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HOW TO ACHIEVE SUCCESSFUL MANGO CLEFT GRAFTING.

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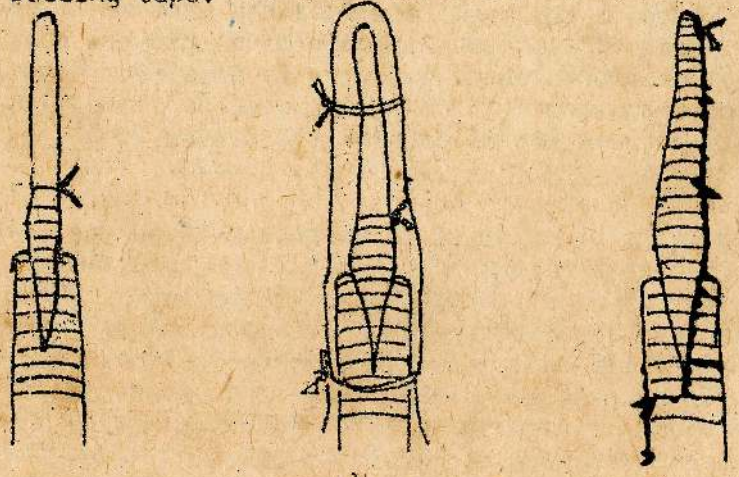
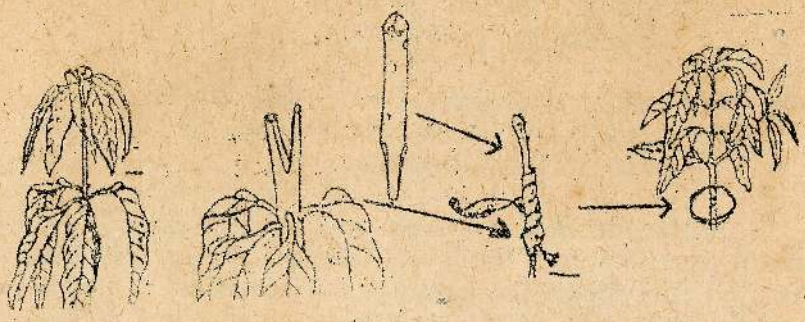
Budding and grafting are very widely used in propagation of of mango. Skilled labour is required for success of the operation. Compared to budding, grafting (shoot) is more convenient to farmer. But in the Dry Zone according to fruiting cycle seeds are available during the period of November to December. Planting of seeds commence when seeds are available and 4 - 5 months are required for plants to attain the budding stage. When the plants are at buddable stage climatic conditions are very dry and the velosity of wind also is very high. Due to these adverse climatic conditions percentage of success of grafting is very low.

An Observational study was carried out at Agricultural Research Station at Vanathavillu to find out a suitable technique to get a higher percentage of success from grafting. The normal practice is to cover the grafted plant with a piece of dry banana pseudo stem. But very high wind velocities can damage the grafted plant inspite of such protection.

The following treatments were used in this study.

(a) Control treatment. Scion not covered.
(b) Scion covered with dry banana pseudostem.
(c) The scion completely covered with budding tape.





Month of Grafting.	No. Grafted.			No. Success			Percentage Success.		
	A	B	C	A	B	C	A	B	C
84 July	25	25	25	5	12	20	20	48	80
85 July	20	20	20	4	11	18	20	55	90
86 July	30	30	30	5	13	26	16	43	86
Average percentage success:							18	48	85

Method C gave a higher percentage of success, indicating that it is the most suitable method of grafting. This method would have given good results due to lesser damage from wind.

Methodology

Select the wild variety of stock plants which are in buddable stage. The stock is topped at a height of 20-25 cm and split vertically from the top to a depth of about 3 - 4 cm. Selected scion (from a desired plant) which is carrying dormant buds, is then shaped into a wedge at the base, and inserted into the cleft made in the stock. About 2.5 cm wide polythene tape could be used as a budding tape. Tape is firmly wrapped starting from stock (15 cm from the ground level) to scion till the scion is completely covered.

Buds of the scion start to sprout 10-20 days after grafting. This sprouting is easily observed due to the transparent nature of the polythene tape. If sprouting is observed open the terminal bud and keep the rest of the scion covering with polythene. When the scion is producing leaves open the scion and remain the union cover with polythene. At the stage of 2-3 leaves, budding tape at union could be released. The time taken for whole procedure is about 30 days.

Advantages:

1) Percentage success is very high. (over 85%)
2) Less laborious because covering with dried pieces of pseudostsm of banana is time consuming operation.
3) No damage from blowing.
4) Observation on sprouting of shoot is easy due to transparent nature of the polythene.
5) Drying of scion is very low.
6) Time period for complete procedure is minimum.
7) Even during very dry seasons this method could be carried out.

Recommendations:

The findings on this study shows that method (c) covering of complete scion with the polythene tape itself would give highest percentage success of grafting. That method is very convenient method and it has more advantages over other after care methods.

THE SMALL FARMERS OF SRI LANKA.

I.M. Gunawardena, S.M.S.,
(Development Communication)

If the biggest group or the majority group of a country could be called the backbone of that country, then the small farmers are the backbone of Sri Lanka. Although the small farmers constitute the majority of the rural as well as national population, yet they remain in continuous battle and struggle with the problems, inadequacies and difficulties peculiar to rural living. They may not enjoy the fruits of technological and scientific advances that has made life exciting, convenient and enjoyable for their urban cousins, who usually would try to pay the lowest price for the grain, fruits, vegetables, firewood and many other items produced through the efforts and labour of the small farmers.

Who is a small farmer ?

He is a farmer cultivating less than 2½ acres (minimum cultivated extent needed for a farm family

to live at subsistence level) of land. In addition, there are landless farmers and agricultural labourers who earn most or all of their annual income from agriculture. The majority of farmers cultivate so small extents that they are not left with anything for sale at the end of a season (A.R.T.I.,1974).

Our Rice Farmers:

A substantial proportion of paddy holdings in Sri Lanka (44%) are less than 1/2 acre in extent, while the total number of paddy holdings is 648,486. In a study on rice farming Ranjith Bandara (1987) found the average cost of cultivating 1/2 acre under rice to be around Rs.2685.00. The average yield reported by his respondents was 40 bushels from 1/2 acre of rice. At Rs 70 per bushel, the average farmers income is Rs.2800.00 assuming he sells the entire produce without retaining any for consumption. While the profit for the entire season (6 months) is Rs.115.00 (from 1/2 acre) a mere loss of 2 bushels due to drought, rain, pest or disease could have resulted in a financial loss

> The present situation demands truly developmental leadership than any other, to lead them away from existing hardships. Overlooking this need can only result in aggravated social problems.

Our responsibility

We must heighten our awareness of the problems of small farmers and their families, such as hunger, malnutrition and poverty. Our future national workforce, to a great extent, will be from the homes of small farmers. If they are to be efficient, alert, strong and dynamic, they must be well nourished, educated, trained and disciplined. Could this be done in an environment of malnutrition, undernutrition, starvation, poverty and frustration.

Therefore the time is now, for us to think, decide, and make a strong determination to initiate and continue to do those things that would positively help the small farmers to overcome the problems plaguing them at present. Let us begin with a question. How can we provide help to the small farmers and their families to progress towards higher production, better nutrition and greater efficiency in their work ?

WHY NOT MAKE YOUR OWN NEEM CAKE COATED UREA.

I.M. Gunawardena

Margosa is also called Neem. After extraction of oil the residue that remains is called Neem cake. Neem Cake Coated urea application has several advantages.

Neem Cake reduces loss of Nitrogen due volatalization and leaching. The result is increased grain yield if Neem Cake coated urea is applied to a rice crop (see Table 1).

Neem Cake coated urea **(NEEM)** can be prepared by mixing dehydrated Neem Cake (30% urea by weight) and one part coal tar (1% urea by weight) mixed with 2 parts of kerosene oil (by weight).

As seen in table 1 Neem cake coated urea (NCCU) significantly reduced Nitorgen loss (34%) and increased yield (17%) as a result of better uptake (7%) of Nitrogen by rice plants.

The result is an appreciable saving on the cost and amount of urea used for a rice crop.

Table 1: Effect of Neem cake coated urea on rice yield.

Treatment	N Loss kg/ha	N uptake kg/ha	Yield t/ha
1. 100 kg N/ha in 3 doses.	31.3	78.3	4.6
2. 80 kg N/ha as NCCU basal application.	20.7	84.1	5.4
3. 80 kg N/ha through 80% N as NCCU basal and 20% N as urea at tilling.	16.2	96.3	6.1
4. Control	8.8	44.1	2.7

(From IRRI News letter, October 1986.)

PRODUCTION OF ONION SEED

Allium cepa.

P.H.D. Fernando, Agric. Research Station,
Kalpitiya.

Although in Sri Lanka the usual planting material for onions is mainly the onion bulb, some onion varieties have the ability (genetic potential) to produce flowers and viable seeds. The preliminary investigations carried out at Agricultural Research Station (ARS) Vanathavillu and Kalpitiya to produce true onion seed have given encouraging results.

While the climatic factors contribute in a large measure to the production of flowers and seeds, selection of the specific cultivar appears to be the key factor. One such variety is the local "Malloonu" which is probably a selection from (Vedalam).

Planting onion seed instead of bulbs is very profitable in the cultivation of this crop, in that one can make a saving of about 40% in the crop budget.

The use of true onion seed allows the saving of 400-500 kg of onion bulbs per each 4000 sqm (1 acre) planted under onions. This also eliminates the need for storage space and increases the supply of onions for consumption. Some additional benefits are :

1. Non-availability or short supply of seed bulbs during the planting season due to storage difficulties and the greater consumer demand resulting in increased cost of onion bulbs.
2. High transport costs.onion bulbs as seed is bulky, (as much as 500 kg. per 4,000 sq.m.) This transport cost also add to the cultivation costs.
3. Since no phytosanitary precautions are taken to prevent dissimination of pests and diseases (especially the nematodes) there is the positive danger of transmitting nematode diseases through planting material causing heavy economic lossess to the farmers.

In this context a strong case exists for use of true seed as against onion bulbs as planting material.

A block of 'Mal loonu' planted during Maha 1980/81 at ARS/Vanathavillu produced 80% flowers. These sun-dried seed were stored in polythene bags for about 10 months and subsequently sown in nurseries at A.R.S/ Kalpitiya. Germination was 90% . The onion seedlings were transplanted and healthy bulbs were obtained from them. These bulbs were planted again next Yala Season. Yield data and plant characteristics pertaining to this variety will be recorded. Seed viability tests were done using seed retained in the inflorescence and also after extraction. Germination tests were done after three months of storage. 95% germination was recorded for both methods of storage. Studies are being made to assess the seed yield which is very vital in a seed production programme.

Other important observations made :-

1. Emergence of flowers takes place (at about) 30 and 45 days from planting for Yala and Maha seasons respectively.
2. The age of bulbs at planting seem to determine the age of flowering as onion bulb has a primary dormancy period of about 45 dayps.
3. Seed viability can be maintained under local farmer conditions without cold storage provided the flowers are harvested at full maturity. It is advisable however to keep the seeds intact in the inflorescence until the time of sowing.

RESEARCH BRIEFS

Wilt resistant Bandakka: The Bandakka varieties resistant to Bacterial Wilt are, VT, MI5 and MI7. The short aged VT variety had 50% flowering in 40 days compared to 65 days to 50% flowering in MI 5 and MI 7.

Sugar Baby: This water melon variety produces very sweet fruits, and matures in 75 days. First picking can be taken at 51 days. Fruit weight 2.5 to 4 Kg. per fruit.

Phytopthora disease of gingelly. In the southern province Phytopthora disease in gingelly is a problem. Two mutant lines resistant to this diseease are 180-52 and 182-3 (182-3 can yield upto 1388 Kg/ha.

BIOLOGICAL CONTROL OF COCOA PODBORER IN MALAYSIA.
Exploration in Sri Lanka.

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Peradeniya.

A brief, small-scale project between the Sri Lanka Department of Agriculture and the International Institute of Biological Control has just been completed very successfully.

Cocoa is an important major export crop of Malaysia. The cocoa crop in East Malaysia is severely attacked by by an insect called (Conopomorpha cramarella. The adult moths are small, almost the size of the common diamond-back moth, Plutella xilostella of cabbage. The caterpillars bore into the cocoa pod causing extensive damage to the cocoa bean. Many control methods were tried on this pest, with no success. It was finally decided to try biological control.

International Institute of Biological Control (CIBC) was invited to look into this aspect. Entomologist Dr. Peter A.C. Ooi was assigned to the project (CPB) on his initial investigation in East Malaysia.

However his investigators revealed that insect parasites of CPB were the same as those parasitising another borer attacking namnam (Cynometra cauliflora) fruits. But Dr. Ooi decided to explore overseas since insect fauna on namnam in Malaysia was sparse.

He established contact with the Sri Lanka Department of Agriculture in 1985. Mr.Mikel Zeise was hired to conduct the preliminary (Phase I) exploration in Sri Lanka. He spent 2-3 months criss-crossing the South-Western quarter of the country examining the namnam trees. Damaged namnam fruits, and the cocoons of the namnam borer were collected and brought to the laboratary. A satisfactory range of parasitic insects was collected.

On systematically identifying these insect parasites Dr. Ooi decided to expand the exploration in Sri Lanka. Phase II of the project started in late 1986 with Mr. Zeiss and two local assistants (Ms. Sheila Basnayake and Mr. D.M. Dahamtilleke). This team established its base camp at the Central Agricultural Research Institute, Peradeniya. Extensive collections were made in the Districts of Kandy, Kegalle, Gampaha, Ratnapura and Kalutara. As before, pest attacked namnam fruits and cocoons were collected. They were held in the laboratory in cages and test tubes for the emergence of parasites. The parasites were fed, mated then allowed to parasitise namnam borers. Thus small populations of these parasites were build up in the laboratory. Life history studies were made in the meantime. Eight insect parasites were selected. They are: Ceraphron aguinaldoi, Goryphus sp., Paraphylax sp; Pediobius sp., Bracon sp., Elasmus sp., Paraphylax vartus and Chrysonotomya.

This exploration for the insect parasites of cocoa podborer was concluded in March 1987. Small nucleus cultures of these parasites were taken live out of Sri Lanka by Dr. Ooi on March 20, 1987 for introduction in East Malaysia. It is the fervent hope of Dr. Ooi that this project would succeed and save the ultimillion dollar cocoa industry in Malaysia. In that happy event, we could pride ourselves that Sri Lanka could collaborate in this bilateral venture to help Malaysia. Phase II of the project covered less than 5,000 km. and the local nuning expenses were about Rs.13,000.00, paid out of the project funds. It is but a tiny investment for a high-value industry at stake!

Inter cropping cotton with legumes.

1. Plant cotton in paired rows, spaced 1.3 m between pairs.
2. In each pair distance between 2 rows is 0.6 m. In the row plant seed at 0.3 m spacing allow 2 plants per hill.
3. In between each set of paired rows of cotton 3 rows of the following pulses can be grown. Green gram, ground nut, cowpea or soyabean.

Crop Combination:	Gross return Per ha.(Rs)
Cotton + ground nut (No.45 variety)	17,460
Cotton + green gram (MI 5 variety)	16,525
Cotton + Soyabean (PB 1 variety)	13,632
Cotton + cowpea (MI 35 variety)	13,908
Cotton only	12,462

AGRICULTURAL INFORMATION SOURCES OF SUBSIDIARY FOOD CROPS GROWERS., IN THE ANURADHAPURA DISTRICT.

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Introduction:

Agricultural production is a function of land, labour, capital and management. The agricultural management performance of a person depend on his/her age, knowledge, skills, attitudes, access to technical and management information. Agricultural productivity can be increased by using modern technologies as well as by improving farmer's knowledge, skills and attitudes through extension and farmer education programmes.

The Department of Agriculture has a well established extension network to disseminate new technical information to the farmers. The chief agricultural extension method used by the Department is the Training and Visit (T&V) System. Under the T & V system of extension, the village level extension worker is entrusted to teach/transfer new production recommendations to farmers (Benor and Baxter, 1984). The "Krushikarma Viyapthi Seva Niladhari"(K.V.S.N.) is the village level extension worker in the Sri Lankan Agricultural Extension Service. However, the extension division of the Department of Agriculture is also facing operational problems due to scarcity of resources such as manpower, equipment, and other institutional facilities. Therefore, alternative and complementary ways to educate the farmers in modern agriulture are needed.

Leaflets, Newspapers, Cinema, Posters, Radio and Television are some of the possible channels of communication to teach the modern technology to farmers to reinforce and supplement the work of the K.V.S.N. Thus, the objective of this study is to identify the sources and channels of agricultural information most relevant and important to subsidiary Food Crops (SFCs) growers in the Anuradhapura District.

Methodology

A total of 570 farmers who grew subsidiary food crops (S.F.C) during the Maha 1985/86 season were selected from 19 Agrarian Services Centres (ASC) in the Anuradha-

pura District to obtain data for this study. Three ASCC areas were selected on the basis of greater extents cultivated under SFCs during the Maha 85/86 season. The information was collected using a structured questionnaire in a single visit survey. The Questionnaire* was designed to identify the cropping patterns and production costs of SFCs. Only a part of the information is analysed and presented here.

* Diversified Agricultural Research Project - baseline survey.

Results and Discussion

The majority of the respondents (68%) reported visits by the K.V.S.N. to advise them during the Maha 85/86. A fair number of farmers (32%) who reported that they were visited by the K.V.S.N indicate the need for idsentifying complementary means of conveying a particular message to the farmers to ensure full coverage.

The findings from this study revealed that the main channels of information on new technologies for the respondents were: neighbours, radio, and extension agents. The survey data presented in Table 1 indicate that all these three modes of disseminating information tend to be almost equally important.

Table 1. Mode of Receiving Agricultural Information by Farmers in Anuradhapura District - 1986 Maha Season. (N= 570)

Mode	Percentage of Farmers Reporting it.
Neighbours	77
Leaflets	45
Radio	73
Television	04
Extension Service	68
Traders	10

Source: DARP baseline survey, Anuradhapura, 1986.

The importance give by farmers to discussions with neighbours could be attributed to the positive impact of the Training and Visit System of Agricultural Extension

or the good social ties of the farming community or both. Most of the farmers had listened to the radio for information on modern technologies. Only 45% of the farmers had read leaflets,which could be due either to in adequate distribution of such materials, or poor reading habits of the farmers or both.

The results of the survey show that the respondent farmers believed the information received from the K.V.S.N to be very important (Table 2). This opinion seems to be reinforced by the personal interactions between the K.V.S.N and the farmers. Even though 77% of the farmers had received information from their neighbours, only 30% felt that the information they thus received from the neighbours was very important. This could be explained by the distortion of information when it is not direct. Of the farmers who received information from the radio, 57% thought that information to be some what important. This can be due to their levels of education or trust in the radio or both. Radio programmes had played an important role in disseminating agricultural information. The agricultural extension service cannot function equally well in all parts of the Anuradhapura District due to problems with transportation; ethnic violence etc. Thus, radio programmes and other modes of communications should contribute substantially to the process of educating farmers on modern agricultural technologies.

Table 2: **Importance attributed by Farmers to Different Modes of obtaining Agricultural Information in Anuradhapura District, 1986. Maha Season (N = 570)**

Mode of obtaining Information	Percent Farmers Reporting as			
	Very Important	Somewhat Important	Not Important	No Response
Neighbours	31	64	05	0
Leaflets	15	76	09	0
Radio	42	57	02	0
Television	04	54	42	0
Extension Services	89	10	01	0
Traders	00	74	19	17

Source: DARP'baseline survey,Anuradhapura, 1986.

Conclusion

From the survey results, it is clear that the radio, leaflets and neighbours have served as important sources of of agricultural information for farmers, complementing the work of the extension service. Many farmers had learnt modern agricultural technologies from their neighbours. In summary, the results suggest the benefits of a combination of both radio programmes and the activities of the agricultural extension service in educating farmers on modern agricultural technologies.

Acknowledgements

I would like to than Dr.B.M.K.Perera (FAO), Dr. L. Navarro (DARP, Economist) and Mr.A.A.B. Hafi (Agricultural Economist) for their comments in developing this paper.

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THE HISTORY OF TOMATO - A REVIEW.

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Introduction:

Tomato (Lycopersicon esculentum) is one of the most important vegetables in the world. It originated in Peru, Latin America. All cultivted tomato varieties descend from seeds taken from Latin America by Spanish and Portugese merchants, during the 16th century (Villareal, 1979). Tomato was grown in England by 1580 largely as a curiosity. However, it was discovered that the Mexican Indians consumed tomato long before the Europeans.

Tomato is an appetizing vegetable containing some of the key nutrients such as vitamin A, ascorbic acid, some protein and iron. Tomato also ranks first in perishability.

Varieties:

Tomato had been named from time to time as Peruvian apple, Golden apple, Love apple and Mad apple, based on various myths and beliefs in different countires. It had also been called the "poor man's orange" in the United States.

Tomato, like most other fruit varieties come in assorted shapes and sizes. Cherry tomato from Ecuador, (and Peru) having small sweet fruits in clusters was possibly the ultimate ancestor of cultivated tomatoes. The Fruit tomato is very juicy and almost seedless. Italian plum tomato is sweet and coarse centered; the Oxheart is large and pink or yellow coloured; the Pear tomato is so named for its shape and is red or yellow. The smallest is the Current tomato or German raisin which belongs to a separate species, S. Pinnpinelifolium.

Utilization:

Different tomato varieities serve different purposes such as processing and for the fresh market. Tomatoes can be grown in the open or in Green houses, supported by stakes or without it.

In most countries the determinate type of tomato varieties are used for processing fruits whereas the indeterminte types are utilized as table tomato.

The size and shape of fruits are important in fresh market tomato, whereas the flesh colour or pigmentation is an essential feature of varieties used for processing.

Production:

Of more than 100 species of vegetable crops selected for intensive study in the Asian countries, tomato ranked first. The leading tomato producers of the world are in the temperate regions, where the highest yields are recorded. Tomato production in tropics however is only one fourth of those produced in temperate regions in relation to the extent. Also thee yield per unit area is low in the tropics, averaging about less than 50% of the yield obtained in temperate regions, (ANON, 1984). Thailand as well as Sri Lanka are among the lowest, when yield per unit area of each country is compared.

Research and improvement:

Today, there are new tomato cultivars and hybrids

which can be grown in climates far different from their site of origin (Villareal., 1979). In general the low yield of tomato in the tropics is due to high temperature excess or very low moisture and some major diseases like bacterial wilt. Also, the use of unadapted varieties, lack of appropriate cultural practices during both dry and wet seasons are some constraints to tomato production.

The stepwise breeding programme initiated at the Asian Vegetable Research and Development Centre (AVRDC) in Taiwan has resulted in new breeding lines suitable for the lowland humid tropics. The are more tolerant to bacterial wilt, heat and drought. New components like resistance to important diseases, and improved fruit quality are now being incorporated and tomato breeding programmes (Opena, 1985).

In Sri Lanka, tomato is a good income generating vegetable crop. It is more appropriate to identify suitable tomato varieties for processing as well as for the fresh market. This could expand the cultivation and open more avenues for processed products such as Ketchups, Source and tomato juice as a fresh drink.

(This review is based on the 5th Thailand out reach programmes/AVRDC training programme on Advanced Vegetable Production held in Thailand from Oct., 1986-Feb.,1987.)

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INTERCROPPING MANIOC WITH VEGETABLES IN THE MID COUNTRY.

S.D.G. Jayawardene, K.P.U.de Silva,
J.C.K. Basnayake,
C.A.R.I., Gannoruwa.

SUMMARY

Intercropping Manioc with fast growing short-statured, and short-duration vegetables could improve the total productivity per unit of land per season, because manioc grows very slowly during its early growth.

This study was conducted to find the consequences of growing vegetables during the early growth stage of manioc, at Central Agricultural Research Institute, Gannoruwa, during October 1983 to June 1984. Manioc variety CMC-84 was intercropped with okra, tomato, cucumber, winged bean and bushitavo.

Intercropping manioc with tomato, bushitavo and cucumber gave significantly higher monetary returns.

Labour inputs to control weeds in Manioc vegetable combinations were less than that manioc monoculture. Therefore, manioc vegetable combinations were comparatively more advantageous as a means of cultural weed control in manioc cultivation.

Manioc has slow initial growth. As it is planted with wide spacing, the utilization of resources such as land light etc.is very minimum in monoculture of manioc during this early phase. Hence, intercropping manioc with fast ground-covering, short statured and short duration crops such as legumes and vegetables (CTCRI, 1978, CIAT,1976: and IITA, 1975) could improve the total productivity per unit of land per season by obtimizing the use of physical and socio-economic resources.

In Sri Lanka manioc production is scattered throughout the country with the largest extents being in the wet zone. The small scale farmers cultivate this crop as a back yard crop or as small main cropped plots or as a border crop around other crops. Although the research and production programmes have demonstrated the great benefits of manioc intercropping (Ismail and Suprato, 1977, Thung and Cock 1978:; Sinthupram 1978) in terms of improving land use, low-input technique and method of maximising net returns,it has not spread widely yet.

Hence, a study on combined productivity and its potentiality in improving farmers income by intercropping short-duration crops with manioc is appropriate in the wet zone. Thus study was carried out to assess the potentiality of growing vegetables with manioc in mid country wet zone.

Material and Method

This study used a replicated randomized complete block design. The manioc variety used was C.M.C-84 : (Moderate branching variety, 9 months duration). The soil is a clay loam. Total nitrogen content 110% soil p$_H$ 4.6 The elevation of experimental site was 487.5m. The rainfall during the experimental period 210.5 mm and the study was carried out under rainfed condition.

The treatments consisted of five manioc-vegetable combinations.

1. They were : Manioc-okra,
2. Manioc-bushitavo,
3. Manic-tomato,
4. Manioc-winged bean,
5. Manioc-cucumber and
6. Manioc control treatment.

Plant density of manioc was 12345 plants/ha. Manioc cuttings were planted vertically spaced 90x90 cm. The vegetable seeds were dibbled at the rate of 4 - 5 seeds per hill immediately after planting manioc cuttings.

1. Okra, tomato, Winged bean, Cucumber were planted in the centre of every four manioc plants.

2. While two rows spaced at 30 cm. between two manioc rows were maintained in respect of bushitavo. Three weeks after planting, vegetable seedlings were thinned leaving 2 plants per hill and stakes were provided for winged bean.

Fertilizer for Manioc

A complete fertilizer mixture of 25 kg N, 45 kg P_2O_5, 60 kg K_2O/ha was applied at planting and 50 kg N, and 60 kg K_2O/ha was applied at four months after planting manioc.

Fertilizer for Vegetables

Farm yard manure at the rate of 12.5 t/ha (at planting) was applied for okra, cucumber and tomato in addition to the inorganic fertilizer (30 kg N, and 30 kg k_2O/ha at one month after planting). In respect of bushitavo and winged bean a common fertilizer mixture (20 kg N, 30 kg P_2O5, 30 kg K_2O/ha) was applied at planting.

The pod yields of vegetables were taken from the harvestable area of manioc. All aspects of harvesting of bushitavo, cucumber, tomato, okra and winged bean were completed 70, 80, 90, 100 and 150 days after planting respectively. Ten plants of manioc from the harvestable area were uprooted to determine the root tuber yield at 9 months age.

Data on labour untis for manual weeding were recorded for each manioc-vegetable combinations. Crop income was calculated at current market price with a view to evaluating the best manioc vegetable combination giving the highest gross return per unit area of land.

Results and Discussion

The yields obtained in respect of fresh weight of manioc and pods of different vegetables are presented in Table 1. With intercropping, noticeable difference in manioc tuber yield affected by growing vegetables were observed. The maximum manioc tuber yield (33.23t/ha recorded in monoculture which was no par with yields obtained from manioc-tomato and manioc-okra combinations (31.38, 31.17t/ha respectively. However, the key differences in yield between manioc monoculture and the combinations of manioc with winged bean bushitavo and cucumber were found. As intercrops, okra and tomato were non-competitive with and more favourable to manioc.

According to Table 1, cucumber showed the most dramatic effect in the reduction of manioc tuber yield. (23.66 t/ha) compared to others. Since cucumber has vigorous growth, it could have exerted the most competitive pressure on manioc resulting in a low tuber yield.

Table: 1. Tuber weight of manioc and pod weight different vegetables in manioc-vegetable intercrop systems (t/ha)

Crop Pattern	Yield in tons/ha	
	Tuber weight	Pod fresh weight
Manioc only	33.23 a	-
Manioc-cucumber	23.66 c	44.52 a
Manioc-bushitavo	26.64 b	10.56 c
Manioc-tomato	31.38 a	21.46 b
Manioc-Winged bean	27.57 b	2.25 d
Manioc-okra	31.17 a	6.78 c
C.V.(%)	4.38	10.44

Values with a common letter are not significantly different at 5% probability level according to D.M.R.T.

The interspecific competition values (Table 2) showed that the highest yield reduction values (29.6%) was associated with cucumber intercropped with manioc.

Table 2. Interspecific competition in Manioc as affected by vegetable intercrops.

Crop Pattern	Yield reduction of manioc (t/ha)	% Yield reduction of manioc
Manioc only	None	None
Manioc-cucumber	33.23-23.66	29.6
Manioc-bushitavo	33.23-26.64	19.83
Manioc-tomato	33.23-31.38	5.56
Manioc-winged bean	33.23-27.57	17.03
Manioc-Okra	33.23-31.17	6.22

In contrast, manioc showed greater yield stability when intercropped with tomato and okra (5.56%,6.22% respectively). The previous observation implied that manioc produces lower yield and hence lower income as a component crop of an in intercrop system than as a sole crop (Ezcllo, 1978, Okioso, 1977, Porto et al. 1978: Sinthuprama, 1978). However, Hart (1975) reported that a stable level of manioc yield can be obtained by overcomiong competitive pressure on manioc in polycultures.

Of the different vegetables tried with manioc, cucumber, tomato and bushitavo have given good results in terms of their pot yields (Table 3). The performance of winged bean was poor probably due to the poor light interception sincecit is a long duration crop (150 days) compared with others.

Table: 3.

Gross Returns of Manioc-Vegetable Intercrop System (Rs./ha).

Crop Pattern	Manioc	Vegetable	Total
Manioc only	24,922.00	-	24,922.00
Manioc+cucumber	17,745.00	44,520.00	62,265.00
Manioc+bushitavo	19,900.00	42,240.00	62,265.00
Manioc+tomato	23,535.00	53,650.00	77,185.00
Manioc-Winged bean.	20,677.00	9,000.00	29,677.00
Manioc+Okra	23,377.00	20,340.00	43,717.00

a - Price of Manioc = Rs.750.00/t.

b - Price of vegetable :-

i) Cucumber = Rs.1.00/kg
ii) Bushitavo = Rs.4.00/kg
iii) Tomato = Rs.2.50/kg
iv) Wingedbean = Rs.4.00/kg
v) Okra = Rs.3.00/kg

The highest gross return was obtained when tomato was intercropped with manioc(Rs.77,185.00) followed by manioc-cucumber (Rs.62,265.00), manioc-bushitavo (Rs.62,220.00) and manioc-okra (Rs.43,717.00) These values were significantly superior to manioc- monoculture (Rs.24,922.00) Findings at CIAT (1975/1976) revealed that the net income from manioc intercrop system was higher as other component crops contributed to the gross income. (Table 3)

Major input for all the cropping patterns was labour. The inclusion of manioc, which is a labour intensive crop (Sinthuprama, 1978), in intercropping would probably have increased requirement of labour. However, since the greater part of manioc production is undertaken by small farmers where excess family labour is available, this may not pose a serious problem. Moreover, manioc planting material is available from the previous crop free of cost. There are two factors make manioc a low-cost cash crop to small farmers (Sinthuprama, 1978). Hence, it has a potential for generating higher incomes when intercropped with vegetables as shown in this study (Table 4).

Table 4. **Labour input and Labout cost for weed control in Manioc-Vegetable intercrop systems.**

Crop Pattern	Weed Control Labour units/ha.	Cost Rs/ha.
Manioc only	56	1960.00
Manioc-cucumber	44	1540.00
Manioc-Bushitavo	36	1260.00
Manioc-tomato	36	1260.00
Manioc-winged bean	32	1120.00
Manioc-okra	36	1260.00

Manioc is a poor competitive species and weed control is very important (Doll, 1978). However, in manioc production weed control seems to be a major cost (Gonzales, 1970;Dolletal 1977). Introducing different kinds of vegetables between the manioc rows resulted in markedly varied labour inputs and cost for weed control in this study (Jable 4). The highest labour input for weed control per hectare was recorded (56 man-days) in monoculture. Considering the effects of different vegetable intercrops on weed control, it was observed that all vegetables other than cucumber did compete well with weeds, hence lower labour inputs were sufficient. The vigorous growth of cucumber covers the ground more rapidly. Hence suppression of both weeds and manioc growth was very distinct The result was a poorly developed manioc canopy which was not enough to cover the ground after the senescence of the cucumber. This could explain the increasing labour units for weed control in this particular combination.

The importance of intercrops as a cultural weed control measure in manioc had been reported by Hart (1975) ; Gonzales (1976). Howeler (1980); Leihner (1980) and CIAT scientists (1981). The present study also apparently showed the importance of vegetable intercropping as cultural practice for weed control in manioc.

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OKRA (Hibiscus esculentus) Seed Production.

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Leaf mosaic virus disease is a major limitation to Okra (Bandakka) production in Sri Lanka. The virus tolerant Okra varieties MI.5 and MI.7 were released by the Department of Agriculture in 1973, They are a cross between H.10 and 'Pusa sawani' from India. Varietal purity of MI.5 and MI.7 was maintained through out at the Agricultural Research Station, Maha Illuppallama, thereafter.

The incidence of virus disease is very sporadic and varies from location to location, depending upon the existence of virus, vector and weather. Seed sowing before onset of Maha or Yala rains is not advocated. Time of planting could minimize the disease, as well as by frequent spraying of an insecticide to control "white-fly" the vector of this virus.

Due to availability of a wide range of local okra strains, true seeds of MI.5 and MI.7 can be obtained by using the procedure given below,(Okra is cross pollinated to a certain extent. Therefore other strains of okra around a seed crop of the recommended variety should be removed, before flowering).

1. When one prefered variety is grown it should be isolated from another variety.

Eg. Type of Seed to Produce		Distance of isolation
Foundation Seed	-	400 metres.
Certified Seed	-	200 metres.

1. Seeds must be collected from the centre plants only, leaving at least five guard rows right round. Selfing is not required.

2. To produce true to type seeds selfing is a must. It can be done in 3 ways:-

a). Cover the flowers before opeing with a polythene bag 4" x 5".

b). Cover the flowers before opening with a Brown paper bag 4" x 5".

c): Tie the flower petals with a string allowing it to fall by itself after fertilization.

The most convenient method can be selected by one's experience.

Procedure:

- Variety MI.5 is recommended for the Maha season.
- Variety MI.7 is recommended for the Yala season.
- Flowering takes 30 - 35 days. All flowers arising before 30 days should be removed. Remove all off type plants.
- Any pods arising at this time too schould be removed.
- All pods from untied flowers should be removed.
- All flowers should be bagged daily or tied in the morning hours before they open. The bag can be removed the following day once the flower is dropped. Fertilization is indicated by a small cone shaped button at the flower stalk which develops into a fruit.
- Allow such fruits to develop well and dry on the plant itself. They should be removed however before the pod dehisce (crack open) or before a heavy shower, as tahe seeds tend to germinate in the pod itself.

Dry the pods in the sun for 2-3 days and extract the seeds manually or by hulling.

Dry the seeds for another 2-3 days and store in cloth bags, treated with a fungicide recommended for seed treatment.

Under cold room storage conditions such seeds are viable for 1½ - 2 years.

MUSHROOM GROWING

Part II.

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The mushroom has great potential as a rich and cheap source of protein, nicasin, thiamine (B_1), riboflavin (B_2), ascorbic acid, (c) nicotine acid, (c) nicotine acid, Pantothene acid, Vitamin K, for the human diet. The availability of edible and delicious species, (indegenous to sub-tropical and tropical region) and possibilities for production using simple techniques makes it a good vocation for self-employment seekers. Like most vegetables, mushrooms mainly consist of water In mushrooms the percentage of carbohydrates and fats is low and the carloric value is not high; about 30 calories per 100 grams. Of the minerals phosphorus can be specially mentioned. Although in small quantities, the mushrooms contain the complete set of amino acids, a human being needs. Its methionine content is relatively small whereas trytophan and lysine are present in relatively high amounts. These essential amino acids are usually deficient in most vegetable proteins. Mushroom protein, (like other fungal protein) is therefore intermediate in quality between vegetable and animal protein. Mushroom is richer in folic acid than meat and vegetables except liver. Therefore while it can prevent and cure anemia, with its low content of a starch and fat. It is suitable for people wishing to reduce their weight or afflicted with diabetes or hypertension.

"On 11th May 1967, Graham Chedd discovered that retine, a substance in the human cell, can stop the growth of tumours. Nobel Prize Winner Albert Szent Gyorgyi found that the human body contains a balanced amount of retine and promine and that excess of promine could produce cancer. Retine may be a substance that slows down tissue growth. Analysis have shown that all fungi, especially opened or mature mushrooms, have as high a retine content of 3 units. Thus if mushrooms and consumed regularly, there might be no chance of having cancer. This observation was confirmed by Professor Stephen Vocel of Duke University, (in May 1970) who stated that mushrooms actually had a substance in their spores that can prevent and stop cancer.

The mushroom association of England conducted an experiment in which cancer patients were given three pounds of mushroom every week

for six months. The patients' condition improved and they were subsequently cured of the disease. Those patients who received medication, other than the mushroom treatment all died." (From a report of FAO Publication)

The average compositions of the straw mushroom, compared with other types of agricultural produce is indicated in Table 1 (in percentages of the fresh weight).

Table 1.
Nutritive value of Mushrooms compared with some food items - % by fresh weight.

Item	Water	Protein	Fats	Carbo-hydrates	Miner-als.	Energic value per 100 grams
Mushroom	88.9	3.4	1.8	3.9	1.0	105
Milk	87	3.5	3.7	4.8	0.7	260
Beef	68	18.0	13.0	0.5	0.5	792
Spinach	93	2.2	0.3	1.0	1.9	63
Asparagas	95	1.8	0.1	2.7	0.6	84
Potato	75	2.0	0.1	21.0	1.1	356

Technology of Mushroom Production.

The development of a technology evolves through several stages. In the first stage there is the discovery that if certain things are done, some predictable results will occur. This kind of information is probably slowly acquired and handed down from person to person. For example, it was learnt early if spawning was done to a particular substrate under certain conditions, one could expect that mushroom would be produced. Initially there was little concern with why and how this happened. So this first stage is solely the "Art" of mushroom growing.

In the second stage of the development of a technology, people ask a few questions, such as: "Why does this work" Are there any methods or materials which can be used to increase the the yield or improve the process?

In this stage a scientific approach is employed and it involves both basic science (attempts to answere how the process works), and applied science (attempts to improve the process). Basic studies on mushroom growing would involve the biology of the organisms (life style,nutritional requirements, genetics, environmental conditions for growth and fruiting etc.) Applied science would involve such studies as: composting, spawn running, environmental conditions to support fruiting, means of controlling pests, development of improved strains etc., using the knowledge gained from the basic scientific studies of the organism. Thus oncea the change is made from an art to science, we find basic and applied science working together, and there is an acceleration in the advancement of technology.

In Sri Lanka there is much hope for the advancement of goowing mushrooms for home consumption and export. This could generate self employment. The island has 758,940 hectares under rice cultivation. Producing plenty of rice straw to be used as a substitute for mushrooms.

Growing mushrooms is an efficient way of utilization of cellulosic wastes. Volveriella Volvacea, the straw mushroom, is a fast-growing, cultivated mushroom. It grows well on rice straw, lotus stems, dried banana leaves, animal compost, and corn stalks etc. The recently introduced oyster mushroom grows well on soft wood like the Rubber, Gliricidia and Sesbania (Katurumurunga).

In general, spawn (seed material) for any type of mushroom culture has to be obtained from pure culture. There are two methods of obtaining pure culture.

1. Using mushroom spores or seeds.
   This method is not very popular due to uncertainity of yields and possibility of variation in the fruit type.

2. Using mycelium from ushroom tissue.
   This method requires less equipment, and simpler techniques.

The mushrooms obtained by this method would be true to type, like in the case of plants propagated by budding, grafting etc.

How to obtain pure culture tissue.

First prepare an Agar media

Formula : PDA + bean

P - Potato	200 gms
D - Dextrose	200 gms
A - Agar	20 gms
Mung bean or soybean	50 gms
Water	1000 gms.

Method:

1. Wash and dice potato (with the peel) into small pieces 1 cm^3.
2. Boil diced potato, mung or soybean and water together for 15 minutes.
3. Strain the preparation through cheese cloth and reheat the liquid.
4. Add the agar and aboil for 8 - 10 minutes and add the dextrose.
5. Add hot water to restore the original volume of 1000 gms.
6. Put 10 ml. of the media in each test tube or 30 ml. into flat whisky bottles. These containers are plugged with cotton wool and the plug wrapped with paper.
7. Sterilise in a pressure cooker for 30-45 minutes. (temp. 121°C - 125°C).
8. After sterilization and while still warm places the tubes at an angle to make the slants, when the agar congeals, the slants are ready for use (to receive the tissue).

Removal of mushroom tissue and the method of innoculation.

Select for desirable qualities, size, prolificeness of the mushroom. It should not be over matured and contaminated by micro-organisms.

Tare the mushrooms into two from the centre of the cap to the base of the stem. Remove a small tissue from the area connecting the stalk and the cap and directly plant it in the Agar slant under aseptic conditions. Experiments have shown that tissue from that part of the mushroom is the most healthy and yields the best true-to-type mycelium.

The lamp for flaming can use alcohol as it is smoke-less, and convenient for sterilizing instruments.

The isolation needle should be prepared beforehand by dipping it in alcohol, and flaming it red hot. The correct flaming is to hold the needle at the rear end and tilt it in a downward position to allow a greater part to be in the flame. Allow it to cool for 15-20 seconds without letting it touch anything. It is more convenient to have two needles so that one could be used while the other one cools.

When the plug of the sterilized bottle has been removed for innoculation the neck of the bottle should be kept over the flame. Immediately after innoculation replace the plug and put the bottle in dark room where the temperature is from 25°C - 30°C. Mushroom will not need light for mycelial growth. Light will only slow the mycelial growth and age quickly.

In 7-10 days the bottle will be covered with mycelium and be ready to innoculate the packs which has got sterilized culture material inside.

Formula of the culture material.

Sawdust or any cellulose containing material dried	... 100 kg.
Fine rice bran as protein and mineral supplements ...	... 10 kg.
Dead lime	... 1 kg
Magnesium sulphate ...	... 200gms
Water	80-100 kg

Mix all the items together, and pack into heat-resistant polythene bags taking care to compress the material in the bag by passing them to the bottom. Insert a plastic or bamboo bottle neck onto the mouth, pull the polythene out of it and pull it down. Tie with rubber band, plug the mouth using cotton wool and cover the whole neckwith a paper.

Sterilization can be done in a steamer or in a boiler at a temperature above the boiling point for two hours.

Innoculation of these bags is similar to making the tissue culture. Use the mycelium already prepared.

Incubation - Keep the bags in a dark room, on shelves or in boxes where air can circulate inside these boxes (empty potato boxes) do not water. The doors and windows should be closedto allow for an ideal condition.- the temperature 24 - 28°C.

The mycelium of oyster mushroom takes about 30 - 40 days to grow over the compost in the bag.

Mushroom production.

In this last stage in the growing process, cropping house and clean water is very essential. If these are not given, all the hard work done will be wasted.

Cropping House.

It should not be too large as ventilation may be adversely affected and the possibility of drafts. The popular size is 4x6x2.5 m. The floor can be paved with gravel or bricks. The house can be partially dark; water is very important for mushrooms. It should not be too acidic or too alkaline, should not contain mineral salts and chlorine etc.

Opening of bags for cropping.

1. Opening and rolling down the mouth.
2. Cutting off the mouth with blade.
3. Slitting the sides of the bag.

After cropping, wet the outside of the bag twice a day; 1/2 a tea cup in the morning and 1/2 a tea cup in the afternoon. Do not allow water go into the bags as it can affect the mycelial growth. In 5-7 days mushrooms will appear and can be harvested in 2 - 3 days. These bags (mushroom kits) will yield 4-6 times. Total production could be 30% - 50% of compost.

Harvesting:- A mature mushroom is plump and firm, with fully extended volva. It should be picked at this stage before opening. Store in a cool place.

An Exploratory Study on the use of Insecticides in Peasant Paddy Production in the Central region of Sri Lanka.

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Introduction:

Since the introduction of insecticides to the Sri Lankan Paddy Sector several decades ago, its use and the related expenditure kept on increasing.

Financial and environmental problems emanated from this situation. Consequently a lot of emphasis is now laid upon minimal and the judicious use of insecticides to minimize the resultant economic, health and environmental problems. Nevertheless the glaring dearth of information on insecticides use in Sri Lanka, adversely affects the efforts of those who plan and implement programmes of the aforesaid nature. Hence this study aims to explore the present knowledge, practices and some factors affecting decision making on the use of insecticides in the paddy sectors of Kandy, Kegalle and Matale districts, which comprises a lager portion of the mid country of Sri Lanka.

The methodological approach to this study was simple tabular analysis of data gathered in a cross sectional sample survey of paddy farmers. 64 paddy farmers were interviewed from each district in Yala 1984. After rejection of inconsistant responses, 63 farmers from Kandy district and 60 each from Kegalle and Matale districts were included in the final analysis.

Socio Economic Background:

Household compositions were found to be close to each other in the three districts. On the average the farmers were 50 years of age and the average family had 5 members. The educational attainment of the farmers could be considered modserate (with 6 years of formal education) while some members reported 8 years of schooling, on the average (Table 1). It is interesting to note that all the farmers were literate and this is certainly helpful using

Table: 1. Farm household composition, education and employment.

	No. of years Formal Education					Off Farm Employment Types % Reporting					On Farm Employment % reporting	
	Average per family	Average Years	% Reporting	Average No. of Years	% Reporting Education.	Unskilled labour	Skilled labour	Business Persons	Employees Mid Level	Employees High level	Full time	Part time
Farmer Household numbers over 16 years	1	32	100	6	100	5.3	213	3.8	14.3	4.0	67.6	32.46
Male	1	-	73	-	-	-	-	-	-	-	-	-
Female	2	-	97	-	-	-	-	-	-	-	-	-
Total:	3	-	99	8	98.3	1.6	2.3	-	3.9	2.3	31.2	74.38
All ages Male	2	-	91	-	-	-	-	-	-	-	-	-
Female	2	-	98	-	-	-	-	-	-	-	-	-
Total	4	-	99	-	-	-	-	-	-	-	-	-

*Means and percentages are rounded up to the closest whole umber
* Computed for the number of cases reporting.

Table: 2.

Annual Income From Farm and Non-Farm Activities.

	Average Farm Income Rs.	% Reporting	Average Non-Farm Income Rs.	% Reporting	Average Total Income Rs.	% Reporting
Farmers Both Full time and Part time.	5934.73	100	5035.91	33	7596.58	100
Pooled Income of the Others in the Household.	2244.10	15	9405.09	25	8463.29	33

Table 3.

Distribution of Land by Dwarfing and Tenure

	HIGHLAND						LOWLAND						ALL CLASSES	
	Irrigated		Rainfed		Both		Irrigated		Rainfed		Both			
	Averages.	% Rep.	Averages.	% Rep.	Averages.	% Rep.	Averages.	% Rep.	Averages.	% Rep.	Average.	% Rep.	Average	% Rep.
OWN	0.49	2	1.54	89	1.56	91	0.58	26	0.68	50	0.91	76	2.68	94
RENTED IN	0.15	2	0.00	0	0.15	2	0.04	2	0.11	4	0.17	4	0.15	6
TENGRTED IN	0.00	0	0.003	1	0.003	1	0.33	6	0.55	17	0.92	23	0.59	23
OTHERS	0.00	0	0.02	1	0.02	1	0.21	5	0.39	4	0.29	7	0.30	8
TOTAL	0.47	3	1,55	91	1.63	94	0.46	36	0.87	66	1.25	100	2.85	100

the insecticides according to applications and may be a potential help in educating farmers on aspects such as safe handling of pesticides, integrated pest control etc.,

Table 4:

Spread of Important Insect Pests on Paddy. (Yala 1984)

Pests	% Area Infested	% Farms Reporting
Total Sample		
Leaf roller	37	42
Paddy bug	14	10
Stem borer	14	14
B P H	13	15
Leaf eating Catapillar	10	12
Thrips	9	7
Kandy		
Leaf roller	27	20
Paddy bug	22	13
Leaf eating Catapiller	11	12
Stem borer	10	9
B P H	5	3
Kegalle		
Leaf roller	61	80
PlantHopper	25	28
Paddy Bug	17	13
Thrips	7	3
Stem borer	2	2
Matale		
Stemborer	29	31
Leaf roller	22	25
Thrips	20	15
Leaf eating Catapiller	19	25
Plant hopper	9	13
Paddy bug	3	5

Farmers engaged fulltime in farming activities and the other family members worked in their farmily farms for a part of their time. However, farming was the major source of income (Table 2). The land ownership/ tenurial pattern was very much similar in all the 3 districts. Owner operated lands were dominant with a few tenant ("Ande") holdings (Table 3). This leaves room to assume that farmers' decision are usually made by themselves or by the family members. The farmers were mostly small holders with about 1.63 ac of high land and 1.25 a ac of (mostly rainfed) low land on the average. It was revealed that most farmers were in the low income category average income of approximately Rs.10,000 per annum). Hence these farmers can be slow adopters of cash inputs like insecticides, but may be very receptive to cost reducing techniques such as integrated pest control.

More than 60% of the farmers both in Kandy and Kegalle districts were using similar paddy cultivation prictices where 3 to 3½ month and 4 to 4½ month varieties were transplanted under rainfed conditions. However Matale was an exception with over 70 per cent of the extent broadcast under shortaged rice varieties. Non of the districts reported the use of any form of agricultural credit for paddy cultivation.

Occurence of Insect Infestations and the use of Insecticides.

The intensity of pest out breaks were found fairly diverse in among individual districts. Of the cumulative area over one third was infested with leaf roller. Stem borer, paddy bug, and brown plant hopper were reportedly found on 41 percent of the area (Table 4). In all cases of major pests, more than 50

Table 5

Successes in Pest Identification and Choosing an Effective Chemical by Paddy Cultivators.

Pest	% Farmers Correct in Identification. 1	2
Kandy		
Leaf roller	33	80
Leaf eating catapiller	16	67
Paddy bug	20	77
Stem borer	10	55
B P H	4	67
Kegalle		
Leaf roller	39	76
Plant hopper	22	71
Paddy bug	2	50
Thrips	2	50
Matale		
Stem borer	29	87
Thrips	15	90
Leaf roller	27	91
Leaf eating catapillar	27	53
Plant Hopper	15	60
Paddy bug	5	82

1. Computed as percentages of the number of farmers reported any Pest Problem.
2. Computed as percentages of the number of farmers reported the respective pests.

percent of the farmers capable of correct identification (Table 5). Comparing the 3 districts Matale farmers were found to be the best in in their ability to correctly identify the pests.

Lowest occurence of pest out breaks was found in Kandy District coupled with low numbers of chemical sprays and low use of insecticides (Table 6). These observations leave room for hypothesising that the chemical applications were basically need based but not prophylatic.

A wide variety of brands of insecticides were used in all the dis tricts surveyed, although the choice of the right pesticide was very poor in Kandy and Kegalle while in Matale a reasonably satisfactory situation was observed (Table 7). The pooled information for all three districts show that the most widely used brands were Tamaron, Curater-G and Monocrotophos. According to the active ingredients, methamidiphos, monocrophos and carbofuran respectively were the most widely adopted chemicals. Nevertheless the above order of preference varied some what among individual districts, due to differences in pest problems, extension advice and commercial advertisments. The farmers in Matale district showed a comparatively high competence in correct identification of Pests as well as in selecting the

Table 6:

USE OF PESTICIDE ON THE PADDY CROP.

Some basic features of the pattern of Pesticide use on the Paddy Crop.

		Percentages. Kandy	Kegalle	Matale.
Percentage farmers using any pesticide.		77.8	90.0	91.0
Percentage farmers using one Pesticide		41.3	36.7	53.0
Percentage farmers using more than one.	2	28.6	40.0	35.0
	3	6.3	13.3	3.0
	4	1.6	0	0
	5	0	0	0
More than ...	5	0	0	0
Percentage farmers making one pesticide application.		30.2	38.0	32.0
Percentage farmers making more than one	2	25.4	43.0	13.0
	3	9.5	9.0	
	4	3.2	0	46
	5	0	0	
More than five	5	0	0	0
Reporting errors		9.5	.0	0

right chemicals, for these different pests, although the overall ability of the farmers in this respect was poor.

It is important to note that except in a few isolated cases, the amounts of insecticides used by the farmers (Table 7) had been lower than the recommendations. Nevertheless, the rates of dilution were correctly followed most probably due to its comparative uniformity over a wide range of chemicals.

Reasons for the Present Practices Relating to Insecticide Use.

Direct questioning revealed that the insecticide applications are mainly curative (Table 8), consistant with the speculations made before. Observations made on the farmers' own fields were the basic criterion behind the decision on whether or not to

37 Carried forward to page 55)

1. It could be fried as athis is the most tasty method of preparation.
2. In soups as the main ingredient.
3. Fried with meat.
4. Fried and mixed in fried rice, noodles etc.
5. Mushrooms could be added in any receipe.

Preservation

1. Sun dried or oven dried.
2. Mushroom pickles.
3. Mushroom canning.
4. Mushroom paste.

Moisture	88.9%	Calcium	8 m.g
Proteins	3.4%	Iron	1.1 m.g
Fats	1.8%	Vitamin B1	0.15 m.g.
Carbohydrates	3.9%	Vitamin 2	0.25 m.g
Fibre	1.4%	Vitamin C	1.00 m.g
Ash	1%	Niacine	13.7 m.g
Energy	44 calories		

NEMATODE DISEASES ON RICE

Rohini Ekanayake (Research Officer)
Central Agricultural Research Institute,
Peradeniya.

The nematode diseases of rice cause severe yield reductions. Aphelenchoides besseyi, Hirschmanniella orysae and Ditylenchus angustus are the most serious plant parasitic nematodes on rice. Other rice nematodes of less importance are Heterodra sp., Meloidogyne sp., Hoplolaimus sp., Pratylenchus sp., and Helicotylenchus sp.

Sri Lanka only few records on rice nematodes are available. Knowledge about the distribution and behaviour of these nematodes under the local conditions is limited. This paper reports the major nematode diseases of rice and their occurrence in Sri Lanka.

White-tip-nematode

The white-tip caused by Aphelenchoides besseyi Christie (1942) is the most common and widespread rice nematode disease. This was first reported in Sri Lanka in 1962 by Peiris. Asurvey (Lambert and Ekanayake, unpublished) indicated that 70% of rice seed samples collected were infested with this nematode.

The name of the disease indicates the symptoms, 3 to 5 cm of the upper leaves turn light yellow or white. The flag leaves have a characteristic twist. Later the leaf tips become necrotic, turn dark and become frayed. These defintc symtoms show up at the tillering stage. A. besseyi is ecto-parasitic and mainly seed borne. They live near the growing point, damaging the inflorescence as well as the leaves. Infected plants show stunted growth and produce sterile panicles.

The nematode is able to survive in anabiosis for 2 to 3 years on dry seeds, usually under the hulls of the grain. Grassy weeds are good alternate hosts. This disease being seed borne, seed treatment is the most appropriate control measure next to the use of resistant varieties.

Root Nematode:

Hirschmanniella oryzae is a root nematode causing damage to rice roots. This was first reported in Sri Lanka by Seneviratne in 1962. It is rather difficult to recognize this disease in the field. The visible symtoms are retarded growth; and damage roots with brown lesions. In Sri Lanka 14% of rice root samples were found to be infested with this nematode (Lamberti & Ekanayake, unpublished).

The nematode enter the young roots through the epidermis and reproduces in the cortex of roots, killing the cells or which they feed. Later Fungi and bacteria invade nematode damage roots. The life cycle can be completed in one month. The nematodes are able to survive in the soil without a host for 10 weeks. Most of the time they stay over in the field in dead roots. Under dry conditions the adults and juveniles will die though the eggs retain their viability. This nematode too is able to infect grassy weeds.

Use of resistant varieties and cultural methods such as crop rotation, weed control and dsry fallow are suitable measures to control this disease.

Stem Nematode

The stem nematode Ditylenchus angustuswas first discovered by Butler (1913) in Bangladesh. This was never detected in Sri Lanka.

The symptoms on seedlings are mosaic-like discolourations on leaves. In advanced stages the leaves may become twisted or malformed. Heavily infected plants are stunted and may even show wilting symptoms. The panicles are malformed and partly sterile. If there is an early infection the panicle may not develop at all but remain trapped within the leaf sheath.

Under favourable humid conditions the ecto-parasitic nematode climbs up the seedlings and penetrates the young tissue. To stay near the young tissues the nematode moves towards the growing point. Under unfavourable conditions, eg. when the plant matures, the nematode reverts into an inactive stage. These inactive nematodes retain their viability for 15 months, and are revived in water or under humid conditions. This disease can be spread by irrigation, water and rain.Different responses have been found in paddy varieties for this nematode. Removal of the stubble immediately after harvest, allowing the soil to dry and crop rotation are obvious control methods.

Other Minor Nematodes on Rice:

Cyst-nematode - Heterodera sp.

This was common on upland rice but never recorded in Sri Lanka.

The symptoms on the seedlings are stunted growth, chlorosis of leaves and drying off in case of a severe infection. In mature plants leaves turn yellow and growth is retarded. Under severe infections the panicles may fail to emerge. It is reported that some grasses are alternate hosts.

Root-Knot Nematode:

Meloidogyne sp.

This was not recorded in Sri Lanka. The host range of this nematode is very wide.

Several other nematode species are reported to be parasitic on rice. Viz:

Stunt nematode - Tylenchorynchus martiani

Ring nematode - Criconomidae spp.

Lance nematode - Hoplolaimus spp.

Root lesion nematode - Pratylenchus spp. and

Spiral nematode - Helicotylenchus spp

All these species except the first have been recorded in Sri Lanka.

Since nematode diseases are liable to cause severe yield reductions, attention of plant breeders should be to develop varieties resistant to nematode diseases and to research on the improvement of these resistant varieties.

Though the higher population densities of H. oryzae have been observed in paddy fields, nematode problems have not yet reached a considerable level in Sri Lanka. However, the expansion and intensification of paddy cultivation would provide more favourable conditions for plant parasitic nematodes to multiply rapidly beyond the economic threshold level and thereby cause serious problems.

The knowledge of incidence and behaviour of rice nematodes under our conditions is very limited. Studies on different aspects of these nematodes are now being programmed with a view to handle problems, that may arise ion the future.

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AVENUE CROPPING.

AN ALTERNATIVE TO SHIFTING CULTIVATION IN THE LOWER UVA REGION.

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A B S T R A C T

Leguminous trees provide plant nutrients when used as green manure or mulching material. These practices improve soil fertility and productivity. Gliricidia sepium is more suitable than Leucaena leucocephala due to its higher nutrient content, consistency to withstand lopping as well as desirable canopy type. Pruning from three years old Leucaena leucocephala plants, at 5714 plants/ha were able to recycle upto 132 kg/ha nitrogen, 47 kg/ha potassium in 1986/87 maha season. Gliricidia sepium plants in same plant densiy could re-cycle 180 kg/ha nitrogen and 94 kg/ha potassium. The yields of maize were 1.883 t/ha and 2.145 t/ha in Leucaena leucocephala and Gliricidia sepium treatments respectively.

INTRODUCTION

Raising food crops in association with tree legumes is an accelerated and systematic development to replace shifting cultivation (Slash and Burn). Human population and other factors in many parts of Sri Lanka can allow only a very short period, so that small farmers find it difficult to effectively restore soil fertility or to get stakes, firewood and other essentials usually harvested from bush fallow (Weerakoon, 1985). To help alleviate this problem investigations were initiated to develop efficient alternatives to shiftig cultivation. One of the alternatives is avenue or alley cropping.

By definition avenue cropping, alley cropping or sylvi-agriculture is an agroforestry inter-cropping system of growing useful shrubs or trees planted relatively close within the row and wide space beween the rows to leave room for growing food crops in between these rows i.e. in the alleys (Anon 1985).

Perennial leguminous shrubs such as L.leucocephala and G.sepium were used as they can fix atmospheric nitrogen. Most of the nitrogen fixed by leguminous plants is finally deposited in the leaves. These legumes shrubs can be periodically pruned, due to its quick recovery and rapid growth. The loppings are spread between the rows of arable crops as a mulch or green manure. There are additional benefits such as curbing soil erosion, conserving soil moisture suppression of weeds, providing favourable conditions for soil macro and micro organisms, and increasing soil fertility, along with evidence that the total productivity from a given piece of land can be increased. The leguminous trees with their deeper roots have access to water and leached nutrients below the root zone of the arable crop. The added organic matter decomposes, releasing plant nutrients to the soil.

The addition of organic matter to the soil, improves its physical condition and increases its base exchange capacity, thus increasing the proportion of potassium, calcium, magnesium that is held in a form readily available to plants (Webster, 1966).

The dense shade of leguminous trees usually minimize the weed development in the avenue during the off or non-arable season (Weerakoon & Senevirathe 1982). Nitrogen content of the fliage dry matter is 4.17% and 3.8% in L. leucocephala and G. sepium respectively (Weerakoon and Gunasekera, 1984) The L. leucocephala canopy is spreading (plagiotropic) and the canopy of G. sepium is erect (orthotropic).

The present study was undertaken to evaluate the contribution of biomass from legume trees to increase yield of food crops and to select suitable leguminous tree species for agroforestry farming system.

MATERIAL AND METHOD

This experiment was carried out at the Agricultural research station in Muthukandiya, Siyambalanduwa, from 1984/85 Maha to 1986/87 Maha. The soil is Reddish Brown Earth with alluvial soil. The pH of the soil ranges from 6.0 to 6.5.

The experimental design was Randomized Complete Block design, with two replicates. The

treatments were Leucaena leucocephala, Gliricidia sepium and a bare plot. Single rows of legumes (G. sepium and L. leucocephala) were grown in alleys 3.5 metre wide, 0.5 within row spacing and compared with bare plots. The leguminous plants were established in December, 1984. The gross plot size was 375 M^2, while the nett plot size was 260.4 M^2. No chemical fertilizer was applied for the maize crop. The trees were lopped at the beginning of the crop season and leaves of the legume plants were incorporated with the soil. The leaves from subsequent loppings were broadcast on the soil. The cultivated maize variety was Badra-1. The inter-row spacing of the maize crop was 60 cms, while intra-row spacing was 30 cms. The number of maize plants were maintained at the rate of one plant/hill. The time of lopping or pruning the trees as well as seeding of the maize crop is given in table 1.

Table 1. The time of lopping of legume trees and seeding maize.

	1985/86 Maha	1986/87 Maha
1st lopping Seeding (Maize)	Same day (1.5 m height from the ground level)	Three weeks before seeding (1.0 M height from the ground level)
2nd lopping	Eight weeks after seeding maize (left three branches per tree)	Four weeks after seeding Maize. (left most of erreet branches)
3rd lopping	No pruning	Eight weeks after seeding Maize. (Removed all branches up to 2m from the ground level).

Weeds were controlled by handweeding. Weeding was only necessary during the first month, after the seeding. The entire plot was harvested to obtain the yield measurement. Yield estimate was taken at 14% moisture level of maize seeds.

RESULTS AND DISCUSSION

It is clear from the Table 2 that the leaf biomass production in second year were higher in both tree species. Gliricidia sepium produced greater leaf biomass compared to Leucaena leucocephala in 1986/87 Maha.

Table 2. Yield of biomass dry matter (t/ha) production with the tree crops species.

Treatment	1985/86 Maha (t/ha)	1986/87 Maha (t/ha)
L. leucocephala	1,71	3.86
G. sepium	1.79	4.70
Bare plots (Control)	0.0	0.0

Studies by Weerakoon (1986) (Personal communication) have shown that biomass production is L.leucocephala declines faster than G.sepium, with age. His study further showed that L. leucocephala could not withstand frequent lopping. Therefore G. sepium may have a better place in an agroforestry development project in dry zone. Therefore G. sepium is superior as a "fertilizer tree" when compared with L. leucocephala.

Table 3. Chemical analysis of G. sepium and leucocephala.
(as percentage of dry matter, Weerakoon and Gunasekara - 1984).

Nutrients	L.leucocephala	G. sepium
Nitrogen	4.17	3.84
Phosphourus	0.18	0.18
Potassium	1.48	2.00
Calcium	0.39	1.01
Magnesium	0.18	0.19
Carbon	43.7	44.1

The crude protein content of the foliage of L. leucocephala is 26%, while in G. sepium is 24%.

Nutrients supplied by the Drymatter (Based on mean value) Table:4

Nutrients Kg/ha	Maha 1985/86		Maha 1986/87	
	L.leuco	G.sepium	L.leuco	G.sepium
Nitrogen	71.3	45.7	132.6	180.48
Phosphorous	3.0	2.14	5.72	8.46
Potassium	25.3	23.8	47.06	94.0
Calcium	6.67	12.0	12.4	47.47
Magnesium	3.0	2.26	5.72	9.93
Carbon	747.27	524.79	1389.66	2072.7

During the first year (maha 1985/86) L.leucocephala to the soil. The advantage of Avenue (alley) cropping is natural re-cycling of fertility, by the deep root system (of leguminous plantas) capturing nutrients moving through the deep layers of the soil profile and pumping those leached nutrients to upper horizon through the leaf litter. In addition nutrient re-cycling, this system provides biologically fixed nitrogen to the companion crop. Further more, this system would provide vital products such as fuel wood and fodder.

Effect of green manure trees on the yield of maize;

TREATMENT	Maha 1985/86		Maha 1986/87	
	Yield t/ha.	% over Cover.	Yield t/ha	% over Cover
L.leucocephala	0.449	-62.92	1.883	68.0
G.sepium	1.689	+39.47	2.143	91.68
Bare plot(control)	1.211	0.0	1.118	0.0
LSD (P=0.05)	0.16	-	0.357	-

In both years G.sepium gave greater yield of maize compared to L.leucocephala or bare plot. Crop yield was low in L.leucocephala treatment in the first year, due to shade created by over hanging branches. This problem was surmounted by including another lopping in the following year. The erroct branches habit (orthotropic) of G. sepium allowed a higher percentage of solar radiations to reach the maize crop reducing competition for sunlight Therefore this system has a greater potential for development of a stable farming system, while replacing shifting cultivation in the lower part of the Uva province.

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LEAF TWISTING WEEVIL IN MANGO

(Apoderus tranquebaricus F.)

S. Gnanachandran, A.O.(S.M.S)
Plant Protection.

This weevil is a pest found in Mango and Gouva which causes considerable damage to the young plants in the Northern Region of Sri Lanka. It is also observed that the weevil also attacks Cashew, Jambu and Jak trees to lesser extent.

Life Cycle:

1. Adult.

The adult weevil is about 10 mm.long and 5 mm.wide. It has a characteristic long snout. The weevil is reddish brown in colour with black margins across the body. It is the adult that causes more damage by cutting and twisting the mango leaves into neat thumble shaped structures. The following steps are involved in making the tumble shaped structure.

Step 1: The Adult weevil withj its snout cuts near to the base of the leaf blade partially by a semi-circle cut which passes through the midrib.

Step 2: The weevil then proceeds to the tip of the leaf. As it proceeds towards the tip of the leafit cuts tiny holes at the lateral veins of the leaf.

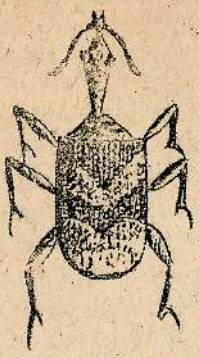
Step 3: Once the weevil reaches the tip of the leaf a single dirty yellow colour egg is laid on the midrib one inch away from the tip of the leaf.

Control:

In hand reached young plants removal of the thumble shaped structures and destroying them and also catching the weevil by a butterfly net during its process of egg - laying can be undertaken in small plantations.

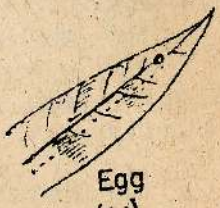
(All observations were made at the In-Service Training Institute, Kilinochchi)

LEAF TWISTING WEEVIL IN MANGO



Adult
(x 6)

Pupa
(X10)



Egg
(x 1)

Damage
Symptom

HOW DOES RAINFALL AFFECT THE GROWTH AND DEVELOPMENT OF BANANA ?

Mrs. I.S. Padmasiri and Dr. V. Arulnandhy
Division of Horticulture, CARI, Peradeniya.

An observational study was performed at ten locations (selected ten farmers) in the Kegalle District to understand the influence of climate (rainfall) on the growth and development of banana. At each location five bananas clumps are selected to measure the plant height and girth of the developing suckers (5-7 in number in each clump). Measurements were taken at monthly intervals for a period of twelve months, starting from November, 1985. The data obtained on increase of plant height and girth were compared with the rainfall pattern of the district.

The lowest rainfall (31.22 mm) was recorded for February and the highest rainfall of 200.90 mm in October during the period of this study. Another dry month identified was July (57.40 mm) and during the rest of the months rainfall was around 80.00 mm. The growth pattern of the suckers showed a noticeable relationship with the rainfall received. The growth rate of suckers, measured in terms of plant height and girth immediately following the dry spells (months of February and July was found to be remarkably slower compared to the growth following those months that received over 80.00 mm rainfall. (These months are considered as wet months). The low growth rate due to dry period was more prominent in the early formed suckers (first and second suckers). The low growth rate was expressed externally by a very slight increase in height and girth or no increase at all.

Variations in growth and development were observed among clumps at the same location and between locations. These could be attributed tao genetic and environmental factors including management. It was also noticed that in some clumps, the first sucker had the highest rate of growth while in the other clumps second and third suckers expressed better growth than the other suckers. Such difference in growth may be possibly due to the competitive advantage of

one over the other which means that the stronger suckers take the advantage and grow at the expense of the weaker ones.

Hence, from the available data it could be possible to conclude that climatic factors such as rainfall may have a reasonable influence on the performance of banana during their growth and development. The drought period that causes moisure stress due to lack of sufficient rainfall at any stage during the growth and development can cease or retard the growth in bananas.

The authors wish to thank Mr.S.A. Somapala, (K.V.S. Division of Horticulure, CARI), for his help in this research work.

New Bush-Sitao varieties

(A) Fertilizer recommendation (N:P:K - 80:60:60 Kg/ha)

Fertilizer application recommended for the new Bush-sitao varieties is

Stage	Fertilizer(in kilograms/ha)		
	Urea	Super Phosphate	Muriate of Potash
Basal application	87.0	133	67
3 weeks after planting.	43.5	-	33.5
6 weeks after planting.	43.5	-	-

Average yields of New Bush Sitao varieties recorded at Maha-Illuppallama.

Variety	Yield (Kg/ha)
BS_1	19,000
BS_3	17,000
Local variety	12,000

THREAT OF CUSCUTA PARASITE IN CHILLI

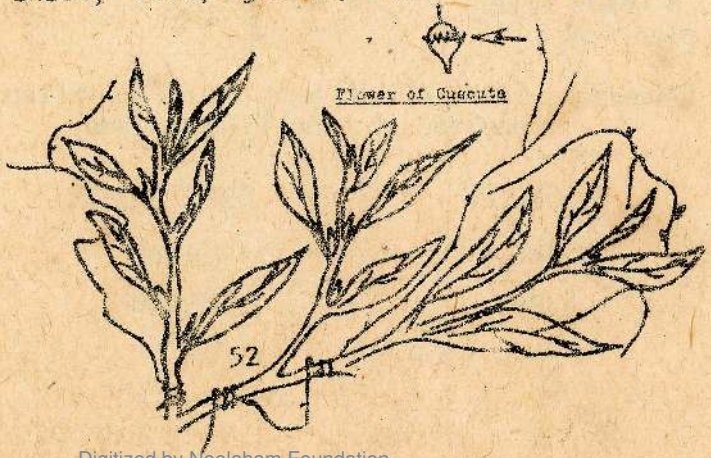
Dr. V. Arulnandhy and Mrs.I.S. Padmasiri
C.A.R.I., Gannoruwa.

Chilli (Capsicum annum L) is grown in many parts of the country; although the dry zone is the major growing area. Chilli crop may be seriously affected by diseases like leaf curl complex that cause substantial yield reduction. The other diseases like anthracnose, powdery mildew and wilt as well as damage from insect pests like aphids pod borer, mites, thrips and white flies directly or indirectly affect the yield in chillies.

Very recently, a Cuscuta sp. (dodder in English, aga-mulancti-wel in Sinhala and Kaskutta in Tamil), which is a total parasitic plant has been found attacking chilli in Minipe area, in the Kandy district. This parasite was observed on chilli plants grown in rice fields,under irrigation in Yala 1987 (dry season); however, the extent of attack was fairly small. The occurrence of Cuscuta sp. was reported earlier on a variety of hosts but often on Mikenia (Dissanayake and Fosberg, 1980). Since the attack of this parasite is apparent on economic important crops like chilli, information on the development, spread and control of Cuscuta would be imperative.

NATURE OF PARASITE AND EFFECT ON HOST.

Cuscuta is a flowering dicotyledenous plant belonging to the family Convolvulaceae. Many species of Cuscuta are known to parasitize on a variety of crops such as alfalfa, amaranthes, cabbage, onion, flax, gourds, tomato etc. Two



species, Cuscuta chinensis Lam. and Cuscuta reflex Roxb. were reported to exist in Sri Lanka (Dissanayake and Fosberg, 1980).

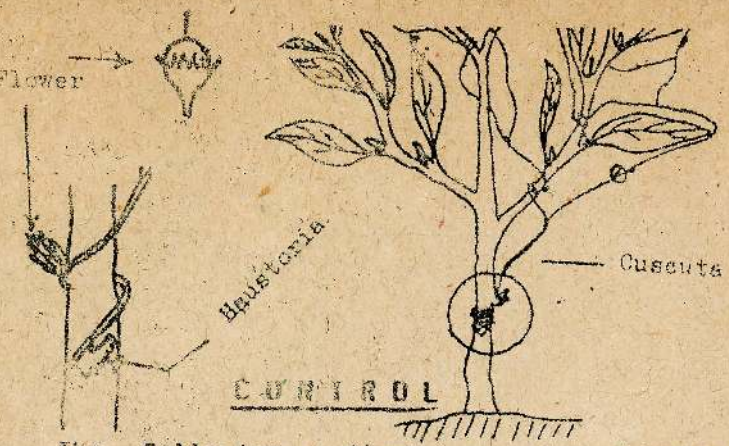
The symptoms of attack of the Cuscuta sp. are very clear and typical in nature. Slender yellow vines are seen entwining the main stem and branches of chilli. At advance stages they cover the host plant completely. This could be visible even from a distance. The infected chillli plants get stunted, as their nutrients are depleted by the parasite. Host plants become weak, unhealthy and ultimately die, without any production.

SPREAD AND PERPETUATION

Primary attack and spread take place through seeds, which can overwinter in soil or carried as contaminants in the crop seed. The seeds remain viable for a long period. A single Cuscuta vine has the capacity to produce few thousand seeds. Further spreading could be possible through grazing animals, birds, farm implements, labourers and field workers and through irrigation water. Apart from chilli, Cuscuta also attacks majority of crop plants mentioned earlier. Non-crop plants like hedges and other road side trees are also attacked. However, cereals, maize, soyabean and cowpea are reported to resist its attack. In the absence of host, it survives either in the soil or through parasitization and gets perpetuated for indefinite period.

MODE OF ATTACK

The seeds of Cuscuta on germination give rise to young seedlings. They have a very weak root system and are in search of a host. As soon as they come in contact with a suitable host they parasitize it, sending minute haustoria or sucking roots into host tissue and extracting the nutrients. Haustoria seem to secret diastase enzyme which hydrolyzes the host starch. Once established, the broken pieces of Cuscuta vine are capable of infecting another host plant, thus help in the spread of the parasite.



The following methods can be adopted to prevent the attack and spread of this parasite.

1. Use crop seeds completely free of Cuscuta seeds. These seeds are lighter and can be easily seperated by dipping in water.
2. Burn Cuscuta vines before seed set.
3. Restrict the flow of irrigation water through the infected field.
4. Keep the irrigation channels free of hosts and parasites.
5. Avoid the use of Cuscuta infested farmyard manure.
6. Avoid animals grazing in the infested field.
7. Follow crop rotation with suitable resistant crops like maize, cowpea and soybean.
8. Destroy the crop plants and alternate host plants (non-crop plants), bearing Cuscuta infestation by burning.

ACKNOWLEDGEMENTS

The authors extend their sincere appreciation to Mr.A.L.W. Premawardene, Segment Agricultural Officer, Kandy district for his fullest co-operation and assistance in the identification of the problem.

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(Continued from page 37)

TABLE 7. USE OF PESTICIDES IN PADDY CULTIVATION. ADOPTED PESTICIDES

KANDY

Pesticides	Percent Reporting 1/	Pest	Percent Reporting 2/	Average Quantity per farm Oz.	Quantity Per Ac.	% Farmers using the Pesticides the correct Pest.
Tamaron	33	Leaf Roller	50	3.3	5.15	
		Leaf eating Caterpillar	19	4.0	8.0	
		Paddy bug	06	20.0	16.0	0
		Stem borer	06	4.0	4.0	
Currector	31	Leaf Roller	-	-	-	
		Leaf eating Caterpillar	07	35.8	46.7	33
		Paddy bug	-	-	-	-
		Stem borer	13	34.9	69.3	-
Monocrotophos	16	Leaf Roller	38	6.3	4.2	50
		Leaf eating caterpillar	12	4.0	2.67	
		Paddy bug	-	-	-	
		Stem borer	25	11.3	19.43	
Monitor-600	10	Leaf Roller	40	3.0	458.	
		Leaf eating caterpillar	20	4.0	8.0	0
		Paddy bug	-	-	-	
		Stem borer	20	2.5	5.0	
Azodring-60	10	Leaf Roller	80	5.5	8.0	
		Leaf eating caterpillar	20	3.0	6.0	37
		Padd bug	-	-	-	
KEGALLE		Stem borer	-	-	-	
Monocrotophos	20	Leaf Roller	63	12.0	9.1	
		Paddy bug	-	-	-	
		B.P.H	18	20.0	40.0	71.0
		Gall Midge	-	-	-	
		Stem borer	-	-	-	
Tamaron	16	Leaf Roller	78	11.1	9.9	
		Paddy bug	22	6.0	6.9	
		B.H.P.	11	3800	13.3	0
		Gall Midge	-	-	-	
		Stem borer	11	8.0	8.0	
Currater	11	Leaf Roller	67	48.0	403.2	
		Paddy bug	-	-	-	
		B.H.P.	17	35.2	140.8	12
		Gall Midge	17	70.4	70.4	
		Stem borer	-	-	-	-
Parathion	11	Leaf Roller	83	7.2	10.3	
		Pad Bug	-	-	-	
		B.P.H.	33	4.0	8.0	0
		Gall Midge	-	-	-	
		Stem borer	-	-	-	
Lebaycid	07	Leaf Roller	50	8.0	10.7	
		Paddy bug	50	7.0	9.3	5
		B.P.H	-	-	-	
		Gall Midge	-	-	-	
		Stem borer	-	-	-	

USE OF PESTICIDES IN PADDY CULTIVATION.

THE CASES OF MAJOR PESTS AND WIDELY ADOPTED PESTICIDES

MATALE

Pesticides	Percent Reporting 1/	Pest	Percent Reporting 2/	Average Quantity per farm Oz.	Quantity Per Ac.	% Farmers using the Pesticides the correct Pest.
Lebaycid	20	Stem borer	21	6.7	9.0	8
	?	Thribs	43	15.0	9.3	8
		Leaf Roller	14	4.0	6.4	
		Leaf eating caterpillar	07	2.0	4.0	
Monitor-600	16	Stem borer	18	12.0	9.0	
		Thrips	9.0	10.0	20.0	
		Leaf Roller	18	12.0	14.0	0
		Leaf eating caterpillar	36	7.0	5.4	
		Paddy bug	09	16.0	5.9	
Ecalux	12	Leaf eating caterpillar	86	6.0	8.5	
		Plant hopper	14	8.0	10.7	40
Nuwacron	09	Stem borer	17	22.0	3.2	
		Leaf Roller	67	6.0	7.8	32
Corrector	09	Stem borer	100	140.8	123.2	26
Tamaron	07	Stem borer	20	16.0	16.0	77.
		Leaf Roller	40	12.0	8.0	8.0
		Leaf eating caterpillar	20	8.0	16.0	
		Plant hopper	20	8.0	10.0	
Monocrotophos	04	Leaf Roller	50	16.0	16.0	
		Leaf eating caterpillar	50	16.0	16.0	14

1. As a percentage of the farmers reporting any pest problem.

2. As a percentage of the farmers reporting the respective pesticide.

apply chemicals. Observations on the near by fields also influenced the farmers in this decision process. Prior advise of extension officers as a decision criterion on insecticide use was found ineffective except for one third of the farmers in Matale. However, after the decision made to use insecticides, extension agents were consulted for information on the suitable types of insecticides, quantities and frequencies of application (Table 8).

Table: 8

ROOTS OF MOTIVATION FOR USING PESTICIDES

	KANDY	KEGALLE	MATALE	TOTAL SAMPLE
		% Reporting		
As a Preventive Measure	17.5	10.00	17.00	14.83
As a curative measure	58.7	80.00	75.00	71.23
Non reporting cases	23.8	-	-	7.93
Reported reasons for resorting to Pesticides.				
Pest problems in the farmers fields	52.3	70.0	67.27	63.19
Pest problems not in the farmers field but in adjoining fields.	12.7	5.0	9.09	8.93
Only as a preventive measure	6.3	1.67	3.63	3.87
Following the advice of officials	1.6	5.00	29.09	11.90
Following the example of the follow farmers	4.8	10.00	14.55	9.78
Following use of pesticides of the other farmers	-	-	9.09	3.03
Others	1.0	8.30	5.45	4.58

this respect too, nevertheless jpast experience was the most powerful decision criterion, though this "past experience" could be originated by past extension activities, a substantial proportion of the farmers resorted to past experience in deciding the quantatives of insecticides applied (Table 10). More than 25% of the farmers claimed their practice as quite adequate to control the insects even though it was shown earlier that farmers used only small quantitiies of chemicals. This is a matter for further investigation because this could happen as a result of the recommendations being too high or the "adequate level" the farmers refer to is lower than the level of control the research recommendations are geared to achieve. It is interesting to note that lack of finances had not been a limiting factor for pest control (Table 10).

Safe Handling of Insecticides:

Avoiding spraying against the wind and and refraining from directly touching the chemical were the safe handling practices followed by almost all the farmers. (Table 11). Long sleeved shirts were the only type of protective clothing reported by them.However, after spraying bathing or having a thorough body wash was practised by almost all farmers. One third of the farmers used to wash the spraying equipment in (unsafe) places such as public bathing places and natural water ways. However, an equal proportion was cautious enough to wash the sprayers and pour the waste water back into the paddy field before leaving it.

Storage of insecticides and disposal of the empty containers were done according ato the standard "safe handling" instructions by nearly all the farmers (Table 12). They were well aware of the poisonous nature of the chemicals and no health hazards due to poisoning were reported (Table 13). None the less this refers only to the clearly visible immediate problems and farmers had no idea that continuous exposure to chemicals may create health problems. Majority of them had the impression that an insecticide applied to the field is effective only for 4 to 5 days.

Table 10.

Reasons for the choice of the Quantities and Frequencies.

	Kandy % Reporting	Kegalle % Reporting	Matale % Reporting	Total Sample
On pas experience	17	30	57	34.57
Just adequate to control	35	-	48	27.67
Advice of officials	14	27	12	17.67
Observation of other practices	27	25	7	11.33
Advice of the other farmers	2	37	-	13.00
Limited money availability	8	10	5	9.33
Non responding cases	8			2.67

Table 11. Adoption of precaution in handling Pesticides

	Kandy % Reporting	Kegalle %Reporting	Matale % Reporting	Total Sample
Avoiding contact	71	83	83	79.0
Avoiding against blowing	71	78	42	63.67
Protection cloths Hats Masks Shoes Gloves	68	53	30	50.33
Bathing	52	53	87	64.0
Washing equipment in public water ways Washing in private water water ways	32	40	25	32.33
Washing in the field	37	40	38	38.33
Other	-	10	13	8.67

able 12. Some information on Storage of Insecticides of Farm Level.

	Kandy % Reporting	Kegalle % Reporting	Matale % Reporting	Total Sample
torage in the house	16	30	37	27.67
ut side	60	53	45	52.67
torage in safe place	8	18	27	26.67
nsafe place	8	12	10	17.00
isposal of emptics: Distroyed Sold	 46 14	 75 7	 38 18	 41.53 13.00
sed as container of non food item	5	12	8	8.33
sed as food container	2	-	-	0.67
sed for other purposes	8	-	15	7.67

Table - 13 Occurence of Health Hazards due to Insecticide Poisoning.

	Kandy % Reporting	Kegalle % Reporting	Matale % Reporting	Total Sample
Health hazard Experienced	2	-	10	4.0
Not Experienced	71	90	80	80.33
(Non responding cases)	3	-	-	1.0

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