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PASSION FRUIT INDUSTRY IN SRI LANKA
A Report on Past and Current Status

by

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The views expressed herein are those of the author and do not represent the official views or position of ACDI or USAID.

ABBREVIATIONS

1. A.C.D.I. - Agricultural Cooperative Development International.
2. C.A.R.I. - Central Agricultural Research Institute.
3. C.T.C. - Ceylon Tobacco Company
4. M.D. - Marketing Department
5. R.T.D. - Ready to Drink
6. Juice U.S.- Unsweetened Juice
7. E.O. - Export Oriented.
8. E. & L.M. - Export and Local Market
9. L.M. - Local Market
10. C.S.P. - Concentrated Super Phosphate
- 11 M.O.P. - Muriate of Potash

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INTRODUCTION

Recent interest in commercial production of passion fruit prompted a study on the present situation and future prospect of the passion fruit industry in Sri Lanka.

This study includes a field survey in two major passion fruit growing areas like Kalutara, Galle, large scale passion fruit farms and the places where experiments were conducted on passion fruit.

Officials of the CTC Passion fruit project, randomly selected passion fruit growers who are presently cultivating and those who have given up the cultivation were interviewed to obtain their experience and views on the cultivation of the crop, costs of production, problems faced by them and the yields.

Details of export and local market demand, juice yield prices paid to the suppliers, and volume of products were obtained from the passion fruit processors.

Research Officers of the Department of Agriculture were interviewed to obtain the results of the research on passion fruit production.

METHODOLOGY

|| Six farmers who have given up passion fruit cultivation and seven farmers who are currently growing passion fruit were interviewed. All the farmers were in the same geographical area in the districts of Galle and Kalutara. Majority of the farmers interviewed in the Galle district had given up cultivation and shifted to other perennial crops such as tea, rubber and cinnamon. The group which presently cultivate passion fruit have either given up cultivation earlier or are new comers to the cultivation and some of them have been cultivating for the past 10-15 years.

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GENERAL BACKGROUND

The genus *Passiflora* includes more than 350 species of subtropical vines, but few of them are grown for their fruits. (Kuhore 1968). The origin of the passion fruit is in the South American rain forests in the Amazon region of Brazil and possibly in Paraguay and Northern Argentina. There are two forms of passion fruit commercially grown for their fruits; the purple skinned *Passiflora edulis* and yellow skinned *P. edulis* F. flavicarpa.

The purple passion fruit is more superior in juice quality compared to the yellow, but the yield is lower in the purple variety.

The major passion fruit producing countries are Kenya, Brazil, Australia, New Zealand, South Africa, Philippines, Thailand, Taiwan, Hawaii, Florida, Venezuela and Colombia. In the majority of these countries the supply depends on the yellow form, while in South Africa, Kenya, New Zealand the supply depends on lines of purple passion fruit.

In Sri Lanka the majority of production comes from the yellow form. The passion fruit industry in Sri Lanka was started in the 1970's. Farmers use plants from own seedlings to start their commercial cultivations of passion fruit. Vegetative propagation is also possible. Methods of vegetative propagation commonly used are: cuttings, grafting and tissue culture.

Climatic Requirement

The yellow passion fruit is tropical and grown well from sea level upto an elevation of 2000 ft. The purple passion fruit is subtropical and it does well between altitudes of 2000 ft and 4000 ft. Both forms require ample amount of sunlight for their best performance. The minimum annual rainfall requirement for the passion fruit is 35 inches, and for a rainfed crop the rainfall should be well distributed throughout the year. Passion fruit can be grown successfully in intermediate and dry zone under irrigation. Table 12 show the distribution of passion fruit cultivation in Sri Lanka during 1991/92.

Soil

Passion Fruit can be grown on many soil types but light to heavy sand loams with medium texture are most suitable. The pH should be in the range of 5.5 - 7.5. If soils are too acidic lime must be applied. Good drainage is essential to minimize incidences of collar rot disease.

Planting

Passion fruit can be propagated from both seedlings and cuttings.

For seedlings, fruits from high yielding vines should be obtained. Seeds must be obtained from fully matured fruits or from fruits which have fallen on the ground. The pulp must be removed from the seeds and washed with water. If the seeds are to be stored, they must be dried in the shade for a few days. If they are kept in controlled atmosphere shelf life is about 3 months without loss in viability. Seeds of 175 fruits should weigh about 500 gms when dry and usually contains about 8,000 - 10,000 seeds.

Seeds will germinate at about 3 weeks after planting. Direct seeding or transplanting can be used to start the crop. Nursery seedlings can be transferred to polytene bags, when 15 cm in height and later planted in the fields. Rooting of cuttings can be improved by applying rooting hormones. Spacing in the field is 2.5 m by 4.5 m. Planting can be done in contours where the land is slopy and in the east - west orientations if the land is flat. Trellises can be made using wooden, or concrete posts and GI wire. Spacing of posts in a row is 4 m and between rows 2.5 m if planting on contours. In flat land, spacing of posts in the row is the same but between rows should be 2m. The wires should be 5.5 - 6ft above the ground level.

Planting holes of 2ft x 2ft x 2ft filled with topsoil mixed with 2 baskets of well decayed cowdung or compost with 1-2 lbs of Sapos Phosphate two weeks prior to planting is recommended.

Training and Pruning

Sticks or coir rope should be provided to the plants to enable them to climb on to the wire. When the vines reach the wire, prune the apical bud, so that it produces lateral shoots which grow along the wire. Excessive shoots must be removed to increase the yield. After harvesting, removal of old lateral shoots is essential to induce new shoots which produce flowers. Removal of tendrils help to keep the vines in a hanging position on the wire which help in pollination, harvesting and pruning.

Flowering

The flowers are produced only in new shoots. Pruning is an essential practice (removing old and excess branches) to increase the flower and fruit production. Passion fruit starts to produce flowers 6-7 months after planting and continues over a period more or less 10 years, but their economical life span is about 3-5 years.

Pollination

Passion fruit is mainly cross pollinated. The flowers open between 12 noon - 3.00 p.m. The pollination of the passion fruits depend on the insects which are active during this time. But normally the pollinating insects are less active during this period. So the fruit set is poor. Large bees are the major insect for pollination of passion fruit (honey bees, Carpenter bees, etc). Artificial pollination should be introduced to improve the success of fruit set (i.e, Hand pollination).

The two forms of passion fruit hybridize readily and produce viable seed and fruits of intermediate in appearance. In crosses it is necessary to use a purple form as the seed parent because flowers of yellow form are not receptive to the pollen of the purple form.

Fruit Harvesting

There are two fruiting seasons: in the wet zone, March - May and June - September. In the dry zone under rainfed conditions, there is only one fruiting season February - March. But two crops can be obtained under irrigation in the dry zone. Harvesting can be done about 45 days after pollination. To prevent post harvest decaying, fruits should be harvested before falling to the ground.

Pests and Diseases

Fortunately, there aren't serious pests for the passion fruits. Sometimes it is damaged by Nematodes, stem borers and fruit flies. The stem borers cause swelling of the vines and eventual death of the vine above its attack specially in wet zone.

Major diseases in the passion fruit are caused by viruses and fungi. Virus diseases are more prevalent in Sri Lanka. Six virus diseases have been established in passion fruit i.e. passion mottle, passion yellow blotch, passion decline, passion mosaic, passion woodiness and passion crumple. The three diseases; passion mottle, passion yellow blotch and passion mosaic are sap transmissible. (Highlights of research progress past 10 years, 28 April 1980, CARI, Gannoruwa).

These viruses are transmitted by aphids. Mechanical transmission is also possible during hand pollination & pruning. These viruses multiply in weeds such as passiflora, foetida, Cassia occidentalis. Plants of the Cucumber family can retain the virus which can cause woodiness disease in passion fruit. All Passiflora species can harbor the viruses. Passion Mottle is highly infectious; spreads very quickly in plantations once an infection occurs and it causes loss in productivity. Under

natural conditions, rapid spread of passion mottle was facilitated by agents as squirrels. (Half Yearly Report Maha 1977/78 CARI, Gannoruwa).

Although the plants get infected with woodiness, virus infected fruits may not show woody symptoms in the wet zone. Removal of infected vines at the early stage of growth is possible but for bearing vines it is uneconomical. Mature plants can withstand the damage caused by viruses to some extent so they can be kept till the end of its economical life.

Collar Rot is prevalent in the lands subjected to water logging. Fungi which can cause collar rot in Sri Lanka are Fusarium moniliforme, Botryodiplodia theobromae and Geotrichium caradum.

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History of the Passion Fruit Industry in Sri Lanka.

Commercial cultivation of passion fruit has been started during the early 1970's in the Kalutara and Galle areas. Youth farm colonies were used for this and they were provided with subsidies for cultivation. Their harvest was taken by the Marketing Department (MD) mainly for export purposes. At the beginning there was a good export market for passion fruit. Sometime later they lost their export market due to the increase in the supply to the world market by other countries. Then the prices for passion fruit came down and farmers were paid very low prices. In some cases collectors were refused to buy the passion fruit and the farmers faced problems in marketing. Some farmers used their lands for other perennial crops such as tea, rubber and cinnamon which gave a steady income. Then, private collectors were dominant in the passion fruit marketing. Farmers were paid very low prices, about 60% of the prices. This is also a reason that the number of farmers cultivating passion fruit have steadily declined.

The violence in the 1980's has hindered the performance of the processing factories, and also farmers were unable to harvest and sell their produce. This has discouraged passion fruit growers.

During 1988 CTC started a fruit production farm at Mahaweli System C where they grew 32 acres of passion fruit. Drip irrigation was applied to 11 acres of land while the rest was rainfed. Good yields were obtained from these plantations during the first two years. During the third year the yields were low due to high incidences of disease and water shortage. There was a very good relationship between the rainfall pattern and the passion fruit yield.

Farmers have been able to minimize the adverse effects caused by diseases by applying fertilizer to increase the vigor of the crop.

Research on passion fruit has been conducted in the research stations at Gannoruwa (CARI), Bombuwela, and Makandura. The areas of research were disease resistance and crop improvement. Researchers of the Rahangala Research station have obtained a cross between purple and yellow forms, the "Rahangala Hybrid" which is more suited for up country. This hybrid has pink colored skin and superior juice quality. Rahangala hybrid is more prone to collar rot in the low country.

A local selection "Madugoda" by CTC has performed well and given good yields.

So far researchers were unable to find out the control method for the virus diseases except crop sanitation. Cross protection with mild strains of virus have been tested. These vines were good in appearance and vigor unless they are not subjected to water stress. With hand pollination, cross protected vines produced good crops under relatively good management (Half yearly report 1983 CARI, Yala, Gannoruwa).

Cross protection research programs will be continued during 1992-1993 under Diversified Agricultural Research Project (DARP) by the Department of Agriculture.

So far virus diseases of passion fruit have been recorded from every passion fruit growing area in the island. Plantations in Mahaweli areas were infected with virus after two years although they were planted in new clearings.

Experiments are being conducted to evaluate the possibility of growing passion fruits under coconut and rubber plantations.

|| With the introduction of RTD (ready to drink) type bottles the demand for the passion fruits have been increasing domestically.

Passion fruit extent and estimated production in Sri Lanka during the past ten years in given in Table (1).

Table 1

Passion Fruit Productions in Sri Lanka during past years.

YEAR	EXTENT (ac)	PRODUCTION (Metric tons)
1980/81	3280	10,755
1982/83	1034.4	11,600
1984/85	3138.5	4,783
1985/86	3716.5	3,023
1986/87	3388.4	2,250
1987/88	4040.1	3,264
1991/92	1996.8	2,884

Source: Agricultural Development Programs
1980-1992.

The land area under passion fruit cultivation has been reduced from 3280 acres to 1996.8 acres during the period of 1980 to 1992. The production of passion fruit also has been reduced to 2884 from 10,775 metric tons during the above period. From the total of 13 farmers interviewed 61.5% have given up or decreased their extent and the rest remained in same extent under passion fruit.

Table (2) shows the extent of the passion fruit cultivation and their average production. The farmers who have given up cultivation have used more land for passion fruit. Presently growers have used less extent of land for passion fruit. The yields of the present growers are higher compared to the farmers who gave up cultivation. CTC farms have obtained the highest yields due to the systematic way of their cultivation.

Farmers used their own seedlings to start the crop. Due to natural cross pollination seedlings differ in vigor and yield. The CTC farm has also used seedlings for their plantations because of their high vigor and low incidences of diseases.

The different cultural practices adopted by the farmers are given in Table (3). All the passion fruit growers have been using fertilizer, weeding, pruning and crop sanitation methods. The percentage for soil conservation for the presently cultivating group was less than 100 due to flat lands that they use for cultivation. The rate for pollination is also less than 100 in present growers because 14.3% farmers had young cultivations and 14.3% of the farmers in present cultivation groups have been watered their crops. CTC farms have been practising drip irrigation for 11 acres of land while the rest of the passion cultivation was rainfed. 50% of the farmers who have given up cultivation have intercropped Sunhemp plants to attract pollinating insects which lead to the increase in fruit set.

All the farmers interviewed used family labor in their plantations and one acre of passion fruit could be looked after by one full time worker. Labor shortages were a problem at the CTC farm during certain periods. Weeding by tractors was used there due to labor shortage. Tine tillers were used in between the rows which will not remove the weeds closer to the vines. The vines at the CTC Farm were planted 10ft x 10ft for the convenience of using tractors for weeding. Mulching has been practiced by the CTC to reduce the water loss from the soil around the vines.

Farmers market their products depending on the prices paid and the accessibility to the different buyers. Table (4) provides the results of the farmers survey conducted during this study. Farmers who gave up cultivation sold their produce to either The MD or a collector in the town. But recently, lorries from town are coming to the farms to buy the harvest.

Table 2 .

Yeild of Passion Fruit

	*Farmer No:	Extent/Acres	Yeild(kg)/Yr	Yield (Kg)/Ac/Yr
Farmers who gave up cultivation	01	2.0	8725	4362.5
	02	1.0	2500	2500
	03	1.0	2512.5	2512.5
	04	1.0	2745	2745
	05	1.0	2400	2400
	06	0.75	1885	2513.3
farmers presently cultivating	1B	0.75	2500	3333.3
	2B	0.75	2375	3166.7
	3B	0.25	--	--
	4B	0.5	2110	4220
	5B	0.75	2500	3333.3
	6B	0.5	2000	4000
	7B	0.5	1850	3700
CTC FARM		13.0	64026.5	4925.1

* Farmers Interviewed by the Author.

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Table 3

Different Cultural Practises adapted by Farmers (%)

Farmer Category	Fertilizing	weeding	pruning	Soil Conservation	Crop sanitation	Pollination	other
Gave up Cultivation	100%	100%	100%	100%	100%	100%	50% V ₁
Presently Cultivate	100%	100%	100%	85.7%	100%	85.7%	14.3% V ₁
Total	100	100	100	92	100	92	
CTC FARM	✓	✓	✓	✓	✓	✓	V ₂

Sample Size 13, Gave up cultivation 6, presently cultivate 7

* V1 – Intercropping Crotalaria

* V2 – Watering

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Table 4

Marketing Channels (% reporting)

Farmer Category	Sample size	Village Collector	Collector in town	Lorries from town	Marketing* Department
Gave up Cultivation	6	—	66.67	--	100
Presently cultivate	7	28.57	71.0	42.86	14.29
Total	13	15.38	69.23	23.08	53.85

* now Lanka Canneries.

The prices for passion fruit paid by the different sources varies with the time. At the beginning of the industry they have received Rs 0.66 to 0.99 per kilo while now they are receiving about Rs 15/- per kilo. At the end of the fruiting season farmers are getting higher prices while during off season collectors pay low prices because they are unable to gather sufficient quantity to send to the processors. Lorries coming from outside reach few farmers due to the bad roads that lead to the farms.

When the lorries come to collect passion fruit, the village collector or collectors in the town pay higher prices. Most farmers prefer to market their products to the sources which pay ready cash.

The cost of production of passion fruit includes all practices from land preparation to harvesting of the crop during the first year. This contains wages for family labour.

Table (5) shows the cost of production of passion fruit by different farmers. The average cost of production of the farmers who gave up the cultivation was 10,668 while the present cultivating group is 17,571. This change may be due to the increase of the cost of inputs and labour with the time.

Table 5.
Cost of production of passion fruit (Rs/Ac/Yr)

Category	Farmer No:	Total cost
Gave up cultivation	1	11,000/=
	2	10,000/=
	3	10,000/=
	4	10,000/=
	5	13,000/=
	6	10,000/=
Presently Cultivate	1B	16,000/=
	2B	16,000/=
	3B	20,000/=
	4B	16,000/=
	5B	17,000/=
	6B	20,000/=
	7B	18,000/=
CTC Farm		23,000/=

The high cost of production in both groups who have given up cultivation and present growers is due to the increased expenditure on soil conservation methods.

The cost of production in the CTC farm is higher than that of farmer level due to the use of irrigation water and high standards of maintenance.

Table (6) presents the profitability of the passion fruit crop. Present cultivators (Farmer No: 1B-7B) receive higher profits compared to earlier cultivators (farmer No: 1-6). Farmer 4B has received less profits compared to other in his group because he has given up the cultivation and recently again started cultivation and the present plantation is not matured. Farmer 3B has recently started cultivation.

The difficulties faced by passion fruit farmers are given in table (7). Both present growers and those who have given up cultivation had difficulty in marketing and it was the main reason for giving up the cultivation by certain farmers. Finding timber for posts, high cost of fertilizer and other inputs were also significant problems.

Passion fruit is mainly processed for juice (both sweetened and unsweetened) and for cordials. Various products of passion fruit by different firms are given in Table (8). Table (9) present the volume of products by different processing firms which were interviewed during this study. Local prices for the products are

Table 6

Profitability of the Passion fruit crop.

	*Farmer No:	Cost of Production	Yield/Ac/Yr Kg	Average Price Rs/Kg	Total Income Rs	Profit Rs/Ac/Yr
Gave up cultivation	01	11,000	4362	3.85	16,796	5,796
	02	10,000	2500	4.20	10,500	500
	03	10,000	2512	4.30	10,804	804
	04	10,000	2745	3.95	10,843	843
	05	13,000	2400	3.85	9,240	3,760
	06	10,000	2513	4.20	10,556	556
Presently cultivate	1B	16,000	3333	11.50	38,333	22,333
	2B	16,000	3167	10.00	31667	15,667
	3B	20,000	--	--	--	--
	4B	16,000	4220	2.65	11,183	4,817
	5B	17,000	3333	9.00	30,000	13,000
	6B	20,000	4000	12.00	48,000	28,000
	7B	18,000	3700	9.00	33,300	15,300
CTC FAR		23,000	4925	13.00	64,026	41,026

* Farmers Interviewed by the Author.

Table 7

Constrains in Passion Fruit cultivation %

Farmer Category	Sample Size	Market-ing	Diseas-es	*	High cost of fert.	trans-port	pests	lack of inputs	drought
Gave up cultivation	06	100	66.7	50	16.7	16.7	33.3	--	--
Presently cultivate	07	28.6	85.7	28.6	42.9	14.3	28.6	14.3	28.6
Total	13	61.5	76.9	38.5	30.8	15.4	30.8	7.7	15.4
C T C FARM		--	✓	--	--	--	--	--	✓

* Unavailability of Posts.

Authors Survey findings.

higher than that of export prices due to various taxes. The demand for jam is very low. Export demand cannot be satisfied due to the increment of local demand and shortage of fruits. Most of the processors are catering to the local consumers and less than 25% of the export demand for passion fruit is satisfied.

Table 8.
Passion fruit products by different processors (number reporting)

Processor category	No: of firms	Products				
		juice	cordials	jams	squash	RTD bottles
Export oriented	01	01	01	01	--	--
Both local & export market	01	01	01	01	--	01
Local market only	03	--	01	02	01	02

November, December and January are the peak demand months for passion fruit products in the local market while during the summer season export demand is high. Locally, sweetened juice and cordials are popular while unsweetened juice has demand in the export market (Table 10). The demand for the passion fruit RTD bottles is less compared to other fruits but it is increasing. Passion fruit is included in mixed fruit cordials and mixed fruit RTD bottles, which are more popular.

According to the demand and supply figures (Table 9 & 10) there is a good future for the passion fruit cultivation if disease problems can be overcome and costs of production controlled. Increasing the extent under passion fruit together with better management could satisfy the demand of passion fruits.

Table 11 presents the fertilizer recommendations for passion fruit by the Department of Agriculture.

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Table 9

Volume of Products 1991 by different processors

Processor Category	Juice		cordials bottles 740ml	Squash Bottles 740ml	RTD bottles 190ml	Jam Jars (450 gms)
	Unsweetened	Sweetened				
Export Oriented	528 MT	---	---	---	---	---
Both local & Export Market	1630 (3010 ml cans)	2223 (3010 ml cans)	173,200	---	---	17,260
Local Market Only	---	---	170,000	340,000	1,210,000	350,000

Estimated by the Author based on interviews with the processors.

Table 10

Demand for passion fruit products 1991

Processor Category	Export		Local					
	Juice U.S.*	Cordials Bot (740 ml)	Juice cans (3010 ml) sweetened	Juice cans (3010 ml) U.S.	Cordials bottles (740 ml)	Squash bottles (740 ml)	RTD Bottles (180 ml)	Jams jars (450 gms)
Export Oriented	528 MT	---	---	---	---	---	---	---
Both local & Export Market	10800 (3010 ml cans)	36,000	more than 2223	1415	more than 116964	---	---	17,067
Local Market Only	---	---	---	---	more than 170,000	more than 340,000	more than 1,210,000	Not Available

Here "more than" is used when the production is sold completely and people who ask for that particular product.

* Unsweetened

Table 11

Fertilizer recommendations for Passion Fruit

	Dry & Intermediate Zone			Wet Zone		
	Urea grms	CSP gms	MOP gms	Urea gms	CSP gms	MOP gms
At the planting mixed with top soil	70	105	55	60	115	55
Two months after planting (if slow growth)	70	105	55	60	115	55
Six months after planting	70	105	55	60	115	55
Every six months during						
Second Year	140	210	110	120	230	110
Third Year	210	315	165	180	345	165
Fourth Year	280	420	220	240	460	220

This amount is sufficient for one plant. When planting in Wet Zone apply Kiesarite, Epsam salt or Magnesium sulphate, 50 gms per planting hole in addition to basal fertilizer.

Source – Agricultural Publication No: 15 (Passion fruit)

Table 12

Districts of Passion fruit cultivation 1991/92

District	Zone	Existing Extent Hectares	Extent to be cultivated in Yala 92	Total Extent Hectares
Colombo	Wet	40	10	50
Gampaha	Wet	35	25	60
Kalutara	Wet	95	400	495
Galle	Wet	50	01	51
Matara	Wet	5	5	10
Badulla	Inter	15	--	15
Monaragela	Inter	05	02	07
Ratnapura	Wet	65	30	95
Kegalle	Wet	02	01	03
Kurunegala	Inter	--	10	10
Batticaloa	Dry	04	02	06
Mahaweli Area				
System C	Inter	4	6	10
System G	Dry	2	1	3

Source: Agricultural Implementation Programme 1991/92

18.

Recommendation

Results of this study shows that marketing is the main constraint in the passion fruit cultivation. Diseases also play an important role in the reduction of the crop both in small scale or in large scale.

Farmers face difficulties in finding wooden posts to build trellices due to reduction of timber in the forests.

High costs of fertilizer and other inputs also effect the cultivation of passion fruits. Most farmers hesitate to apply recommended rates of fertilizer and normally they do not apply the basal mixture. Most farmers use coconut fertilizer mixture due to the unavailability of appropriate passion fruit fertilizer mixture.

Processing firms get lower quantity of passion fruits due to the reduction in the extent of cultivation. Although processors pay higher rates for the passion fruits, cultivators get less than 60%. This is mainly due to the big gap between the producer and the processor.

* Marketing facilities should be improved by starting more collecting centers. This will help to get higher prices to the producers which is likely to encourage cultivation.

Passion fruit cultivation should be introduced to the dry zone & intermediate zone where irrigation is possible.

* Farmers should be educated on the adverse effects of the diseases which can be minimized by reducing the stress to plants. Plants well fertilized and watered are less damaged by the viruses. Drip irrigation can be practiced in the Dry Zone.

* Farmers should be advised to remove the virus infected plants at early stages of detection. (i.e, when leaves show vein clearing and translucent spots).

* Organize a good extension/outreach program to provide technical assistance to farmers willing to grow passion fruit.

* Starting medium scale passion fruit farms.

* Adapting good weed control practices which removes the alternate hosts of the virus and the vectors.

* Passion fruit fertilizer should be provided.

*must start from scratch**

- * A subsidy scheme (in kind instead of cash, i.e, fertilizer, post, wires etc) might be introduced temporarily.
- * Additional loan facilities should be provided for passion fruit farmers.
- * Assistance should be given through Janasaviya scheme which provides self-employment.

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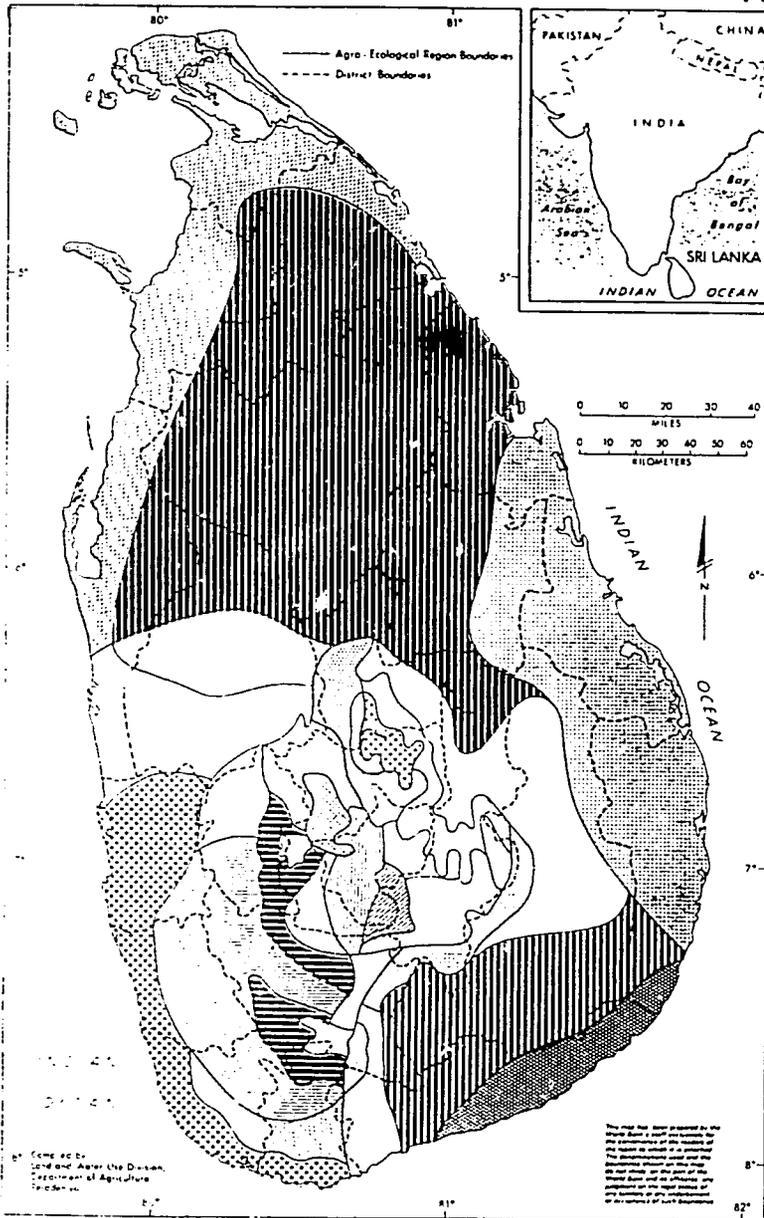
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SRI LANKA AGRO - ECOLOGICAL REGIONS

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ZONE	AGRO-ECOLOGICAL REGION & SYMBOL	MONTHLY HISTOGRAMS OF 75% RAINFALL PROBABILITY FOR RESPECTIVE REGIONS	75% EXPECTANCY VALUE OF ANNUAL RAINFALL (Inches)	75% EXPECTANCY OF DRYNESS FOR PARTICULAR MONTHS												MAJOR SOIL GROUPS	TERRAIN
				JAN	FEB	MAR	MAY	JUN	JUL	AUG	SEP						
UP COUNTRY	WU ₁		> 125	J	F									Red Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply sloping hills and ridges		
	WU ₂		> 75	J	F	M								Red Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply sloping hills and ridges		
	WU ₃		> 55	J	F	M								Red Yellow Podzolic soils with dark B horizon and Red Yellow Podzolic soils with prominent A horizon	Rolling		
WET COUNTRY	WM ₁		> 125	J	F									Red Yellow Podzolic soils and Red Yellow Podzolic soils with sub-compartment A horizon	Smooth, dissected hills and ridges		
	WM ₂		> 55	J	F	M								Reddish Brown Latosolic soils and Brown Loams and Red Yellow Podzolic soils	Smooth, dissected hills and ridges		
	WM ₃		> 50	J	F	M					Aug			Reddish Brown Latosolic soils, Immature Brown Loams, and Red Yellow Podzolic soils	Smooth, dissected hills and ridges and undulating		
LOW COUNTRY	WL ₁		> 100	J	F									Red Yellow Podzolic soils and Red Yellow Podzolic soils with sub-compartment A horizon	Rolling and undulating		
	WL ₂		> 75	J	F									Red Yellow Podzolic soils, Red Yellow Podzolic soils with strongly marked sub soil and low Humic Gley soils	Rolling and undulating		
	WL _{3&4}		> 60	J	F	M					Aug			W1: Red Yellow Podzolic soils with sub soil and low Humic Gley soils W2: Red Yellow Podzolic soils with sub soil and low Latosolic and Red Yellow Podzolic soils	W1: Rolling and undulating W2: Rolling and undulating		
UP COUNTRY	IU ₁		> 85			M			Apr	Aug	Nov			Red Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply sloping hills and ridges		
	IU ₂		> 55		F	M			Jun	Jul	Aug	Sep		Red Yellow Podzolic soils and Mountain Regosols	Mountainous, steeply sloping hills and ridges		
	IU ₃		> 45		F	M			Jun	Jul	Aug	Nov		Red Yellow Podzolic soils	Steeply dissected hills and ridges		
MID COUNTRY	IM ₁		> 55			M			May	Jun	Jul	Aug	Nov	Reddish Brown Earths and Immature Brown Loams	Rolling hills and ridges		
	IM ₂		> 45	J	F				Jun	Jul	Aug	Sep		Reddish Brown Earths and Immature Brown Loams	Rolling hills and ridges		
	IM ₃		> 35		F	M			May	Jun	Jul	Aug	Sep	Immature Brown Earths, Reddish Brown Latosolic soils, and Reddish Brown Earths	Smoothly dissected hills and ridges		
LOW COUNTRY	IL ₁		> 40	J	F	M			Jul	Aug	Nov			Red Yellow Podzolic soils with strongly marked sub soil and low Humic Gley soils, Red Yellow Podzolic soils with sub soil and low Latosolic and Regosols and red and yellow soils	Rolling and undulating		
	IL ₂		> 45		F	M			May	Jun	Jul	Aug	Nov	Reddish Brown Earths, Immature Brown Loams and Low Humic Gley soils	Rolling hills and ridges		
	IL ₃		> 35	J	F	M			May	Jun	Jul	Aug	Nov	Reddish Brown Earths, Immature Brown Loams and Low Humic Gley soils	Undulating		
LOW COUNTRY	DL ₁		> 30	J	F	M			May	Jun	Jul	Aug	Nov	Reddish Brown Earths and Low Humic Gley soils	Undulating		
	DL ₂		> 35		F	M			May	Jun	Jul	Aug	Nov	Non Calcic Brown soils, Reddish Brown Earths, soils and Immature, Semi-arid, Semiarid, Low Humic Gley soils and Regosols	Undulating and flat		
	DL _{3&4}		> 23	J	F	M			May	Jun	Jul	Aug	Nov	DL3: Red yellow Latosolic and Regosols DL4: Semi-arid and Semiarid, Semiarid and	Flat, rolling and undulating		
	DL ₅		> 20	J	F	M			May	Jun	Jul	Aug	Nov	Reddish Brown Earths with high amount of gravel in sub soil, Low Humic Gley soils and Semi-arid and Semiarid	Undulating and flat		

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This map has been prepared on the basis of a soil survey conducted by the Department of Agriculture, Trincomalee, in 1967. The symbols used on this map are not to be confused with the symbols used on the map of the Department of Agriculture, Trincomalee, in 1967.

* Symbols represent the months: J - January, F - February, M - March, Apr - April, May, Jun - June, Jul - July, Aug - August, Sep - September, Nov - November.

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