Reasons for Low Adoption of Selected OFC and Vegetable Varieties Released by the Department of Agriculture

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FOREWORD

Seeds are the basic and most critical input for the sustainability of agriculture. Hence one of the major functions of the Department of Agriculture is to be involved in producing and disseminating of quality seeds for farmers and others involved in agriculture. The DOA has developed a large number of high yielding varieties of paddy, other field crops, vegetables etc. and most of these crop varieties introduced have become highly popular. Meanwhile, some varieties of OFC and vegetables namely maize, chilli, brinjal, tomato, capsicum and long bean which were introduced in the recent past have been limitedly adopted. The DOA is more conscious about the factors affecting the low adoption of the reference varieties. This study on adoption of those crop varieties was conducted by HARTI to fulfill the above need of DOA.

The study has highlighted the level of adoption of reference crop varieties and different factors–social, economic and technical–affecting them. This information is very useful for the DOA to take action to overcome the weaknesses that lead to low adoption of some crop varieties. At the same time, the information contained in the report is beneficial for others who are interested in the subject.

The study was conducted by Mr. J.K.M.D. Chandrasiri and Mrs. B.A.D.S. Bamunuarachchi of this institute. I am very thankful for their commitment and dedication.

Haputhanthri Dharmasena
Director

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EXECUTIVE SUMMARY

The Department of Agriculture (DOA) of Sri Lanka plays a major role in developing and disseminating high yielding varieties of food crops to increase productivity. According to the DOA, farmers' adoption of some of the recently developed Other Field Crops (OFC) and vegetable seed varieties is unsatisfactory. Among those developed were chilli, maize, capsicum, tomato, brinjal and long bean (*mae*) varieties. The DOA was more interested in identifying the factors behind the poor adoption of developed varieties of these crops and the HARTI undertook this study to address the DOA's interest. The specific objectives were to identify the level of acceptance and adoption of reference varieties and to examine the socio-economic, institutional and other factors that influenced their adoption. The study was based on a sample survey of farmers cultivating those crops in Anuradhapura, Puttalam, Kandy, Nuwara Eliya, Badulla, Moneragala and Ampara. Data was analyzed by using of descriptive statistical techniques.

The general conclusion of the study was that in selecting of varieties of crops farmers gave high priority to obtaining a higher yield and income while some other factors were suitability to their agro-ecological conditions to minimize risk and increase profit.

The study found that same varieties were not adopted. Among those were all maize varieties selected (Sampath, Ruwan and Badra) a chilli variety (Galkiriyagama Selection) a brinjal variety (Anjali), four tomato varieties (Maheshi, Bathiya, Lanka Cheri and Lanka Sour), the selected capsicum variety (Lanka yellow Wax) and one *Mae* variety (Hawari). The varieties adopted at low level (adopted farmers were less than 50%) were KA-2 and MI-2 Chilli varieties, Amanda and HORDI-Lena iri brinjal varieties, Thilina tomato variety and three *Mae* varieties known as Panduru Polon, Vel Polon and Bushita.

The reasons for non or less adoption of some of the varieties introduced by DOA have been lack of awareness and knowledge of farmers about those varieties, non availability of quality and sufficient seeds of those varieties to purchase on time due to their insufficient production and inability of the DOA to assure an attractive service (including extension advice and other input supply) as assured by the private sector, farmers' greater attraction towards imported hybrid seed varieties that bring out better yield and income compared with department crop varieties and the less favourable characteristics of some of the department seeds such as susceptibility to pests and diseases.

The study recommends that advanced seed varieties with better characteristics to compete with imported seeds should be developed and distributed to the ADCs, farmers should be made more knowledgeable about the DOA seed varieties, farmers should be given small seed packets as samples to experiment with as done by seed importing and promoting companies in order to convince farmers about the new crop varieties.

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ABBREVIATIONS

DOA	-	Department of Agriculture (DOA)
OFC	-	Other Field Crops (OFC)
AI	-	Agriculture Instructors (AIs)
ARPA	-	Agricultural Research and Production Assistant (ARPA)
ADC	-	Agrarian Development Center (ADC)
NGO	-	Non Governmental Organizations
FO	-	Farmer Organizations

CHAPTER ONE

Introduction

1.1 Background of the Study

The Department of Agriculture (DOA) of Sri Lanka plays a major role in developing and disseminating high yielding varieties of food crops to increase the productivity of them. Recent discussions with some of the higher officials of the DOA with farmers revealed that the level of adoption of some of the recently developed Other Field Crops (OFC) and vegetable varieties is insignificant. Some of the improved OFC varieties which indicate low adoption were chili and maize. Vegetable varieties that indicate low adoption were capsicum, tomato, brinjal and long bean (*mae*). The DOA was interested in identifying the factors behind the low adoption of the above mentioned crop varieties. Therefore, the HARTI undertook this study to fulfill the above requirement of the DOA.

Adoption of technology is a complex process shaped by diverse technical, socio-economic, cultural and institutional factors. Some of these factors are internal to the farm while some are external. This study explored different socio-economic and institutional factors influencing the adoption of some crop varieties (most are recently introduced) of the DOA. Conducting a study on factors impacting farmer's adoption pattern of reference high yielding OFC and vegetable seed varieties is of paramount importance to the DOA as the findings of the study would definitely help the department in better planning for production and distribution of reference OFC and vegetable seed varieties in future.

1.2 Study Objectives

The major objective of the study is to identify the present status and factors which influence the adoption of selected OFC and vegetable varieties released by the DOA.

1.3. Specific Objectives

1. To identify the level of acceptance and adoption of reference varieties of OFC and vegetables.
2. To examine socio-economic, institutional and other factors that influence the adoption of reference crop varieties

1.4 Methodology

1.4.1 Data Collection Methods

The study was based on primary as well as secondary data. An empirical survey of farmers cultivating the reference crop varieties was conducted to obtain primary information. A structured questionnaire was used to obtain information related to adoption of the reference crop varieties. Information collected from discussions with farmer groups as well as from observations was used as supplementary data.

The data related to specific characteristics of the disseminated crop varieties and the facilities given for encouraging their use was obtained through discussions with the relevant scientists of the crop research stations. Agriculture Instructors (AIs) and Agricultural Research and Production Assistants (ARPA) were interviewed as key informants to obtain their views and experiences about farmer's behavior in relation to the reference varieties' adoption.

1.4.2 Study Site and Sampling

To represent each crop variety 50 farmers were selected from the most popular locations of two major growing districts of those crops (25 farmers from each district). The two districts of each crop and their study sites were selected by discussing with the relevant scientists and the officials involved in generation and dissemination of the varieties. The selection of the sample of farmers growing each crop was done randomly by using a relevant farmers' list obtained from the ARPA in the area. The detailed information about selected varieties under each crop, the districts selected for the study and the distribution of sample in different districts are given in Table 1.1.

1.4.3 Data Analysis

The data was analyzed using descriptive statistics using frequencies, percentages and ranking methods. Case studies were also utilized to further elaborate the empirical situation.

Table 1.1: Concerned Varieties under each Crop and the Selected Districts and Locations for the Sample Survey and the Sample Distribution

Crop	Variety Introduced	District	ADC Area	GS Division	Sample Size (number of farms)
Maize	Sampath, Ruwan, Badra	Anuradhapura	Galenbidunu-wewa	Milagaswewa	28 farms
		Ampara	Lahugala	Hulannuge	24 farms
Brinjal	Amanda, Anjalee, HORDI Lenaeri	Anuradhapura	Elayapattuwa	Ulukkulama (Illuppankadaw-ala)	25 farms
		Badulla	Kotabara	Udaperuwa	26 farms
Chili	KA -2, MI-2, Galkiriyagama variety, MI Green	Anuradhapura	Ranorawa,	Kukulkatuwa	26 farms
		Puttalam	Palakuda	Panei-adiya	29 farms
Tomato	Maheshi, Bhathiya, Lanka Cherri, Lanka Sour	Kandy	Marassana	Damunugolla	27 farms
		Nuwara Eliya	Mandaram Nuwara	Labuhenwila	25 farms
Capsicum	Lanka Yellow wax	Nuwara Eliya	Helboda	Palagolla	25 farms
		Monaragala	Thelulla	Kuda Oya	24 farms
Long beans	Panduru Polon, Sena, DS-1, Bushitavo, Wal polon, Hawari, HORDI Diga	Puttalam	Palakuda	Daluwa	27 farms
		Moneragala	Thanamalwila	Soori-ara (Rohanapura)	25 farms

Source, HARTI survey in 2012

1.4.4 Time Frame

Field data was collected during November and December in 2012. Year 2012/2013 or 2011/2012 *Maha* were used as the reference period for data collection.

1.4.5 Problems and Limitations

Locations selected for the sample survey was limited to two locations from two major growing districts of each crop due to time and resource limitations. As a result, the findings cannot be generalized to other districts that were not selected.

Identification and matching some varieties used by farmers with the DOA varieties was a significant constraint on some occasions because of the considerable change of the original characteristics of the DOA varieties due to their continuous cultivation and farmers using local names to identify them. In those instances it was attempted to get assistance of the AIs to identify them. But it was also unsuccessful on some occasions due to different names being given to each variety by farmers.

CHAPTER TWO

Literature Review

2.1 Introduction

This chapter reviews the literature on the importance of technological adoption in development of agriculture and factors influencing the adoption of agricultural technology. The objective of the review was to identify possible factors influencing adoption of varieties concerned under this study.

2.2 Literature Review

According to the available information, changes in agricultural technology have always been an important component in the progress of human societies since the beginning of recorded history. It has become further important under modern agriculture (Huang *et.al*, 2004). According to IFAD (www.ifad.org), among many factors contributing to the increase of agricultural productivity, technology is the most important. Hence, introduction of agricultural technology to farmers is one way of improving agricultural productivity in particular and rural livelihood in general (Doss, 2003). According to Feder *et.al*. (1985), new technology also provides opportunities to increase production and income substantially. Successful adoption of technology can also be a powerful force in reducing poverty (De Janvry *et.al*, 2002). Without adoption of new technology agriculture sector becomes stagnant.

Adoption and diffusion of technology are two interrelated concepts in which prevail the decision to use or not to use and the spread of a given technology among economic units over a period of time. Adoption commonly refers to the decision to use new technology or practice by an economic unit on a regular basis. Diffusion often refers to spatial and temporal spread of the new technology among different economic units (Rogers, 2003).

The level of adopting technology can be identified under three parameters. One is adoption rate that can be measured by the percentage of farmers using a particular technology on a continuing basis. The other one is the degree of adoption that can be measured by the extent of land under new technology (new crop variety). Another one is intensity of adoption that can be maesured by amounts of modern inputs used per unit area (IFAD).

There are many factors that influence adoption of new technologies (Martin and Warr, 1994). According to Griliches (1957) and Mansfield (1961) the rate of adoption of a technology is a function of the extent of economic merits (profitability) of the

technology, the amount of investment required to adopt the technology and the degree of uncertainty associated with it and availability of the technology. Gutkind and Zilberman (1985) explain that there is a tendency among large farmers to adopt them earlier as they have the advantage over smaller farmers in most of the determining factors mentioned above, e.g. better access to education, information and credit.

"Many adoption studies indicate that there is a great variation in the speed of technology diffusion. It has been argued that potential adopters' perceptions of the attributes of the new technology affect the speed with which that technology is adopted. A study by Rogers (1983) identified five characteristics of innovations that have an impact on the speed of adoption. Those characteristics of innovations included: relative advantage, compatibility, complexity, divisibility and observability. Another study by Supe (1983) added two more attributes that affect the rate of adoption: variations in the cost of adoption and group action requirements of the technology" (*Abera, 2008)*

Of the above characteristics, relative advantage is considered the one with the strongest effect on the rate of adoption. The relative advantages can be subdivided into economic and non-economic categories. The economic categories are related to profitability of the technology while the non-economic categories are related to conditions such as saving of time and increase in comfort. The higher the relative advantage the higher the adoption (*Abera, 2008*) .

The compatibility of a technology indicates the degree to which that technology is consistent with the existing social values, cultural norms, experiences and needs of the potential adopters. Hence, compatibility of a technology also plays a key role in influencing the speed of adoption (*Abera, 2008*).

Byerlee and Hesse de Polanco (1986) have examined the relationship between the rates (speed) of adoption of technologies and various economic factors. Their study has shown adoption pattern of a particular technology is a function of five characteristics such as profitability (e.g. availability of better prices), risklessness (e.g. availability of favorable rainfall), divisibility of initial capital requirement, complexity and availability (e.g. availability of sufficient amount of seeds of the newly introduced variety).

According to Battharai *et.al* (2009), levels and types of agricultural support given by government also have important effects on the development and adoption of new technology, and eventually impact on technological change. As further explained by them, technological change is more of local specific, largely affected by variations in economic, social and institutional settings; and so the process of institutionalization of new technology in one place is different from another. According to the same authors, the conventional wisdom regarding constraints for rapid adoption of new technologies

are lack of credit, limited access to technological and market information, inadequate holding of farm-size, insufficient human capitals, chaotic supply of complementary inputs, and inappropriate transportation infrastructure.

According to Chi (2008), who conducted a study on the factors affecting the adoption of rice technology such as IPM row seeding, certified seed and new rice varieties, harvesting machines; farmers'perception about technologies, knowledge level of extension staff, method of organization and management of the extension programme and physical condition of the area are the main factors instrumental in the adoption of technologies. As explained further, low education, low perception, lack of capital, small land, bad infrastructure and limited capacity of extension staff have led to low technology adoption.

According to Ghadim and Panell (1999), majority of research on adoption of hybrid corn in the USA has indicated three types of factors that impact on adoption or rejection of technology. Those belong to socio-economic elements, farm characteristics and policy factors. As Mariyono *et.al* (2009) have cited in their study, "Factors affecting adoption of chillie crop in Central Java", farmers' socio-economic characteristics, education level, assets position, access to credit, and access to communication are very important factors that are decisive in adoption of technology. Summarizing recent literature about the technology adoption in agriculture Doss *et.al* (2003) indicated that there are differences in determining factors for adoption between poor (small) and large farmers. Although education, farm size and frequency of contacts with extension staff are significant factors for poor farmers, they are not so significant for large farmers.

Explaining about the major factors influence on adoption of new hybrid rice technologies in Thailand, Ruttan *et.al*. (1987) have pointed out profitability, experience, education, and credit as important. Concerning the nature of adoption of technologies, some scientists have expressed their opinion about the adopting of a whole package while others have expressed about a stepwise adoption approach. On the other hand, there are early as well as late adopters. According to those studies, the majority of early adopters are younger, more educated, venturesome, and willing to take risks while the late adopters are expected to be older, less educated, conservative, and not willing to take risks (Rogers, 1983).

CHAPTER THREE

Adoption of Maize Varieties Developed by the Department

3.1 Introduction

In this chapter, attention is paid to farmers' adoption of department introduced three maize varieties–Sampath, Ruwan and Badra. Mailagaswewa located in Galenbidunuwewa Agrarian Development Center (ADC) area in the Anuradhapura district and Hulannuge located in Lahugala ADC area in the Ampara district were the selected study locations for this analysis. Both the study locations are in the Dry Zone where maize was grown in the *Maha* season under rain fed conditions, but in Mailagaswewa agro wells were utilized marginally to provide supplementary irrigation facilities (only by 7% of the farmers).

In both study locations majority of farmers (88%) have grown maize mainly for marketing purposes (Table 3.1). Hence, they had grown maize in substantially large lands. According to the survey data, 70% of the operational maize farm lands in both study locations were two acres or above while 24% of operational lands were within 5 to 10 acre category. This picture did not change much when each location was taken separately, e.g. in Mailagaswewa, as much as 79% of maize lands were two acres or above while only as much as 60% of maize farm lands in Hulannuge belonged to that category. In both locations maize is grown in chena type of lands that are used for cultivation annually.

Table 3.1: Main Purpose of Cultivation

Purpose	Mailagaswewa (N=28) %	Hulannuge (N=25) %	Both (N=53) %
Marketing	97	79	88
Consumption & Marketing	3	21	12
Total	100	100	100

Source, HARTI survey in 2012

Table 3.2: Operational Land Size

Land Size (Acres)	Mailagaswewa (N=28) %	Hulannuge (N=24) %	Both (N=52) %
0-1	-	8	4
1-2	21	32	26
2-5	50	40	45
5-10	29	20	25
Total	100	100	100

Source: HARTI Survey in 2012

3.2 Awareness and Adoption

Discussions with the Agricultural Instructors in the relevant study areas revealed that they had been continuously making farmers knowledgeable about maize varieties released by the department through training programmes for which area farmers were selected on ad hoc manner. Farmers' awareness regarding DOA maize varieties was concerned and only one third of the maize farmers' sample knew varieties such as Sampath, Ruwan and Badra (Table 3.3). But, the farmers' awareness of each maize variety changed according to location. For example, as many as 68% of the farmers in Mailagaswewa had known about Sampath and no farmer in Hulannuge had been aware of it. Similarly, as many as 68% of the farmers in Mailagaswewa had known about Ruwan and only 12% of the farmers in Hulannuge knew about it. However, the percentage of farmers knew about the Badra variety was largely similar in the two locations, e.g. 36% of the farmers in Mailagaswewa and 44% of the farmers in *Hulannuge* knew about it.

Table 3.3: Farmers who were Aware of Maize Varieties Developed by the DOA

Variety	No of farmers known		
	Mailagaswewa (N=28) %	Hulannuge (N=25) %	Both (N=53) %
Sampath	68	0	31
Ruwan	68	12	35
Badra	36	44	34

Source: HARTI survey in 2012

Even though a limited number of farmers knew about maize varieties developed by the department, in the two study locations no one had adopted them during the year concerned. Research revealed that main reasons for non adoption of DOA maize varieties were attraction towards the imported hybrid varieties due to higher productivity and higher income that could be derived by adopting them than by adopting local hybrid (Sampath) varieties. Certain other advantages of adopting the reference imported hybrid varieties are provision of necessary inputs, extension advice and marketing facilities free of charge or at subsidized prices or on easy terms for the stakeholders involved in promoting them.

According to the study results, all the farmers in the sample have adopted imported hybrid maize varieties (table 3.4). Out of those, Pacific 999 (65%) and Pacific 984 (46%) were more popular. Pacific 999 was the most popular variety in Mailagaswewa indicating an adoption rate of 96% while Pacific 984 was the most popular at Hulannuge indicating a 48% of adoption. Unlike in Mailagaswewa and Hulannuge farmers had adopted more imported varieties other than Pacific varieties. Those were Rambo 2, TF 222, Jambo, CP 808, American (30Y 87).

Table 3.4: Varieties Adopted by Farmers

Variety	Milagaswewa (N=28) %	Hulannuge (N=25) %	Both Locations (N=53) %
Pacific 999	96	32	65
Pacific 984	42	48	46
Rambo 2	0	16	8
TF 222	0	8	4
Jambo	0	8	4
CP 808	0	4	2
American (30Y 87)	0	4	2

Source: HARTI survey in 2012

In both locations, extent of adoption (Table 3.5) of Pacific 999 was still prominent indicating 51% of the area of maize fields. As much as 67% of the area of maize in Mailagaswewa was under the same. The extent under Pacific 984 was 37% in both locations, but 44% in Hulannuge. The extent under other varieties was less than 10% except Rambo 2 which was recorded as 16% at Hulannuge.

Each of these imported variety had their own specific characteristics to attract farmers. The table 3.6 indicates the characteristics/reasons for farmers (who adopted) to select each of the variety. According to farmers, the most important characteristics for them to adopt imported hybrid varieties, especially Pacific 999 (for 100% of the adopted

farmers) and Pacific 984 (for 79% of the adopted farmers) were high yield and higher income. Some farmers who had grown Jumbo and Rambo varieties also have mentioned the same reasons for adopting them.

Table 3.5: Extent of Adoption of Each Maize Variety

	Milagaswewa (N=28) %	Hulannuge (N=25) %	Both Locations (N=53) %
Pacific 999	67	25	51
Pacific 984	33	44	37
Rambo 2	0	18	7
American (30Y 87)	0	2	1
TF 222	0	8	3
Jambo	0	3	1
CP TF 808	0	1	0
Total	100	100	100

Source: HARTI survey in 2012

As revealed by key informant interviews with farmer leaders in Milagaswewa and the discussions with individual farmers in the same locations, the average yield of Pacific varieties was 3000 - 3200 kg./ac. and the figures given by farmers at Hulannuge was above 4000 kg./ac. (Pacific 999- 4500 kg./ac. Pacific 984 - 4200 kg./ac. Rambo 2- 4200 kg/ac. and CP 808- 3800 kg./ac.). Thus the yield of imported varieties is higher than DOA hybrid varieties which will yield around 1700 kg./ac. (Sampath 1600 kg./ac. and Ruwan 1800 kg./ac.), according to the farmers.

Higher market demand for particular imported variety is another factor which encouraged more farmers for cultivation of the same two varieties, Pacific 999 (47% farmers responded) and Pacific 984 (46% farmers responded) as well as Rambo and Jumbo varieties. As revealed by farmers in Galenbidunuwewa, there are many companies willing to purchase maize and some of them give more preference to Pacific varieties, e.g. outlets of Prima Company and those involved in purchasing of maize. But, at Hulannuge in Ampara, the farmers' response was that the companies and outlets were involved in purchasing maize, all the varieties regardless of a particular variety. According to farmers (3% of farmers adopted Pacific 999 variety and 25% farmers adopted Pacific 984 variety), there is a good demand for Pacific variety to make steamed maize. According to farmers in Milagaswewa, average net income from Pacific varieties was around Rs.74,000/ac (after reducing the operational cost). Further, average net income that can be obtained from the Sampath variety was Rs.36,000/ac (in both cases family labour is excluded which is around 40 days). Average cost of production for

Pacific is Rs 37,000 /ac and Sampath Rs.23,200 /ac, excluding 45 days of family labour. Resistance to pest and diseases is another reason for the farmers (nearly about two third farmers in the sample) to adopt this variety. Characteristics of growth habit such as well grown leaves of Pacific 984 to protect the pods from birds, pods turning towards the ground to protect from rain were appreciated by farmers.

Table 3.6: Characteristics / Reasons for Adoption of Imported Hybrid Maize Varieties

Characteristics / Reasons	Variety	
	Pacific 999 (n=34) %	Pacific 984 (n=24)%
High yield /income	100	79
High demand	47	46
Resistance to pest and diseases	21	17
Suitable to climatic conditions	3	4
Good characteristics of growth habit	9	13
Other	0	17
Sufficient availability of imported seeds at an affordable price	3	8
Ability to be used for consumption as boiled maize	3	25
Ability to be stored for longer time	15	8

Notable: The totals of percentages do not equal to 100 as some farmers have responded to more than one option

Source: HARTI survey in 2012

Factors such as the non availability of varieties in the market, having no experience about other varieties, have made the farmers use the referenced importe varieties.

According to key informant discussions and field observations, there are many field workers appointed by seed importing companies to visit farmers individually and provide them advice to encourage them towards adopting their varieties. The companies also provide easy access to seed, fertilizer, chemicals, other inputs. Therefore, farmers tend to adopt imported hybrids. Seed supply is being done through seed traders, other input suppliers, field workers of such companies and local collectors and traders of maize. The field workers bring the seeds to the farmers' doorstep. The availability of imported varieties at different points has assured the farmers to access them easily. The distribution of seed samples in small packets to farmers by field workers is a good opportunity for farmers to experience the benefits of imported seeds.

According to the observations of the research team, involvement of some NGOs to encourage farmers to grow high yielding imported maize varieties is another important

reason to expand adoption of imported maize varieties. For example, World Vision in Milagaswewa since the end of 1990s has been encouraging farmers to grow imported maize varieties by conducting demonstrations and purchasing farmers' produce. This has been a reason to establish maize cultivation as a large scale commercial venture[1]. Under the intervention of the Ministry of Agriculture to promote *One Crop Under One Village* programme, Plenty Foods Company had provided 5 kg of Pacific seeds to farmers in the same location on agreement to deduct the value from the price paid to products when purchasing them from farmers.

There also have been reasons (Table 3.7) for farmers to be discouraged in adopting DOA introduced maize varieties. One of the major reasons for poor adoption of such varieties was their comparatively low yield and low income derived. Over 40% farmers in the reference category mentioned this with regard to Sampath and Ruwan varieties while 24% of farmers mentioned it in relation to Badra. According to the DOA itself, the average yield level of Badra and Ruwan is 1660 kg/ac and 1740 kg/ac respectively which is very much less compared to Pacific varieties. Further, unavailability of varieties was another issue that led to the poor adoption (20% of the reference farmers on all three maize varieties). There were some farmers who wanted to use the DOA varieties but unavailability was a problem. According to ARPAs and FO leaders in Hulannuge, many farmers of that area were exposed to a demonstration of Badra variety by the DOA and the farmers had understood that its yield was quantitatively high compared to other traditional varieties they practiced but there were no seeds available. The AI in Galenbidunuwewa also confirmed the gravity of the same problem. According to his views, it was impossible to encourage farmer further through more demonstrations due to this issue. On the other hand, Seed and Planting Material Development Center (SPMDC) emphasized that they were ready to supply the farmers' requirement but the supply at the time was only limited due to the demand. This revealed that the expansion of adoption has to be done taking action simultaneously to encourage more farmers to adopt DOA varieties (by increasing their knowledge about those varieties) and also to expand seed production required involving the farmers who adopt them.

Not having seeds up to end of the cob is also a factor mentioned by a considerable percentage of the reference farmers (for Ruwan 23% and for Sampath 16%) for not adopting the department varieties. The farmers observed that all the imported varieties contained seeds up to the end of the cob.

Comparing with some imported varieties farmers had identified problems during growth of some department varieties such as the size of the plant and its poor growth, small size of seeds, lengthy period taken to give yield, and the existence of unproductive

[1] .The World Vision has established a purchasing center at Milagaswewa to purchase the maize produced by village people.

plants. Susceptibility to pests and diseases especially with regard to Badra (stem and pod borer diseases) was another issue (14% of farmers did not use it). Low demand especially regarding Ruwan (23% of the farmers) was also a problem and was observed in Galenbidunuwewa.

Another reason for not adopting (38%, 22% and 14% of the reference farmers regarding respectively Badra, Sampath and Ruwan) were lack of experience about these varieties. The extension staff in Galenbidunuwewa area has confirmed this and the fact that the local hybrid varieties also give out a better yield compared to the traditional varieties, but the farmers were not given an opportunity to experience.

Table 3.7: Reasons for Non Adoption of Maize Varieties of the Department by Farmers

Reasons	Sampath No. Responded %	Ruwan No. Responded %	Badra No. Responded %
Low yield / income	42	45	24
Susceptible to pest and diseases	0	0	14
Low demand	5	23	10
Problems of growth habit	11	14	10
Unavailability of seeds	21	18	19
Not having seeds to the end of the cob	16	23	0
Other	22	14	38

Source: HARTI survey in 2012

3.3 Problems

Though high quality imported varieties are there, same varieties are not consistently available in the market as the leading seed producing companies continuously produce and test new in markets such as Sri Lanka, targeting highly competitive large markets. The rate of price change in such quality varieties is very high and farmers cannot afford them. The research team also observed a considerable variation in the price of the same variety in different locations in the country. For example, a packet of Pacific 984 seeds of 5/kg was Rs.5,200/- in Milagaswewa in Anuradhapura, but it was Rs.7,500/- in Hulannuge in Moneragala (during *Maha* season 2012), which is a difference of Rs. 2,300/- . Declining the productivity after cultivation of maize in the same land over a number of years is another problem and as a result some farmers had understood that cultivation of local varieties was better to have a higher yield than cultivating imported varieties at a higher cost. Some farmers in Hulannuge who could not afford the

imported seed prices, already moved to cultivating local seed varieties. Under the existing circumstances it is more advisable to encourage farmers to grow the DOA hybrid varieties which do not cost that much for seed and other agronomic activities. In line with that, the following issues were identified with regard to DOA seed varieties.

1. Majority of the farmers in the sample selected for maize were not aware of the DOA maize varieties. Even those who knew about the DOA varieties were of the view that their yield level was very low.

2. Although people were interested in adopting some of the DOA varieties such as Badra, unavailability of sufficient quality seeds was a problem for them to adopt them. Hence, ensuring availability of sufficient quality seed and farmers' access to them is a necessary requirement to promote those varieties

3. Farmers were reluctant to adopt DOA varieties such as Badra due to stem and pod borer diseases. Hence there is an urgent need to further improve the varieties' degree of resistance to diseases.

3.4 Recommendations

1. To promote DOA maize varieties, it is a must to increase the farmers' awareness by convincing them about their yield levels especially by way of comparison of DOA and other varieties.

2. Convincing of the farmers on obtainable yield levels of the DOA maize varieties can be done through providing opportunities for the farmers to experiment by themselves, by providing seed samples.

3. There is a need for local high hybrids to compete with imported hybrids. Thus, attention has to be paid to develop high yielding maize varieties with characteristics such as fully filled cobs with grains and high resistance to diseases etc.

CHAPTER FOUR

Adoption of Chili Varieties Developed by the Department

4.1 Introduction

The farmers' adoption of department introduced chilli varieties–,KA-2, MI-2, MI- Green and Galkiriyagama variety — are considered in this chapter. Kukulkatuwa*,* located in Ranorawa ADC area in the Anuradhapura district was one of the chilli cultivating villages selected for this study and there chilli was grown in chena lands in the *Maha* season under rain fed conditions. The other village selected was Panei-adiya in Palakuda ADC in the Puttalam district and there chilli was grown on highlands under irrigated conditions using tube well water. As there was a year round cultivation system in this area, it was impossible to find a clearly demarcated season of cultivation, but farming activities were operated in three or four seasons under crop rotation. For example, in Kukulkatuwa after completion of chilli cultivation in *Maha* season, cowpea was grown along with pumpkin as a mixed crop.

Operational size of 64% chilli lands in both locations were within one acre or above (table 4.1), though that percentage was more or less different in each study location, e.g. in Kukulkatuwa only 58% of operational lands belonged to that category while in Panei-adiya as much as 81% of operational lands belonged to the same category. Discussions with key informants and farmers revealed that farmers in Kukulkatuwa used to operate comparatively large chilli lands (about 5 acre per farmer) in chena cultivation earlier, but by the time of the survey chilli cultivated area had decreased. This was due to the intention of increasing the area cultivated with black gram and green gram which have a better market with the end of the war. However, the farmers in Panei-adiya had been continuously operating bigger chilli lands as they have had a better opportunity to sell their products to nearby Norochcholai Dedicated Economic Center at a better price. Further chilli was mainly grown for marketing (commercial) purpose by all the farmers in both locations (Table 4.2). The farmers are used to sell their harvest as green chilli and no attempt is made to produce dried chilli as they cannot compete with the price of imported dried chilli arriving from India.[2]

[2] As expressed by farmers they have to sell their dried chilli product above Rs.180/- per kg. to gain profit as their cost of production is so high. But Indian dried chilli comes into country at Rs.150.00 per kg. (CIF price). Therefore competing is made impossible.

Table 4.1: Operational Land Size

Land Size (Acres)	Kukulkatuwa (N=26) %	Panei-adiya (N=29) %	Both (N=55) %
>0.75	11	05	08
0.75-1	31	14	28
1-2	46	57	48
2-5	12	19	14
5-10	0	05	02
Total	100	100	100

Source: HARTI survey in 2012

Table 4.2: Purpose of Cultivation

Purpose	Kukulkatuwa % (N=26)	Panei-adiya % (N=29)	Both (N=55) %
Marketing	100	100	100
Seed Production	0	0	0
Consumption	0	0	0
Consumption & Marketing	0	0	0
Total	100	100	100

Source: HARTI survey in 2012

4.2 Awareness and Adoption

The majority of farmers in the sample had known about some of the DOA chilli varieties such as KA-2 and MI-2 (table 4.3). For example, 87% of farmers in the whole sample had known about KA-2 while 76% of the farmers had known about MI-2 which was formerly more popular. But very few farmers (2%) knew about Galkiriyagama Selection while none of them knew about MI-Green. Farmers' awareness about DOA chilli varieties in different study locations indicated a different picture. For example, in Kukulkatuwa, all the farmers (100%) had known about KA-2. Only 76% of the farmers in Panei-adiya had known about it. The farmers' awareness about MI-2 was somewhat similar in both locations; respectively 77% and 76% in the Kukulkatuwa and Panei-adiya.

Table 4.3: Farmers' Awareness about DOA Chilli Varieties

Variety	Percentage of Farmers who are Aware		
	Kukulkatuwa (26) %	Panei-adiya (29) %	Both (55) %
KA-2	100	76	87
MI-2	77	76	76
Galkiriyagama[3] Selection	4	-	4
MI- Green	0	0	0

Source: HARTI survey in 2012

The farmers' adoption of DOA varieties (Table 4.4) was very less in the whole sample. For example, only 27% of the farmers who were aware of KA-2 had adopted it and the picture of adoption of KA-2 was different between the two study locations, e.g. 58% of the Kukulkatuwa farmers who were aware of KA-2 had adopted it while no farmer at Panei-adiya had adopted. In Kukulkatuwa 7% of the sample farmers who were aware about MI- 2, only 12% had adopted. Galkiriyagama Selection (4%) was known among a limited number of farmers (as this variety has been recommended only for the North Central Province, farmers' awareness was checked from Kukulkatuwa). None of them had adopted it.

Table 4.4: Adoption of Chillie Varieties of the Department by Farmers

Variety	Percentage of Adopted Farmers from Known Farmers		
	Kukulkatuwa %	Panei-adiya %	Both %
KA-2	58	0	27
MI-2	12	3	07
Galkiriyagama Selection	0	-	0
MI- Green	0	0	0

Source: HARTI survey in 2012

Traditional (local) chilli variety called *Haen (Bandi) Miris* was widely adopted at Kukulkatuwa (73% of the sample farmers in Kukulkatuwa and no one had adopted that variety in Panei-adiya) (Table 4.5) where farming was still traditional while imported hybrid chilli varieties were broadly adopted at Panei-adiya where farming was highly commercialized. Further, as much as 90% of the sample farmers in Panei-adiya had adopted *Wijaya* variety, but none in Kukulkatuwa had adopted it. In addition, smaller percentages of the farmers at Panei-adiya had adopted some other imported varieties such as Royal Hot (3%), Lanka Hot (3%), Sky Hot (3%) etc.

[3] Farmers' awareness about this variety was examined from Kukulkatuwa only as this variety has only been recommended for the North Central Province.

Table 4.5: Adoption of Traditional and Imported Chilli Varieties by Farmers in the Whole Sample

Varieties	Farmers' Percentage		
	Kukulkatuwa (26)	Panei-adiya (29)	Both locations (55)
Haen (Bandimiris)	46	0	22
Wijaya	0	84	38
Super -874	0	3	5
Royal hot	0	3	1
Lanka hot	0	3	1
Sky hot	0	3	1

Source: HARTI survey in 2012

Regarding the intensity of adoption of DOA varieties, other varieties were also similar to the adoption rates of each variety by the sample farmers in the whole study area and each study location. *Wijaya* was the prominent chilli variety that occupied 38% of the chilli cultivated area of the study (and its prominence was higher in Panei-adiya where 84% of the chilli cultivated area). Then KA-2 covered 24% of the chilli cultivated area and prominence in Kukulkatuwa was higher (40% of the chilli cultivated area). Traditional chilli variety called "*Hean miris*" (*Bandi)* is the other popular variety that covered 22% of the cultivated area, however, that was grown only at Kukulkatuwa (46% of the chilli area). Then MI-2, one of the department varieties was prominent (5%) and in Kukulkatuwa it was more prominent as it covered 11% of the chilli cultivated area of the sample farmers. In Panei-adiya, cultivated area of other imported varieties such as Super-874, Royal Hot, Lanka Hot and Sky Hot was equal.

Table 4.6: Intensity of Adoption by each Chilli Variety

Chilli Variety	Proportionate in each Location		
	Kukulkatuwa %	Panei-adiya %	Both Locations %
DOA varieties			
KA-2	40	0	24
MI-2	11	1	5
MI-1	3	0	1
Other varieties			
Haen (Bandakka)	46	0	22
Wijaya	0	84	38
Super -874	0	3	5
Royal hot	0	3	1
Lanka hot	0	3	1
Sky hot	0	3	1
Total	100	100	100

Source: HARTI survey in 2012

Table 4.7: Reasons for Non Adoption of Department Varieties

Reasons	KA 2 (n=31) %	MI 2 (n=37) %
Low yield / income	19	11
Susceptible to pests and diseases	45	8
Low demand	23	11
Problems of growth habit	74	57
Unavailability of seed	26	11
Need more labour for harvesting	48	41
Low pungency	16	3
Not suitable for drying	10	0
Inability to produce seed	6	0
Other	19	11

Source: HARTI survey in 2012

Table 4.7 presents the reasons for not adopting department varieties especially KA-2 and MI-2; Problems of growth habit (small and short pods compared to the growth habit of *Wijaya*), unproductivity and shortness of plants causing difficulties in harvesting, long duration taken for bearing pods and shedding flowers. According to farmers, when the pods are short and small more time is taken for packing and more labour is needed for harvesting, although some consumers prefer shorter pods. Hence, one of the important issues of the farmers with regard to KA-2 (48%) and MI-2 (41%) was the requirement of more labour for harvesting.

As much as 45% and 8% of farmers did not adopt KA-2 and MI-2 respectively because of susceptibility to pests and diseases and KA-2 is more susceptible to stem rot, root rot, leaf curl, virus, wilt and anthracnose especially in wet conditions. One reason for low adoption of the *Galkiriyagama Varanaya* in Kukulkatuwa was also its susceptibility for pests and diseases. Unavailability of sufficient quality seeds was also a problem with department seeds (26% farmers mentioned this with regard to KA-2 and 11% farmers on MI-2). Although the department seed distribution system is functioning, farmers experience difficulties in accessibility. There is no continous supply of quality assured seeds of the department. Especially in Panei-adiya in Puttalam district there is a greater demand for imported high breed chilly varieties with long and big pods.

KA-2 and MI-2 with comparatively small and short pods have a low demand (23% and 11% of farmers mentioned this with regard to KA-2 and MI-2 respectively). A considerable percentage of farmers (19% and 11%) have mentioned other reasons

including lower germination of seed, -mixed seed (availability of low quality seeds in the open market) and low experience, for their low adoption of KA-2 and MI-2 varieties.

According to the farmers, low yield and income (compared to imported hybrid varieties) with respect to KA-2 and MI-2 (19% and 11% farmers respectively) were reasons for not adopting them. For example, the yield of KA-2 at Panei adiya was 7,000 kg/ac while *Wijaya* (imported hybrid variety) yields 10,000 kg/ac. in the same location. The per acre net income of KA-2 and *Wijaya* was Rs.385,000 and Rs.585,000 per acre (after deducting the operational cost excluding family labour) respectively. Cultivation of *Wijaya* was comparatively profitable and could obtain a 34% higher income.

Based on information obtained from sample farmers (Table 4.8), focus group discussions, key informant interviews as well as field observations, the study team examined the reasons for adoption of different chilli varieties (local and imported hybrid) in each location. The identified reasons were yield levels, high or low demand for the crop, their degree of resistence to diseases, their suitability to available agro-ecological conditions and availability of other necessary facilities such as extension advice, input supply, infrastructure and marketing. Accordingly, KA-2 could grow well in Kukulkatuwa under existing ecological conditions although heavy rain causes various diseases (Table 4.7).

Along with KA-2, cultivation of *Haen miris* under chena farming was very popular (53% of the farmers practiced *Haen miris*) as *Haen miris* is tolerant to heavy rain and various pests and diseases (89% of farmers mentioned it as the reason for cultivating it). Farmers benefit from each variety when cultivated in the appropriate weather condition. For example, the yield of KA-2 is higher compared to MI-2 and *Haen miris*; (KA-2 - 1500 kg/ac at Kukulkatuwa under less use of inputs and 10,000 kg per acre at Panei Adiya under better use of inputs) and *Hean miris* yielded 1,000 kg/ac at the same locations under normal level of using of inputs. Comparatively KA-2 is of high quality and could be harvested early (within 3 months) and easily as pods are bigger compared to *haen miris*. The harvesting period was shorter and this was a relief for the farmers who grow crops in chenas under threat of wild animals. As the pod is bigger than *haen miris,* less labour is required for its harvesting. Green chillie of KA-2 had a better demand as it was of better quality; all pods were same in size, the colour lasts long and fresh since harvesting (40% of the KA-2 adopted farmers also mentioned about their high demand). *Haen miris* also produces a high yield, but to complete the harvest it takes a long period and much labour was required to harvest as fruits were very small and mixed with a number of varieties. The demand for *Haen miris* was lesser than KA-2 (Rs. 5 was lesser than KA-2) because there was no uniformity and could not be kept for long in the market without being spoilt. However, a number of reasons inspacted the adopting of *haen miris* including the ability for producing seeds (26% of the farmers mentioned) and

using it as green chillie (11% farmers) and also possibility of making dry chillie (21% farmers).

Table 4.8: Reasons for Adoption

Reasons	KA-2 (n=15) %	MI-2 (n=4) %	*Haen (Bandi)* (n=19) %	Vijaya (n=26) %
High yield / income	80	100	53	88
Resistant to pest and diseases	7	25	89	12
High demand	40	0	16	50
Suitable to climatic conditions	0	25	53	4
Good characteristic of growth habit	60	50	16	54
Ability to produce seeds	7	0	26	0
Easy to harvest	7	0	5	15
Used as green chillie	0	0	11	4
Used as dried chillie	0	0	21	0

Source, HARTI survey in 2012

Kukulkatuwa, was located in an isolated area (18 miles away from the Anuradhapura-Puttalam road) and famous for chena farming. Chilli is cultivated there to be supplied to local traders depending on traditional input supply system through local boutiques. Panei Adiya was a very dynamic location that produced chillie for the Norochcholai Economic Center located closeby. In this area, farming was highly commercialized with the use of modern agricultural technologies under better marketing facilities. Other input supply facilities were amply available via the involvement of private sector stakeholders like seed firms and traders. Under these circumstances Nawakkadu farmers highly preferred to adopt *Wijaya* variety to produce green chilli. Discussions with wholesale traders at Norochcholai Economic Center revealed that there is a high demand for long larger fruits due to customer preference. *Wijaya* variety, which was imported from India, was more preferred due to useful characteristics (Table 4.8) such as high yield (88%), high demand (50%), good growth habit (54%). These growth habits are long fruit, early harvest, high number of harvesting occasions, uniformity of pods from the beginning to the end of the harvesting period, spread of more branches, high growth and convenient harvesting and existence of big fruits and tall trees (15%). For the high popularity of *Wijaya* variety at Panei-adiya in addition to the inherent characteristics of that variety; the farmers' better access to market infrastructure, input supply and extension advice had contributed. The seeds, extension advice etc. were provided to farmers' doorstep by the representatives of the seed importing companies.

The reasons for adoption of MI-2 in a considerable extent in Kukulkatuwa were higher yield/better income compared to *hean miris*, lower susceptibility to pests and diseases etc.

4.3 Problems

1. Even the farmers in major chilli growing areas as well as in other areas knew DOA chilli varieties and also showed their interest to adopt them. But non-availability of good quality seed was an issue faced by the farmers.

2. It was revealed that even under contract seed production programmes, when prices went up farmers used to sell their product as green chilli instead of keeping the harvest for producing seeds.

3. Lack of extension advice and pests and diseases were issues in adopting the DOA varieties; further, the number of families to be covered by AIs were many.

4. Scarcity of labour and high labour cost (Rs.8,000-1,200/ person/day) remain major problems so that they were considered as major factors by farmers in selecting a variety. For example, the large size of pods is a reason for selection of Wijaya in Nawakkadu.

4.4 Recommendations

1. The department should make arrangements to ensure that farmers have access to quality seed at real prices through Agrarian Development Centers.

2. The department has to take action to prevent farmers selling chilli as green chilli from the department contract seed growers by engaging in constant supervision with the help of *Krupanisas.*

3. Extension advice for the chilli farmers should be expanded via e-communication methods and also by arranging specific visits of the AIs regularly and in time to common places in areas where chilli is grown on large scale for commercial purposes.

4. The Department should develop high yield hybrid chilli as an alternative to imported hybrid chilli

CHAPTER FIVE

Adoption of Brinjal Varieties Developed by the Department

5.1 Introduction

Farmers' adoption of DOA introduced three brinjal varieties: *Amanda*, *Anjali* and HORDI *Lenairi,* is examined in this chapter. Two field locations were selected from two prominent brinjal growing districts. Illuppankadawala is a Dry Zone village in the Illukkulama GND in Elayapattuwa ADC area in the Anuradhapura district. The other was Udaperuwa GND in Kotabara ADC area in the Badulla district. This village has a cool dry climatic condition.

In Illuppankadawala, brinjal has been growing at least for the last 25 years and it was done in *Maha* season as a highland crop under rain fed conditions, but supplementary irrigation facilities were provided from agro wells available in every farmland. In this village commercial vegetable farming was the livelihood of almost all the families and brinjal was grown as a commercial crop. The other crops grown there were capsicum, chilli, tomato and cowpea.

Udaperuwa was also famous for growing of brinjal for commercial purposes a long time ago and the cultivation was done in *Maha* season in both highland as well as lowland (paddy land). Cultivation was based on rain water, but for lowland cultivation anicut water was also utilized. The other crops cultivated were chilli, tomato, maize, kurakkan, raddish, cabbage, bean and carrot.

The size distribution pattern of brinjal lands between two study locations indicates a completely different picture (5.1). For example, the majority of farmers in Illuppankadawala *(*64%) operated somewhat larger land parcels of 0.75-2 acres while majority in Udaperuwa (65%) operated very smaller land parcels of less than 0.5 acres. However, at Udaperuwa also there were a few farmers (12%) operating brinjal lands of the size of one acre and above. All farmers at Illuppankadawala were involved in brinjal cultivation mainly for commercial purposes while the number of farmers who cultivared brinjal for commercial purpose in Udaperuwa were 86% (Table 5.2).

Table 5.1: Operational Land Size of Brinjal Farmers

Land Size (Acres)	Illuppankadawala (N=25) %	Udaperuwa (N=26) %	Both Locations (N=51) %
>0.25	4	19	12
0.25-0.5	28	46	37
0.5-0.75	4	-	2
0.75-1	48	23	35
1-2	16	4	10
2-5	0	8	04
Total	100	100	100

Source: HARTI survey, in 2012

Table 5.2: Major Purpose of Cultivation of Brinjal Farmers

Purpose	Illuppankadawala (N=25) %	Udaperuwa (N=26) %	Both Locations (N=51)%
Marketing	100	86	93
Consumption and Marketing	0	14	7
Total	100	100	100

Source: HARTI survey, in 2012

5.2 Awareness and Adoption

Sample farmers' awareness of concerned varieties (Table 5.3) was very low. Percentage of farmers who knew about *Amanda* and *Anjalee* were 12% and 8% respectively and the level of awereness was similar in both study locations on both varieties. As much as 12% farmers in the sample had known about HORDI *Lenaeri* and their percentage was slightly more than twice (16%) at Illuppankadawala when compared to Udaperuwa (7%).

Table 5.3: Farmers' Awareness of DOA Brinjal Varieties

Variety	Percentage of Farmers who were aware		
	Illuppankadawala (N=25) %	Udaperuwa (N=26) %	Both Locations (N=51) %
Amanda	12	11	12
Anjalee	8	7	8
HORDI *Lena Eri*	16	7	12

Source, HARTI survey in 2012

The adoption of three varieties was low among the farmers in the study sample (Table 5.3). For example the adoption rate of Amanda was 17% and HORDI *Lenaeri* was 33%. None of them had adopted Anjalee. Adoption rates seem to be very low from the total sample and it was 2% for Amanda and 4% for HORDI *Lenaeri*.

However, adoption rate of HORDI *Lenaeri* has been higher than the above information provided by the farmers as different names are used. For example, according to the researchers, observations as well as the information provided by the Key informants in the area and the Assistant Director of Agriculture (ADA) in Badulla District, the popular brinjal variety adopted by farmers in Udaperuwa under the name "local variety" was a variety originated from HORDI *Lenaeri.* The farmers' adoption rate of that variety, (local variety), was 88% of the total sample while the adopted proportion of their lands was 80% of the brinjal cultivated area. Another 8% of the farmers at Illuppankadawala had adopted HORDI *Lenaeri* in the name of "*Lena Batu"*. Around 8% of the farmers at Illuppankadawala had adopted "*Thinnaveli*."

The proportion of adoption (intensity of adoption) of DOA varieties is of a lesser percentage than their adoption rates, e.g. Amanda 1% and HORDI Lenaeri 8% (including 2% of Lena batu) at Illuppankadawala (Table 5.5).

Table 5.4: Adoption of DOA Brinjal Varieties by Farmers

Department Varieties	Adopted Farmers		
	Illuppankadawala %	Udaperuwa %	Both Locations %
Amanda	33	0	17
Anjali	0	0	0
HORDI *Lenaeri* - 1	0	50	33

Source: HARTI survey in 2012

Imported hybrid variety "Raveena" was prominent (72%) in Illuppankadawala and intensity of adoption (Table 5.5) was 70% at Illuppankadawala .

In addition to the unawareness of the majority of farmers about the DOA developed brinjal varieties (Table 5.6) unavailability of seeds (with local seed traders) was another reason for non adoption. All farmers were aware of Amanda and Anjali varieties but had not adopted them and 50% of the farmers had known about HORDI Lenaeri but had not adopted it. Low yield level (20%) of Department varieties was also a reason mentioned.

Table 5.5: Adoption of DOA and other Brinjal Varieties by Farmers in the Whole Sample

Variety	Adopted Farmers		
	Illuppankadawala	Udaperuwa	Both Locations
	(No= 25) %	(No= 26) %	(N=51) %
Amanda	4	0	2
Anjali	0	0	0
HORDI *Lenaeri* - 1	8	0	4
Leena batu	4	0	2
Rathu Batu	4	0	2
Gam Batu	8	4	6
Heen Batu	4	4	4
Local variety	0	88	45
Thinnaveli	8	0	4
Raveena	72	12	41

Source, HARTI survey in 2012

Table 5.6: Intensity of Adoption

Brinjal Variety	Proportionate in Each Location		
	Illuppankadawala %	Udaperuwa %	Both Locations %
Amanda - 2005	1	0	1
HORDI *Lenaeri* - 1	6	0	3
Leena batu	2	0	1
Rathu Batu	3	0	2
Gam Batu	8	1	5
Haen Batu	1	2	2
Local	0	80	39
Thinnaveli	7	0	4
Raveena	70	17	44
Total	100	100	100

Source, HARTI survey in 2012

The yield of Amanda was 19,200 kg per acre while the yield of Raveena, one of the imported hybrid varieties, was 13,500 kg per acre. The farmers' preference to use imported hybrid varieties especially at Illuppankadawala and local popular varieties at Udaperuwa under prevailing circumstances in these locations also contributed towards not adopting the department varieties. These hybrid varieties fulfilled the farmers' requirements such as high yield, market demand and high income and these will be further illustrated in the next section.

Table 5.7: Reasons for Non Adoption

Reasons	Amanda (n=5) %	Anjali (n=4) %	HORDI Lenaeri (n=4) %
Low yield	20	0	0
Susceptible to pest and diseases	0	0	25
Unavailability of seed	100	100	50
Taking more time to harvest	0	0	25

Source, HARTI survey in 2012

As mentioned earlier, farmers at Illuppankadawala were highly commercialized and they used to supply brinjal to the Dambulla Dedicated Economic Center. Therefore they had to adopt varieties which had a better demand. Accordingly, they had adopted varieties such as Raveena (Table 5.5). They purchased seeds from famous agro input supply trade centers in Dambulla (eg. Sara Lanka) and from Tambuttegama and Anuradhapura during their daily visits to the Economic Centers and markets. According to farmers, major reasons for selecting Raveena (Table 5.7) were their high yield[4] levels and possibility of earning a high income[5] (76%), high demand[6] due to better taste and appearance (62%) and the characteristics such as quick harvesting and bigger size of fruit (38%). According to them, the variety is resistant to pests and diseases (19%). In Udaperuwa, reasons for popular adoption of local variety were possibility for self seed production (61%), better market demand due to better taste and appearance (65%), high yield/income, resistance to diseases (30%) etc. Therefore, it has a very high demand at Welimada as well as in Colombo wholesale markets.

Table 5.8: Reasons for the Adoption of Other Brinjal Varieties

Reasons	Raveena (n=21) %	Local variety (n=23) %
High yield/ income	76	39
Resistant to pests and diseases	19	30
High demand	62	65
Suitable to climatic conditions	10	17
Good growth habit	38	26
Ability to produce seeds	10	61
Low post harvest losses	0	9
Other	14	0

Source, HARTI survey in 2012

[4] The yield obtained by farmers at Illuppankadawala from Raveena was 13,500 kg per acre, but the yield level of traditional varieties was 9000 kg.

[5]. The per acre net income obtainable from Raveena was about Rs. 660,000/-(without a cost for family labour which is about 180 man- days per acre and this income was 50% higher than the net income obtained from traditional variety which was Rs. 440,000/- per acre

[6] The difference between the highest and the lowest prices between Raveena and traditional varieties were too apart, e.g. for Raveena it was between Rs. 120 and Rs. 25 / kg and for traditional varieties it was between Rs.60 and Rs.15 per kg

The high yield and demand, high profit, resistance to pest attack were some of the characteristics farmers expect from new varieties to be produced.

5.3 Conclusion

According to the farmers in Illuppankadawala, though they had received some benefits by adopting imported hybrid brinjal varieties they will face difficulties in near future. According to them, production cost is increasing while yield as well as profit is decreasing and environment gets polluted due to excess application of chemicals (farmers apply chemicals once a week for pests and diseases for Raveena). The farmers are interested in adoption of local varieties that need not incur a lot of expenses but return a reasonable profit. The DOA should take the opportunity to expand the adoption of the DOA varieties under existing circumstances for the benefit of farmers as well as the environment.

5.4 Problems

1. One major reason for less adoption of the DOA brinjal varieties was lack of awareness of farmers about the DOA varieties.

2. Although some farmers were aware of the DOA varieties and wanted to adopt them, they faced the problem of non availability of seeds.

3. The farmers in Illuppankadawala lack extension advice when they notice some diseases affecting their crops as they had no contact with AIs. Hence, they used to seek advice from agro input dealers in Dambulla.

5.5 Recommendations

1. To expand the adoption of the DOA brinjal varieties, it is necessary to increase farmers' awareness about the DOA varieties in major cultivation areas through training programmes.

2. Ensure easy access to seed for farmers by assuring the availability of perfect quality brinjal seeds of the DOA varieties at ASC centers and other agro seed suppliers.
3. Make arrangements to establish better contacts between farmers and extension staff by organizing farmers. It would be a better way not only for providing remedies for the issues of farmers' crops, but also for popularizing the DOA varieties among the farmers.

CHAPTER SIX

Adoption of Tomato Varieties Developed by the Department

6.1 Introduction

In this section farmers' adoption of the DOA introduced two hybrid tomato varieties: Maheshi and Bhathiya and three open pollinated varieties: Thilina, Lanka Sour and Lanka Cherri, is examined.

Two study locations selected were Damunugolla in Marassana ADC area in the Kandy District, and Labuhenvila in Mandaram Nuwara ADC area in the Nuwara Eliya district. Both represent upcountry hilly areas under cool climate. The livelihood of the great majority of the people in both villages is farming.

In Damunugolla tomato was grown in low lands (paddy fields) in the *Yala* season and in high lands (in slopes) in the *Maha* season. Both rain water as well as anicut irrigation facilities were utilized for cultivation. This location is well-known for tomato as it is one of the main crops grown there especially in highlands. The other main crops were beans, long beans, raddish and cabbages.

At Labuhenwila there were three seasons of crop growing under prevailed land utilization pattern. The terrace lands in slopes were utilized for cultivation of tomato and other upcountry vegetables in *Yala* (June to September) and in-between *Yala* and *Maha* (from October to January) . Paddy is cultivated in late *Maha* (February to May). Rain water as well as canal water was utilized for cultivation. Tomato was one of the main and popular vegetables cultivated. Other vegetable crops grown there were carrot, beet, raddish, cabbages and leeks.

The size of the majority of tomato lands of the sample farmers in both locations was 0.05 - 2 acre (65%) (Table 6.1), e.g. of the tomato lands under cultivation of the sample farmers, 56% in Labuhenwila and 74% in Damunugolla were within that size limit. However, about 1/20th of the tomato lands of the entire tomato sample farmers was within 2 acres and above, and as much as 36% of the farmers in Labuhenwila belong to that category.

Table 6.1: Operational Land Size of Tomato Farmers

Land Size (Acres)	Labuhenwila (N=25)%	Damunugolla(N=27)%	Both (N=52)%
>0.05	08	15	12
0.05-1	20	37	29
1-2	36	37	36
2-5	28	11	19
5-10	08	0	04
Total	100	100	100

Source, HARTI survey in 2012

According to the survey results, marketing was the main purpose of cultivating tomato by a great majority of the tomato farmers in both locations (Table 6.2), e.g. 89% at Damunugolla and 77% at Labuhenwila.

Table 6.2: Major Purpose of Cultivation of Tomato Farmers

Purpose	Labuhenwila (N=25)%	Damunugolla (N=27)%	Both Locations (N=52)%
Marketing	77	89	83
Seed Production	3	0	3
Consumption & Marketing	20	11	15
Total	100	100	100

Source, HARTI survey in 2012

6.2 Awareness and Adoption

Examination about the sample farmers' awareness of DOA tomato varieties indicated that (Table 6.3) majority of the farmers were aware of Bathiya (50%) and Lanka Sour (52%) while a lesser number of farmers knew about *Maheshi (*33%) and Lanka Cherri (12%). But more farmers knew about Thilina (67%), which was a DOA variety introduced earlier. However, this picture changes when the study locations are considered individually. For example, a large number of farmers were aware of Bathiya at Damunugolla (67%) while a lesser number of farmers knew about it at Labuhenwila (32%). Similarly, a large number of farmers at Labuhenwila knew about Lanka Sour (64%) while a less number of farmers at Damunugolla (41%). Maenwhile, all the farmers at Labuhenwila knew about Thilina (100%) while only a few at Damunugolla (33%).

Table 6.3: Farmers' Awareness about Department Tomato Varieties

Variety	Farmers' Awareness		
	Labuhenwila	Damunugolla	Both Locations
	(N=25) %	(N=27) %	(N=52) %
Maheeshi	36	30	33
Bathiya	32	67	50
Lanka Cherri	20	4	12
Lanka Sour	64	41	52
Thilina	100	33	67

Source, HARTI survey in 2012

Adoption of the DOA tomato varieties by the sample farmers indicates that (Table 6.4) no farmer had adopted all four department tomato varities: Maheshi, Bhathiya, Lanka Cherri and Lanka Sour, during the period of the study. However, Thilina had been adopted by all the farmers at Labuhenwila but not in the other location, Damunugolla. The intensity of adoption (Table 6.5) was 60% of the total cultivated area under tomato in Labuhenwila.

Table 6.5 indicates all other tomato varieties adopted by sample farmers in both study villages. Accordingly, majority of the farmers in the sample had adopted imported hybrid varieties. Among those varieties, Pathma (54%) and Glory (38%) were prominent. Pathma was equally adopted in both study locations while Golori was adopted only at Damunugolla (74%). Damunugolla which was more inclined to adopt imported varieties had adopted some imported varieties at minor scale (Eg. Redinese (8%), Nowa (3%)). Intensity of adoption of each variety indicated that Thilina (37%), Pathma (34%) and Glory (21%) were in that order.

Table 6.4: Adoption of the DOA Tomato Varieties by Farmers

Department Varieties	Adopted Farmers		
	Labuhenwila %	Damunugolla %	Both Locations %
Maheshi	0	0	0
Bathiya	0	0	0
Lanka Cheri	0	0	0
Lanka Sour	0	0	0
Thilina	100	0	48

Source, HARTI survey in 2012

Table 6.5: Adoption of Other Tomato Varieties by Farmers in the Sample

Variety	Percentage of Farmers Adopted		
	Labuhenwila	Damunugolla	Both locations
	(N=25) %	(N=27) %	(N=52) %
Pathma	56	52	54
Volcano	4	0	2
Glory	0	74	38
Redinese	0	7	4
Noah	0	4	2

Source, HARTI survey in 2012

Table 6.6: Intensity of Adoption of each Tomato Variety in Each Location

Tomato Variety	Proportion in each Location		
	Labuhenwila	Damunugolla	Both Locations
Tilina	60	0	37
Pathma	34	34	34
Volcano	5	0	3
Glory	0	56	21
Redinese	0	8	3
Noah	0	3	1
Total	100	100	100

Source, HARTI survey in 2012

One of the major reasons for not adopting many of the department varieties was unawareness. Except few varieties such as Thilina, Bhathiya and Lanka Sour, other varieties were not known by majority of the farmers. Even the level of awareness about these varieties was not similar in all locations, e.g. Thilina was known by all the farmers at Labuhenwila, but only 33% of the farmers knew about the same variety at Damunugolla.

Table 6.6 illustrates the reasons for not adopting the department varieties by farmers who had known about them. Accordingly, the main reasons for not adopting of Maheshi were insufficient knowledge and experience about the crop variety (35%), low yield (29%), unavailability of seeds[7] (18%) and susceptibility to pests and diseases such as damping off (*Hitu mareema*). Other reasons were ripening (maturing) all the fruits at the same time (6%).

6. Although some farmers prefered to purchase department seeds they found it very difficult to find them, especially certified quality seeds.
7. 7,920 Kg per acre

Reasons for non adoption of Bhathiya were not definite: 43% said it requires support sticks in addition to the small size of the fruits (27%) and susceptible to pest and diseases (16%) such as damping off and leaf curl disease. Other reasons were insufficient knowledge and experience about the variety (though the farmers had a cursory knowledge about them), unavailability of seeds and the high seeds cost (farmers used to utilize self prepared seeds or neighbouring farmers' seeds). The farmers growing specially the Thilina variety at Labuhenwila said the price of new seeds purchased from the department was high and some other reasons (12%) such as fruits becoming smaller and of low weight after a number of harvesting turns and being prone to physical damages as the outer cover is thin. Few farmers mentioned, low yield (8%); low demand (4%) and ripening of all fruits at the same time (4%) as the reasons.

Non adoption of Lanka Cherry and Lanka Sour was due to low demand (33% and 52 % respectively), insufficient knowledge and experience (33% and 7% respectivel) and lower availability of seeds (33% farmers with respect to Lanka Sour). The small size of the fruit (4%) was also an identified issue.

Table 6.6 indicates the reasons why farmers adopted different tomato varieties which include the department's as well as imported ones. In addition, discussions with key informants, small farmer groups and the field observations revealed that in selecting varieties, farmers always compare each other. In these comparisons in addition to the inherent characteristics of the varieties, they consider the suitability of those varieties to the agro-ecological conditions of their areas and other available push factors for cultivation such as marketing facilities and access to necessary inputs and other services.

Farmers mentioned that one of the major reasons for adoption of Thilina was its high yield[8] (92%). Further, long period of harvesting that provides opportunity of harvesting for about 15- 20 times, high weight of the fruits and uniform size of the fruits during the whole harvesting period are the positive characteristics of that variety. According to 24% of the farmers, Thilina was resistant to pests and diseases such as dumping off, bacterial wilt and leaf curl and there were low post harvest losses (28%) due to thick outer cover of the fruit. The other major reasons for farmers' preference were high market demand (16%) due to the shape and colour and also its ability in self-seed production (16%). These two reasons impacted greatly for the popularity of this variety especially at Labuhenwila. Many of the local seed firms try to purchase matured Thilina tomato to produce seeds.

[8] The yield level of Pathma variety was 6,000 g per acre

Some of the good characteristics of the growth of the tree (8%) were quick maturing and low branching (4%) which provides the opportunity to tie the tall tree to the support stick in limited places. Those were also cited as the reasons for its adoption. The suitability of climatic conditions (4%) such as tolerance to different weather conditions (drought, rain, mist and cold) was also a favourable factor for adoption in Labuhenwila.

The major reasons for adopting Pathma (one of the imported varieties) have been high yield[9] (46%), and resistance to pests and diseases (43%) such as damping off. This variety which has a good shape and appearance also has the ability to be stored for a few days after harvesting, thus has a high demand (29%). Good characteristics of growth habit of the plant (36%) including high branch formation and quickness in fruit forming (early harvesting) were also important factors that the farmers highlighted. According to the farmers, determinate type of plant (14%) and suitability to climatic conditions (7%) (resistance to cool and mist and resistance to drying of bud) were also the factors that determined the better adoption.

Glory (imported variety) was popular only at Damunugolla. High yield[10] (90%), high demand (30%) suitability to climatic conditions (30%) the long harvesting period, low post harvest losses had been the factors for its popularity. Redinese (imported variety) had been adopted due to high yield, high demand and its suitability to climatic conditions while other two varieties, Noah and Volcano were adopted due to high yield, at Damunugolla.

Thus the farmers have adopted one or more varieties in each location to obtain comparatively more benefits from each. Damunugolla being a well-known tomato growing area for commercial purposes, farmers used to adopt varieties that could attract demand in the market. Accordingly, Glory and Pathma were mostly adopted. Observations revealed that in addition to suitability for agro-ecological conditions, some other factors had influenced their adoption. According to farmers, the yield of Glory was high, its weight was also high and it also had a long harvesting period, but was vulnerable to diseases. Pathma also gives a high yield, but its fruits are small. However, Pathma was disease tolerant. So farmers adopted both Pathma and Glory equally to face any risk and to benefit.

[9] The yield level of Pathma variety was 6,000 kg per acre
[10] The yield level of Golory variety was 8,200 kg per acre

Table 6.7: Reasons for Non Adoption of Tomato Varieties of the Department

Reasons	Maheshi (n=17) %	Bhatiya (n=26) %	Lanka Cherri (n=6) %	Lanka Sour (n=27) %	Thilina (n=9) %
Lack of experience	35	12	33	7	0
Low yield	29	8	17	0	0
Susceptible to pest and diseases	12	16	0	0	44
Low demand	0	4	33	52	0
All fruits ripe together	6	4	0	0	0
As the Plant is tall, a support stick needed and difficult to spray chemical	0	43	0	0	0
Fruit is small	0	27	17	4	0
Lower availability of seed	18	12	0	33	0
High seed cost	0	8	17	0	0
Other	0	12	0	7	44

Source: HARTI survey in 2012

Table 6.8: Reasons for/ Characteristics of Adoption of Thilina and Imported Hybrid Tomato Varieties

		Thilina (n=25) %	Pathma (n=28) %	Golori (n=20) %
1	High yield	92	46	90
2	Resistant to pest and diseases	24	43	15
3	High demand	16	29	30
4	Suitable to climatic conditions	4	7	30
5	Good characteristic of growth habit	8	36	0
6	Ability to produce seed	16	0	0
7	Low post harvest losses	28	4	15
8	Determinate type of plant	0	14	0
9	Low branching	4	0	0
10	Other	16	2	0

Source: HARTI survey in 2012

The major reasons for Thilina becoming popular at Labuhenwila was its high yield, large size of fruits, long harvest period that provides the opportunity to harvest a number of times (15-20) the possibility to get a better price within that period and ability to have a good income under better market demand especially due to the possibility of self seed production. According to the farmers there, though Pathma is very suitable to agro-ecological conditions in the *Yala* season, Pathma was prone to more diseases. So it is not suitable for *Yala*, but in *Maha* season it can be grown well without being affected by diseases. The farmers in Labuhenwila grow both Thilina and Pathma for having alternative benefits from each (grow Pathma and harvesting ends quickly while Thilina harvesting ends slowly).

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The most prominent characteristics the farmers expect from new improved varieties are high yield, resistance to diseases and tolerance to heavy rain, drought and mist and large fruits, thick outer cover etc.

6.3 Conclusion

The farmers adopted imported hybrid seed varieties of tomato as they were more exposed to promotional and awareness creation programmes conducted by field officers of the seed importing and promoting companies. At the same time, the farmers had had no proper knowledge and experience about the concerned varieties of the DOA. A comprehensive programme to enhance farmers' knowledge and experiences about the DOA varieties through active participation in cultivation by giving seeds and other forms of support such as continuous advice and marketing facilities will be a productive effort to promote the DOA seeds. To provide a supportive environment for cultivation, the following issues and the recommended solutions are vital.

6.4 Problems

1. Finding quality seeds was an issue faced by farmers in Labuhenwila. As explained by farmers, seed obtained from area traders were mixed with

different varieties. According to the farmers, the traders in the area used to collect mature tomato from the area and produce and pack the seeds without categorizing into varieties.

2. Unavailability of quality seeds of the DOA was another problem. Some farmers explained that they had obtained DOA seed packets directly from DOA in Kandy . But, the DOA seed packets they obtained from the Agrarian Development Center in the area were different in colour. So they had a problem in identifying the seeds of the DOA.

6.5 Recommendations

1. Regular inspections about traders' seeds in major cultivating areas is necessary to avoid selling of low quality seed

2. It is required to assure the farmers' access to department seeds via ADCs and ARPAs in prominent tomato cultivating areas. Farmers should be made aware of the ways of identifying the DOA seeds.

3. As suggested by farmers, small packets of sample seeds should be given to them to experiment as done by the seed importing and trade companies.

4. When distribution of seeds is done under different programmes, eg. Divi Neguma, it is important to assure the quality of the seeds by the DOA. Otherwise, it will affect the future demand for the DOA Seeds. (When government launches such programmes the ordinary farmer feels that all the given seed were of the DOA.)

CHAPTER SEVEN

Adoption of Capsicum Varieties Developed by the Department

7.1 Introduction

Palagolla in Helboda ADC area in the Nuwara Eliya District and Kuda Oya in Thelulla ADC area in the Moneragala District were the two locations selected for the study. Palagolla is a village with cool, wet climatic conditions and hilly lands where capsicum is grown on heavy slopes by utilizing the rain water as well as spring water diverted to farmlands by small canals. But Kuda Oya is located in the Dry Zone and capsicum was grown on flat lands by utilizing rain water as well as irrigated water pumped from the Kuda Oya.

Farmers in Palagolla are involved in diverse economic activities such as cultivation of vegetables, poultry farming, rearing of cattle and supplying of labour to tea estates. Capsicum was one of the major upcountry vegetables cultivated. Other vegetables cultivated were leeks, beet root, carrot, cabbage and tomato.

Palagolla has been well-known as a capsicum growing village since mid 1990s. Continuous cultivation of capsicum had made it unsuitable for further cultivation due to rapid spread of diseases. Therefore, farmers were advised not to cultivate capsicum in the village for five years. However, the farmers still cultivate capsicum, but in small plots. So the size of majority capsicum lands (52%) less than a quarter of an acre (Table 7.1). Lands in which capsicum is cultivated are less than one acre.

Table 7.1: Operational Land Size of Capsicum Farmers

Land Size (Acres)	Palagolla (N=25)	Kuda Oya (N=24)	Both (N=49)
>0.25	52	13	33
0.25-0.5	36	38	37
0.5-0.75	4	8	6
0.75-1	8	29	18
1-2	0	8	4
2-5	0	4	2
Total	100	100	100

Source: HARTI survey in 2012

Table 7.2: Main Purpose of Cultivation of Capsicum Farmers

Purpose	Palagolla (N=25)	Kuda Oya (N=24)	Both (N=49)
Sale	84	83	83
Seed Production	0	0	0
Consumption	0	0	0
Consumption & Sale	16	17	17
Total	100	100	100

Source: HARTI survey in 2012

The main source of livelihood of almost all people involved in capsicum cultivation in Kuda Oya, was farming. Although they were involved in cultivating a number of other crops such as green chilli, tomato, brinjal, long bean, snakegourd and maize; capsicum was the predominant crop. As a result, it had become a famous capsicum growing location. Farmers grow capsicum in highlands as well as in chena lands and most of them were involved in cultivating of capsicum in smaller lands, but some (12%) were involved in cultivating in bigger lands of 1 - 5 acres.

A great majority of farmers in both locations (about 83%) grow capsicum mainly for selling while the rest grow for both consumption and sale.

7.2 Awareness and Adoption

Regarding the awareness of the farmers about the concerned DOA variety (Table 7.3) Lanka Yellow Wax was known by only a very limited number of farmers (4%). In Thelulla none of them knew while only 8% of the farmers knew about it in Palagolla.

Table 7.3: Farmers' Awareness about Department Developed Capsicum Varieties

Variety	Farmers' Awareness		
	Palagolla	Kuda Oya	Both
	%	%	%
Lanka Yellow Wax	8	0	4

Source: HARTI survey in 2012

Table 7.4 shows the adoption rate of DOA as well as other capsicum varieties by sample farmers. As indicated, none had adopted DOA variety. Instead, all the farmers had adopted imported hybrid capsicum varieties. In addition, majority of farmers did not know about the capsicum variety of the DOA: Lanka Yellow Wax. Susceptibility to

diseases and less encouragement to adopt[11] were the prominent reasons for not adopting the variety (by sample farmers who knew about that variety) (Table 7.6). According to the information, Lanka Yellow Wax is more susceptible to pest and diseases such as collar rot, pod borer attack, leaf spot disease and aphids. Discussions with key informants like farmer leaders also revealed that farmers had no proper knowledge about advantages and disadvantages of the DOA varieties. According to the researchers' observations, unavailability of DOA variety at nearby seed trade centers (at Nuwara Eliya and Kuda Oya) had also caused its non adoption. Encouragement of farmers by field officers of seed companies to adopt their varieties by their frequent visits to the nearby areas of farmers to make the farmers aware of their varieties by demonstrations and field days contributed for greater adoption of imported varieties.

The Table 7.4 further indicates the capsicum varieties adopted by farmers. All were imported hybrid varieties. Farmers refererred to those varieties by the company names. Accordingly the varieties they mentioned as PS and Royal were mostly adopted (53% and 29% respectively) by the farmers in the whole sample. The intensity of adoption of these two varieties, PS (43%) and Royal (29%) was also more or less same as their rate of adoption. PS variety was more broadly adopted than Royal variety at Palagolla (64% and 16% of the farmers at Palagolla respectively adopted each variety). But both varieties had been equally adopted at Kuda Oya (42% of the farmers had adopted each variety). Intensity of their adoption in Palagolla indicated more intensity in adoption of PS variety than Royal variety (the area cultivated under PS was 69% at Palagolla and Royal was 15%). But, the intensity of their adoption at Kuda Oya indicated a greater preference for Royal than PS (the area cultivated under PS was 29% at Kuda Oya while the cultivated area under Royal was 35%).

The farmers at Palagolla as well as at Kuda Oya had adopted some other imported hybrid varieties on a small scale (Table 7.4 & 7.5), e.g. Palagolla farmers adopted CIC and Hungarian Yellow Wax and Kuda Oya farmers adopted Edna, Onex, PS-1 and PS-2.

[11] Continuous spread of diseases in capsicum has forced a ban on the cultivation of it for a period of five years. This has made majority of farmers refrain from cultivating any capsicum variety there

Table 7.4: Adoption of Department Developed and Other Capsicum Varieties

Variety	Adopted Farmers					
	Palagolla		Kuda Oya		Both Locations	
	N=25	%	N=24	%	N=49	%
Department Varieties Lanka Yellow Wax	0	0	0	0	0	0
Other Varieties PS	16	64	10	42	26	53
Royal	4	16	10	42	14	29
CIC	4	16	0	0	4	8
Hungarian yellow wax	1	4	0	0	1	2
Edna	0	0	4	17	4	8
Onex	0	0	3	13	3	6
PS-1	0	0	1	4	1	2
PS-2	0	0	1	4	1	2

Source: HARTI survey in 2012

Table 7.5: Intensity of Adoption of each Capsicum Variety

Curry Chilli Variety	Proportionate in each Location		
	Palagolla %	Kuda Oya %	Both Locations %
Royal	15	35	29
PS	69	29	43
CIC	14	0	5
Hungarian yellow wax	3	0	1
Edna	0	18	12
Onex	0	8	6
PS-1	0	5	3
PS-2	0	5	3
Total	100	100	100

Source: HARTI survey in 2012

Field experiences revealed that farmers had adopted different imported hybrid varieties based on their previous cultivation experiences. Accordingly, (Table 7.6), major reasons for adoption of Royal variety were high yield (79%), high demand (57%) good appearance, long fruit, good characteristics of growth (57%) such as more harvest times, green colour of the fruit and resistance to pest and diseases (21%) and ability to keep for a number of days and maintain quality 7%. Another reason for adoption of PS variety was high yield (79%).

Table 7.6: Reasons for/Characteristics of Adoption of Imported Hybrid Capsicum Varieties

Reasons	Royal (n=14) %	PS (n=26) %
High yield	79	81
Resistant to pest and diseases	21	15
High demand	57	62
Suitable to climatic conditions	0	4
Good growth habit	57	65
Availability of seed	7	0
Low seed cost	0	0
Ability to store for a long time	7	0
Other	7	4

Source: HARTI survey in 2012

The PS variety was more popular due to the reasons like high yield (81%), good characteristics of its growth (65%) strong plants and high growth, quick fruit forming, long fruits and good appearance and resistantnce to pest and diseases (15%).

According to the farmers, the CIC variety was adopted due to high yield (75%) and high demand and good appearance.

The farmers suggested that a new variety should have the ability to resist diseases specially backspot disease, damping off, yellow leaf curl and long and green colour fruits with good appearance and resistance to heavy rain and drought etc.

7.3 Conclusion

Findings revealed that continuous cultivation of imported hybrid capsicum varieties have made some locations like Palagolla more vulnerable to various types of diseases. However, earlier some farmers cultivated the same PS variety because they knew only a limited number of varieties or they had access to seed of limited varieties. Otherwise they could have been promoted for the DOA varieties. The DOA variety can be promoted by providing solutions for the issues identified, by carrying out a vast promotion campaign.

7.4 Problems

1. Most of the farmers in the study locations did not know about the DOA capsicum variety as there was no opportunity for them to participate in awareness training programmes.

2. Sometime ago the DOA seeds were available in the Agrarian Development Centers, but the situation is different. Hence, there is no place to purchase them.

3. Farmers had no opportunity to try out the new capsicum variety of DOA as small quantities of seeds given by seed importing firms since the seeds were not available.

3. In some study locations such as Palagolla there was incidence of diseases due to continuous cultivation of the same capsicum variety. After the five-year abstention period they were advised to cultivate under the guidance of Agricultural Instructors. However, the farmers in Palagolla had resumed cultivation of the same variety of capsicum. So the diseases had further increased.

7.5 Recommendations

1. Providing proper awareness to farmers in main capsicum cultivating areas about the DOA capsicum varieties. Theoretical as well as practical training in this regard is a must.

2. Ensure the availability of DOA capsicum seeds in Agrarian Development Centers.

3. Supplying small quantities of seed samples to regular capsicum growing farmers to try out is important as a mechanism of convincing them about the benefits of such varieties and encouraging farmers to grow.

4. Introduction of different local varieties of capsicum to popularly cultivated areas to identify the most suitable variety for the location may be a better solution.

CHAPTER EIGHT

Adoption of Long Bean Varieties Developed by the Department

8.1 Introduction

The main focus of this chapter is to examine the adoption of the DOA introduced long bean varieties such as Polon, Sena, DS-1, Bushita, Vel polon and Hawari. The selected two field locations for the study were Daluwa GN division in the Palakuda ADC area in the Puttalam District and Sooriya-ara GN division in the Thanamalvila ADC area in the Moneragala District. Both study locations are in the Dry Zone. In Sooriya-ara, cultivation was done in both highland as well as in chena lands and under rain fed conditions in the Maha season. In Daluwa, irrigation is done using pumped water from tube wells. Thus the cultivation was year round. In both locations long beans were cultivated as a single as well as a mixed crop.

The operational size (Table 8.1) of most of the long bean cultivated lands of the sample farmers was very small; 56% of the sample farmers operated small lands of less than half an acre. However, there were farmers operating larger land parcels of one acre or above (20% in the whole sample). When the study locations are considered individually they differ, e.g. operational land sizes are very small in Sooriya-ara (92% were less than half an acre) while they are somewhat larger in Daluwa where the farmers were more commercial oriented so wish to operate larger parcels (76% farmers were operating lands in the size of 0.75 acre or over).

Nearly 77% of the farmers in the sample cultivated long bean mainly for commercial purposes only and in Daluwa the percentage was very high (97%). In addition to availability of suitable resources (suitable land and water) and availability of marketing facilities, Norochcholai Dedicated Economic Center contributed to create a greater demand for long beans at Daluwa.

Table 8.1: Operational Land Size

Land Size (Acres)	Sooriya-ara (N=25) %	Daluwa (N=25) %	Both (N=50) %
>0.25	64	4	33
0.25-0.5	28	16	23
0.5-0.75	-	4	2
0.75-1	4	40	22
1-2	4	28	16
2-5	-	8	4
Total	100	100	100

Source: HARTI survey in 2012

Table 8.2: Main Purpose of Cultivating Long Bean

Purpose	Sooriya-ara (N=25) %	Daluwa (N=25) %	Both (N=50) %
Sale	57	97	77
Consumption	13	0	7
Consumption & sale	30	3	17
Total	100	100	100

Source: HARTI survey in 2012

8.2 Awareness and Adoption

The farmers' awareness of some of the long bean varieties of the DOA was at a high level. For example, 98% of the farmers in the sample had known about Bushita while 75% had known about Vel Polon. The farmers in both study locations had known about these two varieties. The farmers' awareness of Paduru Polon was 56% while it was 35% for Hawari. Location wise this picture was more or less similar. The farmers in the sample were not aware of Sena and DS-1 *mae* varieties.

Table 8.3: Farmers' Awareness about Department Developed Long Bean Varieties

Variety	Farmers' Awareness		
	Sooriya-ara	Daluwa	Both
	(No = 25)	(No=27)	(No.52)
Panduru Polon	52	59	56
Sena	0	0	0
DS-1	0	0	0
Bushita	100	96	98
Vel Polon	80	70	75
Hawari	36	33	35

Source: HARTI survey in 2012

The Table 8.4 indicates the adoption of the DOA long bean varieties and others. Farmers had adopted limited amount of DOA varieties. Those varieties were Bushita, Vel Polon and Polon Mae. Farmers had adopted a number of local long bean varieties and some of these varieties were traditionally cultivated while some originated from the DOA varieties but at present some of them had new characteristics. Bushita was more popular at Daluwa but only 38% of the farmers had adopted it (Table 8.4) in 29% of the

area cultivated with long bean (Table 8.5). But it had not been adopted at Sooriya-ara although all the farmers had been aware of it. The reasons for not adopting at Sooriya-ara were (Table 8.7) difficulties in purchasing of seed and low demand and short pods. Paduru Polon (8% o) as well as Vel Polon had been adopted in both study locations as a single crop and as a mixed crop. Paduru Polon was adopted by 8% and 19% of the farmers respectively at Sooriya-ara and Daluwa. The adoption rate of Vel Polon was respectively 20% and 16% in each study location. In Daluwa, Polon *mae* was broadly cultivated with red and white colour *mae* because the demand from traders was for mixed varieties. For the adoption of Vel Polon, its high yield and good taste had been the factors.

Table 8.4: Adoption of DOA Long Bean Varieties by Farmers

Department Varieties	Adopted Farmers		
	Sooriya-ara %	Daluwa %	Both locations %
Panduru Polon	8	19	14
Vel polon	20	16	18
Bushita	0	38	20
Hawari	0	0	0

Source: HARTI survey in 2012

Of the other long bean varieties adopted by the farmers in the study locations, *Tissa* mae (40% of the farmers and 19% of the area), *Bonchi* Mae (24% of the farmers and 35% of the area) and Mahaweli Mae (20% of the farmers and 19% of the area) were the varieties which were somewhat popular only in Sooriya-ara due to high yield and good taste (Table 8.6).

Table 8.5: Adoption of other Long Bean Varieties by Sample Farmers

Variety	Adopted Farmers		
	Sooriya-ara	Daluwa	Both Locations
	(No=25) %	(No=27) %	(No=52) %
Mix (Red/*Polon*/White)	8	48	29
Tissa mae	40	0	19
Bonchi mae	24	0	12
Mahaweli mae	20	0	10
Waga mae	4	0	2
Red Mae	4	4	4
Bat mae	0	7	4

Source, HARTI survey in 2012

Table 8.6: Intensity of Adoption of Each Long Bean Variety

Long Bean Variety	Proportion in each Location		
	Sooriya-ara %	Daluwa %	Both Locations %
Polon	1	7	5
Vel Polon	13	6	7
Mix (Red/*Polon*/White)	8	51	41
Tissa	19	0	4
B*onchi* Mae	35	0	8
Mahaweli Mae	19	0	4
Waga Mae	5	0	1
Red Mae	1	3	2
Bushita	0	29	23
Bat Mae	0	5	4
Total	100	100	100

Source: HARTI survey in 2012

However, according to the information given by the sample farmers, low adoption of all the DOA long bean varieties was mainly due to difficulty in purchasing seed (8.7). The low demand was also another reason for some varieties like *Polon* when it is grown as a single crop.

Of the reasons for low adoption of each long bean variety, lower yield (21%) of Bushita compared with other popular varieties such as Tissa mae, low demand (27%) due to poor taste, unavailability of seed (9%) and susceptibility to pest and diseases including rotting of bud, aphid damage, yellow spot disease and problems of growth habit (24%) including small size of pods were mentioned by the farmers for not adopting despite being aware.

The reasons such as a comparative low yield (32%), low demand (62%) and unavailability of seeds (9%); some of the growth habit problems including the length of the pod that leads to worm attacks and unavailability of quality seeds (9%) etc. have led to less adoption of Panduru Polon.

As responded by relevant farmers, the major reasons for non adoption of *Vel Polon* were comparatively low yield, low demand, problems of its growth habit (30%), high length of pod that leads to worm attacks and the need of a supporting stick and ample sunlight. Among the reasons for low adoption of *Hawari* variety were low demand (43%), problems of growth habit such as high length of the pod that leads to worm

attacks and poor resistance to climatic problems such as having rotten stem and *Malakada* disease in the rainy season.

Table 8.7: Reasons for Non Adoption of Department Developed Long Bean Varieties by Farmers Known about Them

Reason	Panduru Polon (n=25) %	Bushita (n=41) %	Vel Polon (n=32) %	Hawari (n=18) %
Low yield	32	21	26	7
Susceptible to pest and diseases	13	15	4	0
Low demand	62	27	26	43
Not resistant to climatic changes	13	3	11	7
Problems of growth habit	36	24	30	36
High seed cost	4	3	4	0
Unavailibilty of seed	9	9	0	0
Other	34	24	26	21

Source, HARTI survey in 2012

The characteristics expected by farmers from new varieties were high yield, ability to earn a high income, resistance to diseases and the green colour.

According to the farmers, one of the major reasons for adopting some of the long bean varieties such as Tissa Mae, Bonchi Mae and Mahaweli Mae especially in Sooriya-ara was high demand for these varieties. The percentages of the farmers' responses were respectively 40%, 83% and 60% for these three varieties. According to the farmers, the yield levels of these local varieties were also high, and therefore they could earn a better income. Respectively 50%, 67%, and 60% of the farmers responded this way. Some of the good characteristics of Thissa Mae were good growth habit (5%) eg. quick harvesting, possibility of harvesting long times, vigorous growth and branching of the plant, weight of the pods, delay in maturing the pods and their green colour. Ability in producing seed (30%) was a reason for high adoption of Tissa Mae. Good weight and being similar to beans were the reasons for Bonchi Mae to be more popular and for Mahaweli Mae, the reasons were good appearance and the ability to keep for a longer time.

The farmers who adopted Bushita mentioned some good characteristics of its growth habit (50%) such as non requirement of a supporting stick as reasons for adopting it. The characteristics expected by farmers from new varieties were high yield, ability to earn a high income, ability to resist diseases and the green colour.

Table 8.8: Reasons for Adoption of Department Developed and other Long Bean (mae) Varieties by Farmers

	Polon (n=4) %	Bushita (n=10) %	Vel Polon (n=7) %	Betmae (n=2) %	Mix (red/ Polon white (n=15) %	Thissa (n=10) %	Bonchi mae (n=6) %	Mahaweli mae (n=5) %	Waga mae (n=1)%	Red mae (n=2) %
High income	50	30	29	100	87	50	67	60	100	0
Resistant to pest and diseases	0	10	29	50	20	20	0	20	0	50
High demand	50	30	86	50	80	40	83	60	100	0
Suitable to climate conditions	0	0	0	0	7	0	0	0	0	0
Good characters of growth habit	25	50	0	0	13	50	0		0	0
Ability to produce seed	0	0	14	0	0	30	0	0	0	0
As a mixed crop	25	10	0	0	7	0	0	0	0	0
Ability to keep for a long time	0	0	0	0	13	0	0	20	0	0
Other	0	20	0	0	0	10	33	20	0	50

Source, HARTI survey in 2012

8.3 Conclusion

Long bean is a prominent low country vegetable that has a high market demand, but according to the key informants in the study area, the area under cultivation and the number of farmers involved in cultivation have been diminishing due to a number of reasons such as the competition for allocation of lands for high value crops (eg. papaw and banana) and labour scarcity and difficulty in finding sticks. As long bean is a valuable and a tasty food (related to religious festivals also) the DOA can intervene by producing and promoting varieties with good characteristics.

8.4 Problems

1. Although there are many long bean varieties introduced by the DOA, the farmers' awareness and knowledge about them are not satisfactory and they have already adopted only limited varieties.

2. According to most of the sample farmers, unavailability of the DOA seeds was the major issue they face at present in adopting of the DOA recommended varieties.

8.5 Recommendations

1. Training programmes should be conducted to increase farmers' awareness and knowledge about the long bean varieties recommended by DOA.

2. Availability of seed and production and distribution of quality seed should be ensured.

CHAPTER NINE

Conclusion and Recommendations

9.1 Introduction

In this section an attempt is made to present conclusions and recommendations related to adoption of recently introduced varieties of selected crops by DOA.

9.2 Conclusion

1. Information generated by the study revealed that in general, farmers had given high priority to earn income and profit in adopting crop varieties as they wanted to maximize benefits from all resources they incurred for cultivating each crop.

2. The farmers were also rational to adopt crop varieties by considering their suitability to the agro-ecological conditions, possibilities of using them for risk minimization, leading to profit maximization.

3. Lack of awareness and knowledge of the farmers about the DOA varieties was a major reason for their low adoption.

4. Unavailability of quality seeds in sufficient quantities when required was another major issue farmers faced in adopting DOA seeds.

5. Insufficient production and distribution of DOA varieties was a secondary issue faced by AIs to encourage farmers to adopt reference varieties.

6. Inability of the DOA to ensure an attractive service (including extension advice and other input supply) for farmers to encourage them to adopting DOA varieties as done by the private sector was also an obstacle.

7. When considering about farmers' adoption of maize varieties it was revealed that they had adopted imported hybrid maize varieties more, especially Pacific varieties (pacific 999 and 984) instead of DOA varieties such as Sampath, Ruwan and Badra. In addition to the comparatively higher yield and income that can be derived from imported hybrid varieties, other reasons that influenced the adoption were high facilitation of the seed importing companies to adopt them such as in obtaining seeds, fertilizer and other inputs and extension advice delivered to farmers' doorstep via their agents and also purchasing their products at higher prices. On the contrary, the farmers were not adequately

informed about the yield levels nor incomes that could be earned from DOA seeds and also not enough seeds were available.

8. With regard to the farmers' adoption of DOA chilli varieties; despite having an increased knowledge about KA-2 and MI-2 varieties, farmers' knowledge on Galkiriyagama Varanaya was very low. Other factors such as yield levels and profit, suitability to the climatic conditions and availability of seed and other facilities including extension advice available for them compared with other imported varieties have resulted in their poor adoption. Accordingly, Vijaya, one of the imported hybrid varieties has been more adopted in Panei-adiya, for it has enabled the farmers to meet the high market demand. Both KA-2 and MI-2 as well as *Haen miris*, a traditional variety, have been more adopted at Kukulkatuwa, as by cultivating the both (KA-2 and *Haen miris*) simultaneously the farmers can receive an increased profit by minimizing the risk of cultivating KA-2 which poorly adapts to rain weather condition. *Haen miris* can adapt to both rain and non-rain conditions alike.

9. Regarding brinjal varieties; farmers had not been much aware of DOA varieties such as Amanda, Anjalee and HORDI-Lena-Eri and even those who were aware faced a problem of seeking advice due to weak farmer-officer relationship. As a result, majority of farmers in one location (Illuppankadawala) had adopted the imported variety called Ravina and in another location (Udaperuwa), a local variety derived from Lena Eri was popular as those varieties were more favorable in terms of demand, yield and profit.

10. In the long term, farmers have understood that adopting imported seed would be a problem for the environment and the sustainability of production activities as they have to apply more fertilizer and chemicals to obtain better results. Some farmers who understood the problem reverted to local seeds. They believed low yield under lesser inputs and investment would be more beneficial than obtaining more yields under high inputs and investment. Some AIs also indicated that the yield levels of some DOA seeds (like Sampath maize) were close to the imported varieties, but promoting those varieties was an issue as there were no enough seeds. Accordingly, promoting DOA's seed production and distribution programme and encouraging famers to adopt those seeds is timely for the future sustainability of agriculture and the farming income.

11. Majority of the farmers had been aware of some DOA tomato varieties (like Bathiya, Thilina and Lanka Sour) while a few farmers had known about others (Maheshi and Lanka Cherri). But except Thilina, when a variety had been adopted by all farmers in one location (Labuhenwila), other varieties had not

been adopted by any farmer. Lacking sufficient knowledge about the varieties and non availability of seed were common factors that led to low adoption of the varieties while specific factors have also affected adoption of each variety (eg. Maheshi – susceptibility to pests and diseases such as damping off and ripening all the fruits at the same time, Bathiya- requiring a supporting stick and the small size of fruits: Lanka Cherry and Lanka Sour- low demand and small size of the fruits).

12. Reasons for high popularity of one of the DOA tomato variety, Thilina, at one location Labuhenwila were its high yield, possibility of harvesting for a long period, high weight and the uniformity of the size of fruits, resistance to pests and diseases, thick outer cover of the fruit, good shape and color, high market demand and the tolerance to different weather conditions.

13. Pathma, one of the imported hybrid tomato varieties was popular at both locations of the study while Glory, another imported hybrid tomato variety was popular only at one location, Labuhenwila. Suitability for climatic conditions, high yield, long harvesting period, resistance to pest and diseases and high demand were the reasons for high popularity of both varieties.

14. Regarding the capsicum variety of DOA (Lanka Yellow Wax): the farmers' knowledge was very low as only a very few farmers had the opportunity to become aware of it. Even, those who were aware had not adopted it as there was less encouragement to adopt it, non-accessibility to seed and its high susceptibility to pests and diseases.

15. Farmers in both study locations used to adopt imported hybrid capsicum varieties which were identified by farmers as PS and Royal. Both these varieties have been popular due to high yield, long fruit, green color and good appearance of fruit and good demand etc.

16. Some of the DOA long bean varieties such as Sena and DS-1 were not known and not adopted by any farmer while Hawari Mae was known by about one third of the farmers but again none adopted. Other two Mae varieties of DOA, Bushita and Vel Polon, were known by a great majority of the farmers while Pandura Polon was also known by a majority of farmers. About one fifth of the farmers had adopted each of these three varieties. In addition to difficulties in accessing the seeds of these varieties, the increased adoption of other local/traditional varieties — Tissa mae, Banchi mae and Mahaweli mae — have been the reasons for limited adoption of DOA varieties.

9.4 Recommendations

1. Production of advanced varieties with better characteristics to compete with imported seed varieties is a must.

2. Farmers in the major cultivating areas of relevant crops should be made aware of DOA varieties.

3. Sufficient production as well as distribution of DOA varieties to the ADCs and ensuring farmers' access to new high quality varieties of the DOA on time is an urgent requirement.

4. Supplying farmers with small seed packets as samples to try out as done by seed importing and promoting companies is also a good strategy to convince the farmers about the crop varieties of the DOA and of their benefits.

5. Under crop cultivation programmes, arrangements should be made for the officers to meet farmers in the field (as in Farm Field Schools) and should provide advice to their problems.

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