and Development Center (GLORDC) in Angunakolapelessa is responsible for generating production technology for grain legumes (mungbean, cowpea, soybean, black gram and horse gram) and oil crops (groundnut, sesame, mustard, and sunflower) and coarse grains (maize, finger millet, sorghum and other minor millets), condiments and regionally important fruits and vegetables. GLORDC has a number of divisions. Some key research outputs of the period of review are described below.

4.8.1. *Plant Pathology*:

The Plant Pathology Division has identified some main virus diseases of cowpea followed by the development of control packages. Different cultivation methods to minimize the leaf curl disease were also identified. The other research outputs of the division includes *in vitro* mutagenesis of banana Fusarium wilt, and development of methods to manage virus diseases in curcurbits, legumes and chilli in the southern DZ and screening of mungbean, cowpea and sesame against different diseases. The officers of the division have made four publications in Annals of the Sri Lanka Department of Agriculture.

4.8.2. *Agronomy*:

The agronomic research has revealed that the critical period of weed-competition in 3-8 WAP for the popular ground nut variety, *Thissa*. The division has compiled a weed inventory for the region and developed an agronomic package for rain- fed finger-millet cultivation integrating available technologies in the region. The researchers have found that the black gram is the best pulse crop for the third season cultivation in southern Dry Zone. The division has produced several publications at the Annals of Sri Lanka Department of Agriculture and a few conference proceedings.

4.8.3. *Soil Science*:

The division of Soil Science at present is conducting studies pertaining to local bio-fertilizers, local liquid fertilizer and biochar use. One of the outputs of the division is the development of two biochar pyrolyzers. Studies have also revealed that the farmers in the rainfed farming systems do not practice soil and water conservation measures up to the expectations. The

4.8.4. *Horticulture*:

The Horticulture Division mainly focuses on varietal improvement and germplasm conservation of fruit trees. The division has collected 172 accessions of woodapple and established a 25-acre gene bank. The other field gene banks include citrus (320 accessions), mango (162 accessions) grafted *beli* (32 accessories), banana (34 accessions). Two publications have been made by the Division.

4.8.5. *Breeding*:

The Division of Oil Seed Breeding has released a medium duration (3.5 months) and large seeded (<70g/100 seeds) ground nut variety, "Lanka Jumbo". The other significant contributions of the division include: breeder seed production and generation advancement. Eight articles in international journals have been published, in addition to two local publications.

4.8.6. *Vegetables*:

The Vegetable Division has mainly worked on dry zone vegetables specifically development of hybrid varieties of '*Thumba Karawila*' with farmer participation. The other vegetables covered by the division's research are pumpkins, peas, capsicum, tomato, brinjal and vegetable cowpea. The effect of stem pruning on yield and quality of bell pepper in poly-tunnels was studied and found that two stem prunings with spacing 30 m x 30 m gives the highest yield. The effect of inorganic mulches on yield and quality of carrot was studied and found that yellow-coloured mulches improve the marketable yield and root colour.

4.8.7. *Food Science*:

The Division of Food Science has been involved in several research activities. The significant achievements are: development of vegi-sausages using soybean, mungbean and ground nuts; development of a ready- to- serve '*Embul*' banana beverage. The staff has made four

publications in international journals and 6 publications in Annals of the Sri Lanka Department of Agriculture.

Activities related to mungbean, onion and sesame have been focused on wide areas of germplasm collection hybridization, mutation breeding, varietal selection, breeder seed production and purification. Breeding programmes on grain legumes have been focused on varietal improvement of cowpea and horse gram. It was able to develop drought tolerant varieties ANKCP 01 and ANKPC 02 (cowpea) and ANKK Black and ANKK Brown (horse gram). The division has made four publications in Annals of Sri Lanka Department of Agriculture.

Overall, the research programme and the outputs of the centre are promising. However, it is worthwhile to note that the research programme should be planned with some understanding of the ground realities. For instance, the most of the raw soybeans and value added products are imported, and the local varieties cannot compete with those in terms of cost and quality. An enhancement in production cannot be expected with the existing varieties, hence it is advisable to depend on imported varieties. Instead, the centre's research programme should concentrate on crops such as cowpea and mungbean.

For certain crops, the researchers have conquered their boundaries. One example is promotion of '*Thumba karawila*' in the dry zone with farmer participation. It was revealed that, one farmer who worked with the researchers obtained a recorded income of Rs. 12 million from one hectare per year.

It is recommended that more sophisticated approaches such as use of crop simulation models, soil fertility mapping to be undertaken. Further, any product development should link with industry and market. The researches should consider patenting and commercialization, under the existing legal framework.

As discussed above, the research programme should align with a plan for a production enhancement. A good example is third season cultivation of mungbean in *Kirindi oya* basin. There are number of impediments in the GLORDC system. The main issues are centred around the poor infrastructure such as roads, housing, water supply and drainage (see the section on Recommendations) The social concern of the officers such as schooling of children should also be addressed.

4.9. Agricultural Research and Development Centre, Kilinochchi

4.9.1. *Research infrastructure*

The research activities of the ARS Kilinochchi were recommenced in 2009 with the financial assistance of Government and international organizations. The disturbed field water facilities were also re-established and-rehabilitation damaged office buildings and staff residences were made. Concurrently, the soil science laboratory (with the financial support from FAO), laboratory facilities for Plant Pathology. Entomology, Plant breeding and Agronomy were also established. The coconut yard of the station was replaced with 100 new seedlings and ~~the~~ all available mango germplasm, and germplasm collections of several other crops (banana, papaya etc.) were also established in the premises. Breeder seed production of the following crop varieties developed at ARS Thirunelvely was successfully carried out: bitter gourd (Thirunelvely white); brinjal (Thirunelvely purple); cluster onion (Thirunelvely red); snake guard (Thirunelvely long). Several organic research plots were established and linked to the cattle rearing unit. Some key research outputs of the station are given below.

4.9.2. *Research Output*

Plant Pathology: The pathology laboratory was able to identify and characterize the devastation grape pathogen *Zylaria* spp. through molecular means. Moreover, an appropriate package was developed for the control of fungal bulb rot of onion using organic amendments. Further, promising bio-pesticides to control pest and diseases in chilli, specifically leaf curl complex by using a 3G solution (garlic, ginger, green chilli) were identified. Moreover, an environmentally friendly IPM package for controlling thrips in leaf curl complex was also accomplished. A facility to rear parasitoids of papaya mealy bugs was also constructed.

Soils and Water Management: Establishment of a micro irrigation systems for various crops was done. Furthermore, drip irrigation systems for tissue cultured banana were also established. Under the soil testing programme, it was able to analyze more than 5000 soil samples collected from five districts in the Northern region during the period of 2017-2018 to support the site-specific nutrient recommendations.

Through the financial assistance of FAO, UNDP and IIDP, the station conducted several on-farm research projects with farmer-participation. During last five years, more than 75 research studies and field trials were carried out in collaboration with the universities. Many student-

farmer teaching sessions were done and this was extended also to–staff members of the Institute as well. In addition, a number of seminars on as well as crop clinics were conducted. Furthermore, field days were organized and the success stories related to crop cultivations by farmers were collected and compiled.

Many scientific research papers were published in research journals. Officers also participated in several live radio programmes. Furthermore, several newspaper articles targeting the farming community were also published.

The office premises, laboratories and specially the research fields were well maintained by the ROIC and his staff. The research farm was recognized as the environmentally friendly large scale farm in Sri Lanka, at the Presidential Awards 2017.

4.10. Regional Agriculture Research and Development Center, Aralaganwila

The Regional Agriculture research and Development Center (RARDC) at Aralaganwila was established in 1982 as an Agriculture Research Station with a specific mandate of conducting research and development activities in the Mahaweli System B area. In 1983 it was elevated as a regional research centre to cater to Mahaweli Systems B, C and G. In 1993, the station was brought under the FCRDI with the mandate of conducting research and development activities related to field with a regional focus. Currently, the centre has focused its activities in Mahaweli Systems B, C, D and G, and Ampara, Batticaloa and Trincomalee districts in the Eastern province, and the inter-provincial areas of Hasalaka, Meegahakivula and Mahiyanganaya. It is important to note that for the past four years, the breeder seed production of the papaw variety *Rathna* has only been done at the Aralaganwila station. Some selected key research findings are described below.

4.10.1. *Plant Breeding*

Cluster onion: The center has continued studies on characterization and varietal release of onion. Further evaluation and selection of red onion lines for short age, bolting-type and high-pungent non-bolting varieties are currently being conducted. The VAT for high yielding variety and development of Hybrids through hybridization and selection are among the research priorities on cluster onions. Experiments are also conducted on impact of gametocide for development of hybrid seeds on cluster onions.

Thibbatu (Solanum violaceum): Experiments are being varied out on the control of stem borer attack, in addition to the breeder seed production programme of the variety "*Bindu*".

Thumba karawila (Momordica dioeca): Screening of cultivars and hybridization programmes to produce high quality varieties are on-going.

General: the station supports and facilitates the conduct of NCVTs for rice, mungbean, ground nut, cowpea, and foxtail millet/finger millet.

4.10.2. *Soil and Water Management*

Paddy: Evaluation of soil conservation measures on soil erosion, runoff generation and crop yield: A case study was carried out in the low country dry zone of Sri Lanka to identify agronomic practices that are best for the region. The results have revealed that rotational irrigation provided similar yields as with standing water treatment in non-calcic brown (NCB) soil saving around 900 m^3/ha of irrigation water. A study conducted through a National Agriculture Research Plan (NARP) grant provided by the Sri Lanka Council for Agricultural Research Policy (SLCARP) has revealed that the plot size of 8 m x 8 m is the best for the highest water retention and uniformity of water levels.

Studies also have revealed that increase in temperature has a negative impact on rice yield while increase in CO_2 levels has a positive effect. However, the combined impact of these two parameters should be studied thoroughly prior to drawing conclusions.

Alternate wetting and drying (AWD) is difficult to practice under NCB soils as irrigation should be done at least at 5-day intervals. Studies are also on-going to evaluate the use of bio-fertilizer for long-term impacts.

Okra: Determination of soil moisture depletion patterns in different surface irrigation layouts in the dry zone soils in Sri Lanka (a NARP grant) and evaluation of soil conservation bunds with economically value crops in NCB soil have shown that there is no impact on okra yield, however, plots cultivated with lemon grass has shown the lowest soil erosion.

Cluster onion: Overlapping of spacing at 60% when using a sprinkler irrigation systems is the best for maximum utilization of water and higher cluster onion yield

4.10.3. *Plant Protection*

Cluster onion: studies are on-going to identify the fungicides and the duration of bulb treatment in controlling fungal bulb rot in cluster onion and to select the best disease-resistant red onion variety for the major onion growing areas. Further, development of high yielding red onion verities with resistance or tolerance to purple blotch, evaluation of different nursery management practices to raise red onion using true seeds, evaluation pest and disease incidence of red onion (including purple blotch disease) according to the planting time of the year are the current research priorities. Effect of different gypsum levels on cluster onion disease reduction and different organic manure levels on diseases incidence of cluster onion raised by bulbs are also been studied. Technical and social aspects of agrochemical use agricultural areas, development of high yielding red onion verities with resistance or tolerance to major onion diseases are the other on-going research activities.

Okra: Screening of fungicides for powdery mildew of okra is also a priority research thrust.

Information Management: The centre is actively supporting the construction of Epidemiology Information Interchange-System for Migratory Diseases and Insect Pest in Asia Region, which is coordinated by the Seed Certification and Plant Protection Division (SCPPD) of the Department of Agriculture.

4.11. Concluding Remarks

During the period of review, the FCRDI and its satellite station have carried out the research work according to the National Agricultural Research Plan (NARP) of the Sri Lanka Council for Agricultural Research Policy (SLCARP) and to support the Food Production National programme 2016-2018 of the government of Sri Lanka.

The review of the planning process and the output of research during the past 5 years clearly indicated that FCRDI has developed the future research plans based on the outcome of the research conducted, stakeholder consultation to identify field level problems, field visits and

Provincial Technical Working Group (PTWG) meeting. The research work is also interdisciplinary and multidisciplinary, involved various research institutions within and outside the DoA including Universities, and have studied the scientific needs of the various stakeholders during the planning process. Memoranda of Understanding signed with the international agencies such as AVRDC, CIMMYT, IAEA, KOPIA and USDA clearly indicate the need for infusion of modern technologies and germplasm to research and development activities of the FCRDI.

The staff of the FCRDI has been actively involved in discussions at PTWG, though the efforts are not adequate to understand the actual field level problems. There is a need for more frequent interactions at District and Divisional Secretariat Levels. Information dissemination to the field level is to takes place through the Agricultural Instructors in the inter-provincial areas and Provincial Department of Agriculture under the provinces. Both the systems, however, are unsatisfactory and should be further strengthened with required infusion of resources.

Management of the scientific and financial resources of the FCRDI has been satisfactory though the resources provided are limited. Research outputs, though adequate in number, have been prepared with the intention on publishing them in the ASDA. More focus and drive should be there for publishing in the journals in Science Citation Index (Web of Science) to ensure greater recognition.

5. RESEARCH AND DEVELOPMENT FOCUS – FCRDI AND SATELLITE STATIONS

The following research areas are recommended to be the focus of the institute based on their immediate requirement (priority), and for medium and long-term consideration. Please note that some on-going activities are also identified due to their need in the current context. The resultant yield targets to be achieved in the medium and long-term are presented in Table 5.1.

Table 5.1. Yield targets of OFCs through research interventions proposed

Crop	Medium term yield target for favorable ecosystems (t/ha)	Medium term yield target for unfavorable ecosystems (t/ha)
Green chilli	35	25
Maize	7.5	6
Big onion	40	10
Red onion	14	5
Ground nut	3	2
Finger millet	4	2.5
Black gram	2.5	2
Green Gram	2.8	2
Cowpea	2.5	2
Soybean	4	2.5

The targets in Table 5.1 were also agreed upon as achievable at the stakeholder meeting. The reviewers thank Dr. Malima Perera (Director/FCRDI) and Dr. W. Malaviarachchi of the FCRDI for their assistance given in preparing this document **(Bring it under Acknowledgements)**. The research and development areas given below are listed under three main segments, i.e. Climate smart technologies, plant protection and plant breeding. The proposed priorities do not include the extension related activities. However, adaptive research programs should be strengthened with farmer participation in order ensure the outcomes are effectively disseminated to the practitioners.

5.1. Prioritization of Research and Major Challenges

A workshop held on 28 June 2018 at the FCRDI at Mahailuppallama with the participation of 81 stakeholders representing state and private sector organizations did respond to questionnaire on parameters of research prioritization. Table 5.2 depicts the outcome of the survey highlighting that the cost of importation of food crops as the key parameter to be considered in prioritization of crops for research investment, followed by national requirement, nutritional and health aspects, farmer income, producing ability under Sri Lankan conditions and availability of industrial support.

Table 5.2. Parameters to consider in research prioritization of crops

Parameter/criteria	% responses (n=81)
Cost of imports	67
National requirement	44
Nutritional and Health aspects	41
Farmer income	40
Ability to produce under Sri Lankan conditions	38
Availability of industrial support	26

The recent statistics indicate that soybean, big onion, chilli, mungbean and maize are the five major OFCs that the country has spent most on imports (Table 5.3). The current priority setting of the FCRDI at MI on crops matches well with the information provided in Tables 5.1 and 5.2, except for the caSE OG

Table 5.3. Import bill, national requirement and farmer income of major OFCs (2017)

OFC	Cost of imports (Rs million)	National requirement (mt)	Farmer income (Rs/Ac)
Soybean	14,300	292,435	26,881
Big onion	12,118	285,921	375,019
Chilli	7,882	258.594	47,321
Maize	7,546	375,333	7,750
Mungbean	2,269	24,933	6,888
Red onion	1,285	68,658	114,020
Blackgram	1,194	20,096	3,330
Cowpea	994	15,921	24,155
Groundnut	689	27,320	1,167
Finger millet	243	8,492	11,907
Gingelly	27	7,977	16,959

Source: AgStat (2007)

The stakeholders also identified climate change as a major challenge followed by resource limitation, quality of varieties, high cost of production, high cost of imports and marketing as the major challenges for OFC sector that requires more research focus (Table 5.4). Development of high yielding varieties that are climate-resilient was the top-priority activity proposed by the stakeholders to tackle the challenges in next 10 years followed by mechanization, development of comprehensive crop production/management packages, value addition and marketing (Table 5.5)

Table 5.4. Major challenges faced by the OFC sector during the past 10 years, as identified by the stakeholders

Challenge	% Responses (n=81)
Climate change	65
Resource limitation	57
High quality varieties	47
High cost of production	22
Marketing	19

Table 5.5. Priority activities proposed by the stakeholders to improve the OFC sector in the next 10 years

Challenge	% Responses (n=81)
Climate-resilient high yielding varieties	52
Mechanization	27
Comprehensive crop production/management packages	27
Value addition	22
Marketing	21

The results of the survey also highlighted the importance of development of an index for research prioritization of the FCRDI using the parameters identified to ensure that future research investments are done to optimize the use of limited resources, including trained manpower, finances and infrastructure facilities.

5.2. Priority Research Focus in the Short Term

5.2.1. Climate-smart technologies - Agronomy, soil fertility and water management

(a) Crop-specific research focus

- Identification of drought and temperature-tolerant lines to support future breeding programmes
  Priority Crops: Chilli, Maize, Mungbean, Soybean and Big Onion
- Introduction of foliar fertilizer application technologies (including appropriate mixtures) to enhance the growth and yield of crops
  Priority Crops: Chilli, Maize, Mungbean, Soybean
- Identification of alternative potting media for urban agriculture and problem soils
- Introduction of alternative, environmentally-friendly pesticides to improve the growth and yield of crops
  Priority Crops: Chilli, Maize, Mungbean, Soybean and Big Onion

- Introduction of integrated crop management approaches to enhance crop productivity
  Priority Crop: chilli
- Identification of heat and drought avoidance strategies for field crops, using allele-chemicals such as salicylic acid, and GA3
  Priority Crops: Chilli and Maize

(b) General research Focus

- Use of Nano fertilizer to increase nutrient use efficiency for rainfed cropping conditions under changing and variable weather/climate conditions
- Introduction of automated irrigation systems with soil moisture sensors to enhance input use efficiency in irrigated agriculture
- Development of web-based weather forecasting for crop advisories to support the existing process of generation, dissemination and application of weather forecasts carried out by DOA
- Development of proximal sensing techniques to develop and implement management strategies towards increasing productivity of agricultural lands
- Assessment and monitoring of water quality of surface and ground water in the Dry Zone of Sri Lanka
- Introduction and use of super-water absorbents to increase the nutrient use efficiency under irrigated and rainfed systems
- Introduction of Rhizobium inocula to enhance growth and yield of soybean
- Introduction of Plant Test Kit and Soil Test Kit-based site specific fertilizer management technique for maize
- Identification and characterization of hydrological aspects related to agriculture productivity in 'Malwathu Oya' basin using isotope techniques

5.2.2. Plant Protection

- Identification of effective, economically-viable and environmentally-friendly weed control methods, alternative to the total-killer herbicides
- Identification of Onion Black Mold Complex and its biological control using *Trichoderma* spp.
- Continuation of bio-efficacy testing of commercial pesticides against weeds, insect pests and diseases
- Improved package of integrated pest and disease management packages for all OFCs

- Identification of weed and insect pests population dynamics under changing climatic scenario

5.2.3. Plant Breeding

- Introduction and selection of inbred lines/hybrids/OPV/unimproved population/land races from International research institute for favorable and unfavorable ecosystems (through genetic material transfer agreements to acquire germplasm)
- Exploring the available genetic variability through molecular and morphological characterization and identification of favorable genes (for biotic and abiotic stresses, quality characters)
- Characterization of the vast genetic diversity through ~~G~~ genomic, phenomic and informatics
- Creation of genetic variability through hybridization, mutagenesis and segregation of hybrids

5.3. Research Focus on Medium Term

5.3.1. Climate-smart Technologies: Agronomy, soil fertility and water management

(a) Crop specific research

- Identification of varieties/promising lines for excess water conditions
  Priority Crops: Cowpea, Maize, Soybean
- Identification of demand-driven nutrient management packages
  Priority Crops: Maize and Chilli
- Identification of lines and optimum crop management practices for marginal lands
  Focus crop: Sweet sorghum
- Development and implementation of mitigation and adaptation measures for climate change through re-visiting recommendations on fertilizer, land and water management, etc.
- Identification of a highly adaptable maize plant type for heat--and moderate-drought avoidance through Morpho-physio characterization of crops
  Focus Crop: Maize

(b) General

- Identification of heat-avoidance mechanisms such as early flowering and canopy cooling by use of bio technological tools
- Introduction of new fertilizer recommendations under micro irrigation system for required OFC
- Introduction of new fertilizer recommendations including micro nutrients of OFCs
- Introduced integrated crop management package for productivity improvement of rainfed uplands

5.3.2. Plant Protection

- Development of imaging system for pest monitoring & dissemination information to the end users
- Introduction of nano-technology driven agrochemicals and formulations
- Preparation of a data base on pest and disease populations in relation to weather data

5.3.3. Plant Breeding

- Development of hybrids/inbred lines/OPVs through conventional and mutation breeding methods
- Marker-assisted selection for disease resistance, pests resistance, and enhanced quality characters including nutrient composition
- Adoption of double haploid technology /anther culture to develop inbred lines
- Identification of extraction of secondary metabolites of OFC for industrial purpose (Capsaicin, pigments, oleoresins)
- Development of varieties through gene pyrimidine

5.4. Proposed Research Focus in the Long Term

Based on the stakeholder consultations held during the review process following thrust areas are proposed as research priorities in the FCRDI at Mahailuppallama and its satellite stations.

5.4.1. Climate-smart Technologies: Agronomy, soil fertility and water management

- Introduction of integrated crop management packages for rice-based cropping systems
- Agro-ecological based variety recommendation for Other Field Crops

- Development of management packages for OFCs based on remote/proximal sensing tools (satellite images, drones, electromagnetic induction techniques etc.)
- Development of agronomic packages for efficient use of inputs (automated irrigation systems, solar energy utilization, nano technology, super water absorbents, introduction of high resolution crop sensors to apply correct dosage of inputs, etc).
- Development of crop models for resource-based crop production systems through crop/ soil and water modeling techniques
- Introduction of novel techniques for drainage improvements, planned machinery use, bioremediation, etc., to minimizing soil quality deterioration.

5.4.2. Plant Protection

- Isolation and screening of different microbes for antagonistic effects on pathogens to develop bio-formulations
- Development of plant virus vaccines
- Development of kits and software for detection of pathogens and contaminants
- Development of pest and disease surveillance and forecasting models for selected major pests and diseases
- Development of a system for mass production and application / released of bio-control agents such as microbial pesticides and natural enemies
- Introduction of Ecosystem Engineering Tools for pest and disease management

5.4.3. Plant Breeding

- Research to achieve multiple resistance for major diseases and pests in OFC
- Development of hybrids/inbred lines/OPV using conventional and improved techniques with following yield targets
- Development of inbred lines through anther culture and double haploid techniques
- Variety development through gene editing and transformation techniques – feasibility studies for the problems that cannot be addressed by conventional plant breeding

5.5. Concluding Remarks

Research planning process has been carried out with a wider stakeholder participation including state, private sector and Universities. However, absence of the farming community is noteworthy.

6. CONSTRAINTS

The FCRDI and its satellite stations work on a wide range of annual and perennial crops. The physical infrastructure and human resources play an important role in determining the performance of any institutions. A summary of the resource analysis of the research stations under review are given below

6.1. General – Human resources

All stations reviewed suffer heavily from human resource constraints, which is the general situation in the Department of Agriculture. Retaining staff at all levels in all FCRDI and all satellite stations has been an issue over the years.

Further, the undue delay experienced in the recruitment of officers to the Department of Agriculture has severely affected the capacity of especially the satellite stations, leading to the absence of trained staff after retirement of the senior officers. As the Department of Agriculture currently awaits a court order to initiate the recruitment process, the review will not propose recommendations on this matter, but to request the authorities to expedite the process. However, fresh recruitment of large numbers of officers will not solve the issue unless they are adequately trained under the trained and experienced staff. Hence, re-employment of the retired staff on an assignments and need basis, with a view to support young staff to build their capacity is recommended.

It is important to note that majority of the young research officers have secured positions and scholarships to pursue higher studies at recognized universities in Thaliand, Malaysia and the Philippines. The support is mainly by the funding from the Treasury channeled through the Sri Lanka Council for Agricultural Research Policy (SLCARP). This should hopefully bring an end to the dearth of qualified research Officers in the years to come. On the other hand, the satellite stations are now incapacitated due to the absence of staff for the next few years. However, even with the return of the newly trained staff ~~retaining them in~~ to the peripheral stations such as Aralaganwila, Angunakolapalassa and Girandurukotte, and for that matter even ~~at to~~ Mahailluppallama (MI), retaining them is a critical issue. Further, the agro-ecological differences among FCRDI and satellite stations in the dry zone are small and technologies generated at FCRDI/MI can be employed in the others regions too perhaps, in some instances, with appropriate modifications. Therefore, we recommend a major overhaul of the institutional structure for the future, where all primary research such as genetics &crop breeding, agronomy, plant nutrition, plant protection, physiology and biochemistry etc are conducted at

MI. The satellite stations will only conduct adaptive & farmer participatory research. That way the qualified scientists can all be concentrated at FCRDI/MI and the satellite stations concentrate only on outreach activities. This would necessitate keeping only a core technical field staff at the peripheral stations, except in special circumstances when site-specific problems may have to be handled. Even that can be handled from the centre at MI with the support of staff at the periphery.

Considering the distance of locations of the stations from main cities, a hardship allowance of 20% of the basic salary is recommended to encourage ~~young and senior~~ staff to work ~~and retain~~ at the respective stations.

Several minor incidents about discrepancies relating to ownership of work programmes and outputs, especially in breeding and release of new varieties, have occurred in the past. The review team thus, recommend the establishment of code of conduct and ethics in the institute (preferably for the entire DoA) to avoid any such unpleasant situations in the future. This should not have occurred had the management assigned research tasks discreetly to the individuals/teams. However, this seems difficult to practice in a government institution with the current mode of operation.

6.2. General - Housing

Staff accommodation facilities in the close proximity to the research station is important in retaining staff at all levels and to ensure their maximum contribution. As at present, housing facilities are in a poor condition keeping the scientists away from their use. Termite control seems necessary in all housing facilities available at the FCRDI and satellite stations. This highlights the need to provide (a housing allowance) as a part of the emolument package to all staff, and/or providing accommodation in an "Apartment Complex" in the main cities close to each station. Provision of housing facilities similar to those at Hantana Housing Scheme in Kandy is proposed.

6.3. General – Transport

Being research stations located in the Dry Zone of Sri Lanka at a distance from main cities, it is suggested to provide daily transport facilities to staff of the respective stations up to 50 km radius to travel from home to work and return. This should increase the work efficiency of the staff throughout the week. Provision of transport between main cities such as Colombo and

Kandy and regional research stations and back on weekends should also improve staff outputs by ensuring punctuality.

6.4. Research – Extension Dialogue

The research-extension dialogue among the FCRDI and its satellite stations does not take place effectively as at present. Though joint field visits by research group followed by the meeting of the Provincial Technical Working Groups (PTWGs) takes place, still inadequacy of field exposure and time spent at the PTWGs have constrained the expected results in regard to issues of problem identification and solutions. Availability of more trained man power would provide solutions to this issue. However, there is also a need for more service providers in the present context to support an effective research-extension dialogue.

The FCRDI has produced 37 leaflets to support to disseminate information on important aspects of OFCs during the period of review and two booklets. Majority of them have been produced in Sinhala medium and there is a need to translate the information into English and Tamil medium to ensure wider circulation of the important technical information.

6.5. Adaptive Research, On-farm Research and Varietal Adaptive Trials (VAT)

The discussion held with the officers at the FCRDI and the satellite centers clearly shown that the term "Adaptive Research" has been ranked 'low' in the hierarchical order of activities of the institutes and centres. Thus, the centres designated and officers involved in carrying out adaptive research seems to be receiving step-motherly treatment and lower level recognition. As such, while recognizing the significant role play by adaptive research would have in implementing the research findings at the field level, the review team strongly feels that an acceptable nomenclature for "Adaptive Research" should be developed and used in this regard.

The support given by the Provincial Department of Agriculture to conduct Adaptive research and Varietal Adaptive Trials (VAT) of the FCRDI seem to be weak. Moreover, the situation is the same in the inter-provincial and Mahaweli system areas with weak involvement of relevant agencies and extension staff. Thus, the commitment of the key stakeholder agencies such as the Provincial Department of Agriculture and Mahaweli Development Authority of Sri Lanka in adaptive and farmer participatory research is a dire necessity.

It is recommended that the DoA establish a set of conditions of on-farm research programs highlighting their mode of operations, time schedule and responsibilities of each officer/institution, sampling and data collection. A mechanism[6] should be proposed to remunerate the farmers involved in the research (*e.g.* land rent, labour, etc.). The provincial and district levels officers and field officers who are assigned for such duties should also be remunerated (*e.g.* allowance) to encourage them to perform duties effectively. It is also recommended that the field officers be issued with a certificate by the FCRDI acknowledging their services. Such a certificate of recognition should be used in promotion and scholarship schemes.

6.6. Field Crops Research and Development Institute at Mahailuppallama

The FCRDI has been well-equipped with the physical infrastructure in terms of buildings and equipment required for performing the mandated functions, and with an enthusiastic contingency of research and support staff. With a vast area to be covered including administrative activities and official meetings, the staff is constrained with the transport facilities as suggested previously. Further, it is recommended to construct a new hostel complex with modern facilities than to rehabilitate the decapitated houses available at the premises.

The staff of the FCRDI has shown promise in publication of their research findings at least in the ASDA (Annual Symposium of the Department of Agriculture). The Department of Agriculture also recognizes researchers and extension officers at the ASDA through a competitive evaluation scheme, which is encouraging. However, the focus of the research officers of the institute to publish in ASDA, which provides short term gains, should be re-directed towards publishing in high-impact journals to improve the research culture and positioning the FCRDI and its satellite stations in the global research context. It is strongly recommended to support good publications by providing the publication costs through annual budgetary allocations of the Department of Agriculture. Further, technical training to improve the presentation and writing skills of the scientists is a need to build capacity among scientists on communication skills.

International exposure on crop breeding (*e.g.* mutation breeding, marker-assisted breeding), access to germplasm of promising lines to support breeding programs of priority OFCs, and novel production technologies for crops such as chilli and big onion are urgent needs for the

[6] Detailed operational procedure should be drafted by a committee consisting of Principal Scientists and finalized at a workshop Research and Extension staff from DoA and Provincial Council set up.

development of the sector. The FCRDI has already established linkages with AVRDC, CIMMYT, IAEA KOPIA and USDA through, which the access to gemrplasm could further be strengthened.

Mechanization of agricultural operations is key to improving labour productivity. The machinery research at the Farm Machinery Research Centre (FMRC) is being carried out by Engineers without a significant involvement of the agronomists. Thus, there is a concern among the researchers and extension officers in the FCRDI that the field requirements based on sound science is not effectively addressed through the research work carried out by the FMRC. Hence, it is recommended that the involvement of agriculturists/agronomists and agricultural engineers in the machinery research carried out by the FMRC to further strengthen mechanization of agricultural operations in the OFC sector. Further research should also focus on solving the energy issues related to mechanization to attract the practitioners. The FMRC should also attempt to access technology from the private sector, Universities and other organizations at bath national and international levels. Fine tuning of available technologies to suit our own conditions, especially to adopt available small farmer technologies from outside, would be more beneficial in the short-run compared to investment on identifying new technologies.

6.7. Regional Agriculture Research and Development Centre at Kilinochchi

The station should attempt to develop a complete technology package for each crop, specifically for those such as grapes which have the inherent advantage for growing in the region. The station has concentrated too much of agronomic aspects or varietal improvement. The stations at Thinnaweli, and Vavuniya, have supported the adaptive research programs of the satellite stations. There is a disparity in the process of fund allocation to different satellite stations. It would appear that despite the commendable performance fund allocation is inadequate. Moreover, foreign training opportunities are meagre and it would appear that the satellite stations have been overlooked in this regard.

The regional center suffers from lack of human resources and physical facilities. Severe shortages were observed at Kilinochchi with only one Research Officer (the Additional Director) at service. The centre also does not have a proper office complex, a conference/meeting hall, and a digital library thus affecting the normal day-day-day administration and research activities. Absence of poly-tunnel facilities has also affected the research programmes under specific crops. Further, potable water is not available during the *Yala season* due to salinity. Provision of such facilities will no doubt improve the commitment and the work-efficiency of staff at the center. Absence of an In-Service Training Centre (ISTI) in the North is a major

obstacle including hostel facilities for trainees. Kilinochchi station has also suffered due to language issues as the official correspondence received from the Head Office is in Sinhala language. It is recommended that the official communication should either be in English or with a Tamil translation, as the native language of the majority of officers at the station is Tamil.

6.8. Grain Legume and Oil Crops Research and Development Centre at Angunakolapelessa

The research centre at Angunakolapelessa is performing well despite limited resources. The centre urgently requires an internal road network covering all research fields for easy access. Further, the centre should be provided with a lift-irrigation facility and a water source to further strengthen research activities.

6.9. Regional Agriculture Research and Development Centre at Aralaganwila

Only three research Officers at Aralaganwila are at service at the time of review. The Deputy Director of the Station has been promoted to the position of the Principal Scientist and transferred to FCRDI, and two other young Research Officers are due to be away from the latter part of the 2018 for their postgraduate studies. Immediate replacement of trained manpower at Aralaganwila Centre is unlikely, thus severely affecting the work program at the station.

It is suggested to narrow down the list of crops and focus more on a set of priority crops as identified in the sections 5 and 6 of this report. With these priority crops, the station could work on evaluation and promotion of local varieties. Further, a large area allocated for paddy (15 ha out of about a total of 27 ha) is not a necessity for the station as adequate land is also available at the Samanthurai adaptive research station to be used for the purpose, but allocate land for the other priority crop identified by the FCRDI. This problem is much more prominent with the fruit crops research carried out at the Aralaganwila station due to two reasons: (1) this is the main agricultural research station for North, North Central and Eastern provinces focusing on research and development of priority fruit crops for the dry zone: (2) collaboration with Horana FCRC is difficult due to the distance. The Aralaganwila station should capitalize on the potential of non-calcic brown (NCB) soils to develop OFC and fruit crop sectors. However, the limited upland area, absence of water conservation technologies and drainage facilities, shallow water table especially during *Maha* season, lack of modern irrigation facilities (including micro-irrigation), and poor facilities for soil nutrient analysis despite the demand for such services have affected the functions of the centre. Hence, provision of such facilities together with the

trained/skilled staff would enhance the functional efficiency of the centre. Further, land should be allocated to provide planting materials of the traditional crops *Thibbatu* and *Thumba karawila*, which have a greater demand from the growers.

Human-animal conflict especially arising from wild elephants has hindered the progress of research activities and livelihood of the staff at the station. Hence, erection of an electric fence to safeguard the lives of the staff and the cultivated crop lands is recommended as a priority.

6.10. Concluding Remarks

The FCRDI has a clear, streamlined process for planning of research based on the national development goals, National Agricultural Research Policy, and the National Agricultural Research Plan (NARP). The Director General of Agriculture has shown a keen interest to support the R&D programme of FCRDI and its satellite stations, which is encouraging. Coordination of research activities within and among institutes of DoA takes place with a close coordination from the Directorate. However, as for other institutions such as Universities, the coordination is inadequate and the limited number of activities is coordinated on a personal-basis. This needs further attention of the Directorate of the DoA to streamline the inter-institutional coordination via formal mechanisms, to further strengthen the quality of research and mobility of researchers. The Directorate of the DoA in general, and at FCRDI are competent and possess required professional qualifications. However, the relevant roles or duty lists should be clearly identified to enhance the overall productivity of the institute. The Directorate at the FCRDI has given a well-focused leadership during the past 5 years (review period) and has had a good rapport with the staff, which is a key to the present-day progress shown by the institute.

The nature of budgetary review and evaluation processes and the involvement of important stakeholders such activities related to funding is weak. There is no formal mechanism to obtain financial support from the private sector for technology generation and research. The institutional policies should gear towards attracting more partners and resources leading to effective and productive planning and utilization of resources.

The procedure adopted for deciding and recruiting staffing requirement at all levels is a cumbersome process as per guidelines provided by the Department of Management Services in Sri Lanka. However, progress monitoring and more objective evaluation of the staff at all levels will help improving the quality of the work conducted and services delivered by the institute.

Administration of fiscal, purchasing and supply of personal computers, etc. requires further attention by the authorities. It is important to periodically evaluate and upgrade the equipment available Support the qualified technical staff is a must to maintain the laboratory equipment under good working conditions. Though adequate supply of equipment has been done to FCRDI, the satellite stations still lack basic facilities, and thus the trained human resources. Housing and other facilities including transport and general management services should be enhanced significantly to ensure highest level effectiveness of staff at all levels.

The review clearly indicated that, among others, research-extension dialogue is weak and its effectiveness need to be improved significantly to ensure the end-users in the relevant sectors will benefit the outcome of research carried out at FCRDI and its satellite stations. All aspects in terms of information dissemination including, the effectiveness of its information exchange programmes, timelines, quality, and relevance of the technologies generated and its publications, and the mechanism adopted to get the feedback from stakeholders on research output to plan for future need further improvements. See the section on recommendations.

7. Overall Analysis of the Review – FCRDI

The overall analysis was done based on the progress shown in research planning and implementation, and effective use of the limited resources. The mission of the institute is strongly placed ensuring R&D focus on immediate and long term needs of Sri Lanka, and transfer of technological research outcomes or technological innovations. The research and development programs of the institute are in line the National Agricultural Research Plan (NARP) and focused on achieving the targets of the National Food Production Programme of Sri Lanka 2016-2018. The roles of relevant partners in the formulation and implementation of the Institution's research strategy and priorities needs is appropriate (Table 7.1). Conservation of the natural resources, impact of Institution's practices on natural environment and long -term environmental sustainability are not explicitly addressed.

Table 7.1. The mission of the institute

Aspect (as in the ToR)	Management practice	Evaluation (Strong/Moderate/Weak)
Research and development focuses on immediate and long term needs in Sri Lanka	The national priorities have been identified based on short, medium and long term goals of the country through facilitating the dialogues with stakeholders including farmers, private sector companies, entrepreneurs etc.	Strong
Transferring technological recommendations/Research outcomes to relevant stakeholders.	The farmers have been identified as key stakeholders in the mission. The other stakeholders were not considered in the mission.	Strong to moderate
The policies and directive of the SLCARP and the relevant Ministry regarding the appropriateness of Institution's Mission in the light of important changes taking place in production and product development in Sri Lanka	Assurance of national food security through research and extension have been identified.	Strong
Appropriateness of the roles of relevant partners in the formulation and implementation of the Institution's research strategy and priorities	In line with the mission, the centre has developed detailed project plans after discussing with the institute as well as at relevant technical working group meetings. The centre has the mandate for R&D of all DZ food crops.	Strong
Conservation of the natural resources, impact of Institution's practices on natural environment and long -term environmental sustainability	The importance of sustainable field crops production has been recognized. Conservation of natural resources need to be included.	Moderate

The institute has performed well even under limited human and physical resources. Most of the stations had satisfactory outreach programmes, such as soil testing, linking with other DoA institutes and Universities. The FCRDI is well-equipped with field and laboratory equipment to support the research programmes conducted, however, the regional centres are plagued with lack of human and physical resources. Within the mandate of the institute, the majority of the research has been focused on breeding new varieties, pathology, entomology, agronomy and water management. Despite the satisfactory research programme, studies carried out on economics of the new crop management packages, micronutrients and soil fertility, ground water pollution, hydrology, uses of microorganisms and organic matter, green manure cropping, etc., are not adequately addressed or overlooked at the FCRDI and satellite stations. Integrated Plant Nutrient Management should be promoted for all crops to enhance crop productivity in all agro-ecological regions. Resources allocation and planning needs further improvement to address the emerging and priority needs of the sector. Thus, the overall ranking of the institute on objectives and relevance of the present programme (Table 7.2) and the content and quality, and relevance of the scientific work (Table 7.3) were evaluated as strong to moderate.

Table 7.2. The objective and relevance of the present programme of work, budget and its forward plans

Aspect (as in the ToR)	Management practice	Evaluation (Strong/Moderate/Weak)
The Institution's **mandate and its criteria** for allocation of resources and planning procedures adopted by the Institution and the mechanisms for their formulation.	The institute possesses the mandate to allocate resources to increase the availability of OFCs through generation of technology and making availability of seeds. However, some components are controlled at higher level, i.e., the DoA or MoA.	Strong to moderate
The Institution's **rationale for its present allocation** of resources among research, extension, information exchange and other activities.	The Institute appropriately allocates the financial resources for the above and other activities such as development of physical and human resources.	Strong to moderate

The cost effectiveness of the research being carried out need a separate in-depth analysis looking at the beneficial impacts after adoption of the outputs (Table 7.4). However, the institute has established strong collaborative relationships with other research institutes and with national development programmes, private sector organizations and other stakeholders. The extension programmes of the institute are being carried using the existing machinery of the DoA and provincial DoAs. The set up was not thoroughly evaluated in this review due to involvement of large number of agencies (Table 7.5). Further, the adaptive research has not been well recognized and the on-farm research program also need to be streamlined.

Table 7.3. The content and quality, and relevance of the scientific work

Aspect (as in the TOR)	Management practice	Evaluation (Strong/Moderate/Weak)
Results of research during the past 5 years and their practical applicability and economic feasibility.	The institute has carried out a comprehensive research program during last 5 years. Most of these are practically applicable in Sri Lanka situation. However, more rigorous economic evaluation is needed. Priority setting for resource allocation is also needed.	Strong to moderate
The current and future research plan and the role of the various scientific disciplines therein.	The main stations, MI and ANK had an inclusive research plan, in line with NARP. Researchers more often have multi-disciplinary research.	Strong
The degree and extent to which the specific needs of the various stakeholders were studied and analyzed in the formulation of the past and current research plans.	The institute maintained dialogues with stakeholders (farmers, private sector companies, and entrepreneurs), provincial technical working groups, and experts from universities and from other institutes.	Strong
The information exchange and extension programmes and the participation of the research staff therein.	The institute closely works with provincial technical working groups, ISTI and extension service. However some of the links need to be strengthened.	Moderate
The adequacy of research support and facilities.	Though adequate to a certain extent, still there is a scope to further develop. The out-stations are suffered from lack of human and physical resources.	Moderate
The management of the scientific and financial resources of the Institution and the coordination of its activities.	The existing scientific resources are well managed in all the stations. The annual financial allocations during past five years were managed well.	Strong
Level of national and international recognition of the Institution and its scientific staff	The main stations had a satisfactory local international recognition in the past. This need to be regained through various exchange programmes and scientific publications.	Strong to medium
Cooperation/collaboration with universities, regional and international research organizations	The Institute maintained good links with local Institutes (CARP, NRC and NSF) and international organizations CIMMYT, ICRISAT, AVRDC, RDA, NIAES, etc.). However the collaborative research between universities and international linkages need to be strengthened together with public-private partnerships.	Strong to medium
Adequacy of publications of research findings	The scientists have maintained a satisfactory publication record. However, most are published in the Annals of the DoA. The institute should represent in other local conferences in addition to making publications in indexed journals.	Moderate

Table 7.4. The impact and usefulness

Aspect (as in the TOR)	Management practice	Evaluation (Strong/Moderate/Weak)
The recorded and potential impact of the **Institution's** research	The researchers identify national needs in the agriculture based on directions from national budget and ministry policies followed by discussions with all stakeholders. Though there are reasonable achievements, there is a little impacts on reducing heavy import bill of OFC products in the country.	Moderate
Cooperation with other research institutes and with national development programmes, private sector organizations and other stakeholders	The institute possesses good links with DoA institutes, other agriculture based institutes, universities and the corporate sector.	Strong

Table 7.5. Extension programme of the Institution

Aspect (as in the TOR)	Management practice	Evaluation (Strong/Moderate/Weak)
Effectiveness in the relevant sector	The extension is done through the formal extension hand of the DoA and the provincial council set up.	Not evaluated.
Effectiveness of its information exchange programmes and the timelines, quality and relevance of the technologies generated and its publications.	The timeliness, quality and relevance of the quality of the technology are partially evaluated by the Institute. This aspect need to be externally evaluated.	Moderate
Effectiveness of transferring technological recommendations based on research outputs	The adaptive research has not been well recognized. On farm research program also need to be streamlined.	Weak
Mechanism adopted to get the feedback of stakeholders on research outputs and then planning future R&D.	The outside experts from relevant fields are involved in planning of R&D. In addition, expert advice from international institutes are always solicited.	Strong
The identification of problems and constraints impeding the extension programmes/ dissemination of technological recommendations to the stakeholders.	The research institutes are somewhat isolated from the extension system mainly due to administrative reasons, i.e., extension programmes are conducted by provincial DoAs.	Moderate

Lack of incentives (monetary and physical, including residential facilities) has always been an issue with respect staff at remote locations in Sri Lanka. For example, *wifi* facilities are not available even to a main research station such as FCRDI. Work of Research stations away from the major cities of Sri Lanka has not only been affected but also that of personal operations of officers. Hence, appropriate incentives for those in remote work stations in addition to the

normal emoluments is strongly recommended. Administrative of fiscal, purchasing and supply, personal computers, housing and other facilities including transport and general management services and their effectiveness in supporting the scientific staff are weak (Table 7.6) and should be improved. Several recommendations are provided in this report to this effect. Services provided by the institutes are satisfactory but should be strengthened further by providing adequate trained man power (Table 7.7).

Table 7.6. The quality and effectiveness of the management of the Institution

Aspect (as in the TOR)	Management practice	Evaluation (Strong/Moderate/Weak)
Constitution of research, advisory or sub-committee of the Board.	Since FCRDC is operated under DoA administration, there may not be a provision to accomplish this. However, the main stations could operate and evaluate their research programs based on sub-committees. The progress of research activities need to assessed internally.	Moderate to weak
Adequacy in coordination to ensure excellence of the research programme and related activities	At present, individuals / small group of researchers conduct their programmes. A thematic coordination could help to ensure excellence of the research programmes.	Moderate
Competency and professionalism the senior management of the Institution and the definition of roles, organization and quality of the leadership of the Institution and rapport with staff	The senior management in the stations, MI, ANK and KLN possesses the necessary competency and the professionalism. The management maintains with good rapport with the research and supporting staff.	Strong
Nature of the budgetary review and evaluation processes and the involvement of important stakeholders in the above stability of funding and the relationships between budget, institutes policies and plans and the effectiveness of utilization of resources	The budgetary allocation have been utilized satisfactorily. The budgetary review with the station may not clear. However, directions from national budget and ministry policies were corrected followed.	Strong
Procedure for determining staffing requirement at all levels for selection evaluation and compensation of staff	The staff requirements are annually estimated. The training and other requirements at all levels were satisfactorily addressed.	Strong
Administrative of fiscal, purchasing and supply, personal computers, housing and other facilities including transport and general management services and their effectiveness in supporting the scientific staff	The support provided by the Ministry to the scientific staff need to be upgraded. The housing and transport facilities are not par with the facilities provided to the similar categories of officers.	Weak

Table 7.7. Services provided by the Institution

Aspect (as in the TOR)	Management practice	Evaluation (Strong/Moderate/Weak)
Consultancy and advisory services	A number of consultancy reports, field diagnostic reports and leaflets have been produced.	Moderate
Laboratory services	Most of the stations carry out soil testing services successfully. The quality and efficiency of services provided by the analytical services should assess annually.	Strong to moderate
Pest control and fumigation of ware houses	Not relevant.	Not evaluated.

It is encouraging to note the initiatives taken by the FCRDI, and the DoA as a whole, to establish public-private partnerships thus allowing the private sector to access breeding material for seed production programmes and marketing. This has opened up a new dimensions to the seed industry in Sri Lanka. The agreements are currently limited to chilli with the involvement of six private companies, but should be further expanded to other hybrids crops to expand the national seed requirement. A letter sent by Messrs Hayleys Agro Farms Ltd (Annexure 5) provides evidence for an encouraging response from the private sector in this regard. Further, FCRDI has entered into agreements with SVRDC, CIMMYT, IAEA, KPIA and USDA, however, further strengthening of these international linkages is needed to support achieving the long term breeding objectives of the centre and also to provide international exposure to the scientists.

The Ministry of Agriculture is currently in the process of developing a new National Agriculture Policy while the Department of National Planning is currently preparing an Overarching Agriculture Policy covering all major fields in the agriculture sector of the country (food crops, plantation and export agricultural crops, livestock and poultry, inland fisheries and aquaculture, irrigation, and environment). Further, the SLCARP has already prepared the National Agricultural Research Policy for the period 2016-2027. These would no doubt have a medium to long-term impact enabling the FCRDI and other institutes in the DoA to focus their activities in a coherent manner to overcome some of the threats identified in the SWOT analysis.

Some of the weaknesses identified through the SWOT analysis have been partially fulfilled, such as provision of opportunities for the officer to obtain higher degrees. The opportunity has now been granted by the SLCARP through Treasury funding at three selected Universities in Thailand, Malaysia and the Philippines. Further, recognition of outstanding researchers is has also been done by the SLCARP at its bi-annual awards ceremony and by the DoA at its annual symposium (ASDA). However, the DoA as a whole, needs to further strengthen promotion schemes by introducing a merit-based systems in line with that adopted by the Universities in

Sri Lanka. We are of the view that performance should supersede service/seniority whereas at present seniority overwhelmingly supersedes performance. The dearth of laboratory technical staff is an issue the scientists have to look into in regard to the maintenance issues of the laboratory equipment. Hence, urgent attention should be given to create a cadre and recruiting qualified staff at least to FCRDI to ensure regular maintenance of the laboratory equipment.

The brain drain of experienced DoA officials to other state (especially Universities) and private sector institutions due to high financial perks and elevated retirement age (*e.g.* 65 years in Universities) have been long-standing problems to retain staff at DoA-institutions in addition to other constraints already identified. This has further aggravated by the undue delays in recruitment of staff to scientists cadre. This report suggest viable options to cater to the needs of scientists to ensure their retention, however, the delays in recruitment is beyond remedy as at present as the matter is now in courts pending judgment.

The review team was satisfied with the overall progress made by the FCRDI and the satellite research stations during last five years. The set of draft recommendations given in proceeding chapter were presented to the FCRDI at a meeting held on 19 September 2018 and received their concurrence.

8. RECOMMENDATIONS

8.1. Research Programme

1. Identify the FCRDI at Mahailuppallama as the centre for major research work in OFCs and other crops such as breeding, crop nutrition, agronomy and pest & disease management of the mandated crops, while the other centres/sub-stations be essentially confined to adaptive or farmer participatory research or highly site-specific research, with large demonstration plots, for more effective use of limited resources, especially of qualified manpower.

2. Set clear targets for research disciplines, in collaboration with the other supporting institutes such as the Natural Resource Management Centre (NRMC), Farm Mechanization Research Centre (FMRC), Institute of Post-Harvest technology (IPHT), ~~and~~ Socio-Economic and Planning Centre (SEPC) and Universities.

3. Do priority setting for research and resource allocation in accordance with the National Crop Production and Improvement Targets, *i.e.* maize, soybean, chilli, mung bean, big onion, cluster onion and ground nut

4. Assess the economics of crop management packages, including the use of novel technologies and eco-friendly technologies for their better adoption

5. Set up research programmes on sustainable settled-farming in the Dry Zone giving emphasis to soil fertility and water conservation under different soil types (i.e. reddish brown earth, low humic glay soils, latosols and non-calcic brown soils).

6. Assess the progress of research activities of the FCRDI and satellite stations once in three years to ensure optimal outputs.

7. Develop procedures to provide formal access to genetic resources and technologies from international organizations such as CGIAR and other international institutes to improve breeding programmes in the OFCs sector (*e.g.* agreements with CIMMYT, ICRISAT, AVRDC, RDA, NIAES, etc.)

8. Provide *wifi* facilities for fast-access of literature and database, required licensed statistical software and membership to reputed websites of the scientific journal websites (*e.g.* journals in the web of science)

9. Develop and implement a continuing professional development plans and programs, with foreign training opportunities for all staff based on merit; ideally, provide Ph.D. level training to scientists.

10. Provide continuous, in-house training skills in scientific writing and presentations

11. Recruit a competent technical staff member to look after the interests of laboratory and equipment maintenance

12. Provide tools and facilities to use IT–based techniques such as crop simulation models, *e.g.* APSIM and DSSAT, to generate more comprehensive outputs.

13. Adopt novel approaches such as video conferencing, email and other communication channels to cut down on meetings to save travel time and costs.

14. Introduce and conduct more stringent methods for evaluation and prioritization of research proposals by the research managers to avoid repetition of research especially in the field of agronomy and breeding.

15. An all island On-farm OFC Productivity Research Program is proposed as an urgent step to promote increased local production of crops, to substitute imports. This should be done in conjunction with an effective extension service to encourage the farming community to embark on production programmes such as the "*Yaya* programme" or the "*Thumba Karawila*" programme adopted by the RARDC at Angunakolapelessa, and promoting application of micronutrients such as Zinc, Boron, Sulphur and Magnesium. The program should also be coupled with the introduction of Good Agriculture Practices (GAP).

8.2. Outreach Activities

1. Strengthen the adaptive/farmer participatory research programmes with allocation of adequate extension staff from the DoA and Provincial DoAs

2. Assess the analytical services provided once in two years and provide adequate supporting staff and equipment to expedite the timely release of analytical reports to the stakeholders.

3. Promote site-specific and integrated nutrient management for upland crops for economizing fertilizer use and avoiding the consequences of excess fertilizer use

4. Strengthen the dialogue between research, extension and farming communities to ensure effective problem identification and technology dissemination

5. Transfer the technology generated to the end users as a package including improved varieties, agronomic and fertilizer recommendations, economic benefits, etc.

6. Establish a web-based feedback system for continuous temporal and spatial variation of the demand and supply, consumer preference, and market prices of the agricultural produce, in collaboration with SEPC of the DoA.

7. Appoint an officer at FCRDI for public relations and media to maintain links with the mass media for effective dissemination of information to the general public.

7.3. Administrative Issues

1. Establish a total remuneration package for scientists and extension officers comparable with that of corresponding university academic positions consistent with qualifications and experience, to mitigate the current exodus of trained scientists from the research institutes-for academic positions.

2. Develop and implement a performance-based promotion system for staff, with an overall weightage of 60% in the final selection, to supersede the existing service/seniority.

3. Provide an allowance to officers at all stations under FCRDI, *e.g.* incentive allowance for working in the difficult areas to the value of 20% of the basic salary, and to those who support collection of field level data

4. Establish a mechanism to remunerate officers and farmers who take part in the farmer participatory research programme

5. Establish reliable irrigation schemes for the stations to support research and human consumption.

6. Introduce and promote the use of animal-repellent technologies such as reflectors, supersonic whistles, etc., to control animal damage to the crops in the stations and farmers.

7. Introduce and implement an annual reward scheme (cash/material/certificate) for all staff based on achievements of targets.

8. Implement a viable collaborative research mechanism to obtain services of University academia with an appropriate remuneration package based on their qualifications and experience (*e.g.* one day per week input of academics)

9. Prepare detailed management and operational procedures for farmer-participatory research and VAT.

10. Strengthen the existing mechanism for private-public research partnership with an appropriate incentives to all officers concerned.

11. Establish a patenting mechanism and culture to support innovations under which the researchers, too, receive a share of the royalty.

12. Construct a central hostel facility at an economic rent for Mahailluppallama and Angunakolapelessa to replace the dilapidated and unsuitable staff houses

Annexure 1

Terms of Reference

External Review of the Research Institutions in the National Agricultural Research System (NARS)

Field Crops Research and Development Institute (FCRDI)

Objectives:

The objectives of this independent review are

- To assess the quality, cost0effectiveness, relevance and impact of the scientific programmes carried out by the Field Crops research and Development Institute (FCRDI) at Mahailuppallama, to be reviewed in order to ensure that Government funds are being effectively utilized to address the sector needs
- To look into the appropriateness of the FCRDI 4esearch agenda to meet the emerging challenges in the future and in particular in meeting with the 2030 sustainable development goals and also national targets ensuring food and nutrition security
- To look into the all the aspects of the FCRDI functions directed towards research and development, dissemination of technology through extension and services offered yo its stakeholders and its impact on the usefulness to address the timely needs
- To identify any deficiency in the procedures adopted by the FCRDI in recognizing the research needs of the other field Crops (OFC) Sector
- To give advices on effective planning and implementing of future programmes of the FCRDI

Scope:

To achieve the above objectives of the Review Panel and its implementation with respect to the following aspects

1. The mission of the institute and its interpretation with respect to
    - Research and development focus on immediate and long term needs in Sri Lanka
    - Transferring technological recommendations/research outcomes to relevant stakeholders
    - The policies and directives of the SLCARP and the relevant Ministry regarding the appropriateness of FCRDI's mission in the light of important changes taking place in production and product development in Sri Lanka

- Appropriateness of the roles of the relevant partners in the formulation and implementation of the FCRDI's research strategy and priorities.
- Conservation of the natural resources, impact of FCRDI's practices on natural environment and long-term environmental sustainability

2. The objectives and relevance of the present programme of work, budget, and its forwards plans for the next five years in relation to
    - The FCRDI's mandate and its criteria of allocation of resources and planning procedures adopted by the institution and the mechanisms of their formulation
    - The FCRDI's rationale for its present allocation of resources among research, extension information exchange and other activities

3. The content and quality and relevance of the scientific work with particular reference to
    - Results of research during the past 5 years and their practical applicability and economic feasibility including the impact of the relevant sector
    - The current future research plan and the role of various scientific disciplines therein
    - The degree and extent to which the scientific needs of the various stakeholders were studied and analyzed in the formulation of the past and current research plans
    - The information exchange and extension programmes and the participation of the research staff therein
    - The management of the scientific and financial resources of the FCRDI and the coordination of its activities
    - Level of national and international recognition of the FCRDI and its scientific staff
    - Cooperation and collaboration with Universities, regional and international research organizations
    - Adequacy of publication of research findings

4. The impact and usefulness of the FCRDI's in relation to
    - The recorded and potential impact of the institution's research
    - Cooperation with other research institutes and with national development programmes, private sector organizations and other stakeholders

5. Examine the extension programme of the institution to determine
    - Its effectiveness in the relevant sector
    - The effectiveness of its information exchange programmes and the timelines, quality, and relevance of the technologies generated and its publications
    - The effectiveness of transferring technological recommendations based on research outputs
    - Mechanism adopted to get the feedback of stakeholders on research output and then planning future R&D

- The identification of the problems and constraints impeding the extension programmes/dissemination of technological recommendations to the stakeholders

6. The quality and effectiveness of the management of the institution in relation to
    - Constitution of research, advisory or sub-committees of the board
    - Adequacy in coordination to ensure excellence of the research programme and related activities
    - Competency and professionalism of the directorate and their senior management of the FCRDI and definition of roles, organization and quality of the leadership of the institution and rapport with the staff
    - Nature of the budgetary review and evaluation processes and the involvement of important stakeholders in the above stability of funding and the relationships with budget, institution policies and plans and the effectiveness of utilization of resources
    - Procedure for determining staffing requirement at all levels for selection, evaluation and compensation of staff
    - Administration of fiscal, purchasing and supply, personal computers housing and other facilities including transport and general management services and their effectiveness in supporting the scientific staff

7. Services provided by the staff
    - Consultancy and advisory services
    - Laboratory services
    - Pest control and fumigation warehouse

8. Overall analysis through
    - A SWOT analysis to identify controllable and uncontrollable factors

Annexure 2

Research Programme

2017/ 18 Maha & 2018 Yala

Field Crops Research & Development Institute

Mahailluppallama

CONDIMENTS

CHIL/ TH 01 ***Development of high yielding, pests, disease and drought tolerant chilli varieties with desirable quality.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 01/ IMPR / EX 1	Development of chilli hybrids	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA)	√	√
TH 01/ IMPR / EX 2	Priliminary Yield trials and Major yield trials for new chilli hybrids	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√
TH 01/ IMPR / EX 3	National Coordinated Varietal Trials for promising chilli hybrids	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√
TH 01/ IMPR / EX 4	Varietal Adaptability Trials for promising chilli hybrids	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√
TH 01/ IMPR / EX 5	Development of inbred lines through generation advancement of exotic chilli germplasm	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√
TH 01/ IMPR / EX 6	Evaluation of developed inbred lines	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	-	√
TH 01/ IMPR / EX 7	Development of inbred lines through generation advancement of interspecific chilli hybrids	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 01/ IMPR / EX 8	Transferring of genetic male sterile character to the promising parent lines	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√
TH 01/ IMPR / EX 9	Evaluation of exotic chilli hybrids	H.M.S.N. Herath (ADA) K.N.C. Gunawardena (ADA) W.M.K. Fernando (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√

CHIL/ TH 03 ***Development of low cost, environmentally sound and effective pest and disease management practices for chilli.***

TH 03/ PATH/ EX 1	Evaluation of local chilli hybrids for major diseases	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	√
TH 03/ PATH/ EX 2	Evaluation of chilli OPV lines for major diseases	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	√
TH 03/ PATH/ EX 3	Efficasy testing of mancozeb 70 % + Azoxystrobin 5 % WG for anthracnose of chilli	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	-
TH 03/ ENTO/ EX 4	Evaluation of different local chilli hybrids for major pests	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	√	√
TH 03/ ENTO/ EX 5	Evaluation of different open pollinated chilli varieties for major pests	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	√	√
TH 03/ ENTO/ EX 6	Evaluation of silica containing products as plant resistance inducers for thrips in chilli	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 03/ ENTO/ EX 7	Testing of insecticides to control chilli leaf curl complex	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	√	√

CHIL/ TH 04 ***Development of agronomic practices to increase condiments yields under rainfed and irrigated conditions.***

TH 04/ AGRO/ EX 1	Validation of the LCC readings to decide the nitrogent requirement of chilli	H.M.P.T.K. Hettigedara (ADA) M.A.P.W.K.Malaviarachchi (ADA) D.H.K. De Silva (RA)	√	√
TH 04/ AGRO/ EX 2	Influence of growth regulators on growth and yield of chilli	H.M.P.T.K. Hettigedara (ADA) M.A.P.W.K.Malaviarachchi (ADA) D.H.K. De Silva (RA)	√	√
TH 04/ AGRO/ EX 3	Altanative nursery management techniques for chilli	H.M.P.T.K. Hettigedara (ADA) M.A.P.W.K.Malaviarachchi (ADA) D.H.K. De Silva (RA)	√	√
TH 04/ AGRO/ EX 4	Screening of OFCs for high temperature tolerance	K.H.S.T. Deshabandu (ADA) M.A.P.W.K.Malaviarachchi (ADA) E.M.S.P. Ekanayake (RA)	√	√
TH 04/ AGRO/ EX 5	Screening of other field crops for water stress tolerance	K.H.S.T. Deshabandu (ADA) M.S. Nijamudeen (ADA) R.A.C.J. Perera (ADA) E.M.S.P. Ekanayake (RA)	√	√
TH 04/ AGRO/ EX 6	Integrated effect of plant gowth regulators and nutrients on chilli	M.A.P.W.K.Malaviarachchi (ADA) R.A.C.J. Perera (ADA) H.M.P.T.K. Hettigedara (ADA)	√	√

ONIO/ TH 06 ***Development of high yielding (40t/ha), pest & disease tolerant/ resistant, seed setting onion varieties with good keeping qualities.***

TH 06/ IMPR/ EX 1	Hybridization and selection of onion	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	√	√
TH 06/ IMPR/ EX 2	Generation advancement of onion	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	√	√
TH 06/ IMPR/ EX 3	Evaluation of exotic big onion varieties	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	-	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 06/ IMPR/ EX 4	Development of big onion lines from out crossed populations	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	√	√
TH 06/ IMPR/ EX 5	Evaluation of seed setting cluster onion lines	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	√	√
TH 06/ IMPR/ EX 6	NCVT - Big onion	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	-	√
TH 06/ IMPR/ EX 7	Evaluation of big onion flower crops for male sterility	M.G.S.P. Pathirana (ADA) J.S.M.D.L.Wijerathne (RA)	√	
TH 06/ IMPR/ EX 8	Evaluation of colleced germplasms	B.I. Hettiarachchi (ADA) M.I. Wickramasinghe (TA)	√	√
TH 06/ IMPR/ EX 9	Maintaining parental lines, hybridization, and generation advancement	B.I. Hettiarachchi (ADA) M.I. Wickramasinghe (TA)	√	√

ONIO/ TH 58 ***Development of low cost environmentally sound effective pest and disease management practices for onion***

TH 58/ PATH/EX 1	Identification of onion black mold and its biological control using trichoderma spp	W.M.K. Fernando (ADA) Prof. S. Wilson (ITI Consultant) Dr. D.M.J.B. Senanayake (ADA) M.S.W. Fernando (ADA) P.G.H.M.S.N. Herath (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	√
TH 58/ PATH/EX 2	Development of a weather based disease forecasting model for onion antharacnose	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	-
TH 58/ PATH/EX 3	Screening of onion lines for anthracnose and purple black diseases	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	-
TH 58/ ENTO/EX 4	Effect of different miticides as a bulb treatment to reduce bulb mites in onion seed crop	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	√	-

ONIO/ TH 64 ***Development of suitable agronomic practices to increase yield and storability of onion.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala* 2018
TH 64/ AGRO/ EX 1	Evaluation of effect of partially burnt paddy husk (PBPH) with TSP at different depth of sold on big onion variety Dambulla selection and cultivar Galevela light red in seed and bulb production	B.I. Hettiarachchi (ADA) M.I. Wickramasinghe (TA)	√	√
TH 64/ AGRO/ EX 2	Impack of bulb size and bulb formation on seed yield of big onion	B.I. Hettiarachchi (ADA) M.I. Wickramasinghe (TA)	√	√
TH 64/ AGRO/ EX 3	Study of ideal stage of plant to subject low temperature for bolting in bulb crop of onion variety Dembulla selection and cultivar Galewala light red	B.I. Hettiarachchi (ADA) M.I. Wickramasinghe (TA)	√	√
TH 64/ AGRO/ EX 4	Evaluation of different application methods of systamic fungicide on stored bulbs to reduce post harvest losses.	B.I. Hettiarachchi (ADA) M.I. Wickramasinghe (TA)	√	√

GRAIN LEGUMES

GGRM/ TH 09 ***Development of high yielding (>2.5 t/ha) pest and drought tolerant mungbean varieties with high consumer acceptability for rain-fed and irrigated conditions.***

TH 09/ IMPR/ EX 1	Hybridization and selection of mungbean	M.J.M.P. Kumararathne (ADA) S. Ariyawansa (RA)	√	√
TH 09/ IMPR/ EX 2	Generation advancement of Mungbean breeding lines	M.J.M.P. Kumararatne (ADA) S. Ariyawansa (RA)	√	√
TH 09/ IMPR/ EX 3	Priliminary yield trial mungbean promissing lines	M.J.M.P. Kumararathne (ADA) S. Ariyawansa (RA)	√	√
TH 09/ IMPR/ EX 4	National coordinated varietal trial of promissing lines	M.J.M.P. Kumararathne (ADA) S. Ariyawansa (RA)	√	√
TH 09/ IMPR/ EX 5	Variety Adaptability Trial of promissing lines	M.J.M.P. Kumararathne (ADA) S. Ariyawansa (RA)	√	√
TH 09/ IMPR/ EX 6	Evaluation of M2 generations of mutant mungbean with gamma rays Irradiation (three closes 300 Gy, 450Gy, 600 Gy)	M.J.M.P. Kumararathne (ADA) S. Ariyawansa (RA)	√	√

BGRM/TH 11 ***Development of high yielding (3 t/ha) short /long age, pest and drought tolerant black gram varieties with high consumer acceptability, for rain-fed and irrigated conditions.***

TH 11/ IMPR/ EX 1	Hybridization and selection programme for blackgram	M.J.M.P. Kumararatne (ADA) S. Ariyawansa (RA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 11/ IMPR/ EX 2	Generations advancement of Blackgram promising lines	M.J.M.P. Kumararatne (ADA) S. Ariyawansa (RA)	√	√
TH 11/ IMPR/ EX 3	Preleminary Yeild Trial of blackgram promissing lines	M.J.M.P. Kumararatne (ADA) S. Ariyawansa (RA)	√	√
TH 11/ IMPR/ EX 4	Preleminary Yeild Trial of blackgram promissing lines	M.J.M.P. Kumararatne (ADA) S. Ariyawansa (RA)	√	√
TH 11/ IMPR/ EX 5	National coordinated varital trial of blackgram promissing lines	M.J.M.P. Kumararatne (ADA) S. Ariyawansa (RA)	√	√

COWP/ TH 12 ***Development of high yielding (>2.5t/ha), pest and drought tolerant cowpea varieties with high consumer acceptability.***

TH 12/ IMPR/ EX 1	Hybridization and selection (Generation advancement)	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√
TH 12/ IMPR/ EX 2	National Co-ordinated Varietal Trial	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√
TH 12/ IMPR/ EX 3	Preliminary Yield Trial	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√
TH 12/ IMPR/ EX 4	Preliminary Yield Trial	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√

GRL/ TH 65 ***Development of low cost, environmentally sound and effective pest and disease management practices for grain legumes.***

TH 65/ ENTO/ EX 1	Evaluation of germplasm/ varieties for resistance /tolerance to major pests in mungbean	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√
TH 65/ ENTO/ EX 2	Evaluation of germplasm/ varieties for resistance /tolerance to major pests in black gram	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√
TH 65/ ENTO/ EX 3	Identification of diversity and distribution of predaceous lady bird beetles (Coleoptera: Coccinellidae) in Legumes	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√
TH 65/ ENTO/ EX 4	Identification of suitable flowering plants to enhance natural enemies in legumes	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√
TH 65/ ENTO/ EX 5	Study of Bionomics of pod borer complex in mung bean	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√
TH 65/ ENTO/ EX 6	Screening of insecticides against leaf minor in cowpea	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 65/ ENTO/ EX 7	Evaluation of germplasm/ varieties for resistance /tolerance to major pests in soybean	M.A.R.A. Mandanayake (ADA) S.M.A.O. Nadeeshani (RA)	√	√
TH 65/ PATH/ EX 8	Evaluation of Mungbean NCVT lines for major diseases	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	√
TH 65/ PATH/ EX 9	Evaluation of Blackgram NCVT lines for major diseases	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	√
TH 65/ PATH/ EX 10	Evaluation of cowpea NCVT lines for major diseases	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	√

SOYA/ TH 59 ***Development of high yielding (>3t/ha), pest and drought tolerant soybean varieties with high consumer acceptability.***

TH 59/ IMPR/ EX 1	Hybridization and selection (Generation advancement)	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√
TH 59/ IMPR/ EX 2	Preliminary Yield Trial	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√
TH 59/ IMPR/ EX 3	Improvement of qualitative and quantitative traits in soybean through gamma irradiation	N.H.M.S. Chithrapala (ADA) H.M.L.U. Pushpakumara (RA)	√	√
TH 59/AGRO/EX 4	Study the enhancement of drought stress tolerance in soybean crop by rhizobium inoculum used in Sri Lanka	R. L Senanayake (ADA) N.H.M.S. Chithrapala (ADA) M.J.M.P. Kumararathne (ADA) R.A.C.J. Perera (ADA) S. Wickramasooriya (RA)	√	√
TH 59/AGRO/EX 5	Effect of foliar nutrition on growth and yield of legumes	R. L Senanayake (ADA) N.H.M.S. Chithrapala (ADA) M.J.M.P. Kumararathne (ADA) S. Wickramasooriya (RA)	√	√
TH 59/AGRO/EX 6	Effect of appilcation of plant growth regulators on yield and yield components of legume crops	R. L Senanayake (ADA) N.H.M.S. Chithrapala (ADA) M.J.M.P. Kumararathne (ADA) S. Wickramasooriya (RA)	-	√

OIL SEEDS

GNUT/ TH 17 ***Development of groundnut varieties suitable for rain-fed and irrigated condition.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 17/ GNUT/ EX 1	Evaluation of large seeded, medium duration groundnut lines	K.H.S.T. Deshabandu (ADA) A.M. Perera (Addl. Director) E.M.S.P. Ekanayake (RA)	√	√
TH 17/ GNUT/ EX 2	Seed multiplication of promising confecionary type groungnut	K.H.S.T. Deshabandu (ADA) A.M. Perera (Addl. Director) E.M.S.P. Ekanayake (RA)	√	√
TH 17/ GNUT/ EX 3	National Coordinated Varietal Trial - groundnut lines - Angunakolapelessa	K.H.S.T. Deshabandu (ADA) A.M. Perera (Addl. Director) E.M.S.P. Ekanayake (RA)	√	√
TH 17/ GNUT/ EX 4	National Coordinated Varietal Trial - groundnut - Kilinochchi	K.H.S.T. Deshabandu (ADA) A.M. Perera (Addl. Director) E.M.S.P. Ekanayake (RA)	√	√

COARSE GRAINS

MAIZE/ TH 21 ***Development of high yielding (>7 t/ha), pest, disease and drought tolerant hybrid and OPV maize varieties with desirable quality.***

TH 21/ IMPR/ EX 1	Large scale demonstration of selected drought tolarent maize hybrid received from CIMMYT, India	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	-	√
TH 21/ IMPR/ EX 2	Evaluation of promising maize hybrids and selected CIMMYT hybrids in NCVT and VAT	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	√	√
TH 21/ IMPR/ EX 3	Evaluation of new maize hybrids developed from - CIMMYT inbred lines - Developed from CIMMYT and locally developed inbred lines - Developed from local inbred lines in PYT and AYT	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 21/ IMPR/ EX 4	Development of maize inbred lines Generation advancement S2–S3 and S3 to S4 Established segregation population S0 - S1	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	√	√
TH 21/ IMPR/ EX 5	Development of new maize crosses CIMMYT/CIMMYT crosses Development of new maize crosses with locally lines/ CYMMYT lines Development of new maize crosses from local lines/local inbred lines	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	√	√
TH 21/ IMPR/ EX 6	Evaluation of maize exotic hybrids	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) K.N.C. Gunawardena (Principle Scientist) W.M.K. Fernando (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	√	√
TH 21/ IMPR/ EX 7	Developemnt od drought tolarent maize inbred lines from different source populations S3 -S4- 52lines S4- S5 -32lines	D.C.M.S.I. Wijewardena (ADA) W.M.R.Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) R.M.J.C.B. Senanayaka (RA)	√	√
TH 21/ IMPR/ EX 8	development of pop corn OPVs by using back cross breeding - Seed production of MI popcorn -1	D.C.M.S.I. Wijewardena (ADA) W.M.R.Kumari (ADA) N.A.P.S.G. Upasantha (PA)	√	√
TH 21/ IMPR/ EX 9	Development of new pop corn varieties through hybridization	D.C.M.S.I. Wijewardena (ADA) W.M.R.Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 21/ IMPR/ EX 10	Development of pop corn inbred lines	D.C.M.S.I. Wijewardena (ADA) W.M.R.Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 21/ IMPR/ EX 11	* Development of sweet corn inbred lines using exotic varieties * Evaluation of exotic sweet corn hybrids	D.C.M.S.I. Wijewardena (ADA) W.M.R.Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 21/ IMPR/ EX 12	Application of mutation breeding techniques for development of maize inbred lines	D.C.M.S.I. Wijewardena (ADA) W.M.R.Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	-	√

MAIZE/ TH 22 ***Identification of source of resistance and development of low cost environmentally sound effective management practices for major pests and diseases in coarse grains.***

TH 22/ ENTO/ EX 1	Development of weather based prediction model for maize stem borer	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	√	√
TH 22/ ENTO/ EX 2	Status of pesticide usage and residue analysis of maize in selected major growing areas of the dry zone	K.N.C. Gunawardana (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)	-	√
TH 22/ AGRO/ EX 3	Integrated effect of Plant growth Regulators and nutrients on chilli growth and yield	M.A.P.W.K. Malawaarachchi(ADA) R.A.C.J. Perera (ADA) S.I.S. Wijerathna (RA)	√	√
TH 22/ AGRO/ EX 4	Performance of exotic and local hybrid maize at different density levels	M.A.P.W.K. Malawaarachchi(ADA) S.I.S. Wijerathna (RA)	√	√
TH 22/ AGRO/ EX 5	An investigation to improve the hybrid seed production technology in maize	M.A.P.W.K. Malawaarachchi(ADA) S.I.S. Wijerathna (RA)	√	√
TH 22/ AGRO/ EX 6	Optimizing crop management practices for sweet sorghum as a bio-energy crop in marginal lands	M.A.P.W.K. Malawaarachchi(ADA) R.A.C.J. Perera S.I.S. Wijerathna (RA)	√	√
TH 22/ AGRO/ EX 7	Effect of antitranspirants on growth and yield of mung bean under low moisture stress	M.A.P.W.K. Malawaarachchi(ADA) S.I.S. Wijerathna (RA)	-	√
TH 22/ PATH/ EX 8	Screening of finger millet lines for blast disease	W.M.K. Fernando (ADA) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)	√	-

MILL/ TH 67 ***Development of high yielding finger millet and other millet varieties with pest and disease tolerant, early maturity, short plant heights and good quality seeds.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 67/ MILL/ EX 1	Evaluation of finger millet in AYT	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 2	Generartion advancement of finger millet	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 3	Application of mutation breeding technology for finger millet	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 4	Evaluation of finger millet in NCVT	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 5	Evaluation of new finger millet crosses	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 6	Development of new crosses in maize	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 7	Development of sweet sorghum lines for marginal lands using mutation breeding techniques	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 67/ MILL/ EX 8	Inbred lines development of maize	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√

VEGETABLES

VEGE/ TH 26 ***Development of suitable okra, yard long beans, tomato, brinjal and other vegetable varieties with high yields and resistance to pest and disease.***

TH 26/ IMPR/ EX 1	NCVT -Elabatu	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	√	√
TH 26/ IMPR/ EX 2	NCVT - Okra	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	√	√
TH 26/ IMPR/ EX 3	NCVT - Brinjol	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	√	√

FRUITS

FRUIT/ TH 27 ***Development of high yielding fruit crop varieties for the dry zone.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH27/ IMPR/ EX 1	Maintenance of grapes & Mango germplasm	W.A.S. Vijitha Kumara (ADA)	√	√
TH27/ IMPR/ EX 2	Maintenance of mother plants of three grape varieties	W.A.S. Vijitha Kumara (ADA)	√	√
TH27/ IMPR/ EX 3	Evaluation of exotic grapes wine varieties	W.A.S. Vijitha Kumara (ADA)	√	√
TH27/ IMPR/ EX 4	Maintenance of field gene bank	W.A.S. Vijitha Kumara (ADA)	√	√

FRUIT/ TH 28 ***Development of technologies to increase the fruit productivity.***

TH28/ AGRO/ EX 1	Evaluation of grape vine training systems	W.A.S. Vijitha Kumara (ADA)	√	√
TH28/ AGRO/ EX 2	Identification of wild plants suitable for vine training structures for grapes	W.A.S. Vijitha Kumara (ADA)	√	√
TH28/ AGRO/ EX 3	Maintenance of a demonstration block of drumstick	W.A.S. Vijitha Kumara (ADA)	√	√

RICE

RICE/ TH 29 ***Selection of suitable rice varieties and management technology for irrigated lowlands in the dry zone.***

TH 29/ AGRO/ EX 1	Monitoring canopy temperature in resistance stress environment and phenotyping in maize in well drained paddy soils	L.C.Silva (ADA) D.C.M.S.I. Wijewardena (ADA) H.G.P.B. Dharshana (RA) P. Mahindapala (RSA)	-	√
TH 29/ AGRO/ EX 2	National co-ordinated rice varietal testing 3 months	L.C. Silva (ADA) H.G.P.B. Dharshana (RA) P. Mahindapala (RSA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 29/ AGRO/ EX 3	National co-ordinated rice varietal testing 3.5 months	L.C. Silva (ADA) H.G.P.B. Dharshana (RA) P. Mahindapala (RSA)	√	√
TH 29/ AGRO/ EX 4	Screening Mung bean accessions with establishment methods for drought and moisture stress for cultivation in rice based ecosystems	L.C. Silva (ADA) D.C.M.S.I. Wijewardena (ADA) H.G.P.B. Dharshana (RA) P. Mahindapala (RSA)	√	-
TH 29/ AGRO/ EX 5	Impact of deep ploughing and raised beds system interms of efficent use of rain water in field crops in crop diversification of rice based cropping system	L.C. Silva (ADA) H.G.P.B. Dharshana (RA) P. Mahindapala (RSA)	√	√
TH 29/ AGRO/ EX 6	Monitoring canopy temperature for moisture stress	L.C. Silva (ADA) H.G.P.B. Dharshana (RA) P. Mahindapala (RSA)	√	-

WEED

WEED/ TH 61 ***Development of suitable weed control methods for the dry zone.***

TH 61/ WEED/ EX 1	Management practices to control weeds on field crops	H.M.P.T.K. Hettigedara (ADA) G.H.K. De Silva (RA)	√	√
TH 61/ WEED/ EX 2	Herbicide testing efficiency for pre-imergent weed management in maize	H.M.P.T.K. Hettigedara (ADA) G.H.K. De Silva (RA)	√	√

SOIL FERTILITY, FERTILIZERS AND ENVIRONMENT

FERT/ TH 37 ***Development of integrated nutrient management strategies for achieving stable production status in diversified farming situation.***

TH 37/ FERT/ EX 1	Nutrient management package for sustainable production of greengram	M.A.P.W.K. Malawiarachchi(ADA) M. V.P. Jayasundara (RA)	√	√
TH 37/ FERT/ EX 2	Effect of different rate of urea and micronutrient with different application time on growth and yield if big onion	M.A.P.W.K. Malawiarachchi(ADA) M. V.P. Jayasundara (RA)	-	√
TH 37/ FERT/ EX 3	Determination of N requirement of maize by leaf colour chart (Large scale trial)	M.A.P.W.K. Malawiarachchi(ADA) M. V.P. Jayasundara (RA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 37/ FERT/ EX 4	Site specific fertilizer management for sustainable maize production	M.A.P.W.K. Malawiarachchi(ADA) M. V.P. Jayasundara (RA)	√	√
TH 37/ FERT/ EX 5	Experiments in fertilizer testing program	M.A.P.W.K. Malawiarachchi(ADA) M. V.P. Jayasundara (RA)	√	√
TH 37/ FERT/ EX 6	A study on the response of maize in relation to application of HERP and ESSP	R.A.C.J. Perera (ADA) D.K.M.G.B.P. Jayasundara (RA)	√	√

WATER MANAGEMENT

WMNT/ TH 35 ***Development of water management technology to improve resource use efficiency in other field crops.***

TH 35/ WMNT/ EX 1	Increasing resilience of upland cropping systems to climate change impacts through a modified alley cropping system	M.S. Nijamudeen (ADA) R.A.C.J. Perera (ADA) M.A.P.W.K. Malaviarachchi (ADA) N. R. A. Nawarathne (RA)	√	√
TH 35/ WMNT/ EX 2	Development of the best management packages for enhancement of crop productivity of chilli, onion and greengram (3 field demonstrations)	R.A.C.J. Perera (ADA) K.N.C. Gunawardena (ADA) M.S. Nijamudeen (ADA) M.G.S.P. Pathirana (ADA) M.J.M.P. Kumararathne (ADA) H.M.S.N. Herath (ADA) W.M.K. Fernando (ADA) H.M.P.T.K. Hettigedara (ADA) D.K.M.G.B.P. Jayasundara (RA)	-	√
TH 35/ WMNT/ EX 3	Spatio-temporal characterization of soil salinity in an irrigated cropping system in the dry zone of Sri Lanka using proximal soil sensing	R.A.C.J. Perera (ADA) D.K.M.G.B.P. Jayasundara (RA)	√	√
TH 35/ WMNT/ EX 4	Hydological study in 'Malwathuoya' river basin using isotopic techniques (collaborative study with the Sri Lanka Atomic Energy Board)	R.A.C.J. Perera (ADA) D.K.M.G.B.P. Jayasundara (RA) (collaborative scientists of the Sri Lanka Atomic Energy Board)	√	√

BIO-TECHNOLOGY

BIOTECH/ TH 71 ***Development of technologies to use biotechnology for the crop improvement.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 71/ BIOT/ EX 1	Development of transgenic resistance for chilli leaf curl viruses	W.A.R. Dhammika (ADA) D.M.J.B. Senanayake (ADA) P.N. Deniyagedara (RA)	√	√
TH 71/ BIOT/ EX 2	Marker Assisted Selection of Quality Protein Maize (QPM) incorporated maize lines/ varieties	W.A.R. Dhammika (ADA) W.M.W. Kumari (ADA) D.C.M.I. Wijewardane (ADA) D.M.J.B. Senanayake (ADA) D.N. Jayawardena (RA)	√	√
TH 71/ BIOT/ EX 3	Screening mung bean lines/varieties for bruchid resistance gene (*Br*) and MAS for mungbean breeding against bruchid resistance	W.A.R. Dhammika (ADA)) M.J.M.P. Kumararathne (ADA) D.N. Jayawardena (RA)	√	√
TH 71/ BIOT/ EX 4	Development of inbred lines through generation advancement of opeq -2 gene incoporated maize lines	W.A.R. Dhammika (ADA) D.N. Jayawardena (RA) W.M.W. Kumari (ADA) D.C.M.I. Wijewardane (ADA) D.M.J.B. Senanayake (ADA)	√	√
TH 71/ BIOT/ EX 5	Develoment protocol for Maize Duoble haploid plants through Anther culture	W.A.R. Dhammika (ADA) P.N Deniyagedara (RA)	√	√
TH 71/ BIOT/ EX 6	Identification of Anthracnose disease resistance chilli accessions and detection of associated R genes	W.A.R. Dhammika (ADA) D.M.J.B. Senanayake (ADA D.N. Jayawardena (RA)	√	√
TH 71/ BIOT/ EX 7	Develoment protocol for Maize Duoble haploid plants through Anther culture	W.A.R. Dhammika (ADA) P.N Deniyagedara (RA)	√	√

BREEDERS SEED PRODUCTION

SEED/ TH 30 ***Maintenance of genetic purity and production of breeder seeds of the recommended varieties of other field crops and some horticultural crops.***

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 30 / IMPR/ EX 1	Breeder seed production of recommended varieties of chilli KA 2 and MI Green	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	-
TH 30 / IMPR/ EX 2	Breeder seed production of recommended varieties of chilli MI 2 and Galkiriyagama Selection	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	-	√
TH 30 / IMPR/ EX 3	Breeder mother bulbs and seed production of recommended variety of onion (Dambulla selection and MIBO-1)	M.G.S.P. Pathirana (ADA) J.S.M.D.L. Wijerathne (RA)	√	√
TH 30 / IMPR/ EX 4	Breeder seed production of recommended varieties of maize (Badra and Ruwan, Parental lines and MI Hybrid 1 & 2)	W.M.R.Kumari (ADA) D.C.M.S.I. Wijewardena (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA) A.M.N. Rathnayake (RSA)	√	√
TH 30 / IMPR/ EX 5	Breeder seed production of recommended finger millet varieties	D.C.M.S.I. Wijewardena (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upashantha (PA) D.M.J.K. Dissanayake (RA)	-	√
TH 30 / IMPR/ EX 6	Breeder seed production of mungbean varieties of MI 5, MI 6 and Ari	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	√	√
TH 30 / IMPR/ EX 7	Breeder seed production of blackgram variety MI 1	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	√	√
TH 30 / IMPR/ EX 8	Breeder seed production of bittergourd (MC-43)	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	-	√
TH 30 / IMPR/ EX 9	Breeder seed production of parent line MI Waraniya 1	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√

Project No	Project Title	Officers Responsible	Season	
			Maha 2017/18	*Yala 2018*
TH 30 / IMPR/ EX 10	Breeder seed producton of parent line galkiriyagama	H.M.S.N. Herath (ADA) H.M.S. Bandara (RA) S.M.N.I.K. Saluwadana (RSA) H.M. Karunarathna (RSA)	√	√
TH 30 / IMPR/ EX 11	Breeder seed production of vegetable cowpea (BS-1 and Bushita local)	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	-	√
	Breeder seed production of better gourd (KC43	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	-	√
TH 30 / IMPR/ EX 12	Breeder seed production of snake gourd (MI short)	M.J.N.P. Kumararathne (ADA) R.R.V.S. Ariyawansa (RA)	-	√
TH 30 / IMPR/ EX 13	Breeders seed production of recommended varieties of cowpea (Dhawala, Waruni and Bombay, MICP-1)	N.H.M.S. Chithrapala (ADA) Udaya Pushpakumara (RA)	√	√
TH 30 / IMPR/ EX 14	Seed production of foxtail millet, Proso millet and sorghum	D.C.M.S.I. Wijewardana (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 30 / IMPR/ EX 15	Breeder seed production of recommended varieties of soybean Pb-1, MISB-1	N.H.M.S. Chithrapala (ADA) Udaya Pushpakumara (RA)	√	√
TH 30 / IMPR/ EX 16	Germ plasm conservation of local Dioscorea species	R. L Senanayake (ADA) S. Wickramasooriya (RA)	√	√
TH 30 / IMPR/ EX 17	Seed production poopcorn	D.C.M.S.I. Wijewardena (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upashantha (PA) D.M.J.K. Dissanayake (RA)	√	√
TH 30 / IMPR/ EX 18	Seed production of sweet sorghum	D.C.M.S.I. Wijewardena (ADA) W.M.R. Kumari (ADA) N.A.P.S.G. Upashantha (PA) D.M.J.K. Dissanayake (RA)	√	√

Annexure 3. Tasks accomplished by the FCRDI on Research and Development Activities

Crop / Research	Year	List of Completed tasks - FCRDC
Cowpea	2013	National Co-ordinated Varietal Trials.
	2014	Preliminary yield trial.
		Evaluation of new cowpea lines from PGRC.
		Evaluation of cowpea promising lines under rain-fed conditions.
	2015	Preliminary yield trial.
		Germplasm evaluation – lines from PGRC.
		National Co-ordinated varietal Test.
	2017	National Co-ordinated varietal Test (2).
Big Onion	2013	Hybridization and selection.
		Generation advancement big onion families.
		Evaluation and selection of big onion lines for bulb production –NARP project.
		National coordinated varietal trials for big onion-NARP project.
		Varietal adaptability trials for big onion-NARP project.
		Evaluation of big onion lines/ varieties for off –season cultivation (late Maha).
		Evaluation of cluster onion lines raised from sets.
		Evaluation of seed setting ability of cluster lines.
		Population improvement of cluster onion.
		Generation advancement of cluster onion lines.
	2014	Evaluation of big onion families for yield and other agronomic traits – KOPIA project.
		Evaluation of exotic big onion varieties – KOPIA project.
		Hybridization and selection – KOPIA project.
		National Coordinated Varietal Trials for big onion – NARP project.
		Varietal Adaptability Trials for big onion – NARP project.

		Seed multiplication of the promising line MIBO- 09E2 – NARP project.
Big Onion	2014	Evaluation of seed crop and bulb crop of seed setting cluster onion lines.
		Evaluation of cluster onion lines raised sets.
		Seeds and bulb multiplication – onion families.
		Seed multiplication of big onion variety Dambulla selection in research fields (commercial seeds) – KOPIA project.
	2015	Hybridization and selection – KOPIA project.
	2016	Evaluation of big onion lines for bulb yield and other desirable traits – KOPIA project.
		Evaluation M1 generation and selection of mutated lines –KOPIA project.
		NCVT – Seed setting cluster onion lines.
	2017	NCVT – Seed setting cluster onion lines for seed crop.
Big Onion	2014	Identification of farmers' field problems and giving advices to solve those problem
		Conducting training programs on onion for Farmers, officers, Universities and school students etc.
	2015	Identification of farmers' field problems and giving advices to solve those problem
		Establishment of big onion seed producing model villages in Anuradhapura, Mannar and Hambantota.
		Practical farmer training on big onion cultivation.
		Periodical onion field inspection and guidance
	2016	Identification of farmers' field problems and giving advices to solve those problem
		Conducting training programs on onion for Farmers, officers, Universities and school students etc.
		Establishment of big onion seed producing model villages in Anuradhapura, Mannar and Hambanthota.
		Practical farmer training on big onion cultivation.
		Periodical onion field inspection and guidance
	2017	Identification of farmers' field problems and giving advices to solve those problem
		Establishment of big onion seed producing model villages in Anuradhapura, Mannar and Hambanthota.
		Practical farmer training on big onion cultivation.

		Periodical onion field inspection and guidance
Chilli Hybrid Variety Development	2016	National coordinated varietal trials for promising chilli hybrids.
Coarse grain breeding	2014	Hybridization of finger millet.
	2015	Development of finger millet bulk population using crosses.
		Evaluation of ICRISAT millet germplasm.
Soil and Water Management	2014	A study on fertigation recommendation for chilli under drip irrigation.
		A study on application of sprinkler irrigation systems for onion.
		Development of multifunctional soil conservation bund system for rainfed uplands with supplementary irrigation in the dry zone.
	2015	Development of the best management packages under sprinkler irrigation for chilli, onion and mung bean.
	2017	Development of the vest management packages for the enhancement of the crop productivity of chilli under drip systems.
		Development of the best management packages for the enhancement of the crop productivity of mung bean under sprinkler irrigation system.
Soil Fertility	2013	Effect of Mn, Zn and Cu as foliar application on growth and yield of chilli.
		Testing of N Bio fertilizer on growth and yield of Rice.
		Testing of P Bio fertilizer on growth and yield of Rice.
	2014	Effect of Mn, Zn and Cu as foliar application on growth and yield of chilli.
		Testing of the efficacy of Nano fertilizer as source of N for big onion.
	2015	Determination of requirement for maize by leaf color chart.
		Testing the efficacy of Nano fertilizer as a source of N for maize.
		Identification of soil fertility problems in onion cultivation areas.
		Identification of agronomic practices to increase resource use efficiency and crop productivity of hybrid chilli under sprinkler and surface irrigation.
		Soil incorporation of sunhemp as in-situ green manure to supplement nutrient requirement of maize.

	2016	Identification of agronomic practices to increase resource use efficiency for optimum productivity of local hybrid chilli under sprinkler irrigation.
		Comparative effect of Nano fertilizer and urea on growth and yield of maize
		Soil incorporation of sunhemp as a in-situ green manure to supplement nutrient requirement of maize.
	2017	Identification of agronomic practices to increase resource efficiency for optimum productivity of local hybrid chilli under sprinkler irrigation.
		Comparative efficacy of Nano fertilizer and urea on growth and yield of maize.
Agronomy (M.A.P.W.K Malaviarachchi)	2013	Assessing the climate resilience of maize, mung bean and chilli and increasing their adaptation capacity to long term climate change on upland cropping system in Sri Lanka.
	2016	Integrated effect of plant growth regulators, micro and macro nutrients on growth and yield of chilli under sprinkler irrigation.
		Revisiting the fertilizer recommendation for OFCs.
		Performance of exotic and local hybrid maize at different density levels.
	2017	Integrated effect of Plant Growth Regulators, micro and macro nutrients on growth and yield of chilli under sprinkler irrigation.
		Revisiting the fertilizer recommendation for OFCs.
		Performance of exotic and local hybrid maize at different density levels.
Agronomy (R.L. Senanayake)	2013	Performances of local and hybrid maize varieties under different agronomic management levels.
	2015	Analysis of growth and development of underground organs in D. alata.
		The use of residual N and K fertilizer applied on yam by subsequent cowpea crop in Sri Lanka
Crop Physiology	2013	Screening of Other Field Crops for water stress tolerance performance of mung bean genotypes as affected by soil moisture regimes during the Yala season in the low country dry zone of Sri Lanka.
		Effect of application of KNO_3 on growth and yield of onion seed production
		Impact of bulb size and spacing on seed yield of KNO_3 treated onion.
		National Coordinated Varietal Trial-sesame.
		Seed multiplication of promising confectionary type groundnut.
		Observational trial –Comparison between groundnut seed planting method with water soaking groundnut pod planting method.

	2014	National Coordinated Varietal Trial – medium duration groundnut lines.
Crop Physiology	2014	National Coordinated Varietal Trial – sesame limes.
		Evaluation of large seeded, medium duration groundnut lines.
		Seed multiplication of promising confectionary type groundnut.
	2015	National Coordinated Varietal Trial – sesame line.
		Seed multiplication of promising confectionary type groundnut.
		Evaluation of large seeded, medium duration groundnut lines.
	2016	Observational trial of seed germination study in maize hybrid.
		National Coordinated Varietal Trial – sesame lines.
		Seed multiplication of promising confectionary type groundnut.
		Evaluation of large seeded, medium duration groundnut line.
	2017	National Coordinated Varietal Trial – medium duration groundnut lines.
		National Coordinated Varietal Trial – sesame lines.
		Seed multiplication of promising confectionary type groundnut.
		Evaluation of large seeded, medium duration groundnut lines.
Agronomy and Weed science	2015	Calibration of SPAD meter and Leaf Colour Chart for different chilli varieties.
		Efficacy of Pendimethalin 33%, 45.6% in control of weeds in onion.
	2016	Influence of growth regulators on growth and yield of chilli.
		Calibration of SPAD meter and Leaf Colour Chart for different chilli varieties.
	2017	Calibration of SPAD meter and Leaf Colour Chart for different chilli varieties.
Rice Agronomy	2013	Effect of temperature stress on canopy temperature of rice in early and late season flowering.
		Impact of flag leaf characters on pollen and spikelet sterility at late season temperature stress of rice.
	2014	Impact of late flowering of rice on canopy temperature and pollen sterility.
	2015	Soil moisture depletion on canopy temperature and pollen sterility of rice.
		Screening Mung bean and cowpea for excess moisture stress and duration.
	2016	Impact of heat and drought stress on rice canopy temperature on pollen and spikelet sterility.
		Herbicide evaluation for maize.

		Identification of phenotypic markers rice for temperature and drought stress.
Entomology	2013	Evaluation of different local chilli hybrids for major pests.
		Evaluation of different exotic chilli hybrids for major pests.
		Laboratory evaluation of mungbean lines for bruchid resistance.
		Evaluation of mungbean lines for major pests.
		Evaluation of blackgram lines for major pests.
		Evaluation of exotic maize hybrid for pest damages.
		Identification of new pests in onion.
		Evaluation of exterra termite bites system for the management of termites.
	2014	Evaluation of different local chilli hybrids for major pests.
		Evaluation of different exotic chilli hybrids for major pests.
		Evaluation of exotic maize hybrids for pest damages.
		Evaluation of mungbean lines for major pets.
		Evaluation of blackgram lines for major pets.
		Effect of different nitrogen fertilizer sources on leaf curl complex and yield of chilli.
		Effect of silver colour reflective mulch to reduce leaf curl complex in chilli.
		Bio efficacy evaluation of Hexythiazox 5% Ec to control mites in Brinjal.
		Bio efficacy evaluation of diazinon and fipronil against maize stem borer (re-registration).
		Testing of pirimiphos methyl 2% D for the control of maize weevil.
	2015	Evaluation of different local chilli hybrids for major pests.
		Evaluation of different exotic chilli hybrids for major pests.
		Evaluation of exotic maize hybrids for pest dames.
		Evaluation of mungbean lines for major pests.
		Evaluation of blackgram lines for major pests.
		Bio efficacy evaluation of new source of diazinon against maize stem borer.
		Collection of light trap and sticky trap data on insect pests of chill.
	2016	Evaluation of different local chilli hybrids for major pests.

		Effect of different repellent plants to control chilli leaf curl complex.
Entomology	2016	Testing of insecticides to control leaf curl complex in chilli.
		Management of stem borer using selected botanicals in maize.
		Evaluation of exotic maize hybrids for pest damages.
		Evaluation of breeding lines and exotic varieties for resistance/ tolerance to major pests in onion.
	2017	Evaluation of different local chilli hybrids for major pests.
		Effect of different sizes of nylon nets to control chilli leaf curl complex.
		Testing of plant extract (Synkromax) to control leaf curl complex.
		Effect of different size shade nets on chilli leaf curl virus and pest populations.
		Evaluation of exotic chilli hybrids for pest damages.
		Effect of intercropping maize with different legumes to control stem borer in maize.
		Evaluation of exotic maize hybrids for pest damages.
		Evaluation of germplasm / varieties for resistance / tolerance to major pests in mungbean.
Entomology	2017	Identification of biotypes of *Nilaparvata lugence.*
Plant Pathology	2013	Screening of Soybean lines for the soybean mosaic virus disease.
	2014	Identification of variety screening technique for sheath blight of maize.
		Germplasm evaluation of mungbean for yellow mosaic virus (MYMV) disease.
		Germplasm evaluation of blackgram for yellow mosaic virus (YMV) disease.
		Screening of cowpea promising lines for the anthracnose and powdery mildew diseases.
		Bio-efficacy of new fungicides against downy mildew of Grapes (Plasmopara viticola)
	2015	Evaluation of different inoculation techniques for sheath blight of Maize
		Screening of chilli (OPV) for CLCV.
		Screening of local chilli hybrids (NCVT) for CLCV
		Germplasm evaluation of mungbean for yellow mosaic virus (MYMV) Cercospora leaf spot (CLS) and powdery mildew diseases.
		Germplasm evaluation of blackgram for powdery mildew and yellow mosaic virus (YMV) diseases.
		Screening of finger millet accessions for finger millet blast disease

	2016	Evaluation of mung bean PYT lines for major diseases.
		Screening of finger millet lines for blast disease.
		Screening of promising NCVT local chilli hybrids for CLCV.
		Screening of parent lines of chilli hybrid programme for CLCV.
		Status of chilli leaf curl virus and pest population dynamics with varying micro environment under different shade levels.
	2017	Evaluation of onion lines for Anthracnose disease.
		Screening of finger millet lines for blast disease.
		Screening of promising NCVT local chilli hybrids for CLCV
		Screening of chilli for CLCV
		Efficacy testing of Azoxystrobin 250g/ 1 SC for Anthracnose and purple blotch of onion.
		Retesting of Fluzinam 50% SC, Tryfloxystrobin 250+ Tebuconazole 500g/kg WG and Chlorothalonil 75% WP for Anthracnose and purple blotch of onion.
Bio Technology and Tissue culture	2014	Identification of resistant / tolerant source for chilli leaf curl viruses.
	2015	Development of Embryo rescue technique for Chilli wide hybridization.
		Detection of chilli leaf curl Sri Lanka virus in chilli plants showing different virus like symptoms and in alternative hosts.
		Development of fingerprints for cluster onion accessions.
	2016	Micro propagation of important grape varieties through seed culture/ Shoot culture.
		Development of fingerprints for recommended chilli varieties.
	2017	Assessment of genetic diversity of selected Capsicum chinense and frutescence accessions using molecular techniques.

Annexure 4

Technical Action Plan - 2018

Department of Agriculture - Institute/Centre: FCRDI/ Mahailluppallama

Research Project	Activities	Financial allocation (Rs)	Unit	Annual target	2017/18 Maha	2018 Yala	Expected benefit or output	Responsibilty
Chilli breeding	Development of chilli hybrids for favourable environment		No of hybrids	Making 85 new crosses and F1 seed production for field evaluation , Identification of promising hybrids for MYT and NCVT	√	√	High yielding chilli hybrids with resistant/tolerat to major pests and diseases in chilli for favourable environments	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
	National Coordinated Varietal Trials and Varietal Adaptability Trials for Promising Chilli Hybrids		No of hybrids	Identification of more than 5 promising hybrids for NCVT	√	√	High yielding chilli hybrids with resistant/tolerat to major pests and diseases in chilli for favourable environments	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
	Development of inbred lines through generation advancement of exotic chilli hybrids		No of progenies	Achieving the homozygous condition through further selection and self pollination	√	√	Inbred lines with better agronomic traits for chilli hybrid development	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
	Development of inbred lines through generation advancement of interspecific chilli hybrids		No of progenies	Achieving the homozygous condition through further selection and self pollination	√	√	Inbred lines with specific characters of *Capsicum chininse*	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)

	Evaluation of developed inbred lines		No of inbred lines	Identification of suitable parent lines for hybrid development	√	√	Idebtification of inbred lines with high general combining ability	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
	Development of moisture stress tolerant chilli hybrids		No of hybrids	Making crossses among identified moisture stress tolerant inbred lines and field evaluation.Selection of promising hybrids	√	√	Chilli hybrids suitable for moisture stress environment	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
	Transferring of genetic male sterile character to the promising parent lines		No of lines	Completing the 5th back cross end economic analysis of usage of developed GMS line	√	√	F1 seed production without hand emasculation and pollination	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
	Evaluation of exotic chilli hybrids		No of hybrids	Testing the suitability of chilli hybrids imported by the private companies for commercial cultivation	√	√	Imported chilli hybrids suitable for commercial cultivation within the country	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), S.M.N.I.K. Saluwadana (RSA), H.M.Karunarathne (RSA)
Onion breeding	Hybridization and selection		No. of crosses	3 crosses and 3 families	√	√	Create variability developing new breeding lines	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)

Generation advancement		No. of families	advancement 24 F3 cluster onion familaies families to next generation	√	√	Incresing uniformity of breeding lines	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)
Development of onion varieties from composited population		y/n	2nd cycle will be completed	√	√	development of high yielding big onion varitiy with other desirable traits	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)
Maintenance of breeding lines, accessions		No. of lines, accessions	24 cluster onion families,15 cluster onion lines/ accessions, 12 breeding lines	√	√	Maintain germplasm for future research programme	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)
Evaluation of exootic big onion germplasm		No. of germplasm evaluated and selected	7 lines will be evaluated	√	√	to select elatie lines for further evalauation	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)
NCVT big onion		No. of lines and locations	4 big onion lines will be evalauted in 4 locations to test their adaptability	√	√	To evaluate the adaptability of promising line	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)
VAT- Cluster onion		No. of locations	1 seed setting lines will be evaluated in 8 locations to test their adaptability under farmer managemnt conditions	√	√	To evaluate the adaptability of promising line	MGSP Pathirana-ADA(Res.) Dr.Karunainathan – OIC –DDA Res Thinnaweli Ms. C. Hitinayake - ADA Res Ms. Mr. Yapa - ADA Res

	Breeder seed production of recommended varieties		kg	20 kg of breeder seeds	√	√	To dessaminate varieties	MGSP Pathirana-ADA(Res.) DSMDL Wijeratne (RA)
	Evaluation of collected germless		No	Big onion accessions 09 - local 07 - Foreign Cluster onion 03 Accession	√	√	to identify better parents for new varieties	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
	Maintaining parental lines, hybridization, and generation advancement		No	F1 - 27 nos F2 - 05 nos F3 - 03 nos Crosses -27 nos	√	√	New better varieties future	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
	Evaluation of combinations of partially burnt paddy husk and TSP with depth of soil in seed and bulb production on big onion variety Dambulla selection		No	Data	√	√	New technology for better yield	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
	Study the effectiveness of low temperature on phase changes of life cycle in onion variety Dambulla selection		No	Data	√	√	New technology for better yield	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
	Impact of harvesting stage on post harvest lossess		No	Data	√	√	New technology for better yield	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
	Impact of Calsium application on health of crop		No	Data	√	√	New technology for better yield	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
	Impact of ways of application of fungicide on post harvest lossess of mother bulbs of big onion		No	Data	√	√	New technology to reduce post harvest lossess of mother bulbs	B.I. Hettiarachchi (ADA-Research) M.I. Wickramasinghe (TA)
Mungbean breeding	Hybridization and selection of mungbean.		No. of crosses	70	√	√	Sucssesful F1 generations	MJMP Kumararathne (ADA-Research)
			No. of populations	F_1-45	√	√	Promissing lines	MJMP Kumararathne (ADA-Research)

Cowpea breeding	Hybridization and selection		No.of lines	No. of crosses and no.of lines selected for generation advancement	√	√	No. of crosses Generation advancement of F1, F2, F3, F4, F5 and F6 populations	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	National Co-ordinated Varietal Trial		No.of lines	Selection of promising lines for VAT	√		Promising lines for VAT	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Preliminary Yield Trial		No.of lines	Selection of promising lines for NCVT	√	√	Promising lines for NCVT	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Seed multiplication of cowpea germplasm		Amount of seeds	Multiplication of germplasm	√	√	Seeds for hybridization program	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Breeder seed production		Amount of seeds	Supplement of breeder seed requirement	√	√	Breeder seeds for SPMDC	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
Soybean breeding	Hybridization and selection		No.of lines	No. of crosses and no.of lines selected for generation advancement	√	√	Generation advancement of F1, F2, F3, F4 and F5 populations	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Preliminary Yield Trial		No.of lines	Selection of promising lines for NCVT	√	√	Promising lines for NCVT	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Improvement of qualitative and quantitative traits in soybean through gamma irradiation		No.of lines	Selection of promising lines	√	√	M6 and M7 generation will be advanced	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Seed multiplication of soybean germplasm		Amount of seeds	Multiplication of germplasm	√	√	Seeds for hybridization program	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)
	Breeder seed production		Amount of seeds	Supplement of breeder seed requirement	√	√	Breeder seeds for SPMDC	N H M S Chithrapala (ADA-Research) U Pushpakumara (RA)

				F_2-50	√	√		
				F_3-38	√	√		
				F_4-31	√	√		
				F_5- 19	√	√		
				F_6-9	√	√		
	Preliminary yield trial of promising mungbean lines		No.of lines	20	√	√	promissing lines	MJMP Kumararathne (ADA-Research)
	National Coordinated Varietal Trial for promising mungbean breeding lines under irrigated and rainfed conditions		No.of lines	10	√	√	New varities	MJMP Kumararathne (ADA-Research)
	Varity Adaptability Trial		No.of lines	4	√	√		MJMP Kumararathne (ADA-Research)
	Improved mungbean varities through mutation (M_2)		number of mutant plants	5000 plants of each doses	√	√	New varieties/promis sing parantal lines	MJMP Kumararathne (ADA-Research)
Blackgram breeding	Hybridization and selection of blackgram		No. of crosses	40	√	√	Sucssesful F1 generations	MJMP Kumararathne (ADA-Research)
			No. of populations	F_1-35	√	√	Promissing lines	MJMP Kumararathne (ADA-Research)
				F_2-30	√	√		
				F_3-12	√	√		
				F_4 .6	√	√		
				F_5 .6	√	√		
	Preliminary yield trial of promising mungbean lines		No.of lines	10+2check	√	√	Promissing lines	MJMP Kumararathne (ADA-Research)
	National Coordinated Varietal Trial for promising blackgram breeding lines		No.of lines	10	√	√	New varities	
	Varity adaptability Trial		No.of lines	2		√	New varities	MJMP Kumararathne (ADA-Research)

Groundnut evaluation and seed multiplication	Screening of OFCs for high temperature tolerance		No of screned lines Chilli Mungbean Soybean	07 07 07	√	√	Identify High temperature tolerance Lines in Chilli, Mungbean, Soybean	KHST Deshabandu (ADA-Research) EMPSP Ekanayake (RA) WMW Weerakoon
	Screening of other field crops for water stress tolerance		no of screned lines Maize Chilli Mungbean	30 56 40	√	√	Identify Low moisture tolerancce Maize, Chilli, Mungbean and Onion	KHST Deshabandu (ADA-Research) EMPSP Ekanayake (RA) WMW Weerakoon CJ Perera (ADA-Research)
	Evaluation of large seeded, medium duration groundnut lines		No. of evaluated lines	16	√	√	Identify suitable ground nut line sutable for LDZ	KHST Deshabandu (ADA-Research) EMPSP Ekanayake (RA) AM Perera (Addl. Director)
	Seed multiplication of promising confecionary type groungnut		No. of multilply varites	11	√	√	seed multiply for research purpose	KHST Deshabandu (ADA-Research) EMPSP Ekanayake (RA) AM Perera (Addl. Director)
	National Coordinated Varietal Trial - medium duration groundnut lines - Angunakolapelessa		No. of evaluated lines	7	√	√	Identify suitable ground nut line sutable for LDZ	KHST Deshabandu (ADA-Research) EMPSP Ekanayake (RA) AM Perera (Addl. Director)
	National Coordinated Varietal Trial - groundnut - Kilinochchi		No. of evaluated lines	7	√	√	Identify suitable ground nut line sutable for LDZ	KHST Deshabandu (ADA-Research) EMPSP Ekanayake (RA) AM Perera (Addl. Director)
Maize breeding	Large scale demonstration of selected drought tolarent maize hybrid received from CIMMYT, India		No. of demonstrations	Farmer prefernce and adaptability- 1-2 hyb.		√	to select most adaptable maize hybrid to nominate VRC	Extention officers Mrs. R. Kumari,RO.Mr D.C.M.S.I Wijewardana RO, N.A.P.S.G. Upashantha PA,

Evaluation of promising maize hybrids in VAT		No. of promising hybrids	Identifying promising hybrids - 1-2hyb.	√	√	to identify most adaptable and stable maize hybrids for national release	Extention officers Mrs. R. Kumari,RO.Mr D.C.M.S.I Wijewardana RO, N.A.P.S.G. Upashantha PA,
Evaluation of promising maize hybrids in NCVT			6 hybrids			to identify most adaptable and stable maize hybrids for VAT	R. Kumari, I. Wijewardana, Deepani Liyange P. Upasantha, Dr.
Evaluation of new maize hybrids developed from - CIMMYT inbred lines - Developed from CIMMYT and locally developed inbred lines - Developed from local inbred lines in PYT.		No. of promising hybrids	100 crosses	√	√	To develop high yeilding (8-9t/ha) maize hybrids	Mrs. R. Kumari,RO.Mr D.C.M.S.I Wijewardana RO, N.A.P.S.G. Upashantha PA, D.M.J.K. Dissanayake RA, Nimal Ratnayake (RSA)
Evaluation of new maize hybrids developed from - CIMMYT inbred lines - Developed from CIMMYT and locally developed inbred lines - Developed from local inbred lines in AYT			20 crosses	√	√	To develop high yeilding (8-9t/ha) maize hybrids	
Evaluation elite maize hybrid trials from CIMMYT, India in NCVT and VAT			50 hybrids	√	√	Identify most adaptable and promisisng hybrids	
Development of maize inbred lines		No. of selfed lines advanced to next generation	S3 -S4 -100 S4 -S5 - 80 s0-s1 -200 S1-S3 - 100	√	√	to develop parental lines with combining ability to develop maize hybrids	
Generation advancement S2–S3 and S3 to S4				√	√		
Established segregation population S0 - S1				√	√		

Development of new maize crosses CIMMYT/CIMMYT		No. of signgle crosses	developement of 20 new signle crosses from each combination of inbred lines for evalaution	√	√	new single cross maize hybrids for evalaution	
Development of new maize crosses with locally lines/ CYMMYT lines				√	√		
Development of new maize crosses from local lines/local inbred lines				√	√		
Evaluation of maize exotic hybrids		No. exotic hybrids	10 exotic hybrids	√	√	to identify high yeilding pest and disease resistant maize exotic hybrids	W.M.R.Kumari (ADA-Research) D.C.M.S.I. Wijewardena (ADA-Research) K.N.C. Gunawardena (ADA-Research) W.M.K. Fernando (ADA-Research) N.A.P.S.G. Upasantha (PA) D.M.J.K. Dissanayake (RA)
Seed production of MI popcorn 1		Amunt of seed produced	60kg of seeds	√	√	increase seed availability for released line	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
Evaluation of locally developed popcorn crosses		No. of crosses	20 crosses	√	√	New promising crosses for cultivation	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)

	Development of new pop corn varieties through hybridization		No. of varieties	3 varieties	√	√	New popcorn hybrids	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
	Application of mutation breedinf for maize		Number of selected lines	40 lines (Plants)	√	√	Devlopment of inbred lines using mutated populations	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
	Development of double cross hybrid and selection of inbred lines from the segrigation population		Selcted lines			√	Inbred lines developent for hybrid development progrm	D.C.M.S.I Wijewardana (ADA.R) W.M.R. Kumari (ADA.R) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (SLBA)
	Development of popcorn inbred lines		No. of inbred lines	20 lines	√	√	20 advanced inbred lines	D.C.M.S.I Wijewardana (ADA.R) W.M.R. Kumari (ADA.R) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA)
Finger millet & other millets	Development of sweet corn inbred lines using exotic varietiesvarieties		No. of lines	20 lines	√	√	15 advanced inbred lines	D.C.M.S.I Wijewardana (ADA.R) W.M.R. Kumari (ADA.R) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (SLBA)

* Evaluation of finger millet accessions in VAT		No. of lines	1 lines	√	√	Promissing finger millet lines for DUST	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka (RA) Nimal Rathanayaka (RSA)
Evaluation of finger millet AYT		Number of lines	7 line	√	√	Promising lines for NCVT	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA.R) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
Application of mutation breeding for finger millet		Number of populations	10 mutated populations		√	Development of variable populations for selection	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
Evaluation of Finger millet in NCVT		Number of lines	1 Line	√	√	Promising finger millet lines for VAT	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M J Dissanayaka (RA) Nimal Rathanayaka (RSA)

	Evaluation of foxtail millet in VAT		Number of lines	2 lines	√	√	Promising foxtail millet lines for DUST	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA.R) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
	* Development of new finger millet lines through hybridization and selection		No. of populations	15 selected pedigree lines for further selection	√	√	Creation of variability and development of new populations for selection	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
	* Evaluation of sorghum Accessions in VAT		No. of lines	2 lines	√	√	Promising Sorghum lines for DUST	D.C.M.S.I Wijewardana (ADA-Research) W.M.R. Kumari (ADA-Research) N.A.G.Upashantha (PA) R.M.J.C.B. Senanayaka (RA) D.M. J Dissanayaka(RA) Nimal Rathanayaka (RSA)
Vegetables	National Coordinated Varietal Trial for promising breeding lines Elabatu & Okra		No.of lines	Identify promissing elabatu & okra lines	√	√	New varieties	MJMP Kumararathne (ADA-Research)
					√	√		MJMP Kumararathne (ADA-Research)
Fruits	Maintenance of grapes & Mango germplasm				√	√	Availability of germplasms for future crop improvement programmes.	WAS Vijitha Kumara (ADA-Development)
	Mantanence of tom &JC Mango plants		Number of plants	200	√	√	Maintaining plants	WAS Vijitha Kumara (ADA-Development)

	Maintenance of Guvawa plantation		Number of plants	75	√	√	Maintaining plants	WAS Vijitha Kumara (ADA-Development)
	Maintenance of Lime plantation		Number of plants	7	√	√	Maintaining plants	WAS Vijitha Kumara (ADA-Development)
	Maintenance of wood apple germplassm		Number of lines	200	√	√	Maintaining plants	WAS Vijitha Kumara (ADA-Development)
	Maintianing drum stick cultiâtion		Number of plants	240	√	√	Maintaining plants	WAS Vijitha Kumara (ADA-Development)
	Maintenance of mother plants of three grape varieties				√	√	maintenannce of genatic purity of recomonded varities and availability of	WAS Vijitha Kumara (ADA-Development)
Entomology	Evaluation of different local chilli hybrids for major pests		No. of resistant/tolerant hybrids	Identify resistant/toleran t hybrids	√	√	Management of chilli leaf curl complex	K. N. C. Gunewardena (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)
	Evaluation of different open pollinated chilli varieties for major pests		No. of resistant/tolerant open pollinated chilli varieties	Identify resistant/toleran t OPVs	√	√	Management of chilli leaf curl complex	K. N. C. Gunewardena (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)
	Evaluation of different chilli inbreds for major pests		No. of resistant/tolerant chilli inbreds	Identify resistant/toleran t inbreds	√	√	Management of chilli leaf curl complex	K. N. C. Gunewardena (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)

Testing of insecticide to control chilli leaf curl complex		No. of effective insecticides	Identify effective insecticides	√		Management of chilli leaf curl complex	K. N. C. Gunewardena (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)
Development of weather based prediction model for maize stem borer		Effective pest forcasting model	Develop weather based prediction model for maize stem	√	√	Management of maize stem borer	K. N. C. Gunewardena (PAS P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)
Effect of different bulb treatments to control bulb mites in onion seed crop		No. of effective bulb treatment	Identify effective bulb treatment	√	√	Management of onion bulb mite	K. N. C. Gunewardena (PAS)P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)
Evaluation of silica containing products as plant resistant inducers for thrips in chilli		Effective plant resistant inducer	Identify effectiveness of silica containing product	√	√	Management of chilli leaf curl complex	K. N. C. Gunewardena (PAS) P.A.I. Sandaruwani (RA) K.P. Jayanthi (RSA)
Identification of diversity and distribution of predaceous lady bird beetles (Coleoptera: Coccinellidae) in Legumes		No.of lady bird Spp.	Identify potential lady bird spp. As a bio control aent	√	√	Management of sucking pests of legumes	M.A.R.A. Madanayaka ADA-Research) S.M.A.O. Nadeeshani (RA) K.P. Jayanthi (RSA)
Identification of suitable flowering plants to enhance natural enemies in legumes		No. of flowering plants	Identify pest natural enemy relationship	√	√	Management of major pests of legumes	M.A.R.A. Madanayaka ADA-Research) S.M.A.O. Nadeeshani (RA) K.P. Jayanthi (RSA)
Study of Bionomics of pod borer complex in mung bean		No. of pod borers	base line data of poulation dynamics of pod borers in	√	√	Management of Pod borers	M.A.R.A. Madanayaka ADA-Research) S.M.A.O. Nadeeshani (RA) K.P. Jayanthi (RSA)
Evaluation of germplasm/ varieties for resistance /tolerance to major pests in mungbean		No. of resistant/tolerant germplasm	Identify resistant/toleran t lines	√	√	Management of mungbean pests	M.A.R.A. Madanayaka ADA-Research) S.M.A.O. Nadeeshani (RA) K.P. Jayanthi (RSA)
Evaluation of germplasm/ varieties for resistance /tolerance to major pests in blackgram		No. of resistant/tolerant germplasm	Identify resistant/toleran t lines	√	√	Management of blackgram pests	M.A.R.A. Madanayaka ADA-Research) S.M.A.O. Nadeeshani (RA) K.P. Jayanthi (RSA)

Pathology	Evaluation of local chilli hybrids for major diseases		No. of resistant/tolerant varieties	1	√	√	Resistant/tolerant varieties for chilli diseases	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Evaluation of chilli open pollinated varieties for major diseases		No. of resistant/tolerant varieties	1	√	√	Resistant/tolerant varieties for chilli diseases	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Evaluation of red onion lines for major diseases		No. of resistant/tolerant varieties	1	√		Resistant/tolerant varieties for onion diseases	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Identification of onion black mold and its biological control using Trichoderma spp.		No.of effective techniques	1	√	√	Development of protocol for onion black mold control	W.M.K. Fernando (ADA-Research)) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Development of a weather based disease forecasting model for onion Anthracnose		Disease forecasting model	1	√		Effective disease forecasting	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Evaluation of mung bean lines for major diseases		No. of resistant/tolerant varieties	1	√	√	Resistant/tolerant varieties	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Evaluation of black gram lines for major diseases		No. of resistant/tolerant varieties	1	√	√	Resistant/tolerant varieties	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Evaluation of cowpea lines for major diseases		No. of resistant/tolerant varieties	1	√	√	Resistant/tolerant varieties	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)

	Basict scale testing of Triforine for Anthracnose of onion		No. of fungicides	1	√		Effective fungicide	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Basict scale testing of Mancozeb 70% + Azoxystrobin 5% WG and Triforine for Anthracnose of chilli		No. of fungicides	1	√		Effective fungicide	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA) D.M.K. Dissanayake (RSA)
	Screening of finger millet lines for blast disease		No. of resistant/tolerant varieties	1	√		Resistant/tolerant lines for finger millet blast	W.M.K. Fernando (ADA-Research) W.M.S.D.K. Wijerathne (RA)
Weed management	Testing of new herbicidesto control weeds in maize		number of Herbicides	6 trts	√	√	Effective herbicide	HMPTK Hettigedara(ADA-Research) GHK De Silva (RA)
	Management practices to control weeds in field crops		technology to control weeds	18 trts	√	√	Effective package for weed management	HMPTK Hettigedara(ADA-Research) GHK De Silva (RA)
Agronomy	Integrated effect of micro, macro nutreintss and PGR on growth and yield of chilli		Number	To conduct 2 experiments with 8 combinations	√	√	Identification of effective combinations of micro, macro nutreints and PGRs	MAPWK Malaviarachchi (ADA-Research)
	Performance of exotic and local hybrid maize at different density levels		Number	To complete the rainfed experiment and start an experiment on large plots with	√	√	To identify better performing varieties	MAPWK Malaviarachchi (ADA-Research)
	An investigation to improve the hybrid seed production technology in maize		Number	To conduct an observation study and initiate a designed	√	√	To obtain a seed yield >1 t/ha	MAPWK Malaviarachchi (ADA-Research) DCMSI Wijewardana (ADA-Research)

Effect of antitranspirants on growth and yield of mung bean		Number	To complete the first experiment in yala season		√	Increased yield under moisture stress	MAPWK Malaviarachchi (ADA-Research) DCMSI Wijewardana (ADA-Research)
NCVT trial for moisture stress		Number of varieties/promising lines	14	√	√	Completed	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
National co-ordinated rice varietal testing 3 months		number of varieties/promising lines	14	√	√	Maha established	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
National co-ordinated rice varietal testing 3.5 months		Number of varieties/promising lines	14	√	√	Maha established	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
Impact of high air temperature and moisture stress on pollen and spikelet sterility		Number of treatment	8	√	√	Maha established	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
Screening of mungbean a cowpea for excess moisture stress		Number of accessions	99	√	√	Selected accessions for future rersearchcompl	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
phenotipic characterization of rice for high temperature stress		Number of rice varieties	9	√	√	Phenotypic markers were identified & continued for simiulation modeling	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
Screening of rice varieties for canopy cooling in temperature and moisture stress		Treatment and varieties	50	√	√	Phenotypic markers were identified & continued for simiulation modeling	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)

	Access the impact of future temperature change on maize production in dry zone using crop modeling approach		Number of maize varieties	4	√	√	Completed	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
	Selection rice lines for wider spacing for mechanical planting		Number of rice varieties	25	√	√	Not conducted	L.C.Silva (ADA-Research), H.G.B.P.Darshana (RA)
	Validation of the leaf colour chart readings to decide the N requirement of chilli		6 trts	a technology to decide the N requirement	√	√	Nitrogen application based on the leaf colour chart value	HMPTK Hettigedara(ADA-Research) KA Renuka (ADA-Research) GHK De Silva (RA)
	Alternative nursery management techniques for chilli		9 trts	identify a best nursery type and best age for transplanting	√		Best nursery management technoque for chilli	HMPTK Hettigedara(ADA-Research) MAPWK Malaviarachchi (ADA-Research) GHK De Silva (RA)
	Influence of growth regulators on growth and yield of chilli		12 trts	no of technology to enhance the growth and yield	√		Enhaced growth and yield of chilli	HMPTK Hettigedara(ADA-Research) GHK De Silva (RA)
	Organic formulations to improve the growth and yield of mung bean and cowpea		6 trts	effective organic solution to enhace the growth and yield of field crops		√	An organic nutrient supplying package for field crops	HMPTK Hettigedara(ADA-Research) GHK De Silva (RA)
	Foliar spray of Urea, NAA to improve the growth and yield of mung bean		5 trts	no of technology to enhance the growth and yield		√	increased the growth and yield of mung bean	HMPTK Hettigedara(ADA-Research) GHK De Silva (RA)
Soil fertility	Nutrient management package for sustainable greengram production		Number	To conduct the preliminary experiment with 10 packages		√	To identifiy a new nutrient management package	MAPWK Malaviarachchi (ADA-Research)

	Effect of different rate of Urea and micro nutrients with different application time on growth and yield of big onion		Number	To conduct the preliminary experiment with 13 packages			To identifiy a new nutrient management package	MAPWK Malaviarachchi (ADA-Research)
	Determination of N requirement of maize by leaf colour chart (Large scale/Farmer fields)		Number	To conduct large scale on-station & on-farm research	√	√	To finalized the adaptability under farmer condition	MAPWK Malaviarachchi (ADA-Research)
	Improvement of soil fertility and crop productivity of RBE soil through incoorparation of organic amendments		Number	To conduct 2 experiments on the same site	√	√	Identify organic soil amendments	MAPWK Malaviarachchi (ADA-Research)
	Testing commercial fertlizer products under the fertlizer testing program		Number	To conduct 2 experiments	√	√	Identified the effect of different commercial fertlizers on maize	MAPWK Malaviarachchi (ADA-Research)
	A study on the response of maize in relation to application of 'HERP' and 'ESSP'		No. of experiments	2	√	√	Effectiveness of 'HERP' and 'ESSP' on maize	R.A.C.J. Perera (ADA - Research) B.K.M.G.D.P. Jayasundara (RA)
Soil & Water Management	Spatio-temporal characterization of soil salinity in an irrigated cropping system in the dry zone of Sri Lanka using proximal soil sensing		No. of experiments	1	√	√	Information on the effective novel technologies to characterize soil salinity	R.A.C.J. Perera (ADA - Research) N. R. A. Nawarathne (RA)
	Isotope investigation in 'Malwathu Oya' basin (collaborative study with Sri Lanka Atomic Energy Board)		No. of experiments	2	√	√	Identified flood impacts on the groundwater using isotope techniques in hydrology	R.A.C.J. Perera (ADA - Research) B.K.M.G.D.P. Jayasundara (RA) Scientists from Sri Lanka Atomic Energy Board

	Field verification trials of the developed best management packages for chilli, onion and mung bean under micro irrigation systems		No. of experiments	5		√	Verified best management packages for chilli, onion and mung bean under micro irrigation systems	R.A.C.J. Perera (ADA - Research) M.S. Nijamudeen (ADA - Research) B.K.M.G.D.P. Jayasundara (RA)
	Increasing resilience of upland cropping systems to climate change impacts through a modified alley cropping system		No. of experiments	2	√	√	Modified alley cropping for land productivity climate change	M.S. Nijamudeen (ADA-Research) R.A.C.J. Perera (ADA-Research) M.A.P.W.K. Malaviarachchi (ADA-Research)
Bio-technology	Development of transgenic resistance for chilli leaf curl viruses		Testing of different protocols for plant regeneration of	Leaf curl virus resistant chilli line	√	√	Regeneration of chilli plant with chilli leaf curl resistance	DMJB Senanayake (ADA - Research) ,WAR Dhammika (ADA-Research),- RA , P.C.N.Deniyagedara-RA
	Identification of Anthracnose disease resistance chilli accessions and detection of		Molecular screening of 21 chilli accession	Identify the Antracnose resistance of	√	√	Identify the Antracnose resistance of chilli	DMJB Senanayake, (ADA - Research) ,WAR Dhammika ADA-Research), D.N
	Marker Assisted Selection of Quality Protein Maize (QPM) incorporated maize lines/ varieties		Completion of self polination for molecular screened lines Measuring of protein (Lysin & Tryptohan of content for selected line	No of Lines selected for generation advancemen	√	√	Development of qpm incorporated maize variety	WAR Dhammika (ADA-Research), DMJB Senanayake, ADA -Research) D.N Jayawardana- RA
	Preliminary Yield trial of promising QPM incorporated maize lines		No of lines	Selection of promising lines for NCVITY	√	√	Selection of promising lines for NCVITY	WAR Dhammika (ADA-Research), D.N Jayawardana- RA

	Screening mung bean lines/varieties for bruchid resistance gene (*Br*) and MAS for mungbean breeding against bruchid resistance		Screening of mung bean lines for bruchid resistance	Identified lines for bruchid resistant	√	√	No of lines molecular screened to identify the bruchid resistance	WAR Dhammika (ADA-Research), DMJB Senanayake (ADA - Research) D.N Jayawardana-RA
	Double haploid plant production of Maize		Testing of different protocols for Anther culture plant regeneration	Haploid/ double haploid plants for Maize	√	√	Devlopment of protocol for Maize anther culture	WAR Dhammika (ADA-Research), DMJB Senanayake, (ADA - Research), P.N.Deniyagedara
	Double haploid plant production of Chilli		Testing of different protocols for Anther culture plant regeneration	Haploid/ double haploid plants for Maize	√	√	Devlopment of protocol for chilli anther culture	WAR Dhammika (ADA-Research), DMJB Senanayake, (ADA - Research), P.N.Deniyagedara
Breeder seed production	**Chilli**							
	MI2		No. of kgs	2 kg	√		Provide the Breeder Seed	B.M.K Senarathna Menike (ADA(R))
	MI Green		No. of kgs	1 kg	√		Provide the Breeder Seed	B.M.K Senarathna Menike (ADA(R))
	Galkiriyagama sel.		No. of kgs	2 kg		√	Provide the Breeder Seed	B.M.K Senarathna Menike (ADA(R))
	MI Waraniya 1		No. of kgs	2 kg		√	Provide the Breeder Seed	B.M.K Senarathna Menike (ADA(R))
	Parent line - MI Waraniya 1 IB		No. of kgs	2.5 kg	√	√	Increase the availability of seeds of parent	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), K. Saluwadana (RSA)
	Parent line - Galkiriyagama IB		No. of kgs	5 kg	√	√	Increase the availability of seeds of parent lines of the chilli hybrid MICH HY1	H.M.S.N.Herath - (ADA - Research), H.M.S.Bandara (RA), K. Saluwadana (RSA)
	Maize							
	Bhadra		No. of kgs	30kg		√	in progress	WMR Kumari (ADA-Research)

Ruwan			No. of kgs	30kg		√	in progress	WMR Kumari (ADA-Research)
Parental line CML 161			No.of kgs	1000kg	√	√	in progress	WMR Kumari (ADA-Research)
Parental line CML 194			No. of kgs	500kg	√	√	in progress	WMR Kumari (ADA-Research)
Parental line CML451			No. of kgs	500kg	√	√	in progress	WMR Kumari (ADA-Research)
Parental line CL0 2450			No. of kgs	250kg	√	√	in progress	WMR Kumari (ADA-Research)
F1 seeds MI Hybrid 01			No. of kgs	500kg			in progress	WMR Kumari (ADA-Research)
F1 seeds MI Hybrid 02			No. of kgs	500kg	√	√	in progress	WMR Kumari (ADA-Research)
Finger millet	Oshadha		No. of kgs		√	√	in progress	D.C.M.S.I Wijewaradana
	Rawana		No. of kgs		√	√	in progress	D.C.M.S.I Wijewaradana
Mungbean	MI 6		No. of kgs		√	√	in progress	M.J.M.P. Kumararathna (ADA-Research)
	Ari		No. of kgs		√	√	in progress	M.J.M.P. Kumararathna (ADA-Research)
	MI5		No.of kgs		√	√	in progress	M.J.M.P. Kumararathna (ADA-Research)
Blackgram	Anuradha		No. of kgs		√	√	in progress	M.J.M.P. Kumararathna (ADA-Research)
	MI1		No. of kgs		√	√	in progress	M.J.M.P. Kumararathna (ADA-Research)
Cowpea	Waruni		No. of kgs		√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)
	Dhawala		No. of kgs		√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)
	MI-35		No. of kgs		√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)
	MICP-1		No. of kgs		√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)
	Bombay		No. of kgs		√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)

Soybean	Pb-1				√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)
	MISB-1				√	√	Requested by SPDC	N H M S Chithrapala (ADA-Research)
Snake gourd	MI short		No. of kgs		√	√		M.J.M.P. Kumararathna (ADA-Research)
Bitter gourd	KC-1		No. of kgs		√	√		M.J.M.P. Kumararathna (ADA-Research)

Prepared by

Director/FCRD

Annexure 5

Hayleys AGRICULTURE

Hayleys Agro Farms (Pvt) Ltd.

Reg. No. PV 5865

Head Office : 25, Foster Lane, Colombo 10, Sri Lanka.
Tel : 011 2688960-5, Fax : 011 2697202

31 MAR 2016

28th March 2016

6703

Director,

Field Crops Research and Development Institute,

Mahailluppallama .

Dear Sir,

This is reference to the letter dated 16th March 2016 received by your institute (FCRDI) . We highly appreciate your consideration regarding our request (Dated 26th January 2016) to obtain the parent lines of chilli hybrid for producing the newly introduced chilli hybrid of MICH HY 1 in our location on forthcoming Maha season 2016. We are expecting to arrange pilot project in our own premises in Boralanda (Quality Seed Company) under poly tunnels by using 1000m^2 . Further , we would like to request you following seeds quantities in order to initiate the project.

1) Male line- 50 gr

2) Female line -100 gr

Mrs Chathika
PI Specialist
31/3

Thank you,

Yours truly,

HAYLEYS AGRO FARMS (PVT) LIMITED

Sunil Gamaethige
(General Manager)

M H T D Perera
(Management Executive)

Received
2016/4/6

Copy- 01 Director General, Department of Agriculture, Old Galaha Road, Peradeniya.

Copy -02 Director, Horticultural Crops Research and Development Institute , Gannoruwa