



Appendixes

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

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Appendix A

Questionnaire for study of some factors affecting reduction of mandarin cultivated orchards in Mae Soon sub district

Objective : This questionnaire is used in order to study of the farmer practices for mandarin orchard management in Mae Soon sub district with the aim to clearly identify the factors affecting productivity declination of the mandarin trees. The hypothesis is that the problem in each area will be different according to the differences among the mandarin cultivated areas. Once the real problem is identified the suitable problem solving can be applied. The information obtained from this study will be useful for the farmers who want to cultivate mandarin trees in the new area for planning of cultivation schedule in advance.

The questionnaire consists of 4 parts.

Part 1 General information of the farmer who fill up the questionnaire.

Part 2 General information about the orchard.

Part 3 Orchard management information.

Part 4 Evaluation of the orchard status.

Part 5 The test : How do you manage the soil in the orchard?

Please kindly answer the questionnaire according the real fact. The data obtained will be kept secretly and used for research only. Thank you for your kind cooperation in answering the questions and providing your useful opinion.

Miss Vassana Viroonrat

Mobile phone 084-8049247

1) General information of the farmer

1.1 First name.....Family name.....

1.2 Address.....Moo.....Sub-district.....

1.3 Telephone no.

1.4 Age.....year

1.5 Level of highest education.....Specialized field.....

1.6 Major career Mandarin orchard

Others.....

2) Information about mandarin orchard

2.1 Location of the orchard

Mu.....Mae Soon sub district

Mu.....Sub-district.....District.....

2.2 Age of mandarin trees.....year.

2.3 Orchard history

Used to be litchi orchard New area Paddy field

Other crops specified.....

2.4 Total area.....rais Total no. of mandarin trees.....trees

If you have more than orchard please provide the details for the other orchards

Second orchard area.....rais, Total no. of tree.....trees

Third orchard area.....rais, Total no. of tree..... trees

2.5 Location of the orchard

Unwounded by mandarin orchards

The orchard nearby is still productive

Abandon orchard

The orchard is far away from the major mandarin cultivated area and it is close to the forest or the area cultivated with the other crops

2.6 Topographic condition of the orchard

Highland Foothill

Paddy field

2.7 Land preparation of the orchard Bedding No bedding

2.8 mostly used planting material

Grafting

cv. troyer cv. cleopata

Air layering

Other.....

2.9 Availability of water used in the orchard

Sufficient all year second

Insufficient solving problem by.....

2.10 Normal irrigation schedule

Once a day for a period of.....hr.

Twice a week each for.....hr.

Once a week for a period of.....hr.

..... a week each for.....hr.

2.11 Source of irrigated water for the orchard

Huoy Nam Uoon

Huoy Nam Dung

Mae Soon river

Others.....

2.12 Methods of irrigation in the orchard

High pressure sprinkle pressurelb/in

Mini sprinkle pressure lb/in

Rain fed

Sun face irrigation

Others.....

2.13 Type of soil in the orchard

- Clayey
 Loam
 Sandy
 Other

3) *Soil management in the orchard.*

3.1 Have you ever check soil quality of your orchard?

- Yes
 No

3.2 Fertilizer usage in your orchard

- Only chemical fertilizers
 Only organic fertilizers
 Both element and organic fertilizers

3.3 Application of manure or compost in the orchard

- No application because.....
 Application at approximatelykg/tree
 Seldom
 Every other year
 Every year.....times/year

3.4 Do you use mulching under the tree canopy?

- Yes because.....
 No because.....

3.5 Criteria use for fertilizer application in your orchard

- Experience
 Recommendation by dealer of fertilizer distributes
 Text book, Agricultural Journal
 Information from the experienced farmers or adjacent orchard
 The result of soil testing
 Others

3.6 Fertilizer grade which you used regularly can be answers more than 1 item

- 46-0-0
 15-15-15
 13-13-21
 0-46-0
 0-0-60
 15-0-0
 0-52-34
 Other grades.....

3.7 Rate of chemical fertilizer application for mandarin trees

- 1 kg/tree/M 0.2 kg/tree/M
 0.5 kg/tree/M kg/tree/M

3.8 Have you ever adjusted your soil pH?

- Yes liming material used is
 Quick lime marl dolomite others.....
 No

3.9 Are there any mandarin trees in your orchard showed plant nutrient deficiency symptom?

- Yes No

Occurred symptom

- The older leaves have yellow color towards the apex with a inverted V shaped area remaining green at the base
 The leaves are small, having yellow mottle with green veinal area
 Splitting fruit
 Other symptoms.....
 None

3.10 When do you apply foliar spraying ?

- When the trees show nutrient deficiency symptom
 Spraying to prevent nutrient deficiencies

4) *Evaluation of the status of mandarin orchard*

4.1 Present status of the orchard

- Not productive, the orchard has be collapsed
 Still productive for at least 2-3 more years
 Productive and provide good fruit production continuously

4.2 Cause of orchard failure (can answer more than one item)

- No skill to produce mandarin Insufficient of water
 Root rot Greening disease
 Limit of fertilizer application Other.....

4.3 approximate fruit yield

Yield (period)	No : of basket (3kg/basket)		
	2010	2009	2008
In season fruit yield (Dec-Jan)			
1 st off season fruit yield (Feb)			
2 nd off season fruit yield (Mar)			
3 rd off season fruit yield (July-Aug)			

4.4 In 2010 was there any problem on immature fruit with the red point symptom?

- Yes approximately.....% of the total yield
 No

4.5 Do you have the unhealthy mandarin trees in your orchard?

- Yes distribution pattern of unhealthy trees in the orchard
 - Border (adjacent to deteriorating orchard)
 - Spreading from the central area of the orchard
 - Patchy distribution throughout the whole area
 - Other pattern No

4.6 If your orchard is collapsed what is your plan for the next career?

- Mandarin cultivation
- Agriculture but changing the crop by expecting to grow.....
- Change the career to.....
- Do not know what to do

4.7 previous situation of your mandarin production

- Gained profit in the year
- Lost profit in the year.....
- Zero gain
- No information

5) ***The test “How do you manage the soil in your orchard ?”***

Concept : check only one correct answer

5.1 Concept for fertilizer application to mandarin trees

- Based on available input cost
- Use high dose in order to get more fruit yield
- Based on the requirement of the trees
- Follow the information labeled on fertilizer bag

5.2 How is your ideal soil for mandarin cultivation?

- Sandy soil with very good drainage
- Clayey soil with very good water holding capacity
- Loamy soil with good drainage
- Lateritic gravel soil with rapid water percolation

5.3 Which item is not the usefulness of manure/compost?

- Soil aggregate formation resulting in better soil structure
- Soil microbial food
- Improving the growth of root system resulting in healthy root
- Increasing of plant nutrients and can be used as the alternative source of chemical fertilizer

5.4 If your soil is strong acidic how do you apply lime to get the highest effectiveness?

- Mixing lime with chemical fertilizer and then immediately broadcast into the soil
- Mixing lime with compost or manure, then thoroughly mix into the soil following with irrigation
- Patchy application of lime on the soil surface
- Apply urea fertilizer and then broadcast lime on top – urea fertilizer

5.5 What is the suitable pH of water used for mixing with insecticides or foliar fertilizer?

- Do not know this information before
- I know the suitable pH but cannot know how to the problem
- I know and I will use commercial acetic acid to acidity water high pH
- I know if the water is acidic the pH should be adjusted to neutral

5.6 Criteria that you use insecticide spraying

- Spraying according to spraying schedule (every 3 days/every 7 days/every 10 days)
- Randomly check the number of insect pest. Use insecticide spraying if 1-3 insect pests were found.
- Spraying when insect damage was found
- Consider climatic condition and environment before spraying and use insecticide spraying when 1-5 insect pests were found

5.7 The most dangerous disease in your orchard

- Canker
- Root rot
- Fungal disease at the point of the fruits
- Greening disease

Please draw roughly the map of your orchard



Appendix B

Table Appendix 1 Soil properties of soil series

soil series	name series	soil group	soil texture	level soil	Horizon A			drainage	runoff	permeability	soil depth (cm)
					%sand	%silt	%clay				
Mt-slB	Mae Taeng	29B	sl	Ap(A)-Bt	59.3	25.1	15.6	well	moderate to rapid	moderate	75-100
Mt-slC	Mae Taeng	29C	sl	Ap(A)-Bt	59.3	25.1	15.6	well	moderate to rapid	moderate	75-100
Mt-clD	Mae Taeng	29D	sl	Ap(A)-Bt	59.3	25.1	15.6	well	moderate	moderate	75-100
Bg-clD	Ban Chong	19	cl	Ap(A)-Bt	40.1	25.1	34.8	moderate	moderate to rapid	moderate	75-100
Kp-silA	Kamphaeng Phet	33	l	Ap(A)-Bt	51.8	38.5	9.7	moderate well	moderate to rapid	moderate	>100
Don-silA	Dong Yang En	33	sil	Ap(A)-Bt	15.5	70	14.5	poorly	rapid	slow	>100
Don-silB	Dong Yang En	33B	sil	Ap(A)-Bt	15.5	70	14.5	poorly	rapid	slow	>100
Pe-slC/d5	Phetchabun	36C	sl	Ap(A)-Bt-Btc-(Cr)	63.2	22.9	13.9	well	slow	rapid	50-75
Sg-silA	Sai Ngam	38	sl	Ap(A)-Bt	60.3	29.2	10.5	well	slow	rapid	>100
Li-gclD	Li	47D	sic	Ap(A)-Bt-Cr	9.2	50	40.8	poorly	rapid	slow	25-50
Ph-sic1A	Phan	5	sic1	Apg-Btg-Btgv	21	48.5	30.5	poorly	rapid	slow	>100
Hd-str-sic1A	Hang Dong	5	sic	Apg-Btg	2.3	43.7	54	poorly	rapid	slow	>100
Wch-sic1A	Wang Chomphu	5	l	Ap(A)-Bss-Ck	33.9	38.5	27.6	moderate	moderate to rapid	moderate	75-100
Pe-slB	Phetchabun	36B	sl	Ap(A)-Bt-Btc-(Cr)	63.2	22.9	13.9	well	slow	rapid	50-75
SC	Slope Complex	62						rapid	rapid	slow	25-50

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Table Appendix 2 Risky classification of factors contributing to root rots each orchard

No.	owner	slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	total porosity (% by volume)	pH	organic matter (%)	total score	risky level
1	Mrs.Jansom YaJai	0-5	Pe-slC/d5	well	<590	1.29	51.59	5.95	2.59	0.50	3
2	Mr.Charoen Tanomsin	0-5	SC	well	590-740	1.12	57.21	6.57	4.17	0.43	2
2	Mr.Charoen Tanomsin	12-20	SC	well	590-740	1.12	57.21	6.57	4.17	0.22	1
2	Mr.Charoen Tanomsin	5-12	SC	well	590-740	1.12	57.21	6.57	4.17	0.27	1
3	Mr.Chamnong Tummakunkaew	0-5	Pe-slC/d5	well	<590	1.37	46.34	5.64	2.45	0.60	3
4	Mr.Saokaew Jitrawong	0-5	Pe-slC/d5	well	<590	1.32	49.09	6.18	3.17	0.48	2
5	Mr.Jai Aetama	0-5	Pe-slC/d5	well	<590	1.26	52.31	6.04	3.07	0.46	2
5	Mr.Jai Aetama	0-5	Don-silB	poorly	<590	1.26	52.31	6.04	3.07	0.62	4
6	Mr.Ming Lungkana	0-5	SC	well	590-740	1.22	52.52	5.71	3.00	0.48	2
6	Mr.Ming Lungkana	12-20	SC	well	590-740	1.22	52.52	5.71	3.00	0.28	1
6	Mr.Ming Lungkana	5-12	SC	well	590-740	1.22	52.52	5.71	3.00	0.33	1
7	Mr.Krisorn Tontang	0-5	Don-silB	poorly	<590	1.32	49.38	5.77	2.34	0.70	4
8	Mr.Jomreang Kumpat	0-5	Don-silB	poorly	<590	1.34	47.41	5.01	2.65	0.77	5
9	Mr.Intorn Keawsuriya	0-5	Don-silB	poorly	<590	1.49	40.05	5.82	1.38	0.80	5
10	Mr.Winit Saisahingarn	0-5	Don-silB	poorly	<590	1.41	46.40	5.40	1.79	0.87	5
11	Mr.Wai Bungkommate	0-5	Don-silB	poorly	<590	1.32	49.00	5.73	2.37	0.70	4
12	Mr.Tae wongsai	0-5	Don-silB	poorly	<590	1.28	49.47	5.50	2.65	0.66	4
13	Mr.Kom Srila	0-5	Pe-slC/d5	well	<590	1.16	54.64	5.96	2.48	0.51	3
13	Mr.Kom Srila	0-5	Don-silB	poorly	<590	1.16	54.64	5.96	2.48	0.68	4
14	Mrs.Yupin Intatar	0-5	Don-silB	poorly	<590	1.31	48.97	6.13	2.92	0.64	4
15	Mr.Sawang Wongkat	0-5	Don-silB	poorly	<590	1.20	53.60	6.05	2.74	0.62	4

No.	owner	slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	total porosity (% by volume)	pH	organic matter (%)	total score	risky level
16	Mr.Sawang Wongkat	0-5	Don-silB	poorly	<590	1.30	52.07	6.75	2.17	0.66	4
17	Mrs.Ratana Intatar	0-5	Don-silB	poorly	<590	1.25	51.61	6.28	2.90	0.62	4
18	Mr.Yanyong Chaiwut	0-5	Don-silB	poorly	590-740	1.29	46.98	5.33	2.17	0.81	5
19	Mr.Kumpun Yana	0-5	Don-silB	poorly	<590	1.26	51.16	5.00	2.27	0.76	5
20	Mr.Jitti Pipatpittayasakul	12-20	Li-gclD	poorly	590-740	1.27	49.35	5.12	3.54	0.51	3
20	Mr.Jitti Pipatpittayasakul	5-12	Li-gclD	poorly	590-740	1.27	49.35	5.12	3.54	0.56	3
21	Mr.Tae wongsai	12-20	Li-gclD	poorly	590-740	1.32	49.98	4.80	3.14	0.59	3
21	Mr.Tae wongsai	5-12	Li-gclD	poorly	590-740	1.32	49.98	4.80	3.14	0.64	4
22	Mr.Kumpun Yana	12-20	Li-gclD	poorly	590-740	1.31	50.04	5.76	3.03	0.46	2
22	Mr.Kumpun Yana	5-12	Li-gclD	poorly	590-740	1.31	50.04	5.76	3.03	0.51	3
23	Mr.Boonmee Kaewsingkum	0-5	Don-silB	poorly	590-740	1.29	49.14	5.48	3.34	0.73	4
23	Mr.Boonmee Kaewsingkum	0-5	Don-silB	poorly	<590	1.29	49.14	5.48	3.34	0.75	5
23	Mr.Boonmee Kaewsingkum	5-12	Don-silB	poorly	590-740	1.29	49.14	5.48	3.34	0.57	3
23	Mr.Boonmee Kaewsingkum	5-12	Don-silB	poorly	<590	1.29	49.14	5.48	3.34	0.59	3
24	Mr.Thanom siti	0-5	Don-silB	poorly	590-740	1.29	48.39	3.98	3.27	0.77	5
24	Mr.Thanom siti	0-5	Li-gclD	poorly	590-740	1.29	48.39	3.98	3.27	0.77	5
25	Mr.Artit Sujai	0-5	Mt-slC	well	590-740	1.41	46.11	6.08	2.59	0.55	3
25	Mr.Artit Sujai	0-5	Don-silB	poorly	590-740	1.41	46.11	6.08	2.59	0.71	4
26	Mr.Luan Yavilart	0-5	SC	well	590-740	1.29	50.91	5.36	2.16	0.58	3
26	Mr.Luan Yavilart	0-5	Li-gclD	poorly	590-740	1.29	50.91	5.36	2.16	0.74	5
26	Mr.Luan Yavilart	5-12	SC	well	590-740	1.29	50.91	5.36	2.16	0.42	2
26	Mr.Luan Yavilart	5-12	Li-gclD	poorly	590-740	1.29	50.91	5.36	2.16	0.59	3
27	Mr. Son Charoenchep	0-5	Mt-slC	well	590-740	1.29	48.09	5.34	2.25	0.58	3

No.	owner	slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	total porosity (% by volume)	pH	organic matter (%)	total score	risky level
27	Mr. Son Charoenchep	0-5	SC	well	590-740	1.29	48.09	5.34	2.25	0.58	3
27	Mr. Son Charoenchep	0-5	Li-gclD	poorly	590-740	1.29	48.09	5.34	2.25	0.74	5
27	Mr. Son Charoenchep	5-12	Li-gclD	poorly	590-740	1.29	48.09	5.34	2.25	0.59	3
28	Mr.Somkiat Wongta	0-5	Mt-slC	well	590-740	1.33	50.68	5.66	1.72	0.52	3
29	Mr.Boonmee Wongchai	5-12	Mt-slC	well	590-740	1.29	50.72	5.31	2.48	0.42	2
30	Mr.Choochert Chaisu	0-5	Mt-slC	well	590-740	1.19	53.63	5.26	3.75	0.55	3
30	Mr.Choochert Chaisu	0-5	Bg-clD	moderate	590-740	1.19	53.63	5.26	3.75	0.63	4
30	Mr.Choochert Chaisu	5-12	Mt-slC	well	590-740	1.19	53.63	5.26	3.75	0.40	2
31	Mr. Bunpot Doawee	0-5	Bg-clD	moderate	590-740	1.19	55.67	4.44	3.87	0.67	4
31	Mr. Bunpot Doawee	5-12	Bg-clD	moderate	590-740	1.19	55.67	4.44	3.87	0.52	3
32	Ms. Renu Paodoapan	0-5	Li-gclD	poorly	590-740	1.25	50.01	6.24	4.60	0.58	3
33	Mr.Montree Wongroy	0-5	Don-silB	poorly	<590	1.27	49.61	5.49	2.78	0.75	5
33	Mr.Montree Wongroy	5-12	Don-silB	poorly	<590	1.27	49.61	5.49	2.78	0.59	3
34	Mr.Srima Jitrawong	12-20	SC	well	590-740	1.02	59.14	4.55	3.34	0.40	2
34	Mr.Srima Jitrawong	5-12	SC	well	590-740	1.02	59.14	4.55	3.34	0.45	2
35	Mr.Aumnui WongJun	12-20	Li-gclD	poorly	590-740	1.21	52.76	4.18	3.48	0.56	3
35	Mr.Aumnui WongJun	5-12	Li-gclD	poorly	590-740	1.21	52.76	4.18	3.48	0.62	4
36	Mr.Chamrat Tejakeaw	0-5	Bg-clD	moderate	590-740	1.24	53.43	5.02	3.42	0.64	4
37	Mr.Sunit Sang Ai (#1)	0-5	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.66	4
37	Mr.Sunit Sang Ai (#1)	12-20	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.46	2
37	Mr.Sunit Sang Ai (#1)	20-35	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.46	2
37	Mr.Sunit Sang Ai (#1)	5-12	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.51	3
38	Mr.Sukit Sang Ai	0-5	Bg-clD	moderate	590-740	1.14	54.72	3.86	3.54	0.67	4

No.	owner	slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	total porosity (% by volume)	pH	organic matter (%)	total score	risky level
38	Mr.Sukit Sang Ai	12-20	Bg-clD	moderate	590-740	1.14	54.72	3.86	3.54	0.47	2
38	Mr.Sukit Sang Ai	5-12	Bg-clD	moderate	590-740	1.14	54.72	3.86	3.54	0.52	3
39	Mrs.Ratana Potijan	0-5	Bg-clD	moderate	590-740	1.14	54.43	5.52	3.65	0.55	3
39	Mrs.Ratana Potijan	5-12	Bg-clD	moderate	590-740	1.14	54.43	5.52	3.65	0.40	2
40	Mrs.Wassana Sittima	5-12	Bg-clD	moderate	590-740	1.08	58.71	5.34	3.50	0.49	3
41	Mr.Sunit Sang Ai (#2)	12-20	Bg-clD	moderate	590-740	1.02	61.44	4.48	4.31	0.47	2
41	Mr.Sunit Sang Ai (#2)	20-35	Bg-clD	moderate	590-740	1.02	61.44	4.48	4.31	0.47	2
41	Mr.Sunit Sang Ai (#2)	5-12	Bg-clD	moderate	590-740	1.02	61.44	4.48	4.31	0.52	3
42	Mr. Ruruong Doawee	0-5	Mt-slC	well	590-740	1.36	47.78	4.49	1.45	0.65	4
42	Mr. Natee Intawong	0-5	SC	well	590-740	1.36	47.78	4.49	1.45	0.65	4
43	Mr. Natee Intawong	0-5	SC	well	590-740	1.06	67.56	4.30	4.59	0.58	3
43	Mr. Natee Intawong	12-20	SC	well	590-740	1.06	67.56	4.30	4.59	0.37	2
43	Mr. Natee Intawong	12-20	Bg-clD	moderate	590-740	1.06	67.56	4.30	4.59	0.46	2
43	Mr. Natee Intawong	20-35	SC	well	590-740	1.06	67.56	4.30	4.59	0.37	2
43	Mr. Natee Intawong	20-35	Bg-clD	moderate	590-740	1.06	67.56	4.30	4.59	0.46	2
43	Mr. Natee Intawong	5-12	SC	well	590-740	1.06	67.56	4.30	4.59	0.42	2
43	Mr. Natee Intawong	5-12	Bg-clD	moderate	590-740	1.06	67.56	4.30	4.59	0.51	3
44	Mr. Taworn Mungjai	0-5	Li-gclD	poorly	590-740	1.38	43.80	5.13	2.71	0.81	5
44	Mr. Taworn Mungjai	12-20	Li-gclD	poorly	590-740	1.38	43.80	5.13	2.71	0.61	4
44	Mr. Taworn Mungjai	5-12	Li-gclD	poorly	590-740	1.38	43.80	5.13	2.71	0.66	4
45	Mr. Uoonruoan Punya (#1)	12-20	Li-gclD	poorly	590-740	1.33	47.93	6.39	4.82	0.40	2
46	Mr. Uoonruoan Punya (#2)	0-5	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.61	4
46	Mr.Uoonruoan Punya (#2)	12-20	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.41	2

No.	owner	slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	total porosity (% by volume)	pH	organic matter (%)	total score	risky level
46	Mr.Uoonruoan Punya (#2)	20-35	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.41	2
46	Mr.Uoonruoan Punya (#2)	5-12	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.46	2
47	Mr. Boontum Punsurin	12-20	Li-gclD	poorly	590-740	1.21	50.15	4.92	3.06	0.56	3
47	Mr. Boontum Punsurin	20-35	Li-gclD	poorly	590-740	1.21	50.15	4.92	3.06	0.56	3
47	Mr. Boontum Punsurin	5-12	Li-gclD	poorly	590-740	1.21	50.15	4.92	3.06	0.62	4
48	Mr. Kummoon Taladkeaw (lowland)	0-5	Don-silB	poorly	<590	1.28	49.17	4.20	2.47	0.80	5
49	Mr.Tawechai Kotrakul	0-5	Pe-slC/d5	well	<590	1.29	49.68	5.47	2.14	0.60	3
50	Mr. Kummoon Taladkeaw (sloping land)	12-20	Li-gclD	poorly	590-740	1.19	55.27	6.60	3.42	0.40	2
50	Mr. Kummoon Taladkeaw (sloping land)	5-12	Li-gclD	poorly	590-740	1.19	55.27	6.60	3.42	0.45	2

Appendix 3 Risky classification of factors contributing to nutrient lost though leaching and runoff each orchard

No.	Owner	Slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	porosity (% by volume)	pH	organic matter (%)	total score	risky level
1	Mrs.Jansom YaJai	0-5	Pe-sIC/d5	well	<590	1.29	51.59	5.95	2.59	0.50	3
2	Mr.Charoen Tanomsin	0-5	SC	well	590-740	1.12	57.21	6.57	4.17	0.43	2
2	Mr.Charoen Tanomsin	12-20	SC	well	590-740	1.12	57.21	6.57	4.17	0.22	1
2	Mr.Charoen Tanomsin	5-12	SC	well	590-740	1.12	57.21	6.57	4.17	0.27	1
3	Mr.Chamnong Tummakunkaew	0-5	Pe-sIC/d5	well	<590	1.37	46.34	5.64	2.45	0.60	3
4	Mr.Saokaew Jitrawong	0-5	Pe-sIC/d5	well	<590	1.32	49.09	6.18	3.17	0.48	2
5	Mr.Jai Aetama	0-5	Pe-sIC/d5	well	<590	1.26	52.31	6.04	3.07	0.46	2
5	Mr.Jai Aetama	0-5	Don-silB	poorly	<590	1.26	52.31	6.04	3.07	0.62	4
6	Mr.Ming Lungkana	0-5	SC	well	590-740	1.22	52.52	5.71	3.00	0.48	2
6	Mr.Ming Lungkana	12-20	SC	well	590-740	1.22	52.52	5.71	3.00	0.28	1
6	Mr.Ming Lungkana	5-12	SC	well	590-740	1.22	52.52	5.71	3.00	0.33	1
7	Mr.Krisorn Tontang	0-5	Don-silB	poorly	<590	1.32	49.38	5.77	2.34	0.70	4
8	Mr.Jomreang Kumpat	0-5	Don-silB	poorly	<590	1.34	47.41	5.01	2.65	0.77	5
9	Mr.Intorn Keawsuriya	0-5	Don-silB	poorly	<590	1.49	40.05	5.82	1.38	0.80	5
10	Mr.Winit Saisahingarn	0-5	Don-silB	poorly	<590	1.41	46.40	5.40	1.79	0.87	5
11	Mr.Wai Bungkomnate	0-5	Don-silB	poorly	<590	1.32	49.00	5.73	2.37	0.70	4
12	Mr.Tae wongsai	0-5	Don-silB	poorly	<590	1.28	49.47	5.50	2.65	0.66	4
13	Mr.Kom Srila	0-5	Pe-sIC/d5	well	<590	1.16	54.64	5.96	2.48	0.51	3
13	Mr.Kom Srila	0-5	Don-silB	poorly	<590	1.16	54.64	5.96	2.48	0.68	4
14	Mrs.Yupin Intatar	0-5	Don-silB	poorly	<590	1.31	48.97	6.13	2.92	0.64	4
15	Mr.Sawang Wongkat	0-5	Don-silB	poorly	<590	1.20	53.60	6.05	2.74	0.62	4

No.	Owner	Slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	porosity (% by volume)	pH	organic matter (%)	total score	risky level
16	Mr.Sawang Wongkat (#2)	0-5	Don-silB	poorly	<590	1.30	52.07	6.75	2.17	0.66	4
17	Mrs.Ratana Intatar	0-5	Don-silB	poorly	<590	1.25	51.61	6.28	2.90	0.62	4
18	Mr.Yanyong Chaiwut	0-5	Don-silB	poorly	590-740	1.29	46.98	5.33	2.17	0.81	5
19	Mr.Kumpun Yana (lowland)	0-5	Don-silB	poorly	<590	1.26	51.16	5.00	2.27	0.76	5
20	Mr.Jitti Pipatpittayasakul	12-20	Li-gclD	poorly	590-740	1.27	49.35	5.12	3.54	0.51	3
20	Mr.Jitti Pipatpittayasakul	5-12	Li-gclD	poorly	590-740	1.27	49.35	5.12	3.54	0.56	3
21	Mr.Tae wongsai	12-20	Li-gclD	poorly	590-740	1.32	49.98	4.80	3.14	0.59	3
21	Mr.Tae wongsai	5-12	Li-gclD	poorly	590-740	1.32	49.98	4.80	3.14	0.64	4
22	Mr.Kumpun Yana (sloping land)	12-20	Li-gclD	poorly	590-740	1.31	50.04	5.76	3.03	0.46	2
22	Mr.Kumpun Yana (sloping land)	5-12	Li-gclD	poorly	590-740	1.31	50.04	5.76	3.03	0.51	3
23	Mr.Boonmee Kaewsingcum	0-5	Don-silB	poorly	590-740	1.29	49.14	5.48	3.34	0.73	4
23	Mr.Boonmee Kaewsingcum	0-5	Don-silB	poorly	<590	1.29	49.14	5.48	3.34	0.75	5
23	Mr.Boonmee Kaewsingcum	5-12	Don-silB	poorly	590-740	1.29	49.14	5.48	3.34	0.57	3
23	Mr.Boonmee Kaewsingcum	5-12	Don-silB	poorly	<590	1.29	49.14	5.48	3.34	0.59	3
24	Mr.Thanom siti	0-5	Don-silB	poorly	590-740	1.29	48.39	3.98	3.27	0.77	5
24	Mr.Thanom siti	0-5	Li-gclD	poorly	590-740	1.29	48.39	3.98	3.27	0.77	5
25	Mr.Artit Sujai	0-5	Mt-sIC	well	590-740	1.41	46.11	6.08	2.59	0.55	3
25	Mr.Artit Sujai	0-5	Don-silB	poorly	590-740	1.41	46.11	6.08	2.59	0.71	4
26	Mr.Luan Yawilart	0-5	SC	well	590-740	1.29	50.91	5.36	2.16	0.58	3
26	Mr.Luan Yawilart	0-5	Li-gclD	poorly	590-740	1.29	50.91	5.36	2.16	0.74	5
26	Mr.Luan Yawilart	5-12	SC	well	590-740	1.29	50.91	5.36	2.16	0.42	2
26	Mr.Luan Yawilart	5-12	Li-gclD	poorly	590-740	1.29	50.91	5.36	2.16	0.59	3
27	Mr. Son Charoenchep	0-5	Mt-sIC	well	590-740	1.29	48.09	5.34	2.25	0.58	3

No.	Owner	Slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	porosity (% by volume)	pH	organic matter (%)	total score	risky level
27	Mr. Son Charoenchep	0-5	SC	well	590-740	1.29	48.09	5.34	2.25	0.58	3
27	Mr. Son Charoenchep	0-5	Li-gclD	poorly	590-740	1.29	48.09	5.34	2.25	0.74	5
27	Mr. Son Charoenchep	5-12	Li-gclD	poorly	590-740	1.29	48.09	5.34	2.25	0.59	3
28	Mr.Somkiat Wongta	0-5	Mt-sIC	well	590-740	1.33	50.68	5.66	1.72	0.52	3
29	Mr.Boonmee Wongchai	5-12	Mt-sIC	well	590-740	1.29	50.72	5.31	2.48	0.42	2
30	Mr.Choochert Chaisu	0-5	Mt-sIC	well	590-740	1.19	53.63	5.26	3.75	0.55	3
30	Mr.Choochert Chaisu	0-5	Bg-clD	moderate	590-740	1.19	53.63	5.26	3.75	0.63	4
30	Mr.Choochert Chaisu	5-12	Mt-sIC	well	590-740	1.19	53.63	5.26	3.75	0.40	2
31	Mr. Bunpot Doawee	0-5	Bg-clD	moderate	590-740	1.19	55.67	4.44	3.87	0.67	4
31	Mr. Bunpot Doawee	5-12	Bg-clD	moderate	590-740	1.19	55.67	4.44	3.87	0.52	3
32	Ms. Renu Paodoapan	0-5	Li-gclD	poorly	590-740	1.25	50.01	6.24	4.60	0.58	3
33	Mr.Montree Wongroy	0-5	Don-silB	poorly	<590	1.27	49.61	5.49	2.78	0.75	5
33	Mr.Montree Wongroy	5-12	Don-silB	poorly	<590	1.27	49.61	5.49	2.78	0.59	3
34	Mr.Srima Jitrawong	12-20	SC	well	590-740	1.02	59.14	4.55	3.34	0.40	2
34	Mr.Srima Jitrawong	5-12	SC	well	590-740	1.02	59.14	4.55	3.34	0.45	2
35	Mr.Aumnui WongJun	12-20	Li-gclD	poorly	590-740	1.21	52.76	4.18	3.48	0.56	3
35	Mr.Aumnui WongJun	5-12	Li-gclD	poorly	590-740	1.21	52.76	4.18	3.48	0.62	4
36	Mr.Chamrat Tejakeaw	0-5	Bg-clD	moderate	590-740	1.24	53.43	5.02	3.42	0.64	4
37	Mr.Sunit Sang Ai (#1)	0-5	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.66	4
37	Mr.Sunit Sang Ai (#1)	12-20	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.46	2
37	Mr.Sunit Sang Ai (#1)	20-35	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.46	2
37	Mr.Sunit Sang Ai (#1)	5-12	Bg-clD	moderate	590-740	0.90	66.84	4.26	4.94	0.51	3
38	Mr.Sukit Sang Ai	0-5	Bg-clD	moderate	590-740	1.14	54.72	3.86	3.54	0.67	4

No.	Owner	Slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	porosity (% by volume)	pH	organic matter (%)	total score	risky level
38	Mr.Sukit Sang Ai	12-20	Bg-clD	moderate	590-740	1.14	54.72	3.86	3.54	0.47	2
38	Mr.Sukit Sang Ai	5-12	Bg-clD	moderate	590-740	1.14	54.72	3.86	3.54	0.52	3
39	Mrs.Ratana Potijan	0-5	Bg-clD	moderate	590-740	1.14	54.43	5.52	3.65	0.55	3
39	Mrs.Ratana Potijan	5-12	Bg-clD	moderate	590-740	1.14	54.43	5.52	3.65	0.40	2
40	Mrs.Wassana Sittima	5-12	Bg-clD	moderate	590-740	1.08	58.71	5.34	3.50	0.49	3
41	Mr.Sunit Sang Ai (#2)	12-20	Bg-clD	moderate	590-740	1.02	61.44	4.48	4.31	0.47	2
41	Mr.Sunit Sang Ai (#2)	20-35	Bg-clD	moderate	590-740	1.02	61.44	4.48	4.31	0.47	2
41	Mr.Sunit Sang Ai (#2)	5-12	Bg-clD	moderate	590-740	1.02	61.44	4.48	4.31	0.52	3
42	Mr. Ruruong Doawee	0-5	Mt-sIC	well	590-740	1.36	47.78	4.49	1.45	0.65	4
42	Mr. Natee Intawong	0-5	SC	well	590-740	1.36	47.78	4.49	1.45	0.65	4
43	Mr. Natee Intawong	0-5	SC	well	590-740	1.06	67.56	4.30	4.59	0.58	3
43	Mr. Natee Intawong	12-20	SC	well	590-740	1.06	67.56	4.30	4.59	0.37	2
43	Mr. Natee Intawong	12-20	Bg-clD	moderate	590-740	1.06	67.56	4.30	4.59	0.46	2
43	Mr. Natee Intawong	20-35	SC	well	590-740	1.06	67.56	4.30	4.59	0.37	2
43	Mr. Natee Intawong	20-35	Bg-clD	moderate	590-740	1.06	67.56	4.30	4.59	0.46	2
43	Mr. Natee Intawong	5-12	SC	well	590-740	1.06	67.56	4.30	4.59	0.42	2
43	Mr. Natee Intawong	5-12	Bg-clD	moderate	590-740	1.06	67.56	4.30	4.59	0.51	3
44	Mr. Taworn Mungjai	0-5	Li-gclD	poorly	590-740	1.38	43.80	5.13	2.71	0.81	5
44	Mr. Taworn Mungjai	12-20	Li-gclD	poorly	590-740	1.38	43.80	5.13	2.71	0.61	4
44	Mr. Taworn Mungjai	5-12	Li-gclD	poorly	590-740	1.38	43.80	5.13	2.71	0.66	4
45	Mr. Uoonruoan Punya (#1)	12-20	Li-gclD	poorly	590-740	1.33	47.93	6.39	4.82	0.40	2
46	Mr. Uoonruoan Punya (#2)	0-5	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.61	4
46	Mr.Uoonruoan Punya (#2)	12-20	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.41	2

No.	Owner	Slope (%)	soil series	drainage	elevation (m)	bulk density (g/cm ³)	porosity (% by volume)	pH	organic matter (%)	total score	risky level
46	Mr.Uoonruoan Punya (#2)	20-35	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.41	2
46	Mr.Uoonruoan Punya (#2)	5-12	Li-gclD	poorly	590-740	1.31	47.23	6.57	3.73	0.46	2
47	Mr. Boontum Punsurin	12-20	Li-gclD	poorly	590-740	1.21	50.15	4.92	3.06	0.56	3
47	Mr. Boontum Punsurin	20-35	Li-gclD	poorly	590-740	1.21	50.15	4.92	3.06	0.56	3
47	Mr. Boontum Punsurin	5-12	Li-gclD	poorly	590-740	1.21	50.15	4.92	3.06	0.62	4
48	Mr. Kummoon Taladkeaw (lowland)	0-5	Don-silB	poorly	<590	1.28	49.17	4.20	2.47	0.80	5
49	Mr.Tawechai Kotrakul	0-5	Pe-sIC/d5	well	<590	1.29	49.68	5.47	2.14	0.60	3
50	Mr. Kummoon Taladkeaw (sloping land)	12-20	Li-gclD	poorly	590-740	1.19	55.27	6.60	3.42	0.40	2
50	Mr. Kummoon Taladkeaw (sloping land)	5-12	Li-gclD	poorly	590-740	1.19	55.27	6.60	3.42	0.45	2

Appendix 3 Risky classification of factors contributing to nutrient imbalance each orchard

No	owner	pH	CEC (cmol/kg)	%OM	Avai.P (mg/kg)	Exch.K (mg/kg)	total score	risky level
1	Mrs.Jansom YaJai	5.95	9.47	2.59	226.08	68.80	0.57	2
2	Mr.Charoen Tanomsin	6.57	10.04	4.17	73.79	118.80	0.42	1
3	Mr.Chamnong Tummakunkaew	5.64	14.79	2.45	135.53	86.93	0.56	2
4	Mr.Saokaew Jitrawong	6.18	10.67	3.17	124.87	130.95	0.54	2
5	Mr.Jai Aetama	6.04	10.33	3.07	189.55	69.00	0.45	1
6	Mr.Ming Lungkana	5.71	8.21	3.00	126.34	162.02	0.66	3
7	Mr.Krisorn Tontang	5.77	7.01	2.34	327.50	63.00	0.61	2
8	Mr.Jomreang Kumpat	5.01	5.58	2.65	121.20	43.00	0.72	3
9	Mr.Intorn Keawsuriya	5.82	5.64	1.38	20.84	28.00	0.56	2
10	Mr.Winit Saisahingkarn	5.40	5.64	1.79	47.85	59.00	0.67	3
11	Mr.Wai Bungkomnate	5.73	10.67	2.37	239.31	68.80	0.56	2
12	Mr.Tae wongsai	5.50	9.81	2.65	274.58	211.22	0.66	3
13	Mr.Kom Srila	5.96	9.41	2.48	177.79	79.16	0.61	2
14	Mrs.Yupin Intatar	6.13	9.93	2.92	229.02	128.36	0.59	2
15	Mr.Sawang Wongkat (#1)	6.05	10.96	2.74	265.77	84.34	0.45	1
16	Mr.Sawang Wongkat (#2)	6.75	9.47	2.17	87.76	81.00	0.54	2
17	Mrs.Ratana Intatar	6.28	11.13	2.90	132.59	93.00	0.45	1
18	Mr.Yanyong Chaiwut	5.33	4.67	2.17	179.26	70.00	0.76	4
19	Mr.Kumpun Yana (sloping land)	5.00	12.73	2.27	212.85	71.39	0.71	3
20	Mr.Jitti Pipatpittayasakul	5.12	8.84	3.54	489.20	138.72	0.77	4
21	Mr.Tae wongsai	4.80	9.47	3.14	384.83	237.12	0.88	5
22	Mr.Kumpun Yana (๒๒)	5.76	8.56	3.03	312.80	237.12	0.66	3
23	Mr.Boonmee Kaewsingkum	5.48	10.50	3.34	94.00	57.00	0.67	3
24	Mr.Thanom siti	3.98	10.04	3.27	114.58	97.00	0.75	4

No	owner	pH	CEC (cmol/kg)	%OM	Avai.P (mg/kg)	Exch.K (mg/kg)	total score	risky level
25	Mr.Artit Sujai	6.08	7.07	2.59	112.01	112.00	0.50	1
26	Mr.Luan Yawilart	5.36	3.18	2.16	201.23	94.00	0.76	4
27	Mr. Son Charoenchep	5.34	9.19	2.25	166.03	92.00	0.76	4
28	Mr.Somkiat Wongta	5.66	6.90	1.72	234.90	80.00	0.61	2
29	Mr.Boonmee Wongchai	5.31	8.79	2.48	339.26	170.00	0.84	4
30	Mr.Choochert Chaisu	5.26	11.01	3.75	251.07	141.31	0.72	3
31	Mr. Bunpot Doawee	4.44	13.36	3.87	227.55	291.50	0.80	4
32	Ms. Renu Paodoapan	6.24	9.53	4.60	355.43	70.00	0.43	1
33	Mr.Montree Wongroy	5.49	10.21	2.78	199.62	81.00	0.67	3
34	Mr.Srima Jitrawong	4.55	12.62	3.34	109.44	286.32	0.83	4
35	Mr.Aumnui WongJun	4.18	12.22	3.48	177.05	275.96	0.83	4
36	Mr.Chamrat Tejakeaw	5.02	10.90	3.42	249.60	112.82	0.67	3
37	Mr.Sunit Sang Ai (#1)	4.26	14.44	4.94	373.07	335.52	0.76	4
38	Mr.Sukit Sang Ai	3.86	11.47	3.54	408.35	239.71	0.80	4
39	Mrs.Ratana Potijan	5.52	7.36	3.65	34.75	76.00	0.45	1
40	Mrs.Wassana Sittima	5.34	6.50	3.50	115.32	102.00	0.68	3
41	Mr.Sunit Sang Ai (#2)	4.48	10.67	4.31	315.74	755.02	0.80	4
42	Mr. Ruruong Doawee	4.49	5.81	1.45	140.31	459.81	0.95	5
43	Mr. Natee Intawong	4.30	6.27	4.59	233.43	317.39	0.81	4
44	Mr. Taworn Mungjai	5.13	8.90	2.71	358.37	677.33	0.81	4
45	Mr. Uoonruoan Punya (#1)	6.39	11.07	4.82	376.01	395.08	0.47	1
46	Mr. Uoonruoan Punya (#2)	6.57	6.90	3.73	383.36	322.57	0.55	2
47	Mr. Boontum Punsurin	4.92	11.07	3.06	312.80	441.69	0.83	4
48	Mr. Kummoon Taladkeaw (lowland)	4.20	22.49	2.47	684.70	151.66	0.82	4
49	Mr.Tawechai Kotrakul	5.47	11.30	2.14	193.96	296.68	0.80	4

No	owner	pH	CEC (cmol/kg)	%OM	Avai.P (mg/kg)	Exch.K (mg/kg)	total score	risky level
50	Mr. Kummoon Taladkeaw (sloping land)	6.60	13.42	3.42	211.38	433.92	0.54	2

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