Minimization of Post- Harvest loss of vegetables and fruits in Sri Lanka and the intervention of related public entities for marketing at fair price

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01

Executive Summary

According to the United Nations Food and Agricultural Organization, the quantity of food wastes annually approximately 1.3 billion metric tons and approximately 1 billion persons starve in the whole world. It is hoped that the World population will be 10.5 billion by the year 2050 and as such the food supply needs to be improved by 60 per cent. In addition, to the improvement of distribution of commodities minimisation of Post-Harvest loss is a deciding factor and the international researches had also established that the minimisation of Post-Harvest loss is a deciding factor and the international researches had also established that the minimisation of Post-Harvest loss is used as a remedy.

Accordingly, vegetable and fruits waste about 270,000 tons or 30 to 40 per cent annually up to come to the consumer from the farm, thereby losing about Rs.20 billion to the economy of Sri Lanka. Therefore, special attention in this regard needs to be paid.

Furthermore, according to the data in the Ministry of Health about 73 percent of the elders do not consume vegetable and fruits sufficiently and the malnutrition level of children below the age of 5 years stands at 21 per cent. The importance of the minimisation of Post-Harvest loss is further increased by this serious matter and the malnutrition condition of Sri Lankans.

Despite, the nutrition's level and the impact caused by Post Harvest loss to the overall economy, there are occasions that Sri Lankan peasantry throws away their crops during the harvesting periods as animal foods as they can not market their products in most cases and it is also regularly reported that the peasantry becomes destitute, since they could not even cover the cost of production as they do not get at least a minimum price or a reasonable price for their products. Likewise, despite the harvests could not be marketed in certain areas of the Island, it is reported that such harvests are sold at high prices in some other areas. Accordingly, this study predominates the issues exist in the mechanism distribution of harvests and the controversial matters exist in the strategies of Agriculture, trade, imports and exports affected thereon in Sri Lanka. In this connection, elements for these issues can be identified by the evaluation of functions of the public entities identified as sustainable development. Of theme, public entities under the Ministry of Agriculture and other government institutions conduct researches on Post-Harvest Technology by incurring a lot of money. It is predominant that the results of researches could not be enjoyed due to such reasons including the essential crops had not been covered by these researches and their recommendations are not adequately implemented by the relevant public entities. Even though, research and training programme are conducted during the excessive harvesting seasons of vegetable and fruits to convert them into value added products, they are insufficient and to gain access to export vegetable and fruits had been an extremely small quantity. Even though, the National Post Harvest Management Institute had taken various steps to minimise Post-Harvest loss, comprising the introduction of ripen and indicators, introduction of harvesting equipment, distribution of packagers, monitoring loss of fruits through the fruit processing zones, it was observed that inappropriate follow up had caused thereto. The interior usage and imported hybrid seed usage of farmers in Sri Lanka represent 30 per cent and 70 per cent respectively, resulting in getting more harvest. Since there is no cultivation plan but ample surplus harvest is reported in certain crops in the Island. However, weaknesses in the distribu-

tion mechanism have caused to wast the harvest.

As observed in the examination of marketing fruit and vegetable in Sri Lanka, there are still unresolved issues in respect of economic centres established under the Ministry of Rural Economy and Commenced with the objective of formalisation of harvest distribution mechanism, including expansion implementation problems, insufficient physical resources the price received by the peasant in selling fruit and vegetables and insufficient intervention by the responsible public entities for monitoring such prices. Accordingly, the public entities at various levels need to be intervened to prevent Post-Harvest loss, since the existence of such causes including non-receipt of a reasonable price to the farmer, the consumer has to incure high cost for purchasing, and decrease in demand therefor, resulting a creation of surplus and the quality issues from the producer to retainer and finally to the consumer. In order to minimise or control such weaknesses researches and training on Post-Harvest technology need to be monitored by on public entity and their recommendations need to be implemented. Specially suitable packing methods to control the loss causes in the transportation and packing of harvest need to be introduced and implemented. Being increased the interior seed production cultivation of crops suitable for each area and the quantity sufficient to meet local requirement needs to be influenced. Export facilities must be promoted and the government intervention needs to be necessarily required to sell vegetable and fruits to get a reasonable price to the peasant and enabling to get fresh and quality fruit and vegetable by consumers at fair price through economic centres in the marketing process. In reaching sustainable development objectives on the elimination of hunger and poverty, the problems exist in this field need to be clearly identified. Without taking action in a manner, adding a value to the economy of the country, reaching sustainable development objectives may be difficult.

02

Introduction

2.1 Background

According to the Food and Agricultural Organization's estimates, after being harvested the crops, 1.3 billion tons thereof is lost annually. This harvest loss is strongly affected to economy and food safety. Therefore, many countries in the World are regionally developing various systems and equipment. The agricultural systems in south Asian countries mostly consists of small scale peasants and they have insufficient knowledge in Post-Harvest Technologies resulting that the Post -Harvest loss of vegetable and fruits exists between 20 and 40 per cent. Only a few surveys on vegetable and fruit Post-Harvest loss in Sri Lanka have been conducted. According, to the survey conducted by the Institute of Technology in the year 1999 on 3 types of fruits viz, pineapple, plant and papaw, the Post-Harvest loss had been between 30 to 36 per cent. According, to the survey carried out in the year 2014 again by the ITg, the Post-Harvest loss on mango had been identified as 33 per cent.

The Institute of Post-Harvest Technology has been established in the year 2000 in terms of subsection 1 of section 2 of the state industrial corporation act No.11 of 1972 to perform the functions of Post-Harvest in Sri Lanka. The survey conducted by that Institute in respect of Post-Harvest loss of vegetable and fruits in Sri Lanka observed that Post-Harvest loss incurs in Sri Lanka between 30 and 40 per cent. Use of weak Post-Harvest Technologies, poor packaging and deficiencies in transportation system had been identified as reasons for Post-Harvest loss.

The Institute of Post-Harvest Technology had conducted a study in the year 2003 on the use of plastic baskets instead of polysack bags to pack vegetable and fruits in order to minimise Post-Harvest loss. Accordingly, the distribution of plastic basket programme had been begun and implemented in the year 2007. However, the loss of Post-Harvest vegetable and fruits could not be reduced at a considerable level by the end of 2018. By now the Post-Harvest loss remains at a very high level and the reason identified therefor is that the plantation of crops without being forecasted by analysing the previous years data in respect of crops. As a remedy the Department of Agriculture is taking action to strengthen the crop forecast information system, denoted as "Pre-warning alarming system" in minimising surplus and shortage of food crops"

2.2 Authority for Audit

This audit was carried out under my direction in pursuance of provisions in Article 154(1) of the constitution of the Democratic Socialist Republic of Sri Lanka and sections 3(1)(d), 5.2 and 12(h) of the National Audit Act No.19 of 2018.

2.3 Reasons for choosing the topic for audit

2.3.1 Reporting the inability of selling harvest by mass media

Varied media has reported the opportunities that the peasants engage in cultivation in making great efforts could not sell their harvest, since they do not get a reasonable price.

2.3.2 Non - fulfilment of nutritious requirement

As stated in the report of a research conducted by an officer in the Mechanical Department of the Kothalawala Defence University in 2015 under the theme of "the broad vision on the Socia-economic impact caused by the use of informal methodologies (following) in the transport and

handling of vegetable in Sri Lanka," vegetable contains major constituents that transmit nutrient matters essential necessitate to the human body. Accordingly, vegetable provides nutrient constituents require to human body comprising 92.2 per cent of celery, 65.5 per cent of protein and 82.3 per cent of fat. At present, only 42.9 per cent of the above requirements is completed and Post-Harvest loss also primarily affects thereto. The ancient Sri Lankan peasants understood the value thereof and the crop harvesting had been considered as a predestination and had a methodology to do the task appropriately at the correct time.

2.3.3 Weaknesses exist in the transportation from crop harvesting to the consumer

Miscellaneous research reports, conducted by the various entities connected with agriculture stated that non-identification of suitable maturity stage, harvesting the crops by following wrong methods use of unsuitable packing methods and in appropriate transportation are subjected to thrash, scratch and injure the agricultural products and as a result, the loss of vegetable and fruits during that process ranged as high as 30-40 per cent. As stated in the report of a research conducted by an officer of the mechanical Department of Kothalawala Defence University the impact on the economy thereon is a loss of Rs.20 billion per year.

2.3.4 Existence of a bicycle price fluctuation in vegetable and fruit

As reported by mass media from time to time there are ocations that peasants become destitute as they are unable to sell their vegetable harvest and the harvest purchased from the peasants at a very low price are sold at an exorbitant price to consumers. Therefore, it is implied that the intervention of the related public entities in respect of selling vegetable and fruits in Sri Lanka at a fair price is not done adequately.

2.3.5 Compliance with Sustainable Development Goals

According to the Sustainable Development Goal 12.3, the responsible entities need to take action to minimise per capita food waste at retail and consumption levels by 2030 and to minimise wastages in the production and supply chain, including the Post-Harvest loss. In terms of goal 2.5.2 (c), action needs to be taken in compliance with targets ensuring the prevention of extremely fluctuations of food prices including food reserved and well-functioning of food production markets and their by products as appropriate.
Accordingly, for the evaluation of performance of public entities relate to this contact, carrying out of this performance audit under the title of minimisation of Post-Harvest loss of vegetable and fruits in Sri Lanka and the intervention of related public entities for marketing at fair prices has been based.

2.4 Audit Approach

The following approaches have been directed on this audit.

(a) Use of websites/ annual reports/ progress reports/ Annual Accounts/ Researches reports of the related entities.

(b) Calling for information through questionnaires/ forms

(c) Physical observations by visiting farms and markets.

(d) Holding conference being the officers engage in the field.

2.5 Related entities

As recognised in this audit, the manner how to intervene the public entities engage in agricultural sector in respect of Post-Harvest loss of vegetable and fruits and price control is as follows.

	Name of Entity	How to connect with
(a)	Ministry of Mahaweli Agriculture, Irrigation and Rural Development	i) This Ministry is entrusted functions comprising the formulation of policies, programmes and project on the development of agricultural sector. Provision of facilities giving policy guidance and administration to the agricultural entities under the control of the ministry and the supervision of performance ii) special economic centres are operated under this Ministry.
(b)	Department of Agriculture	Functions include, generation of agri-technology pertinent to various agricultural environmental zones in the Island through researches, preparation of a suitable cultivation plan and expand of such plan among peasantry through the agricultural instructors, production and distribution of high quality seeds and planting substance, conducting training programms to farmers and officers, conducting socio-economic surveys relate to manufacture of food crops.
(c)	Department of Agrarian Development	Formulation of regular times relating to the registration and operation of farmers organizations and to ensure whether such regulations are implemented, awareness of peasantry in respect of cultivation plans through the Agrarian services centres established island wide and Agricultural Research and production assistants are entrusted to the Department.
(d)	Post - harvest Technology Institute	This has been established with the aim of development activities in post-harvest technology relating to crops such as cereal, pulses plants, seed oil, other field crops, fruits, vegetable and spices.
(e)	Hector Kobbakaduwa Agrarian Research and Training Institute	Holding discussions and seminars relate to Agrarian research and training publication of related periodicals and act as a centre for the collection and distribution of agricultural information.
(f)	Sri Lanka Agricultural Research Policy Council	According to the Act establishment the Institute the following functions should be performance. i. Organising agricultural research, coordinating, planning and implementing National agricultural research policies & priorities. ii. Act as a means of communication between the agricultural research Institute and the Government.

	Name of Entity	How to connect with
(g)	Special Economic Centres	Established to achieve the following functions with the objectives of giving a fair price to the producer by establishing a targeted market for their products and to provide facilities to consumers to get food stuff with a low price. i) Collection and distribution of fress and high quality crops specially collection of crops on regional specialization. ii) Wholesale and retail sales iii) Taking action to minimize middlemen within the distribution network from producer to consumer. iv) To assist for the maintenance of stability in price level in the whole economy within a competitive environment. v) Facilitate to get goods and services required by consumers under one roof.
(h)	Consumable Affaires Authority	Published by 2 extra ordinary gazette notifications under the consumable Affairs Authority Act about the use of packages in the collection, storing and transportation of harvest.
(i)	Export Development Board	Action in respect of export of Sri Lankan products.
(j)	Industrial Technology Institute	Action in respect of various field in the agriculture sector including conduct of agricultural researches and training, introduction of value added products etc.

2.6 Audit objectives and criteria

	Main audit objective	Sub-audit objective		Audit Criteria	
1.	Evaluate whether the functions of the public entities for the minimisation of Post - Harvest loss fruit and vegetable are adequately fulfilled.	(a)	Evaluate whether the relevant public entities conduct required researches and training on Post-Harvest lost.	i.	In terms of gazette notification extra-ordinary No.1137/10 of 19 June 2000, objectives and functions of the establishment of Institute of Post-Harvest Technology.
		(b)	Evaluate whether the relevant public entities are taking action to direct the surplus harvest in to a value addition process and to export.	ii.	Objectives and functions of the Sri Lanka Agricultural Research policy council Act No.47 of 1987 and the establishment of the policy council.
				iii.	Objectives and functions of the establishment of Hector Kobbekaduwa Agricultural Research and Training Institute incorporate under the Act of parliament No.06 of 1972 on 21 February 1972.
				iv.	Objectives and functions of the Department of Agriculture, established on 20 May 1912.
				v.	Objectives and functions of the Industrial Technology Institute established under section 11 of the Science and Technology Promotion Act of 1994.
				vi.	Functions of the provincial Departments of Agriculture.
				vii.	Agrarian Development Act No.46 of 2000 and functions of the Agrarian Service Centres.
				viii.	Consumer Affairs Authority Act No.9 of 2003.

	Main audit objective	Sub-audit objective	Audit Criteria
2.	Under the maximum price to the manufacture and reasonable price to the consumer, the functions need to be performed to create a balanced (equilibrated) market without surplus and shortage.		i. Cabinet paper No.ඇමෙ/05/2119/027/003 dated 16 January 2006 (Legal provisions for the establishment of Economic Service Centres) ii. Vision, mission and functions of the Ministry of Rural Economic Affairs. iii. Principle objective No.03 of the Article of Association of the Lanka Sathosa Ltd. iv. Consumer Affairs Authority Act No.09 of 2003. v. Circular No.CIT/6/5/EC issued on 02 April 2015.

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2.7 Scope of Audit

This audit was carried out within the following limitations.

(a) I conducted my audit in accordance with International Standards of Supreme Audit Institutions (ISSAI 3000 – 3200)

(b) Even though many types of fruits and vegetables are cultivated in various territories in the country, audit of Post-Harvest of all types of fruits and vegetables has not been carried out due to such limitations as staff, other resources and time factor. Therefore, it was decided to carry out the audit in a manner that covers the Post-Harvest loss of only the following types of fruits and vegetables in the selected areas and locations.

i. Vegetables viz; tomato, pumpkin cucumber, cabbage, leek, radish, been, carrol, capsicum, cucumber and fruits viz'manago, plantatnts, papaw only have been selected.

ii. Wastages of vegetables and fruits taken place only in the economic centres and farms have been examined.

iii. Only Anuradhapura, Nuwaraeliya, Badulla, Kandy and Ratnapura districts in which vegetables and fruits are cultivated in planty have been selected.

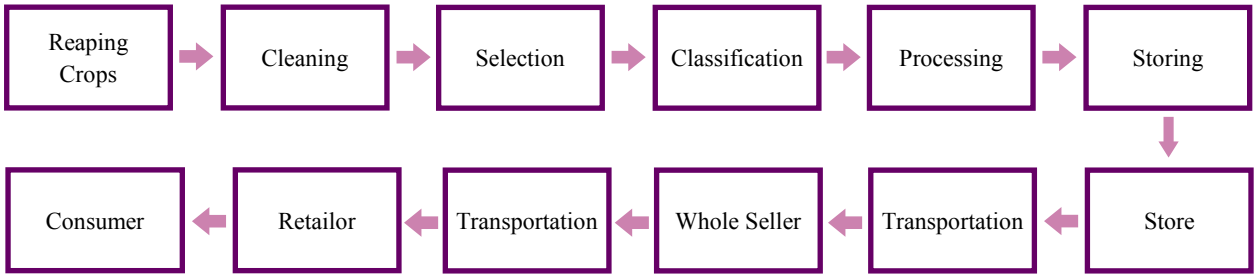
iv. Even though, the process of Post-Harvest loss spreads from harvesting to come to the customer and consume, by him, the audit had emphasised the Post-Harvest loss from the reaping of harvest coming up to the consumer.

03

Detailed Audit Findings

3.1 Various events happened to Post-Harvest loss

Since vegetable and fruits remain at naturalist condition while in the tree as well as after being reaped, every stage in the supply process of vegetable and fruits needs to be notable for delivering quality, nitrous and fresh vegetable and fruits to the market. As described in paragraph 3.7 of this report and according to the researches carried out in the field of Post-Harvest loss, currently it ranges from 30 per cent to 40 per cent. Post-Harvest loss starts from reaping the harvest by peasants and can be identified under several steps comprising, handling the harvest, classification of harvest, packing, transportation, storing, marketing and consumption etc. as shown below.



3.1.1 Pre-Harvest control effects the quality of Post- Harvest

In maintaining crop and cultivated lands by providing fertilizer and water in an appropriate quality and adequate quantity, quick treatments for melodies, removal of weed and removal of deceased plant substance from the farm a good quality production can be obtained. Such crops are not subjected to deteriorate soon and the damage causes in storing, packing, transportation and handling can be minimised.

3.1.2 Reaping stage of crops

(a) Reaping crops in deviation from maturation

Harvest is wasted by reaping after being maturated as well as by reaping before being maturated, because they could not be consumed. Therefore, the correct identification of reaping stage which differs from each crop is a basic need. The farmers decide the suitable time to reap harvest by their knowledge and experience even from the past. At present, it is stated in the information obtained from the Department of Agriculture and the Institute of Post-Harvest Technology that in the reaping of harvest, indicators are used for the determination of ripen condition. The number of days elapsed from the date of blossom of fruit and vegetable cultivations, length, weight, colour, breakability and hardness of fruit as well as high technological methods are used therefore. Even though, those indicators are identified at an institutional level, communication to the producer and they should be practised. According to the information obtained from the Post-Harvest Technology Institute in respect of the introduction of these methods to the farmer, observed the following.

i. Specific maturity indicators since 2000 for fruits like mangoes, guana, plantatnts, papaw and pine apple and for vegetables like beans, ridge gourd, bitter gourd, chillies, brinjol and tommatos including the number of days the harvest is reaped after being bloomed shape, quantity, weight native colour, moisture, chemical composition and texture had been determined and it was stated that 3919 persons in the year 2016, 5433 persons in the year 2017 and 4923 persons in the year 2018 had been trained comprising farmers all over the country, members of farmers societies vegetable and fruit collectors, transporters, traders, school and university students and the officers in the public and private sectors who are in the supply chain of vegetable and fruits. Of these, persons, 895 Agricultural Instructors and 9325 Agricultural Research, Production Assistant Officer in the years 2016 and 2697 officers in the year 2017 had only been trained who serve in the Department of Agriculture and directing connect with the farmers.

ii. As mentioned in the publication called vegetable harvesting and Post-Harvest management issued by the Department of Agriculture, such equipment called "Penetro meter" is available for the measurement of hard less/ structure the use ripen index prepared based on data obtain from that equipment, can be popularized among farmers such index prepared by the Industrial Technology Institute has been introduced to the exporters and it was stated that "Digital Penetrometer" can be introduced to the large scale businessmen. The Post-Harvest Technology Institute had also trained the farmers on this equipment. Even though, indicators have been identified at Institutional level, it was observed that such methods had not been followed, in considering the quality of vegetable and fruits in the market.

iii. It is a practice that reapers/ collectors of fruit harvest, lease the trees specially mangos and rambutan trees and reap the nuts together when they are maturated. When they come to the market, the consumer become inconvenience by purchasing crops which can not be consumed.

(b) Use of appropriate systems

As harvest is not carefully reaped there may be a possibility of scarping, thrashing and damaging near the stem, affecting the quality of product. Harvest can be reaped by hand or using a tool. Reaping harvest of certain crops by hand can minimise scrapes and thrashings and the researchers identified that it is appropriate to use an instrument to separate the fruit of certain crops from the stem. It was also identified that an instrument such as a "Secateraror" can be used for crops like grapes and a special instrument need to be used to reap the fruits fructify in high trees like mangos, wood-apple and orange.

According to the explanations given by the National Institute of Post-Harvest Management in this regard, harvest reaping equipment for mangos, papaw and other cluster fruits since 2001 and for bananas since 2016 had been introduced. The harvest reaping instrument for mangos and clusler fruits had been introduced under the "Api Wawamu Rata Nagamu" 2007-2008 programme and implemented for the beneficiaries of the fruit processing villages project. They had been distributed among 105 persons in the mango processing zones during 2017-2018 who were made aware through the training programmes. Similarly, harvest reaping equipment had been distributed to beneficiaries in the processing zones who involve in papaw and bananas.

3.1.3 Handling picked harvest

Harvest reaped from the farm needs to be kept in a manner not to expose to sun-light and rain. As vegetable and fruits are exposed to the sunlight, the volume of water content included therein is evaporated and to become ensured in rain they will suddly become perishable. In picking fruits white juice of managos and papaws etc. is

smeared with the surface of nuts and as such they are infected. Reaping and handling of harvest need to be done in a manner that minimises the damage caused due to secretion of white juice. Since the secretion of white juice of mangos effects the quality and external appearance of mangos, they have to be sold at a low price. The manner how to handle picked harvest is identified as it should not be staked on the floor at any time and to be kept in ventilated manner. If it is not so done the harvest is cracked, infected by micro-organism and damaged the nutritious level. Nevertheless, the discussions held with farmers revealed that action need to be taken in handling harvest was not made aware of the peasants and a programme that can be practically implemented was also not available.

(a) Selection, cleaning and grading of picked harvest

If injured, crushed, scrunched rotton damaged by insects, more maturated and ripest vegetable and fruits are available they should be removed. Thereafter, crack pesticide, not grown well and small nuts can be selected and removed. If it does not so select diseased condition may spread over the whole stock. If washing is needed only crops should be suddenly washed and dried and then stored for the washing of such vegetable such as carrot and beet a special smooth and soft Bruch needs to be used. In reaping harvest it should be appropriately graded so that the nature and characteristics differ from each other. Ripen and matured fruits need to be separately packed, selected and graded. When they are graded they can be supplied to a better market and get a good price as their quality and condition are high. Therefore, farmers need to be made aware of them.

Moreover, the research reports state that National standards on grading of picked harvest needs to be established. However, such standards had not been established by the National Post-Harvest Management Institute. Even though, the Sri Lanka Standards Institution had fixed standards on various fruit grades such as mangos, papaw and grapes etc. they are not used in the market.

3.1.4 Packaging and Transportation

Storing and transportation of vegetables and fruits without a proper package mainly cause to increase the Post-Harvest loss. Lesser ventilation in lorries availability of minimum facilities in the Colombo market complex in unloading fruits and vegetables from lorries, receipt of lesser ventilation due to loading a large number of polysack gung bags one another striking crushed and scrunched vegetable and fruits with good staff largely increase the harvest loss. Since the roof of the lorries use in the transportation is not covered the harvest gets wet and congregates water in the raining and dries in the sun-light adding the warm emits from harvest (respiratory air) damage the harvest quantitatively and qualitatively. Furthermore, it can be generally seen that the persons who go with the lorries transport vegetables sit sleep on the packages and it will affect the lift time of crops but not rules or laws will apply thereon. Parking and unloading the goods in economic centres need to be happened in a shaded proofed place. Therefore, action taken by the consumable affairs Authority with the intention of minimising post-harvest loss and observations thereon appear below.

(a) Necessity to use packages

Directions have been issued to all local vegetable and fruits transporters, distributors and traders by gazette extra ordinary No.1728/5 of 17 October 2011 and gazette extra ordinary No.1740/22 of 13 January 2012 published under section 10(1)(b)(2) of the consumable Affairs Authority Act No.09 of 2003 in respect of the use of packages when collecting, storing and transporting of harvest of locally produced 37 types of vegetables and 21 varieties of fruits stating that when they transport and storing, crops, packages made up of plastic or solid papers or timber need to be used.

The following observations are made in this regard.

i. The gazette notification No.1728/5 of 17 October 2011 had been cancelled and issued the

gazette notification No.1740/22 of 13 January 2012. In issuing this new gazette notification 16 types of vegetables and fruits for which packing need to be used had been withdrawn. However, the results of the survey conducted by the National Post Harvest Management Institute established that the maximum harvest loss occurred while in the transportation of 8 types of vegetables thereof in 2014 had been 27 per cent as per detailed below.

Fruits and Vegetables which withdraw by second gazette notification

Type	Post harvest loss (in transporting) %
Long bean	27.44
Ridge gourd	14.92
Green Chillies	22.14
Brinjal	6.36
Okra	6.93
Cabbage	17.07
Beetroot	1.01
Beans	3.49

ii. According to the computation of post harvest loss of mangos which had been stated in the first gazette notification but removed from the next gazette, carried out by the Industrial Technology Institute in the year 2014. it was observed that the post harvest loss was 32.7 per cent.

(b) Use of traditional packages

Physical verifications carried out in the economic centres of Thabuththegama, Meegoda and Dambulla observed that in transporting and storing tomatos out of the vegetables and fruits stated in the gazette notification, boxes made up of timber need to be used. However, since the timber box used for tomatoes is deeper soft crop like tomato may be much more. It is important to make boxes in a manner, available air space between wooden straps. It was observed that in storing and transporting other vegetables and fruits traditional methods (polusack bags) or gunny bags are used at a very high level.

(c) Use of plastic packages

According to the research report on the "evaluation study of the effect of using plastic packages for marketing" of vegetable and fruits conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute, the following observations were made.

i. Even though, many farmers express willingness to use plastic packages, as compared with the gunny bags, only few quantity of products can be packed in plastic packages and as a result, an exorbitant needs to be paid as more space is required for the transportation of their products (As loading and unloading cost is more) transporters reject to carry their products which contain in plastic packages non-availability of a formal methodology in giving packages to send their products to the market and as such they use to use the poly sack gunny bags continuously (net gunny bags) which is a traditional package.

ii. However, the significant of the use of plastic packages is recognised and the vegetable suppliers for the super market network exporters of vegetable and fruits and the whole sellers who supply agri-products to tourist hotels are the important parties among them. In addition, the suppliers of products who supply products to limited traders in the economic centres are the other party.

iii. It was stated that many peasants use plastic boxes believe that carrying their products pack in plastic boxes, though a high price is not always paid will decrease or damages or no any damage whatsoever is caused and the weight of the package is 100 per cent accurate and there for they can get certain benefits as compared with the use of traditional gunny bags.

(d) Accustom the use of plastic packages

The National Post Harvest Technology Institute had distributed plastic packages to various market parties as per detail below.

i. 103,407 Plastic packages valued about Rs.125 million had been distributed among farmers, transporters, persons and retailers during the period from 2001 to 2018 at a concessionary price.

ii. For the papaw project, banana project and guava project implemented in the years 2017 and 2018 by the Post Harvest Technology Instituted, 41,000 cardboard boxes had been issued to the farmers engage in those projects.

iii. In order to minimise the Post Harvest loss, 12,345 plastic baskets valued at Rs.5,809,015 had been distributed during the years 2016, 2017 and 2018 by the District Offices of Badulla and Nuwaraeliya.

iv. It was also observed that sufficient attention for the implementation of the recommendations stated in the report of the research conducted by the Hector Kobbekaduwa Agrarian and Training Institute in the year 2011 on the evaluation study of the effect of using plastic packages for marketing of vegetable and fruits had not been paid.

The field audit inspection observed that despite the legal policies are available for the compulsory use of packages and a lot of money has been spent by the government for the distribution of plastic baskets as mentioned above, they are not plentifully used for the packaging of vegetable and fruits.

(Meegoda special Economic centre on 26.06.2018)

(Dambulla special Economic centre on 19.03.2019)

According to the research report, the manner now to cause harvest loss in the transportation of various kinds of vegetable under the traditional methods and plastic packages (polysac bags) methods is as follows.

Crop	Percentage of Loss	
	Polysac gunneys	Plastic packages
Brinjal	22	5
Cabbage	24	5
Bean	22	4
Capsicon	26	5
Tomato	14	6

Source: Evaluation study report of the effect of using plastic packages for marketing of vegetable and fruits published by the Hector Kobbekaduwa Agrarian Research and Training Institute.

According to the above data it was observed in audit that the harvest loss occurs in the transportation of crops by packing in polysac gunny bags can be reduced to an extent of 20 to 25 per cent by plastic packages.

(Dambulla special Economic Centre on 20.07.2018)

(Dambulla Special Economic Centre on 19.03.2019)

3.1.5 Storage

Biologically vegetable and fruit is a part of the nature with life giving quality as well. Even after reaping harvest, such crops respire and as such storing the crops without specific temperature, it damages such phenomenon, resulting that lesser quality fruits and vegetables have to be consumed. Observations in this regard appear below.

(a) Storage facilities

According to the researches carried out by the Hector Kobbekaduwa Agrarian Research and Training Institute the minimum storage facilities available in sales centres has mostly affected to damage the quantity and quality of vegetable and fruit products.

(b) Consideration of the temperature

The picked harvest needs to be stored under the specific temperature, until it comes to the consumer from the cultivated land. It was observed in audit that crops are stored in a manner not to get enough ventilation or under the condition that gets more or less ventilation than that of the specific ventilation.

(c) Storing Methodology

Is vegetable stored temporary in a room temperature it needs to be packed in a shaded place receiving temperature. Field inspections carried out in few economic centres revealed that vegetables had been stored with in mobile marketing stalls, and generally deviating from these requirements. In addition, vegetables and fruits are stacked on each gunny bag resulting that they are affected to crush and deteriorate since there were insufficient secured rooms/ stores facilities to protect from rain and sunlight, their quality is damaged.

(Thambuththegama Special Economic Centre on 20.07.2018)

(Dambulla Special Economic Centre on 19.03.2019)

(d) Wet Refrigerators cabins

It was stated that the Post Harvest Management Institute has introduced to use wet cold stores for fruits and vegetable in their training courses since 2005 and wet refrigerator cabins had been issued to beneficiaries through the fruits processing villages project. Nevertheless, it was observed that the use of this cold store system is insufficient in Sri Lanka.

3.1.6 Establishment of cold storage

A few public institutions had taken action to put up cold storage facilities associated with economic centres to minimise post harvest loss. Details appear below.

(a) Industrial Technology Institute

The industrial Technology Institute had participated in two occasions to conduct feasibility studies for the construction of cold stores (1994 and 2010). Accordingly, are the cold stores put up in

connection with economic centres it needs to be carried out under the following limitations.

(i) Vegetable and fruits in Sri Lanka are grown under the torried zone, the period of storing under the cooling condition is less.

(ii) Since, various varieties of vegetable and fruits contain varied optimum temperature and humidity, all varieties can not be stored in one cold store and therefore separate cold storage system under varied temperature and humidity levels is required. There, should be pre-cooling facilities before being stored in cold stores for certain variety of crops.

(iii) Vegetables/ fruits produce more ethine can not be stored together with crops sensitive the ethylene gas and as such, there should be a knowledge on the suitability of crops.

(iv) As the maintenance cost of cold stores is very high, crops stored therein have to be sold at a high price. Expenditure can be reduced by using solar power or any other alternative energy instead of using cold stores which operates by electricity.

(v) Crops need to be harvested at the time being properly maturated to be stored in cold stores and crops without being cracked, decomposed, bruised and crushed need to be selected.

(vi) It was also mentioned that crops transported to economic centres by using packing and transportation means available in the market today but could not be sold can not be stored in cool rooms and kept for a long period. Therefore, they need to be brought direct from the cultivated land, which means vegetable and fruits to be set in cold stores need to be transported under a cooling condition.

(vii) If fruits need to be ripen after being stored, recommended methods need to be followed.

(b) Ministry of Rural Economic Affairs

(i) According to the budget proposal of 2016, a provision of Rs.2,000 million had been made in the Ministry of Rural Economic Affairs for putting up 5 cold stores. According to the cabinet decision No.අමස/16/1081/723/016-II title at 11 implementation of 2016 budget proposals. Putting up cold stores" presented by the minister of Rural Economic Affairs on 07 June 2016 in respect of the establishment of cold stores and the cabinet decision No.17/0415/005/TBR "Implementation of 2016 budget proposals – Establishment of cold stores" dated 22 March 2017, it was decided to award the contract to a private entity for a sum of Rs.30,123,906 (excluding VAT)

(ii) Accordingly, an agreement had been signed with the consultant company on 05 April 2017 for the provision of consultancy services to put up cold stores. According to the agreement the feasibility study report that should be prepared by them had been presented on 29 November 2017. Among the deficiencies stated therein include, non-identification of the extent of land area requires to implement the project joining a private investor for the implementation of the project or implementation of the project by the government. It was observed that the achievement of objectives is problematic due to above issues. Due to land problem, the project was not implemented and therefore the agreement had been invalidated, resulting that the sum of Rs.11.3 million paid to the consultancy firm had become fruitless.

(c) Ministry of National policies and Economic Affairs

The approval of the cabinet of Ministers had been granted on 31 July 2018 for the following proposals, stated in paragraph 3 of the cabinet memorandum submitted on 19 July 2018 titled as the

establishment of a temperature control stores facility in Dambulla jointly by the Ministry of National policies and Economic Affairs and the Ministry of Megapolis and Western Development.

(i) Establishment of temperature control stores facilities in Dambulla

(ii) The use of the land belongs to the urban Development Authority at present for the establishment of this stores facility and the ownership of this land be vested to the Food Commission Department (After being assessed an appropriate methodology will be determined for the valuers of the Urban Development Authority who determine the value of land)

(iii) Obtain a grant of Rs.300 million from the government of India.

In addition, to the above cabinet decision the approval had been granted for 2 cabinet memorandums on 31 August 2018 and 25 June 2019 for the establishment of a temperature control store in Dambulla.

The following observations are made in this connection.

(i) A sum of Rs.300 million had been granted by the government of India as a relief to cover one part of the temperature control store project in Dambulla. In terms of the Memoradum of understanding signed between the government of India and Sri Lanka, procurement process had been carried out on Design and Build basis. Accordingly, this construction contract had been awarded to the Joint Venture (Pvt) Ltd which had submitted the lowest bid for Rs.525 million.

(ii) Agreements had been signed for the construction of a temperature control store with a capacity of 5000 metric tons with the Joint Venture (Pvt) Ltd. for a value of Rs.524,244,587 and the project needs to be completed on 26 September 2019.

(iii) According to the project, it was planned to use 4,562.76 square meters, within the land area of 2.0069 hectares for the construction works, including the temperature control store. A feasibility study report had not been prepared thereon and the recommendations of the Central Environmental Authority had not been given for this project even 30 September 2019.

(iv) A sum of Rs.184 million with taxes had been paid as at 30 September 2019 relating to this project and the physical project as at that date had been 55 per cent.

3.1.7 Marketing

Particulars appear below.

(a) Impact caused by various losses

If a specific standard product comes to the retailer, the loss caused within the marketing process will be minimal. Vegetable and fruits brought from the farm to the market are subjected to damage in several stages which include reaping harvest before being maturated and deviating from specific methods and filled in gunny bags and therefore the gravity of impact is further increased.

(b) Irregular Trade Stalls

It was observed in audit that vegetable and fruits kept for sale after removing the damaged parts within the stall are subjected to damage due to strong sun light and many open vegetable stalls are operated both sides of the highways but they are monitored by any government entity whatsoever.

3.2 Action to minimise post -harvest loss

3.2.1 Various methods in minimising post -harvest losses of fruits

Particulars appear below.

(a) Use of packaging equipment

(i) The post -harvest Technology Institute has identified 7 zones in which papaw is

cultivated under this project for the minimisation of post- harvest loss and packages and various items of equipment use for the minimisation of post- harvest loss had been given to 116 farmers and spent a sum of Rs.17.2 million therefor. In addition, 9 zones identified from the banana cultivated zones and given various items of equipment valued at Rs.16.8 million to 160 farmers.

(ii) Under the Mango supplies and value Chain Management and Improvement Project implemented by the post- harvest Technology Institute, 50 mango processing units had been established in the years 2017 and 2018 by incurring sums of Rs.23.62 million and Rs.4.08 million respectively islandwide and the required plastic boxes had been given and 9 high quality standards had been introduced to the market.

(iii) Guava supplies and value chain management and improvement project had established 27 guava processing units in Anuradhapura District by spending sums of Rs.8.54 million and Rs.8 million in the years 2017 and 2018 respectively and the Mahailuppallama guava trade name had been introduced to market. Training programmes, for beneficiaries in other districts had been conducted and 90 per cent of required equipment had been distributed to establish 20 processing units.

(iv) Papaw supplies and value chain Management and Improvement Project had established 12 papaw processing units in Anuradhapura District by spending sums of Rs.5.1 million and Rs.19.4 million in the years 2017 and 2018 respectively and Thambuththegama papaw trade name had been introduced to the market. Ninety per cent of equipment had been distributed to establish 50 processing units being conducted training programmes for beneficiaries of other districts.

(v) Under the banana supplies and value chain Management and Improvement Project had established 12 banana processing units by spending sums of Rs.5 million and Rs.20.7 million in the years 2017 and 2018 respectively within the Anuradhapura District and Rajanganaya Trade name had been introduced to the Market. Training courses beneficiaries in other Districts had been conducted and required equipment for the establishment of processing units had been issued.

(b) Chain Management

Under the value Chain Management on agri-crop supply and improvement project, a sum of Rs.0.65 million had been spent in the year 2018. It was observed that the farmer organizations require for the supply chain management in the relevant districts had been established and the data are being analysed.

(c) Value Added Products

In order to minimise post- harvest loss of vegetables and fruits and to control the economic disadvantage caused to peasants as a result of throwing away of surplus crops without being marketed, several value added products had been introduced by various government entities. Accordingly, the Industrial Technology Institute Food Research Unit of the Department of Agriculture and the National post- harvest Management Institute had introduced 117, 57 and 12 value added products respectively. (Annexure 1)

(i) Since such value added products are not commonly available in the market, it was observed that the assistance for the provision of capital, and infrastructure facilities require for the promotion of entrepreneur is sufficient and therefore special attention in this regard needs to be paid.

(ii) Even though the introduction of training courses on “value added products” conducted by the National post harvest Management Institute can be identified as an

another significant step it was observed that they insufficient. Of the total training programmes conducted in the years 2017 and 2018 the number of three training courses conducted on value added products was only 10 per cent and 8 per cent respectively for which 4,993 persons and 5,369 persons had participated in the years 2017 and 2018 respectively for main 3 courses. However, a follow up process due had not been introduced to ensure whether they engage in that field.

\Even though, it is observed that certain provable steps had been taken having being identified these issues from the implementation of the above projects, in considering the importance of the post-harvest loss of vegetable, the areas selected for the implementation of those project are not at a sufficient level to address the overall problem.

3.3 Alternative methods to be taken to minimise post -harvest loss

3.3.1 Establishment of a cultivation plan

As action is taken in accordance with a cultivation plan the productivity can be maximized in each crop and as such the requirement of a cultivation plan is important therein. It was observed in audit that there is an excess in certain varieties of vegetable in certain season cultivated in Sri Lanka and as such post- harvest loss is very high. Since the supply is increased the farmers do not get a reasonable price even to cover their cost.

(a) Giving primary instructions

(i) Farmers are compelled to implement the cultivation plan which has to be prepared by indicating each crop to be cultivated in each area and in each season, through the relevant officials. However, it was observed in audit that such a procedure was not in operation and it had been confirmed by the Hector Kobbekaduwa Agrarian Research and Training Institute as well such guidance needs to be given though the Agricultural Instructors of the Department of Agriculture with the instructions of the Ministry of Agriculture. It was observed that the officers engage in the field including the Agricultural officers had failed to influence for a cultivation plan and a methodology.

(ii) By following an appropriate post-harvest control methodology, high quality harvest of lasting a long time. Attention in this regard needs to be paid by controlling the use of more fertilizer and agro-chemicals, the peasants need to be encouraged for the proper crop maintenance. In introducing seeds and reproducing, studies need to be carried out not only on the harvest of the crop but also the quality of harvest and make recommendations.

(iii) At the Divisional Agricultural Committee meeting in Nuwaraeliya discussed the decrease of the quality of agro-seeds increase of prices of agricultural equipment, falling down to the prices of vegetable and it was also discussed the specimen forms sent to the District Secretariat for the preparation of 2018/ 2019 annual crop production plan.

(b) Implementation of the recommendations

According to the survey conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute in the year 2016 which was titled “An analysis of farmer decision making and its effect on price volatility in mid country vegetable sector in Sri Lanka”, it was observed that farmers incline to cultivate, if there is a possibility of getting a high price for their crops, number of reaping times of harvest, differences arised as a result of use of hybrid seeds, persuasion to plan for the product base market, nature of the land uses and direction to cultivation methods which target at products of preplanned crops. Even though, this survey report had been published in May 2016, it was

observed at the conversation exchanged with the farmers and traders community made at the audit examination carried out on 19 March 2019 in Dambulla Economic Centre that such recommendations stated in this survey report had not been implemented.

3.3.2 Direction to vegetable and fruit Export Market

Particulars appear below.

(a) Broadening the export market

Broadening the vegetable and fruit export market can be introduced as an alternative solution to minimize post-harvest loss. However, export data analysis shows that a salient growth in the local vegetable export industry could not be achieved as yet. Accordingly, small quantity of about 40 varieties of various vegetable and fruits grow in the varied whether zones in Sri Lanka are exported to about 11 countries being processed as fresh and refrigerated. Accordingly, of the total production of vegetable and fruits during the period from 2014 to 2018, the export percentage had ranged as low as 2 to 4 per cent. Therefore, it was observed that can the export market be further enhanced, it can get a certain relief to maintain the price stability of those products.

Year	Quantity of vegetable production (M.T.)	Export quantity of vegetable (M.T)	Export percentage (%)
2014	1,098,490	42,322	4
2015	1,096,923	24,970	2
2016	1,129,987	18,657	2
2017	998,341	26,255	3
2018	1,167,141	24,845	2

(Source: Sri Lanka Customs, Department of Census and Statistics)

Year	Fruit export quantity (M.T.)
2014	148,346
2015	112,795
2016	124,174
2017	85,981
2018	76,997

(Source: Sri Lanka Customs)

(b) Obstacles to direct export market

According to the report of survey conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute in the year 2015 which was titled "Supply chain analysis associated with vegetable export" the export market of various countries and ones is created for the export of vegetable products cultivated domestically and small and grand scale in the farms as up country vegetable and low country vegetable. However, it is observed that this market is not improved due to various issues face by farmers and exporters who directly involve in this market and the reasons therefore had also been recognized. Identified issues include; obtaining vegetable seeds, fertilizer requirement, financial problems, non-utilization technological methods appropriately etc. problems face by vegetable suppliers for exports include problems in getting orders, transport, stores facilities and getting financial facilities and some other issues. According to this survey report, the present position of export market and the problems affected therefore had been identified and the following recommendations had been presented to solve such issues and how to take action by the public entities to improve this sector.

(c) Recommendations on exports

It was observed in audit that the following recommendations made by the report of the research conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute in the year 2015 which was titled "Supply chain Analysis associated with vegetable export" had not been sufficiently implemented.

(i) Action needs to be taken to formulate an appropriate methodology for the widening export market in order to formalize the export industry by government intervention and increase the number of orders getting to the country.

Through local and foreign trade exhibitions introductory programs for local vegetable varieties and widening the export market for local vegetable through their value added products. Strengthening the relationship between vegetable suppliers and producers and the export Development Board and the Department of Agriculture and provide opportunities to get more benefits through the widened export market opportunities.

(ii) Since the promotion of vegetable production in a secured shelters is an appropriate option for ensuring the periodic supply and vegetable export value chain related quality and quantity, action needs to be taken to resolve the problems face by those producers and to take action to convert their products target for export and also to convert their industry targets at export standards.

(iii) In order to popularize the cultivation of crops within the secured shelters, it is important to improve the knowledge and skills of farmers in respect of finding exclusive export market facilities by providing subsidies to build secured shelters to facilitate for the provision of capital, minimization o the use of pesticide use of advanced technology etc. steps need to be taken to produce vegetable products within the secured shelters, by providing the above inputs and services with specific orders through the government programs.

(iv) More attention of the Department of Agriculture is needed to ascertain high quality products from the vegetable producers. In this context, it is required to give regular modern technological instructions to Agricultural Extension officers and farmers. Since the supply of high quality greenhouse crop seeds is problematic to farmers, attention of the seeds and planting material development centre and the seeds certification service is to be paid.

(v) In order to minimize uncertainties in orders face by producers and suppliers within the vegetable export value chain, loan facilities need to be provided to persons by whom vegetables are collected and supplied to exporters to get the cold stores facilities and give way to store vegetable and to present orders at the correct time.

(vi) In addition, in order to increase the range of countries to which vegetables are exported like European and other developed countries, vegetable needs to be cultivated by reducing the use of fertilizer and pesti side by using Good Agricultural Practices (GAP) method.

3.3.3 Contribution of the District Agricultural Committees for the minimization of post- harvest loss

Required provisions for holding District agricultural committees in 25 Districts in Sri Lanka are given by the Ministry of Agriculture to the District Secretaries. Accordingly, a provision of Rs.2,500,000 had been given to hold District agricultural committees in the years 2017 and 2018. Several such meetings had been held in each district and the officers representing the public institutions in the relevant district had participated in those meetings. Several problems faced by the people of these districts had been discussed at the meetings and the District Secretary had entrusted the responsibility to resolve such problems to the officer or officer of the government entity which relates to the problem.

Audit observation on the monitoring of these committees appear below.

(a) Sectors addressed for discussion

Twenty nine committee meeting reports held in the years 2017 and 2018 in Kandy, Nuwaraeliya, Badulla, Anuradhapura, Matale and Ratnapura districts in which vegetable and fruits crops are cultivated in plenty are subjected to audit examination. Problems faced by farmers in respect of cultivation of vegetable and fruits, reaping harvest and marketing had been discussed at the meetings and 15 such matters discussed at the meetings during the past 2 years were observed. Many significant matters, including the distribution of plastic baskets to minimize post-harvest loss conduct of training courses on the cultivation of vegetable under the secured shelters, awareness of farmers about the land area in which each crop is cultivated based on accurate data, awareness of farmers about the importance of value added products of vegetable and fruits etc.

(b) Awareness programmes

(i) Even though, it was discussed at the District Agricultural committee meeting held on 26 April 2018 in order to make aware of the farmers about the extent of land to be cultivated each crop, based on correct data, it was unable to supply correct data on the extent of lands to be cultivated and make the farmers aware.

(ii) Even though, 44 training programmes on the cultivation of vegetable within the secured shelters in Badulla District in the years 2017 and 2018 had been conducted and the farmers were made aware of the value added vegetable and fruits products, a formal procedure to distribute required financial and material assistance incline among the farmers had not been prepared.

(c) Introduction of the use of plastic baskets

Plastic baskets had been distributed for the minimization of post-harvest loss but they had been distributed among a few farmers of the entire peasantry in the districts. It was observed that 12345 such plastic baskets had been distributed during the period of audit.

(d) Performance of the committees

(i) Even though, the committee meetings had been held individually in all districts in Sri Lanka, a methodology to discuss agricultural issues having being integrated by the chairman of each district agricultural committee was not available and as such it was difficult to give solutions to the farmers problems.

(ii) It was observed that the participation of the members of farmers organizations in the District Agricultural committee meetings is minimal and only a few problems in respect of selling the farmers harvest and price that they face had been presented.

(iii) At the District Agricultural meeting of Badulla, a letter titled "proposals made to the government to protect vegetable cultivation" had been submitted to the District Secretary by the farmers organizations. Those proposals include putting up cold stores, enabling to issue vegetable during off seasons being retained surplus vegetable generates during the season supply of seeds to farmers to protect local seeds and connect foreign market agents for the export of vegetable etc.

3.3.4 Contribution of the Divisional Agricultural Committees to minimize post harvest loss

Divisional Agricultural committees are held in all the Divisional Secretariats in Sri Lanka by leading the Divisional Secretary and the problems face by the people within the Divisional Secretariat area are discussed at these meetings. In the examination of matters discussed in relation to post-harvest loss and price behavior at the Divisional Secretariats of Welimada, Nuwaraeliya, Kotmale, Rideemaliyadda and Uva-paranagama where the largest quantity of vegetable and fruits are cultivated during the period from January to 30 June 2018 the following matters were observed.

(a) Popularization of the use of plastic baskets

Under the post-harvest Technology methods promotion project in the Welimada Divisional Secretarial Division 160 basket of 50 kg and 849 basket of 30 kg had been issued. Even though, the decrease of price of vegetable had been discussed it was failed to produce targeted quantity of vegetable in terms of a cultivation plan.

At the agricultural committee meeting of Uva-Paranagama Divisional Secretariat, giving fertilizer subsidy for the cultivation of paddy in the maha season of 2017/ 2018 and subsidiary crops, incline the farmers to cultivate vegetable in addition to the paddy cultivation due to insufficient water for paddy cultivation distribution of seeds in order to increase the productivity of vegetable cultivation had been discussed and 305 plastic baskets had been issued under the post-harvest Technology methods promotion project.

(b) Counseling and awareness

At the meetings of the Kothmale Divisional Agricultural Committees, growing crops within the secured shelters issuing vegetable packing baskets, issuing agri- equipment 10 post-harvest Technology directions 50 crops conservation directions conducting 10 farmers awareness programmes based on agricultural products had been discussed.

(c) Maintenance of price stability

Decrease in prices of vegetable so as to getting an ample harvest due to hybrid seeds and climatic mutation and continuous maintenance of price stability of vegetable and putting up cold stores facilities had been discussed at the Uva Paranagama Divisional Agricultural Committee meetings.

3.3.5 Contribution of the Agrarian Services Centres for the minimization of Post-Harvest loss

The formal organizational structure that represents grass roll level farmers is the farmers organization and it is the function of the Agrarian ser-

vices centres, established under the Department of Agrarian Development to establish, register and operate the farmers organizations. According to the information obtained in meeting farmers in this audit farmers organizations function, based on Paddy Cultivation but not organized in respect of farmers problems relate to vegetable and fruit cultivation.

Furthermore, the Agricultural Research Production Assistants who actively and closely engage in the activities of farmers, implement the fertilizer programme and perform a specific function, but it was observed that their active functions with farmers organizations on Post-Harvest loss are insufficient and basic instructions on crop cultivation period in terms of a cultivation plan, type of crops and quantity are not given.

Similarly, according to the committee report on the inqury of prices of consumable items in special economic centres prepared by the Ministry of Rural Economic Affairs, it was stated that it is very important to establish active and improve farmers organizations for the control of price mechanism of agri-products and prepare and implement such plans. By means of that agricultural technology can be easily given to them and a provable opportunity to decide cost and price of agri-products can be given to the farmer.

3.3.6 Crops forecast programme

In the intervention of the Socio-Economic and Planning Centre of the Department of Agriculture with the corporation of the all Island Agricultural Instructors a software system to improve the efficiency of information flow up to the national level by obtaining information from the farm level named as “crop forcast information system” had been built up with the assistance of the National Agricultural Information and Communication Centre (NAICC) observation in this regard appear below.

(a) Function of the cabinet of Ministers

(i) According to the cabinet decision relating to the cabinet paper No.18/2421/820/046 of 05 November 2018 on this programme approval had been granted to strengthen the crop forecast Information System (CFIS) as a pre-warning system to minimize surplus and shortage of food crops.

(ii) Observations of the Minister of Finance and Economic Affairs made on this cabinet decision bearing No. MFS/NP/CP/18/138 of 02 November 2018 state that in order to take decision on crop production price decisions, marketing, imports, exports etc. accurate and periodic data of agricultural products are required and as such strengthening the crop forecast information system (FIS) is suitable as a pre-warning signal system to minimize surplus and shortages of food crops. It was also suggested that since the provision of TAB Computers to Agricultural Instructors is costly, using the existing computers available in the Agrarian Services Centres covering all over the country, offices of the Deputy Director of Agriculture and Mahaweli zones as an alternative a system needs to be formulated to enter data and update of these data.

(b) Contribution to the data system

(i) In this programme operated in obtaining data, details of optimal crops to be grown within 2 weeks, the quantity of such crops to be grown, prices which may be available within 2 weeks and crops for which low price/ high price receivable are entered.

(ii) Nevertheless, in place of growing in accordance and with the data given by the crop forecast information system as a pre warning signal system in the minimization of surplus and shortages of food stuff it was observed from the information obtained from farmers come to Dambulla and Thamuththegama economic centres that farmers cultivate and reap their harvest of their own discretion.

(iii) According to the statement of crop forecast published by the socio-economic and planning centre of the Department of Agriculture out of the anticipated extent of cultivation lands in respect of 18 varieties of vegetable the extent of land actually cultivated ranged a minimum percentage between 11 to 65. According to these data only about 50 per cent of the expected harvest in Maha season of 2018 had been cultivated. The field inspection carried out on 08 April 2019 at Dambulla Economic Centre observed that even that harvest could not be sold and as such the peasants had become a feeling of great worry. (Annexure 2)

3.4 Maintenance of accurate data and information

3.4.1 Information maintains by the Hector Kobbekaduwa Agrarian Research and Training Institute

i. All information including retail price wholesale price, price received by the farmer etc. is presented by the weekly food stuff bulleting of the Hector Kobbekaduwa Agrarian Research and Training Institute, covering all 25 districts in Sri Lanka in the agricultural sector specially in respect of vegetable. This information is provided to the cost of living committee of the country and all government parties that take economic policy decisions. It aim is to establish food security. Weaknesses observed in that connection are given below.

ii. It was observed in audit that decisions, helpful based on these data during certain surplus harvesting periods.

iii. This Institute Agrarian Research and Training (ARTI) daily collects prices of vegetable and fruits in special economic centres and this information can be obtained by interested parties of prices calling via mobile telephone No.6666, joining with a private telephone entity. However, it was observed that the farmers who came to Thambuththegama and Dambulla Economic centres, subjected to sample check were not aware about that telephone number and price information is obtained from the traders of the economic centres.

3.4.2 Post-harvest Technology Institute

Information on post- harvest loss of vegetable and fruits is maintained by this Institutes. The survey conducted by this institute in the year 2016/ 2017 in respect of vegetable varieties had covered only bean and banana.

3.4.3 Department of Census and Statistics

(a) Collection of data on harvest loss

A manual named "Agricultural crops and animal control statistics" had been given to the Agricultural Research Production Assistants for the collection of data and it provides space to enter data about the extent of cultivated land and the extent of land from which harvest was reaped but data on post harvest loss had not been collected.

(b) Collection of overall data

In the report of the domestic income and expenditure survey conducted by the Department the quantity of vegetable and fruits consume domestically is included but it does not include data on the quantity of vegetable and fruits consumed by industries and institutions. Therefore, data on the overall quantity of vegetable and fruits consumption of the country are not collected.

3.4.4 Department of Agriculture

A crop forecast information system has been established by the socio-economic & planning centre of the Department of Agriculture and it issues signs to farmers about the variety of vegetable to be cultivated within the next 2 week period. Even though, in the forms prepared for obtaining information a separate from is presented to enter the information about post- harvest loss, such information has to not been collected and as such the attention paid in that connection is in sufficient.

Accordingly, the existence of data and information require for finding solutions for problems faced by self-production and sector in the development of such sector as a country based on an agricultural economy highly underlay for decisions taken by the relevant entity and forecasts. However, the perform once of such functions by each public entity as mentioned above is not at a satisfactorily level and those issues effect for the solution of this problem.

3.5 Audit observations on specialized crops

3.5.1 Pumpkin

Pumpkin denotable as a low country vegetable is a superb nutritious kind of vegetable belongs to 'Kukabatesi' strain. Sri Lankans take pumpkin in many occasions as a carry. Medical specialists' opinion is that when taking pumpkin for your diet, many healthful benefits, including improve eye-sight improve immunity protect skin teenage, reduction of cancer risk diabetic control, normalization of blood pressure etc.

Production and consumption of pumpkin

Observations appear below.

i. Data of the Department of Census and Statistics appear that pumpkins are largely growned in Anuradhapura, Matale, Moneragala and Kururnegala Districts in Sri Lanka Data in respect of the extent of lands in which pumpkins are grown and the production for year from 2014 to 2018 are given below.

Year	Extent of cultivated lands (Hectares)	Harvest (M.T.)
2014	9,360	126,278
2015	7,752	105,877
2016	6,980	98,303
2017	6,159	82,934
2018	8,469	123,261

(Source: Department of Census and Statistics)

ii. As compared with the extent of pumpkin cultivated lands in the yala seasons of 2017 and 2018 the extend of cultivated lands by farmers had increased in Maha seasons. Accordingly, the pumpkin harvest in the Maha season of 2018 amounted to 83,350 metric tons. Attention in this regard had not been paid by the Ministries of Agriculture, Rural Economic Affairs, Irrigation and Fisheries and Aquatic Resources Development.

(b) Pumpkin cultivation in the Mahavilachchiya Divisional Secretarial area in Anuradhapura

Farmers belong to Pemaduwa, Thanthirimale, Nochchiyagama and Ranorawa Agrarian services centres in Mahavilachchiya Divisional Secretariat Division Cultivate pumpkin since a long period. Particulars appear below.

i. Particulars of the extent of pumpkin cultivate lands and Harvest in 2017 to 2018.

Period	Extent of cultivated lands (Acres)	Harvest (MT)
2017- Yala Season	207.7	840.9
Maha Season	3,370.5	21,542
2018- Yala Season	831	4,484.8
Maha Season	7,697	40,223.6

(Source: Data obtained from Agrarian services centres)

ii. According to the information obtained from the farmers of Sivalapitiya, Danumedalawa, Kiralpetiyawa belong to Pemaduwa Agrarian services centre of the Mahavilachchiya Divisional Secretariat Division, where pumpkins audit inspection carried out on 10 January 2019 in respect of pumpkin harvest of Maha season in the year 2018 which was unable to sell, the following observations are made.

- About a sum of Rs.85,000 is spent per acre for the cultivation of pumpkin during the period of 3 months from the cultivation to reap the harvest by using imported seeds, fertilizer and pesticide.

- According to the information obtained from 10 farmers, a harvest of 392,000 kg has been obtained in the maha season of 2018 but only 296,000 kg thereof could be sold representing 75 per cent of the harvest.
- Since, obtaining loans from financial institutions is difficult loans had been obtained such sources being mortgaged their private jewelries and as such they had become severe financial risk.
- Even though, Mahavilachchiya pumpkin growing areas do not get permanent water supply, harvest was increased due to sufficient rain in this season. However, the price that could be received per kilo ranged between Rs.5 to 10, but the cost of cultivation per kg ranged from Rs.15-20 as confirmed by the Department of Agriculture.
- Even though, the nearest market, is the Thambuththegama Economic Centre, its trading activities are limited to a shorter period and therefore the farmers have to bring their products to Dambulla Economic Centre by travelling a distance of about 130 Km away from their farmers. Even though they get minimum prices of Rs.5 to 10 therein. Due to this reason the Agrarian Development Officer confirmed that the quantity of unsold pumpkin production by 10 January 2019 was 800,000 kg.

(Pumpkin cultivation in Vilachchiya on 20 January 2019)

(b) Intervention of the government for the purchase of pumpkin harvest of 2018 Maha Season

Since the pumpkin harvest was increased and prices received by farmers were decreased in the Maha season, the ministry of Agriculture had intervened for the purchase of pumpkin from farmers of the dry zone as a solution to the problem faced by farmers of dry zone under the livelihood Development Programme of farmers and a sum of Rs.19,806,082 had been given by the Farmers Trust Fund, as detailed below.

i. Purchase of pumpkin in the Anuradhapura District had been made by the Nochchiyagama and Pemaduwa Agrarian Services Centres belong to Anuradhapura Agrarian Development District office of the Department of Agrarian Development and the coordination of marketing the purchased pumpkins had been entrusted to the National Food Promotion Board.

ii. A sum of Rs.15,078,090 had been paid to 356 farmers for 502,603 Kg of pumpkin at Rs.30 per Kg during the period from 20 January to 25 January 2019, subject to a maximum of 1500 Kg from one farmer. During the period from 29 January to 01 February 2019, a sum of Rs.1,918,480 had been paid to 98 farmers for 95,294 kg of pumpkin at Rs.20 per Kg subject to a maximum of 1000 Kg from one farmer. Accordingly, a total sum of Rs.16,996,570 had been paid for the purchase of pumpkins.

iii. Even though, 598,527 Kg of pumpkins had been purchased through Agrarian Services Centres 126,146 Kg of them had deteriorated, representing 21 per cent of the quantity purchased since one Kg of pumpkin had been purchased at prices from Rs.30 and Rs.20, the value of loss from spoilt pumpkins could not be specially stated as compared with purchased price but the loss computed under the minimum price of Rs.20 amounted to Rs.2,522,920.

iv. The Food Promotion Board had issued 5000 Kg pumpkin to the post harvest Management Technology Institute on 02 February 2019 to desiccate out of which 1209 Kg had rotten. The value of rotten pumpkin in terms of minimum purchase price amounted to Rs.24,180. The balance 3791 Kg of pumpkins had been dried and obtained 304 Kg. The physical verification carried out on 08 April 2019 observed that a few of them had been pumpkin powder and the balance had been stored.

v. Even though, a sum of Rs.20,029,297 had been spent for the purchase of pumpkin and administrative expenses in the Anuradhapura District, the total income earned from sale of pumpkins amounted to Rs.5,034,709 and as such the loss incurred on purchase of pumpkins amounted to Rs.14,994,588.

vi. The National Food Promotion Board had failed to coordinate properly the sale of pumpkins purchased by the Department of Agrarian Development and the post- harvest Technology Institute had failed to give necessary technology contribution for the preservative functions.

vii. Even though, a quantity of 598,527 Kg of pumpkins had been purchased during a shorter period, there were no suitable stores facilities to store them and it was observed that a large stock of pumpkins had deteriorated due to lack of a proper stock handling method.

viii. Similarly, Dambulla Economic Center had received an ample stock of vegetable in the year 2018 as well and as a result the farmers could not sell their vegetable due to reduction of prices. As a remedy to the problem faced by the farmers, a provision of one million had been released to the District Secretary, Matale on 11 May 2018 by the Ministry of Agriculture. Of this provision a sum of Rs.400,000 had been given to the Civil Security Department as an advance for the purchase of vegetable. By that time there were no surplus in the market and as such about

2086 Kg of pumpkins had been purchased from farmers and a sum of Rs.20,860 had been spent thereon.

(d) Value Added Products of pumpkins

Consumption of pumpkin as a traditional carry needs to be further encouraged and action also needs to be taken to popularize value added products within the consumers. In this regard the food research unit operates under the garden crops research and development institute of the Department of Agriculture and the Industrial Technology Institute had introduced value added products of pumpkin. However, it was observed that a formal and sufficient programme to popularize among businessmen and consumer had not been planned.

Particulars of value added products connected with pumpkin and market condition are as follows.

Institute	Product	Market Condition
Food research unit operates under the Garden Crops Research and Development Institute of the Department of Agriculture.	Pumpkin powder Instant drinks soup, smoothi Ice Cream	These value added products not commonly available the market.
Industrial Technology Institute	Pumpkin sauce, chips, powder (with flesh and seed), dehydrated pumpkin, pumpkin puri, pumpkin pulp, pumpkin lether, Asrathy dehydrated, pumpkin, pumpkin drinks, soup mixture, pumpkin bread smear, pectin extraction.	According to the research results, value added products were developed but not introduced to the market.

The internet verification seen that products like pumpkin powder, pumpkin caused pumpkin chocolate, yogurt, pumpkin pie and use of pumpkin in place of oil or butter are produced in many countries at present. Accordingly, the introduction of products which have been already subjected to research to the market of Sri Lanka and those products need to be popularized among the consumers.

3.5.2 Tomato

Tomato is a nutritious and salutary food containing mineral, vitamin, amino acid with sugar and fibber. This contains vitamin A, B, C and E iron pospuras, and 93 per cent - 84per cent water and increases appetite as well. It was observed that when reaping harvest, supply is increased more than the demand and as such farmers have to sell them at a minimum price. Since the production is increased, harvest loss is also increased. Significance of this crop is the even though the annual cultivated lands do not increase the annual production is increased. The reason therefore is that the imported Hybrid seed varieties are popularized among the farmers.

According to the data on the extent of tomato cultivated lands and annual production for the last few years, the average extent of cultivated lands for the last 5 years from 2014 to 2018 had been 6437 hectares and the production averaged at 88,790 metric tons. The production in the year 2018 had increased 25 per cent as compared with that of the previous year.

(a) Post-harvest loss of tomato

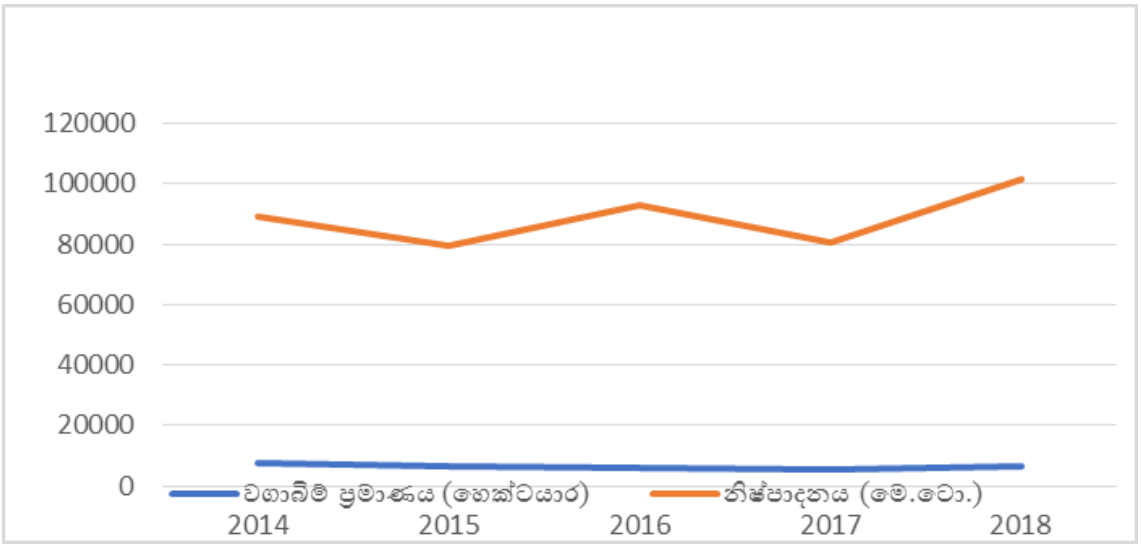
According to a case study carried out by an officer of the Hector Kobbekaduwa Agrarian Research and Training Institute in September 2016 in respect of tomato cultivation and processing in Matale District, the post-harvest loss of tomato is about 40 per cent. Of this, 12.5 per cent at the producer's level, 25 per cent at the collector's level, 37.5 per cent at wholesaler's level and 25 per cent at retailer's level are lost. Similarly, the tomato surplus during the period 2006 to 2010, according to this case study amounted to 27,894 metric tons.

(b) Value added products

Even though, the surplus tomato harvest can be used as a raw-material of the related industries, it is not used as a raw-material of related industries or for export. However, tomato raw-materials are imported for the related industries by incurring foreign exchange. Accordingly, during the period 2014 to 2018 tomato had been imported ranging from 0.01 metric tones to 6.7 metric tons as fresh or refrigerated tomato. In order to minimize the foreign exchange, spends for the import of tomato, it need to be processed during the surplus harvest period and it is create more appropriate value added products.

(c) Sectors related to tomato products

According to the researches carried out in this regard identified that tomato source can be manufactured from tomato categories grown locally and Heads of public entities were made aware about it. However, it was observed even at the time of audit, that related public entities had not intervened in this connection sufficiently as per detail below.



i. The Industrial Technology Institute had conducted a research project on the manufacture of tomato source being used 5 categories of tomatoes obtained from research farms of the Department of Agriculture. A letter dated 22 March 2018 had been sent to the Director General of Agriculture with the proposals require for the improvement if tomato categories and the latest findings of the project and the ability to produce tomato source using Sri Lankans tomato. Similarly, maturate index had been created to decide the harvesting period for these 5 tomato categories.

ii. The conclusion of the research result is that the 'tharindu' tomato variety is more suitable for making tomato pulp but they had recommended "thilina tomato" category as well. That letter states that a new tomato category needs to be introduced or it is appropriate improve the existing tomato categories, enabling to reach 'brix' value level between 8-10. The letter further states that it can minimize the post-harvest loss and the local tomato can be used as an imported substitute. Action had not been taken to draw attention on the issues mentioned in the research and to create tomato related products even up to now.

iii. According to a report of the Hector Kobbekaduwa Agrarian Research and Training Institute it was found that the popular tomato product is the tomato source. By the date of the research 1250 metric tons of tomato pulp or paste is imported to make tomato sauce, while the surplus tomato production during 2006-2010 in Sri Lanka amounted to 27,894 metric tons. Tomatoes are grown mostly in mid country from hybrid seeds named "Padma" and "Markis" imported from India. Since these 2 varieties contain very high pericarp thickness, packing and transport is easy contains soluble solid context (Brix value). However, for processing tomato source the brix value needs to be more than 5.5. Accordingly, suitable tomato to make source is sufficiently available in Sri Lanka and the farmers need to be instigated therefore but such a programme is not yet operated.

(d) Future forecasts of tomato cultivation

According to a survey conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute, the extent of tomato cultivated lands and harvest from 1999 to 2012 had increased by 26 per cent and 70 per cent respectively. Similarly, it was forecasted that bean production will increase by 16 per cent while tomato production will increase by 85 per cent in future resulting that the price level will decline as well.

According to this forecasts it is observed that the problem of post-harvest loss of tomato cultivation will be improved in future but it was observed that attention on this issue had not been sufficiently paid by related entities.

3.6 Operations and price of vegetable and fruits

3.6.1 Anticipated objectives with the establishment of economic centres in Sri Lanka

It was proposed by the budget for 1988 to establish Regional Marketing Centres in order to facilitate trading activities of agri-products. Since the establishment of Dambulla Economic Centre Subsequently, in 1999 a favourable environment was created to develop market for private and public sectors specially for marketing vegetable. By the establishment of special economic centres in agriculture product areas in Sri Lanka based on wholesale and retail distribution centres centralized in urban areas, it was expected to achieve the following objectives.

(i) Giving a reasonable price to the producer by creating a targeted market for their products.

(ii) To facilitate the consumer to obtain food stuff at a low price.

(iii) To provide opportunities the whole sallers to get fresh vegetable and fruits direct from producers.

(iv) Encourage the Trading Community to operate

wholesale business within a competitive environment.

The number of economic centres set up in Sri Lanka from 1999 to 2017 amounted to 15 Audit observations on economic centres appear below.

(a) Ownership of lands where economic centres are situated

Even by 28 January 2019 the legal ownership of lands of Piliyandala, Ratmalana, Nuwaraeliya, Keppetipola, Kuruduwatta, Meegoda and Ampara economic centres had not been acquired by the Ministry of Agriculture, Rural Economic Affairs, Livestock Development, Irrigation and Fisheries and Aquatic Resources Development. It was observed in audit that trade stalls put up in a land which had no legal ownership had been leased to businessmen and the legal ownership is important in taking action in respect of problems that may arise on these trade stalls. (Annexure 3)

(b) Sub-letting of business premises

During the period special economic centres operated under the Ministry of Food Security the circular No.CIT/6/5/EC of 02 April 2015 issued to the Chairman of the special economic centres Management Trust and in terms of paragraph 22 of that circular had the original owners sublet or sold the business premises they should be sealed and take legal action and the Ministry needs to lease those premises under the public competitive bidding system. However, 242 businessmen belong to 9 economic centres had sublet their premises as at 31 December 2018 as detailed below.

Name of Economic Centre	Number of businessmen who sub-let premises
Nuwaraliya	67
Dambulla	60
Keppetipola	14
Embilipitiya	13
Kanda Handiya	01
Narahenpita	47
Meegoda	18
Ratmalana	19
Kurunduwatta	3
	242

(c) Leasing basis

In leasing trade stalls in special economic centres no common basis had been applied and business premises had been leased under 5 time periods between the period of 5 years and 30 years under lease agreements. Trade stalls in Embilipitiya and Welisara Economic Centres had been leased out without lease agreements.

(d) Outstanding lease rents

In terms of paragraph 11 of the circular No.CIT/6/5/EC of 02 April 2015 issued to the chairman of the special Economic Centres Management Trust, issued during the period operated economic centres under the Ministry of Food Security if any businessman does not pay stall rent or breaches the conditions imposed on them when trade stalls are given the relevant business premises need to be re-undertaken. As action had not been taken accordingly, it was observed that the outstanding lease rents as at 31 December 2018 amounted to Rs.14,409,042 from 5 economic centres.

(e) Assessment of value

In renting trade stalls in economic centres the monthly rental to be recovered from one stall had been assessed during the period 2014-2017 by the government but it was observed that 390 trade stalls in 7 economic centres did not pay monthly rentals as per the government assessment.

(f) Contradiction to basic objective

Even though had been established with the objectives of marketing agre products and essential food stuffs by wholesale and retail, 57 trade stalls in 5 economic centres had been given to operate mental counseling and astrological services CCTV equipment and services, drivers' training schools, house hold equipment etc. which are no any connection with the objective.

(g) Quantity the land loss

In order to successful operation of an economic centre, sufficient accommodation facilities in-

cluding putting up trade stalls, other infrastructure facilities comprising vehicle parks, stores facilities, sanitary facilities, waste disposal facilities and space for future development works are required. However, it was observed that Ampara and Kandehandiya economic centres had been put up in small plots of lands, 0.52 acres and 0.33 acres in extent respectively.

(h) Utilisation of trade stalls in economic centres

It was observed that the Kandehandiya economic centre consists of 25 trade stalls, put up in the year 2006 by incurring an expenditure of Rs.19 million and developed by incurring an expenditure of Rs.2.6 million in the year 2015 had become inoperative even by 31 December 2018, although only one trade stall is open for sale of food stuffs.

(i) Putting up shelters for loss caused less or more

It is observed that putting up a roof in a manner covering the premises in front of trade stalls for the protection of farmers from sunlight and rain until they sell their vegetable and fruits brought to economic centres is useful to minimize post harvest loss. However, such a shelter had been put up in Dambulla economic centre but such a protected roof had not been put up in economic centres of Thambuththegama, Veyangoda and Nuwaraeliya and as such post harvest loss has increased.

(j) Use of polythene bags in the transportation

When farmers bring harvests to economic centres, a large quantity of vegetable is packed in one polysack bag (30 – 80 kg) and as such it was observed that labourers load and unload a large quantity of such bags per day. While they unload and load harvest bags to lorries post -harvest loss is at a very high level due to being thrashed and crunched.

(k) Collection of data

Action had not been taken to collect data in respect of the quantity brought to the economic centre daily, quantity sold and the quantity of wastage. According to the information roughly

(Disposal waste at Dambulla Economic Centre on 04.10.2019)

obtained from the manages in charge of economic centres it was observed that 121 metric tons in 12 varieties of vegetable were damaged during the period from 10 to September 2018 in this audit.

(l) Distribution of harvest stock among the economic centres

A program requires in a manner, encourage farmers for the distribution of excess harvest stock received by economic centres. Like Dambulla among other economic centres and to act as a network of all economic centres had not been prepared by the ministry or the management trusts of economic centres.

(m) Display of prices

It was observed that price lists or electronic price lists have not been displayed in any of the shops in economic centres.

(n) Number of wholesalers come to economic centres

According to the information obtained from the Manager of Economic Centre Dambulla, the number of lorries come to purchase farmers products amounted to 500 to 1000 per day. Due to this transport congestion traders who come to purchase vegetable from outstations meet problems. It was observed that farmers present a large quantity of harvest in the same variety of vegetable at the same time to the market but a large number of traders ass compared with large quantity do not present to the market and as such wastage of harvest had been at a high value.

(o) Harvest which could not be sold

Certain periods in which surplus supply of vegetable exists, the farmers could not sell them and throw away in the Dambulla economic centre premises. It was observed in audit that such vegetable is taken away for elephants food at Digampathana area.

However, it was observed that prices of vegetable in other areas of the country are not decreased in this same period and therefore there shall be a network to distribute vegetable to other areas which could not be sold at Dambulla.

(Digampathana garbage pit – 05.10.2018)

3.6.2 Distribution Network

(a) Harvest loss incurred while being distributed

According to a survey conducted by the Post-harvest Technology Institute in the year 2016/ 2017, it was observed that in the transportation of 18 varieties of vegetable and fruits through 11 distribution network percentages ranging from 10.00 per cent to 34.73 per cent in transportation and 2.87 per cent to 49.56 per cent is damaged. According it was observed that when vegetables are brought to distribution centres from distance places of Jaffna to Dambulla, Nuwaraeliya to Colombo, Thambuththegama to Kegalle, harvest loss is increased.

Distribution Network	Crop	Damage in transporta-tion (%)	Damage in marketing (%)
Thambuththegama - Veyango-da	Cucumber	5.21	4.25
	Brinjol	2.63	4.38
	Okra	4.85	8.01
	Tomato	3.20	3.64
Dambulla - Colombo	Capsicum	2.25	9.46
	Lufa	14.92	13.10
	Cabbage	7.78	11.19
	Snake Guard	8.03	28.77
Nuwara-Eliya - Dambulla	Beetruit	1.01	4.52
	Leeks	2.82	14.88
	Carrot	6.68	32.10
Nuwara-Eliya - Colombo	Beans	3.49	4.19
	Cabbage	16.22	7.75
Norochcholei - Dambulla	Okra	0.53	13.55
	Beetruit	0.09	9.47
	Radish	2.73	15.09
	Brinjol	0.31	16.00
Embilipitiya - Colombo	Banana	1.64	2.87
	Papaya	7.68	37.58
Bandarawela - Matara	Beans	0.00	6.14
	Tomato	10.81	12.84
	Carrot	8.33	8.00
Thabuththegama-Kegalle	Long beens	19.20	57.33
	Okra	12.08	12.99
	Cucumber	9.62	31.59
Dambulla - Katugastota	Snake Guard	14.57	33.45
	Guava	11.32	3.30
Jaffna - Dambulla	Carrot	34.73	31.72
	Okra	6.93	24.58
	Brinjol	6.36	11.83
Norochcholei –Meegoda	Cabbage	17.07	30.24
	Green chili	22.14	13.21
	Long beens	27.44	49.56

(b) Expansion of economic centres

It was observed in audit that Jaffna vegetable comes to Dambulla being travelled about 243 Km for away in the distance, vegetable transport to southern province come to Dambulla first and exchange there and instead of coming to Colombo, certain vegetable stock come to Dambulla from Norochchole. It is further observed that the economic centres had not established regional wise as appropriately in order to change this exchange network. It was also observed that this has arisen and price variance is increased, due to the in equality of establishing economic centres within the whole island.

3.6.3 Intervention of the government for the control of vegetable prices

(a) Discussion held in the presidential secretariat on 27 April 2018

It was reported that due to abnormal decrease of vegetable prices in economic centres in the Island the peasantry finds it difficult to sell their products at an appropriate price. Therefore, necessary decisions had been taken at the discussion held on 27 April 2018 in order to give a reasonable solution to both peasantry and the consumers and the responsible institution had also been identified with the intervention of government. Action at district level, obtaining private sector contribution and the avoidance of arising such problems in future had been discussed at this meeting.

(b) Entrusting the responsibility at institutional level

The executing responsibility to minimize this problem had been entrusted to the secretary to the Ministry of Industries and Commerce Commissioner of Co-operative Development, Chairman of the Lanka Sathosa, District Secretaries of Kandy, Anuradhapura, Polonnaruwa, Matale, Nuwaraeliya and Badulla, but their performance is not satisfactory.

3.6.4 Committee report in finding prices of consumer goods in special economic centres

The objective of the special economic centres operate island wide under the Ministry of Rural Economic Affairs is to provide products under the maximum price to the agri-products and fair price to the consumer. However, representations had been made stating that prices of products in these centres are high, prices are increased as a result of many middlemen and agri-producers do not get a maximum price. Therefore, a committee to inquire into price increase had been appointed by the Ministry comprising the officers of the Ministry of Rural Economic Affairs entrusted to the subject, Sri Lanka Hadabima Authority, consumable Affairs Authority, Department of Agriculture, Department of Census and Statistics and the Hector Kobbekaduwa Agrarian Research and Training Institute Recommendations include,

3.6.4.1 Short term recommendations

(a) Formulation of a method to inform the producers and consumers about daily prices who come to the economic centre by using printed and electronic media as follows.

   i. Make aware of prices through SMS

   ii. Establishment of digital price lists to display daily wholesale prices from every economic centre

   iii. The information system already establishment needs to be appropriately updated in respect of daily wholesale prices via common loudspeakers.

   iv. Make aware of information about daily wholesale prices, packaging methods and other information of the economic centres.

(b) Massages about the requirement and significant of organizing farmers to be frequently published.

(c) Introduction of modern Technology farmers which can be used in the cultivation of crops with the assistance of the Department of Agriculture.

(d) Maintenance of price stability of production by a Technological method in minimizing

cost of agri-production.

(e) Preparation of a distribution methodology enabling to quick distribution of agri-crops, introduction of short market chain patterns.

(g) Encourage for the use of suitable packages in packing storing, transporting and presenting for sale of harvest (accustom of using 10 kg bags, 25 kg bags, plastic basket)

(h) Awareness of parties come to market in respect of post harvest loss and formal cultivation methods via handouts, video shows and street drams.

(l) Awareness of farmers about proper packaging and presenting agri-products to market being grouped.

3.6.4.2 Long term Recommendations

(a) Building direct coordination with the market by strengthening farmers development societies come under the Department of Agrarian Development.

(b) Establishment of harvest processing centres, connected with economic centres.

(c) Establishment of a data information system being net worked with all economic centres.

(d) Establishment of Regional economic centres

(e) Being minimized input cost by using local seeds in place of imported seeds, main once of price stability.

(f) Introduction and implementation of value added projects in respect of agri-products

(g) Creation of a strengthened and active farmers network, updating the inactive farmers organizations already established.

(i) Implementation of a national level cultivation time table.

(j) Direction of farmers for eco-friendly cultivation methods as much as possible.

(k) Extension of market by strengthening fair concept connected with appropriate areas.

(l) With the assistance of the Department of Agriculture programmes need to be introduced of Agricultural market expansion, so that the farmers can be able to manage their products in accordance with market demand.

(m) Formulation of a policy based on scientific information in order to regularization of state mechanism for the import control of agri products.

(n) Provision of stores facilities with modern Technology.

(o) Establishment of an Authority for the monitoring of sale of agri-products.

(p) Popularization of by-products relate to agri-products.

3.6.5 Concentration of information on post -harvest

According to the objective of the establishment of special economic centres, it is important to collect data in respect of the quantity of vegetable brought daily to economic centres, daily sales quantity daily wastages in order to achieve the objectives including to give a reasonable price to the producer, facilitate the consumer in getting food stuffs at a low price, provide opportunities to the whole sallers to obtain fresh vegetable and fruits direct from the producer. Nevertheless, such data had not been concentrated. Therefore, with the objective of getting information for this audit, price details relate to 11 variaties of vegetable displayed in the economic centres from 10 to 30 September 2018 had been obtained and analysed. Audit observations in this connection appear below.

(a) Price variance exists between economic centres

There was a vast price difference between the wholesale prices of vegetable existed at economic centres, centralized on production areas (Nuwaraeliya, Dambulla, Keppetipola, Tham-

buththegama, Embilipitiya) and the prices existed in the distribution centres of agri-products and essential food stuffs (Welisara, Meegoda, Veyangoda, Ratmalana) as well as the prices existed at economic centres centralized on urban areas (Narahenpita, Piliyandala). It was observed in audit that the reason for this vast price difference is the high transport cost and a large number of intermediaries. It was further revealed that non of the government entity intervene to control this price increase.

Type of vegetable	Wholesale price range in the economic centres centralised on production areas	Wholesale price range of distribution centres	Retail price range of economic centres centralised on urban areas
	(Rs) Per Kg	(Rs) Per Kg	(Rs) Per Kg
Carrot	140-186	174-198	250-262
Leeks	43-62	43-81	107-120
Capcum	61-85	72-105	156-175
Riddish	19-37	36-46	104-111
Cucumber	18-23	31-53	69-97
Cucumber	13-16	40	72-89
Brinjal	15-30	35-50	68-94
Pumpkin	70-79	80-103	133-143
Cabbage	30-58	36-62	93-100
Okra	57-84	100-115	162-166
Tomato	29-30	52-65	114-138

(b) Existence of different wholesale and retail prices in the same economic centre

In terms of the following table, there are wholesale shops as well as retail shops in certain economic centres. It was observed in audit that even though an addition expense is not added to vegetables purchased from farmers they are sold at high prices in the same place in Keeping as a profit e.g.particulars of price difference between wholesale and retail prices in Welisara, Veyangoda and Ratmalana economic centres are as follows.

It was also observed that the retail price in Welisara economic centre is higher than that of the Veyangoda economic centre and the retail price in Ratmalana economic centre is determined in keeping a highest profit.

Type of vegetable	Economic centre								
	Welisara			Veyangoda			Ratmalana		
	Whole sale price	Retail price	Difference	Whole sale price	Retail price	Difference	Whole sale price	Retail price	Difference
Beans	107	123	16	109	118	9	90	108	18
Leeks	81	91	10	-	-	-	-	-	-
Carrot	198	219	21	181	194	13	174	201	27
Capsicum	105	121	16	92	110	18	72	100	28
Riddish	46	61	15	36	39	3	42	66	24
Cucumber	44	58	14	31	40	9	53	81	28
Cucumber	40	50	16	-	-	-	40	66	26
Tomato	45	59	14	35	43	8	50	80	30
Brinjal	103	118	15	80	90	10	93	114	21
Pumpkin	52	66	14	36	45	9	30	62	32
Cabbage	115	130	15	102	110	8	100	136	36
Okra	65	76	11	52	67	15	65	98	33

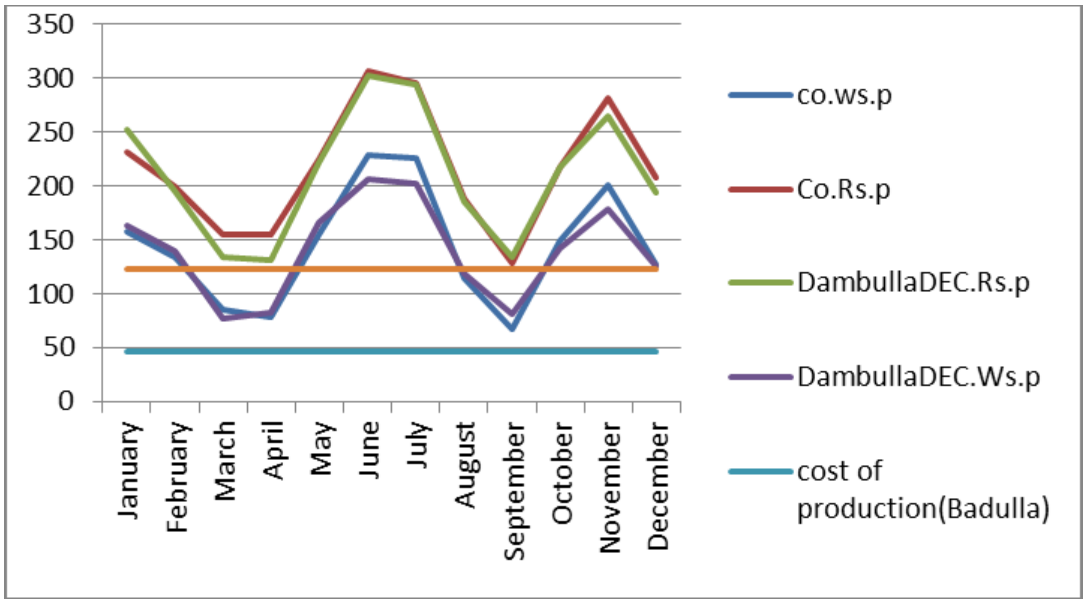
3.6.6 Different price behaviour

(a) Price behaviour of beans

Bean is an up country vegetable with high consumption in Sri Lanka. During the period of 03 years from 2016 to 2018, bean production ranged from 80,000 metric tons to 90,000 metric tons and bean influences to determine the prices of other vegetable. If price of bean is low price of other kinds of vegetable also decreases. The price of bean severely decreased during the period of reaping harvest of Maha season from February to April and the period of reaping harvest of Yala season from August to September 2018. It was observed that during the period wholesale prices of one kg of bean in Dambulla and Pettah Markets had dropped than that of the cost of production of one kg (Badulla). According, to the domestic income and expenditure in the year 2016 of the Department of Census and Statistics bean consumption in the year 2016 amounted to 74,760 metric tons. Accordingly, it was observed that getting a bean production, exceeding the consumption affects to decrease the price. Even though, the demand for bean is slightly increased during festive season, the uniform demand for bean in Sri Lanka exists within the whole year. It was observed that a high price was reported for bean in the months of October and November during which lands are arranged for Yala and Maha seasons for cultivation.

Of the price paid by the consumer in the Dambulla area in March which reported the minimum price for bean, 57 per centhad belonged to the farmer and 43 per cent had belonged to pavement merchant.

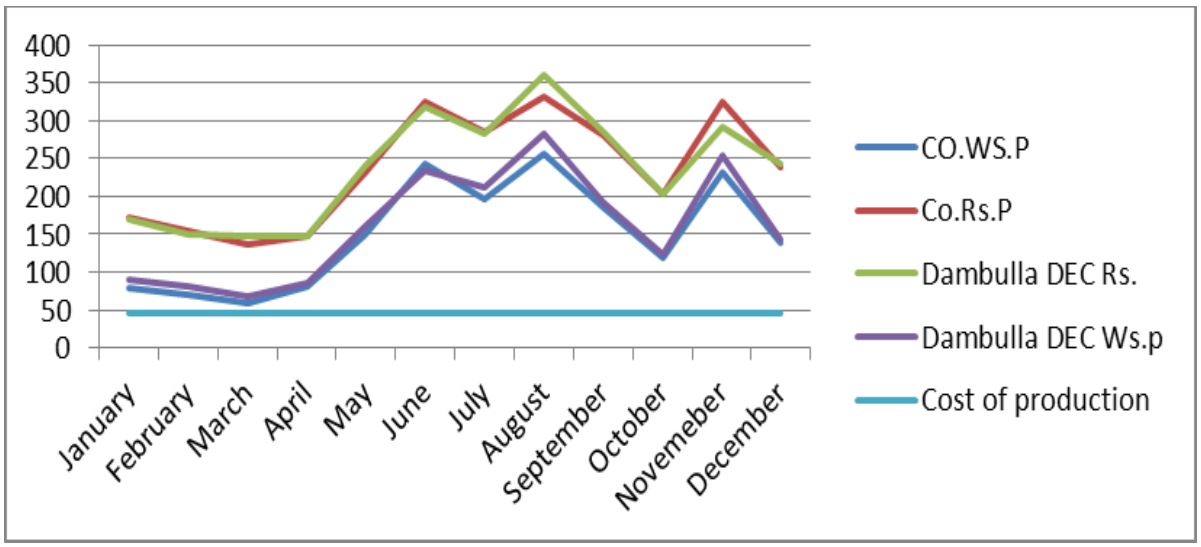
In June in which the maximum price was reported in Dambulla area, prices had been determined in a manners Rs.69 belongs to the farmer and Rs.32 belongs to middle traders per kg.Likewise according the Pettah Manning Market price, prices had been determined as Rs.74 to the farmer and Rs.32 to the middlemen. Accordingly, it is observed that when increasing the price of bean farmers are more benefited cost to be incurred for the production of beans differs from one area to another and according to the cost of production estimate of the Department of Agriculture in the Maha season of 2017/ 18, the cost of production per one Kg of bean in Badulla area amounted to Rs.47. Therefore, it is observed that farmers are benefited by growing bean.



(b) Price behaviour of carrot

Carrot is an up country vegetable with high consumption in Sri Lanka. During the period of 3 years from 2016-2018, carrot production had ranged from 70,000 metric tons to 80,000 metric tons. The price of carrot fairly decrease during the harvest reaping period of Maha season from January to April 2018. According to the cost of production estimate of the Department of Agriculture in Maha season in 2017/ 18, the cost of production per one kg of carrot amounted to Rs.45. As compared with the cost of production, a high price was reported during more period in the year. During the period from May to December, a high wholesale price of Rs.119 – 282 per kg was reported.

In March in which the minimum price was recorded for carrot, out of the price paid by the consumer in Dambulla area, 47 per cent and 53 per cent belonged to the farmer and pavement trader respectively. In June in which the maximum price was reported in Dambulla area 87 per cent and 13 per cent belonged to the farmer and middle traders respectively.

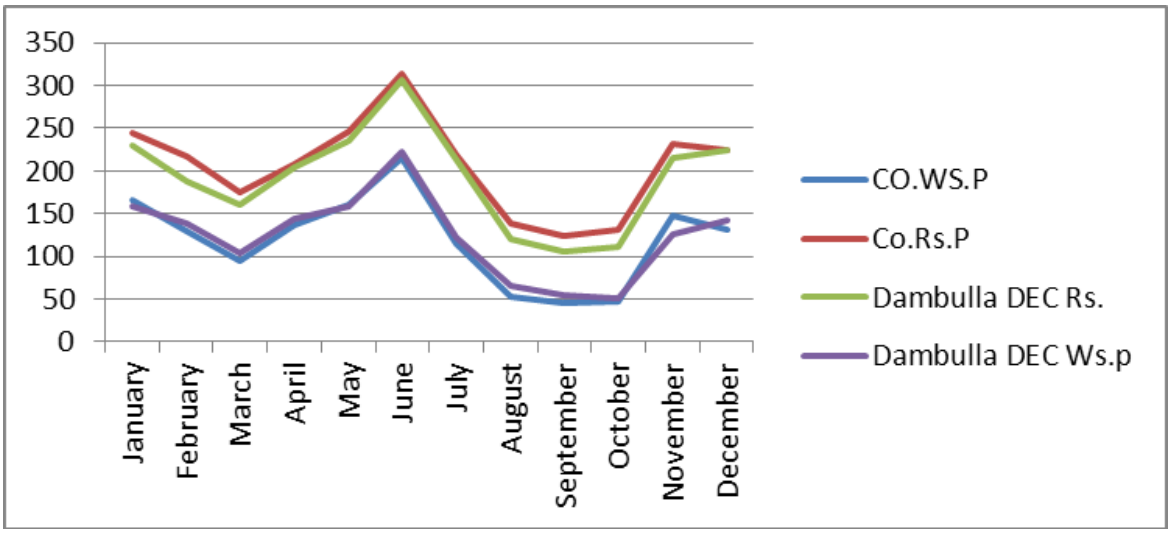


(c) Vegetable varieties for which farmers get disadvantageous price

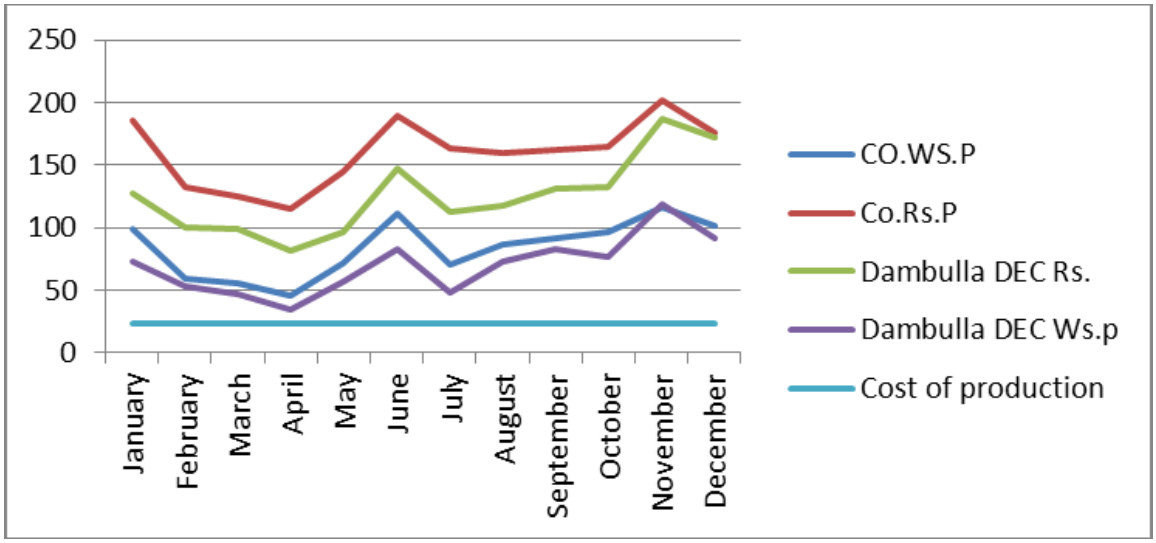
It is observed that in the months of decreasing prices of vegetable such as leeks, brinjal, riddish, cucumber, okra and cabbage, more percentage of price paid by the consumer goes to the middle trader and lesser percentage goes to the farmer. Even though, farmers get a lesser price during the period of low price, middlemen keep a high profit margin resulting that the consumers unable to get at a low price. Therefore, it was observed that both the farmer and the consumer become predicament situation.

Prices of leeks, brinjal, riddish, cucumber, okra and cabbage are increased in the months of November, December and January. It is observed that many part of the price paid by the consumer goes to the producer. Similarly, during that period the profit margin receive by the middle traders is less than that of the profit margin of vegetables obtain by middle traders, consumers have to buy vegetables at high prices. Therefore, the government entities sufficiently need to intervene even to cover the cost of production of farmers and the consumers to buy vegetable at a reasonable price as well.

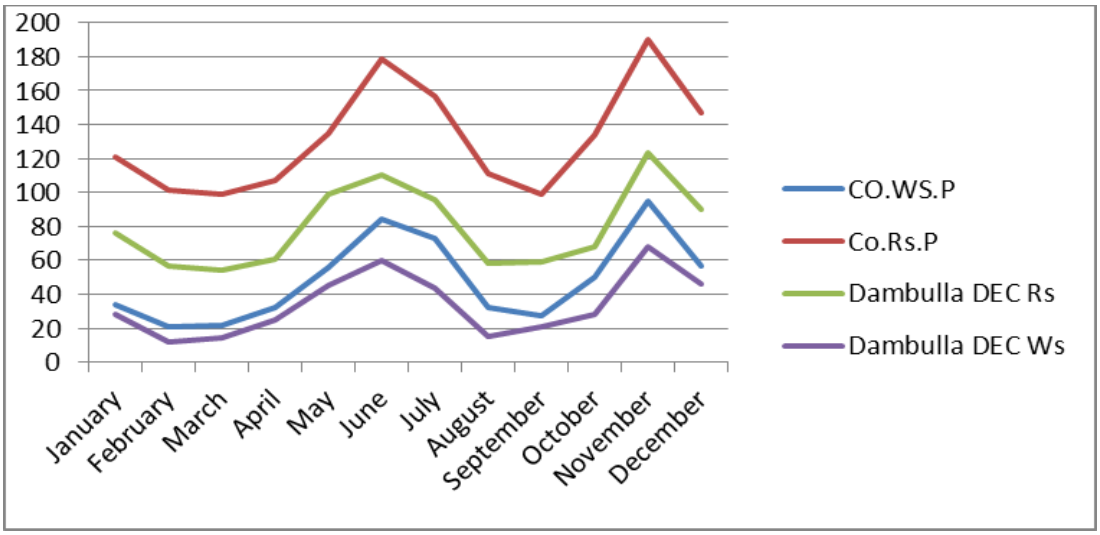
Price behaviour of Leeks



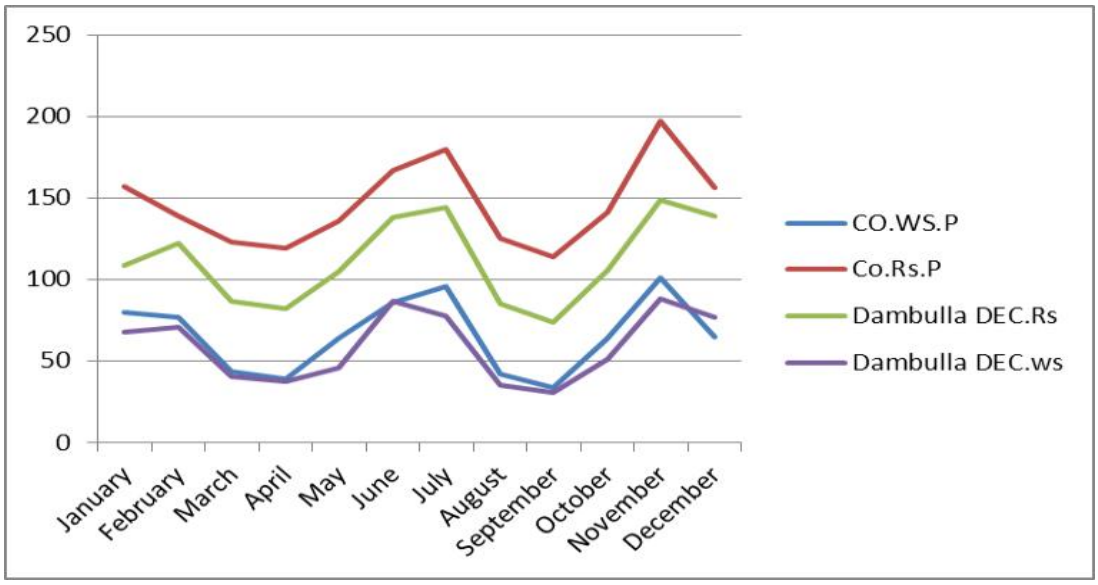
Price behaviour of Brinjal



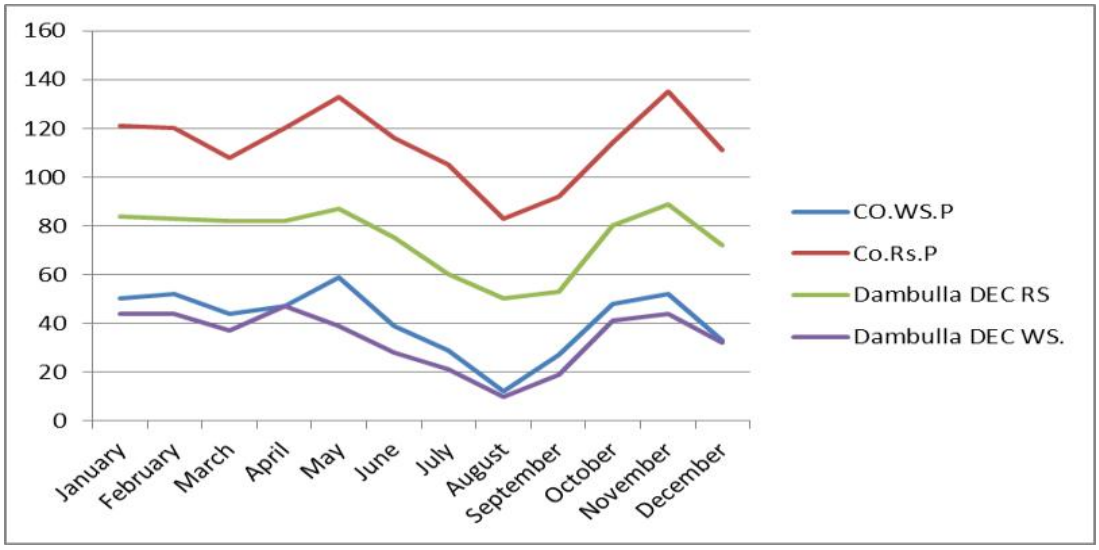
Price behaviour of Riddish



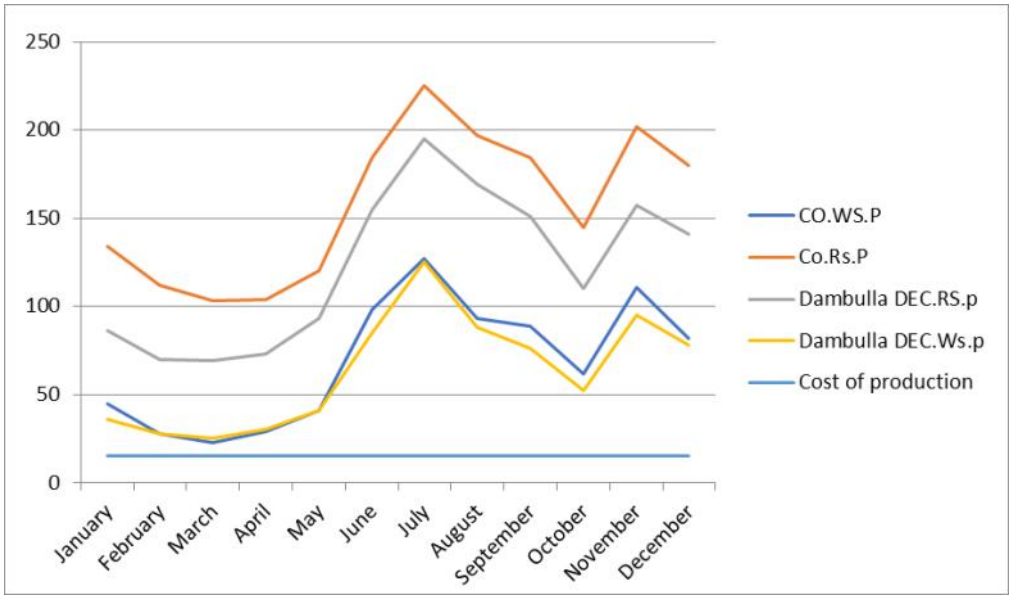
Price behaviour of Cucumber



Price behaviour of Okra



Price behaviour of cabbage



Accordingly, the following observations are made.

(a) The retail price of cabbage in Dambulla Economic Centre had increased by 176 per cent than the wholesale price in March which had recorded a minimum price.

(b) The price of cucumber in Pettah retail market had increased by 591 per cent that the wholesale price in August in the Pettah Manning Market which had recorded the minimum wholesale price.

(c) The minimum wholesale price for reddish had recorded in February in the Pettah Manning Market but the price of reddish in Pettah retail market had increased by 380 per cent.

3.6.7 Behavior of wholesale and retail prices associate with Pettah

According to the Sri Lanka journal of Agrarian Studies presented in the year 2008 by the Hector Kobbekaduwa Agrarian Research and Training Institute, the price paid by the consumer for vegetable in domestic vegetable business, divides among the producer, wholesaler and retailer is calculated as follows.

(1) $$\text{Share of the farmer who products vegetable} = \frac{\text{Price receives to farmer}}{\text{Retail market + price}} \times 100$$

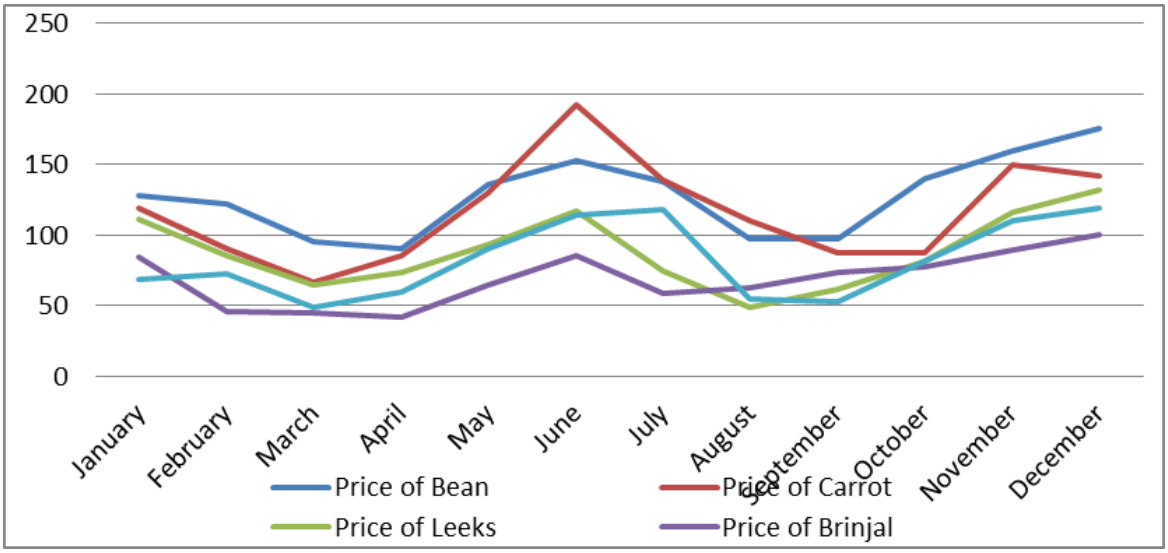
(2) $$\text{Share received by retailer} = \frac{\text{Retail price + Wholesale price}}{\text{Retail price}}$$

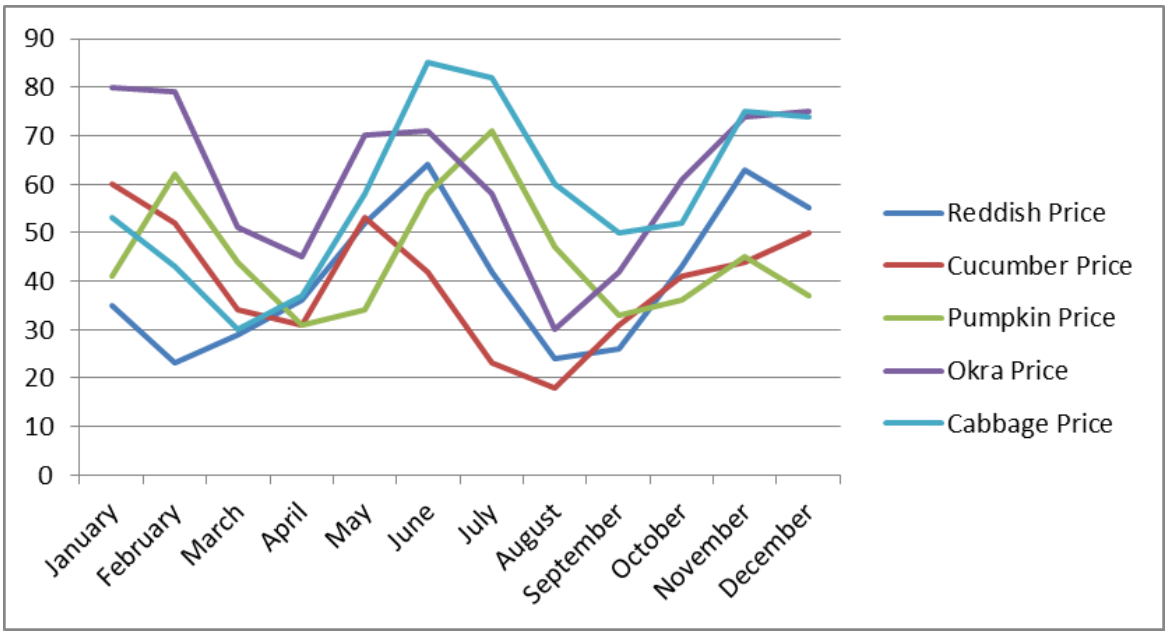
Based on the above calculation, data in respect of retail price in Manning Market Colombo (Retail market associates with Colombo) and Dambulla Economic Centre (Associates with Dambulla Town) had been collected by the Hector Kobbekaduwa Agrarian Research and Training Institute in the year 2018 and the price behavior of 8 varieties of selected vegetables appears in Annex 04.

In considering the wholesale prices 10 varieties of vegetables presented to Pettah market for sale during the period of 5 years from 2014 to 2018

(Bean, Carrot, Leeks, Cabbage, Okra) 2 periods during which the minimum monthly average wholesale price were reported. It is observed that the wholesale price from March to April and August to September is at a low level.

In considering the period of 5 years, 2 periods during which the average wholesale price of 10 vegetables had recorded at a very high level. It was observed that during the period from June to July and from November to January, the retailers of vegetables have to purchase vegetables stock at a very high price. Particulars appear in Annex 05.





Accordingly, it was observed in audit that the relevant public institutions need to intervene the farmer and the consumer to get a reasonable price by controlling the prices during the period of increasing vegetable prices and to maintain a balanced price level being distributed the surplus harvest during the period of decreasing vegetable prices island wide.

3.7 Significance of the researches on the minimization of post-harvest loss

Sustainable Development objective 12 means the establishment of a Sustainable consumer and production pattern. The target 12.3 thereof is to minimize per capita food wastage at retail and consumable levels and to reduce wastages caused in

production and supply chain including post-harvest loss by the year 2030. Similarly, Sustainable Development objective 2 means the promotion of sustainable agriculture by achieving moral nutritious condition and food protection having being eradicated the hunger. Accordingly, if Sri Lanka needs to reach these objectives researches need to be conducted on the minimization of post-harvest loss which had been identified at 30 to 40 per cent level at present by the post-harvest Technology Institute and the public institutions have to pay attention on the results of such researches.

3.7.1 Agricultural policy council

The Sri Lanka Agricultural Research Policy Council has been established under the Sri Lanka Agricultural Research Policy Council Act No.47 of 1987 for the purpose of monitoring researches in respect of agricultural field. Accordingly, it performs a large task by conducting local researches in the field of agriculture with international relationship relating to researches. In order to perform the wide functions stated therein the Sri Lanka Agricultural Research, Policy Council has established 12 National Committee to resolve the problems faced in researches by exchanging information of relevant subject field. Two main committees had been established therefrom.

(a) The first committee

(i) This committee has been named as "post-harvest Technology and value addition National Committee for 2011 - 2015". It had identified that action needs to be taken under 9 priorities which comprise, promotion of loss and quality management establishment of an technological information network improvement of researches at national level, capacity building value addition infrastructure development identification of international quality control standards process development in approving researches in each field.

(ii) According to the enquiry made from the Agricultural Research Policy Council in respect of research reports presented to this national council, the secretary of the Agricultural Research Policy Council had informed by his reply letter No.SLLARP/ Admin/ ADG/ 2018-01 of 16th October 2018 that any research reports what so ever had not been pressed in the years 2011 – 2015.

(iii) This first committee has been established named as "Post-harvest Technology and Human Nutrition" for the period 2017 – 2027 and this committee had also expected to reduce the post-harvest loss while vegetables being transported from 30 to 10 per cent and fruits being transported from 30 to 15 per cent. Nevertheless, only two researches had been presented during the period 2017-2018 and one was for traditional rice and the other one related to fruit crops.

(b) The second National Committee

The second committee meant to the analysis of socio-economic and policies has been establish to draw attention on the following thrust areas.

- Development of lands and labour
- Minimization of cost of production, especially labour cost
- Strengthening potentials for mechanization
- Minimization of using chemical raw-materials and upliftment of using carbonic raw-materials
- Productivity improvement of factory operations
- Minimization of post-harvest loss

The Secretary of Sri Lanka Agricultural Policy Council had informed by his reply Letter No.SLCARP/Admin/ADG/2018-01 of 16 October 2018 that no any research project whatsoever was presented to this committee as well. Accordingly, it was observed in audit that even though these committees had been established and priori-

ty targets had been recognized functions in respect of minimizing post-harvest loss expected from these committees had not been performed sufficiently during the relevant periods.

3.7.2 Conducting researches on post-harvest field by various public entities

Functions of the council include, exchange views between Agricultural research institutions and the government review of performance of the agricultural research projects, entities and divisions. The above national councils had been established to strengthen researches and development in the agricultural sector as well. The following observations are made in this connection.

(a) Contribution of the researches

As stated below, 5 public institutions connected with agricultural sector had conducted 82 researches by incurring an expenditure of Rs.145 million during the period from 2013 to 2018 to minimize post-harvest of vegetable and fruits but those researches had not been monitored by the Agricultural Research Policy Council under the above committees. Accordingly, it was observed that the researchers conducted on post-harvest subject had not contributed to minimize the issues post -harvest loss. (Annexure 6)

	Institution	Number of researches	Expenditure incurred	
			(Rs.)	(USD)
i.	Post - harvest Technology Institute	18	6,456,095	
ii.	Hector Kobbekaduwa Agrarian Research and Training Institute	11	5,133,000	
iii.	Food Research Unit of the Department of Agriculture	42	3,467,000	
iv.	Industrial Technology Institute	15	192,703,155	70,500
v.	National Science Foundation	9	32,158,055	
	Total	**82**	**239,917,305**	**70,500**

(b) Coordinate between the institutions that conducted researches

Certain occasions observed that several researches institutions had conducted researches on Post-harvest loss in respect of similar subjects each other. Accordingly, without any coordination several research institutions had conducted researches on similar subject by incurring expenditure and as such it was observed that general state policy on researches is not implemented. It was also observed that the National Policy Council which is the government entitle responsible for the coordination of these research institution is not adequate performed its functions. (Annexure 7)

3.7.3 Conducting researches and surveys by the National Post-harvest Management Institute

In compliance with the state Agricultural Corporation Act No.11 of 1972, the post-harvest Technology Institute has been established by the gazette notification extra-ordinary No.1137/10 of 19 June 2000. The post-harvest Technology Institute operates under the Ministry Agriculture. This is the main institution which has been established in Sri Lanka for carrying out researches, training extension services and other development activities with the objective of improving post-harvest Technological functions of paddy and other types of grains, flesh crops, field crops, fruits, vegetables fancy flowers and plants.

(a) Objectives and goals/ aims

Objectives and aims of this institute include, upliftment of income condition of peasantry, by minimizing post-harvest loss creation of value added products improvement of nutritious condition of foods by introducing appropriate packaging technological methods, minimization of cost of production, upliftment of livelihood by promoting employment opportunities and increase the demand for domestic food stuffs etc.

(b) Overall analysis of researches

i. In order to achieve the objective of the establishment of Institute, the post-harvest Management Institute had conducted 132 researches comprising 54 for rice, 25 for vegetable, 26 for fruits and 28 for other fields during the period 2000 to 2016.

   Of these, total researches 19 per cent and 21 per cent related to vegetable and fruits respectively but the post-harvest loss of vegetable and fruits by now as observed in audit is at high level between 30 per cent to 40 per cent.

ii. Researches on vegetables conducted from 2000 to 2016 had covered bitter gourd, ridge gourd, chilies, brinjal, drumstick, cabbage, tomato, red chilies, bean, pumpkin, leeks and red onions. Researchers conducted in respect of these vegetables is a good tendency but the audit view is that researches in respect of snake gourd, long bean etc. which cause more post-harvest loss need to be conducted as well.

iii. The National post-harvest Technology Institute had conducted 25 researches on mango, banana, lime, oyster, tamarind, wood-apple, grapes and other vegetables during the period 2000 to 2016. In this 12 researches on value added fruit products had been conducted but the number of researches conducted on papaw and pineapple caused more post-harvest loss was insufficient and those researches need to be continuously introduced.

iv. In the report presented after being reviewed the researchers conducted during the period 2000 to 2016, the present position of 12 researches is stated as "Technology is introduced through technology dissemination activities". Similarly, future expectations are stated as "continue to introduce". Accordingly, it was observed in audit that the future expectations which could be obtained from 12 researches carried out from 2000 to 2016 need to be further well-timed.

v. Present position stated in 8 research reports that the technology had been introduced but "call for E01 to be given for manufacture" is stated as future expectations. Accordingly, it was observed that there is along delay in contributing to production from 8 researches carried out during the period 2007 to 2016.

(c) Survey Data

i. The Institute had conducted surveys only on 11 varieties of vegetables in respect of post-harvest loss in the transportation and marketing in the year 2014. It had been based on the transportation and marketing basically between the economic centres of Dambulla, Thambuththegama, Jaffna, Norochchole, Nuwaraeliya, Meegoda, Bandarawela and Matara. According to the data of these surveys harvest loss in the transportation and marketing of each variety of vegetable ranged from 0 to 34 per cent and 4.19 to 57.38 per cent respectively and the overall loss ranged at high level from 6.14 to 76.53 per cent. It is a high value in respect of long bean and carrot. (Annexure 8)

ii. In this survey loss in transportations and marketing only had been considered but any survey whatsoever had not been conducted on losses in reaping and collecting harvest. (Annexure 8)

3.7.4 Surveys conducted for the assessment of post-harvest loss of fruits

The National post-harvest Institute and Industrial

Technology Institute had conducted surveys in respect of harvest loss of fruits caused in the cultivated land, transportation and retail shops and wholesale shops. According to those survey results post-harvest loss of 4 varieties of fruits had exceeded 30 per cent. (Annexure 9)

3.7.5 Research Grants

As explained by the National Science Foundation in respect of researches conducted on post-harvest subject on 05 October 2018, a research grant of Rs.8,297,000 had been given by the National Science Foundation to an officer of the Department of Agriculture for the period of 2 years. Its objective was to provide cultivation information at the farm level, being correctly forecasted through an internet based program. Nevertheless, according to the information revealed in audit in this regard the related internet data supply software had not been used for crop forecast purpose of the Department of Agriculture and it had been used for the fertilizer subsidy scheme of the Ministry of Agriculture. Accordingly, it was observed that the expected objective had not been achieved by this researches grant.

3.8 Connection with Sustainable Development Goals by the National post-harvest Management Institute.

In order to reach Sustainable Development Goals in poverty alleviation and access to protected and quality foods, the National post-harvest Management Institute has expected to reduce the post-harvest loss of vegetables and fruits up to 15 per cent by the year 2022. According to the explanation of the Institute the post-harvest loss of only mango crop had decreased from 39.6 per cent to 6 per cent by improving supply chain activities of mango, guava, papaw and banana in the zones monitored by them. Even though, this a commendable tendency, it was observed that this project which monitored only in selected areas needs to be extended islandwide. However, it was observed that since the post-harvest loss of other crops has not been computed the expected targets had not been achieved.

To ensure the Sustainable consumption and production patterns which is a sustainable goal the price fluctuation of food stuffs needs to be controlled. In this regard the National Post-harvest Management Institute, has expected to maintain the price fluctuation at 5 per cent boundary. Accordingly, action had been taken only in respect of price fluctuation of paddy. In order to ensure the sustainable consumption and production patterns, investments in agricultural Research Technology publicity and Technological outputs need to be increased. The Institute had anticipated to conduct researches for the minimization of post-harvest loss for this purpose. Nevertheless, the Institute had conducted 3 researches on post- harvest management of mango crop, spending a sum of Rs.3.183 million 01 research on preservation of guava, pineapple, papaw, spending Rs.3.698 million and an instrument relates to identify the maturity stage of fruits only.

04

Recommendations

4.1 Action needs to be in accordance with a cultivation plan

Since the Department of Agriculture states that crops are not grown in accordance with a pre-prepared cultivation plan based purely on the requirement, mainly affected for an excess harvest, the following proposals are made.

i. Based on such factors as environmental condition of various areas in the Island, price data obtain in terms of production requirement weather forecasts and price behavior of previous seasons farmers need to be made aware before each season in accordance with a cultivation plan prepared in a manner with a maximum efficiency.

ii. Confirmation and encouragement of farmers programs needs to be prepared for working the farmers in accordance with a cultivation plan.

iii. In order to select the crop to farmers, assistance instructions and supervision of the officers of the Department of Agriculture and the Department Agrarian Development need to be continually Agrarian Development need to be continually given.

4.2 Instructions on how to take action so as to minimize the harvest in reaping harvest, handling the harvest and classification of harvest need to be given to farmers by visiting them. New Technologies to be following in those stages need to be introduced.

4.3 Recommendations on packaging

The following recommendations made by the researchers conducted on the use of plastic baskets are recommended to implement as appropriate.

i. The integrated supply network for widening the use of plastic packages which comprises the persons engage in several functions such as production, collection transportation and trading needs to be strengthened.

ii. In order to succeed the above purpose and to facilitate the building of pre and post production coordination, the co-operations of the government needs to be obtained for the concentration of farmers and establishment of organizations.

iii. Construction of roads in the agri-products areas, putting up collection centres of products modification of economic centres with packaging house facilities suitable for packing, improvement fairs as appropriate in which final products are supplied etc. need to be done.

iv. Implementation of the following proposals mentioned in the researchers conducted on proper packaging can be recommended.

- Use of stackable and instable plastic packing's suitable for transport.
- Use of cushioning materials between layers in transporting vegetable.
- Painting the vehicles which transport vegetables and fruits with white or light colour paints in order to minimize the absorption of solar rays
- Allow air, comes in to the vegetable transport vehicles through windows.
- Use of equipment like fork lifts, conveyers etc. in loading and unloading vegetables.
- Packing vegetables in the transportations in a manner last loaded stock

first unloading method.

- Storing in a manner not to illuminate direct sun light
- Maintenance of Depots in vegetable transport transit centres to keep plastic baskets in various sizes to ease exchange.
- Provision of facilities to purchase plastic baskets at least at a 50 per cent subsidized price.
- Introduction of plastic baskets to main exchange centres with separate colours and code numbers.
- Establishment of a system to return plastic baskets
- After being implemented a pilot project in this regard, disseminate it to all exchange centres.
- Introduction of different prices for vegetables transport by baskets.
- Provision of a fuel subsidy.

v. Introduction of systems for the effective use of non-usable surplus supply if any.

4.4 Recommendations to increase the contribution of public entities

4.4.1 Recommendations relate to District Agricultural committees

(a) Formulation of a program for the proper distribution of harvest as a solution to the marketing problems of farmers products by holding agricultural committees representing at districts in Sri Lanka.

(b) Being strengthened the farmers problems need to be each district, farmers problems need to be discussed at District Agricultural Committee meeting and those issues need to be referred to the Ministry of Agriculture and relevant public entities.

4.4.2 Recommendations relate to Divisional Agricultural Committee

(a) Improve the participation of farmers organizations in the Divisional Agricultural Committee meetings and take action to resolve the problems of farmers organizations, harvesting problems and marketing problems by contributing public institutions.

(b) Find out whether vegetable packing baskets given to farmers are used for packing harvests and make aware of the public entities to solve the problems faced in using.

(c) Provision of qualitative local seeds for the cultivation to farmers, instigate the farmers to cultivate in accordance with the cultivation plan and facilitate to market their harvest at a reasonable price.

(d) In order to solve farmers problems within the district, Divisional Agricultural and do their works.

(e) Supply of required equipment and technical knowhow to farmers to create value added products to minimize post-harvest loss and provide a market to sell their products.

(f) Since surplus vegetables are cultivated in Yala and Maha seasons, the required standards need to be maintained, enabling them to export and introduce exporters to farmers.

4.4.3 Expedite the implementation of following recommendations made by the food Research Unit of the Department of Agriculture.

- Formulation of a common National Policy.
- Distribution network of vegetable and fruits needs to be more systemized.
- Promotion of value added products.
- Transmission of accurate knowledge in post-harvest Technology.
- Provision of required infrastructure facilities

and assistance.

- Introduction of technology and modern systems.

4.4.4 Recommendations relate to export

It is recommended that the recommendations presented in the research report titled analysis of vegetable export related supply chain conducted by the Hector Kobbekaduwa Agrarian Research and Training Instituted in the year 2015 need to be implemented.

4.4.5 Prevention of price fluctuation of vegetables

According to the researchers conducted by the Hector Kobbekaduwa Agrarian Research and Training Institute, it was identified that the government needs to intervene the control of price fluctuation of vegetable by determining a minimum price to cover the cost of production and the surplus harvest needs to be subjected to a processing system. In addition, the cost of living committee needs to intervene the prices of vegetables in relevant occasions, based on the data given by the Hector Kobbekaduwa Agrarian Research and Training Institute.

4.5 Recommendations relate to researches

i. Researches on the minimization of post-harvest loss need to be further developed. Researchers conducted by all public institutions on post-harvest loss agricultural and non-agricultural should be monitored by the Agricultural Research Policy Council, being not to monotonous and the recommendations of such researches need to be implemented.

ii. Priority needs to be given to crops which cause the most post-harvest loss and researches need to be conducted to cover all stages of post-harvest loss.

4.6 Recommendations relate to Training

Farmers and other related parties need to be trained well-timed in respect of the following and investigations have to be made to see whether the instructions given therein are followed.

- In respect of correct inputs require for farming

- Post-harvest Management

- Manufacture of value added food products.

- Food Security (for local consumption as well as for export)

4.7 Before vegetables come to the market during the excess harvest seasons, the government needs to intervene being dominated the quality of that type of vegetable by way of various pre-publicity medium and instigate the consumer for consumption.

4.8 Maintenance of a data system

A formal data system needs to be maintained in respect of post-harvest loss up to the harvest comes to the consumer from the farm level.

05

Conclusion

The Ministry of Mahawelia, Agriculture, Irrigation and Rural Development and institutions under that ministry are the public institutions intervene the minimization of post-harvest loss of vegetables and fruits in Sri Lanka and marketing at reasonable prices. Even though, institutions had conducted researches on post-harvest loss and implemented the recommendations of such researches, introduction of equipment and packing materials to minimize post-harvest loss, provision of training and various counseling services had been performed at a minimum level, they had not made contribution contribution sufficiently influence at the national level. The reason therefore is that there was no proper coordination between those institutions and the functions of each of these institutions were not properly operated. Similarly, any institution does not maintain a proper data system in order to compute the quantity and the value of post-harvest loss. According, to the survey data carried out during the past periods the post-harvest loss of vegetables and fruits ranged from 30 to 40 per cent up to now and the cost of this wastage has to bear the farmer and the consumer, resulting the reduction of farmers income and increase the cost of living of consumers.

Sgd./W.P.C. Wickramaratne
Auditor General

W.P.C.Wickramarathne
Auditor General

Annex 01

Details regarding the projects which value additions were done by each of the government institution

Institute	Vegetable	Value added products
Industrial Technology Institute	Rambutan	• Frozen rambutan • Rambutan chutney • Rambutan candy • Canned/ bottled rambutan with pineapple pieces • Rambutan jam
	Lime	• Black lime • Date and lime chutney • Lime juice • Lime marmalade • Sports drink1 • Lime Isotonic drink • Lime peel powder • Lime peel candy • Semi processed lime
	Mushroom	• Battered mushroom • Dehydrated mushroom • Mushroom chutney • Mushroom pickle • Mushroom sandwich paste • Mushroom sauce • Mushroom sausage • Mushroom soup • Dehydrated mushroom powder
	Tamarind	• Tamarind powder • Tamarind toffee • Tamarind paste • Tamarind sauce • Tamarind chutney • Tamarind toffee • Tamarind drink • Tamarind pulp
	Banana	• Banana cake • Banana puree • Dehydrated banana • Flavored banana chips/ slices • Banana sauce • Banana jam • Banana pulp • Banana toffee • Banana dodol • Minimally processed Banana flower • Minimally processed cooking banana

Institute	Vegetable	Value added products
	Jak	• Immature jak pickle (bottled) • Canned immature jak curry • Canned jak (kiri kos) • Dehydrated jak • Jak bread/ buns • Jak pickle • Jak seed fried/badun • Jak snacks • Minimally processed mature jak • Minimally processed polos mallum • Minimally processed polos • Vela cordial • Jak flour • Varaka candy • Canned jakseed curry
	Cashew	• Cashew chocolate spread • Cashew kernel snack • Flavoured cashew kernel • Kithul treacle flavoured cashew • Instant cashew drink • Canned cashew nut curry
	Bitter gourd	• Bitter gourd burger spread • Bitter gourd sandwich spread • Instant bitter gourd badun
	Pumpkin	• Pumpkin soup powder • Pumpkin sauce • Pumpkin preserve • Osmatically dehydrated pumpkin • Dehydrated pumpkin • Dehydrated pumpkin seeds • Pumpkin bread spread • Pumpkin jam • Pumpkin ready to serve drink • Pumpkin leather • Pectin from Pumpkin
	Tomato	• Tomato source • Tomato pulp • Tomato paste • Low cost technology for tomato puree using local varieties
	Potato	• Flavoured potato chips • Flavoured sweet potato chips • Flavoured fried potatoes
	Mango	• Steeped mango slices • Semi processed mango • Canned mango in syrup • Mango jam • Mango spread • Mango butter

Institute	Vegetable	Value added products
	Mango	• Mango RTS • Dehydrated mango • Osmotically dehydrated mango • Mango leather
	Fruit based products	• Dehydrated fruits • Osmotically dehydrated fruits • Fruit sauce • Fruit chutney • Fruit jam • Fruit leather • Fruit bar • Ready to service fruit drink • Fruit cordial /squash • Fruit jujubes • Fruit ice cream • Fruit cocktail • Organic fruit pulps without preservative • Fruit pulp • Fruit vinegar
	Minimally processed products	• Bread fruits • Durian, Jack • Kohil, Leafy gram • Nelum Ala • Polos
	Nelli	• Nelli cordial with no added sugar
	Dragon fruit	• Dragonfruit balls in syrup • Dragonfruit RTS
	Starfruit	Starfruit drink
	Tomato	Immerse dry particles sugar solution sauce instat drink, powder
	Beans	Degydration, Vaccum dehydration product, soup mix-tees
	Carrot	Dehydrate, Vaccum dehydrate, Jam, Ianstant Drink
	Leeks	Dehydrate,Minimum product, Soup, Mix, Vaccum
	Brinjal	Dehydration, moju
	Raddish	Bite,cake,moju
	Pumpkin	Powder, Soup,instant Drink
	Marrow	Jelly, Jam
	Okra	Caccum Dehydrate
	Mango	Degydration , instant Drink, minimum products, Chuney,Bottling, Cordial, Powder Vaccum Dehydra-tion,Jam

Institute	Vegetable	Value added products
	banana	Degydration , Byte, Vaccum Dehydration,Jam
	Papaw	Dehydration,Instant Drink, minimum products, Bottling, cordial, Vaccum Dehydration,Jam
	Sweet melon	Dehydration , Instant Drink, Minimum Products, Jam
	Custard Apple	Instant Drink, Cordial
	Jackfriut	Bottling
	Slimpple/ Wood Apple	Instant Drink, Jam
	Vegetable	Dehydrated Vegetable, ,Pickle,Sausages
	Fruits	Instant Drink,Cordial, fruit pulp, Jam, Chutney, Dehydrated fruits salt lime, lime juice, Source
	Tomato	Tomato souce,Dehydrated tomato, Tomato powder

Annex 02

Expected extent of land of vegetable relating to 2018 Maha Season and actual extent of land cultivated

Crop	Expected extent of Land (HC)	Actual extent of Land (CH)	Percentage %
Snalce guard	1912	921	48
Tomato	3430	1653	48
Cucumber	1479	174	11
Bitter guard	2511	1384	55
Ash Plantain	875	543	62
Okra	3822	2402	63
Brinjal	5092	2930	57
Lufa	2055	1046	51
Long beans	4510	2944	65
Marrow	570	312	55
beans	4184	2527	60
Beet root	1263	612	48
Cabbage	2242	1320	59
carrots	1719	1072	62
Knokhol	545	2779	-
leeks	1072	659	61
Raddish	1560	821	52
Pumpkin	6257	2825	45

Source: forecast statement publish by the social, economic & Planning centre of Department of Agriculture

Annex 03

Details of Dedicated Economic Centre

Economic Centre name	Build year	Extent of Land (HC)	Number of Boutiques	Date of acquiring of land
Weyangoda	2007	2.2043	71	2016.12.21
Piliyandala	2010	1.3.3	58	Land had not been aquired
Ratmalana	2009	11.62	128	Land had not been aquired
Nuwara Eliya	2006	2.0.12	138	Land had not been aquired
Narahenpita	2008	10.27	196	2014.09.02
Dambulla	1999	8.2.2	157	2016.03.03
Cinnamon Garden	2008	40 Perches	14	Land had not been aquired
Kappetipola	2001	2.4	71	Land had not been aquired
Kanda Handiya	2006	0.33	25	2006.01.27
Embilipitiya	2003	1.87	46	2017.05.15
Thambuththegama	2005	2.9	59	2015.09.10
Welisara	2003	2.1.11.5	133	2017.06.22
Kilinochchiya	2017	5.5	40	2017.10.04
Ampara	2017	0.52	24	Land had not been aquired
Meegoda	2003	2.2.24	105	Land had not been aquired

Annex 04

Analysis of minimum and maximum prices of vegetable reported in the year 2018

Vegetable variaty	Economic centre	March/ April/ September (Minimum vegetable price)			As compared with the price paid by consumer		November/ December (Maximum vegetable price)			As compared with the price paid by consumer	
		Whole-sale price	Amount paid by consumer	Differ-ence	Share to the producer	Share to the middle Trader	Whole sale price	Amount paid by consumer	Differ-ence	Share to the producer	Share to the middle trader
Bean	Dambulla	77	134	57	57	43	207	302	95	68	32
Bean	Pettah	86	155	69	55	45	229	307	78	74	26
Carrot	Dambulla	69	147	78	47	53	255	292	37	87	13
Carrot	Pettah	59	137	78	43	57	232	324	92	72	28
Brinjal	Dambulla	34	81	47	42	58	119	187	68	63	37
Brinjal	Pettah	45	115	70	39	61	116	202	86	57	43
Riddish	Dambulla	12	57	45	21	79	68	123	55	55	45
Riddish	Pettah	21	101	80	21	79	95	190	95	50	50
Cucumber	Dambulla	10	50	40	20	80	44	89	45	49	51
Cucumber	Pettah	12	83	71	14	86	52	135	83	39	61
Okra	Dambulla	31	74	43	42	58	88	149	61	59	41
Okra	Pettah	34	114	80	30	70	101	197	96	51	49
Cabbage	Dambulla	25	69	44	36	64	95	157	62	60	40
Cabbage	Pettah	23	103	80	22	78	111	202	91	54	46
Leeks	Dambulla	50	111	61	45	55	222	306	84	72	28
Leeks	Pettah	48	132	84	36	64	216	314	98	68	32

Annex 05

Average wholesale prices of 10 varieties of vegetable presented to Pettah market during the period of 5 years from 2014 to 2018

Month	Price of bean (Rs.)	Price of carrot (Rs.)	Price of Leeks (Rs.)	Price of Brinjal (Rs.)	Price of Tomato (Rs.)	Price of Riddish (Rs.)	Price of Cucumber (Rs.)	Price of Pumpkin (Rs.)	Price of Okra(Rs.)	Price of Cabbage (Rs.)
January	128	119	111	84	68	35	60	41	80	53
February	122	90	85	46	72	23	52	62	79	43
March	95	66	65	45	49	29	34	44	51	30
April	90	85	73	42	60	36	31	31	45	37
May	136	130	93	65	90	52	53	34	70	58
June	153	192	117	85	114	64	42	58	71	85
July	138	139	74	59	118	42	23	71	58	82
August	97	110	49	63	55	24	18	47	30	60
September	97	87	62	73	53	26	31	33	42	50
October	140	87	81	77	81	43	41	36	61	52
November	160	150	116	89	110	63	44	45	74	75
December	175	142	132	100	119	55	50	37	75	74

Annex 06

Research done by various government Institutions relatives to the field of post-harvest

Institute	Research Topic	Duration	Amount (Rs.)
Post-harvest Technology Institute	1. Study on feasibility of safe packaging for fruit and vegetables transportation	2013	380,000
	2. Bio – Efficiency Insecticide Incorporated bags on storage pest under Sri Lankan Conditions	2014	64,600
	3. Survey in Identification of Mango Post Harvest Re-lated Problems in Sri Lanka	do	300,000
	4. Extension of post-harvest life of "ambul" bananas through applications of MCP Methylcyclopropane	do	365,000
	5. Quality Improvement for shelf life extension of ready to use fruit salad	do	12,500
	6. Evaluation of IPHT Extractor for Mango Papaya and Pineapple	do	-
	7. Studied of wine production form locally available grapes	2015	136,700
	8. Cryogenic size reduction of chili powder	do	757,500
	9. Screening of traditional plant leaves and passion fruit for their efficiency in including fruit ripening and develop-men of a plant based ripening inducer	do	10,000
	10.Estimation of heavy metal contamination in some popular vegetable grown in selected district of Sri Lanka	do	854,980
	11.Development of technology for cleaning and de-stoning of agricultural commodities	do	900,000
	12.Process Development for freeze preservation of local vegetable	do	400,000
	13.Processing and Quality Evaluation of Chili sauce develop using a chili variety with higher pungency	2016	55,000
	14.Optimization of the Dehydration process of fruits and vegetable in tray type mechanical dryer	do	108,000
	15.Control of post-harvest diseases of vegetables by organic silicon sources	do	592,200
	16.Study on blackening of skin in TJC mango and ap-plication of control measures	do	110,000
	17.Evaluation of the effect of fruits coating on shelf life extension of lime under different storage condi-tions	do	9,615
	18.Pre-harvest and postharvest disease management of green chilies using rice husk Silicon as an alterna-tive strategy for synthetic fungicides	2017	1,400,000

Institute	Research Topic	Duration	Amount (Rs.)
Hector Kobbekaduwa Agrarian and Research and Training Institute	1. Study if the impact of utilizing the plastic package for marketing vegetables and fruits.	2014	Not given
	2. Analysis of supply chairs in relation to export of vegetables.	2016	666,000
	3. Production and Marketing of Other Field crops: A Review	2012	679,000
	4. Issues in Big Onion Seed Production Marketing	2013	372,000
	5. An Overall Assessment Of the Agricultural Marketing System in Northern Province of Sri Lanka	2015	1,040,000
	6. Vegetable Collection Centers in Badulla and Monaragala	2015	193,000
	7. Present Stats Of Vegetable Direct Marketing in selected Districts ins Sri Lanka	2016	56,000
	8. An Evaluation Of Selected Dedicated Economy Centers: Comparative analysis in Norochchole and Nuwaraeliya	2016	381,000
	9. An Analysis of Farmer Decision Making ad Price Volatility in Mid Country Vegetable sector in SriLanka	2016	568,000
	10.Experience and Lessons From An Investment in Tomato Processing	2011	304,000
	11.Hybrid Seeds & Vegetables Cultivations in Sri Lanka vs Imported	2018	874,000
Department of Agriculture – Food Research Unit	1. Preservation of fruits juices without additives as preservative	2015	25,000
	2. Development of technology for vacuum drying of fruits	2015	50,000
	3. Determination of antioxidant levels and shelf life of organically grown fresh herbs	2015	75,000
	4. Analysis of physico-chemical parameters and value addition of sweet potato and diascorea spp.	2015	22,000
	5. Effect of dehydration of leafy vegetables on quality and palatability	2015	15,000
	6. Development of palatable food products from dragon fruit.	2015	30,000
	7. Development of processed food products for mango varities using vacuum dehydration technology.	2015	30,000

Institute	Research Topic	Duration	Amount (Rs.)
	8. Development of technology for frozen vegetables	2015	380,000
	9. Antioxidants levels of vegetables affected by method of growing and method of cooking	2016	64,600
	10.Quantification of antioxidant levels of fruits as affected by stage of maturity at harvest and the method of ripening	2016	300,000
	11.Development of microwave assisted dehydration of fruits	2016	365,000
	12. Effect of preservation techniques, cooking methods and different storage conditions on chemical constituents and functional properties of selected vegetables.	2016	12,500
	13. Determination of microbial contamination of leafy vegetables of conventional produce and organic produce in Kandy district.	2016	-
	14. Increasing of vegetables consumption through value addition drinks.	2016	136,700
	15. Identification of minimum concentration and exposure time for induce ripening (Ethel, natural treatments) for Mango, Banana, Papaya.	2016	757,500
	16. Development of palatable food products from dragon fruit.	2016	10,000
	17. Development of technology for frozen vegetables.	2016	854,980
	18. Development of processed food products for vegetables	2016	900,000
	19. Development of processed food products for vegetables using vacuum dehydration technology.	2016	400,000
	20. Development of processed food products for Mango variety – Tom JC, Karthakolomban, & Villard using vacuum dehydration technology	2016	30,000
	21. Organic fertilizer enhances antioxidant activity, post-harvest quality and shelf life of cucumber	2017	70,000
	22. Effects of different activated carbon source on ripening, quality and self life of tomato	2017	50,000
	23. Investigation of physical properties of anona species (*AnonaMuritica/AnonaSqumata*) powder produced by spray drying technique	2017	50,000
	24. Investigation of the suitability, banana stem and coam flour for bakery products.	2017	30,000
	25. Analysis physical properties of avocado oil produced by low cost extraction method at different boiling times	2017	60,000

Institute	Research Topic	Duration	Amount (Rs.)
	26. Fumigation and aqueous methylcyclopropene (1-MCP) treatments for extending shelf life and quality of 'TJC' mangos for export market.	2017	70,000
	27. Determination of antioxidant levels of vegetables and their as affected by cooking method	2017	15,000
	28. Microwave assisted vacuum dehydration of fruits	2017	30,000
	29. Increasing of vegetable consumption through value addition.	2017	20,000
	30. Development of processed products for vegetables through vacuum dehydration	2017	50,000
	31. Development of processed products for vegetables	2017	20,000
	32. Development of value added products for underutilized fruits and vegetables	2017	20,000
	33. Development of processed products for fruits through vacuum dehydration	2017	30,000
	34. Effects of different activated carbon source on ripening, quality and self - life of tomato	2018	50,000
	35. Investigation of physical properties of anona species (*AnonaMuritica/AnonaSqumata*) powder produced by spray drying technique	2018	50,000
	36. Effect of 1-methylecyclopropane on shelf life, postharvest quality and nutritional properties of leafy vegetables.	2018	30,000
	37. Analysis physical properties of avocado oil produced by low cost extraction method at different boiling times	2018	60,000
	38. Identification of suitable Dehydration technique for production of vegetables leathers	2018	30,000
	39. Development of processed products for vegetables through vacuum dehydration	2018	40,000
	40. Development of processed products for vegetables	2018	20,000
	41. Development of value added products for underutilized fruits and vegetables	2018	40,000
	42. Development of processed products for fruits through vacuum dehydration	2018	40,000

Institute	Research Topic	Duration	Amount (Rs.)
Industrial Technology Institute	1. Study on later composition and sap burn injury of different varieties of Mango	2010-2012	1,906,080
	2. Value addition to Fruits and Vegetables by Clarifying concentrating and separation of bio active Components using Membrane filtration technology and process	2010-2012	1,920,000
	3. Enhanced presentation of Fruits by controlled delivery of Hex anal using Nano-Fibers & Bio-Films Developed from indigenous crops	2012-2014	38,469,075
	4. Enhanced Presentation of Fruits using Nano Technology	2015-2018	54,640,000
	5. Post -Harvest	2012	150,000
	6. Assessment of suitability of Selected Sri Lankan Tomato Verities for Development of Physiochemically & functionally Sound Tomato puree under Different processing Conditions	2014-2015	500,000
National Science Foundation	1. Development of a web-based crop forecasting system in Sri Lanka to provide timely and reliable information on crop yields and area planted and production through the collection of agronomic and other farm information at farm level.		15,605,000
	2. Asocial Life network to enable farmers to meet the varying food demands of the population.by providing needed information just in time (real time basis) and better monitoring and management of crop production (A Mobil based Agriculture information System for Farmers)		
	3. Food security through adoption of pre-harvest Technologies; Improving Quality of Fresh produce by soil application of potassium and silicon.	5,830,000	
	4. Application of novel techniques to minimize postharvest losses of five selected fruit and vegetables varieties.		2,659,600
	5. Investigation of fruit phenology and preharvest foliar treatment of growth regulators on fruit quality and postharvest life of lime.		1,849,513
	6. Study on latex composition and sap burn injury of different varieties of mangoes.		1,906,080
	7. Efficacy of soluble silicon in including disease resistance against postharvest fungal pathogens in Banana.		2,196,862
	9. Industrial fruit waste derived ingredients for commercial food production		2,111,000

Annex 07

Research done by various government Institutions relatives to the field of post harvest

Description	Institution	Research Topic	Year	Amount
Relating Packaging	Hector Kobbekaduwa Agrarian Research and Training Institute	Study of the impact of utilizing the plastic package for marketing vegetables and fruits.	2011	Not given
do -	Post-Harvest Technology Institute	Study on possibility of safe packaging for fruits and vegetables transportation	2013	380,000
Relating to Mango	Post-Harvest Technology Institute	1. Survey in identification of Mango post harvest realated problems in Sri lanka	2014	300,000
do -		2. Evaluation of IPHT Extractor for Mango Papaya and Pine Apple	2014	-
do -		3. Study of blackening of skin in TJC Mango and application of control measures	2016	110,000
	Department of Agriculture – Food Research Unit	1. Fumigation and aqueous methyleycolpropene (1-MCP) treatment for extending shelf life and quality of JIC mangoes for Export Market	2018	70,000
		2.Fumigation and aqueous Methyleycolpropene (1-MCP) treatment for extending shelf life and quality of JIC mangoes for export market	2017	70,000
		3. Development of processed food product for mango variety tom JC Korthakolomba,& villart using Vacuum dehydration Technology	2016	30,000
		4. Development of processed food product for Mango variety using Vacuum Dehydration Technology	2015	30,000
Relating to Tomatoes	Hector Kobbakaduwa Agrarian Research and Training Institute	Experience and Lessons from an investment in Tomato processing	2017	304,000
	Food Research Unit	1. Effect of different activated carbon source on ripening Quality & self-life of Tomato	2017	50,000
		2. Effect of different activated carbon source on ripening Quality & self-life of Tomato	2017	50,000

Annex 08

The survey data of National Post harvest Institute done on post harvest loss of vegetables

Crop	Distribution Network	Transport (%)	Marketing (%)	Total loss
Cucumber	Thambuththegama to Colombo	3.12	5.25	8.37
	Thambuththegama to Kegalle	9.62	31.59	41.21
Brinjal	Thambuththegama to Colombo	2.63	4.38	7.01
	Norochchole to Dambulla	0.31	16.00	16.31
	Jaffana to Dambulla	6.93	24.58	31.51
Okra	Thambuththegama to Veyangoda	4.85	8.01	12.86
	Norochchole to Dambulla	0.53	13.55	14.08
	Jaffna to Dambulla	6.93	24.58	31.51
Tomato	Thambuththegama to Veyangoda	3.20	3.64	6.84
	Bandarawela to Matara	10.81	12.84	23.85
Lufa	Dambulla to Colombo	14.92	13.10	28.02
Cabbage	Dambulla to Colombo	7.78	11.19	18.97
	Nuwaraeliya to Dambulla	16.22	7.75	23.97
	Norochchole to Meegoda	17.07	30.24	47.31
Snake gourd	Dambulla to Colombo	8.03	28.77	36.08
	Dambulla to Katugastota	14.57	33.45	48.02
Long Beans	Norochchole to Meegoda	27.44	49.56	77
	Thambuththegama to Kegalle	19.20	57.33	76.53
Leeks	Nuwaraeliya to Dambulla	2.82	14.88	17.7
Carrot	Nuwaraeliya to Dambulla	6.68	32.10	38.78
	Bandarawela to Matara	8.33	8.00	16.33
	Jaffna to Dambulla	34.73	31.72	66.45
Beans	Nuwaraeliya to Colombo	3.49	4.19	7.68
	Bandarawela to Matara	0.00	6.14	6.14

Survey data for assessing the post- harvest loss of fruits

Fruits	Post- Harvest Technology Institute				Industrial Technology Institute					
	Year	At Trans-portation (Ambilipitiya to Colom-bo %)	Marketing %	Total loss	Year	At land	At the Colletion	Retail seller	Whole-sale saller	Total loss
Banana	2016/2017	1.64 -	2.87 -	4.51 20	1999	5.27	7.58	3.25	14.13	30.23
Papaya	2016/2017	7.68	37.58	45.26 46	1999	5.78	10.12	4.95	15.28	36.12
Pine apple	-	-	-	-	1999	7.21	8.53	2.89	12.53	31.16
Mango	2016/2017	-	39.6	-	2014	3.5	3.3	12.6	11.3	32.7