

2.5 GREENING DISEASE PROTECTION:-

It was a sad moment for the project when the presence of greening disease at Sindhuli farm & nearby area of Sindhuli Madhi was reported by Japanese plant pathologist Dr. Imada in November 1986, but on the other hand, it became very good to identify the disease before spreading in the orchard areas. Sindhuli farm and the private nurseries at Sindhuli Madhi were allotted to produce junar/citrus plants to fulfill the target of the district for junar/citrus. As the greening disease is transmitted by vector citrus psylla which was found at Sindhuli Madhi area, so all the nurseries plants at Sindhuli farm as well as of private nurseries of that area were stopped after the recommendation of Nepalese experts who surveyed this area after the report of Japanese expert. So in 1986/87 not even a single plant was distributed from this place and all the plants were destroyed. It was good symptom for the project that the experts did not find any disease Symptom at the higher altitude where the junar cultivation is in abundance. So only set back in 1986/87 that the distribution target for the Sindhuli district could not be achieved due to destruction of diseased plants.

Some of the plants had been distributed to Kapilakot pan-chayat from Janakpur Agriculture Development Project (JADP), Naktajhi before identification of the disease, so a regular technical guidance have been made to that area and the farmers are made aware of this fact to avoid further spread of the disease to other area of the district. A poster consisting the general symptomology of the greening disease with control measures have been published & distributed to the farmers of both the districts.

Junar of Mr. Ram Bahadur Koirala of Baseswar village panchayat was found to have the maximum brix i.e. 14 of brix followed by that of Mr. Nar Bahadur Magar of Baseswar village panchayat having 13.0%. This will be a landmark for taking the scion or to preserve as mother plant, so the quality of the junar fruits can be improved. In 1987/88, there is programme to make a survey of citrus fruits in Ramechhap district.

2.6. GREENING DISEASE & CITRUS PSYLLA SURVEY:

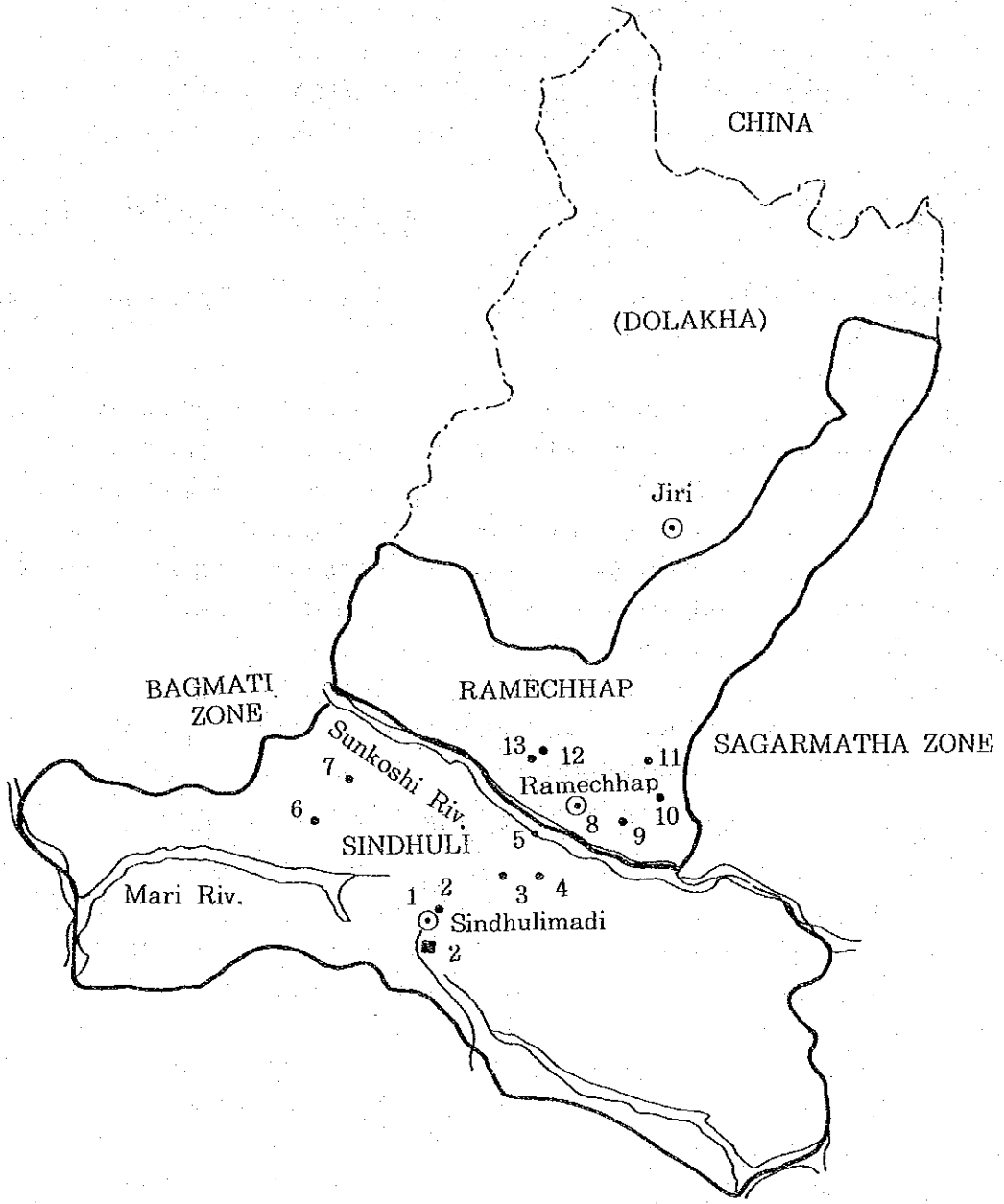
Greening is a dreaded disease of citrus. It destroys plants and it is very difficult to control. It is most unfortunate part that this disease is present at Sindhuli Madhi area of the sub centre. In Nepal, Pokhara's citrus were badly damaged and destroyed by this disease. The vector citrus psylla was not found at the higher altitude in Sindhuli and Ramechhap area. The major orchards are at higher altitude than that of Sindhuli Madhi in both districts. In Sindhuli Madhi, there are no orchards of Junar so as this disease identified at the early stage, all the nurseries were closed down and the plants were destroyed to check further spread of the disease, in disease free areas. Orchards of the Sindhuli Farm also have been destroyed. All the preventive measures for the control of this disease are taken.

After receiving the report of Dr. Imada, this division surveyed for this disease in some panchayats in Sindhuli district and also surveyed the presence of the vector citrus psylla. It is a matter of great satisfaction that the vector citrus psylla was not found at Ratanchura, Nakajoli, & Jalkanya, etc. Ramechhap district, citrus psylla & greening affected plants could not be found at different panchayats at different altitude. This year also this division aims to survey the rest of the village panchayat especially where there be chance of this disease i.e. Junar growing at the lower altitude area. Not only Sindhuli and Ramechhap areas were surveyed for greening and citrus psylla, other places were also surveyed for these to confirm the presence/absence of this disease. Presence of greening was found at Panchkhal Hort. Research Station, Pokhara & Hyangja in Kaski district & JADP at Naktajhij in Dhanusha district while presence of citrus psylla as well as greening was found at Trisuli (Nuwakot district),

Naxal (Kathmandu district), Damauli (Tanahu district), Rampur Campus (Chitwan district).

SURVEY OF GREENING & CITRUS PSYLLA.

	<u>District</u>	<u>Area</u>	<u>Altitude. (M)</u>	<u>Psylla</u>	<u>Remarks</u>
1.	Sindhuli	Sub-Centre	500	Present	Greening
2.	"	Madhi	500	Present	Demo. Farm
3.	"	Bijayachhap	1,100	Non	
4.	"	Khanyakarka	1,000	Non	
5.	"	Khurkot	450	Present	
6.	"	Kapilakot	500	Present	
7.	"	Ratmata	1,100	Non	
8.	Ramechhap	Ramechhap	1,300	Non	
9.	"	Sukhajor	900	Non	
10.	"	Gaitatar	1,200	Non	
11.	"	Salu	1,250	Non	
12.	"	Bhaluwajor	900	Non	
13.	"	Bhaluwajor	1,200	Non	



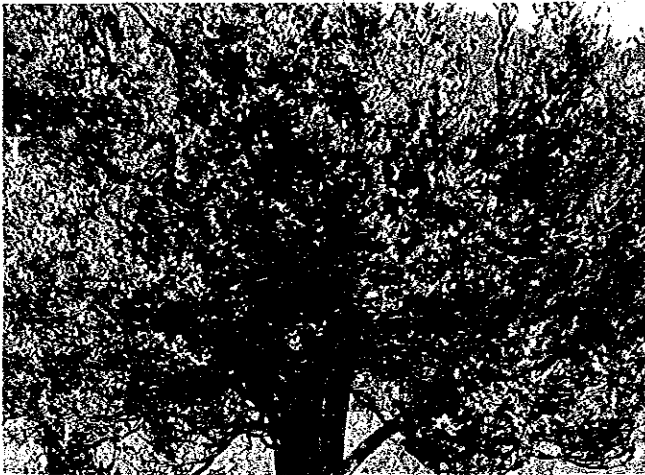
Survey of Greening & citrus psylla in Sindhuli and Ramechhap.



Greening affected leaves at Sindhuli.



Greening affected plants at Sindhuli.



Greening affected Suntala plant at Horticulture

Research Station, Pokhara.

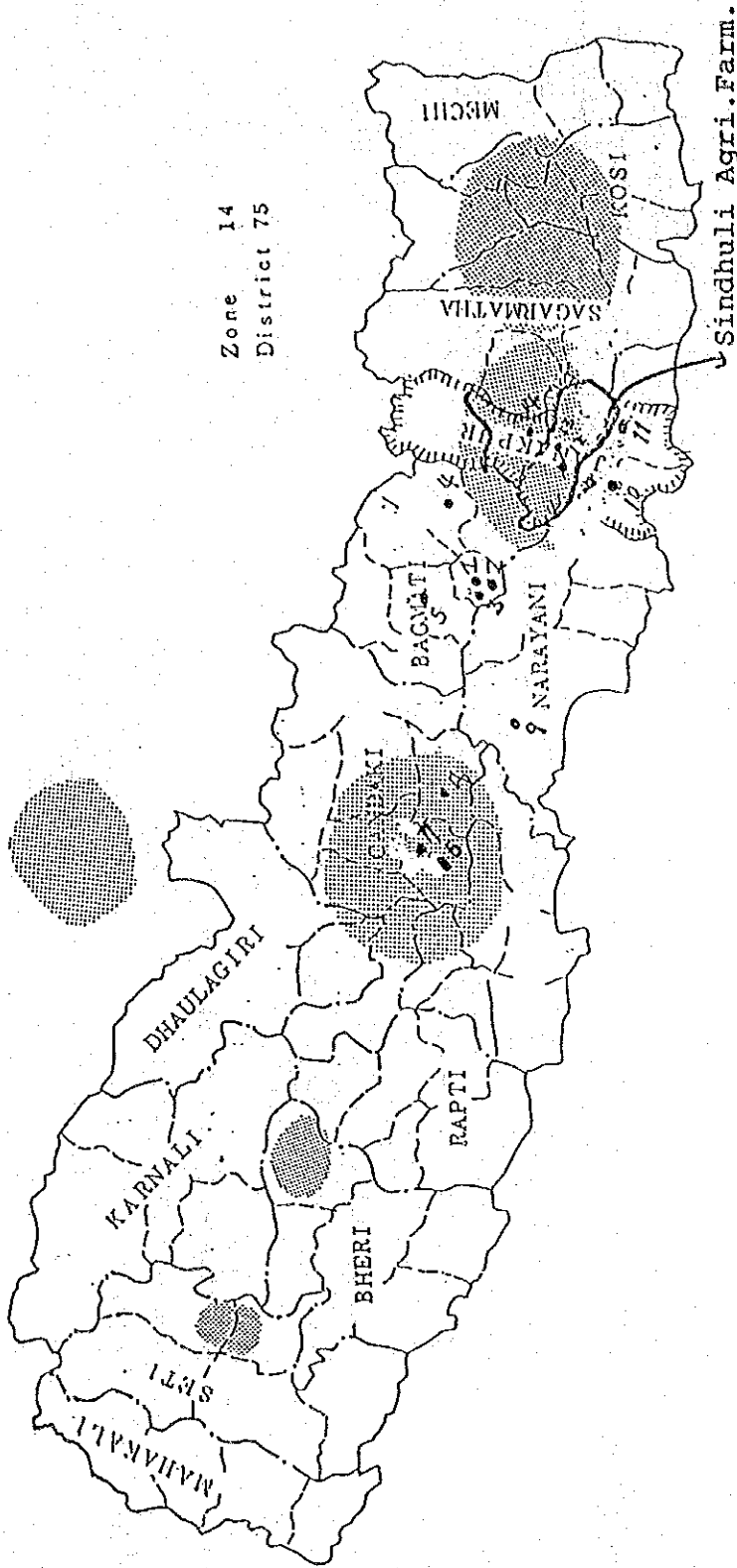


Greening affected Kinnow plant at Horticulture

Farm, Panchkhal.

SURVEY OF GREENING & CITRUS PSYLLA.

<u>District</u>	<u>Area</u>	<u>Altitude (m)</u>	<u>Citrus psylla</u>	<u>Greening</u>	<u>Remarks.</u>
1. Kathmandu	Baluwatar	1350	Present	-	
	Naxal	1350	"	-	
	Kirtipur	1350	None	-	Continuing
2. Sindhupalchok	Hort. Farm, Panchkhal.	650	Present	Present	Kinnow orange brought from Pakis'
3. Nuwakot	Trisuli Hort. Farm	650	Present	-	
4. Kaski	Hyangja	750	"	Present	
	Hort. Res. Station. Malepatan.	650	"	"	
5. Tanahu	Damauli	550	"		
6. Chitwan	Rampur Campus	250	"	Present	On Kamini
7. Sarlahi	Hort. Farm, Nawalpur	150	"	"	"
8. Dhanusha	JADP	100	"	"	"
9. Sindhuli	Sub centre, Sindhuli Madhi.	500	"	"	"
	Demo. Farm, Bijayachhap.	1100	None	-	
10. Ramechhap	Demo. Farm, Salu.	1250	none	-	-



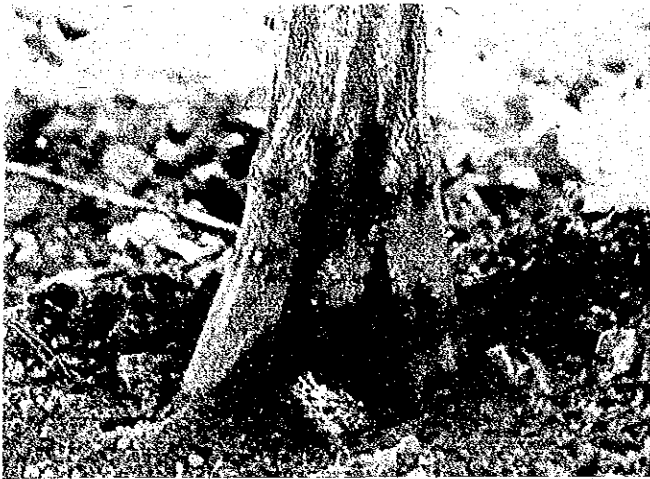
Survey pocket of greening and citrus psylla

in 1986/87.

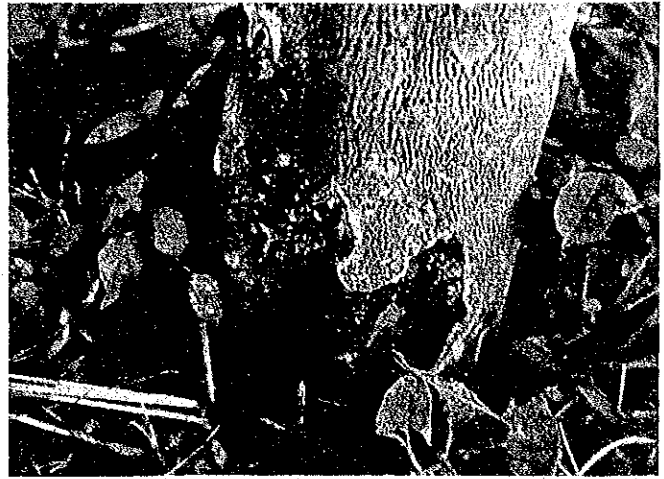
2.7. FOOT ROT DISEASE PROTECTION:

Mostly junar plants planted in Sindhuli & Ramechhap districts are grafted either on citrus jambheri or of seedling origin. Foot rot disease caused by phytophthora spp. has been observed in Junar plants in these area. This division has distributed a poster regarding the control of the disease. While inspecting the orchards/nurseries, technicians of the centre/sub centre explain the precaution & control measures to the farmers. During training period for the leader farmers, the control measures of this disease is especially emphasized.

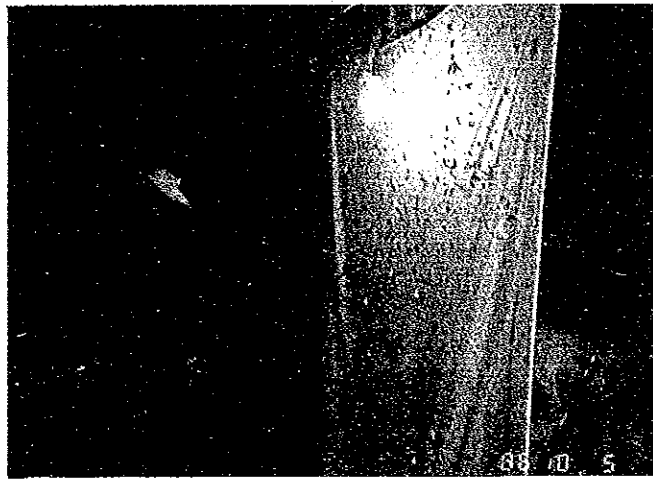
This year this division has planned to do 'netsugi' (approach grafting) to all the diseased plants besides Bordeaux paste to each plants.



'Netsugi' (approach grafting) in disease infected junar plant.



Foot rot disease at Sindhuli.



Light trap for the insects.



A view of demonstration farm at Salu, Ramechhap.



A view of demonstration farm at vijayachhap, Sindhuli.

3. DEMONSTRATION FARM:

There is a proverb "Seeing is believing". A farmer can be made convinced or can be motivated easily if he sees himself in the field what one tries to explain in theory. So demonstration farm can help to a great extent to change the farmer's attitude. The project has established demonstration farms in the project areas, one in Sindhuli district and other in Ramechhap for citrus. The demonstration farms are directly supervised by Japanese as well as Nepalese experts with the active participation of farmers & Agriculture Development Office. The farmers were selected on the following criteria which were approved by 2nd joint committee meeting.

- 3.1. The project experts and ADO should recommend the site and farmer for the demonstration farm.
- 3.2. The demonstration farm's area should not be more than 2 hectares.
- 3.3. The site and farmers should be chosen on the availability of irrigation and other physical facilities.
- 3.4. The land should be as near as possible by the roadside.
- 3.5. The demonstration farm should be situated near the centre of fruit growing areas.
- 3.6. Land having wide terrace for Junar and upland for grapes should be selected and should be in a block.
- 3.7. Priority will be given to the farmer who has experience in particular fruit cultivation and the one interested in learning improved technology of fruit cultivation.
- 3.8. Farmer who will give suitable land on lease free of cost till the project period will be given priority.
- 3.9. Farmer eager to cooperate the project in different aspects will also be given due priority.

After the selection of the farmers and the land, an agreement was made between the farmers and project. The terms and conditions of the agreement are as follows:-

- 3.2.1 The land will remain under the possession of the project for seven years and if necessary will be renewed with the consent of the both.
- 3.2.2 Under no circumstances the Land Owner will sell, partition, donate or

mortgage the land.

As per its programme, the Project will construct/demolish the structures, or plant/uproot the plants.

Project will help and support the Land Owner in making available the tools and equipment & agriculture inputs required for Demonstration Farm.

The Land Owner will provide labour required for carrying various operations in Demonstration Farm. Moreover, he will be required to work himself in the Demonstration Farm.

Demonstration Farm will be used for various training and trials & other activities of the Project. Land Owner will be responsible for maintenance & security of the Demonstration Farm.

Project will utilize the produce of Demonstration Farm for its research and study purposes and rest of the produce can be utilized by the Land Owner.

Land Owner will follow the technical as well as administrative advise of the Project.

If the Land Owner will not obey the agreement he will be deemed to pay all the incurred expenses.

Land Owner will maintain a daily record of the day to day operations carried out in the Demonstration Farm.

3.2. PROGRESS OF THE DEMONSTRATION FARM:

As per the criteria framed out & passed by the joint committee meeting, after the agreement the work for the demonstration farm was started. In Sindhuli district Mr. Bishnu Bahadur Shrestha of Ratanchura village panchayat and in Ramechhap district Mr. Punya Prasad Adhikary of Salu village panchayat were selected. The area of Mr. Bishnu Bdr. Shrestha is 0.85 ha. while that of Mr. P.P. Adhikary is 0.5 ha. In 1986/87 wind break plants were planted all around the farm site. Compost pits were dug to fulfill manurial requirement of the plant. Besides these two works, clearing & cleaning of the site were done. A layout was made after the harvest of maize

crop in both the places. The distances of the pits were kept 3 m., 4 m. & 5 m. As pruning will be a major operation for the cultivation of the junar, small spacing have been kept. It will improve the quality of the fruit as well as more plants can be accommodated in less area. The pits were dug and every pit was filled with compost, lime and complex fertilizer.

A boundary wall of stone & cement was constructed to check from the damage by the cattle in Ramechhap while the fencing of the demo. farm site was done with barbed wire in Sindhuli. A water tank having the capacity of 500 litres were constructed at Ramechhap & Sindhuli respectively to ensure irrigation water as well as will solve the problem of drinking water. But due to lack of pipes these tanks have yet not been connected with water source but will be connected by the end of Dec. 1987.

The following citrus fruits were planted in both the demonstration farms:-

<u>Sindhuli Demonstration Farm:</u>	<u>No. of plants.</u>
1. Junar	119
2. Suntala (Mandarin)	23
3. Lime	83
4. Chestnut	20
5. Pear	10
6. Peach	10
7. Pujya Feijoua	10
8. Kiwi	7
9. Trifoliate orange	9
10. Maki	76
11. Guava	100
12. Melberry	40
13. Ipil ipil	190
14. Utlish	400

<u>Ramechhap Demonstration Farm:</u>	<u>No. of plants.</u>
1. Junar	151
2. Lime	30
3. Peach	7
4. Pear	12
5. Feijowa	4
6. Chestnut	18
7. Guava	12
8. Ipil ipil	150
9. Utlish	20

Regular operations are done under the supervision of technicians of the Sindhuli farm and JT/JTA of ADO's concerned districts. Besides this, regular visit by the experts of the project is paid & technical guidance and operational works are guided by them to the technicians involved in supervision of the demo. farm. The plants are in good conditions till now.

4. UPGRADING TECHNICAL LEVEL OF STAFF:

The project envisages that the quality of the work can only be maintained when the personnel are qualified and well trained having good practical experience. A regular training of citrus division is conducted for the JT/JTA and leader farmers. Besides this, to enhance the knowledge in citrus cultivation the counterpart experts were sent to Japan to have more practical knowledge along with the latest development in citriculture. In 1986/87, the Nepalese expert Assistant Pomologist Mr. Suresh Kr. Verma was sent to Japan for training in citrus cultivation. He was at Okitsu branch of fruit tree research station under Ministry of Agri. Forestry & Fisheries for 6 months. In the beginning of 1987/88, Mr. Bhairab Raj Kaini has been sent to Japan for training in citrus cultivation. He is under going for training at Shikoku & Okitsu branch of fruit tree research station. There is a regular programme for training in Japan till the project period.

5. TRAINING FOR JT/JTA and farmers:

A regular training for JT/JTA and citrus farmers are given. The following are the training conducted at Kirtipur and Sindhuli.

<u>Kirtipur.</u>	<u>Time</u>	<u>No. of participants.</u>
1 st time	May 24 - 27	Sindhuli - 13 Ramechhap - 11
2 nd time	June 7 - 10	Sindhuli - 10 Ramechhap - 10
3 rd time	June 21 - 24	Sindhuli - 10 Ramechhap - 10

<u>Sindhuli.</u>	<u>Time</u>	<u>No. of participants</u>	<u>Remarks</u>
1 st time	Aug. 26- 1 Sept. '86.	Sindhuli - 12 Ramechhap - 2	Nursery
2 nd time	Jan 21-27, 1987	Sindhuli - 14 Ramechhap - 11	Agri.Asst.
3 rd time	Feb 20-26, 1987	Sindhuli - 6	JT/JTA
4 th time	March 2 - 5, "	Sindhuli - 15 Ramechhap - 8	Leader Farmers.
5 th time	March 9-12, "	Sindhuli - 10 Ramechhap - 10	Agri.Asst.
6 th time	April. 1-7, "	Sindhuli - 15 Ramechhap - 15	Leader farmers.
7 th time	April. 19-22, "	Sindhuli - 10 Ramechhap - 15	"
8 th time	April 20-26, "	Sindhuli - 15 Ramechhap - 15	"
9 th time	April 28- 1 May, '87	Sindhuli - 7 Ramechhap - 8	JT/JTA
10 th time	May. 3 - 6, 1987	Sindhuli - 15 Ramechhap - 10	Leader farmers.
11 th time	May. 18-21, "	Sindhuli - 10 Ramechhap - 14	"

Total No. of participants: 223

	<u>JT/JTA</u>	<u>Agri.Asst</u>	<u>Leader farmers.</u>
Sindhuli -	13	24	80
Ramechhap -	8	21	77
Total	21	45	157

The technical know how levels of the general farmers are low so it is necessary to train as much as farmers can be. Many farmers are doing the cultivation of citrus (junar) fruits but they are not adopting the standard practices for the successful

cultivation of the junar due to lack of technical know how. This division believes that training will enhance their knowledge and the outcome of the training can be evaluated when the fruits will start coming into the market.

A regular training of citrus nurserymen is also conducted so that they can produce standard quality plants. The training of this type is already enlisted.

6. PUBLICATIONS:

This division has published the following extension, training, teaching material and book in 1986/87.

6.1. Extension material:

Considering the problems of the citrus cultivation and to acquaint with the remedies, this division has published three bulletins (in poster form) and distributed among the farmers of Sindhuli and Ramechhap and other places. The first poster was regarding the symptom & control of foot rot disease of citrus, the second one was regarding points to be kept in mind while planting junar. This poster was distributed in June/July (at the time of plantation) and the third one is about the general information of greening disease and its preventive & control measures. All these posters have made positive results. There is plan to publish many poster like this in different aspects of citrus cultivation so that the technical know-how of the citrus cultivation can be reached to many citrus growers (old and new growers both).

6.2. Training teaching material:

During the training period to JT/JTA & farmers, teaching material regarding the citrus cultivation is distributed which consists the points to be considered for every operation of citrus cultivation especially in junar. So in 1986/87, this division has published one teaching booklet for the trainees. This division aims to improve in the teaching booklet in coming years so that up to date knowledge can be given to the JT/JTA & farmers. This will be helpful in successful cultivation of citrus.

6.3. Book on Junar cultivation:

This division under the name of the project has published a book entitled "Junar utpadan tatha samrachhan" written by Mr. Bhairab Raj Kaini in 1986/87. The book covers not only the citrus cultivation but also covers the economics of citrus cultivation as compared to other crops. This book is also distributed to the trainees when they come for training. It will be a reference book for them in future too.

This division also aims to improve this book to make it up to date in cultivation of citrus as per required.

फेद कुहिने रोग (FOOT ROT DISEASE) बाट सुन्तला जात फलफूलको रोकथाम गर्ने

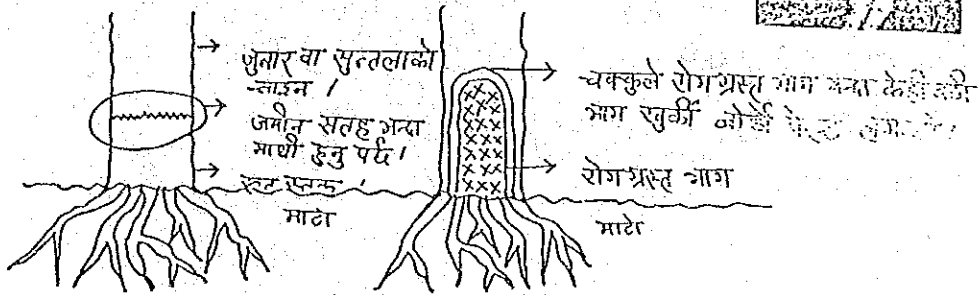
तरीका

रोगको लक्षणहरूः

१. शुरूमा खास गरी वोटको फेद तीर बोक्रा भागमा देखा पर्दछ/ रोग लागि गरी सकेको बोक्राहरू कडा नै रही रहन्छन्।
२. वोटको फेद तीर बोक्रामा टाँस्सिने केही गम युक्त पदार्थहरू देखिन्छन्।
३. रोग ग्रस्त वोटहरू क्रमशः सुकदै जान्छन् र अन्तमा गर्दछन्।



रोगको रोकथाम गर्ने तरिकाहरूः



१. सुन्तला जातका फलफूलहरू धेरै गहिरो नरोप्ने।
२. सुन्तला जात फलफूलका विरुवाहरू नजीक अन्तरबाली नलिने।

बोर्डो पेस्ट बनाउने तरिकाः

- १ भाग नीलो तृथो १ भाग चून र पानी (आवश्यक मात्रामा)

- बागबानी विकास परियोजना, कीर्तिपुर

सुन्तला जात फलफूल (जुवार) रोपना ध्यान दिनु पर्ने आवश्यक कुराहरूः

१. विरुवा रोप्नु भन्दा अगाडी खाडो रक्ती रसमा जोखर
हे रेरुवा रोप्नु पर्छ। साथै रसमा जोखर

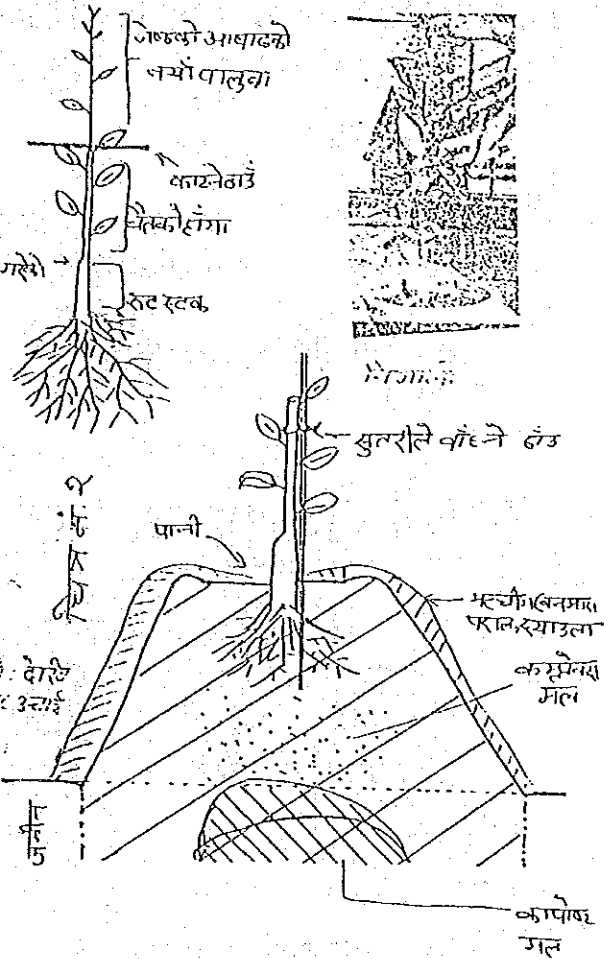
२. विरुवा $1\frac{1}{2}$ - २ फीटको अग्लो
हुनुपर्छ। विरुवा रोप्नु भन्दा अगाडी
आएको नयाँ पालुवाहरू सिकेपर
लेकाउनु पर्छ। (चित्र नं. १)

३. विरुवा रोप्दा जमीन देखि १ -

$1\frac{1}{2}$ फिटमाथी रोप्ने, रोपी सरेको
पाछि विरुवाहरूमा पानी हाल्नु
पर्छ। (चित्र नं. २)

४. जरुरी विरुवाहरू रोपी सकेपछि
विरुवाहरूको चरिपारे वनमारा,
परास, च्याउला हरुले राम्ररी छोप्नु
पर्छ। (सल्लुथींग गर्ने) (चित्र नं. ३)

५. रोपेको विरुवा हरुलाई राम्ररी देखि
देई सुकुरी छोरीले राम्ररी बाँच्नु
पर्छ। (चित्र नं. ४)



बागवानी विकास आयोजना
सुन्तला जात फलफूल शाखा
कीर्तिपुर

जुनार उत्पादन

तथा

संरक्षण



- मेरब राज केनी

7. PROGRAMME FOR THE FISCAL YEAR 1987/88.

The following are the target approved by National Planning Commission for this division for 1987/88 (commencing from July 15, 1987 to July 14, 1988).

4 monthly target.

Work	1 st 4 month	2 nd 4 month	3 rd 4 month
1. Training	-	5	5
2. Maintenance of demo.farm. continue		continue	continue
3. Survey of citrus fruits and area in Ramechhap district.	-	1	-
4. Technical support to two districts.	continue	continue	continue
5. Publication of extension and teaching materials.	-	-	2
6. <u>Research & study:</u>			
a. Plant propagation in junar.	continue	continue	continue
b. Study of citrus diseases.	"	"	"
c. Varietal trial on citrus.	"	"	"

8. STAFF:

The following are the staff at centre & sub centre working for this division:

1. Kirtipur centre.

- | | |
|--------------------|-----------------------|
| a. Mr. Y. Tomiyasu | Citrus Expert (Japan) |
| b. Mr. S.K.Verma | " " (Nepal) |
| c. Mr. B.R.Pandey | JTA |

2. Sindhuli sub centre:

- | | |
|--------------------|---|
| a. Mr. B.R.Kaini | Deputy Pomologist.Citrus Expert (Nepal)
Presently in Japan for training. |
| b. Mr. R.L.Sah | Asst.Plant Protection officer. |
| c. Mr. C.B.Tamang | JT |
| d. Mr. R.H.Upadhya | JTA |
| e. Mr. K.R.Gouli | JTA (Demonstration Farm,Ramechhap). |
| f. Mr. K. Khati | JTA (Demonstration farm,Sindhuli). |
| g. Mr. K.K.Gautam | JTA |
| h. Mr. G.P.Singh | JTA |

3. Demonstration Farms: (JT/JTA from ADO Office)

- | | | |
|------------------|-----|--------------------------------|
| a. Mr. G. Misra | JT | (Demonstration farm,Ramechhap) |
| b. Mr. D.B.Thapa | JT | (" " ,Sindhuli) |
| c. Mr. D. Thapa | JTA | (" " , ") |

9. PROBLEMS

This division feels there is not sufficient staff for the smooth running of the division. With very limited staff the division has to carry out the orchard management, nursery management, quality analysis and technical guidance trip to Sindhuli and Ramechhap districts.

Secondly, for the survey programme this division needs more man power but it has to be carried out with limited man power, so maximum village panchayats cannot be covered even planned.

短期專門家報告書

1. 虫害分野短期専門家報告書

農林水産省果樹試験場安芸津支場 芦原 亘

派遣期間：1987年9月21日～11月6日

ネパールのカンキツ栽培上重要な問題となっているグリーンング病の媒介昆虫ミカンキジラミの分布調査を行うとともに、その他のカンキツ害虫とブドウの害虫の発生状況について調査した。

1. ミカンキジラミ

a. 寄生植物

ミカンキジラミはカンキツ類とゲッキツ（現地では kaminin）から採集された。寄生密度はカンキツよりもゲッキツで高かった。

b. 分布

カトマンズ近郊の Panchkhal（標高 700 m）、Kirtipur（1,350 m）、ネパール東部の Sarlahi（150 m）、Sindhuli madi（500 m）、Bijayachhap（1,100 m）、South Dhankuta Bazar の南部（1,100 m）、Dhankuta Hort. Farm Plate（1,350 m）で発生状況を調べたところ、ミカンキジラミは Sarlahi のゲッキツ、Panchkhal、Sindhuli madi のカンキツから採集されたが、標高が 1,000 m を超える Kirtipur、Bijayachhap、Dhankuta では発見できなかった。

c. 個体数変動や発生状況の効率的な調査法を明らかにするために、種々のカラートラップをミカンキジラミの発生地（Sarlahi、Panchkhal）に設置したが、ミカンキジラミはほとんど捕獲されなかった。したがって、少なくとも今回の調査時期においては、カラートラップの個体数調査法としての有効性は低いと考えられる。春期（3～6月）の有効性については再検討の価値がある。

2. その他のカンキツ害虫

聞き取り調査によれば、fruit fly が Bhojpur（Dhankuta の西部）で多発した。カンキツが増産されるようになると、重要な問題になる可能性がある。

3. ブドウの害虫

長期専門家によれば、コガネムシ科の一種がブドウ葉を、アザミウマ科の一種が果実を加害し、大きな被害をこうむった。両種はブドウ以外の植物で発育し、侵入してくるので、防除の徹底が困難な害虫である。前者は若木の発育に大きな影響を与えるので、MEP、DEP、NAC

等で防除する必要がある。

以上の調査結果から、以下の点をネパール当局に強く recommend した。

ミカンキジラミは Bijayachhap、Dhankuta では発見されなかった。したがって現時点では両地域はグリーンング病に汚染される可能性が少なく、カンキツ生産地として適していると思われる。しかし、“発見されなかった”ことは“生息していないこと”あるいは“キジラミが低地から高地へ飛来しグリーンングを伝搬しないこと”を意味していない。したがって、

- 1) キジラミの発生については今後も監視を続けること。
- 2) ミカンキジラミとネパールでも発生の多いミカンハモグリガの増殖時期は似ていると思われるので、ミカンハモグリガの防除を行う場合、キジラミにも効果があると考えられるジメトエート、ミカントップ等を散布する。ただしこれら薬剤のジュナール、スタラ等への生育の影響が明らかでないので薬害試験を行ってから使用すること。
- 3) カンキツ栽培地域でのゲッキツ栽植禁止

fruit fly は防除が極めて困難なので、発生地の果物の移動を禁止するとともに被害果を消却すること。

- 問題点：グリーンング病をネパールから一掃するためには伝染源となる罹病樹を伐採する必要があるが、保証問題などで進捗していない。農薬や散布器具が少なく、病害虫防除が十分なされていない。

Report on Survey of
Psylla Vectors of the Citrus Greening Disease,
Citrus Pests other than Psylla and Grape Pests

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"Greening" is one of the most serious disease of citrus in South Africa and South-east Asia. Two psyllids: Diaphorina citri Kuwayama and Trioza erytreae (Del Guericcio) were known to be vectors of the greening disease. D. citri distributed throughout the South-east Asia and Brazil, and is called the Oriental or Asian citrus psyllid. Its distribution records in the Asia includes India, Pakistan, Bangladesh, Malaya, Java, South China, Moluccas, Formosa and Philippines and South Japan (Ryukyu and Amami Oshima). T. erytreae distributed in Africa and called the African psyllid but was not found from Asia.

Catling (1970) and Knorr and Shah (1971) reported that D. citri occurs in the Pokhara Valley, where severe greening has caused a serious decline of Citrus trees since 1964. In 1986, Messrs. Sakurai (Niigata Horticultural Experiment Station) and Imada (Fruit Tree Research Station) respectively surveyed citrus pest and diseases in Nepal, as a short term experts of the Horticultural Development Project. In the report of the survey, Mr. Sakurai recommended that further investigations about the

distribution, seasonal occurrence and the host range of D. citri were needed. Mr. Imada has reported that the greening occurred in citrus orchard of Pokhara Horticultural Research Station, Sindhuli sub-center and JADP, but not in the farmer's fields of Sindhuli, Ramechhap and Dhankuta.

From these circumstances, it is thought that eradication of the greening disease is the most important for establishing citrus industry in Nepal. For the eradication, it is necessary to investigate the distribution of the source of inoculum, i.e., diseased tree and the psylla vectors.

During my stay in the Kingdom of Nepal, I conducted survey on distribution of the psylla and investigation on monitoring method to estimate population size of the insect.

In this report, the results of survey on citrus pests including other than psylla and grape pests were also described.

CITRUS PSYLLA

Citrus Psylla and its Host Plant

The citrus psylla infesting citrus was D. citri but not T. erytreae was found.

D. citri was collected from Kaminin (Mullaya paniculata) and two varieties of citrus: Kinnow and Junar. The psylla population densities were higher on kaminin than citrus.

Before visiting Nepal, I surveyed D. citri at Okinawa Island from September 2 to 5 in 1987 to make previous observation on the ecology of the citrus psylla. Vigorous populations of the psylla occurred only on kaminin where very young shoot were growing.

These indicate that kaminin is more favorable than citrus as a host plant for the citrus psylla.

Distribution of Citrus Psylla

I have surveyed the citrus psylla in the fields of Panchkhal Hort. Farm (altitude 650m), Kirtipur Hort. Development Center (1,350m), Sarlahi Hort. Farm (150m), Sindhuli Sub-center (Sindhuli madi, 500m), farmers orchards at Bijayachhap (1,100m), South of Dhankuta Bazar (1,000m) and Dhankuta Hort. Farm Plate (1,350m) by direct observation, sweeping and beating against citrus and kaminin foliage.

The psylla was not collected on citrus at Kirtipur, Bijayachhap and Dhankuta, whereas abundant populations observed on citrus at Panchkhal and on kaminin at Sarlahi. A few individuals were collected from citrus at Sindhuli madi.

Monitoring Method

To develop an efficient method for monitoring psylla population density, effectiveness of color traps was tested at the field where the psylla were abundantly found. Non-transparent white and yellow, semi-transparent lemon yellow, yellow orange and orange plates coated with sticky material were hung among clusters of citrus trees and on 1.5m height bars.

The number of psyllids attracted to the plates were, however only few.

The results of the test indicate that color plate method is not effective for monitoring psylla population density during autumn when psylla is not active. The attractiveness of the color plates should be tried again in spring.

Citrus Pests other than the Citrus Psylla

Mr. Sakurai, the short term expert from Japan reported that the Oriental fruit fly was collected at Kirtipur and Sindhuli madi. I have heard that the fly had caused serious damages to citrus fruit at Bhojpur, and I also collected the flies in the citrus field at Kirtipur. When citrus production in Nepal will be increased and established, there is high possibility that the flies spread out widely in Nepal.

I have collected two species of spider mites and Tenuipalpid species that was not described in the report by Mr. Sakurai. The yellow patch on the citrus leaves and rusty color on the fruits might be caused by the Tenuipalpid mite. Those mite may be controlled by acaricides such as kelthane (dicofol), tetradifon, akal (chlorbenzilate).

Grape Pests

I have heard that the young leaves were voraciously fed by a cockchafer beetle and fruit growing was seriously inhibited by a thrips species. Both species are difficult to control by insecticides, because they can immigrate from other plants than grape. The former insect cause serious damages to young grape trees. So, it may be necessary to spray insecticides such as MEP (sumithion), DEP (dipterex) and NAC (carbaryl).

CONCLUDING REMARKS

Citrus Psylla

The citrus psylla was not collected at Bijayachhap and

Dhankuta. For the present, it seems to be adequate that citrus production was recommended in these areas, because there are few chances of transmission of greening disease by the psylla. However, the result that "no psylla was collected" does not mean that "no psylla distributed" or "no psylla may immigrate from lower altitude areas and transmit greening disease to citrus trees planted at higher altitude.

I recommended to continue and conduct following efforts to inhibit transmission of the greening disease to greening-free areas.

- 1) To continue the observation of occurrence of citrus psylla in Bijayachhap, Ramechhap, Dhankutta and other areas where no psylla has been observed.

- 2) It is thought that the citrus psylla population builds up at the same time as the citrus leaf miner which is a major pest of citrus, so the insecticides used to control leaf miner must be effective also to the psylla. Though I have no information about such insecticides, dimethoate and dimethoate-fenvarate mixture may be effective to both insects. Before use these insecticides, it is necessary to check the toxic effects to citrus varieties.

- 3) Not to permit planting kaminin in the area where citrus production are recommended.

Fruit Fly

- 1) To prohibit transporting any fruits produced in the area where fruit flies occurred, to the fruit fly-free areas.

- 2) To destroy fruits infested by the fruit flies.

2. 土壤肥料分野短期専門家報告書

農林水産省果樹試験場 壽松木 章

派遣期間：1987年10月25日～12月24日

1. ネパール国園芸開発プロジェクト計画における土壤肥料短期専門家として1987年10月26日より12月23日までネパール国に派遣された。今回の主な任務はキルティプール園芸試験場の土壤肥料関係実験室の整備と各種分析機器の使用法及び土壤養分分析法をネパール国側カウンターパートに修得させること、また同試験場とネパールガンジー、シンズリ両サブセンター圃場の土壤調査を行い、それらの結果に基づいて、今後の土壤管理、肥培管理の指針を明らかにすることである。2ヶ月間という短期間であり、不十分な点はあったが、一定の成果は得られたので、以下その概要を報告する。

2. 実験室及び付設分析機器類の整備

未使用状態であった土壤肥料実験室 (No 1 Laboratory) を分析業務が遂行できる状態に整備した。室内に付設されている主な分析機器は、PH測定器、電気伝導度測定器、イオン濃度測定器、分光光度計及び窒素分解装置、同蒸留装置であった。また汎用機器として、天秤、恒温器、乾燥器、電気炉、土壤粉碎器、振とう器等であった。これらの機器については使用可能な状態に整備・調整するとともに、その使用法をカウンターパートのMiss マナダールに修得させた。

現有機器で分析可能な土壤養分は、PH、窒素 (全窒素、 $\text{NH}_4\text{-N}$ 、 $\text{NO}_3\text{-N}$)、リン酸、電気伝導度である。その他、主要目的である塩基置換容量、カルシウム、マグネシウム、カリ及び微量元素等については測定機器が未整備のため現状では分析できなかった。

3. 土壤養分分析結果

長期専門家が事前に採取しておいた土壤は約130点であったが、それらを全て分析することは時間的に無理であったので、粉砕調整の終わった約80点の試料を用いて各分析法をカウンターパートに指導した。その結果、指導した分析法についてはほぼ修得できたものと判断した。その他の項目及び土壤物理性の測定等については次の機会にゆずりたい。

今回分析した結果は第1表に示した。

4. 土壤の断面調査

キルティプール、ネパールガンジー及びシンズリの3ヶ所の土壤断面調査を行った。それらの断面写真と調査結果は第1～3図に示したが、その特徴の概略は以下のとおりである。

キルティプール：造成時の土壌の移動で、土層が攪乱されているが、おおよそ 30 cm 程度までが表層土壌を形成している。腐植含量が少なく、強粘質土で礫は少ない。構造は塊状で団粒は未発達である。土壌水分が多く、土壌硬度は山中式硬度計で 15～17 と軟かいが、乾燥すると硬くしめることが予想される。30 cm 以下は土色が黄灰色で、表層よりもさらに粘土含量の多い土壌で、透水性不良である。グライ斑（鉄分が酸素不足のため還元色を示す状態）が多く、明らかに排水不良状態を示している。

ネパールガンジー：土性はキルティプールと同様、強粘質土壌であるが、土壌断面からは排水は比較的良好と思われた。土色は灰黄褐色から褐色で、有機物含量は少ない。調査時は乾季で土壌が乾燥しており、0～30 cm までは土壌硬度が 34 と極めて硬い状態であった。

シンズリ：土性は粘質土壌であるが、砂含量はやや多い。直径 10 cm 程度までの礫を含み、団粒構造も比較的発達して、透水性は良好である。表層の硬度は土壌が乾燥しており、山中式で 24 とやや硬いが 50 cm 以下は適湿状態であり、根の伸長には影響ない。樹（ジュネール）の幹から 1 m 離れた断面で、細～中根が多く観察された。

5. 土壌管理対策

今回の土壌断面調査及び土壌分析結果から摘出された問題点と今後の土壌管理対策は次のように考えられる。

キルティプール：

- ①排水対策：もともと強粘質土壌で透水性が不良なところへ、造成時の機械の踏圧により排水不良が著しい。根域が拡大するにつれてこの影響が大きくなるので、現在のところ排水対策が最重点と考えられる。高畝、明渠による表面停滞水の除去、及び暗渠排水は既に実施されているが、今後もより徹底して行うことが望まれる。
- ②有機物の施用：土壌 PH は 6.5～6.8 と適当であり、酸度矯正は現在のところ必要ないが、土壌の全窒素含量や土色から判断して、有機物、量の少ないせき薄な土壌である。稲わら、刈草等の粗大有機物を根域中心に、有効的、計画的に施用する。その際は施用部分に滞水しないように留意する。
- ③草生管理：現在地表面管理は清耕または雑草草生のようにであるが、有機物の自園内生産、土壌の団粒化促進、透水性改善のためにも牧草による草生管理がより有効と思われる。その場合、樹冠下は清耕にし、刈草を還元する。草種は生草量の多い禾本科のものが適当と思われる。

ネパールガンジー：土性はキルティプールと同様強粘質土であるが、透水性は比較的良好である。土壌 PH が 8.0 と高いこと、高温地帯のため有機物の分解が激しく、土壌有機物含量が極めて少ないことが問題点として挙げられる。今回の調査ではブドウの葉色には要素欠乏等の症状はみられなかったが、今後、葉分析等により注意する必要がある。

シンズリ：土壤の物理的性質は比較的良好なので、有機物等の施用により土壤養分の富化を計画的に実施する。

その他：農家の圃場も数ヶ所で視察する機会があったが、いずれも圃場内にナタネ、トウモロコシ等を幹の近くまで栽培している状態であった。経済的にはやむを得ないものと思われるが、樹の生育は当然遅れるので、少なくとも樹冠内は清耕にし、適切な管理をしていくことが望ましい。

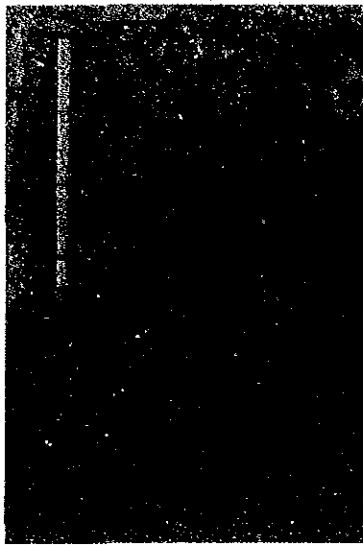
第1表 各圃場の土壤分析結果

場 所 (樹 種)		PH(H ₂ O)	全 窒 素 (%)	有効態りん酸 (mg/100g乾土)
キルティプール (ブドウ)	表層	6.70 (6.82~6.54)	0.16	11.9
	下層	6.80 (7.05~6.27)	0.16	13.3
ネパールガンジー サブセンター (ブドウ)	表層	8.00 (8.80~7.50)	0.05	trace
	下層	7.99 (8.80~7.46)	0.05	trace
ネパールガンジー サブセンター (ブドウ)	表層	7.86	0.06	2.5
	下層	7.91	0.05	2.3
キルティプール (カンキツ)	表層	6.55 (6.73~6.42)	0.17	18.9
	下層	6.70 (6.92~6.47)	0.12	12.7
シンズリ (カンキツ)	表層	6.50 (7.00~5.42)	0.11	9.9
	下層	6.69 (7.27~5.52)	0.10	2.2
ラメチャップ (カンキツ)	表層	6.71 (6.86~6.40)	0.15	2.3
	下層	6.53 (6.84~6.25)	0.09	1.8

(注) 分析値は各場所の平均値で表わした。PHの()は最大値と最小値である。

各場所の土壌断面

1. キルティプール ブドウ園場 No. 6 地点



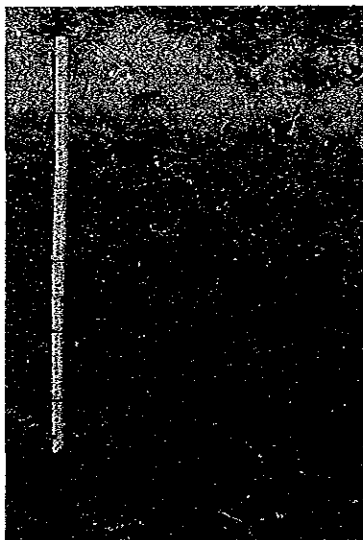
cm	土性	土色	硬度 (山中式硬度計)
0			
	Lic (微粒質)	10YR4/2 (灰黄褐色)	1.5
30	HC (微粒質)	2.5Y4/1 (黄灰色)	1.5
60		ブライ色 7.5Y4/1	

2. ネバルガンジー ブドウ園場



cm	土性	土色	硬度
0			
	CL (細粒質)	10YR4/2 (灰黄褐色)	3.4
30			
	Lic (微粒質)	10YR4/4 (褐色)	2.4 2.1
60			

3. シンズリ



cm	土性	土色	硬度
0			
	SCL (細粒質)	10YR4/2 (灰黄褐色)	2.4
30			
	SCL	10YR3/3 (暗褐色)	2.4
50			
	CL (細粒質)	10YR3/3 (暗褐色)	2.0

JICA