

## CHAPTER 3

### PRESENT STATUS AND FUTURE PROSPECTS OF ONION CULTIVATION IN SRI LANKA

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#### Abstract

Onion is an important cash crop in Sri Lankan agriculture and attention is given to increase the production through increasing productivity and area under cultivation to achieve market demand in big onion and self-sufficiency in red/cluster onion. Several technologies have been identified to increase the productivity while massive production campaigns have been launched to achieve this task. Expansion of true seed production of big onion and red/cluster onion has been identified as one of the key factor to increase productivity while expansion of cultivation in non-traditional areas is identified as an appropriate strategy to ascertain continuous production to meet the market demand. Department of Agriculture with the Provincial Departments of Agriculture is engaged in a systematic program to achieve this task to reduce the dependency on imports to reduce foreign exchange incurred on seed and bulb imports to meet the consumer demand of onion.

#### Introduction

Onion is one of the important spice crops of Sri Lanka and is extensively used in all Sri Lankan cuisines. Further, onion is used for different purposes in Ayurvedic medicine and therapies. The crop is well adapted to Sri Lankan conditions with long days (>12 hours/day) and cultivated in dry and intermediate zones. Two main types of onions are consumed by Sri Lankans namely, big onion (*Allium cepa* L. var. *cepa*) and red/cluster onion (*Allium cepa* L. var. *aggregatum*). The annual requirements of big and red onion are 220,000 t and 80,000 t, respectively in 2013 (Tables 1 and 2; DCS, 2013). Average per capita requirement

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of onion is around 10-11 kg. Based on the availability and the market price of big and red onion, consumer demand for big and red/cluster onion change to meet the domestic demand. Sri Lanka produces about 80,000 t of big onion, which accounts for the 36% of national requirement. The average annual production of cluster/red onion is around 72,000 t which is close to self-sufficiency.

**Table 1: Big onion production, imports and seed requirement - 2000 to 2013.**

Year	Big onion production			Imports		Seed Requirement (kg) (@ 6.5 kg/ha)
	Ext (ha)	Prod (mt)	Av. Yld (mt/ha)	Quantity (mt)	Value (Rs. 000)	
2000	2,796	36,560	13	117,500	1,501,538	18,174
2001	2,815	31,966	11	110,181	1,749,368	18,298
2002	2,906	31,560	11	131,851	1,900,174	18,889
2003	2,770	32,301	12	130,535	2,057,177	18,005
2004	3,075	37,508	12	115,120	2,168,760	19,988
2005	4,552	55,552	12	110,713	1,826,136	29,588
2006	6,814	73,616	11	119,478	1,940,185	44,291
2007	6,988	92,167	13	140,773	4,392,183	45,422
2008	4,091	57,371	14	146,623	3,473,243	26,592
2009	5,081	81,707	16	143,274	4,687,649	33,027
2010	4,158	58,930	14	158,086	6,649,347	27,027
2011	3,451	45,682	13	170,731	6,556,191	22,432
2012	5,387	83,561	16	145,912	3,757,873	35,016
2013	4,223	69,638	16	168,874	9,179,011	27,450

Source: SEPC, 2013

### **Varieties**

Before early 1980's big onion cultivators mainly used imported seeds from India and the varieties were Pusa Red, Puna Red, Nasik Red and Red Creyol. During 1992, Department of Agriculture released the first big onion variety Kalpitiya to the farmers. The main advantage of this variety was that it flowers and produces viable seeds under dry zone conditions without vernalization of mother bulbs (Kurupparachchi and Fernando, 1993). Therefore, this variety attracted

many farmers in some of the onion growing areas and replaced the Indian varieties to some extent. Meanwhile selecting better mother bulbs either from imported Pusa Red or Puna Red, farmers of Dambulla area started producing seed, designating a cultivar called Dambulla Red. Few farmers initiated self-seed production in Dambulla area during mid 1980's and expanded season by season to replace the Indian seed market. Similarly, farmers in the Galewela area have also undertaken mother bulb selection using imported variety Agrifound Light Red and named a new cultivar as Galewela Light Red. This cultivar is dominant in the Galewela area. With the initiation of onion breeding program in mid 70's, Field Crops Research and Development Institute (FCRDI), Mahalluppallama released variety Dambulla Selection in 2009 (DOA, 2009). In 2014, FCRDI released another big onion variety namely MI BO 01.

**Table 2: Red onion production, imports and seed requirement - 2000 to 2013.**

Year	Red onion production			Imports		Seed requirement (kg) (@ 1.5 mt/ha)
	Ext (ha)	Prod (mt)	Av. yld (mt/ha)	Quantity (mt)	Value (Rs. 000)	
2000	6,095	42,502	7.0	5,940	107,444	9,143
2001	5,124	36,863	7.2	2,726	64,782	7,686
2002	4,968	35,334	7.1	1,827	57,373	7,452
2003	4,894	35,514	7.3	276	7,355	7,341
2004	4,391	39,453	9.0	2,570	73,467	6,587
2005	5,790	53,729	9.3	10,233	303,770	8,685
2006	6,228	60,754	9.8	10,859	377,137	9,342
2007	5,609	57,041	10.2	23,754	949,336	8,414
2008	4,994	49,290	9.9	26,854	1,583,309	7,491
2009	4,498	46,234	10.3	16,207	1,082,713	6,747
2010	5,228	61,811	11.8	11,907	641,286	7,842
2011	6,146	72,339	11.8	6,807	464,355	9,219
2012	2,921	27,585	9.4	7,017	378,123	4,381
2013	4,605	55,608	12.1	15,386	1,383,387	6,908

Source: SEPC, 2013.

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Vethalan and Jaffna Local are the main cultivars, which are popular among cluster/red onion growers in Sri Lanka. Department of Agriculture has released the first ever cluster/red onion variety namely Thirunelvely Red (synonyms of Thinnavelly Red) for cultivation in the northern region in 2009, which matures at 70 days (DOA, 2009). Apart from those varieties and cultivars some other cultivars such as Vellarai in Jaffna district and Telulla Selection in Moneragala district are also being cultivated by farmers.

#### **Cultivating Season**

Big onion is mainly cultivated in the dry (*yala*) season during mid April to mid June and the crop is ready to harvest from end of July till early September in Matale and Anuradhapura districts, which are the major onion growing areas. Comparatively smaller extent is cultivated in late *maha* wet season (late December to early January). Recently, big onion cultivation has been expanded to Hambantota and Moneragala districts for off season production.

Red/cluster onion is grown both *maha* and *yala* seasons in the northern and eastern regions of Sri Lanka avoiding heavy rainy periods for planting and harvesting. In Kalpitiya area in the Puttalam district red onion is cultivated continuously except in February to avoid the possible frost damages. Red onion is grown in Telulla area of Moneragala and Ratnapura districts mainly in *yala* season.

Since the onion is harvested within a short period of time in the months of July to September, and due to perishable nature of the crop, long term storage is difficult to supply the monthly market demand. Therefore, Sri Lanka imports large quantities of big onion from the region to meet the off season demand. The Department of Agriculture in 2013, has identified few locations in the southern and northern provinces to produce off season big onions and red onions.

The mass onion production drive carried out in Hambantota area, in the DL, Agro-ecological region, during 2013/14 *maha* was successful. Extension programs have used a novel approach in utilizing trained farmers to work hand in hand to disseminate knowledge and experience to new farmers to make this effort a success.

Department of Agriculture strongly believes that the cultivation of onion in non-traditional areas in off seasons will provide the opportunity to scatter production to supply the monthly demand, thereby, reduce imports.

### **Establishment**

At present, big onion is cultivated mainly from seeds while dry sets had been used by some farmers in early 1980's as a planting material to raise the crop. In this method, farmers have to raise dry sets in nursery beds using true seeds and subsequently, store them till the beginning of planting season. Red/cluster onion is normally established using mother bulbs. In 1999 Department of Agriculture introduced red onion cultivation using true seeds in view of reducing the cost of production (Sumanarathna *et al.*, 2002). Nearly 1,500 kg/ha is of good quality mother bulbs are required when red/cluster onion is raised by bulbs. Only the cultivar Vethalan can be raised by seeds while Jaffna Local and all other cultivars can only be raised using mother bulbs. Based on the varietal spread, 55% of the cultivation is with Vethalan, while 45% covers Jaffna Local and other non bolting varieties and cultivars.

On average 5-6 kg/ha of good quality seeds are required as planting material for big onion or cluster/red onion (Sumanarathna *et al.*, 2002). When onion is raised using true seeds, properly prepared sterilized seed beds are used for raising seedlings. The seedlings are usually ready for transplanting after 28-30 days. Incorporation of organic manure to the soil is vital for the success of the onion crop. Fernando *et al.* (2013; 2014) reported that application of Farm Yard Manure at the rate of 15 t/ha will reduce the fungal bulb rot disease incidence significantly. This will also increase the soil moisture retention and efficient use of inorganic fertilizers applied to soil. Onion seedlings or mother bulbs are usually planted on raised beds, which are normally 1m in width. The length of the bed varies according to the soil type and the method of irrigation used. During the dry season (*yala*) some parts of Jaffna, farmers use to plant red/cluster onion on sunken beds to conserve water. Seedlings are normally planted at 10 cm x 10 cm intervals on beds after proper fungicide drenching to control fungal bulb rot incidence during the early stage of the crop. It is reported that soaking of cluster/red onion bulbs one hour in

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Captan (50% wp) at the rate of 1 g/l is effective in controlling bulb rot incidence (Fernando *et al.*, 2013; 2014).

Application of inorganic fertilizer as basal and top dressing to supply N, P and K requirement is vital for the growth and yield of onions. Department of Agriculture has recommended to apply N as Urea (195 kg/ha), P as Triple super Phosphate (100 kg/ha), K as Muriate of Potash (75 kg/ha) during the growth period. The prolong application of N fertilizer after 6 weeks will extend the vegetative period and increase the vulnerability of bulbs to higher storage losses. Control of weeds during the early growth of onion is important for better growth and subsequent yield. Most of the farmers who cultivate more than 250 m<sup>2</sup> practice chemical weed control using pre-emergence weedicides. Others practice hand weeding to keep the cultivation free from noxious weeds.

#### **Irrigation and Other Field Management Practices**

Surface irrigation using open canals or hose irrigation is commonly practiced in onion cultivations. However, there is an increasing trend in the use of micro irrigation practices such as sprinklers, drips and micro jets for cultivating onion in recent times to save water and to increase the productivity. A recent study revealed that micro sprinklers can be used with 60% overlapping for onion grown on Noncalcic Brown soils and 40% overlapping when grown on Reddish Brown Earth soil (Perera *et al.*, 2014) When surface irrigation is practiced farmers irrigate once in 2-3 days based on the soil conditions and the season. In the dry season the farmers' practice frequent irrigations to avoid stress to the plants. Sprinkling of water using sprinklers or through watering cans is necessary to control the tip burn caused by accumulation of dew in the early morning.

#### **Preparation for Harvest and Postharvest Handling**

All big onion varieties/cultivars grown in Sri Lanka mature around 90-110 days after establishment. When the crop is ready for harvest, irrigation should be stopped, and the plants should be allowed to fall the leaf and to form the neck between bulbs and leaves tight. Onion is perishable and liable to heavy post harvest

losses in storage and handling if proper care is not taken. Maturity level at the harvest is one of the critical factors, which determines the shelflife. It is reported that harvesting at 50% leaf fall stage is necessary to obtain good quality (<50 g/bulb) smaller bulbs (Mettananda, 1991; 1993). Well maintained big onion crops will produce an average bulb yield of 20-25 t/ha.

Red/cluster onion variety Thirunelvely Red matures around 75 days while Jaffna Local matures in 75-90 days. Vethalan takes 110-120 days to mature depending on the soil fertility and weather conditions. Average yield of short age variety/cultivars is about 10-11 mt/ha while Vethalan can produce 15 mt/ha.

**Cost and Benefit of Onion Cultivation**

Onion is a lucrative cash crop generating substantial income for farmers. Figure 1 shows the fluctuation of average retail price of imported and local big and cluster/red onion in 2013. The profitability of big and red onion cultivations in 2012 yala season, is shown in Table 3.

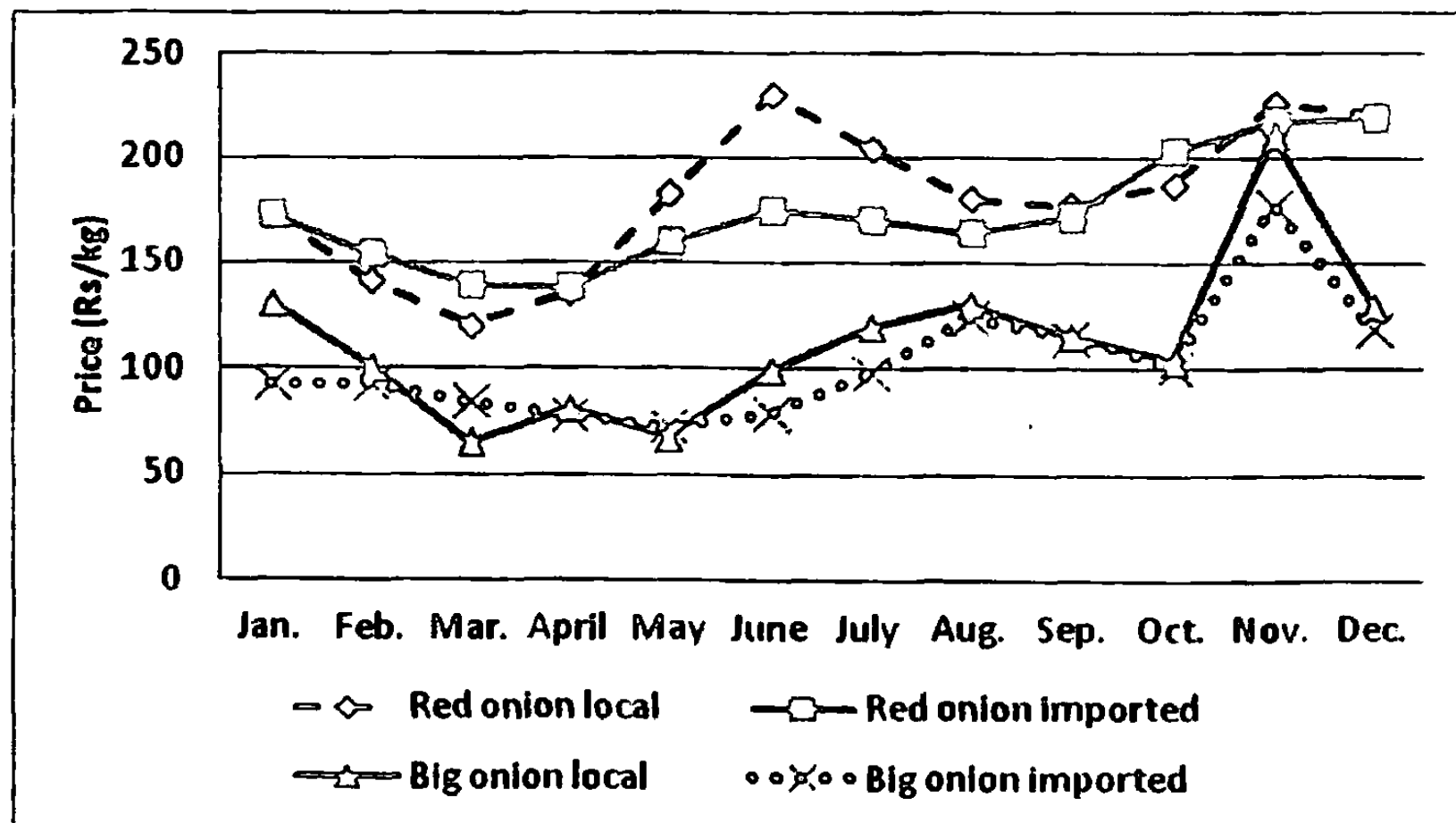


Figure 1: Monthly retail prices of onion in year 2013.

**Table 3: Cost and benefit of cultivation of big onion and red/cluster onion in 2012 Yala season.**

<b>Item</b>	<b>Big onion (Matale)</b>	<b>Red onion (Puttalam)</b>	<b>Red onion (Trincomalee)</b>
Total Cost (Rs./ha)	463,004	413,772	388,291
Gross income (Rs./ha)	1,175,080	923,295	630,717
Profit (Rs./ha)	712,076	509,524	242,426
Unit cost (Rs./kg)	22.42	50.00	35.15
Yield (kg/ha)	20,652	8,262	11,046

Source: SEPC, 2013

### **True Seed Production**

Sri Lanka is expanding true seed production in onion to reach near self-sufficiency using many strategies. One of the strategies is to increase the productivity using cultivations with locally produce seeds. As the availability of lands to expand the cultivation of onion is limited this is considered as one of the best strategies. Table 4 indicates the quantities of true seeds imported during 2004-2011. It clearly shows the importance of expanding the local seed production to reduce the seed imports as well as to increase productivity.

During last few years Sri Lanka has launched production and productivity improvement programs to increase the production of food crops, which can be locally grown successfully. Big onion and red/cluster onion also has been identified as crops under this category. Therefore, special extension, research and development programmes were launched by the Department of Agriculture with the help of the Ministry of Agriculture to achieve these targets. Department of Agriculture and Provincial Agriculture Departments have taken numerous initiatives to encourage farmers and enhance the true seed production of onion. The following assistances have been provided to the farmers to promote onion seed production in Sri Lanka.

1. Storage facilities for small and medium scale farmers, who cultivate 120 and 1,200 kg of mother bulbs, respectively have been subsidized.

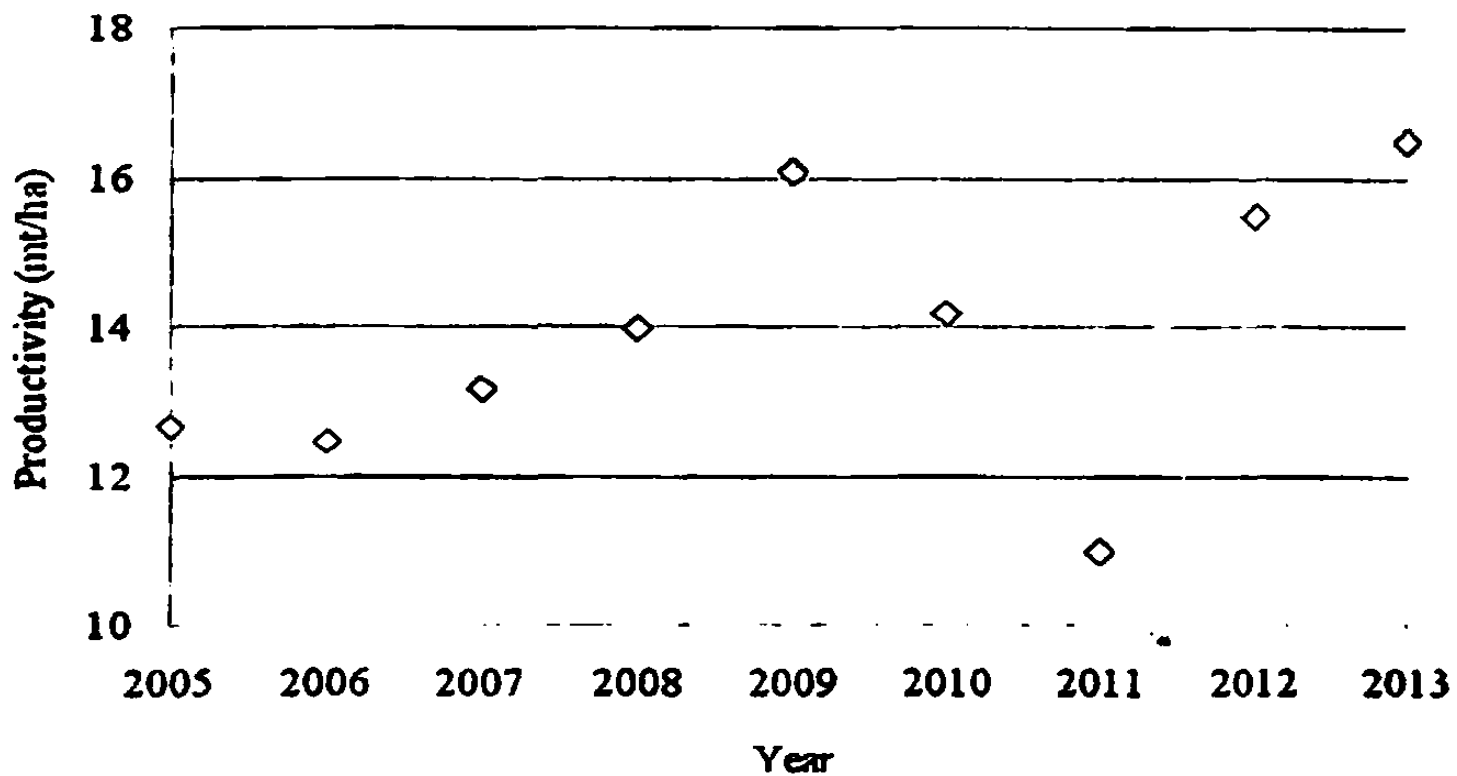
2. Vernalization process and coordination has been provided.
3. Newly designed plastic crates with improved ventilation were supplied to facilitate transport and prevent physical damages when mother bulbs were transported in gunny bags and wooden boxes.
4. Rain shelters were provided for selected enthusiastic farmers to encourage and increase the seed production.
5. Separation of seeds from dried umbels is laborious and time consuming, especially in medium to large scale seed production ventures. Therefore, arrangements have been made with Farm Mechanization Centre, Mahalluppallama to design and manufacture simple threshing machinery for seed separation.

**Table 4: True seeds of red and big onion imported to Sri Lanka 2007-2014.**

Year	Red onion			Big onion		
	Companies (Number)	Varieties (number)	Quantity (kg)	Companies (number)	Varieties (Number)	Quantity (kg)
2007	-	-	-	6	8	41,494
2008	-	-	-	9	8	32,097
2009	-	-	-	7	6	21,639
2010	-	-	-	7	5	38,210
2011	-	-	-	3	2	8,968
2012	-	-	-	6	4	23,113
2013	1	1	600	2	5	7,500
2014	2	1	1,200	6	3	20,597

Source: NPQS, 2014

Figure 2 shows the productivity increase achieved by the country in big onion using different strategies set by the onion crop development program. Except for the drop in 2010 and 2011, average productivity has shown increasing trend. Decrease in productivity during 2010 and 2011 was due to high disease incidence associated with extreme weather conditions.



**Figure 2: National average productivity improvement of big onion, 2005-2013.**  
Source: CBSL, 2013.

Vernalization of mother bulbs is the primary operation in onion true seed production. This is practiced by placing mother bulbs which are already completed dormancy (nearly 2 months after harvest) in favourable environments for a period of 2-3 weeks to induce uniform flowering. Conventionally Rahangala in Nuwara-eliya district was identified as the place for vernalization of big onion and red/cluster onion mother bulbs. Therefore, actions are being taken to construct new facility to initiate vernalization process at Rahangala. Recent studies revealed that the same climatic conditions can be provided for vernalization of onion in Riverstem area of Matale district.

Once the vernalization process is completed mother bulbs can be treated with fungicides and plant in raised beds. Vernalized bulbs are low seed yielders due to few of flowers has been identified as a one of the key issues in seed production of big onion when compared to onion seed producing countries in the region. Ratio between bulb (kg): seed (kg) is 10:1 in Sri Lanka where as it is higher in other countries. In India,  $KNO_3$  is used to reduce the ratio and improve the growth and yield of onion seed production. The Field Crops Research and Development Institute, Mahailuppallama has shown that dipping onion bulbs in 10%  $KNO_3$  has given significant increase of about 15-25% seed yield. The ratio between bulb (kg):

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seed (kg) has reduced from 10:1 to 7:8: (when compared to others; Deshabandu *et al.*, 2014). This is being practiced by some farmers in the recent past.

As a farmer supporting service, mother bulbs to be cultivated in *Maha* (wet) season have been collected from farmers and transported to Rahangala at the third week of December where ambient temperature ranges from 7-14 °C to store for 2-3 weeks. After 2-3 weeks storage under cold temperature (vernalization) bulbs are redistributed among farmers for field planting in the first week of January. Crop is covered with 36” width 300 gauge clear polythene sheet arranged as an arch shape roof using wooden or bamboo sticks to protect it from intermitted rains and heavy dew during *maha* (wet) season and to protect from fungal diseases such as purple blotch and anthracnose. Before the initiation of inflorescences (umbels), fishing nylon net (6-7) is placed horizontally over the crop to support the flower stalks and avoid the lodging of developing flower stalks. Mature umbels with stalks are harvested at 3 months of age onwards several times and dried under shade for further maturation of seeds. These are then subjected to sun drying and threshed manually to separate seeds. Seeds normally produced during *maha* (wet) season are marketed from April for *yala* (dry) season bulb crop (Tables 5 and 6).

Red/cluster onion true seed production has been recently started in the districts of Jaffna, Hambantota and Ratnapura. This will be expanded to Ampara and Monergala areas soon. Department of Agriculture is targeting to popularize the use of true seeds in view of reducing the cost of production of red/cluster onion. Average annual cultivated area of red onion is 6,000-6,200 ha, of which 55% covers with cultivar Vethalan or bolting type red/cluster onions. Programmes are under way to raise 40% of the Vethalan type red/cluster onion cultivations using true seeds in future under crop leader program.

## **Conclusion**

Both big onion and red onion are very important condiment crops in Sri Lankan agriculture and present strategies adopted by research and extension sectors of the department of Agriculture was able to increase the productivity and the production. Use of local seeds and improved management practice were some of the key factors

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improvements in productivity. Identification of areas for off season cultivation will also be an important strategy to obtain steady supply of onion to meet the market demand.

**Table 5: Big onion seed production in *maha* season in Matale district.**

Season	No. of farmers	Amount of mother bulbs planted (kg)	Seed yield (kg)	Selling price (Rs.)	Value (Rs. million)
1984/85	4	60	3		
1992/93	45	1,800	105		
1995/96	118	3,636	202		
2000/01	152	8,000	345		
2001/02	257	9,301	370		
2002/03	247	10,478	430		
2003/04	207	10,000	553		
2004/05	205	12,378	857		
2005/06	379	25,480	1,300	5,000	6.5
2006/07	500	30,000	1,725	7,500	13
2007/08	671	48,468	1,132	7,500	8.5
2008/09	750	55,000	4,183	9,000	38
2009/10	1,000	61,000	4,500	9,500	43
2010/11	1,200	93,850	3,500	12,000	42
2011/12	1,500	120,000	11,600	12,000	139.2
2012/13	1,500	125,000	9,000	12,000	108
2013/14	1,700	117,910*	11,822	15,000	177.3

\*Amount of vernalized (108,530 kg) and non vernalized mother bulbs in 2013/14 *maha*.

**Table 6: Big onion seed production in *yala* season in Matale district.**

Season	Farmers (number)	Amount of mother bulbs planted (kg)	Seed yield (kg)	Seed selling price (Rs.)	Value (Rs. million)
2001	7	113	4.7		-
2002	11	1,805	71.5		-
2003	15	1,955	66		-
2004	30	2,000	65		-
2005	34	2,900	163	5,000	0.8
2006	51	5,000	522	7,500	4.0
2007	60	9,043	925	7,500	7.0
2008	113	8,036	1,083	9,000	8.2
2009	170	21,940	2,225	9,000	20.1
2010	250	29,000	3,000	9,500	28.5
2011	300	22,000	2,600	12,000	31.2
2012	350	60,000	6,043	12,000	72.5
2013	350	55,000	4,185	15,000	62.8
2014	355	56,000			

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