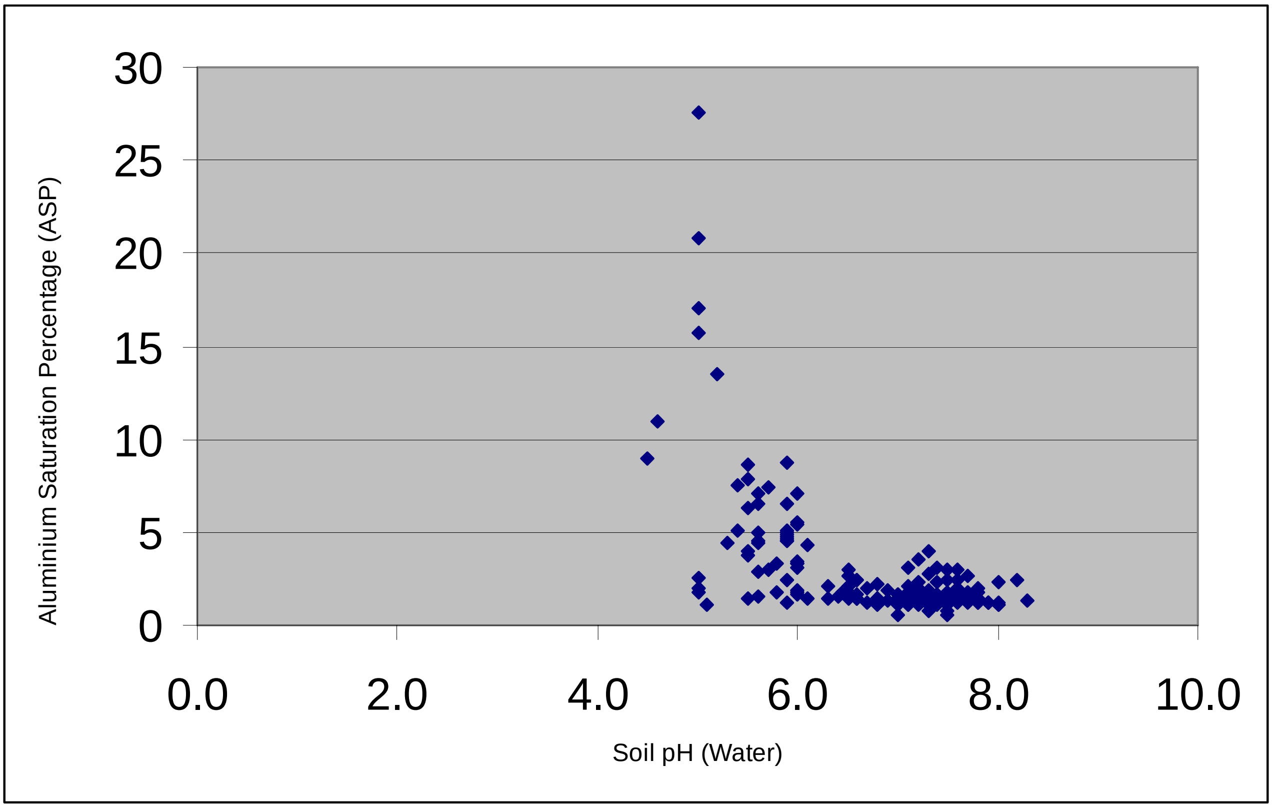
Earthquake & Tsunami Emergency Support Project

ETESP

Detailed Study of Irrigation Component Laboratory Data



(April 2006)

SUMMARY

INTRODUCTION

Previous investigation and study of available soil analytical data revealed very little and the study (ETESP "Irrigation Labdata" update of March 2006) was summarised as:

"Overall the soils for which data are available would appear to be rather infertile, quite often have rather low fertility potential and may well be slightly saline or, in some cases, acidic in reaction. Also, a general possible deficiency of magnesium was indicated".

The present study was undertaken following a "brainstorming" and "exchange of ideas" meeting held in Banda Aceh at the offices of Balai Pengkajian Teknologi Pertanian (BPTP) on 28th March 2006. This meeting did not produce any new ideas and all parties seemed to be working along the same lines to try and get agriculture in the tsunami devastated area back on course. One point that was discussed at length was the situation reported in connection with rice growth in more than one location. The report was that "the crop grew vigorously during the vegetative stage but it then failed to produce, or produce much, grain". In other words, at first farmers' hopes were raised then dashed when there was virtually no yield.

The present study looked at the available data in much more detail and utilised an updated form of the ETESP Labdata tool where the existing data from the Lotti study of irrigation schemes was compiled and collated in the Excel spreadsheet "LabData Collation". The following points were drawn as observations, conclusions and recommendations:

SOIL SALINITY

The original ETESP Labdata report concluded that it would appear as though the soils of Aceh Utara were more heavily salinised than the other areas with an overall average EC (Electrical Conductivity) value of almost 2.3 dS/m whilst Singkil was the least effected with an average of just over 0.8 dS/m. This is a direct north south relationship and the level of precipitation is the most likely explanation. Aceh Utara, at the eastern end of the north coast has annual precipitation of about 1,365 mm (ETESP Report "Annual & Monthly Rainfall", October 2005) whilst Aceh Singkil must have about double that amount since it is located south of Aceh Barat Daya (3,300 mm) and in line with Simeulue (3,000+ mm) However, the important thing is that the salinities are negligible and no or very little long-lasting effect on the land should ensue – assuming there is active soil drainage and either very high rainfall and / or irrigation water to leach the salts (ETESP "Executive Summary", December 2005).

Recent work (ETESP "Executive Summary" 205) in Aceh Besar, Pidie and Bireuen has shown that the salinity status of many soils has changed in the year following the tsunami – some have become more saline whilst others have reduced levels through natural leaching. No further study of salinity has been done in this current report.

Table S.1 Overall Salinity in the Areas Studied - decreasing sort order

	ACEH UTARA	BIREUEN	ACEH JAYA	ACEH TIMUR	PIDIE	ACEH BESAR	SINGKIL
Salinity	2.28 dS/m	2.01 dS/m	1.64 dS/m	1.31 dS/m	1.06 dS/m	0.99 dS/m	0.82 dS/m
Salinity Class	SC1 Very slightly saline	SC1 Very slightly saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline
Rainfall	1,365	1,613	2,649	2,222	1,889	1,668	3,000+
Irrigation	Little	Fairly extensive	Little	Little	Fairly extensive	Little	No

Note: SC – Salinity Class, refer ETESP Soil Salinity & Improvement Mobilisation Report, November 2005
Note: The salinity figures refer to areas inundated by the tsunami and subject of salinity survey

SOIL SODICITY

There does not seem to be a widespread soil sodicity problem since only about 10 - 11% of the mineral soil samples collected in the irrigation schemes study proved to be 'sodic' – that is with ESP (Exchangeable Sodium Percent) >15%. In addition, the level of sodicity that does exist is not high and no sample had ESP in excess of 20%. One scheme which may have a problem is Kreung Ateu in Aceh Jaya since it proved to have several sites with sodic soils. The distribution of ESP levels in the various kabupaten, from where samples were taken, is shown in Table S.2 which is sorted in increasing number of sites sampled.

Aceh Timur, Singkil, Pidie and Aceh Utara show no "sodic" samples at all though Pidie and Aceh Utara have a few sites with very slight or low levels of ESP. Bireuen has one sodic site with the rest showing very low levels of ESP. Aceh Besar and Aceh Jaya have 19 and 13% respectively of the sampled sites noted as sodic whilst over 60% of the samples taken in these areas have ESP levels greater than 10%.

Table S.2 Distribution of ESP Levels of Mineral Soils

Kabupaten	Non-sodic		Very Slightly Sodic		Slightly Sodic		Sodic		Total samples
	ESP <5%		ESP 5 – 9%		ESP 10 – 15%		ESP 15 – 20%		
	No	%	No	%	No	%	No	%	
Aceh Timur	0	0	2	100	0	0	0	0	2
Singkil	7	88	1	13	0	0	0	0	8
Pidie	0	0	8	89	1	11	0	0	9
Aceh Utara	1	8	12	92	0	0	0	0	13
Bireuen	5	38	7	54	0	0	**1**	8	13
Aceh Besar	0	0	13	41	13	41	**6**	19	32
Aceh Jaya	1	1	33	35	48	51	**12**	13	94

No obvious relationship could be seen or established between soil sodicity and precipitation level and / or irrigation supply since Aceh Jaya has relatively high rainfall, Aceh Besar has relatively low rainfall and little formal irrigation and Bireuen has relatively low rainfall but does have formal irrigation schemes. However the recent status of the efficiency of the irrigation schemes sampled is not known.

Only four of the sites were saline-sodic and normal, good irrigated agriculture with adequate leaching fraction should overcome the problem without any need for special amendments. The other sodic sites (Refer Table 3.2 for locations) could prove to be slightly more difficult to reclaim since they are classified as non-saline sodic and care should be taken to ensure that the situation is not made worse by totally leaching out the salinity without addition of sources of calcium, or magnesium, to replace the sodium on the soil exchange complex. The normal amendment would be the incorporation of gypsum ($CaSO_4$) into the soil before leaching.

SOIL ACIDITY and ALUMINIUM SATURATION PERCENT

There is not a large soil acidity problem in the mineral soils investigated and there are not many samples where soil reaction falls below about pH 5.5. (Table S.3). Normally aluminium saturation percentage (ASP) increases dramatically in mineral soils when the soil pH (water) falls to about 5.5. This relationship holds true for the data examined since the ASP increases from around 5% up to about 28% once pH falls below 6, but the number of samples where this happens is very limited. Very high values of ASP were not encountered and though the value of 28% is rated as "high" only 7 samples out of the total exceed ASP of 10%, which would be expected since these soils are normally flooded and used for padi cultivation. The relatively low number of low pH (acidic) soils, plus no obvious correlation between soil pH and sulphate levels, suggests that overall there is not an acidity problem.

Table S.3 Mineral Samples with pH 5.5 or Less

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Lab Texture	pH H2O	Exchangeable H	Exchangeable Al	Al Sat%
Singkil	Tana Bara	TB 2	O	CL	4.5	0.40	2.17	9
Singkil	Tana Bara	TB 1	O	C	4.6	0.20	2.22	11
Aceh Jaya	Bunbun	BL N1	O	SL	5.0	0.62	0.18	2
Aceh Jaya	Panghuleu Harakat	PH D1	D	SL	5.0	0.58	0.22	2
Aceh Jaya	Blang Jempeuk	BJ B3	O	C	5.0	0.78	0.24	3
Pidie	Beuracan	Beuracan iron mix	M	SL	5.0	0.22	0.52	5
Singkil	Parakan Sulampi	PS 1	O		5.0	0.16	1.90	16
Singkil	Sidorejo	SD B1	O	C	5.0	0.24	3.22	17
Singkil	Sidorejo	SD A1	O	C	5.0	0.19	4.22	21
Singkil	Sidorejo	SD B1	O	C	5.0	0.24	3.55	28
Singkil	Sidorejo	SD A1	O	SCL	5.2	0.24	3.00	14
Bireuen	Paya Nie	PYN 2	D	CL	5.3	0.20	0.53	4
Bireuen	Peudada	PAD 25	O	C	5.4	0.42	0.62	5
Pidie	Cubo Trienggading	CT C1 mix	M	CL	5.4	0.42	0.75	7
Aceh Jaya	Bunbun	BL N7	O	SCL	5.5	0.43	0.18	1
Aceh Utara	Krueng Tuan	BKB7	O	CL	5.5	0.32	0.42	4
Bireuen	Paya Nie	PN 1	O	C	5.5	0.31	0.49	4
Aceh Utara	Krueng Tuan	BK6	O	CL	5.5	0.40	0.76	6
Aceh Jaya	Alue Monmata	MD 2	O	C	5.5	0.12	0.88	8
Pidie	Beuracan	Be C2 mix	M	CL	5.5	0.21	0.82	9

IRON TOXICITY

According to the IRRI, iron toxicity is likely to occur in most mineral soils that do not attain pH 6.5 after flooding. As the bulk of the soils tested have pH of 6.5 or greater and, it is assumed that the pH of the more acidic samples would increase as and when the soil is flooded for padi cultivation, there is little risk of toxicity. However, as a precaution it might be wise to monitor soil pH in the mineral soils deemed to have an acidity problem as and when those soils are flooded and puddled in preparation for padi use. The sites involved are detailed in Table S.4 where the most acidic soils have the pH coloured blue and the higher ferrous iron levels coloured green – both in bold.

Table S.4 Acidic Mineral Soils with Possible Iron Toxicity Risk

Kabupaten	Scheme	Site No	Soil (O) Deposit (D)	Depth From	Range To	Lab Texture	pH H2O	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm
Singkil	Tana Bara	TB 2	O	0	25	CL	4.5	0.40	2.17	111	199
Singkil	Tana Bara	TB 1	O	0	20	C	4.6	0.20	2.22	126	210
Aceh Jaya	Bunbun	BL N1	O	12		SL	5.0	0.62	0.18	60	593
Aceh Jaya	Panghuleu Harakat	PH D1	D	0	18	SL	5.0	0.58	0.22	98	925
Aceh Jaya	Blang Jempeuk	BJ B3	O	30		C	5.0	0.78	0.24	405	81
Singkil	Parakan Sulampi	PS 1	O	ND			5.0	0.16	1.90	77	135
Singkil	Sidorejo	SD B1	O	0	20	C	5.0	0.24	3.22	133	189
Singkil	Sidorejo	SD A1	O	10	50	C	5.0	0.19	4.22	175	201
Singkil	Sidorejo	SD B1	O	15	50	C	5.0	0.24	3.55	68	89
Singkil	Sidorejo	SD A1	O	0	10	SCL	5.2	0.24	3.00	154	190
Bireuen	Paya Nie	PYN 2	D	0	10	CL	5.3	0.20	0.53	119	122
Bireuen	Peudada	PAD 25	O	0	25	C	5.4	0.42	0.62	170	132
Pidie	Cubo Trienggading	CT C1 mix	M	0	30	CL	5.4	0.42	0.75	12.8	105
Aceh Jaya	Bunbun	BL N7	O	ND		SCL	5.5	0.43	0.18	16	430
Aceh Utara	Krueng Tuan	BKB7	O	0	25	CL	5.5	0.32	0.42	130	111
Bireuen	Paya Nie	PN 1	O	10	25	C	5.5	0.31	0.49	107	197
Aceh Utara	Krueng Tuan	BK6	O	0	25	CL	5.5	0.40	0.76	138	15
Aceh Jaya	Alue Monmata	MD 2	O	ND		C	5.5	0.12	0.88	75	24
Pidie	Beuracan	Be C2 mix	M	0	25	CL	5.5	0.21	0.82	88	123
Pidie	Beuracan	Be E2	O	0	25	CL	5.6	0.22	0.72	128	105
Singkil	Ujung Bawang	IUB 1	O	0	40	CL	5.9	0.42	0.90	201	91
Pidie	Cubo Trienggading	CTA3 mixed	M	0	30	C	6.0	0.27	0.33	109	122

IRON DEFICIENCY

Iron deficiency is possible on flooded high pH soils that are low in organic matter. High soil pH has been assumed as a pH 8 or greater and the mineral soils with this feature are listed in Table S.5 where those with low organic matter have been highlighted and coloured (in the ratings used by ETESP organic carbon level of less that 1.2 is rated as low).

Table S.5 High pH or Alkaline Mineral Soils

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	S %	Si %	C %	Lab Texture	pH H2O	Exchangeable H	Exchangeable Al	Fe ppm	SO4 ppm	Org C %	Total N %	C:N
Aceh Jaya	Kr. Ateu	KD 10	D	67	11	22	SL	8.3	0.19	0.21	16	316	1.40	0.30	5
Aceh Jaya	Kr. Ateu	KAC4	D	86	0	14	LS	8.2	0.01	0.40	21	153	1.42	0.12	12
Aceh Besar	Geunteut Lamsujen	GL R2	D	91	6	3	S	8.0	0.27	0.32	18	150	1.01	0.30	3
Aceh Besar	Blang Luas	BL A2	D	82	4	14	LS	8.0	0.23	0.18	7	129	1.44	0.13	11
Aceh Jaya	Lambesoi	LS 10	D	22	44	34	CL	8.0	0.42	0.18	182	124	1.71	0.21	8
Aceh Besar	Geunteut Lamsujen	GL Q5	D	18	11	71	SiCl	8.0	0.02	0.18	5	3	2.80	0.15	19

As can be seen only one sample appears to fall into this possible risk category and hence this risk is considered as virtually non-existent. However, in the above table it can be seen that the levels of ferrous iron are actually generally rather low in these soils with:

- one sample – GL Q5 in Aceh Besar - being just above the deficiency rating with a level of 5 ppm, and
- one site – BL A2 in Aceh Besar – being rated as “low” with a value of 7 ppm

Most of the other sites are rated as having “moderate” level of iron whilst one site has a high rating with 182 ppm. Overall it is concluded that there does not appear to be a risk of iron deficiency.

EXCHANGEABLE HYDROGEN

There appears to be a very crude correlation with level of exchangeable hydrogen falling with increasing soil pH – which would be expected – but there is not a very clear relationship visible. The bulk of the samples have an exchangeable hydrogen level of 0.4 me/100g or less and these levels are rated low to very low and would cause no obvious problems.

SOIL FERTILITY

Attempts were made to identify actual deficiencies and overall it is concluded that there is a problem with levels of magnesium. As can be seen in Table S.6, between 80 – 100% of the soils analysed had some deficiency indicated. It is obvious that soil analytical data should be made use of before applying fertilisers to ensure the “possible” deficiencies are rectified in the various locations. A blanket cover of a standard fertiliser packet is not recommended. In most cases magnesium would appear to be deficient.

Overall 20% of the soil samples tested show low to very low inherent soil fertility whilst, as stated above, most samples show some deficiency of one nutrient or the other. The fertility status of the poorest soils is given below Table S.6.

Table S.6 Deficiencies in Mineral Soils by Kabupaten

	Number of Samples in each Kabupaten							
Deficiency	**Aceh Jaya**	**Aceh Besar**	**Bireuen**	**Aceh Utara**	**Pidie**	**Singkil**	**Aceh Timur**	**Totals**
Calcium	1	2		1	1			5
Slight calcium	4	2		3		1		10
Magnesium	3	1	8	6	4	4	2	28
Magnesium + possible Phosphorus	37	10	1	1	2			51
Slight magnesium	49	14	4	2	1	3		73
Potassium		3						3
Totals	94	32	13	13	8	8	2	**170**
Ratio of total samples	88%	84%	100%	100%	100%	89%	100%	**87%**

The total number of mineral soil samples analysed was 193 but several with suspect data have been excluded

Fertility status of the most infertile soil samples:

- **Soil reaction or pH** – very strongly and extremely acid soils have been highlighted as problems and about 50% of the low inherent fertility soils have acidity problems
- **Organic-C** (organic matter) – the organic matter content of these poorly fertile soils would appear to be normal with no samples having low / very low or excessively high levels of organic carbon
- **Total-N** (Nitrogen) – virtually all of the inherently infertile soils have low level of total nitrogen but only one sample has a very low level. Obviously all of these soils require nitrogenous fertiliser – either mineral or via composts
- **C:N ratio** – the low levels of nitrogen reported are reflected in the poor C:N ratio and, again, this will be improved with addition of nitrogenous material
- **Exchangeable Calcium** – most of the samples show low levels of exchangeable calcium and a few show very low levels. Addition of superphosphate fertiliser would add calcium as would organic manures or liming materials or gypsum. Gypsum might be added in some cases if the soil required "cleaning-up" and the removal of sodium from the exchange complex
- **Exchangeable Magnesium** – virtually every sample in this subset shows low to very low levels of exchangeable magnesium. Magnesium could be added as a magnesium rich mineral fertiliser or supplied via the application of dolomitic limestone if an amendment for acidity has to be applied
- **Exchangeable Potassium** – levels of this nutrient appear to be acceptable and no specific requirement can be seen for any special fertiliser application
- **Exchangeable Sodium** – none of the samples show low or very low levels of exchangeable sodium, which is to be expected. However, one or two samples do contain high to very high levels
- **Cation Exchange Capacity** (CEC) – this is included to allow cross checking; CEC does not come into the inherent fertility scenario but does determine the fertility potential
- **Total Exchangeable Bases** (TEB) – this is the sum of Exch-Ca, Exch-Mg, Exch-K plus Exch-Na and virtually all of the samples are noted as having low TEB and even some very low levels were noted
- **Aluminium Saturation Percent** – ASP can be a problem but only a few of these samples are noted as having anything like excessive values. Generally the ASP problem vanishes or diminishes greatly once a soil is flooded
- **Exchangeable Sodium Percent** – none of these poorly fertile soils have excessive exchangeable sodium since sodic soils are normally slightly alkaline to alkaline and all these soils are acidic to some degree
- **Base Saturation** – this is the main measure used to determine inherent fertility and the starting point in the above exercise

MICRO-NUTRIENTS

No micro-nutrient levels have been determined in the soil analyses available to ETESP for manipulation and study.

On some peat soils used for wetland rice production in SE Asian countries (*C. J. Hatten, private communication*) it has been found that rice has often grown fairly well but produced very little grain and this failure has been attributed to trace element deficiency - notably **copper** -. The micro-nutrient status of the NAD mineral soils should possibly be investigated with some urgency in case this is the cause of the failure of some crops to produce a yield. Similarly, field trials should be setup to test the application of various micro-nutrients.

However, it is suggested that any micro-nutrient studies are conducted via foliar analyses since there are so many interacting factors in soils which can affect the levels. In addition there is very poor agreement in literature and the deficiency levels quoted vary widely and depend on the exact extraction method used in the laboratory. A general statement in literature studied indicates that there are seldom deficiencies of micro-nutrients when soil pH is below 7 – as indicated above many of the soils investigated do have pH levels of 7 or less.

PEAT SOILS

Of the 193 original samples taken there were 13 classified as peats and all the samples described as peat in origin are:

- Non-saline and non-sodic (Refer Table 3.9)
- Strongly, very strongly and extremely acidic in reaction with pH ranging from 5.10 to 3.00

- Most of the samples have a low level of Exchangeable-H^+ (<0.5 me/100g) three are moderately high (>0.5 - <2.0 me/100g) though one sample is coded as high (2 – 5 me/100g) and three have very high levels (>5 me/100g)
- As would be expected in organic soils the exchangeable aluminium levels are not particularly high since aluminium is sourced in mineral materials and forms a complex with organic material and is taken out-of-play. Five samples have moderate level and only two noted as having high levels of Exch Al^{3+}
- Four samples have extremely high levels of ferrous iron and three samples are considered to have what would be toxic levels of iron
- Levels of sulphate are generally moderate to high but one sample is noted as having high level and two samples are considered to contain toxic levels

The fertility status of peats soils is never easy to assess since there can be relatively high levels of several nutrients but features such as acidity render the soil an unsuitable medium for the growth of many plants.

- Organic carbon levels are high to very high
- Slightly over half the samples have low levels of nitrogen whilst most of the others fall into the moderate class
- Due to the high organic carbon levels more than half of the samples have unacceptable C:N ratios
- Generally the levels of the exchangeable cations calcium (Ca^{2+}) and magnesium(Mg^+) are low to very low and two samples also have low level of potassium (K^+)
- Over half of the samples have low levels of total exchangeable bases (TEB) and generally the inherent fertility of the peat soils is extremely low with several base saturation (BS) levels below 35% but three samples show normal BS levels of 79 – 83%

Tropical peats have major problems of development and the consensus is that where more than 1.5 - 2m of peat materials overlie mineral material they should not be touched. Where peats are shallower and overlie riverine alluvium - and particular where it is intermixed with alluvial lenses - then there are better possibilities for successful agricultural development due to the mineral content.

The two major problems of tropical peat are the much higher water contents and the generally much lower mineral content. The tropical climate also leads to much accelerated oxidation of the peat if the peat is drained. (If there was system of carbon taxation & credits applied internationally then no peat soils would be used for agriculture as peat oxidation and CO_2 production is so enormous).

Shallow peats have been successfully developed for oil palm and coconut production in Malaysia under very good estate management. But the economics of this can be very marginal, and such areas are the first to be abandoned when market conditions become difficult. Oil palm would generally be planted in holes excavated in the peat to help ensure that the roots reach the mineral soil more easily.

Where peat has been used for wetland rice production the rice has often grown fairly well but produced very little grain. This has been attributed to trace element - notably copper - deficiency. There are difficulties in applying the trace element cocktail to peat soil (fixation, etc) and foliar spraying is a specialist subject.

OVERALL

1. It appears as though there is a deficiency of magnesium in most of the soils

2. All the soils sampled are infertile to a lesser or greater extent and specific fertiliser packages have to be designed to overcome the various deficiencies

3. There is not an overall sodicity problem with the samples tested

4. There is not a large residual salinity problem following the tsunami

5. There is not a large soil acidity and aluminium saturation problem but there are some rather acidic soils and liming materials are indicated as amendments for such soils if the pH does not revert to neutral when the soil is flooded and for padi use

6. The peat soils are very acidic, infertile and their use for agriculture should be avoided if at all possible, and

7. Failure of rice to produce grain after vigorous vegetative growth has been found to be due to “micro-nutrient” deficiency – in particular copper. However this finding was for peat soils but the possibility of this being the reason for the same phenomenon in some of the NAD soils should be investigated

ETESP Agriculture component has compiled this report in the hope that it might assist other organisations save time in establishing the same or similar facts and assist in the designing of integrated, cooperative programmes that might assist answer the problems still facing agriculture in the tsunami damaged area.

CONTENTS

1. INTRODUCTION

As reported in the ETESP report "Interpretation of Laboratory Data for ETESP Irrigation Component' – update of March 2006 - the ETESP Soil Salinisation and Improvement Specialist was requested to "cast his eye" over the laboratory data being supplied to the Irrigation and Drainage component of ETESP. These data were sourced from the Northern Sumatra Irrigated Agriculture Sector Project, which closed in December 2005, with the laboratory analyses being carried out by C. Lotti and Associati, Consulting Engineers, Rome Italy.

ETESP Agriculture component was supplied a copy of the raw or semi processed soil data in mid December 2005 and the first rapid assessment was completed by late December 2005 and further manipulation and study in February with reporting finalised in March 2006.

The original dataset, in Microsoft Excel format, comprised the basic laboratory values for standard soil analyses as shown in Table 1. No data on soil phosphorus (Avail-P) or micronutrients were included.

Table 1 Original Dataset Composition

	PSC			Salinity	Reaction / Acidity				Risk factors		Fertility			Exchangeables			
Item	S	Si	C	EC	pH	pH	H^+	Al^{3+}	Fe	S	OC	N	CEC	Ca	Mg	K	Na
Unit	%	%	%	mmhos/cm	H_2O	KCl	me/100g	me/100g	ppm	ppm	%	%	Me/100g	Me/100g	Me/100g	Me/100g	Me/100g
									Ferrous	SO_4		Total					

In total there were data items for just over 200 samples from 38 irrigation schemes falling within 7 separate Kabupaten.

Table 2 Areas with Schemes and Sample numbers

ACEH BESAR	ACEH JAYA	ACEH TIMUR	ACEH UTARA	BIREUEN	PIDIE	SINGKIL
38 samples	117 samples	2 samples	13 samples	13 samples	8 samples	12 samples
4 schemes	19 schemes	1 scheme	3 schemes	5 schemes	2 schemes	4 schemes
Names	*Names*	*Names*	*Names*	*Names*	*Names*	*Names*
Blang Luas	Alue Monmata	Julok Tunong	Krueng Tuan	Pandrah	Beuracan	Parakan Sulampi
Geunteut Lamsujen	Baba Awe		Pase Kanan	Pate Lhong	Cubo Trienggading	Sidorejo
Krueng Geupeu	Baba Ie		Pase Kiri	Paya Nie		Tana Bara
Krueng Kala	Blang Alue Gajah			Peudada		Ujung Bawang
	Blang Jempeuk			Samalanga		
	Bunbun					
	Jabie					
	Krueng Tunong					
	Kr. Ateu					
	Kuala Meurisi					
	Kulam Asan					
	Lambaro					
	Lambesoi					
	Meudheun					
	Meulha					
	Panghuleu Harakat					
	Rawa Krueng Itam					
	Seneubok Padang					
	Treng Lipeh					

Further study of the data was commenced following a "brain-storming" and "exchange-of-ideas" meeting in the offices of BPTP (Balai Pengkajian Teknologi Pertanian) Banda Aceh attended by staff of:

- BPTP (Balai Pengkajian Teknologi Pertanian)
- ACIAR (Australian Centre for International Agricultural Research)
- AusAID (Australian Aid organisation – mainly CSIRO staff)
- ISRI (Indonesian Soil Research Institute)
- Aceh Rehabilitation & Reconstruction Programme, GTZ (German Aid Organisation)
- ETESP Agriculture Component, and
- Various NGOs including Mercy Corp

The notes made during the above meeting are presented as Appendix 1 to this report. The main reasons for the further study was due to the fact that the ACIAR team was of the opinion that soil sodicity might be a problem – a statement more or less rejected by ETESP at the meeting - this further study should prove or disprove the possibility of a problem due to sodic soils. Other features which might be limiting plant growth, development and fruiting are also considered.

2. DATA MANIPULATION

2.1 Aims and Introduction

The aim of the original study of these data was to manipulate the data and use that data to establish the fertility status and the risk factors presented by the chemical composition of the soils for each sample, site, scheme and kabupaten.

The main features being investigated this time comprise factors which might be able to explain the failure of crops to grow successfully on land which would appear to have recovered or been reclaimed following the tsunami inundation. There have been several reports of crops showing strong growth during the vegetative stage then failing to produce grain or fruit. The original study indicated that there was salinity to some degree in all study areas but excessive salinity did not exist. Basically the following features are investigated in this report:

- Soil sodicity, as reflected by ESP (Exchangeable Sodium Percentage)
- Soil acidity, as reflected by soil reaction (pH) and ASP (Aluminium Saturation Percentage), plus
- Low inherent fertility as reflected by low and very low BS (Base Saturation) and TEB (Total Exchangeable Bases)

2.1.1 Soil Sodicity

The current study followed the same procedures but using an updated version of the ETESP Labdata Summary tool which includes ratings for such items as ESP – exchangeable sodium percentage – and determines if the soil is “sodic” to any extent. The term “sodic” is used in preference to the older expression “alkali” since there has always been the possibility to confuse an “alkali” soil with an “alkaline” soil. Sodic (alkali) refers to the presence and amount of “sodium” attached to the soil exchange complex whilst “alkaline” refers to the reaction (pH) of the soil. The variously defined categories of soil sodicity being looked for are given in Table 2.1

Table 2.1 Saline Sodic Soil Definitions

Name	EC (Electrical Conductivity) dS/m	ESP (Exchangeable Sodium) %	Soil Reaction	Soil pH
Non-saline Non-sodic	<4	<15	Not strongly alkaline	<8.5
Saline Non-sodic	>4	<15	Not strongly alkaline	<8.5
Saline Sodic	>4	>15	Not strongly alkaline	<8.5
Non-saline Sodic	<4	>15	Usually strongly alkaline	>8.5

2.1.2 Soil Acidity

In addition, all soils that were strongly acidic to extremely acidic were paid special attention and correlations sought as to why they were so acidic. The obvious things being looked for being:

- exchangeable aluminium
- presence of peat, and
- possible correlations with high levels of sulphates and iron.

The acidity classes targeted for study are defined in Table 2.2

Table 2.2 Soil pH values for Strongly to Extremely Acidic Reaction

pH(water)	<4.00	4.00	4.50	4.60	5.00	5.10	5.50
Reaction	Ext Acid	Extremely Acid	Extremely Acid	Very Strongly Acid	Very Strongly Acid	Strongly Acid	Strongly Acid

2.1.3 Inherent Soil Fertility

Inherent fertility is the fertility of the soil as found in its natural condition in the field after the tsunami and before any additions of fertilisers or manures, unless of course farmers applied fertilisers or manures before the soils were sampled and did not advise the survey party that they had done so.

The total sum of the various major nutrient cations (Calcium, Magnesium, Potassium and Sodium) is known as the TEB (Total Exchangeable Bases) and is the normal measure of inherent fertility. In addition, the proportion of the soil’s cation exchange capacity (CEC) occupied by the above cations is also used and this value is known as the Base Saturation (BS) and is expressed as a percentage. The critical values used for this study are shown in Table 2.3

Table 2.3 Low and Very Low TEB and BS Values and Ratings

TEB me/100g	0.01	2.99	3.00	7.49
Rating	Very Low	Very Low	Low	Low
BS %	0.01	34.99	35.00	49.99
Rating	Very Low	Very Low	Low	Low

2.2 Procedure

As previously reported the data set was studied to ensure that the units being reported were the internationally accepted norm – all apart from the salinity values appeared to be as expected and the salinity figures were converted to the now accepted EC (Electrical Conductivity) format of dS/m.

Next any obviously incorrect data items were either deleted or corrected, in some cases this was a matter of repositioning the decimal point which had been misplaced via a typographical error. Some values could not be corrected as they depended on other values and in such cases the "suspect" values were colour coded to ensure they were excluded once manipulation was undertaken.

The data were then added to an expanded version of the ETESP Agriculture component tool "ETESP Labdata Summary" sheet Version 4 which is an MS Excel spreadsheet with inbuilt functions which calculate other parameters from the data and apply ratings to the various outputs. The expanded spreadsheet used is named "ETESP Labdata Collation.XLS". The actual tool is described further in the original report (ETESP March 2006).

2.3 ETESP Labdata Collation

The format of this tool is that the data for each sample, site or horizon is entered and ratings automatically generate below the data. The type of material is designated by entering a "D" for deposits or sediments and an "O" for original soil – this data is contained in the original dataset.

Instructions on how to use the tool are contained on the "introduction" sheet which is the first page of the spreadsheet.

Figure 2.1 ETESP Labdata Summary Tool

			Country:	Indonesia		Indonesia														
			Location:	Sumatra								Saturations								
						Exchangeables								ASP	ESP	Base	Cation Ratios		Cation Ratios	
Kabupaten	Scheme	Site	Soil (O)	Depth	Range	meq / 100g						Mg	K	Al	Na	BS				
	/ Desa	No	Deposit (D)	From	To	Ca	Mg	K	Na	CEC	TEB	Sat%	Sat%	Sat%	Sat%	%	Ca/Mg	Rating	Mg/K	Rating
Aceh Besar	Blang Luas	BLG 13	O	ND		7.35	1.52	0.13	0.77	10.81	9.77	14	1	2	7	90	4.84	OK	11.69	K sli deficient
				Rating		Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Blang Luas	BLG 13	D	ND		6.5	1.11	0.09	0.7	9.59	8.40	12	1	2	7	88	5.86	Mg sli deficient	12.33	K deficient
				Rating		Mod	Low	V Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Blang Luas	BLDO 3B	D	30 -		8.73	1.7	0.1	0.86	13.16	11.39	13	1	1	7	87	5.14	Mg sli deficient	17.00	K deficient
				Rating		Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL Q5	D	50 -		10.83	1.72	0.36	3.07	16.58	15.98	10	2	1	19	96	6.30	Mg sli deficient	4.78	OK
				Rating		High	Mod	Mod	V High	Mod	High	ND	V Low	V Low	Sodic	V High				
Aceh Besar	Krueng Kala	KKD 4	D	ND		7.76	1.3	0.19	0.91	12.62	10.16	10	2	1	7	81	5.97	Mg sli deficient	6.84	OK
				Rating		Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Kala	KK F2	D	0	12	7.76	1.3	0.39	0.91	12.49	10.36	10	3	1	7	83	5.97	Mg sli deficient	3.33	OK
				Rating		Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				

3 RESULTS

3.1 Introduction

The full output of results is not presented here but is contained in Appendix B as a series of tables. In this section there is a short presentation and discussion of findings or observations that have been determined by study of the data. Generally the data for the mineral soils and the organic soils (peat) are presented separately since these soils are so different. The more acidic mineral soils have a reaction range of pH 5.5 – 4.5 whilst the organic soils range from pH 5.1 – 3.0. The soils considered as acidic are all non-saline and non-sodic.

3.2 ESP – Soil Sodicity in Mineral Soils

The first step in this part of the study was to copy all the data for the soils which classified as "sodic" to a separate sheet and an extract of that sheet is shown below as Table 3.1. As can be seen this table only contains data from the mineral soils since none of the organic soils are sodic to any extent.

Table 3.1 Samples Classified as Sodic

Irrigation Componment Sites Classified as Sodic

Kabupaten	Scheme / Desa	Site No	EC dS/m	pH H2O	Exchangeables meq / 100g: Ca	Mg	K	Na	CEC	TEB	Saturations: Mg Sat%	K Sat%	ASP: Al Sat%	ESP: Na Sat%	Base: BS %	Cation Ratios: Ca/Mg	Rating	Cation Ratios: Mg/K	Rating
Aceh Besar	Geunteut Lamsujen	GL Q5	0.59	7.5	9.36	1.31	0.60	2.94	16.33	14.21	8	4	2	18.0	87	7.15	Mg deficient with P inhibition	2.18	Mg sli deficient
Aceh Besar	Krueng Kala	KKE 10	0.84	7.3	6.04	0.97	0.29	2.10	11.54	9.40	8	3	1	18.2	81	6.23	Mg sli deficient	3.34	OK
Aceh Besar	Geunteut Lamsujen	GL Q5	0.29	8.0	10.83	1.72	0.36	3.07	16.58	15.98	10	2	1	18.5	96	6.30	Mg sli deficient	4.78	OK
Aceh Besar	Krueng Geupeu	KG I 2A	2.60	7.6	5.04	1.28	0.57	1.98	10.04	8.87	13	6	2	19.7	88	3.94	OK	2.25	Mg sli deficient
Aceh Jaya	Kuala Meurisi	TL 7	1.70	7.3	8.01	1.17	0.61	2.04	13.60	11.83	9	4	3	15.0	87	6.85	Mg sli deficient	1.92	Mg deficient
Aceh Jaya	Kr. Ateu	KA 8 Mean	4.85	6.5	6.91	1.65	0.33	1.76	11.39	10.65	14	3	2	15.5	94	4.18	OK	5.00	OK
Aceh Jaya	Lambesoi	LS N4	1.02	5.9	7.01	2.23	0.35	2.25	14.41	11.84	15	2	1	15.6	82	3.14	OK	6.37	OK
Aceh Jaya	Blang Jempeuk	BJ B3	5.50	7.4	9.74	1.29	0.35	2.51	15.80	13.89	8	2	1	15.9	88	7.55	Mg deficient with P inhibition	3.69	OK
Aceh Jaya	Kr. Ateu	KA 8	2.20	7.4	8.18	2.46	0.52	2.31	14.28	13.47	17	4	1	16.2	94	3.33	OK	4.73	OK
Aceh Jaya	Kr. Ateu	KA 8	8.10	6.0	6.24	1.63	0.24	1.74	10.73	9.85	15	2	2	16.2	92	3.83	OK	6.79	OK
Aceh Jaya	Treng Lipeh	KM C2	1.26	5.6	6.35	0.95	0.17	1.89	11.63	9.36	8	1	2	16.3	80	6.68	Mg sli deficient	5.59	OK
Aceh Jaya	Kr. Ateu	KA 14	0.90	7.3	6.54	1.34	0.49	1.84	11.30	10.21	12	4	1	16.3	90	4.88	OK	2.73	Mg sli deficient
Aceh Jaya	Karang Tunong	KTG1	4.50	7.0	8.21	1.97	0.80	2.49	15.18	13.47	13	5	1	16.4	89	4.17	OK	2.46	Mg sli deficient
Aceh Jaya	Blang Jempeuk	KJ 2	1.54	6.5	6.59	1.09	0.38	1.70	10.23	9.76	11	4	2	16.6	95	6.05	Mg sli deficient	2.87	Mg sli deficient
Aceh Jaya	Blang Alue Gajah	BUG I2	3.00	6.6	6.17	1.82	0.55	2.21	13.03	10.75	14	4	2	17.0	83	3.39	OK	3.31	OK
Aceh Jaya	Karang Tunong	KT H1	0.97	7.3	9.14	1.55	1.08	2.86	15.95	14.63	10	7	1	17.9	92	5.90	Mg sli deficient	1.44	Mg deficient
Aceh Jaya	Kr. Ateu	KA B	0.33	6.3	6.04	0.90	0.29	2.10	11.55	9.33	8	3	1	18.2	81	6.71	Mg sli deficient	3.10	OK
Bireuen	Samalanga	S1 0	6.33	6.0	2.23	0.71	0.65	1.55	10.14	5.14	7	6	3	15.3	51	3.14	OK	1.09	Mg deficient
		Mean	2.58	6.9	7.15	1.45	0.48	2.19	12.98	11.26	11	4	2	17	86	5.19	Mg sli deficient	3.54	OK
		Max	8.10	8.0	10.83	2.46	1.08	3.07	16.58	15.98	17	7	3	20	96	7.55	Mg deficient with P inhibition	6.79	OK
		Min	0.29	5.6	2.23	0.71	0.17	1.55	10.04	5.14	7	1	1	15	51	3.14	OK	1.09	Mg deficient

Of the total 207 samples only 18 are classified as being "sodic" and most of theses are "non-saline sodic" (refer Table 2.1 for definition) but there is some minor content of salt in all the samples as reflected by the EC figures shown below.

The presence of some salinity in the soil is important from the reclamation point of view since totally non-saline soils are much more difficult to reclaim than those with some salinity.

Table 3.2 Sodic Samples by Kabupaten

Kabupaten	Scheme	Site No	EC dS/nm	ESP	Classification
Aceh Besar	Geunteut Lamsujen	GL Q5	0.59	**18.0**	Non-saline sodic
Aceh Besar	Geunteut Lamsujen	GL Q5	0.29	**18.5**	Non-saline sodic
Aceh Besar	Krueng Geupeu	KG I 2A	2.60	**19.7**	Non-saline sodic
Aceh Besar	Krueng Kala	KKE 10	0.84	**18.2**	Non-saline sodic
Aceh Jaya	Blang Alue Gajah	BUG I2	3.00	**17.0**	Non-saline sodic
Aceh Jaya	Blang Jempeuk	BJ B3	5.50	15.9	Saline sodic
Aceh Jaya	Blang Jempeuk	KJ 2	1.54	**16.6**	Non-saline sodic
Aceh Jaya	Karang Tunong	KT H1	0.97	**17.9**	Non-saline sodic
Aceh Jaya	Karang Tunong	KTG1	4.50	16.4	Saline sodic
Aceh Jaya	Kr. Ateu	KA 14	0.90	**16.3**	Non-saline sodic
Aceh Jaya	Kr. Ateu	KA 8	2.20	**16.2**	Non-saline sodic
Aceh Jaya	Kr. Ateu	KA 8	8.10	16.2	Saline sodic
Aceh Jaya	Kr. Ateu	KA 8 Mean	4.85	15.5	Saline sodic
Aceh Jaya	Kr. Ateu	KA B	0.33	**18.2**	Non-saline sodic
Aceh Jaya	Kuala Meurisi	TL 7	1.70	**15.0**	Non-saline sodic
Aceh Jaya	Lambesoi	LS N4	1.02	**15.6**	Non-saline sodic
Aceh Jaya	Treng Lipeh	KM C2	1.26	**16.3**	Non-saline sodic
Bireuen	Samalanga	S1 0	6.33	15.3	Saline sodic

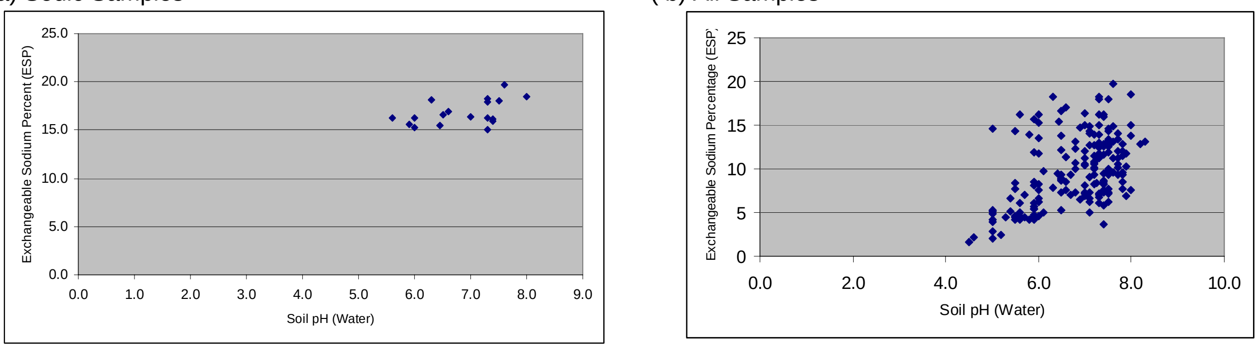
Some simple observations based on Tables 3.1 and 3.2 are listed below:

- Mean pH value of these sodic soils is 6.9 – that is, soil reaction is neutral which is acceptable for most plant growth
- Aceh Jaya had most of the sodic samples (13), Aceh Besar had 4 and there was one sample from Bireuen
- Less than 9% of the samples taken for the irrigation study proved to be "sodic" – that is sodicity is NOT a major problem

- For the sodic soils the range of ESP vales is from 15 – 20% as can be seen in Figure 3.1a - that is, the "sodicity' level is relatively low. Study of figure 3.1b shows that the ESP levels for all samples are mainly between 4 – 15% with soil reaction of pH5 – pH7.5
- The mean BS is 86% - that is these soils have good inherent fertility, based on BS – that is a very high rating However, the BS is high mainly because the CEC is so low so overall these sodic soils are not too fertile
- The mean TEB for these sodic soils is 11.26 me/100g – that is "moderate" and the situation needs improving by appropriate fertilisation and addition of amendments such as organic manures
- The mean CEC for these sodic soils is 12.98 me/100g – that is "low' and these soils have a low fertility potential and this would need to be boosted by additions of copious amounts of organic manures and composted materials since the CEC of such material is generally high and helps the soil
- Of the 18 samples 11 (60%) are noted as tsunami deposits and 7 samples (40%) are original soil material
- The 13 samples from Aceh Jaya came from a total of seven schemes and one scheme, Kreung Ateu, accounted for 5 of those samples suggesting that, perhaps, there is some sodicity problem within this scheme

Figure 3.1 Soil pH (Water) versus Exchangeable Sodium Percentage

(a) Sodic Samples (b) All Samples

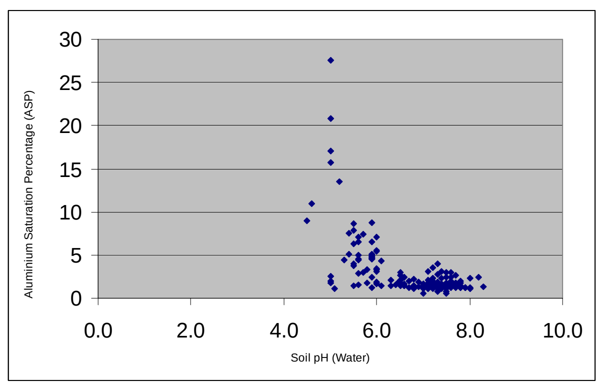


3.3 Soil Acidity – Mineral Soils

3.3.1 Aluminium Saturation Percent (ASP)

The norm is that aluminium saturation percentage (ASP) increases dramatically in mineral soils when the soil pH (water) falls to about 5.5. As can be seen in Figure 3.2 below this relationship holds for the data being examined since the ASP increases from around 5% up to about 28% once pH falls below 6. Explanation of the processes is presented in ETESP report "Soil Acidity and Aluminium".

Figure 3.2 Soil pH (water) Versus ASP- Mineral Soils



However, with the samples being studied, very high values of ASP were not encountered and though the value of 28% is rated as high only 7 samples out of the total exceed ASP of 10%. Only 3.6% of the total mineral soil samples have an ASP level of moderate or worse - 10% ASP being the start of the moderate class of ASP.
This indicates that there is NOT a problem with exchangeable aluminium in the mineral soils, which would be expected since these soils are basically non-hill soils, normally flooded and used for padi cultivation.

3.3.2 Sulphate Levels

There appears to be no clear relationship between soil pH (water) and the level of sulphate found in the mineral samples as can be seen in Figure 3.3. All that can be determined from Figure 3.3 is that most sulphate levels fall below 500 ppm which puts them in the low to moderate category. Only about 7 samples show values in excess of 1,000 ppm and are classified as having high sulphate levels.

3.3.3 Ferrous Iron Levels

Figure 3.4 shows a very broad, poor correlation between levels of ferrous iron and soil pH in that, the higher the pH (more alkaline the soil) then the lower is the level of ferrous iron. The highest concentration of samples is found between pH7 – pH8 and the level of ferrous iron is between 0 – 100 ppm and mostly less than 50 ppm. Definition of toxicity levels of ferrous iron is not good with some bodies claiming >40 ppm as toxic whilst others claim toxicity does not occur till levels reach 400 ppm. General advice is to accept the 400 ppm as the trigger level for toxicity. Soils possibly at risk are listed in Table 3.3 with an explanation given below.

Figure 3.3 Soil pH Versus Sulphate in Mineral Soils

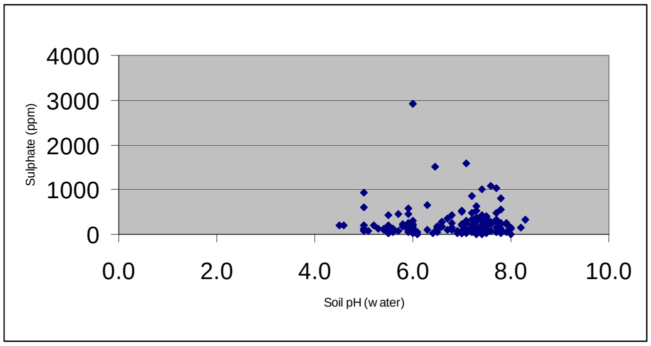


Figure 3.4 Soil pH Versus Ferrous Fe Levels (ppm)

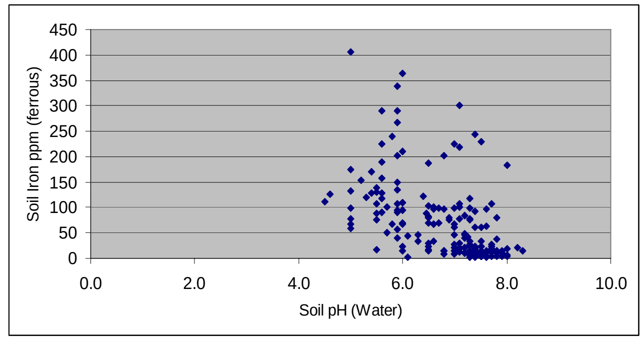


Table 3.3 Acidic Mineral Soils with Possible Iron Toxicity Risk

Kabupaten	Scheme	Site	Soil (O)	Depth	Range	Lab	pH	Exchangeable		Fe	SO_4
		No	Deposit (D)	From	To	Texture	H2O	H	Al	ppm	ppm
Singkil	Tana Bara	TB 2	O	0	25	CL	4.5	0.40	2.17	111	199
Singkil	Tana Bara	TB 1	O	0	20	C	4.6	0.20	2.22	126	210
Aceh Jaya	Bunbun	BL N1	O	12		SL	5.0	0.62	0.18	60	593
Aceh Jaya	Panghuleu Harakat	PH D1	D	0	18	SL	5.0	0.58	0.22	98	925
Aceh Jaya	Blang Jempeuk	BJ B3	O	30		C	5.0	0.78	0.24	405	81
Singkil	Parakan Sulampi	PS 1	O	ND			5.0	0.16	1.90	77	135
Singkil	Sidorejo	SD B1	O	0	20	C	5.0	0.24	3.22	133	189
Singkil	Sidorejo	SD A1	O	10	50	C	5.0	0.19	4.22	175	201
Singkil	Sidorejo	SD B1	O	15	50	C	5.0	0.24	3.55	68	89
Singkil	Sidorejo	SD A1	O	0	10	SCL	5.2	0.24	3.00	154	190
Bireuen	Paya Nie	PYN 2	D	0	10	CL	5.3	0.20	0.53	119	122
Bireuen	Peudada	PAD 25	O	0	25	C	5.4	0.42	0.62	170	132
Pidie	Cubo Trienggading	CT C1 mix	M	0	30	CL	5.4	0.42	0.75	12.8	105
Aceh Jaya	Bunbun	BL N7	O	ND		SCL	5.5	0.43	0.18	16	430
Aceh Utara	Krueng Tuan	BKB7	O	0	25	CL	5.5	0.32	0.42	130	111
Bireuen	Paya Nie	PN 1	O	10	25	C	5.5	0.31	0.49	107	197
Aceh Utara	Krueng Tuan	BK6	O	0	25	CL	5.5	0.40	0.76	138	15
Aceh Jaya	Alue Monmata	MD 2	O	ND		C	5.5	0.12	0.88	75	24
Pidie	Beuracan	Be C2 mix	M	0	25	CL	5.5	0.21	0.82	88	123
Pidie	Beuracan	Be E2	O	0	25	CL	5.6	0.22	0.72	128	105
Singkil	Ujung Bawang	IUB 1	O	0	40	CL	5.9	0.42	0.90	201	91
Pidie	Cubo Trienggading	CTA3 mixed	M	0	30	C	6.0	0.27	0.33	109	122

According to Ponnamperuma (IRRI) iron toxicity is likely to occur in most mineral soils that do not attain pH 6.5 after flooding. As can be seen in Figure 3.4 the bulk of the soils tested have pH of 6.5 or greater and, it is assumed that the pH of the more acidic samples would increase as and when the soil is flooded for padi cultivation. However, as a precaution it might be wise to monitor soil pH in the mineral soils deemed to have an acidity problem as and when those soils are flooded and puddled in preparation for padi use. The sites involved are detailed in Table 3.3 where the most acidic soils have the pH coloured blue and the higher ferrous iron levels coloured green – both in bold.

Iron deficiency is possible on flooded high pH soils that are low in organic matter. Flooding a soil will reduce the pH of an alkaline soil and increase the pH of an acid soil, ie the pH of all soils except acid peats and those low in active iron, converges to the range 6.5 to 7.0.

High soil pH has been assumed as a pH greater than 8 and the mineral soils with this feature are listed in Table 3.4 where those with low organic matter have been highlighted and coloured (in the ratings used by ETESP organic carbon level of less that 1.2 is rated as low).

As can be seen only one sample appears to fall into this possible risk category and hence this risk is considered as virtually non-existent. However, in the above table it can be seen that the levels of ferrous iron are actually generally rather low in these soils with:

- one sample – GL Q5 in Aceh Besar - being just above the deficiency rating with a level of 5 ppm, and
- one site – BL A2 in Aceh Besar – being rated as "low" with a value of 7 ppm

Most of the other sites are rated as having "moderate" level of iron whilst one site has a high rating with 182 ppm. Overall it is concluded that there does not appear to be a risk of iron deficiency.

Table 3.4 High pH or Alkaline Mineral Soils

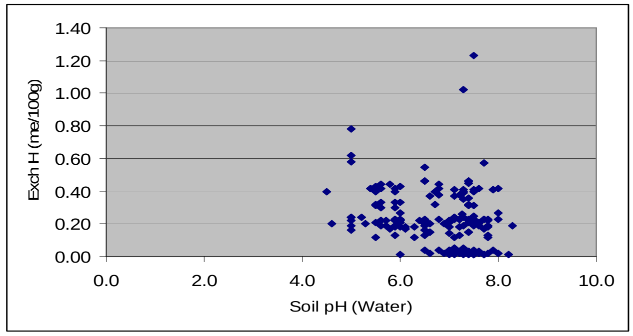
Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	S %	Si %	C %	Lab Texture	pH H2O	Exchangeable		Fe ppm	SO4 ppm	Org C %	Total N %	C:N
									H	Al					
Aceh Jaya	Kr. Ateu	KD 10	D	67	11	22	SL	8.3	0.19	0.21	16	316	1.40	0.30	5
Aceh Jaya	Kr. Ateu	KAC4	D	86	0	14	LS	8.2	0.01	0.40	21	153	1.42	0.12	12
Aceh Besar	Geunteut Lamsujen	GL R2	D	91	6	3	S	8.0	0.27	0.32	18	150	1.01	0.30	3
Aceh Besar	Blang Luas	BL A2	D	82	4	14	LS	8.0	0.23	0.18	7	129	1.44	0.13	11
Aceh Jaya	Lambesoi	LS 10	D	22	44	34	CL	8.0	0.42	0.18	182	124	1.71	0.21	8
Aceh Besar	Geunteut Lamsujen	GL Q5	D	18	11	71	SiCL	8.0	0.02	0.18	5	3	2.80	0.15	19

3.3.4 Exchangeable Hydrogen

Figure 3.5 plots soil pH (water) against exchangeable hydrogen (H^+ in me/100g) and there appears to be a very crude correlation with level of exchangeable hydrogen falling with increasing soil pH – which would be expected – but there is not a very clear relationship visible.

The bulk of the samples have an exchangeable hydrogen level of 0.4 me/100g or less and these levels are rated low to very low and would cause no obvious problems.

Figure 3.5 Soil pH Versus Exchangeable Hydrogen



3.4 Inherent Soil Fertility

3.4.1 Use of base Saturation

Inherent, or existing, soil fertility is the natural fertility of the soil as it is found in the field before any amendments, in the form of fertilisers or manures, are added and it is determined from the laboratory analyses as reported by Lotti by using the base saturation (BS%) as a measure of inherent fertility. Inherent fertility must not be confused with fertility potential or how well the soil can hold any added nutrients – fertility potential is assessed using the cation exchange capacity (CEC). For the purposes of this exercise soil samples with a BS of less than 50% are considered to have poor inherent fertility, if BS is less than 35% the status is noted as very poor.

All samples of mineral soils meeting the above criteria are listed in Table 3.5 sorted in order of decreasing BS. Colour coding and 'emboldening" has been used to further highlight perceived problems. Generally "BLUE" has been denoted to poor fertility or serious problems whilst "RED" is used for very poor fertility or very serious problems.

In total 40 of the 195 mineral soil samples fall into this poor fertility category and, as can been seen below, there are 18 samples (9% of the mineral soils) noted as having poor inherent fertility and 22 (11%) with very poor fertility.

To further identify possible or perceived nutrient problems the following factors have also been added to the table since they are all part and parcel of fertility:

- Soil reaction or pH – very strongly and extremely acid soils have been highlighted as problems, about 50% of the low inherent fertility soils have acidity problems
- Organic-C (organic matter) – the organic matter content of these suspect soils would appear to be normal with no samples having low / very low or excessively high levels of organic carbon
- Total-N (Nitrogen) – virtually all of the inherently infertile soils have low level of total nitrogen but only one sample has a very low level. Obviously all of these soils require nitrogenous fertiliser – either mineral or via composts
- C:N ratio – the low levels of nitrogen reported are reflected in the poor C:N ratio and, again, this will be improved with addition of nitrogenous material
- Exchangeable Calcium – most of the samples show low levels of exchangeable calcium and a few show very low levels. Addition of superphosphate fertiliser would add calcium as would organic manures or liming materials or gypsum. Gypsum might be added in some cases if the soil required "cleaning-up" and the removal of sodium from the exchange complex
- Exchangeable Magnesium – virtually every sample in this subset shows low to very low levels of exchangeable magnesium. Magnesium could be added as a magnesium rich mineral fertiliser or supplied via the application of dolomitic limestone if an amendment for acidity has to be applied
- Exchangeable Potassium – levels of this nutrient appear to be acceptable and no specific requirement can be seen for any special fertiliser application
- Exchangeable Sodium – none of the samples show low or very low levels of exchangeable sodium, which is to be expected. However, one or two samples do contain high to very high levels and are marked accordingly

- Cation Exchange capacity (CEC) – this is included to allow cross checking but CEC does not come into the inherent fertility scenario
- Total Exchangeable Bases (TEB) – this is the sum of Exch-Ca, Exch-Mg, Exch-K plus Exch-Na and virtually all of the samples are highlighted as having low TEB and even some very low levels were noted
- Magnesium Saturation Percent – this is a non-standard presentation but could prove useful
- Potassium Saturation Percent - this is a non-standard presentation but could prove useful
- Aluminium Saturation Percent – ASP can be a problem but only a few of these samples are noted as having anything like excessive values. Generally the ASP problem vanishes or diminishes greatly once a soil is flooded
- Exchangeable Sodium Percent – none of these poorly fertile soils have excessive exchangeable sodium since sodic soils are normally slightly alkaline to alkaline and all these soils are acidic to some degree
- Base Saturation – this is the main measure used to determine inherent fertility and the starting point in this exercise

Table 3.5 Mineral Soils with Poor to Very Poor Inherent Fertility

Kabupaten	Scheme	pH	Org C	Total N	C:N	Exchangeables Cations etc				me /	100g	Mg	K	ASP	ESP	Base
												Mg	K	Al	Na	BS
		H2O	%	%		Ca	Mg	K	Na	CEC	TEB	Sat%	Sat%	Sat%	Sat%	Sat%
Singkil	Ujung Bawang	5.9	4.00	0.19	21	2.88	0.57	0.71	0.62	10.29	4.78	6	7	9	6	46
Aceh Utara	Pase Kiri	6.0	3.23	0.22	15	2.64	0.61	0.57	0.59	9.52	4.41	6	6	7	6	46
Pidie	Beuracan	6.1	2.12	0.12	18	2.87	0.17	0.61	0.99	10.23	4.64	2	6	4	10	45
Aceh Utara	Pase Kanan	6.0	2.78	0.18	15	2.99	0.40	0.55	0.67	10.21	4.61	4	5	5	7	45
Bireuen	Pate Lhong	6.0	3.47	0.17	20	2.80	0.49	0.56	0.63	10.14	4.48	5	6	5	6	44
Bireuen	Pandrah	5.6	4.78	0.22	22	3.88	0.59	0.31	0.62	12.33	5.40	5	3	5	5	44
Aceh Jaya	Alue Monmata	5.5	2.77	0.12	23	2.73	0.70	0.55	0.86	11.13	4.84	6	5	8	8	44
Pidie	Beuracan	5.9	3.78	0.12	32	2.88	0.55	0.71	0.62	10.99	4.76	5	6	4	6	43
Aceh Utara	Pase Kanan	5.9	3.45	0.19	18	0.59	3.00	0.56	0.59	11.00	4.74	27	5	5	5	43
Aceh Jaya	Karang Tunong	7.0	1.34	0.15	9	9.02	1.52	1.23	2.94	36.13	14.71	4	3	0	8	41
Pidie	Cubo Trienggading	5.9	2.78	0.25	11	2.18	0.55	0.81	0.92	11.33	4.46	5	7	5	8	39
Aceh Utara	Krueng Tuan	5.5	3.08	0.19	16	2.08	0.50	0.81	0.95	11.25	4.34	4	7	4	8	39
Bireuen	Samalanga	5.8	3.35	0.20	17	2.93	0.38	0.75	0.51	12.09	4.57	3	6	3	4	38
Pidie	Cubo Trienggading	5.4	2.40	0.11	22	1.90	0.62	0.60	0.66	10.01	3.78	6	6	7	7	38
Pidie	Cubo Trienggading	6.0	2.45	0.15	16	2.12	0.19	0.59	0.76	10.01	3.66	2	6	3	8	37
Bireuen	Peudada	5.9	4.47	0.26	17	3.00	0.56	0.46	0.53	12.46	4.55	4	4	7	4	37
Bireuen	Paya Nie	5.5	3.78	0.18	21	3.00	0.56	0.46	0.53	12.46	4.55	4	4	4	4	37
Bireuen	Samalanga	5.9	3.32	0.19	17	2.50	0.61	0.45	0.55	11.55	4.11	5	4	5	5	36
Aceh Utara	Pase Kiri	5.6	2.87	0.17	17	2.33	0.55	0.56	0.56	11.34	4.00	5	5	3	5	35
Aceh Timur	Julok Tunong	5.9	2.76	0.15	18	1.93	0.51	0.55	0.95	11.20	3.94	5	5	5	8	35
Pidie	Beuracan	5.6	3.40	0.16	21	1.90	0.52	0.60	0.46	10.22	3.48	5	6	7	5	34
Singkil	Sidorejo	5.0	3.55	0.17	21	2.74	0.52	0.60	0.50	12.90	4.36	4	5	28	4	34
Aceh Timur	Julok Tunong	5.7	3.01	0.14	22	2.00	0.59	0.65	0.85	12.12	4.09	5	5	7	7	34
Aceh Utara	Pase Kiri	5.7	3.87	0.17	23	2.30	0.50	0.50	0.50	11.34	3.80	4	4	3	4	34
Singkil	Parakan Sulampi	5.0	3.12	0.17	18	2.47	0.48	0.61	0.50	12.12	4.06	4	5	16	4	33
Bireuen	Pate Lhong	5.9	4.01	0.16	25	2.08	0.50	0.71	0.52	11.55	3.81	4	6	5	5	33
Aceh Utara	Krueng Tuan	5.6	3.78	0.25	15	2.18	0.50	0.88	0.82	13.35	4.38	4	7	4	6	33
Bireuen	Peudada	5.4	4.00	0.19	21	2.00	0.54	0.76	0.63	12.24	3.93	4	6	5	5	32
Bireuen	Paya Nie	5.3	3.47	0.16	22	2.08	0.52	0.66	0.53	11.84	3.79	4	6	4	4	32
Bireuen	Pate Lhong	5.6	2.99	0.20	15	2.20	0.56	0.51	0.55	12.01	3.82	5	4	6	5	32
Pidie	Beuracan	5.5	3.07	0.16	19	1.80	0.44	0.36	0.43	9.55	3.03	5	4	9	5	32
Bireuen	Pate Lhong	5.9	4.01	0.17	24	2.20	0.56	0.51	0.55	12.04	3.82	5	4	5	5	32
Aceh Utara	Krueng Tuan	5.5	3.40	0.21	16	1.90	0.60	0.70	0.56	12.05	3.76	5	6	6	5	31
Bireuen	Paya Nie	5.6	3.14	0.16	20	2.00	0.56	0.59	0.51	12.13	3.66	5	5	5	4	30
Aceh Jaya	Kr. Ateu	7.0	1.35	0.08	17	0.35	1.52	0.23	0.77	10.81	2.87	14	2	2	7	27
Singkil	Sidorejo	5.0	3.77	0.19	20	2.00	0.57	0.66	0.54	18.90	3.77	3	3	17	3	20
Singkil	Tana Bara	4.6	5.06	0.17	30	2.01	0.57	0.89	0.43	20.23	3.90	3	4	11	2	19
Singkil	Sidorejo	5.0	3.57	0.16	22	2.14	0.56	0.56	0.42	20.33	3.68	3	3	21	2	18
Singkil	Sidorejo	5.2	3.50	0.18	19	1.65	0.56	0.76	0.55	22.15	3.52	3	3	14	2	16
Singkil	Tana Bara	4.5	4.44	0.17	26	2.22	0.57	0.66	0.40	24.23	3.85	2	3	9	2	16

Table 3.6 was compiled to try and get some idea of the location of these apparently rather infertile soils. As can be seen, in Table 3.7 most of the sites are found on the north or east coasts with infertile soils in all but Aceh Besar.

Table 3.6 Poor Inherent Fertility by Kabupaten and Scheme

Kabupaten	Scheme	Site No	pH H2O	Org C %	Total N %	C:N	Me / 100g Ca	Mg	K	Na	CEC	TEB	Mg Sat%	K Sat%	Al Sat%	Na Sat%	BS %
Aceh Jaya	Alue Monmata	MD 2	5.5	2.77	0.12	23	2.73	0.70	0.55	0.86	11.13	4.84	6	5	8	8	44
Aceh Jaya	Kreung Tunong	KTG1	7.0	1.34	0.15	9	9.02	1.52	1.23	2.94	36.13	14.71	4	3	0	8	41
Aceh Jaya	Krreung Ateu	KA A5	7.0	1.35	0.08	17	0.35	1.52	0.23	0.77	10.81	2.87	14	2	2	7	27
Aceh Timur	Julok Tunong	JT B2	5.9	2.76	0.15	18	1.93	0.51	0.55	0.95	11.20	3.94	5	5	5	8	35
Aceh Timur	Julok Tunong	JT B7	5.7	3.01	0.14	22	2.00	0.59	0.65	0.85	12.12	4.09	5	5	7	7	34
Aceh Utara	Krueng Tuan	BK6	5.5	3.40	0.21	16	1.90	0.60	0.70	0.56	12.05	3.76	5	6	6	5	31
Aceh Utara	Krueng Tuan	BK7	5.6	3.78	0.25	15	2.18	0.50	0.88	0.82	13.35	4.38	4	7	4	6	33
Aceh Utara	Krueng Tuan	BKB7	5.5	3.08	0.19	16	2.08	0.50	0.81	0.95	11.25	4.34	4	7	4	8	39
Aceh Utara	Pase Kanan	PKM B5	5.9	3.45	0.19	18	0.59	3.00	0.56	0.59	11.00	4.74	27	5	5	5	43
Aceh Utara	Pase Kanan	PKNI	6.0	2.78	0.18	15	2.99	0.40	0.55	0.67	10.21	4.61	4	5	5	7	45
Aceh Utara	Pase Kiri	PKR A3	5.7	3.87	0.17	23	2.30	0.50	0.50	0.50	11.34	3.80	4	4	3	4	34
Aceh Utara	Pase Kiri	PKR B4	5.6	2.87	0.17	17	2.33	0.55	0.56	0.56	11.34	4.00	5	5	3	5	35
Aceh Utara	Pase Kiri	PKR B5	6.0	3.23	0.22	15	2.64	0.61	0.57	0.59	9.52	4.41	6	6	7	6	46
Bireuen	Pandrah	PD 1	5.6	4.78	0.22	22	3.88	0.59	0.31	0.62	12.33	5.40	5	3	5	5	44
Bireuen	Pate Lhong	PL 1	5.9	4.01	0.16	25	2.08	0.50	0.71	0.52	11.55	3.81	4	6	5	5	33
Bireuen	Pate Lhong	PL 13	5.6	2.99	0.20	15	2.20	0.56	0.51	0.55	12.01	3.82	5	4	6	5	32
Bireuen	Pate Lhong	PL13	6.0	3.47	0.17	20	2.80	0.49	0.56	0.63	10.14	4.48	5	6	5	6	44
Bireuen	Pate Lhong	PL2	5.9	4.01	0.17	24	2.20	0.56	0.51	0.55	12.04	3.82	5	4	5	5	32
Bireuen	Paya Nie	PN 1	5.5	3.78	0.18	21	3.00	0.56	0.46	0.53	12.46	4.55	4	4	4	4	37
Bireuen	Paya Nie	PYN 2	5.3	3.47	0.16	22	2.08	0.52	0.66	0.53	11.84	3.79	4	6	4	4	32
Bireuen	Paya Nie	PYN 2	5.6	3.14	0.16	20	2.00	0.56	0.59	0.51	12.13	3.66	5	5	5	4	30
Bireuen	Peudada	PAD 25	5.4	4.00	0.19	21	2.00	0.54	0.76	0.63	12.24	3.93	4	6	5	5	32
Bireuen	Peudada	PAD D3	5.9	4.47	0.26	17	3.00	0.56	0.46	0.53	12.46	4.55	4	4	7	4	37
Bireuen	Samalanga	S6	5.9	3.32	0.19	17	2.50	0.61	0.45	0.55	11.55	4.11	5	4	5	5	36
Bireuen	Samalanga	S7	5.8	3.35	0.20	17	2.93	0.38	0.75	0.51	12.09	4.57	3	6	3	4	38
Pidie	Beuracan	Be C2 mix	5.5	3.07	0.16	19	1.80	0.44	0.36	0.43	9.55	3.03	5	4	9	5	32
Pidie	Beuracan	Be E2	5.6	3.40	0.16	21	1.90	0.52	0.60	0.46	10.22	3.48	5	6	7	5	34
Pidie	Beuracan	BE F3 mix	6.1	2.12	0.12	18	2.87	0.17	0.61	0.99	10.23	4.64	2	6	4	10	45
Pidie	Beuracan	Beuracan I	5.9	3.78	0.12	32	2.88	0.55	0.71	0.62	10.99	4.76	5	6	4	6	43
Pidie	Cubo Trienggading	CT C1 mix	5.4	2.40	0.11	22	1.90	0.62	0.60	0.66	10.01	3.78	6	6	7	7	38
Pidie	Cubo Trienggading	CT I1 mix	5.9	2.78	0.25	11	2.18	0.55	0.81	0.92	11.33	4.46	5	7	5	8	39
Pidie	Cubo Trienggading	CTA3 mix	6.0	2.45	0.15	16	2.12	0.19	0.59	0.76	10.01	3.66	2	6	3	8	37
Singkil	Parakan Sulampi	PS 1	5.0	3.12	0.17	18	2.47	0.48	0.61	0.50	12.12	4.06	4	5	16	4	33
Singkil	Sidorejo	SD A1	5.2	3.50	0.18	19	1.65	0.56	0.76	0.55	22.15	3.52	3	3	14	2	16
Singkil	Sidorejo	SD A1	5.0	3.57	0.16	22	2.14	0.56	0.56	0.42	20.33	3.68	3	3	21	2	18
Singkil	Sidorejo	SD B1	5.0	3.55	0.17	21	2.74	0.52	0.60	0.50	12.90	4.36	4	5	28	4	34
Singkil	Sidorejo	SD B1	5.0	3.77	0.19	20	2.00	0.57	0.66	0.54	18.90	3.77	3	3	17	3	20
Singkil	Tana Bara	TB 1	4.6	5.06	0.17	30	2.01	0.57	0.89	0.43	20.23	3.90	3	4	11	2	19
Singkil	Tana Bara	TB 2	4.5	4.44	0.17	26	2.22	0.57	0.66	0.40	24.23	3.85	2	3	9	2	16
Singkil	Ujung Bawang	IUB 1	5.9	4.00	0.19	21	2.88	0.57	0.71	0.62	10.29	4.78	6	7	9	6	46

Table 3.7 Location of the More Infertile Mineral Soils

Kabupaten	Scheme	Infertile Samples	Infertile Samples in Kabupaten	Number of Mineral Soils Analysed by Kabupaten	% of Total Samples with Noted Deficiencies
Bireuen	Pate Lhong Paya Nie Peudada Samalanga Pandrah	4 3 2 2 1	12	13	92
Aceh Utara	Krueng Tuan Pase Kiri Pase Kanan	3 3 2	8	13	62
Singkil	Siderojo Tana Bara Parakan Sulampi Ujung Bawang	4 2 1 1	8	9	89
Pidie	Beuracan Cubo Trienggading	4 3	7	8	88
Aceh Jaya	Alue Monmata Kreung Tunong Kreung Ateu	1 1 1	3	107	2.8
Aceh Timur	Julok Tunong	2	2	2	100
Aceh Besar		0		38	0

As most intensive irrigated agriculture exists on the north or east coast it is possible that this is the reason for the lower fertility level and most of the nutrients have been extracted by cropping and hence depleted. However, it is just possible that since the north and east coast received a less violent flood and that flood was often trapped for longer on the land more nutrients were leached out by the sea water. Whatever the cause or explanation of the "lower" fertility of these soils special attention must be paid to ensuring that adequate amounts of the appropriate fertilisers are employed as amendments to help get the soils back into agricultural production.

One nutrient that was not checked via soil analyses is phosphorus, neither Available-P nor Total-P was determined in the laboratory studies. However, most reports from farmers and field staff are that when the soil has apparently recovered there is vigorous vegetative growth – this could be an indication that levels of soil phosphorus are adequate since phosphorus is mainly responsible for root growth. However, reports from the field then indicate that after the vigorous vegetative grow there is no grain filling or fruit production – this is not likely to be due to lack of phosphorus but due to some of the possible deficiencies reported above. However, if after correcting the indicated deficiencies crops still fail to produce grain or fruit the possibility of micro-nutrient deficiencies should be investigated.

3.4.2 Use of Exchangeable Cation Ratios

In the data listed in Table 3.6 two features show relatively strongly – low levels of exchangeable calcium and magnesium. To further check this the Ca:Mg and Mg:K ratios, as defined by FAO, have been studied as a check on the possible deficiencies of either or both calcium and / or magnesium. The output of this study is presented in a series of tables in Appendix C and summarised in Table 3.8.

Table 3.8 Deficiencies in Mineral Soils by Kabupaten

	Number of Samples in each Kabupaten							
Deficiency	**Aceh Jaya**	**Aceh Besar**	**Bireuen**	**Aceh Utara**	**Pidie**	**Singkil**	**Aceh Timur**	**Totals**
Calcium	1	2		1	1			5
Slight calcium	4	2		3		1		10
Magnesium	3	1	8	6	4	4	2	28
Magnesium + possible Phosphorus	37	10	1	1	2			51
Slight magnesium	49	14	4	2	1	3		73
Potassium		3						3
Totals	94	32	13	13	8	8	2	**170**
Ratio of total samples	88%	84%	100%	100%	100%	89%	100%	**87%**

Tables 3.7 and 3.8 cannot be directly compared since 3.8 lists all the samples from the sites displaying some indication of a nutrient deficiency whilst 3.7 lists the most infertile samples from the various sites. However, study of the two tables makes it clear that there are nutrient deficiency problems in virtually all of the soil samples analysed with an overall 87% of the mineral samples indicating some deficiency.

The major plant nutrient that "triggers" a deficiency signal in most cases is magnesium and it is obvious that this possible problem must be addressed. Further soil sampling and laboratory analyses should be carried out and farmer field trials testing various applications of magnesium bearing fertilisers and composts should be designed and setup. A good research agronomist should be consulted in the design and there must be full integration with Dinas Pertanian staff in any such trials.

Although soil phosphorus (Avail-P) was not included in the soil analyses programme the ratio of Ca:Mg does often pinpoint a possible problem due to soil phosphorus being inhibited. There are over 50 samples where this has happened and the possibility of has been "flagged' and a deficiency of Avail-p should be considered. The explanation for or cause of inhibition of "P" is normally due to high levels of free carbonate in the soil when calcium phosphate forms and this compound is rather insoluble and hence the "P" becomes unavailable for plant growth. No data on free $CaCO_3$ levels in the soils are available but it is just vaguely possible that this possible deficiency occurs in areas with limestone geology. At this time the resources are just not available to check if this is the case or even possible. However, it is suspected that this "trigger" has activated simply because the magnesium level is so low in comparison to the calcium level – it is 20% lower than in the normal magnesium deficient samples.

3.5 Micro-Nutrients

Unfortunately, no micro-nutrient analyses were conducted on the samples under study and, with the lack of any obvious reasons for the failure of some soils to produce yields after showing strong vegetative growth, it must be considered a possibility that there might be some micro-nutrient deficiency.

However, a literature search suggested that micro-nutrient deficiency is rare when soil reaction is neutral to acidic – that is with pH <7 and, since the bulk of the soil samples tested have pH in this range, deficiency would not be expected. Availability is normally reduced when soil pH >8.0.

One phenomenon that has been raised in the tsunami area is that of rice showing strong vegetative growth then failing to produce a yield at all or only a much reduced yield. In a private communication (C.J.Hatten) ETESP was advised of a similar happening on peat soils used for padi and the reason was eventually established as due to micro-nutrient deficiency, notably copper. It is emphasised that this was on peat soils but the possibility of a deficiency should be investigated on the mineral soils in the NAD area since copper deficiency can be exacerbated by:

- Sandy soil textures – naturally have low levels of all nutrients
- High iron levels - can induce copper deficiency
- High zinc levels
- High Organic content, and
- High levels of soil phosphorus - reduces concentration of copper in roots and leaves and heavy application of phosphate fertilisers can induce copper deficiency

Sand contents of the NAD soils have, in many places, been increased by sandy sediment addition, ferrous iron levels are generally quite high, organic contents are relatively high in some soils but no data are available on zinc or phosphorus levels.

Micro-nutrient levels are better investigated via foliar analysis since there are so many interacting factors involved in the soil which can affect levels. For example, it is indicated that soil copper level is possibly affected by Nitrogen, Iron, Magnesium, Molybdenum, Phosphorus and Zinc. Also, soil deficiency levels are quoted in literature as ranging from 0.2 – 100 ppm depending on the extraction method used. Indicative ranges for foliar levels are much better documented and the following concentrations of copper would be expected in mature leaves:

- <4 ppm - deficient
- 5 – 20 ppm - sufficient
- >20 - excessive or toxic

3.6 Organic Soil Samples

3.6.1 Introduction

Study of the laboratory data for the peat soil samples actually reveals very little useful information as compared to the study of the mineral soil data. Several factors were plotted against each other but no or very few meaningful relationships were seen or imagined and hence very little data is presented in this section.

The peat soil samples were located in irrigation schemes in two kabupaten only – Singkil and Aceh Jaya with one scheme in Singkil and four in Aceh Jaya. Two tables are presented below:

- Table 3.9 presents the salinity and acidity data for the peat soils, whilst
- Table 3.10 presents the fertility data

3.6.2 Peat Soil Features

Data for the peat samples is presented in Tables 3.9 and 3.10; all the samples described as peat in origin are:

- Non-saline and non-sodic
- Strongly, very strongly and extremely acidic in reaction with pH ranging from 5.10 to 3.00
- Many of the samples have low level of Exchangeable-H^+ (<0.5 me/100g) three are moderately high (>0.5 and <2.0 me/100g) though one sample is coded as moderately high (colour code blue) and three are colour coded red with high levels (>5 me/100g)
- As would be expected in organic soils the exchangeable aluminium levels are not particularly high with five samples having moderate level (blue) and only two noted as having high level (red)r
- Four samples have extremely high levels of ferrous iron (blue) and three samples are considered to have what would be toxic levels of iron (red)
- Levels of sulphate are generally moderate to high but one sample is noted as having high level (blue) and two samples are considered to contain toxic levels (red)

The fertility status of peats soils is never easy to assess since there can be relatively high levels of several nutrients but features such as acidity render the soil an unsuitable medium for the growth of many plants.

- Organic carbon levels are high to very high and are coded blue and red respectively
- Over half the samples have low levels of nitrogen (blue code) whilst most of the others fall into the moderate class
- Due to the high organic levels more than half of the samples have unacceptable C:N ratios
- Generally levels of the exchangeable cations calcium and magnesium are low to very low and two samples also have low level of potassium
- Over half of the samples have low levels of total exchangeable bases (TEB) and generally the inherent fertility of the peat soils is extremely low with several base saturation (BS) levels below 35% (red) but three samples show normal BS levels of 79 – 83%

Table 3.9 Salinity and Acidity Data for the peat Soil Samples

Kabupaten	Scheme / Desa	Site No	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm
Singkil	Ujung Bawang	UB A4	1.05	4.30	4.00	0.30	0.35	1.55	320	360
Singkil	Ujung Bawang	UB A4	0.76	4.00	3.40	0.60	0.23	2.55	144	289
Singkil	Ujung Bawang	UB B5	1.05	4.30	4.00	0.30	0.35	2.12	251	368
Aceh Jaya	Alue Monmata	MO2 (PAM2)	0.30	5.10	4.30	0.80	0.13	0.26	23	74
Aceh Jaya	Kulam Asan	LBG1	0.34	4.00	3.60	0.40	4.04	0.56	8	140
Aceh Jaya	Rawa Krueng Itam	Gambut KH12	0.47	4.30	3.70	0.60	0.70	0.93	681	3534
Aceh Jaya	Rawa Krueng Itam	Gambut KH7	1.72	4.50	3.90	0.60	0.65	0.75	707	232
Aceh Jaya	Rawa Krueng Itam	KH12	0.30	4.00	3.50	0.50	5.19	0.30	55	200
Aceh Jaya	Seneubok Padang	Gambut RK 1	1.44	4.00	3.10	0.90	0.37	0.86	272	1466
Aceh Jaya	Seneubok Padang	Gambut SP C1	3.00	3.00	2.30	0.70	0.49	0.93	780	7198
Aceh Jaya	Seneubok Padang	SP 0 - 70 peat	1.18	4.10	3.50	0.60	0.80	0.24	232	829
Aceh Jaya	Seneubok Padang	SPC2 peat	0.40	4.10	3.50	0.60	5.42	0.22	23	321
Aceh Jaya	Seneubok Padang	SPJ2	0.35	4.10	3.40	0.70	6.22	0.32	76	126

As stated earlier no meaningful correlations could be established between the various data-items for the peat soils.

The best near-correlation was between organic matter level and the total exchangeable bases (TEB); this is shown in Figure 3.6.

Basically most of the samples show a straight / level line relationship but six samples do show an increase in TEB with percentage of organic matter.

Figure 3.6 Organic Carbon versus TEB for Peat Soils

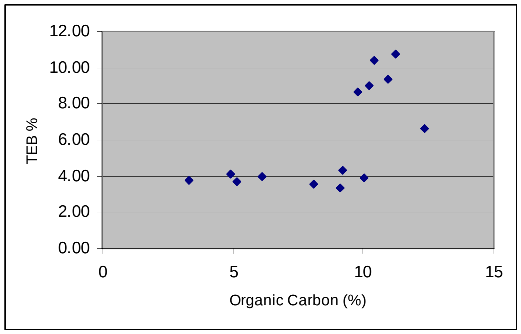


Table 3.10 Fertility Data for the Peat Soil Samples

Kabupaten	Scheme	Site No	Org C %	Total N %	C:N	meq / 100 Ca	meq / 100 Mg	meq / 100g K	meq / 100 Na	meq / 100 CEC	meq / 100 TEB	BS %
Singkil	Ujung Bawang	UB A4	10.01	0.18	56	2.00	0.59	0.89	0.43	30.33	3.91	13
Singkil	Ujung Bawang	UB A4	9.12	0.17	54	1.89	0.51	0.44	0.50	24.66	3.34	14
Singkil	Ujung Bawang	UB B5	8.12	0.19	43	1.99	0.59	0.67	0.34	42.76	3.59	8
Aceh Jaya	Alue Monmata	MO2 (PAM2)	12.34	0.22	56	4.76	1.30	0.39	0.19	22.49	6.64	30
Aceh Jaya	Kulam Asan	LBG1	4.90	0.15	33	2.12	0.67	0.57	0.77	24.21	4.13	17
Aceh Jaya	Rawa Krueng Itam	Gambut KH12	9.78	0.63	16	6.22	0.85	0.30	1.26	18.21	8.63	47
Aceh Jaya	Rawa Krueng Itam	Gambut KH7	10.93	0.65	17	7.06	1.00	0.40	0.91	18.85	9.37	50
Aceh Jaya	Rawa Krueng Itam	KH12	9.22	0.14	66	2.23	0.72	0.73	0.67	30.22	4.35	14
Aceh Jaya	Seneubok Padang	Gambut RK 1	11.26	0.66	17	6.56	2.24	0.78	1.13	13.64	10.71	79
Aceh Jaya	Seneubok Padang	Gambut SP C1	10.22	0.63	16	4.82	2.43	0.23	1.55	10.84	9.03	83
Aceh Jaya	Seneubok Padang	SP 0 - 70 peat	10.41	0.64	16	6.29	2.45	0.28	1.35	13.08	10.37	79
Aceh Jaya	Seneubok Padang	SPC2 peat	6.12	0.12	51	2.04	0.78	0.57	0.58	24.35	3.97	16
Aceh Jaya	Seneubok Padang	SPJ2	5.14	0.18	29	2.05	0.55	0.56	0.51	20.31	3.67	18

4. CONCLUSIONS and RECOMMENDATIONS

4.1 Soil Salinity

As stated in the original ETESP Labdata report it would appear as though the soils of Aceh Utara were more heavily salinised than the other areas with an overall average EC (Electrical Conductivity) value of almost 2.3 dS/m whilst Singkil was the least effected with an average of just over 0.8 dS/m. This is a direct north south relationship and the level of precipitation is the most likely explanation. Aceh Utara, at the eastern end of the north coast has annual precipitation of about 1,365 mm (ETESP Report “Annual & Monthly Rainfall”, October 2005) whilst Aceh Singkil has about double that amount since it is located south of Aceh Barat Daya (3,300 mm) and in line with Simeulue (3,000+ mm) However, the important thing is that the salinities are negligible and no or very little lasting effect on the land should ensue – assuming there is active soil drainage and either very high rainfall and / or irrigation water to leach the salts out of the soil and into the drainage system, which would then remove the saline leachate from the site (ETESP “Executive Summary”, December 2005).

Before any plans are made to install reclamation programmes it needs to be established just when the samples were taken for measurement of salinity. Recent work (“Executive Summary” 205) by ETESP in Aceh Besar, Pidie and Bireuen has shown that the salinity status of many soils has changed in the year following the tsunami – some have become more saline whilst others have reduced through leaching and the presence of even minimal drainage system. In the individual summaries of the schemes in the original ETESP “Labdata” report (ETESP March 2005) it is stated that salinity needs to be re-measured after any civil engineering works to rehabilitate or build new irrigation and drainage systems. Any reclamation leaching would then be designed based on the most recent data available. The likelihood is that well managed water application under normal irrigation will remove the residual salinity and no programme of reclamation leaching will be required except in areas have become significantly more saline since the samples were taken by Lotti; such sites could be found in then situation as described as Scenario 4 in ETESP Scenarios update March 2006.

No further study of salinity has been done in this current report.

Table 4.1 Overall Salinity in the Areas Studied - decreasing sort order

	ACEH UTARA	BIREUEN	ACEH JAYA	ACEH TIMUR	PIDIE	ACEH BESAR	SINGKIL
Salinity	2.28 dS/m	2.01 dS/m	1.64 dS/m	1.31 dS/m	1.06 dS/m	0.99 dS/m	0.8.2 dS/m
Salinity Class	SC1 Very slightly saline	SC1 Very slightly saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline	SC1 Non-saline
Rainfall	1,365	1,613	2,649	2,222	1,889	1,668	3,000+
Irrigation	Little	Fairly extensive	Little	Little	Fairly extensive	Little	No

Note: SC – Salinity Class, refer ETESP Soil Salinity & Improvement Mobilisation Report, November 2005
Note: The salinity figures refer to areas inundated by the tsunami and subject of salinity survey

4.2 Soil Sodicity

There does not seem to be a soil sodicity problem since only about 10 - 11% of the mineral soil samples collected in the irrigation schemes study proved to be ‘sodic’ – that is with ESP (Exchangeable Sodium Percent) >15%. One scheme which may have a problem is Kreung Ateu in Aceh Jaya since it proved to have several sites with sodic soils. The distribution of ESP levels is shown in Table 4.2 which is sorted in increasing number of sites sampled.

Table 4.2 Distribution of ESP Levels of Mineral Soils

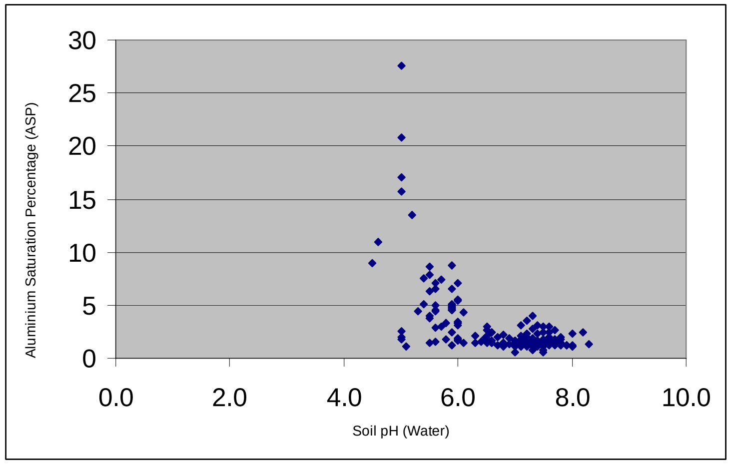
Kabupaten	Non-sodic		Very Slightly Sodic		Slightly Sodic		Sodic		Total samples	% of Total Samples in Kabupaten
	ESP <5%		ESP 5 – 9%		ESP 10 – 15%		ESP 15 – 20%			
	No	%	No	%	No	%	No	%		
Aceh Timur	0	0	2	100	0	0	0	0	2	1
Singkil	7	88	1	13	0	0	0	0	8	5
Pidie	0	0	8	89	1	11	0	0	9	5
Aceh Utara	1	8	12	92	0	0	0	0	13	8
Bireuen	5	38	7	54	0	0	1	8	13	8
Aceh Besar	0	0	13	41	13	41	6	19	32	19
Aceh Jaya	1	1	33	35	48	51	12	13	94	55

Aceh Timur, Singkil, Pidie and Aceh Utara show no sodic samples at all though Pidie and Aceh Utara have a few of the sites with very slight or low levels of ESP. Bireuen has one sodic site with the rest showing very low levels of ESP. Aceh Besar and Aceh Jaya have 19 and 13% respectively of the sampled sites noted as sodic whilst over 60% of the samples taken in these areas have ESP levels greater than 10%.

Only four of the sites were saline-sodic and normal, well managed irrigated agriculture with adequate leaching fraction should overcome the problem without any need for special amendments. The other sodic sites could prove to be slightly more difficult to reclaim since they are classified as non-saline sodic and care should be taken to ensure that the situation is not made worse by totally leaching out the residual salinity without addition of sources of calcium, or magnesium, to replace the sodium. The normal amendment would be the incorporation of gypsum ($CaSO_4$) into the soil before leaching. In the worst case scenario soil dispersion could occur if all the basic cations of calcium and magnesium are leached out and replaced with sodium but this is most unlikely in the existing situation.

4.3 Soil Acidity

Figure 4.1 Soil pH (water) Versus ASP- Mineral Soils



There is not a large soil acidity problem in the mineral soils investigated and, as shown in Figure 4.1 there are not many samples where soil reaction fell below about pH 5.5.

The norm is that aluminium saturation percentage (ASP) increases dramatically in mineral soils when the soil pH (water) falls to about 5.5. As can be seen in Figure 4.1, this relationship holds true for the data being examined since the ASP increases from around 5% up to about 28% once pH falls below 6, but the number of samples where this happens is very few.

Very high values of ASP were not encountered and though the value of 28% is rated as “high” only 6 samples out of the total exceed ASP of 10%. Only 3.6% of the total mineral soil samples have an ASP level of moderate or worse - 10% ASP being the lower limit of the moderate class of ASP. This indicates that there is NOT a problem with exchangeable aluminium in the mineral soils, which would be expected since these soils are basically non-hill soils, normally flooded and used for padi cultivation. The relatively low number of low pH (acidic) soils, plus no correlation between soil pH and sulphate levels, suggests that overall there is not an overall acidity problem.

4.4 Soil Fertility

Inherent, or existing, soil fertility is the natural fertility of the soil as it is found in the field before any amendments, in the form of fertilisers or manures, are added and it is determined from the laboratory analyses as reported by Lotti by using the base saturation (BS%). Inherent fertility must not be confused with fertility potential or how well the soil can hold any added nutrients – fertility potential is assessed using the cation exchange capacity (CEC).

For the purposes of this exercise soil samples with a BS of less than 50% are considered to have poor inherent fertility, if BS is less than 35% the status is noted as very poor and basically only the soil with poor and very poor inherent fertility soils are discussed here.

There do seem to be fertility problems with the soils investigated – mineral and peat soils. Of the 190 odd samples of mineral soil analysed 40 of them indicate soils with poor or very poor inherent fertility. The infertility problem appears to be worst along the north coast but much less so in Aceh Jaya on the west coast. Of the soils sampled in Aceh Timur 100% were infertile, 92% in Bireuen, followed by Pidie 88%, and Aceh Utara 62%. In Aceh Singkil on the lower west coast 89% of samples were infertile.

The reason for the various infertilities has not been established but the following possibilities are presented for consideration:

- Through over-use and inadequate fertilisation / manuring the soil nutrient levels in the most heavily exploited soils could have been depleted – if this is the case carefully designed fertiliser packages have to be compiled and applied
- The soils might always have had poor inherent fertility level and could be associated with the parent material from which the soils were formed. Study of the geological map might give some clues to the pattern as might study of any archival soil data that can be located
- Lower inherent fertility is more easily explained in the very high rainfall areas since the high level of precipitation tends to leach-out the more soluble nutrients leaving the soils infertile

Overall the more infertile mineral soils had the following features:

- Soil reaction or pH – very strongly and extremely acid soil reaction, about 50% of the low inherent fertility soils have acidity problems
- Organic-C (organic matter) – the organic matter content of these suspect soils would appear to be normal with no samples having low / very low or excessively high levels of organic carbon
- Total-N (Nitrogen) – virtually all of the inherently infertile soils have low level of total nitrogen but only one sample has a very low level. Obviously all of these soils require nitrogenous fertiliser – either mineral or via composts
- C:N ratio – the low levels of nitrogen reported are reflected in the poor C:N ratio and, again, this will be improved with addition of nitrogenous material
- Exchangeable Calcium – most of the samples show low levels of exchangeable calcium and a few show very low levels. Addition of superphosphate fertiliser would add calcium as would organic manures and liming materials or gypsum. Gypsum might be added in some cases if the soil required “cleaning-up” and the removal of sodium from the exchange complex
- Exchangeable Magnesium – virtually every sample in this subset shows low to very low levels of exchangeable magnesium. Magnesium could be added as a magnesium-rich mineral fertiliser or supplied via the application of dolomitic limestone if an amendment for acidity has to be applied
- Exchangeable Potassium – levels of this nutrient appear to be acceptable and no specific requirement can be seen for any special fertiliser application
- Exchangeable Sodium – none of the samples show low or very low levels of exchangeable sodium, which is to be expected in the present situation post-tsunami. However, one or two samples do contain high to very high levels
- Cation Exchange capacity (CEC) – this is included to allow cross checking but CEC does not come into the inherent fertility scenario. However, if the low inherent fertility soils have low or very low CEC improving their fertility status is more difficult as added nutrients can be easily lost via leaching from irrigation or rainfall
- Total Exchangeable Bases (TEB) – this is the sum of Exch-Ca, Exch-Mg, Exch-K plus Exch-Na and virtually all of the samples are highlighted as having low TEB and even some very low levels were noted
- Aluminium Saturation Percent – ASP can be a problem but only a few of these samples are noted as having anything like excessive values. Generally the ASP problem vanishes or diminishes greatly once a soil is flooded
- Exchangeable Sodium Percent – none of these poorly fertile soils have excessive exchangeable sodium since sodic soils are normally slightly alkaline to alkaline and all of these soils are acidic to some degree
- Base Saturation – this is the main measure used to determine inherent fertility and the starting point in this exercise and levels in these samples were low to very low

Table 4.2 Deficiencies in Mineral Soils by Kabupaten

	Number of Samples in each Kabupaten							
Deficiency	**Aceh Jaya**	**Aceh Besar**	**Bireuen**	**Aceh Utara**	**Pidie**	**Singkil**	**Aceh Timur**	**Totals**
Calcium	1	2		1	1			5
Slight calcium	4	2		3		1		10
Magnesium	3	1	8	6	4	4	2	28
Magnesium + possible Phosphorus	37	10	1	1	2			51
Slight magnesium	49	14	4	2	1	3		73
Potassium		3						3
Totals	94	32	13	13	8	8	2	**170**
Ratio of total samples	88%	84%	100%	100%	100%	89%	100%	**87%**

The total number of mineral soil samples analysed was 193 but several with suspect data have been excluded

Attempts were made to identify actual deficiencies and overall it is concluded that there is a problem with levels of magnesium. As can be seen Table 4.2, between 80 – 100% of the soils analysed had some deficiency indicated. It is obvious that soil analytical data should be made use of before applying fertilisers to ensure the “possible” deficiencies are rectified in the various locations. A blanket cover of a standard fertiliser packet is not recommended. In most cases magnesium would appear to be deficient.

On some peat soils used for wetland rice production (C.J. Hatten, private communication) where rice has often grown fairly well but produced very little grain the failure has been attributed to trace element - notably copper - deficiency. There are difficulties in applying the trace element cocktail to the soil (fixation, etc) and foliar spraying is a specialist subject. The micro-nutrient status of the NAD soils should possibly be investigated.

4.5 Micro Nutrients

It is suggested that micro nutrient status should be investigated and that foliar rather than soil analyses should be employed.

4.6 Organic Soils

Of the 193 original samples taken there were 13 classified as peats and all the samples described as peat in origin are:

- Non-saline and non-sodic (Refer Table 3.9)
- Strongly, very strongly and extremely acidic in reaction with pH ranging from 5.10 to 3.00
- Most of the samples have a low level of Exchangeable-H^+ (<0.5 me/100g) three are moderately high (>0.5 - <2.0 me/100g) though one sample is coded as high (2 – 5 me/100g) and three have very high levels (>5 me/100g)
- As would be expected in organic soils the exchangeable aluminium levels are not particularly high since aluminium is sourced in mineral materials and forms a complex with organic material and is taken out-of-play. Five samples have moderate level and only two noted as having high levels of Exch Al^{3+}
- Four samples have extremely high levels of ferrous iron and three samples are considered to have what would be toxic levels of iron
- Levels of sulphate are generally moderate to high but one sample is noted as having high level and two samples are considered to contain toxic levels

The fertility status of peats soils is never easy to assess since there can be relatively high levels of several nutrients but features such as acidity render the soil an unsuitable medium for the growth of many plants.

- Organic carbon levels are high to very high
- Slightly over half the samples have low levels of nitrogen whilst most of the others fall into the moderate class
- Due to the high organic carbon levels more than half of the samples have unacceptable C:N ratios
- Generally the levels of the exchangeable cations calcium (Ca^{2+}) and magnesium(Mg^+) are low to very low and two samples also have low level of potassium (K^+)
- Over half of the samples have low levels of total exchangeable bases (TEB) and generally the inherent fertility of the peat soils is extremely low with several base saturation (BS) levels below 35% but three samples show normal BS levels of 79 – 83%

Tropical peats (unlike many temperate peat soils) have major problems of development. The consensus is that where more than 1.5 - 2m of peat materials overlie mineral material they should not be touched and certainly not used for smallholder management. Where peats are shallower there are better possibilities for wetland development, but with very careful management.

The two major problems of tropical peat are the much higher water contents and the generally much lower mineral content. The tropical climate also leads to much accelerated oxidation of the peat if the peat is drained. (If there was system of carbon taxation & credits applied internationally then no peat soils would be used for agriculture as peat oxidation and CO_2 production is so enormous).

Where peat has been used for wetland rice production the rice has often grown fairly well <u>but produced very little grain</u>. This has been attributed to trace element - notably copper - deficiency. There are difficulties in applying the trace element cocktail to peat soil (fixation, etc) and foliar spraying is a specialist subject.

Where peat material overlies riverine alluvium - and particular where it is intermixed with alluvial lenses - then there are better possibilities for successful agricultural development due to the mineral content.

Shallow peats have been successfully developed for oil palm and coconut production in Malaysia under very good estate management. But the economics of this can be very marginal, and such areas are the first to be abandoned when market conditions become difficult. Oil palm would generally be planted in holes excavated in the peat to help ensure that the roots reach the mineral soil more easily.

Table 4.3 Summary of Possible Deficiencies

Deficiency	Samples	Value	S %	Si %	C %	EC dS/m	pH H2O	Exch H	Exch Al	Fe ppm	SO_4 ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturation Percentages Ca Sat%	Mg Sat%	K Sat%	Al Sat%	Na Sat%	BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
Calcium		Mean	53	32	18	1.84	6.7	0.21	0.35	104	146	2.78	0.20	17	1.24	5.58	18.85	0.97	12.19	26.64	10	44	136	3	8	198	0.22	Ca deficient	6.44	OK
	5	Max	91	57	32	2.18	8.0	0.33	0.52	228	279	6.47	0.30	40	2.13	9.06	92.00	1.90	14.20	104.24	18	65	662	5	13	750	0.32		11.16	
		Min	23	6	3	1.40	5.0	0.02	0.18	18	22	1.01	0.08	3	0.35	1.52	0.23	0.53	10.81	2.87	3	14	2	2	5	27	0.14		0.10	
Calcium		Mean	57	27	24	1.12	6.6	0.25	0.51	58	182	3.10	0.21	15	4.70	2.04	0.55	1.30	13.20	8.59	37	17	4	3	10	68	2.35	Ca sli deficient	5.73	OK
(Slight)	**10**	Max	92	48	45	2.60	7.4	0.43	3.00	154	430	5.53	0.42	20	8.05	2.69	0.93	2.36	22.15	13.30	52	23	8	14	15	91	2.99		13.45	
		Min	10	2	3	0.35	5.2	0.15	0.16	14	23	1.41	0.14	7	1.65	0.56	0.20	0.55	10.19	3.52	7	3	1	1	2	16	1.00		0.74	
Magnesium		Mean	54	21	26	1.88	7.0	0.22	0.23	66	282	2.03	0.23	9	8.14	0.88	0.49	1.24	12.60	10.76	64	7	4	2	10	85	10.01	Mg deficient with P inhibition	2.40	Mg sli deficient
+ possible Pinhibition	**51**	Max	97	61	69	8.40	7.9	0.78	0.56	405	2931	5.77	0.46	18	10.95	1.46	1.49	2.94	16.54	15.32	82	10	10	5	18	100	22.23		9.86	
		Min	4	0	1	0.10	5.0	0.01	0.16	2	14	0.31	0.08	3	2.12	0.17	0.11	0.39	8.75	3.66	21	2	1	1	4	37	7.15		0.28	
Magnesium		Mean	50	22	28	1.45	6.6	0.23	0.48	77	216	2.51	0.20	14	6.14	1.08	0.56	1.23	13.12	9.02	47	8	4	4	9	69	5.42	Mg sli deficient	2.83	Mg sli deficient
(Slight to deficient)	**100**	Max	95	74	73	13.64	8.0	1.02	4.22	339	1594	6.60	1.00	33	10.83	1.97	1.23	3.07	36.13	15.98	72	14	11	28	20	100	7.08		17.00	
		Min	2	0	1	0.20	4.5	0.01	0.09	2	3	0.21	0.08	1	1.80	0.44	0.09	0.40	9.04	3.03	9	2	1	0	2	16	3.06		0.51	
Potassium		Mean	66	12	22	0.37	7.5	0.02	0.19	10	111	0.71	0.12	6	8.06	2.07	0.19	1.06	12.74	11.38	63	16	1	2	8	89	4.03	OK	11.23	K sli deficient
(Slight)	**3**	Max	84	23	29	0.58	7.7	0.03	0.22	22	271	0.81	0.15	7	9.40	2.74	0.26	1.29	14.67	13.52	68	19	2	2	10	92	4.84		11.69	
		Min	48	2	13	0.14	7.3	0.01	0.17	3	2	0.56	0.08	5	7.35	1.52	0.13	0.77	10.81	9.77	58	14	1	1	7	85	3.43		10.54	
Peat Soils		Mean				0.93	4.21	1.80	1.00	263	1093	8.63	0.34	35	3.72	1.09	0.54	0.77	22.22	6.11	21	7	3	5	5	35	3.75	OK	2.77	Mg sli deficient
	14	Max				3.00	5.10	6.22	2.55	780	7198	12.34	0.66	66	7.06	2.45	0.89	1.55	42.76	10.71	48	22	6	14	14	83	7.32		10.57	
		Min				0.30	3.00	0.13	0.22	8	74	3.31	0.12	16	1.89	0.51	0.23	0.19	10.84	3.34	5	1	2	1	1	8	1.98		0.66	

Appendix A Coordination Meeting with AusAID and ACIAR

Place: BPTP Offices, Banda Aceh

Date: 28th March 2006

Purpose: Brain-storming and pooling of ideas and activities focusing on possible interventions in post-tsunami NAD west coast areas to assist re-establishing farming

Participants: Dr Ian Willett, Research Programme Manager, ACIAR, Canberra
Dr Chris Smith, CSIRO Land and Water Scientist, Canberra
Dr Achmad Rachman, Director, Indonesian Soil Research institute, Bogor
Mr David Ellis, CSIRO Land and Water Scientist, Adelaide
Dr Peter Slavich, NSW DPI Scientist, Alstonville (ACIAR Team Leader for NAD Salinity Project)

Helmut Krist, Aceh Rehabilitation & Reconstruction Programme, GTZ
Tan Bok Than, Agricultural Economist, ETESP Agriculture
Austin Hutcheon, Soil Desalinisation & Improvement, ETESP Agriculture

Various BPTP staff and NGO representatives including Mercy Corp

Points Discussed:

1. ETESP missed some of the presentation of the existing ACIAR project carried out in NAD on the north and east coasts, this was the EM38 salinity survey. ETESP has utilised the data from this survey and the ACIAR staff were pleased that we had done so

2. Currently ACIAR were re-equipping the soils laboratory at BPTP and offering further training to the staff with the promise that the laboratory would be able to meet any requirements in the NAD area for soil analyses

3. Pak Tan presented a brief outline of what ETESP Agriculture was doing and hoped to do, but there was no opportunity to raise the question of "livestock" as was hoped since the team was composed of researchers only

4. Austin Hutcheon gave a brief summary of what he had achieved, the conclusions reached and the outputs compiled as a result of ETESP soils and land studies. Basically the ACIAR team had no more ideas than ETESP already has concerning land drainage and soil improvement but the ACIAR team:

   - had not considered the negative effects of housing IDPs in barracks away from their land or villages
   - did appreciate the need to consider the wider (downstream) effects of any drainage rehabilitation that was attempted
   - did appreciate that in some places the land had been improved as a result of deposition of material by the tsunami as well as problems caused by the sandier deposits
   - appreciated that farmers were already monitoring the status of their land and its recovery status by keeping a close note on natural vegetative growth
   - made note of the comment that in some west coast areas Dinas Pertanian did NOT want more research done unless they were actively involved as previous researchers did not supply any feedback
   -

5. Lengthy discussions then took place around the subject of land recovery, fertility and the fact that some crops grew very well in the vegetative stages but totally failed to produce any grain or fruit. The causes for this situation could be:

   - Some continuing level of salinity
   - Nutrient imbalances and / or deficiencies

6. ETESP pointed out that all laboratory data manipulation and analyses carried out by ETESP to date indicated a possible deficiency of magnesium (Mg) in the various soils. ACIAR responded that this seemed strange since sea water contains relatively large amounts of Mg and that marine deposits should / could be quite well supplied with Mg. Points to consider arising from the above include:

   - ETESP has concluded that generally there are not many "marine" deposits; what came from the sea was mainly sand deposits and sands would not have had much Mg, or any other nutrient or element, absorbed or adsorbed in/ on them. Most finer textured deposits comprise redistributed topsoils

   - Has anyone actually tested the sea-water off the NAD area? What are the contents of the various dissolved salts? Perhaps the main salt really is sodium (chloride) and salinisation of the soils came from the infiltration of the sea-water and very little salinisation came from the sediments – since the sediments were mainly redistributed topsoils relocated by the tsunami flood

- If the main salt is / was Na then the infiltration of the sea flood-water would have led to most of the exchangeable plant nutrients (Ca, Mg and K) being replaced on the exchange complex by Na leaving a saline soil and leaching out the Ca, Mg and K as well as other, soluble nutrients such as nitrogen and phosphorus

- Does any agency have a collection of pre-tsunami soil analytical data that can be sued as a "bench-mark" to allow comparison with the situation post-tsunami? All the analyses that ETESP have checked (refer ETESP Labdata Summary, interpretation of Laboratory data for ETESP irrigation Component) have been passed over to the ACIAR team so they could, if they so wish, start compiling a pre and post-tsunami database to try and establish if there is now a obvious nutrient problem

- In some areas, where cropping has resumed, yields are already restored to close to pre-tsunami levels suggesting there is no obvious, major problem with the macro nutrients. However, if in some areas where desalinisation has been achieved the yields do not recover and study of the analytical data suggest few or no macro-nutrient problems then some investigations should be taken and micro-nutrient levels should be studied

- In the light of a study of the post-tsunami fertility status and levels of nutrients there is every case for the fertiliser recommendations that are currently in place to be reviewed to ensure all the necessary nutrients are included. However, care must be taken when dealing with the west coast especially if there is a need to change from wetland (padi) to dryland (palawija etc) cropping since the west coast soils (particularly upland soils and low lying soils derived from the uplands) have a known acidity problem which develops as the soils dry and pH falls and Aluminium saturation percentage increases. Fertilisers that acidify the soil must be applied only where there is no risk of natural soil acidification.

After the meeting ETESP Agriculture discussed with ACIAR team members what had been done and compiled by ETESP to date and digital copies of all reports and manipulated data were left with the team for use in planning and on future studies that may undertaken by ACIAR. This includes the ETESP Agriculture "Scenarios", Aceh Besar, Pidie and Bireuen Kabupaten and Banda Aceh Kota reports that utilised the ACIAR data and ETESP land reclamation tools etc.

Appendix B Data Collation Tables

Table B.1 ETESP LabData Collation – Aceh Besar

Location: Sumatra

Add Date in WHITE boxes by Sample or Horizon

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Depth From	Range To	S %	Si %	C %	Lab Texture	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm	Avail P ppm	Avail K ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturations Mg Sat%	K Sat%	ASP Al Sat%	ESP Na Sat%	Base BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
Aceh Besar	Blang Luas	BLG 13	O	ND		66	11	23	SCL	0.14	7.3	6.4	0.90	0.02	0.18	2.8	2.2			0.56	0.08	7	7.35	1.52	0.13	0.77	10.81	9.77	14	1	2	7	90	4.84	OK	11.69	K sli deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Defic	ND			V Low	V Low	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Blang Luas	BLG 13	D	ND		83	1	16	SL	0.20	7.4	6.6	0.80	0.03	0.16	20.8	5.4			0.53	0.09	6	6.5	1.11	0.09	0.7	9.59	8.40	12	1	2	7	88	5.86	Mg sli deficient	12.33	K deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	ND			V Low	V Low	Mod	Mod	Low	V Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Blang Luas	BLDO 3B	D	30 -		71	13	16	SL	0.20	6.9	5.7	1.20	0.02	0.18	75.7	14			2.49	0.24	10	8.73	1.7	0.1	0.86	13.16	11.39	13	1	1	7	87	5.14	Mg sli deficient	17.00	K deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	High	V Defic			Mod	Mod	Good	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL Q5	D	50 -		18	11	71	SiCL	0.29	8.0	7.4	0.60	0.02	0.18	4.7	3			2.8	0.15	19	10.83	1.72	0.36	3.07	16.58	15.98	10	2	1	19	96	6.30	Mg sli deficient	4.78	OK
				Rating						Non Sal	Sli Alk	ND	ND	V Low	V Low	Mod / OK	ND			Mod	Low	Mod	High	Mod	Mod	V High	Mod	High	ND	V Low	V Low	Sodic	V High				
Aceh Besar	Krueng Kala	KKD 4	D	ND		91	1	9	S	0.30	7.5	6.4	1.10	0.03	0.16	23.6	74.2			0.60	0.09	7	7.76	1.3	0.19	0.91	12.62	10.16	10	2	1	7	81	5.97	Mg sli deficient	6.84	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Low			Low	V Low	Mod	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Kala	KK F2	D	0	12	84	12	4	LS	0.32	7.5	6.4	1.10	0.03	0.16	23	74			1.34	0.09	15	7.76	1.3	0.39	0.91	12.49	10.36	10	3	1	7	83	5.97	Mg sli deficient	3.33	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Low			Mod	V Low	Good	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL O5	O	0	15	11	40	49	SiC	0.34	7.8	7.0	0.80	0.22	0.18	11	32.1			1.38	0.16	9	9.36	1.08	0.62	1.63	12.70	12.69	9	5	1	13	100	8.67	Mg deficient with P inhibition	1.74	Mg deficient
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Defic			Mod	Low	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Blang Luas	BLA 8	D	0	20	97	1	3	S	0.35	7.6	6.7	0.90	0.19	0.20	14.6	234.1			0.42	0.11	4	6.23	0.72	0.13	0.97	10.18	8.05	7	1	2	10	79	8.65	Mg deficient with P inhibition	5.54	OK
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Mod / OK	Mod			V Low	Low	V Poor	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	High				
Aceh Besar	Krueng Geupeu	KG I 2B	D	ND		62	20	18	SL	0.35	6.4	5.2	1.20	0.22	0.18	122.2	23.3			3.57	0.18	20	5.05	2.55	0.26	1.10	11.60	8.96	22	2	2	9	77	1.98	Ca sli deficient	9.81	OK
				Rating						Non Sal	Sli Acid	ND	ND	Low	V Low	V High	V Defic			High	Low	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	High				
Aceh Besar	Krueng Kala	KKE 10	D	ND		87	4	9	LS	0.35	7.7	6.5	1.20	0.23	0.16	11.8	160.1			0.41	0.14	3	7.09	1.06	0.57	1.34	11.90	10.06	9	5	1	11	85	6.69	Mg sli deficient	1.86	Mg deficient
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Mod			V Low	Low	V Poor	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Blang Luas	BL A2	D	0	40	82	4	14	LS	0.36	8.0	8.0	0.00	0.23	0.18	6.8	128.5			1.44	0.13	11	9.66	1.43	0.34	2.2	14.61	13.63	10	2	1	15	93	6.76	Mg sli deficient	4.21	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Good	Mod	Low	Mod	V High	Low	Mod	V Low	V Low	V Low	Mod-sodic	V High				
Aceh Besar	Blang Luas	BLH 20	D	0	10	84	2	13	LS	0.39	7.7	6.9	0.80	0.01	0.22	3.7	270.7			0.76	0.13	6	7.44	1.95	0.17	1.29	12.75	10.85	15	1	2	10	85	3.82	OK	11.47	K sli deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Defic	Mod			Low	Low	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GLK1	D	0	10	90	1	10	S	0.40	7.9	6.7	1.20	0.04	0.16	5.1	234.7			0.50	0.08	6	9.93	1.06	0.28	1.6	13.62	12.87	8	2	1	12	94	9.37	Mg deficient with P inhibition	3.79	OK
				Rating						Non Sal	Sli Alk	ND	ND	V Low	V Low	Mod / OK	Mod			V Low	V Low	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Blang Luas	BL A2	O	40 -		63	3	34	SCL	0.47	7.5	5.6	1.90	0.23	0.19	4.7	83.8			1.8	0.22	8	8.85	0.8	0.34	1.49	11.61	11.48	7	3	2	13	99	11.06	Mg deficient with P inhibition	2.35	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Low			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Blang Luas	BLDO 3A	D	0	30	90	1	10	S	0.47	7.8	6.9	0.90	0.23	0.16	4.7	239.3			0.26	0.08	3	8.49	1.26	0.19	1.19	12.72	11.13	10	1	1	9	88	6.74	Mg sli deficient	6.63	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Mod			V Low	V Low	V Poor	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Blang Luas	BLA 8	O	20 -		62	1	38	SCL	0.52	7.1	6.5	0.60	0.23	0.17	107.8	97.2			1.70	0.12	14	6.04	1.03	0.29	1.39	9.69	8.75	11	3	2	14	90	5.86	Mg sli deficient	3.55	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	V High	Low			Mod	Low	Good	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GLK1	O	10 -		48	23	29	SCL	0.58	7.4	6.1	1.30	0.03	0.17	22.4	58.9			0.81	0.15	5	9.4	2.74	0.26	1.12	14.67	13.52	19	2	1	8	92	3.43	OK	10.54	K sli deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Low			Low	Low	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL Q5	D	0	50	74	17	9	SL	0.59	7.5	6.8	0.70	0.01	0.39	3.5	318.6			2.62	0.23	11	9.36	1.31	0.6	2.94	16.33	14.21	8	4	2	18	87	7.15	Mg deficient with P inhibition	2.18	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Defic	Mod			Mod	Mod	Good	Mod	Low	High	V High	Mod	Mod	V Low	V Low	V Low	Sodic	V High				
Aceh Besar	Blang Luas	BLH 20	O	10 -		11	45	45	SiC	0.61	7.1	6.2	0.90	0.24	0.17	19.6	45.1			4.64	0.42	11	8.05	2.69	0.2	2.36	15.85	13.30	17	1	1	15	84	2.99	Ca sli deficient	13.45	K deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	V Low			High	Mod	Good	Mod	Mod	Low	V High	Mod	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL H2	D	0	17	90	6	3	S	0.66	7.3	6.5	0.80	0.05	0.17	25	88			0.78	0.08	10	7.72	1.09	0.29	1.37	12.23	10.47	9	2	1	11	86	7.08	Mg deficient	3.76	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod High	Low			Low	V Low	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GLA6	D	0	25	91	2	7	S	0.66	7.6	6.5	1.10	0.03	0.17	5.1	266.3			0.31	0.08	4	7.92	1.09	0.29	1.37	12.23	10.67	9	2	1	11	87	7.27	Mg deficient with P inhibition	3.76	OK
				Rating						Non Sal	Sli Alk	ND	ND	V Low	V Low	Mod / OK	Mod			V Low	V Low	V Poor	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Krueng Kala	KKE 10	O	ND		18	48	34	SiC	0.84	7.3	6.6	0.70	0.02	0.17	75.9	166.2			0.80	0.15	5	6.04	0.97	0.29	2.1	11.54	9.40	8	3	1	18	81	6.23	Mg sli deficient	3.34	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	High	Mod			Low	Low	Mod	Mod	Low	Low	V High	Low	Mod	V Low	V Low	V Low	Sodic	V High				
Aceh Besar	Krueng Geupeu	KG C3	O	22 -		23	32	45	C	0.90	7.2	6.1	1.10	0.03	0.17	22	59			0.13	0.35	0	8.4	1.74	0.26	1.12	13.67	11.52	13	2	1	8	84	4.83	OK	6.69	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Low			V Low	Mod	Ext Poor	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Kala	KKD 4	O	ND		33	27	40	CL	0.90	7.3	6.5	0.80	0.02	0.19	118.8	165.9			2.56	0.22	12	6.54	1.37	0.44	0.84	13.67	9.19	10	3	1	6	67	4.77	OK	3.11	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	V High	Mod			Mod	Mod	Good	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	High				
Aceh Besar	Geunteut Lamsujen	GL O5	O	15		53	18	29	SCL	0.95	7.7	6.9	0.80	0.17	0.21	22.9	53.1			0.46	0.18	3	8.89	1.08	0.63	1.21	12.99	11.81	8	5	2	9	91	8.23	Mg deficient with P inhibition	1.71	Mg deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Mod / OK	Low			V Low	Low	V Poor	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Kala	KK F2	O	ND		14	35	51	C	0.95	7.3	6.4	0.90	0.02	0.19	78	165			2.61	0.22	12	6.64	1.37	0.54	0.84	11.96	9.39	11	5	2	7	79	4.85	OK	2.54	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	High	Mod			Mod	Mod	Good	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	High				
Aceh Besar	Krueng Geupeu	KGC4	D	0	28	93	7	1	S	1.02	7.5	6.3	1.20	0.23	0.17	12.3	400.4			0.96	0.12	8	7.63	1.70	0.36	1.71	13.64	11.40	12	3	1	13	84	4.49	OK	4.72	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Low	Low	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Krueng Geupeu	KGC4	D	28		27	16	56	CL	1.09	7.1	6.2	0.90	0.05	0.16	12.1	97.3			3.22	0.38	8	6.19	1.81	0.21	0.92	12.66	9.13	14	2	1	7	72	3.42	OK	8.62	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Low			High	Mod	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	High				
Aceh Besar	Geunteut Lamsujen	GL H2	O	ND		14	35	51	C	1.19	7.1	6.4	0.70	0.05	0.17	101	103			2.93	0.22	13	7.01	1.78	0.47	1.07	11.80	10.33	15	4	1	9	88	3.94	OK	3.79	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	V High	Mod			Mod	Mod	Good	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Geupeu	KG C3	D	0	22	86	10	4	LS	1.20	7.5	6.7	0.80	0.04	0.16	15	27			0.89	0.08	11	7.62	0.6	0.28	1.6	12.62	10.10	5	2	1	13	80	12.70	Mg deficient with P inhibition	2.14	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Defic			Low	V Low	Good	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Blang Luas	BLE 7	O	9 -		59	19	23	SCL	1.54	6.8	5.6	1.20	0.04	0.16	8.1	149.4			1.31	0.15	9	6.83	1.19	0.38	1.45	11.07	9.85	11	3	1	13	89	5.74	Mg sli deficient	3.13	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL R2	O	30		50	32	18	L	1.75	7.5	6.9	0.60	0.19	0.24	228.4	279			1.62	0.29	6	1.13	8.07	0.9	1.9	14.20	12.00	57	6	2	13	85	0.14	Ca deficient	8.97	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Ext High	Mod			Mod	Mod	Mod	V Low	V High	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GL R2	D	0	30	91	6	3	S	1.90	8.0	7.5	0.50	0.27	0.32	18.1	149.9			1.01	0.30	3	2.13	9.06	92	1.05	13.90	104.24	65	662	2	8	750	0.24	Ca deficient	0.10	Mg deficient
				Rating						Non Sal	Sli Alk	ND	ND	Low	Low	Mod / OK	Mod			Low	Mod	V Poor	Low	V High	V High	High	Low	V High	ND	V High	V Low	VSli-sodic	V High				
Aceh Besar	Blang Luas	BLE7	D	0	9	82	1	17	LS	2.00	7.5	6.3	1.20	0.41	0.17	5.2	309.0			0.91	0.15	6	7.78	0.35	0.5	1.02	10.39	9.65	3	5	2	10	93	22.23	Mg deficient with P inhibition	0.70	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Low	Low	Mod	Mod	V Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Geunteut Lamsujen	GLA6	D	25		81	1	18	SL	2.20	7.1	6.4	0.70	0.04	0.17	101.8	111.6			2.38	0.22	11	7.21	1.78	0.47	1.07	11.80	10.53	15	4	1	9	89	4.05	OK	3.79	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	V High	Mod			Mod	Mod	Good	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Geupeu	KG I 2A	D	15		94	5	2	S	2.60	7.6	6.7	0.90	0.42	0.16	10.1	221.1			0.41	0.09	5	5.04	1.28	0.57	1.98	10.04	8.87	13	6	2	20	88	3.94	OK	2.25	Mg sli deficient
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Mod			V Low	V Low	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Besar	Krueng Geupeu	KG D1	O	36		46	39	15	L	3.00	7.5	7.5	0.00	0.23	0.19	8.6	274.6			2.06	0.29	7	9.28	1.18	0.54	1.15	12.31	12.15	10	4	2	9	99	7.86	Mg deficient with P inhibition	2.19	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Besar	Krueng Geupeu	KG D1	D	0	36	77	13	10	SL	4.90	7.4	7.4	0.00	0.46	0.20	23.2	1004.2			1.9	0.34	6	9.58	1.48	0.48	1.13	13.67	12.67	11	4	1	8	93	6.47	Mg sli deficient	3.08	OK
				Rating						Sli Sal	Neutral	ND	ND	Low	Low	Mod / OK	High			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				

Table B.2 ETESP LabData Collation – Aceh Jaya (1)

Location: Sumatra

Add Date in WHITE boxes by Sample or Horizon

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Depth From	Range To	S %	Si %	C %	Lab Texture	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm	Avail P ppm	Avail K ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturations Mg Sat%	K Sat%	ASP Al Sat%	ESP Na Sat%	Base BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
Aceh Jaya	Alue Monmata	MD 2	O	ND		16	23	61	C	0.50	5.5	5.0	0.50	0.12	0.88	75	24			2.77	0.12	23	2.73	0.7	0.55	0.86	11.13	4.84	6	5	8	8	44	3.90	OK	1.27	Mg deficient
				Rating						Non Sal	Str Acid	ND	ND	V Low	Mod	High	V Defic			Mod	Low	Poor	Low	Low	Mod	High	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
Aceh Jaya	Alue Monmata	MN5	O	40		20	31	48	C	2.00	6.6	5.5	1.10	0.02	0.18	97.2	275.8			2.61	0.28	9	8.35	0.95	1.18	0.96	12.69	11.44	7	9	1	8	90	8.79	Mg deficient with P inhibition	0.81	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	High	Mod			Mod	Mod	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Alue Monmata	MN5	D	0	40	90	1	9	S	0.95	7.8	6.9	0.90	0.02	0.18	11.9	230.4			1.74	0.31	6	10.06	1.13	1.49	1.72	15.00	14.40	8	10	1	11	96	8.90	Mg deficient with P inhibition	0.76	Mg deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	High	Low	V High	High	Mod	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Alue Monmata	MO2 (PAM2)	D	0	30	Hemist				0.30	5.1	4.3	0.80	0.13	0.26	23	74			12.34	0.22	56	4.76	1.3	0.39	0.19	22.49	6.64	6	2	1	1	30	3.66	OK	3.33	OK
				Rating						Non Sal	Str Acid	ND	ND	V Low	Low	Mod / OK	Low			V High	Mod	Poor	Low	Low	Mod	Low	Mod	Low	V Low	V Low	V Low	Non-sodic	V Low				
Aceh Jaya	Alue Monmata	PM 14	O	15		51	22	27	SCL	1.72	6.5	5.9	0.60	0.46	0.20	81.4	175.6			3.06	0.20	15	7.11	1.22	0.59	1.09	12.26	10.01	10	5	2	9	82	5.83	Mg sli deficient	2.07	Mg sli deficient
				Rating						Non Sal	Sli Acid	ND	ND	Low	Low	High	Mod			High	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Alue Monmata	PM 14	D	0	15	90	1	9	S	0.94	7.4	6.5	0.90	0.45	0.19	3.9	129			2.85	0.17	17	10.41	1.62	0.60	1.50	15.97	14.13	10	4	1	9	88	6.43	Mg sli deficient	2.70	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Defic	Mod			Mod	Low	Mod	High	Mod	High	High	Mod	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Alue Monmata	PM4	O	25		32	31	37	CL	0.77	5.8	4.6	1.20	0.44	0.19	239.5	169			2.29	0.17	13	6.01	0.69	0.48	1.47	10.53	8.65	7	5	2	14	82	8.71	Mg deficient with P inhibition	1.44	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	V Low	Ext High	Mod			Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Alue Monmata	PM4	D	0	25	89	2	9	L	2.30	7.0	6.5	0.50	0.15	0.19	45.5	521.2			2.21	0.31	7	9.62	1.52	1.01	1.68	14.93	13.83	10	7	1	11	93	6.33	Mg sli deficient	1.50	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	High	M High			Mod	Mod	Mod	Mod	Mod	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Baba Awe	CB A1	O	30		50	31	19	L	0.88	7.5	6.3	1.20	0.02	0.22	11.6	184			2.71	0.35	8	10.42	1.57	0.49	2.12	17.90	14.60	9	3	1	12	82	6.64	Mg sli deficient	3.20	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Mod	Mod	High	Mod	Mod	V High	Mod	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Baba Awe	CB A1	D	0	30	88	8	4	LS	0.70	7.4	6.6	0.80	0.01	0.18	18.6	312.2			1.37	0.15	9	8.6	1.49	0.45	1.86	14.60	12.40	10	3	1	13	85	5.77	Mg sli deficient	3.31	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Baba Awe	CBA B3	D	12		58	26	16	SL	0.60	7.5	6.8	0.70	0.23	0.18	5.3	399.9			1.51	0.15	10	9.99	1.85	0.24	2.13	16.28	14.21	11	1	1	13	87	5.40	Mg sli deficient	7.71	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Good	Mod	Mod	Low	V High	Mod	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Baba Awe	CBA B3	D	0	12	62	22	16	SL	1.50	7.0	6.6	0.40	0.22	0.18	60.7	81.8			1.38	0.18	8	9.72	1.22	1.09	2.45	16.27	14.48	7	7	1	15	89	7.97	Mg deficient with P inhibition	1.12	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	High	Low			Mod	Low	Mod	Mod	Low	High	V High	Mod	Mod	V Low	V Low	V Low	Mod-sodic	V High				
Aceh Jaya	Baba le	BI 3	D	40		87	10	3	LS	2.00	6.8	5.2	1.60	0.38	0.22	13.9	140.8			1.41	0.16	9	5.25	2.25	0.72	1.09	10.19	9.31	22	7	2	11	91	2.33	Ca sli deficient	3.13	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Mod	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Baba le	BI ES	O	35		37	16	47	C	3.50	6.7	6.1	0.60	0.40	0.23	69	107.1			1.89	0.22	9	8.58	0.64	0.36	0.83	11.84	10.41	5	3	2	7	88	13.41	Mg deficient with P inhibition	1.78	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	Mod			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Baba le	BI ES	D	0	35	94	5	1	S	0.81	7.8	7.1	0.70	0.12	0.19	15	87.7			3.04	0.17	18	10.44	1.25	0.52	1.37	14.36	13.58	9	4	1	10	95	8.35	Mg deficient with P inhibition	2.40	Mg sli deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	V Low	Mod / OK	Low			High	Low	Mod	High	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG 12	ND	ND		66	11	24		2.15	7.25	6.6	0.65	0.26	0.21	42	97.4			2.465	0.195	13	9.51	0.945	0.44	1.1	13.1	12.00	7	3	2	8	92	10.06	Mg deficient with P inhibition	2.15	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	Low			Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG C3	D	8		85	7	8	LS	0.92	7.3	6.5	0.80	0.39	0.24	14.3	632.5			2.77	0.34	8	8.91	1.64	0.38	1.51	12.84	12.44	13	3	2	12	97	5.43	Mg sli deficient	4.32	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	M High			Mod	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG C3	D	0	8	76	9	15	LS	0.47	7.2	6.6	0.60	0.02	0.20	39.7	45.1			2.81	0.23	12	8.87	1.82	0.27	1.39	13.85	12.35	13	2	1	10	89	4.87	OK	6.74	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Mod High	V Low			Mod	Mod	Good	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG D8	D	20		83	14	3	LS	1.88	7.4	6.6	0.80	0.21	0.17	2.3	44.4			1.33	0.15	9	8.84	0.6	0.12	0.39	10.84	9.95	6	1	2	4	92	14.73	Mg deficient with P inhibition	5.00	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	V Defic	V Low			Mod	Low	Mod	Mod	Low	Low	Mod	Low	Mod	V Low	V Low	V Low	Non-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG D8	D	0	20	82	13	5	LS	0.26	7.1	6.3	0.80	0.01	0.38	300.1	58.8			1.66	0.19	9	8.94	1.49	0.12	0.62	12.36	11.17	12	1	3	5	90	6.00	Mg sli deficient	12.42	K deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Ext High	Low			Mod	Low	Mod	Mod	Low	Low	Mod	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG F6	O	35		52	16	32	SCl	1.38	7.0	6.2	0.80	0.21	0.21	67.5	13.8			0.4	0.10	4	8.52	0.88	0.67	1.29	12.31	11.36	7	5	2	10	92	9.68	Mg deficient with P inhibition	1.31	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	V Defic			V Low	Low	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG F6	O	0	35	90	5	5	SCl	2.50	7.2	6.3	0.90	0.38	0.38	11.5	483.1			0.21	0.21	1	9.96	1.92	0.61	1.9	16.53	14.39	12	4	2	11	87	5.19	Mg sli deficient	3.15	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			V Low	Mod	Ext Poor	Mod	Mod	High	High	Mod	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG G1	D	23		65	2	7	SL	0.95	7.4	6.6	0.80	0.22	0.18	92.1	51.1			1.35	0.23	6	10.49	0.83	0.45	1.27	14.99	13.04	6	3	1	8	87	12.64	Mg deficient with P inhibition	1.84	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	High	Low			Mod	Mod	Mod	High	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG G1	D	0	23	95	15	20	S	2.10	7.3	6.6	0.70	0.35	0.23	10.2	524.5			1.33	0.29	5	10.95	0.94	0.64	1.05	15.49	13.58	6	4	1	7	88	11.65	Mg deficient with P inhibition	1.47	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	M High			Mod	Mod	Mod	High	Low	High	High	Mod	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG I2	O	30		40	30	30	CL	0.84	7.2	6.3	0.90	0.23	0.43	47.4	71.5			3.93	0.17	23	7.8	1.69	0.67	1.29	12.10	11.45	14	6	4	11	95	4.62	OK	2.52	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	Low			High	Low	Poor	Mod	Mod	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG I2	D	0	8	91	1	8	SL	3.00	6.6	5.9	0.70	0.37	0.22	33.5	180.7			1.14	0.14	8	6.17	1.82	0.55	2.21	13.03	10.75	14	4	2	17	83	3.39	OK	3.31	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod High	Mod			Low	Low	Mod	Mod	Mod	Mod	V High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG I2	D	8	30	69	21	10	SL	3.10	7.1	6.4	0.70	0.41	0.18	30	1594			3.1	0.21	15	7.14	1.08	0.62	1.84	13.08	10.68	8	5	1	14	82	6.61	Mg sli deficient	1.74	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod High	High			High	Mod	Good	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG K4	O	25		16	33	51	C	0.76	6.8	6.4	0.40	0.42	0.18	201.6	257.6			3.19	0.34	9	9.14	0.75	0.24	0.93	12.81	11.06	6	2	1	7	86	12.19	Mg deficient with P inhibition	3.13	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Ext High	Mod			High	Mod	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Alue Gajah	BUG K4	D	0	25	89	1	10	S	0.55	7.2	6.7	0.50	0.23	0.18	9.5	189			1.53	0.31	5	10.66	1.38	0.14	2	15.75	14.18	9	1	1	13	90	7.72	Mg deficient with P inhibition	9.86	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	High	Low	Low	V High	Mod	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Jempeuk	BJ B3	O	30		18	19	63	C	2.90	5.0	4.2	0.80	0.78	0.24	405.2	81.2			2.51	0.31	8	5.30	0.29	0.38	0.51	9.60	6.48	3	4	3	5	68	18.28	Mg deficient with P inhibition	0.76	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	Mod	Low	Toxic	Low			Mod	Mod	Mod	Mod	V Low	Mod	Mod	Low	Low	V Low	V Low	V Low	VSli-sodic	High				
Aceh Jaya	Blang Jempeuk	BJ B3	D	0	15	78	11	11	SL	5.50	7.4	6.7	0.70	0.02	0.23	19	180			1.89	0.20	9	9.74	1.29	0.35	2.51	15.80	13.89	8	2	1	16	88	7.55	Mg deficient with P inhibition	3.69	OK
				Rating						Sli Sal	Neutral	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Low	Mod	V High	Low	Mod	V Low	V Low	V Low	Sodic	V High				
Aceh Jaya	Blang Jempeuk	BJ B3	O	15	30	8	51	41	SiC	8.40	7.2	6.4	0.85	0.23	0.18	83.2	859.5			2.16	0.21	10	8.33	1.14	0.52	1.50	14.30	11.49	8	4	1	10	80	7.31	Mg deficient with P inhibition	2.19	Mg sli deficient
				Rating						Mod Sal	Neutral	ND	ND	Low	V Low	High	M High			Mod	Mod	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Jempeuk	BJ D3	O	25		32	27	41	C	0.25	6.8	5.1	1.70	0.44	0.18	97.1	419.7			3.17	0.28	11	10.67	1.70	0.31	1.70	16.95	14.38	10	2	1	10	85	6.28	Mg sli deficient	5.48	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	High	Mod			High	Mod	Good	High	Mod	Mod	High	Mod	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Blang Jempeuk	BJ D3	O	0	25	64	2	34	SCL	0.56	6.6	5.5	1.10	0.20	0.24	101.2	289.2			3.20	0.27	12	10.16	1.48	0.29	1.30	16.69	13.36	9	2	1	9	80	6.86	Mg sli deficient	5.10	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	V High	Mod			High	Mod	Good	High	Low	Low	High	Mod	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Jempeuk	BJB3 Mean	O	ND		48	15	38		0.41	6.70	5.30	1.40	0.32	0.21	99.15	354.45			3.19	0.28	12	10.42	1.59	0.30	1.57	16.82	13.87	9	2	1	9	82	6.55	Mg sli deficient	5.30	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	Mod			High	Mod	Good	High	Mod	Mod	High	Mod	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Blang Jempeuk	KJ 2	O	25		45	17	38	CL	1.50	6.0	5.2	0.80	0.22	0.18	108.4	216.7			2.24	0.46	5	5.93	0.61	0.29	0.81	9.80	7.64	6	3	2	8	78	9.72	Mg deficient with P inhibition	2.10	Mg sli deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	V Low	V High	Mod			Mod	Mod	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	High				
Aceh Jaya	Blang Jempeuk	KJ 2	D	0	25	84	5	11	LS	1.54	6.5	5.9	0.60	0.23	0.18	16.8	149.3			1.40	0.15	9	6.59	1.09	0.38	1.70	10.23	9.76	11	4	2	17	95	6.05	Mg sli deficient	2.87	Mg sli deficient
				Rating						Non Sal	Sli Acid	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Bunbun	BL N1	O	12		80	2	18	SL	0.53	5.0	4.2	0.80	0.62	0.18	59.8	593.2			2.54	0.36	7	6.78	0.56	0.36	1.46	10.01	9.16	6	4	2	15	92	12.11	Mg deficient with P inhibition	1.56	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	Mod	V Low	High	M High			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Bunbun	BL N7	O	ND		63	2	36	SCL	0.67	5.5	4.7	0.80	0.43	0.18	15.8	430.2			1.89	0.28	7	6.38	2.14	0.35	1.76	12.27	10.63	17	3	1	14	87	2.98	Ca sli deficient	6.11	OK
				Rating						Non Sal	Str Acid	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				

Table B.3 ETESP LabData Collation – Aceh Jaya (2)

Location: Sumatra   Add Date in WHITE boxes by Sample or Horizon

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Depth From	Range To	S %	Si %	C %	Lab Texture	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm	Avail P ppm	Avail K ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturations Mg Sat%	K Sat%	ASP Al Sat%	ESP Na Sat%	Base BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
Aceh Jaya	Jabie	JB 4	D	8		55	29	16	SL	0.46	7.5	6.8	0.70	0.01	0.22	4	63			3.22	0.29	11	10.85	1.19	0.3	1.51	15.15	13.85	8	2	1	10	91	9.12	Mg deficient with P inhibition	3.97	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Defic	Low			High	Mod	Good	High	Low	Mod	High	Mod	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Jabie	JB 4	D	0	8	84	6	10	LS	0.46	7.6	7.0	0.60	0.02	0.18	3.1	63			1.72	0.21	8	10.66	1.66	0.87	1.46	15.18	14.65	11	6	1	10	97	6.42	Mg sli deficient	1.91	Mg deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	V Low	Defic	Low			Mod	Mod	Mod	High	Mod	High	High	Mod	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Jabie	JG 2	O	12		4	27	69	C	0.76	6.0	5.5	0.50	0.01	0.38	364	122.8			1.72	0.30	6	8.23	0.87	0.2	1.31	11.14	10.61	8	2	3	12	95	9.46	Mg deficient with P inhibition	4.35	OK
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Low	Ext High	Mod			Mod	Mod	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Jabie	JG 2	D	0	5	30	28	42	C	0.61	7.3	6.5	0.80	0.40	0.23	7	370.4			2.96	0.44	7	10.62	1.44	1.21	2.05	16.54	15.32	9	7	1	12	93	7.38	Mg deficient with P inhibition	1.19	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			Mod	Mod	Mod	High	Low	V High	V High	Mod	High	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Jabie	JG 2	O	5	12	56	16	18	SCl	0.70	7.5	6.9	0.60	0.23	0.19	4.2	281.6			1.54	0.22	7	9.28	1.49	1.21	1.83	13.80	13.81	11	9	1	13	100	6.23	Mg sli deficient	1.23	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Defic	Mod			Mod	Mod	Mod	Mod	Low	V High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Jabie	JG2 Mean	O	ND		43	22	30		0.66	7.4	6.7	0.70	0.315	0.21	5.6	326			2.25	0.33	7	9.95	1.465	1.21	1.94	15.17	14.57	10	8	1	13	96	6.79	Mg sli deficient	1.21	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Low	V High	High	Mod	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Karang Tunong	KT A1	O	40		10	45	45	SiC	0.70	7.1	6.2	0.90	0.24	0.17	19	120			5.53	0.32	17	8.05	2.69	0.2	2.36	15.85	13.30	17	1	1	15	84	2.99	Ca sli deficient	13.45	K deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			V High	Mod	Mod	Mod	Mod	Low	V High	Mod	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Karang Tunong	KT H1	O	12		47	18	35	SCL	3.10	7.1	6.5	0.60	0.12	0.18	218.1	247.7			2.64	0.24	11	8.26	1.29	0.68	1.6	12.66	11.83	10	5	1	13	93	6.40	Mg sli deficient	1.90	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Ext High	Mod			Mod	Mod	Good	Mod	Low	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Karang Tunong	KT H1	D	0	12	94	1	5	S	0.97	7.3	6.3	1.00	0.41	0.17	14.8	127			1.43	0.22	7	9.14	1.55	1.08	2.86	15.95	14.63	10	7	1	18	92	5.90	Mg sli deficient	1.44	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Mod	High	V High	Mod	Mod	V Low	V Low	V Low	Sodic	V High				
Aceh Jaya	Karang Tunong	KTG1	O	38		73	16	11	SL	4.50	7.0	6.4	0.60	0.18	0.22	20.5	217.2			1.39	0.19	7	8.21	1.97	0.8	2.49	15.18	13.47	13	5	1	16	89	4.17	OK	2.46	Mg sli deficient
				Rating						Sli Sal	Neutral	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Mod	High	V High	Mod	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Karang Tunong	KTG1	D	0	38	95	1	1	S	3.80	7.0	6.3	0.70	0.02	0.18	14.5	209.9			1.34	0.15	9	9.02	1.52	1.23	2.94	36.13	14.71	4	3	0	8	41	5.93	Mg sli deficient	1.24	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Mod	V High	V High	High	Mod	V Low	V Low	V Low	VSli-sodic	Low				
Aceh Jaya	Kr. Ateu	KA 1	O	18		42	45	13	L	1.41	7.5	6.6	0.90	0.01	0.38	11.2	375.6			2.6	0.18	14	9.14	0.71	0.62	0.80	12.82	11.27	6	5	3	6	88	12.87	Mg deficient with P inhibition	1.15	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Good	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA 1	D	0	18	40	14	46	C	0.25	7.9	7.2	0.70	0.41	0.18	15.3	242			1.91	0.15	13	10.12	1.53	0.64	1.00	14.53	13.29	11	4	1	7	91	6.61	Mg sli deficient	2.39	Mg sli deficient
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Good	High	Mod	High	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA 14	D	14		25	45	30	CL	0.90	7.5	6.3	1.20	1.23	0.07	12.3	40.4			3.24	0.12	27	6.63	1.71	0.39	1.71	13.60	10.44	13	3	1	13	77	3.88	OK	4.38	OK
				Rating						Non Sal	Neutral	ND	ND	Mod	V Low	Mod / OK	V Low			High	Low	Poor	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	High				
Aceh Jaya	Kr. Ateu	KA 14	D	0	14	85	10	5	SL	0.90	7.3	6.5	0.80	1.02	0.09	99	65.9			6.6	0.20	33	6.54	1.34	0.49	1.84	11.30	10.21	12	4	1	16	90	4.88	OK	2.73	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Mod	V Low	High	Low			V High	Mod	Poor	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Kr. Ateu	KA 30	D	43		54	33	14	SL	3.05	7.1	7.1	0.00	0.37	0.22	77.8	292.4			1.93	0.29	7	8.08	0.97	0.3	0.65	10.54	10.00	9	3	2	6	95	8.33	Mg deficient with P inhibition	3.23	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	Mod			Mod	Mod	Mod	Mod	Low	Mod	Mod	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA 30	D	20	43	79	20	1	SL	3.00	7.8	7.8	0.00	0.13	0.24	37.3	557.6			1.46	0.17	9	9.61	1.1	0.41	0.96	12.36	12.08	9	3	2	8	98	8.74	Mg deficient with P inhibition	2.68	Mg sli deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Mod High	M High			Mod	Low	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA 30	D	0	20	84	0	18	LS	5.60	7.8	7.8	0.00	0.19	0.23	80.4	801.9			2.17	0.31	7	9.66	1.14	0.4	1.13	13.27	12.33	9	3	2	9	93	8.47	Mg deficient with P inhibition	2.85	Mg sli deficient
				Rating						Sli Sal	Sli Alk	ND	ND	V Low	Low	High	M High			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA 8	O	8	20	10	48	42	SiC	2.20	7.4	5.5	1.90	0.23	0.19	18.4	428.4			1.56	0.16	10	8.18	2.46	0.52	2.31	14.28	13.47	17	4	1	16	94	3.33	OK	4.73	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Mod	Mod	Mod	Mod	V High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Kr. Ateu	KA 8	D	0	8	87	5	8	SL	8.10	6.0	5.1	0.90	0.23	0.19	94.9	2930.7			1.45	0.20	7	6.24	1.63	0.24	1.74	10.73	9.85	15	2	2	16	92	3.83	OK	6.79	OK
				Rating						Mod Sal	Mod Acid	ND	ND	Low	V Low	High	V High			Mod	Mod	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Kr. Ateu	KA 8	O	20		17	43	25	SiCl	1.60	6.9	5.4	1.50	0.20	0.22	80.8	87.4			2.52	0.27	9	7.57	1.67	0.42	1.78	12.04	11.44	14	3	2	15	95	4.53	OK	3.98	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	High	Low			Mod	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA 8 Mean	MIX	8	20	52	24	17		4.85	6.45	5.25	1.20	0.215	0.205	87.85	1509.05			1.985	0.235	8	6.905	1.65	0.33	1.76	11.385	10.65	14	3	2	15	94	4.18	OK	5.00	OK
				Rating						Sli Sal	Sli Acid	ND	ND	Low	Low	High	High			Mod	Mod	Mod	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Kr. Ateu	KA A5	O	25		34	34	32	L	1.40	7.0	6.2	0.80	0.02	0.18	28	22			1.35	0.08	17	0.35	1.52	0.23	0.77	10.81	2.87	14	2	2	7	27	0.23	Ca deficient	6.61	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod High	V Defic			Mod	V Low	Mod	V Low	Mod	Low	High	Low	V Low	ND	V Low	V Low	VSli-sodic	V Low				
Aceh Jaya	Kr. Ateu	KA A5	D	0	25	83	7	15	SL	2.00	7.1	6.3	0.80	0.03	0.16	20	23			0.89	0.09	10	6.5	1.11	0.29	0.7	10.59	8.60	10	3	2	7	81	5.86	Mg sli deficient	3.83	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	V Defic			Low	V Low	Mod	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KA B	O	10		22	43	35	CL	0.33	6.3	6.5	-0.20	0.12	0.17	33	92.1			2.3	0.15	15	6.04	0.9	0.29	2.1	11.55	9.33	8	3	1	18	81	6.71	Mg sli deficient	3.10	OK
				Rating						Non Sal	Sli Acid	ND	#N/A	V Low	V Low	Mod High	Low			Mod	Low	Mod	Mod	Low	Low	V High	Low	Mod	V Low	V Low	V Low	Sodic	V High				
Aceh Jaya	Kr. Ateu	KA B3	D	0	10	92	48	4	S	0.56	6.8	6.0	0.80	0.23	0.16	15	105.5			2.06	0.14	15	3.09	1.16	0.52	1.34	10.91	6.11	11	5	1	12	56	2.66	Ca sli deficient	2.23	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Good	Low	Low	Mod	High	Low	Low	ND	V Low	V Low	Sli-sodic	Mod				
Aceh Jaya	Kr. Ateu	KAC	O	9		13	61	26	SiL	0.86	7.5	7.5	0.00	0.23	0.18	4.4	96.3			1.89	0.24	8	8.81	0.99	0.34	0.95	12.24	11.09	8	3	1	8	91	8.90	Mg deficient with P inhibition	2.91	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Defic	Low			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kr. Ateu	KAC	D	0	9	60	0	40	SC	0.27	7.9	7.9	0.00	0.41	0.18	11.3	51			1.37	0.18	8	10.28	1.91	0.39	1.54	14.94	14.12	13	3	1	10	95	5.38	Mg sli deficient	4.90	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Low			Mod	Low	Mod	High	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KAC4	D	30		60	29	10	SL	0.24	7.0	7.0	0.00	0.22	0.18	99	30.9			1.72	0.16	11	9.15	1.39	0.50	1.31	12.63	12.35	11	4	1	10	98	6.58	Mg sli deficient	2.78	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	High	Defic			Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KAC4	D	0	30	86	0	14	LS	0.44	8.2	8.2	0.00	0.01	0.40	20.5	153.3			1.42	0.12	12	10.39	2.87	0.74	2.10	16.33	16.10	18	5	2	13	99	3.62	OK	3.88	OK
				Rating						Non Sal	Mod Alk	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Good	High	Mod	High	V High	Mod	High	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KAI 4	O	50		49	46	4	L	0.40	7.6	7.6	0.00	0.21	0.39	63.0	73.1			1.84	0.32	6	9.20	1.43	0.20	1.69	12.94	12.52	11	2	3	13	97	6.43	Mg sli deficient	7.15	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	Low	High	Low			Mod	Mod	Mod	Mod	Low	Low	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KAI 4	D	0	50	39	23	38	CL	0.51	7.5	7.5	0.00	0.31	0.10	10.5	197.2			1.66	0.35	5	8.26	1.18	0.20	1.82	12.75	11.46	9	2	1	14	90	7.00	Mg deficient	5.90	OK
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KD 10	O	23		56	26	17	CL	1.13	7.4	7.4	0.00	0.02	0.18	3.3	209.9			1.63	0.16	10	9.14	1.61	0.53	1.76	14.00	13.04	12	4	1	13	93	5.68	Mg sli deficient	3.04	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Defic	Mod			Mod	Low	Good	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kr. Ateu	KD 10	D	0	23	67	11	22	SL	0.61	8.3	8.3	0.00	0.19	0.21	15.7	316			1.4	0.30	5	10.14	2.3	0.68	2.04	15.62	15.16	15	4	1	13	97	4.41	OK	3.38	OK
				Rating						Non Sal	Mod Alk	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Mod	Mod	High	Mod	High	V High	Mod	High	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Krueng Tunong	KT A1	D	0	40	84	3	13	SL	0.40	7.7	6.9	0.80	0.01	0.22	12	55			0.87	0.09	10	6.44	0.95	0.27	1.29	12.25	8.95	8	2	2	11	73	6.78	Mg sli deficient	3.52	OK
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Mod / OK	Low			Low	V Low	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	High				
Aceh Jaya	Krueng Tunong	KT D1	D	0	36	89	2	9	LS	0.45	7.5	6.5	1.00	0.25	0.18	34	88			2.52	0.14	18	5.04	1.03	0.69	1.39	10.69	8.15	10	6	2	13	76	4.89	OK	1.49	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod High	Low			Mod	Low	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	High				
Aceh Jaya	Krueng Tunong	KT D1	O	36	50	12	50	38	SiCL	0.67	7.5	6.5	1.00	0.40	0.18	5.2	101.2			2.68	0.15	18	5.78	0.35	0.5	1.02	10.39	7.65	3	5	2	10	74	16.51	Mg deficient with P inhibition	0.70	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Mod	Mod	V Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	High				
Aceh Jaya	Krueng Tunong	KTC	D	0	60	93	1	6	S	0.47	6.5	5.8	0.70	0.13	0.23	22.2	177.7			1.54	0.15	10	5.92	0.72	0.61	0.46	8.75	7.71	8	7	3	5	88	8.22	Mg deficient with P inhibition	1.18	Mg deficient
				Rating						Non Sal	Sli Acid	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Good	Mod	Low	High	Mod	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kuala Meurisi	ML	D	0	20	85	10	5	LS	0.66	7.0	6.2	0.80	0.04	0.17	9	34			1.4	0.12	12	7.92	0.78	0.3	1.37	11.40	10.37	7	3	1	12	91	10.15	Mg deficient with P inhibition	2.60	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	V Low	Mod / OK	Defic			Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kuala Meurisi	ML	O	20	50	12	40	48	SiC	0.78	6.5	6.0	0.50	0.04	0.17	30	109			2.93	0.22	13	5.21	0.95	0.47	1.07	12.25	7.70	8	4	1	9	63	5.48	Mg sli deficient	2.02	Mg sli deficient

Table B.4 ETESP LabData Collation – Aceh Jaya (3)

Location: Sumatra | Add Date in WHITE boxes by Sample or Horizon

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Depth From	Range To	S %	Si %	C %	Lab Texture	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Al	Fe ppm	SO_4 ppm	Avail P ppm	Avail K ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturations Mg Sat%	K Sat%	ASP Al Sat%	ESP Na Sat%	Base BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
Aceh Jaya	Kulam Asan	LB B3	D	30		47	31	22	L	1.13	7.4	6.6	0.80	0.32	0.18	244.3	65.1			2.75	0.21	13	9.15	1.51	0.53	1.1	13.42	12.29	11	4	1	8	92	6.06	Mg sli deficient	2.85	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	V Low	Ext High	Low			Mod	Mod	Good	Mod	Mod	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Kulam Asan	LB B3	D	0	30	90	8	2	S	1.25	7.7	7.1	0.60	0.57	0.22	27.9	322			1.57	0.15	10	9.46	1.95	0.64	2.18	15.45	14.23	13	4	1	14	92	4.85	OK	3.05	OK
				Rating						Non Sal	Sli Alk	ND	ND	Mod	Low	Mod High	Mod			Mod	Low	Good	Mod	Mod	High	V High	Mod	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Kulam Asan	LBG1	ND	ND					Saprist (pea	0.34	4.0	3.6	0.40	4.04	0.56	8	140			4.9	0.15	33	2.12	0.67	0.57	0.77	24.21	4.13	3	2	2	3	17	3.16	OK	1.18	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	High	Mod	Mod / OK	Mod			High	Low	Poor	Low	Low	Mod	High	Mod	Low	V Low	V Low	V Low	Non-sodic	V Low				
Aceh Jaya	Lambaro	LB9	O	ND		62	12	26	SCL	1.18	7.3	6.4	0.90	0.01	0.39	26.5	350.3			1.97	0.41	5	5.25	1.34	0.42	1.28	9.87	8.29	14	4	4	13	84	3.92	OK	3.19	OK
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Mod High	Mod			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambaro	LD1	D	20		51	22	27	SCL	2.60	6.6	6.0	0.60	0.15	0.26	68	182.2			1.99	1.00	2	5.85	0.96	0.87	1.19	10.54	8.87	9	8	2	11	84	6.09	Mg sli deficient	1.10	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	High	Mod			Mod	V High	Ext Poor	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambaro	LD1	D	0	20	85	3	12	LS	3.20	7.2	6.5	0.70	0.18	0.22	21.4	328			1.42	0.13	11	8.94	1.38	1.17	1.87	13.43	13.36	10	9	2	14	99	6.48	Mg sli deficient	1.18	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Good	Mod	Low	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambaro	LDI	O	20		31	21	49	C	2.60	6.6	6.0	0.60	0.15	0.26	68	182.2			1.99	0.21	9	6.85	0.98	0.87	1.19	10.54	9.89	9	8	2	11	94	6.99	Mg sli deficient	1.13	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	High	Mod			Mod	Mod	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambaro	LDI	D	0	20	83	9	8	SL	3.20	7.2	6.5	0.70	0.18	0.22	21.4	328			1.42	0.13	11	8.94	1.39	1.17	1.37	13.43	12.87	10	9	2	10	96	6.43	Mg sli deficient	1.19	Mg deficient
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Good	Mod	Low	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS 10	O	20		28	61	11	SiL	1.70	6.5	5.9	0.60	0.16	0.28	187.4	126			2.14	0.25	9	7.42	0.86	0.11	1.30	10.73	9.69	8	1	3	12	90	8.63	Mg deficient with P inhibition	7.82	OK
				Rating						Non Sal	Sli Acid	ND	ND	V Low	Low	V High	Mod			Mod	Mod	Mod	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS 10	D	0	6	94	2	4	S	2.70	7.7	7.0	0.70	0.23	0.19	107.8	1035.9			1.56	0.15	10	9.24	1.41	0.44	1.83	13.68	12.92	10	3	1	13	94	6.55	Mg sli deficient	3.20	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	V High	High			Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS 10	D	6	20	22	44	34	CL	1.64	8.0	7.3	0.70	0.42	0.18	182	123.7			1.71	0.21	8	10.01	2.43	0.64	2.24	16.25	15.32	15	4	1	14	94	4.12	OK	3.80	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	V High	Mod			Mod	Mod	Mod	High	Mod	High	V High	Mod	High	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS 13	O	10	50	40	51	9	L	0.47	7.2	6.6	0.60	0.23	0.26	10	66			1.34	0.12	11	6.49	1.26	0.59	1.19	12.75	9.53	10	5	2	9	75	5.15	Mg sli deficient	2.14	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Low			Mod	Low	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	High				
Aceh Jaya	Lambesoi	LS 13 CLAY	O	ND		14	30	56	C	1.09	6.5	6.0	0.50	0.55	0.26	102	97			5.77	0.38	15	6.63	0.81	0.41	0.92	12.60	8.77	6	3	2	7	70	8.19	Mg deficient with P inhibition	1.98	Mg deficient
				Rating						Non Sal	Sli Acid	ND	ND	Mod	Low	V High	Low			V High	Mod	Mod	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	VSli-sodic	High				
Aceh Jaya	Lambesoi	LS 26	O	15		13	33	54	C	4.50	7.0	6.2	0.80	0.01	0.21	224.4	502.4			2.32	0.26	9	9.12	1.2	0.44	1.09	15.91	11.85	8	3	1	7	74	7.60	Mg deficient with P inhibition	2.73	Mg sli deficient
				Rating						Sli Sal	Neutral	ND	ND	V Low	Low	Ext High	M High			Mod	Mod	Mod	Mod	Low	Mod	High	Mod	Mod	V Low	V Low	V Low	VSli-sodic	High				
Aceh Jaya	Lambesoi	LS 26	D	0	4	45	33	22	L	4.50	7.6	6.9	0.70	0.20	0.41	96.5	1084.2			1.79	0.19	9	10.06	2.82	0.74	2.53	17.02	16.15	17	4	2	15	95	3.57	OK	3.81	OK
				Rating						Sli Sal	Sli Alk	ND	ND	Low	Low	High	High			Mod	Low	Mod	High	Mod	High	V High	Mod	High	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS 26	D	4	15	16	74	11	SiL	3.25	7.7	7.0	0.70	0.23	0.19	17.5	483.1			1.99	0.16	12	9.73	1.43	0.21	1.89	15.73	13.26	9	1	1	12	84	6.80	Mg sli deficient	6.81	OK
				Rating						Non Sal	Sli Alk	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Low	Good	Mod	Low	Low	High	Mod	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS N17	O	30		29	50	21	L	1.46	6.0	5.2	0.80	0.43	0.18	22.2	157.4			2.11	0.28	8	6.53	0.97	0.70	1.46	10.84	9.66	9	6	2	13	89	6.73	Mg sli deficient	1.39	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	V Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Low	High	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Lambesoi	LS N4	D	0	50	37	30	33	CL	1.02	5.9	5.1	0.80	0.22	0.18	267.7	86			1.82	0.31	6	7.01	2.23	0.35	2.25	14.41	11.84	15	2	1	16	82	3.14	OK	6.37	OK
				Rating						Non Sal	Mod Acid	ND	ND	Low	V Low	Ext High	Low			Mod	Mod	Mod	Mod	Mod	Mod	V High	Low	Mod	ND	V Low	V Low	Sodic	V High				
Aceh Jaya	Meudheun	M3	O	7		44	23	34	CL	2.70	6.5	6.0	0.50	0.46	0.20	68.7	187.6			2.63	0.30	9	6.34	1.22	0.3	0.91	9.71	8.77	13	3	2	9	90	5.20	Mg sli deficient	4.07	OK
				Rating						Non Sal	Sli Acid	ND	ND	Low	Low	High	Mod			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Meudheun	M3	D	0	7	92	7	1	S	1.75	7.7	7.1	0.60	0.01	0.38	18	279			1.67	0.22	8	8.83	1.92	0.75	1.93	14.49	13.43	13	5	3	13	93	4.60	OK	2.56	Mg sli deficient
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Mod	High	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Meulha	MA9	O	25		20	63	17	SiCL	3.40	5.9	5.9	0.00	0.19	0.22	338.7	240.3			2.61	0.32	8	5.83	0.92	0.58	1.08	9.04	8.41	10	6	2	12	93	6.34	Mg sli deficient	1.59	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Low	Ext High	Mod			Mod	Mod	Mod	Mod	Low	Mod	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Meulha	MA9	D	0	25	54	3	43	SC	6.00	7.2	7.2	0.00	0.13	0.23	46.8	151.3			2.37	0.31	8	10.65	1.46	0.72	1.70	15.64	14.53	9	5	1	11	93	7.29	Mg deficient with P inhibition	2.03	Mg sli deficient
				Rating						Sli Sal	Neutral	ND	ND	V Low	Low	High	Mod			Mod	Mod	Mod	High	Low	High	High	Mod	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Panghuleu Harakat	PH A3	O	24		59	30	11	SCl	1.09	7.4	6.8	0.60	0.46	0.20	10.4	122.5			3.06	0.27	11	8.7	1.16	0.4	1.41	12.20	11.67	10	3	2	12	96	7.50	Mg deficient with P inhibition	2.90	Mg sli deficient
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			High	Mod	Good	Mod	Low	Mod	High	Low	Mod	V Low	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Panghuleu Harakat	PH A3	D	0	24	93	2	5	S	0.35	7.8	7.0	0.80	0.18	0.20	14.1	129.7			2.72	0.19	14	9.81	1.75	0.27	1.71	14.19	13.54	12	2	1	12	95	5.61	Mg sli deficient	6.48	OK
				Rating						Non Sal	Sli Alk	ND	ND	V Low	Low	Mod / OK	Mod			Mod	Low	Good	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				
Aceh Jaya	Panghuleu Harakat	PH D1	O	18		60	15	25	SCl	8.10	6.0	5.1	0.90	0.22	0.40	94.9	2930.7			2.13	0.31	7	7.95	0.88	0.62	0.58	12.73	10.03	7	5	3	5	79	9.03	Mg deficient with P inhibition	1.42	Mg deficient
				Rating						Mod Sal	Mod Acid	ND	ND	Low	Low	High	V High			Mod	Mod	Mod	Mod	Low	High	Mod	Low	Mod	V Low	V Low	V Low	Non-sodic	High				
Aceh Jaya	Panghuleu Harakat	PH D1	D	0	18	59	30	11	SL	1.45	5.0	4.1	0.90	0.58	0.22	97.9	925			2.67	0.33	8	7.50	0.74	0.46	0.56	11.00	9.26	7	4	2	5	84	10.14	Mg deficient with P inhibition	1.61	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	Mod	Low	High	M High			Mod	Mod	Mod	Mod	Low	Mod	Mod	Low	Mod	V Low	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Rawa Krueng Itam	Gambut KH12	O	70					peat	0.47	4.3	3.7	0.60	0.70	0.93	681	3533.6			9.78	0.63	16	6.22	0.85	0.30	1.26	18.21	8.63	5	2	5	7	47	7.32	Mg deficient with P inhibition	2.83	Mg sli deficient
				Rating						Non Sal	Ext Acid	ND	ND	Mod	Mod	Toxic	V High			V High	High	Mod	Mod	Low	Mod	High	Mod	Mod	V Low	V Low	Low	VSli-sodic	Low				
Aceh Jaya	Rawa Krueng Itam	Gambut KH7	O	0	50				peat	1.72	4.5	3.9	0.60	0.65	0.75	707.4	232.1			10.93	0.65	17	7.06	1.00	0.40	0.91	18.85	9.37	5	2	4	5	50	7.06	Mg deficient	2.50	Mg sli deficient
				Rating						Non Sal	Ext Acid	ND	ND	Mod	Mod	Toxic	Mod			V High	High	Mod	Mod	Low	Mod	High	Mod	Mod	V Low	V Low	V Low	Non-sodic	Low				
Aceh Jaya	Rawa Krueng Itam	KH12	O	ND					Febric	0.30	4.0	3.5	0.50	5.19	0.30	55	200.1			9.22	0.14	66	2.23	0.72	0.73	0.67	30.22	4.35	2	2	1	2	14	3.10	OK	0.99	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	V High	Low	High	Mod			V High	Low	Poor	Low	Low	High	Mod	High	Low	V Low	V Low	V Low	Non-sodic	V Low				
Aceh Jaya	Seneubok Padang	Gambut RK 1	O	ND					Hemist	1.44	4.0	3.1	0.90	0.37	0.86	271.7	1465.6			11.26	0.66	17	6.56	2.24	0.78	1.13	13.64	10.71	16	6	6	8	79	2.93	Ca sli deficient	2.87	Mg sli deficient
				Rating						Non Sal	Ext Acid	ND	ND	Low	Mod	Ext High	High			V High	High	Mod	Mod	Mod	High	High	Low	Mod	ND	V Low	Low	VSli-sodic	High				
Aceh Jaya	Seneubok Padang	Gambut SP C1	O	90					Hemist	3.00	3.0	2.3	0.70	0.49	0.93	780.1	7198.1			10.22	0.63	16	4.82	2.43	0.23	1.55	10.84	9.03	22	2	9	14	83	1.98	Ca sli deficient	10.57	K sli deficient
				Rating						Non Sal	Ext Acid	ND	ND	Low	Mod	Toxic	V High			V High	High	Mod	Low	Mod	Low	High	Low	Mod	ND	V Low	Low	Sli-sodic	V High				
Aceh Jaya	Seneubok Padang	SP 0 - 70 peat	O	0	70				Hemist	1.18	4.1	3.5	0.60	0.80	0.24	232.4	829.1			10.41	0.64	16	6.29	2.45	0.28	1.35	13.08	10.37	19	2	2	10	79	2.57	Ca sli deficient	8.75	OK
				Rating						Non Sal	Ext Acid	ND	ND	Mod	Low	Ext High	M High			V High	High	Mod	Mod	Mod	Low	High	Low	Mod	ND	V Low	V Low	Sli-sodic	High				
Aceh Jaya	Seneubok Padang	SPC2 peat	O	ND					Hemist	0.40	4.1	3.5	0.60	5.42	0.22	23	321			6.12	0.12	51	2.04	0.78	0.57	0.58	24.35	3.97	3	2	1	2	16	2.62	Ca sli deficient	1.37	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	V High	Low	Mod / OK	Mod			V High	Low	Poor	Low	Low	Mod	Mod	Mod	Low	V Low	V Low	V Low	Non-sodic	V Low				
Aceh Jaya	Seneubok Padang	SPJ2	O	ND					Saprist	0.35	4.1	3.4	0.70	6.22	0.32	76	125.6			5.14	0.18	29	2.05	0.55	0.56	0.51	20.31	3.67	3	3	2	3	18	3.73	OK	0.98	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	V High	Low	High	Mod			V High	Low	Poor	Low	Low	Mod	Mod	Mod	Low	V Low	V Low	V Low	Non-sodic	V Low				
Aceh Jaya	Treng Lipeh	KM B2	0	10		3	24	73	C	1.45	6.1	5.4	0.70	0.18	0.18	2.1	3.1			2.34	0.21	11	8.84	1.49	0.12	0.62	12.36	11.07	12	1	1	5	90	5.93	Mg sli deficient	12.42	K deficient
				Rating						Non Sal	Sli Acid	ND	ND	V Low	V Low	V Defic	ND			Mod	Mod	Good	Mod	Low	Low	Mod	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Treng Lipeh	KM B2	D	0	10	91	2	7	S	1.05	7.4	6.5	0.90	0.36	0.36	15.5	127.8			1.54	0.29	5	7.08	1.72	0.46	0.68	11.79	9.94	15	4	3	6	84	4.12	OK	3.74	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Mod	Mod	Mod	Low	Mod	ND	V Low	V Low	VSli-sodic	V High				
Aceh Jaya	Treng Lipeh	KM C2	O	20		2	36	62	C	1.26	5.6	4.7	0.90	0.44	0.18	224.8	61.9			2.54	0.19	13	6.35	0.95	0.17	1.89	11.63	9.36	8	1	2	16	80	6.68	Mg sli deficient	5.59	OK
				Rating						Non Sal	Mod Acid	ND	ND	Low	V Low	Ext High	Low			Mod	Low	Good	Mod	Low	Low	High	Low	Mod	V Low	V Low	V Low	Sodic	V High				
Aceh Jaya	Treng Lipeh	KM C2	D	0	20	90	6	4	S	0.36	7.3	6.4	0.90	0.24	0.20	7.2	151.3			1.98	0.23	9	9.54	1.93	0.39	2.02	14.55	13.88	13	3	1	14	95	4.94	OK	4.95	OK
				Rating						Non Sal	Neutral	ND	ND	Low	Low	Mod / OK	Mod			Mod	Mod	Mod	Mod	Mod	Mod	V High	Low	Mod	ND	V Low	V Low	Sli-sodic	V High				

Table B.5 ETESP LabData Collation – Aceh Timur, Aceh Utara & Bireuen

Location: Sumatra

Add Date in WHITE boxes by Sample or Horizon

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Depth From	Range To	S %	Si %	C %	Lab Texture	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm	Avail P ppm	Avail K ppm
Aceh Timur	Julok Tunong	JT B7	O	0	25	25	33	42	CL	1.06	5.7	5.2	0.50	0.19	0.90	50.99	457.66		
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Mod	High	Mod		
Aceh Timur	Julok Tunong	JT B2	O	0	25	19	44	37	SiCL	1.55	5.9	5.5	0.40	0.18	0.56	40.24	567.12		
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Mod	High	M High		
Aceh Utara	Pase Kanan	PKNI	O	0	25	23	29	48	C	0.10	6.0	5.5	0.50	0.23	0.56	15	32		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	Mod / OK	Defic		
Aceh Utara	Pase Kiri	PKR B5	O	0	25	19	24	57	C	0.42	6.0	5.4	0.60	0.33	0.67	67	45		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	High	V Low		
Aceh Utara	Pase Kiri	PKR A3	O	0	25	20	25	54	C	0.76	5.7	5.3	0.40	0.22	0.34	100.5	66		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Low	V High	Low		
Aceh Utara	Pase Kiri	PKR B4	O	0	25	30	45	24	CL	0.90	5.6	5.3	0.30	0.22	0.33	189.9	115.35		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Low	V High	Mod		
Aceh Utara	Krueng Tuan	BK7	O	0	25	19	42	39	SiCL	0.93	5.6	5.0	0.60	0.42	0.59	116.91	89.25		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	V High	Low		
Aceh Utara	Krueng Tuan	BKB7	O	0	25	33	27	40	CL	0.97	5.5	5.0	0.50	0.32	0.42	130.31	111.5		
				Rating						Non Sal	Str Acid	ND	ND	Low	Low	V High	Mod		
Aceh Utara	Pase Kiri	PKR 28	O	0	25	80	14	6	SL	1.02	7.4	6.7	0.70	0.15	0.25	60.63	303.68		
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	High	Mod		
Aceh Utara	Krueng Tuan	BK6	O	0	25	21	45	34	CL	1.05	5.5	5.0	0.50	0.40	0.76	137.9	15.27		
				Rating						Non Sal	Str Acid	ND	ND	Low	Mod	V High	V Defic		
Aceh Utara	Pase Kanan	PKM B5	O	0	25	23	57	20	SiL	1.95	5.9	5.6	0.30	0.33	0.50	135.12	165.12		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	V High	Mod		
Aceh Utara	Pase Kanan	PKM B1	O	0	25	32	36	32	CL	2.05	5.9	5.5	0.40	0.19	0.54	95.55	160.59		
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Mod	High	Mod		
Aceh Utara	Pase Kiri	PASE KIRI MIX	D	0	10				LS	2.60	7.4	6.7	0.70	0.15	0.25	60.63	303.69		
				Rating						Non Sal	Neutral	ND	ND	V Low	Low	High	Mod		
Aceh Utara	Pase Kiri	PKR 28	O	10	50	41	35	24	L	3.29	6.3	5.8	0.50	0.18	0.24	45.87	657.47		
				Rating						Non Sal	Sli Acid	ND	ND	V Low	Low	High	M High		
Aceh Utara	Pase Kiri	Pase Kiri III	D	0	10				LS	13.64	7.0	6.6	0.40	0.18	0.24	45.87	657.47		
				Rating						Mod Sal	Neutral	ND	ND	V Low	Low	High	M High		
Bireuen	Paya Nie	PYN 2	O	10		22	25	52	C	0.64	5.6	5.0	0.60	0.19	0.61	91.33	100.33		
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Mod	High	Mod		
Bireuen	Paya Nie	PYN 2	D	0	10	43	25	32	CL	0.79	5.3	4.7	0.60	0.20	0.53	119.07	122.44		
				Rating						Non Sal	Str Acid	ND	ND	Low	Mod	V High	Mod		
Bireuen	Peudada	PAD 25	O	0	25	30	29	41	C	0.89	5.4	4.6	0.80	0.42	0.62	169.77	132.27		
				Rating						Non Sal	Str Acid	ND	ND	Low	Mod	V High	Mod		
Bireuen	Pate Lhong	PL 1	O	0	25	33	25	42	C	0.90	5.9	5.5	0.40	0.23	0.55	90.5	45		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	High	V Low		
Bireuen	Pate Lhong	PL2	O	10	25	25	29	56	C	0.90	5.9	5.5	0.40	0.23	0.55	289.9	132.56		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	Ext High	Mod		
Bireuen	Pandrah	PD 1	O	10	25	22	45	33	CL	1.62	5.6	5.2	0.40	0.30	0.56	156.66	132.55		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	V High	Mod		
Bireuen	Paya Nie	PN 1	O	10	25	30	31	39	C	2.05	5.5	5.0	0.50	0.31	0.49	106.91	197.25		
				Rating						Non Sal	Str Acid	ND	ND	Low	Low	V High	Mod		
Bireuen	Peudada	PAD D3	O	0	25	30	32	38	CL	2.05	5.9	5.4	0.50	0.22	0.82	149.22	132.45		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	V High	Mod		
Bireuen	Pate Lhong	PL13	O	0	10	40	20	40	L	2.18	6.0	5.5	0.50	0.21	0.55	209.45	213.71		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	Ext High	Mod		
Bireuen	Pate Lhong	PL 13	O	10	50	19	45	36	SiCL	2.19	5.6	5.3	0.30	0.33	0.78	289.9	132.56		
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	Ext High	Mod		
Bireuen	Samalanga	S6	O	0	25	15	20	65	C	2.20	5.9	5.5	0.40	0.13	0.54	56.17	442.12		
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Mod	High	Mod		
Bireuen	Samalanga	S7	O	0	25	25	27	48	C	3.36	5.8	5.2	0.60	0.17	0.40	66.66	234.34		
				Rating						Non Sal	Mod Acid	ND	ND	V Low	Low	High	Mod		
Bireuen	Samalanga	S1 0	O	0	25	23	21	56	C	6.33	6.0	5.6	0.40	0.18	0.34	70.33	302.22		
				Rating						Sli Sal	Mod Acid	ND	ND	V Low	Low	High	Mod		

Site No	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturations Mg Sat%	K Sat%	ASP Al Sat%	ESP Na Sat%	Base BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
JT B7	3.01	0.14	22	2	0.59	0.65	0.85	12.12	4.09	5	5	7	7	34	3.39	OK	0.91	Mg deficient
	High	Low	Poor	Low	Low	High	High	Low	Low	V Low	V Low	Low	VSli-sodic	V Low				
JT B2	2.76	0.15	18	1.93	0.51	0.55	0.95	11.20	3.94	5	5	5	8	35	3.78	OK	0.93	Mg deficient
	Mod	Low	Mod	V Low	Low	Mod	High	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
PKNI	2.78	0.18	15	2.99	0.4	0.55	0.67	10.21	4.61	4	5	5	7	45	7.48	Mg deficient with P inhibition	0.73	Mg deficient
	Mod	Low	Mod	Low	V Low	Mod	Mod	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
PKR B5	3.23	0.22	15	2.64	0.61	0.57	0.59	9.52	4.41	6	6	7	6	46	4.33	OK	1.07	Mg deficient
	High	Mod	Good	Low	Low	Mod	Mod	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
PKR A3	3.87	0.17	23	2.3	0.5	0.5	0.5	11.34	3.80	4	4	3	4	34	4.60	OK	1.00	Mg deficient
	High	Low	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	V Low				
PKR B4	2.87	0.17	17	2.33	0.55	0.56	0.56	11.34	4.00	5	5	3	5	35	4.24	OK	0.98	Mg deficient
	Mod	Low	Mod	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	Low				
BK7	3.78	0.25	15	2.18	0.5	0.88	0.82	13.35	4.38	4	7	4	6	33	4.36	OK	0.57	Mg deficient
	High	Mod	Mod	Low	Low	High	High	Low	Low	V Low	V Low	V Low	VSli-sodic	V Low				
BKB7	3.08	0.19	16	2.08	0.5	0.81	0.95	11.25	4.34	4	7	4	8	39	4.16	OK	0.62	Mg deficient
	High	Low	Mod	Low	Low	High	High	Low	Low	V Low	V Low	V Low	VSli-sodic	Low				
PKR 28	2.57	0.15	17	3.7	1.9	0.93	0.95	10.99	7.48	17	8	2	9	68	1.95	Ca sli deficient	2.04	Mg sli deficient
	Mod	Low	Mod	Low	Mod	High	High	Low	Low	ND	V Low	V Low	VSli-sodic	High				
BK6	3.4	0.21	16	1.9	0.6	0.7	0.56	12.05	3.76	5	6	6	5	31	3.17	OK	0.86	Mg deficient
	High	Mod	Mod	V Low	Low	High	Mod	Low	Low	V Low	V Low	Low	Non-sodic	V Low				
PKM B5	3.45	0.19	18	0.59	3	0.56	0.59	11.00	4.74	27	5	5	5	43	0.20	Ca deficient	5.36	OK
	High	Low	Mod	V Low	High	Mod	Mod	Low	Low	ND	V Low	V Low	VSli-sodic	Low				
PKM B1	3.23	0.16	20	2.56	2.56	0.6	0.6	11.20	6.32	23	5	5	5	56	1.00	Ca sli deficient	4.27	OK
	High	Low	Poor	Low	Mod	High	Mod	Low	Low	ND	V Low	V Low	VSli-sodic	Mod				
PASE KIRI MIX	2.57	0.15	17	3.2	1.91	0.91	0.9	10.99	6.92	17	8	2	8	63	1.68	Ca sli deficient	2.10	Mg sli deficient
	Mod	Low	Mod	Low	Mod	High	High	Low	Low	ND	V Low	V Low	VSli-sodic	Mod				
PKR 28	3.92	0.17	23	3.7	0.6	1.17	0.88	11.14	6.35	5	11	2	8	57	6.17	Mg sli deficient	0.51	Mg deficient
	High	Low	Poor	Low	Low	High	High	Low	Low	V Low	ND	V Low	VSli-sodic	Mod				
Pase Kiri III	3.92	0.17	23	3.23	0.61	1.15	0.81	11.14	5.80	5	10	2	7	52	5.30	Mg sli deficient	0.53	Mg deficient
	High	Low	Poor	Low	Low	High	High	Low	Low	V Low	ND	V Low	VSli-sodic	Mod				
PYN 2	3.14	0.16	20	2	0.56	0.59	0.51	12.13	3.66	5	5	5	4	30	3.57	OK	0.95	Mg deficient
	High	Low	Mod	Low	Low	Mod	Mod	Low	Low	V Low	V Low	Low	Non-sodic	V Low				
PYN 2	3.47	0.16	22	2.08	0.52	0.66	0.53	11.84	3.79	4	6	4	4	32	4.00	OK	0.79	Mg deficient
	High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	V Low				
PAD 25	4	0.19	21	2	0.54	0.76	0.63	12.24	3.93	4	6	5	5	32	3.70	OK	0.71	Mg deficient
	High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	Low	VSli-sodic	V Low				
PL 1	4.01	0.16	25	2.08	0.5	0.71	0.52	11.55	3.81	4	6	5	5	33	4.16	OK	0.70	Mg deficient
	High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	V Low				
PL2	4.01	0.17	24	2.2	0.56	0.51	0.55	12.04	3.82	5	4	5	5	32	3.93	OK	1.10	Mg deficient
	High	Low	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	V Low				
PD 1	4.78	0.22	22	3.88	0.59	0.31	0.62	12.33	5.40	5	3	5	5	44	6.58	Mg sli deficient	1.90	Mg deficient
	High	Mod	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	VSli-sodic	Low				
PN 1	3.78	0.18	21	3	0.56	0.46	0.53	12.46	4.55	4	4	4	4	37	5.36	Mg sli deficient	1.22	Mg deficient
	High	Low	Poor	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	Low				
PAD D3	4.47	0.26	17	3	0.56	0.46	0.53	12.46	4.55	4	4	7	4	37	5.36	Mg sli deficient	1.22	Mg deficient
	High	Mod	Mod	Low	Low	Mod	Mod	Low	Low	V Low	V Low	Low	Non-sodic	Low				
PL13	3.47	0.17	20	2.8	0.49	0.56	0.63	10.14	4.48	5	6	5	6	44	5.71	Mg sli deficient	0.88	Mg deficient
	High	Low	Poor	Low	V Low	Mod	Mod	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
PL 13	2.99	0.20	15	2.2	0.56	0.51	0.55	12.01	3.82	5	4	6	5	32	3.93	OK	1.10	Mg deficient
	Mod	Mod	Good	Low	Low	Mod	Mod	Low	Low	V Low	V Low	Low	Non-sodic	V Low				
S6	3.32	0.19	17	2.5	0.61	0.45	0.55	11.55	4.11	5	4	5	5	36	4.10	OK	1.36	Mg deficient
	High	Low	Mod	Low	Low	Mod	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	Low				
S7	3.35	0.20	17	2.93	0.38	0.75	0.51	12.09	4.57	3	6	3	4	38	7.71	Mg deficient with P inhibition	0.51	Mg deficient
	High	Mod	Mod	Low	V Low	High	Mod	Low	Low	V Low	V Low	V Low	Non-sodic	Low				
S1 0	2.92	0.17	17	2.23	0.71	0.65	1.55	10.14	5.14	7	6	3	15	51	3.14	OK	1.09	Mg deficient
	Mod	Low	Mod	Low	Low	High	High	Low	Low	V Low	V Low	V Low	Sodic	Mod				

Table B.6 ETESP LabData Collation – Pidie & Aceh Singkil

Location: Sumatra   Add Date in WHITE boxes by Sample or Horizon

Kabupaten	Scheme / Desa	Site No	Soil (O) Deposit (D)	Depth From	Range To	S %	Si %	C %	Lab Texture	EC dS/m	pH H2O	pH KCl	pH diff	Exchangeable H	Exchangeable Al	Fe ppm	SO_4 ppm	Avail P ppm	Avail K ppm	Org C %	Total N %	C:N	Exchangeables meq / 100g Ca	Mg	K	Na	CEC	TEB	Saturations Mg Sat%	K Sat%	ASP Al Sat%	ESP Na Sat%	Base BS %	Cation Ratios Ca/Mg	Rating	Cation Ratios Mg/K	Rating
Pidie	Beuracan	Beuracan I	M	10	20				SL	0.62	5.9	5.0	0.90	0.30	0.48	116.90	97.55			3.78	0.12	32	2.88	0.55	0.71	0.62	10.99	4.76	5	6	4	6	43	5.24	Mg sli deficient	0.77	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	Low	V High	Low			High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	V Low	VSli-sodic	Low				
Pidie	Beuracan	BE F3 (mix)	M	ND		31	30	39	CL	0.67	6.1	5.4	0.70	0.17	0.44	45.00	45.00			2.12	0.12	18	2.87	0.17	0.61	0.99	10.23	4.64	2	6	4	10	45	16.88	Mg deficient with P inhibition	0.28	Mg deficient
				Rating						Non Sal	Sli Acid	ND	ND	V Low	Low	High	V Low			Mod	Low	Mod	Low	V Low	High	High	Low	Low	V Low	V Low	V Low	VSli-sodic	Low				
Pidie	Cubo Trienggading	CT I1 mixed	M	0	30	21	37	42	C	0.83	5.9	5.3	0.60	0.40	0.58	106.92	99.75			2.78	0.25	11	2.18	0.55	0.81	0.92	11.33	4.46	5	7	5	8	39	3.96	OK	0.68	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	V High	Low			Mod	Mod	Good	Low	Low	High	High	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
Pidie	Beuracan	Be C2 mix	M	0	25	23	41	36	CL	0.85	5.5	5.1	0.40	0.21	0.82	87.95	122.93			3.07	0.16	19	1.80	0.44	0.36	0.43	9.55	3.03	5	4	9	5	32	4.09	OK	1.22	Mg deficient
				Rating						Non Sal	Str Acid	ND	ND	Low	Mod	High	Mod			High	Low	Mod	V Low	V Low	Mod	Mod	Low	Low	V Low	V Low	Low	Non-sodic	V Low				
Pidie	Beuracan	Be E2	O	0	25	30	31	39	CL	1.05	5.6	5.1	0.50	0.22	0.72	127.95	105.27			3.4	0.16	21	1.9	0.52	0.6	0.46	10.22	3.48	5	6	7	5	34	3.65	OK	0.87	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	V High	Mod			High	Low	Poor	V Low	Low	High	Mod	Low	Low	V Low	V Low	Low	Non-sodic	V Low				
Pidie	Cubo Trienggading	CT C1 mix	M	0	30	34	35	31	CL	1.05	5.4	5.0	0.40	0.42	0.75	127.95	105.27			2.4	0.11	22	1.9	0.62	0.6	0.66	10.01	3.78	6	6	7	7	38	3.06	OK	1.03	Mg deficient
				Rating						Non Sal	Str Acid	ND	ND	Low	Mod	V High	Mod			Mod	Low	Poor	V Low	Low	High	Mod	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
Pidie	Cubo Trienggading	CTA3 mixed	M	0	30	19	25	56	C	1.25	6.0	5.4	0.60	0.27	0.33	109	122			2.45	0.15	16	2.12	0.19	0.59	0.76	10.01	3.66	2	6	3	8	37	11.16	Mg deficient with P inhibition	0.32	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	Low	V High	Mod			Mod	Low	Mod	Low	V Low	Mod	High	Low	Low	V Low	V Low	V Low	VSli-sodic	Low				
Pidie	Beuracan	Beuracan iron mix	M	0	25				SL	2.18	5.0	4.5	0.50	0.22	0.52	109.87	112.27			6.47	0.16	40	2.0	6.25	0.56	0.53	11.04	9.34	57	5	5	5	85	0.32	Ca deficient	11.16	K sli deficient
				Rating						Non Sal	VStr Acid	ND	ND	Low	Mod	V High	Mod			V High	Low	Poor	Low	High	Mod	Mod	Low	Mod	ND	V Low	V Low	Non-sodic	V High				
Singkil	Sidorejo	SD B1	O	15	50	24	31	45	C	0.56	5.0	4.5	0.50	0.24	3.55	67.8	89			3.55	0.17	21	2.74	0.52	0.6	0.5	12.90	4.36	4	5	28	4	34	5.27	Mg sli deficient	0.87	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	Low	High	High	Low			High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	High	Non-sodic	V Low				
Singkil	Ujung Bawang	IUB 1	O	0	40	20	40	40	CL	0.62	5.9	5.3	0.60	0.42	0.90	200.9	90.5			4	0.19	21	2.88	0.57	0.71	0.62	10.29	4.78	6	7	9	6	46	5.05	Mg sli deficient	0.80	Mg deficient
				Rating						Non Sal	Mod Acid	ND	ND	Low	Mod	Ext High	Low			High	Low	Poor	Low	Low	High	Mod	Low	Low	V Low	V Low	Low	VSli-sodic	Low				
Singkil	Sidorejo	SD A1	O	0	10	50	21	29	SCL	0.65	5.2	4.7	0.50	0.24	3.00	153.58	190.34			3.5	0.18	19	1.65	0.56	0.76	0.55	22.15	3.52	3	3	14	2	16	2.95	Ca sli deficient	0.74	Mg deficient
				Rating						Non Sal	Str Acid	ND	ND	Low	High	V High	Mod			High	Low	Mod	V Low	Low	High	Mod	Mod	Low	V Low	V Low	Mod	Non-sodic	V Low				
Singkil	Parakan Sulampi	PS 1	O	ND		17	32	51		0.67	5.0	4.6	0.40	0.16	1.90	76.77	135.22			3.12	0.17	18	2.47	0.48	0.61	0.5	12.12	4.06	4	5	16	4	33	5.15	Mg sli deficient	0.79	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	V Low	Mod	High	Mod			High	Low	Mod	Low	V Low	High	Mod	Low	Low	V Low	V Low	Mod	Non-sodic	V Low				
Singkil	Ujung Bawang	UB A4Mean	M	0	50					0.66	5.1	4.65	0.45	0.2	2.45	115.175	162.78			3.31	0.175	19	2.06	0.52	0.685	0.525	17.135	3.79	3	4	14	3	22	3.96	OK	0.76	Mg deficient
				Rating						Non Sal	Str Acid	ND	ND	Low	High	V High	Mod			High	Low	Mod	Low	Low	High	Mod	Mod	Low	V Low	V Low	Mod	Non-sodic	V Low				
Singkil	Ujung Bawang	UB A4	O	30	50				Peat	0.76	4.0	3.4	0.60	0.23	2.55	143.56	288.56			9.12	0.17	54	1.89	0.51	0.44	0.5	24.66	3.34	2	2	10	2	14	3.71	OK	1.16	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	Low	High	V High	Mod			V High	Low	Poor	V Low	Low	Mod	Mod	Mod	Low	V Low	V Low	Mod	Non-sodic	V Low				
Singkil	Sidorejo	SD A1	O	10	50	23	21	56	C	0.78	5.0	4.5	0.50	0.19	4.22	175.34	201.34			3.57	0.16	22	2.14	0.56	0.56	0.42	20.33	3.68	3	3	21	2	18	3.82	OK	1.00	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	V Low	High	V High	Mod			High	Low	Poor	Low	Low	Mod	Mod	Mod	Low	V Low	V Low	High	Non-sodic	V Low				
Singkil	Sidorejo	SD B1	O	0	20	33	25	42	C	0.90	5.0	4.7	0.30	0.24	3.22	133.12	189.34			3.77	0.19	20	2	0.57	0.66	0.54	18.90	3.77	3	3	17	3	20	3.51	OK	0.86	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	Low	High	V High	Mod			High	Low	Mod	Low	Low	High	Mod	Mod	Low	V Low	V Low	Mod	Non-sodic	V Low				
Singkil	Tana Bara	TB 1	O	0	20	24	34	42	C	0.98	4.6	4.2	0.40	0.20	2.22	125.7	209.88			5.06	0.17	30	2.01	0.57	0.89	0.43	20.23	3.90	3	4	11	2	19	3.53	OK	0.64	Mg deficient
				Rating						Non Sal	VStr Acid	ND	ND	Low	High	V High	Mod			V High	Low	Poor	Low	Low	High	Mod	Mod	Low	V Low	V Low	Mod	Non-sodic	V Low				
Singkil	Tana Bara	TB 2	O	0	25	24	42	34	CL	1.01	4.5	4.0	0.50	0.40	2.17	110.9	199.23			4.44	0.17	26	2.22	0.57	0.66	0.4	24.23	3.85	2	3	9	2	16	3.89	OK	0.86	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	Low	High	V High	Mod			High	Low	Poor	Low	Low	High	Mod	Mod	Low	V Low	V Low	Low	Non-sodic	V Low				
Singkil	Ujung Bawang	UB A4	O	0	30				Peat	1.05	4.3	4.0	0.30	0.35	1.55	320.45	359.57			10.01	0.18	56	2	0.59	0.89	0.43	30.33	3.91	2	3	5	1	13	3.39	OK	0.66	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	Low	Mod	Ext High	Mod			V High	Low	Poor	Low	Low	High	Mod	High	Low	V Low	V Low	Low	Non-sodic	V Low				
Singkil	Ujung Bawang	UB B5	O	0	50				Peat	1.05	4.3	4.0	0.30	0.35	2.12	250.9	367.89			8.12	0.19	43	1.99	0.59	0.67	0.34	42.76	3.59	1	2	5	1	8	3.37	OK	0.88	Mg deficient
				Rating						Non Sal	Ext Acid	ND	ND	Low	High	Ext High	Mod			V High	Low	Poor	V Low	Low	High	Mod	V High	Low	V Low	V Low	V Low	Non-sodic	V Low				

APPENDIX C Nutrient Cation Ratios and Deficiencies

Table C.1 Calcium Deficiencies

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Aceh Besar	Geunteut Lamsujen	GL R2	D	104.24	0.24	Ca deficient	0.10	Mg deficient
Aceh Besar	Geunteut Lamsujen	GL R2	O	12.00	0.14	Ca deficient	8.97	OK
Aceh Jaya	Kr. Ateu	KA A5	O	2.87	0.23	Ca deficient	6.61	OK
Aceh Utara	Pase Kanan	PKM B5	O	4.74	0.20	Ca deficient	5.36	OK
Pidie	Beuracan	Beuracan mix	M	9.34	0.32	Ca deficient	11.16	K sli deficient

***NB** Main deficiency seems to be Calcium with some possible deficiency of magnesium and Potassium*

Table C.2 Slight Calcium Deficiencies

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Aceh Besar	Blang Luas	BLH 20	O	13.30	2.99	Ca sli deficient	13.45	K deficient
Aceh Besar	Krueng Geupeu	KG I 2B	D	8.96	1.98	Ca sli deficient	9.81	OK
Aceh Jaya	Baba Ie	BI 3	D	9.31	2.33	Ca sli deficient	3.13	OK
Aceh Jaya	Bunbun	BL N7	O	10.63	2.98	Ca sli deficient	6.11	OK
Aceh Jaya	Karang Tunong	KT A1	O	13.30	2.99	Ca sli deficient	13.45	K deficient
Aceh Jaya	Kr. Ateu	KA B3	D	6.11	2.66	Ca sli deficient	2.23	Mg sli deficient
Aceh Utara	Pase Kanan	PKM B1	O	6.32	1.00	Ca sli deficient	4.27	OK
Aceh Utara	Pase Kiri	PASE KIRI MIX	D	6.92	1.68	Ca sli deficient	2.10	Mg sli deficient
Aceh Utara	Pase Kiri	PKR 28	O	7.48	1.95	Ca sli deficient	2.04	Mg sli deficient
Singkil	Sidorejo	SD A1	O	3.52	2.95	Ca sli deficient	0.74	Mg deficient

NB *Calcium slightly deficient with Magnesium often slightly deficient to deficient and Potassium also sometimes deficient*

Table C.3 Magnesium Deficiencies

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Aceh Jaya	Alue Monmata	MD 2	O	4.84	3.90	OK	1.27	Mg deficient
Aceh Jaya	Krueng Tunong	KT D1	D	8.15	4.89	OK	1.49	Mg deficient
Aceh Timur	Julok Tunong	JT B2	O	3.94	3.78	OK	0.93	Mg deficient
Aceh Timur	Julok Tunong	JT B7	O	4.09	3.39	OK	0.91	Mg deficient
Aceh Utara	Krueng Tuan	BK6	O	3.76	3.17	OK	0.86	Mg deficient
Aceh Utara	Krueng Tuan	BK7	O	4.38	4.36	OK	0.57	Mg deficient
Aceh Utara	Krueng Tuan	BKB7	O	4.34	4.16	OK	0.62	Mg deficient
Aceh Utara	Pase Kiri	PKR A3	O	3.80	4.60	OK	1.00	Mg deficient
Aceh Utara	Pase Kiri	PKR B4	O	4.00	4.24	OK	0.98	Mg deficient
Aceh Utara	Pase Kiri	PKR B5	O	4.41	4.33	OK	1.07	Mg deficient
Bireuen	Pate Lhong	PL 1	O	3.81	4.16	OK	0.70	Mg deficient
Bireuen	Pate Lhong	PL 13	O	3.82	3.93	OK	1.10	Mg deficient
Bireuen	Pate Lhong	PL2	O	3.82	3.93	OK	1.10	Mg deficient
Bireuen	Paya Nie	PYN 2	D	3.79	4.00	OK	0.79	Mg deficient
Bireuen	Paya Nie	PYN 2	O	3.66	3.57	OK	0.95	Mg deficient
Bireuen	Peudada	PAD 25	O	3.93	3.70	OK	0.71	Mg deficient
Bireuen	Samalanga	S1 0	O	5.14	3.14	OK	1.09	Mg deficient
Bireuen	Samalanga	S6	O	4.11	4.10	OK	1.36	Mg deficient
Pidie	Beuracan	Be C2 mix	M	3.03	4.09	OK	1.22	Mg deficient
Pidie	Beuracan	Be E2	O	3.48	3.65	OK	0.87	Mg deficient
Pidie	Cubo Trienggading	CT C1 mix	M	3.78	3.06	OK	1.03	Mg deficient
Pidie	Cubo Trienggading	CT I1 mix	M	4.46	3.96	OK	0.68	Mg deficient
Singkil	Sidorejo	SD A1	O	3.68	3.82	OK	1.00	Mg deficient
Singkil	Sidorejo	SD B1	O	3.77	3.51	OK	0.86	Mg deficient
Singkil	Tana Bara	TB 1	O	3.90	3.53	OK	0.64	Mg deficient
Singkil	Tana Bara	TB 2	O	3.85	3.89	OK	0.86	Mg deficient
Aceh Besar	Geunteut Lamsujen	GL H2	D	10.47	7.08	Mg deficient	3.76	OK
Aceh Jaya	Kr. Ateu	KAI 4	D	11.46	7.00	Mg deficient	5.90	OK

NB *Magnesium deficient but both calcium and potassium appear OK*

Table C.4 Magnesium Deficiencies with Possible Phosphorus Inhibition

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Aceh Besar	Blang Luas	BL A2	O	11.48	11.06	Mg deficient with P inhibition	2.35	Mg sli deficient
Aceh Besar	Blang Luas	BLA 8	D	8.05	8.65	Mg deficient with P inhibition	5.54	OK
Aceh Besar	Blang Luas	BLE7	D	9.65	22.23	Mg deficient with P inhibition	0.70	Mg deficient
Aceh Besar	Geunteut Lamsujen	GL O5	O	12.69	8.67	Mg deficient with P inhibition	1.74	Mg deficient
Aceh Besar	Geunteut Lamsujen	GL O5	O	11.81	8.23	Mg deficient with P inhibition	1.71	Mg deficient
Aceh Besar	Geunteut Lamsujen	GL Q5	D	14.21	7.15	Mg deficient with P inhibition	2.18	Mg sli deficient
Aceh Besar	Geunteut Lamsujen	GLA6	D	10.67	7.27	Mg deficient with P inhibition	3.76	OK
Aceh Besar	Geunteut Lamsujen	GLK1	D	12.87	9.37	Mg deficient with P inhibition	3.79	OK
Aceh Besar	Krueng Geupeu	KG C3	D	10.10	12.70	Mg deficient with P inhibition	2.14	Mg sli deficient
Aceh Besar	Krueng Geupeu	KG D1	O	12.15	7.86	Mg deficient with P inhibition	2.19	Mg sli deficient
Aceh Jaya	Alue Monmata	MN5	D	14.40	8.90	Mg deficient with P inhibition	0.76	Mg deficient
Aceh Jaya	Alue Monmata	MN5	O	11.44	8.79	Mg deficient with P inhibition	0.81	Mg deficient
Aceh Jaya	Alue Monmata	PM4	O	8.65	8.71	Mg deficient with P inhibition	1.44	Mg deficient
Aceh Jaya	Baba Awe	CBA B3	D	14.48	7.97	Mg deficient with P inhibition	1.12	Mg deficient
Aceh Jaya	Baba Ie	BI ES	O	10.41	13.41	Mg deficient with P inhibition	1.78	Mg deficient
Aceh Jaya	Baba Ie	BI ES	D	13.58	8.35	Mg deficient with P inhibition	2.40	Mg sli deficient
Aceh Jaya	Blang Alue Gajah	BUG 12	ND	12.00	10.06	Mg deficient with P inhibition	2.15	Mg sli deficient
Aceh Jaya	Blang Alue Gajah	BUG D8	D	9.95	14.73	Mg deficient with P inhibition	5.00	OK
Aceh Jaya	Blang Alue Gajah	BUG F6	O	11.36	9.68	Mg deficient with P inhibition	1.31	Mg deficient
Aceh Jaya	Blang Alue Gajah	BUG G1	D	13.58	11.65	Mg deficient with P inhibition	1.47	Mg deficient
Aceh Jaya	Blang Alue Gajah	BUG G1	D	13.04	12.64	Mg deficient with P inhibition	1.84	Mg deficient
Aceh Jaya	Blang Alue Gajah	BUG K4	O	11.06	12.19	Mg deficient with P inhibition	3.13	OK
Aceh Jaya	Blang Alue Gajah	BUG K4	D	14.18	7.72	Mg deficient with P inhibition	9.86	OK
Aceh Jaya	Blang Jempeuk	BJ B3	O	6.48	18.28	Mg deficient with P inhibition	0.76	Mg deficient
Aceh Jaya	Blang Jempeuk	BJ B3	D	13.89	7.55	Mg deficient with P inhibition	3.69	OK
Aceh Jaya	Blang Jempeuk	BJ B3	O	11.49	7.31	Mg deficient with P inhibition	2.19	Mg sli deficient
Aceh Jaya	Blang Jempeuk	KJ 2	O	7.64	9.72	Mg deficient with P inhibition	2.10	Mg sli deficient
Aceh Jaya	Bunbun	BL N1	O	9.16	12.11	Mg deficient with P inhibition	1.56	Mg deficient
Aceh Jaya	Jabie	JB 4	D	13.85	9.12	Mg deficient with P inhibition	3.97	OK
Aceh Jaya	Jabie	JG 2	D	15.32	7.38	Mg deficient with P inhibition	1.19	Mg deficient
Aceh Jaya	Jabie	JG 2	O	10.61	9.46	Mg deficient with P inhibition	4.35	OK
Aceh Jaya	Kr. Ateu	KA 1	O	11.27	12.87	Mg deficient with P inhibition	1.15	Mg deficient
Aceh Jaya	Kr. Ateu	KA 30	D	12.08	8.74	Mg deficient with P inhibition	2.68	Mg sli deficient
Aceh Jaya	Kr. Ateu	KA 30	D	12.33	8.47	Mg deficient with P inhibition	2.85	Mg sli deficient
Aceh Jaya	Kr. Ateu	KA 30	D	10.00	8.33	Mg deficient with P inhibition	3.23	OK
Aceh Jaya	Kr. Ateu	KAC	O	11.09	8.90	Mg deficient with P inhibition	2.91	Mg sli deficient
Aceh Jaya	Krueng Tunong	KT D1	O	7.65	16.51	Mg deficient with P inhibition	0.70	Mg deficient
Aceh Jaya	Krueng Tunong	KTC	D	7.71	8.22	Mg deficient with P inhibition	1.18	Mg deficient
Aceh Jaya	Kuala Meurisi	ML	D	10.37	10.15	Mg deficient with P inhibition	2.60	Mg sli deficient
Aceh Jaya	Kuala Meurisi	TL 7	D	12.92	7.69	Mg deficient with P inhibition	3.90	OK
Aceh Jaya	Lambesoi	LS 10	O	9.69	8.63	Mg deficient with P inhibition	7.82	OK
Aceh Jaya	Lambesoi	LS 13 CLAY	O	8.77	8.19	Mg deficient with P inhibition	1.98	Mg deficient
Aceh Jaya	Lambesoi	LS 26	O	11.85	7.60	Mg deficient with P inhibition	2.73	Mg sli deficient
Aceh Jaya	Meulha	MA9	D	14.53	7.29	Mg deficient with P inhibition	2.03	Mg sli deficient
Aceh Jaya	Panghuleu Harakat	PH A3	O	11.67	7.50	Mg deficient with P inhibition	2.90	Mg sli deficient
Aceh Jaya	Panghuleu Harakat	PH D1	O	10.03	9.03	Mg deficient with P inhibition	1.42	Mg deficient
Aceh Jaya	Panghuleu Harakat	PH D1	D	9.26	10.14	Mg deficient with P inhibition	1.61	Mg deficient
Aceh Utara	Pase Kanan	PKNI	O	4.61	7.48	Mg deficient with P inhibition	0.73	Mg deficient
Bireuen	Samalanga	S7	O	4.57	7.71	Mg deficient with P inhibition	0.51	Mg deficient
Pidie	Beuracan	BE F3 (mix)	M	4.64	16.88	Mg deficient with P inhibition	0.28	Mg deficient
Pidie	Cubo Trienggading	CTA3 mixed	M	3.66	11.16	Mg deficient with P inhibition	0.32	Mg deficient

NB ***Magnesium generally deemed deficient via both ratios with the a possibility that due to imbalance of nutrients phosphorus could be inhibited. No Available-P or Total-P values determined so no comment can be made on this topic***

Table C.5 Slight Magnesium Deficiencies

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Aceh Besar	Blang Luas	BL A2	D	13.63	6.76	Mg sli deficient	4.21	OK
Aceh Besar	Blang Luas	BLA 8	O	8.75	5.86	Mg sli deficient	3.55	OK
Aceh Besar	Blang Luas	BLDO 3A	D	11.13	6.74	Mg sli deficient	6.63	OK
Aceh Besar	Blang Luas	BLDO 3B	D	11.39	5.14	Mg sli deficient	17.00	K deficient
Aceh Besar	Blang Luas	BLE 7	O	9.85	5.74	Mg sli deficient	3.13	OK
Aceh Besar	Blang Luas	BLG 13	D	8.40	5.86	Mg sli deficient	12.33	K deficient
Aceh Besar	Geunteut Lamsujen	GL Q5	D	15.98	6.30	Mg sli deficient	4.78	OK
Aceh Besar	Krueng Geupeu	KG D1	D	12.67	6.47	Mg sli deficient	3.08	OK
Aceh Besar	Krueng Kala	KK F2	D	10.36	5.97	Mg sli deficient	3.33	OK
Aceh Besar	Krueng Kala	KKD 4	D	10.16	5.97	Mg sli deficient	6.84	OK
Aceh Besar	Krueng Kala	KKE 10	O	9.40	6.23	Mg sli deficient	3.34	OK
Aceh Besar	Krueng Kala	KKE 10	D	10.06	6.69	Mg sli deficient	1.86	Mg deficient
Aceh Jaya	Alue Monmata	PM 14	D	14.13	6.43	Mg sli deficient	2.70	Mg sli deficient
Aceh Jaya	Alue Monmata	PM 14	O	10.01	5.83	Mg sli deficient	2.07	Mg sli deficient
Aceh Jaya	Alue Monmata	PM4	D	13.83	6.33	Mg sli deficient	1.50	Mg deficient
Aceh Jaya	Baba Awe	CB A1	O	14.60	6.64	Mg sli deficient	3.20	OK
Aceh Jaya	Baba Awe	CB A1	D	12.40	5.77	Mg sli deficient	3.31	OK
Aceh Jaya	Baba Awe	CBA B3	D	14.21	5.40	Mg sli deficient	7.71	OK
Aceh Jaya	Blang Alue Gajah	BUG C3	D	12.44	5.43	Mg sli deficient	4.32	OK
Aceh Jaya	Blang Alue Gajah	BUG D8	D	11.17	6.00	Mg sli deficient	12.42	K deficient
Aceh Jaya	Blang Alue Gajah	BUG F6	O	14.39	5.19	Mg sli deficient	3.15	OK
Aceh Jaya	Blang Alue Gajah	BUG I2	D	10.68	6.61	Mg sli deficient	1.74	Mg deficient
Aceh Jaya	Blang Jempeuk	BJ D3	O	13.36	6.86	Mg sli deficient	5.10	OK
Aceh Jaya	Blang Jempeuk	BJ D3	O	14.38	6.28	Mg sli deficient	5.48	OK
Aceh Jaya	Blang Jempeuk	BJB3 Mean	O	13.87	6.55	Mg sli deficient	5.30	OK
Aceh Jaya	Blang Jempeuk	KJ 2	D	9.76	6.05	Mg sli deficient	2.87	Mg sli deficient
Aceh Jaya	Jabie	JB 4	D	14.65	6.42	Mg sli deficient	1.91	Mg deficient
Aceh Jaya	Jabie	JG 2	O	13.81	6.23	Mg sli deficient	1.23	Mg deficient
Aceh Jaya	Jabie	JG2 Mean	O	14.57	6.79	Mg sli deficient	1.21	Mg deficient
Aceh Jaya	Karang Tunong	KT H1	O	11.83	6.40	Mg sli deficient	1.90	Mg deficient
Aceh Jaya	Karang Tunong	KT H1	D	14.63	5.90	Mg sli deficient	1.44	Mg deficient
Aceh Jaya	Karang Tunong	KTG1	D	14.71	5.93	Mg sli deficient	1.24	Mg deficient
Aceh Jaya	Kr. Ateu	KA 1	D	13.29	6.61	Mg sli deficient	2.39	Mg sli deficient
Aceh Jaya	Kr. Ateu	KA A5	D	8.60	5.86	Mg sli deficient	3.83	OK
Aceh Jaya	Kr. Ateu	KA B	O	9.33	6.71	Mg sli deficient	3.10	OK
Aceh Jaya	Kr. Ateu	KAC	D	14.12	5.38	Mg sli deficient	4.90	OK
Aceh Jaya	Kr. Ateu	KAC4	D	12.35	6.58	Mg sli deficient	2.78	Mg sli deficient
Aceh Jaya	Kr. Ateu	KAI 4	O	12.52	6.43	Mg sli deficient	7.15	OK
Aceh Jaya	Kr. Ateu	KD 10	O	13.04	5.68	Mg sli deficient	3.04	OK
Aceh Jaya	Krueng Tunong	KT A1	D	8.95	6.78	Mg sli deficient	3.52	OK
Aceh Jaya	Kuala Meurisi	ML	O	7.70	5.48	Mg sli deficient	2.02	Mg sli deficient
Aceh Jaya	Kuala Meurisi	TL 7	D	11.83	6.85	Mg sli deficient	1.92	Mg deficient
Aceh Jaya	Kuala Meurisi	TL B3	O	9.20	5.41	Mg sli deficient	2.73	Mg sli deficient
Aceh Jaya	Kulam Asan	LB B3	D	12.29	6.06	Mg sli deficient	2.85	Mg sli deficient
Aceh Jaya	Lambaro	LD1	D	13.36	6.48	Mg sli deficient	1.18	Mg deficient
Aceh Jaya	Lambaro	LD1	D	8.87	6.09	Mg sli deficient	1.10	Mg deficient
Aceh Jaya	Lambaro	LDI	O	9.89	6.99	Mg sli deficient	1.13	Mg deficient
Aceh Jaya	Lambaro	LDI	D	12.87	6.43	Mg sli deficient	1.19	Mg deficient
Aceh Jaya	Lambesoi	LS 10	D	12.92	6.55	Mg sli deficient	3.20	OK
Aceh Jaya	Lambesoi	LS 13	O	9.53	5.15	Mg sli deficient	2.14	Mg sli deficient
Aceh Jaya	Lambesoi	LS 26	D	13.26	6.80	Mg sli deficient	6.81	OK
Aceh Jaya	Lambesoi	LS N17	O	9.66	6.73	Mg sli deficient	1.39	Mg deficient
Aceh Jaya	Meudheun	M3	O	8.77	5.20	Mg sli deficient	4.07	OK
Aceh Jaya	Meulha	MA9	O	8.41	6.34	Mg sli deficient	1.59	Mg deficient
Aceh Jaya	Panghuleu Harakat	PH A3	D	13.54	5.61	Mg sli deficient	6.48	OK
Aceh Jaya	Treng Lipeh	KM B2	0	11.07	5.93	Mg sli deficient	12.42	K deficient
Aceh Jaya	Treng Lipeh	KM C2	O	9.36	6.68	Mg sli deficient	5.59	OK
Aceh Utara	Pase Kiri	Pase Kiri III	D	5.80	5.30	Mg sli deficient	0.53	Mg deficient
Aceh Utara	Pase Kiri	PKR 28	O	6.35	6.17	Mg sli deficient	0.51	Mg deficient
Bireuen	Pandrah	PD 1	O	5.40	6.58	Mg sli deficient	1.90	Mg deficient
Bireuen	Pate Lhong	PL13	O	4.48	5.71	Mg sli deficient	0.88	Mg deficient
Bireuen	Paya Nie	PN 1	O	4.55	5.36	Mg sli deficient	1.22	Mg deficient
Bireuen	Peudada	PAD D3	O	4.55	5.36	Mg sli deficient	1.22	Mg deficient
Pidie	Beuracan	Beuracan I	M	4.76	5.24	Mg sli deficient	0.77	Mg deficient

Table C.5 Slight Magnesium Deficiencies **(Continued)**

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Singkil	Parakan Sulampi	PS 1	O	4.06	5.15	Mg sli deficient	0.79	Mg deficient
Singkil	Sidorejo	SD B1	O	4.36	5.27	Mg sli deficient	0.87	Mg deficient
Singkil	Ujung Bawang	IUB 1	O	4.78	5.05	Mg sli deficient	0.80	Mg deficient
Aceh Besar	Krueng Geupeu	KG I 2A	D	8.87	3.94	OK	2.25	Mg sli deficient
Aceh Besar	Krueng Kala	KK F2	O	9.39	4.85	OK	2.54	Mg sli deficient
Aceh Jaya	Blang Alue Gajah	BUG I2	O	11.45	4.62	OK	2.52	Mg sli deficient
Aceh Jaya	Karang Tunong	KTG1	O	13.47	4.17	OK	2.46	Mg sli deficient
Aceh Jaya	Kr. Ateu	KA 14	D	10.21	4.88	OK	2.73	Mg sli deficient
Aceh Jaya	Meudheun	M3	D	13.43	4.60	OK	2.56	Mg sli deficient

NB *In the above group magnesium deemed deficient via the Ca:Mg ratio but in at least 50% of the samples also deemed slightly deficient to deficient via the Mg:K ratio*

Table C.6 Potassium Deficiencies

Kabupaten	Scheme	Site No	Soil O Deposit D	TEB	Ratio Ca/Mg	Rating	Ratio Mg/K	Rating
Aceh Besar	Blang Luas	BLG 13	O	9.77	4.84	OK	11.69	K sli deficient
Aceh Besar	Blang Luas	BLH 20	D	10.85	3.82	OK	11.47	K sli deficient
Aceh Besar	Geunteut Lamsujen	GLK1	O	13.52	3.43	OK	10.54	K sli deficient

NB ***Potassium deemed only slightly deficient whilst other nutrients would appear to be OK***

Appendix D ETESP Reports and Tools plus References

D.1 ETESP Soil Desalinisation and Improvement Reports

D.1.1 Technical Data Reports

ETESP Agricultural Component, Desalinisation & Soil Improvement, Mobilisation Report, OCTOBER 2005, Updated FEBRUARY 2006

ETESP, Banda Aceh Kota, Kuta Alam, Data Assessment and Soil Reclamation, NOVEMBER 2005

ETESP, Aceh Besar Kabupaten, *Lhoknga, Darussalam and Baitissalam*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Pidie Kabupaten, *Meureudu, Triang Gadeng, Panteraja and Simpang Tiga*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Bireuen Kabupaten, *Samalanga, Jeunieb, Jeumpa, Jangka and Ganda Pura*, Data Assessment and Soil Reclamation, DECEMBER 2005

ETESP, Executive Summary, Soil and Land Reclamation, DECEMBER 2005

ETESP, Soil and Land Reclamation Scenarios, DECEMBER 2005, Updated March 2006

ETESP, Interpretation of Laboratory Data for ETESP Irrigation Component, FEBRUARY 2006

ETESP, Detailed Study of Laboratory Data, APRIL 2006

D.1.2 Background Technical Papers

ETESP, Background Paper, Annual & Monthly Rainfall, OCTOBER 2005

ETESP, Background Paper, Soil Acidity and Aluminium, DECEMBER 2005

ETESP, Digital Maps, FEBRUARY 2006, Update MARCH 2006

ETESP, Sandy Sediments, FEBRUARY 2006, Updated March 2006

ETESP, Soil Conditions for Wetland Rice, MARCH 2006

D.1.3 Site Visit and Tour Reports

ETESP, Site Visit Report – BRR Area at Lhoong: Kemukiman Cot Jeumpa, DECEMBER 2005

ETESP, Site Visit report, BLANG KREUNG SITE, DECEMBER 2005

ETESP, Tour Report, Field Tour Report NAD Areas, Feb 20th – Feb 24th 2006, FEBRUARY 2006

ETESP, Site Visit Report, Visit to Oxfam Sites Calang, MARCH 2006

ETESP, Site Visit Report, Visit to Red Cross Site, Aceh Besar, MARCH 2006

ETESP, Site Visit Report, Lhamno Irrigation Sites, Aceh Jaya, MARCH 2006

D.2 ETESP Soil Desalinisation and Improvement Tools

File name and date	Purpose
ETESP ECe from EM38 data.XLS OCTOBER 2005	Calculate soil salinity (ECe) values from raw data collected by EM38 salinity device when no calibration information provided
ETESP Leaching Water Requirements.XLS NOVEMBER 2005	Calculate the depths and volumes of water that have to be applied and pass through a selected depth of soil to achieve desalinisation. Information required includes: • Textural class of soil • Initial salinity of the soil (dS/m) • Target salinity wished to be achieved (dS/m)
ETESP Irrigation Leaching Progress.XLS NOVEMBER 2005	Determine how many irrigation gifts have to be applied to achieve de-salinisation of various depths of variously textured soil. Information required includes: • Soil textural group, or • AWHC (Available Water Holding Capacity) • Estimate of water application efficiency, or use default values • Size of irrigation gift as mm of water
ETESP Survey Density.XLS DECEMBER 2005	1. Correlate the scale at which to map surveys of various types from reconnaissance to very detailed level 2. Determine observation density (Sites / hectare) 3. Calculate the total number of sites for surveys at various reliability levels Requirements: • Survey area extent in hectares (ha) Also presents various map and mapping information
ETESP Labdata summary.XLS Version 4 FEBRUARY 2006	Enter standard laboratory data and obtain ratings as to the level of all the various nutrients and chemical properties. Also calculate weighted mean vales for topsoil and subsoil plus obtain automatic simple summary of: • Inherent fertility • Fertility potential • Possible nutrient deficiencies • Salinity status, and • Reaction Also experimental estimate of possible perceived risks
ETESP Site Monitoring tool.XLS March 2006	Enter field data for specific sites or villages making note of : 1. <u>Locational information</u> • Kabupaten • Kecamatan • Desa • Farmer or Land-owner, and • Geographic coordinates 2. <u>Soil, land and crop features</u> • surface soil textural group • soil salinity • soil acidity • irrigation water quality (salinity) • status of drains, plus • estimate (%) of the actual pre-tsunami crop yield to monitor land reclamation progress and get information on further interventions possibly required

ETESP Soil Conditions Database tool.XLS March 2006	Enter field collected on the site form, or data collated and analysed from the data on the site form into a format that will be the first stages of a dbms / GIS compilation: • surface soil textural group • soil salinity • soil acidity • irrigation water quality (salinity) • status of drains, plus • estimate (%) of the actual pre-tsunami crop yield The data are stored against the official Dinas selected villages that qualify for ETESP inputs. This collation will allow monitoring land reclamation progress within kecamatan and kabupaten and get information on further interventions possibly required
ETESP Auger Description Form	Simple pro-forma for recording data collected during soil investigations to establish depths and distribution of sandy sediments
ETESP Labdata Collation.XLS APRIL 2006	Enter standard laboratory data and obtain ratings as to the level of all the various nutrients and chemical properties pH ECe Exch H and Al Exch-cations Total-N Organic-C CEC TEB BS ASP ESP Ca:Mg ratios Mg:K ratios

D.3 References

Booker Tropical Soil manual, Editor J R Landon, "A handbook for soil survey and agricultural land evaluation in the tropics and subtropics, Longman Scientific and Technical 1991. ISBN 0-582-00557-4

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