Appendix 4-3 Achievement of short term expert in 2014

Appendix 4-3-1 Report of short term expert (DNA analysis)

Expertise	Name	Term
DNA analysis	Dr. So Hanaoka	6.4.2014 – 15.4.2014

Itinerary

Date	Activity
6-Apr	Depart Japan
7-Apr	Arrive to Nairobi, Move to Kitui
8-Apr	Collection in Tiva seed orchard
9-Apr	Collection in Tiva seed orchard, Move to Nairobi
10-Apr	Instruction in KEFRI laboratory
11-Apr	Instruction in KEFRI laboratory
12-Apr	Documentation
13-Apr	Documentation
14-Apr	Depart Nairobi
15-Apr	Arrive to Japan

Result of major activities

● Collection of the materials from the *Melia* seed orchard in Tiva

The leaves of approximately 700 individuals in newly established seed orchard and 250 ones in old seed orchard were collected. They will be used for clone identification.

● Experiment in the laboratory

DNA analyzing software was installed in the computer. DNA data were well analyzed using this software. In *Acacia tortilis* 17 candidate DNA markers were obtained. After adopting them for 60 to 90 individual samples appropriate markers will be selected.

Photo 1. Gate of the Tiva seed

Photo 2. Tiva seed orchard

Photo 3. Collection of the leaves

Photo 4. Tiva seed orchard

Photo 5. Old seed orchard in Tiva

Photo 6. Old seed orchard in Tiva

Appendix 4-3-2 Report of short term expert (Breeding)

Expertise	Name	Term
Breeding	Dr. Hisaya Miyashita	1.6.2014 – 15.6.2014

Itinerary

Date	Activity
1-Jun	Depart Japan
2-Jun	Arrive to Nairobi, move to Kitui
3-Jun	Tiva pilot forest
4-Jun	Tiva pilot forest
5-Jun	Kitui Regional Research Centre
6-Jun	Tiva seed orchard
7-Jun	Tiva seed orchard
8-Jun	Tiva seed orchard
9-Jun	Tiva seed orchard
10-Jun	Tiva seed orchard
11-Jun	Move to Nairobi, Forest Products Research Centre
12-Jun	Forest Products Research Centre
13-Jun	Forest Products Research Centre
14-Jun	Depart Nairobi, Arrive Japan

Result of major activities

● Wood property study in *Melia volkensii*

To know the basic characteristics of *Melia* wood samples were collected. Thirty trees in Tiva pilot forest were logged and sample wood pieces were obtained. In Tiva seed orchard wood density and wood stiffness were measured.

● Heartwood study in *Melia volkensii*

Study of heartwood concerning insect resistance was planned.

photo 1-6. Sampling of wood pieces for wood property measurement in Tiva pilot forest

Photo 1. Stem measurement

Photo 2. Sampling each 1m

Photo 3. Sampling till 8m from the ground

Photo 4. Sampling

Photo 5. Weight measurement

Photo 6. Sampling of wood pieces

Photo 7-12. Sampling of wood pieces for heartwood study in Tiva pilot forest

Photo 7. Recording ID to each wood pieces

Photo 8. Site/No/Part

Photo 9. For chemical composition analysis use

Photo 10. Sampling each 1m

Photo 11. Sampling each 1m till 8m

Photo 12. Sampling

Photo 13-18. Wood property study in the laboratory

Photo 13. Instruction of cutting

Photo 14. Cutting through the pith

Photo 15. Cutting into a rectangle pieces

Photo 16. Drying after cutting

Photo 17. Growth ring analysis

Photo 18. High-performance liquid chromatography

Photo 19-24. Measurement in the Tiva seed orchard

Photo 19. Measurement with pilodyn

Photo 20. Coating with Topsin Paste

Photo 21. Obtaining skill

Photo 22. Melia trees grown measurable size

Photo 23. How to care measurement equipment

Photo 24. Instruction of vertex

Appendix 4-3-3 Report of short term expert (Project management)

Expertise	Name	Term
General issues	Dr. Masatoshi Ubukata	8.6.2014 – 15.6.2014

Itinerary

Date	Activity
8-Jun	Depart Japan
9-Jun	Arrive to Nairobi, JICA, KEFRI, move to Karura and Kitui
10-Jun	Kitui Regional Research Centre, Tiva
11-Jun	Move to Kibwezi, Kibwezi Centre, seed orchard, farmer, move to Nairobi
12-Jun	KEFRI
13-Jun	Karura Centre
14-Jun	Depart Nairobi
15-Jun	Arrive to Japan

Result of major activities

● General issues

The progressing project activities were discussed with JICA and KEFRI.

● Seed orchard

Some *Melia* trees grow quite better than ordinary seedlings in Tiva seed orchard. Most trees grow well. In some trees insect-damaged leaves and yellowish leaves, resin producing were found. Eighty clones were planted and further 20 clones will be planted in this fiscal year. Trees were smaller in Kibwezi seed orchard, as they planted a half year later than Tiva.

● *Melia* progey test trial establishment

Seeds for the progeny trial have been obtained. Land preparation of the trial will be start in November.

Photo 1. *Melia* seed orchard

Photo 2. Flower budding

Photo 3. Yellowish leaves in Melia seed orchard

Photo 4. Recovery of the infected tree

Photo 5. Leaned tree in the Kibwezi seed orchard

Photo 6. Kibwezi seed orchard

Photo 7. *Melia* plantation of a farmer

Photo 8. KEFRI calendar

Photo 9. *Melia* fruit setting in the old seed orchard in Tiva

Photo 10. Seeds of each clone

Photo 11. Cutting the *Melia* fruit coat

Photo 12. Seeds of *Melia*

Photo 13. Germination bed of *Melia*

Photo 14. Potted seedlings of *Melia*

Photo 15. Gas chromatography in the laboratory of Karura Centre

Photo 16. A supplied transformer

Appendix 4-3-4 Report of short term expert (Drought tolerance)

Expertise	Name	Term
Drought tolerance	Dr. Koichiro Gyokusen	13.7.2014 – 27.7.2014

	AM	PM
07.13(Sun.)		Departure(Fukuoka)
07.14(Mon.)	Arrival(Nairobi) Transfer from Nairobi to Kitui and visiting the seed orchard in Tiva nursery. Kick off meeting	Check of the components of weather station send to Kitui center
07.15(Tue.)	Setting the weather station inTtiva seed orchard	.Check of the automatic camera
07.16(Wed.)	Setting the weather station in Tiva seed orchard	Meeting with Muchiri. Preparation for setting of the weather station in Kibwezi.
07.17(Thu.)	Resetting the auto cameras and repair of dendrometer in Tiva seed orchard	Downloading of dendrometer data and repair of dendrometer at Tiva nursery. Preparation for setting of the weather station in Kibwezi.
07.18(Fri.)	Transfer from Kitui to Kibwezi	Setting the weather station in Kibwezi seed orchard
07.19(Sat.)	Setting the weather station in Kibwezi seed orchard	Take photos of both of inferior and superior clones in Kibwezi seed orchard
07.20(Sun.)	Data analysis	Transfer from Kibwezi to Kitui
07.21(Mon.)	Preparation for pressure chamber measurement	P-v curve measurement of Eucalyptus
07.22(Tue.)	Take photos of selected clones inTiva orchard and sampling for p-v curve measurement	P-v curve measurement of Gmelina
07.23(Wed.)	P-v curve measurement of Melia volkensii	P-v curve measurement of Melia azedarach
07.24(Thu.)	P-v curve measurement of Acacia tortiris	Wrap up meeting
07.25(Fri.)	Measurement of water potential in Tiva orchard	Data analysis
07.26(Sat.)	Departure (Nairobi)	
07.27(Sun.)	Arrival (Fukuoka)	

KEFRI staff
Mr. Kigwa
Mr. Muchiri
Dr. Muturi
Dr. Ndufa

2. Activities and results

2.1. Set up of weather monitoring equipment

The weather monitoring equipments were set up at Tiva and Kibwezi seed orchards (fig.1). Air temperature, humidity, solar radiation and precipitation sensors were attached to a small support tower (1.8m height) in each height with one data logger (fig.2). The soil moisture sensors were installed in 15cm, 30cm, 50cm, and 100cm soil depth and the data logger was put in a small box made of iron and wood (fig.2). Holes for sensor were dug using a handy drill (fig.2).

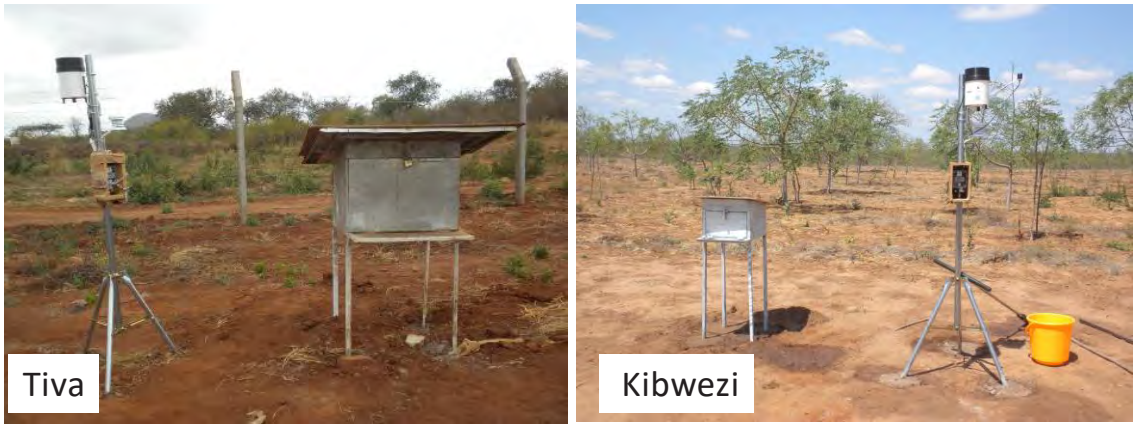


Fig.1 Weather monitoring equipments set up at Tiva and Kibwezi seed orchards.

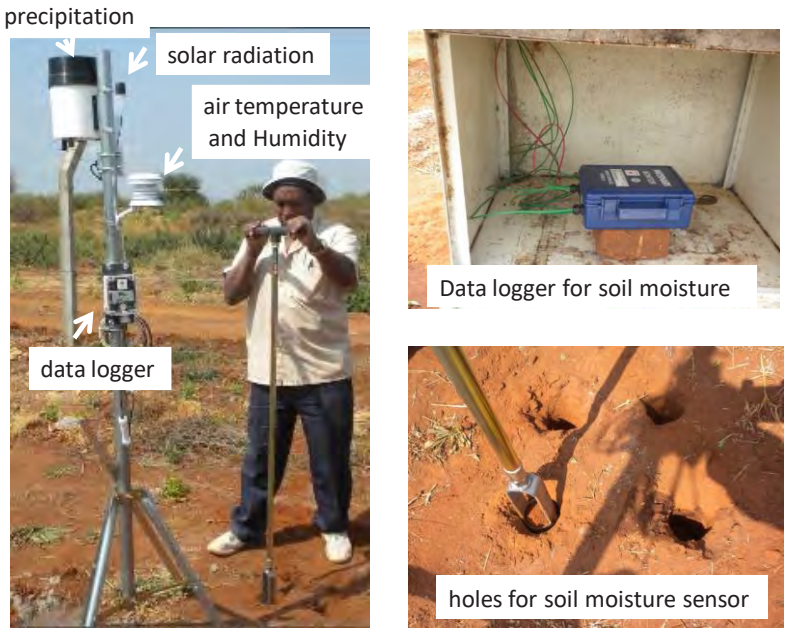


Fig.2 Sensors attached to a small support tower, data logger for soil moisture put in an iron box, and holes for moisture sensor dug by handy drill.

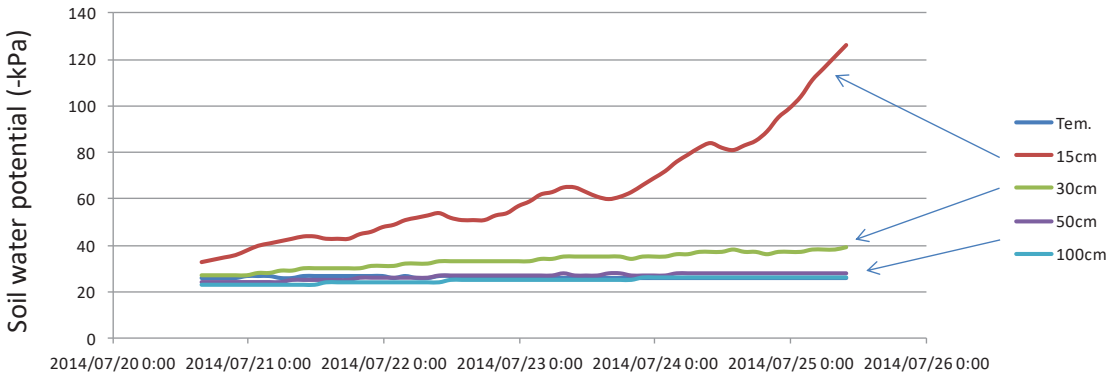


Fig.3 Changes of soil water potential for five days.

Changes of soil water potential for five days measured by installed equipment were shown in fig.3. Soil water potential of 15cm, 30cm, 50cm, and 100cm depth at 5 days after the sensor installment, were -120 kPa (-1.2bars), -40kPa, -22kPa, and -22kPa, respectively. In spite of the dryness of the soil surface (15cm depth), inside of soil (30cm, 50cm, and 10cm) were still wet.

2.2 Growth phenology of *Melia volkensii* in Tiva nursery

[Activities]

To reveal the stem growth phenology of *Melia.volkensii*, we started to measure the stem growth of about 20 year old Melia trees in Tiva nursery at31th. August, 2012. The new data, logged by automatic dendrometer from 21th September, 2013 to 14th July, 2014 were downloaded and analyzed.

[**Results**]

Seasonal changes of stem radius increment and precipitation were shown in fig.4. The stem growth of tree No.1 was shown as a representative data in fig.4.

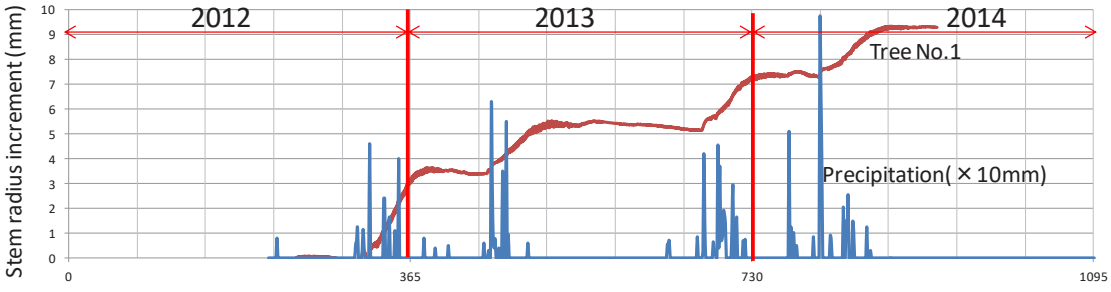


Fig4. Seasonal changes of stem radius increment of *Melia volkensii* growing in Tiva nursery. Precipitation data were collected at Tiva nursery manually.

There were two times of stem increment in a year, namely, from March to May and from November to December. The beginning of stem increment was likely to be synchronized with the beginning of precipitation..

2.2. Physiological characteristic of superior and inferior clones

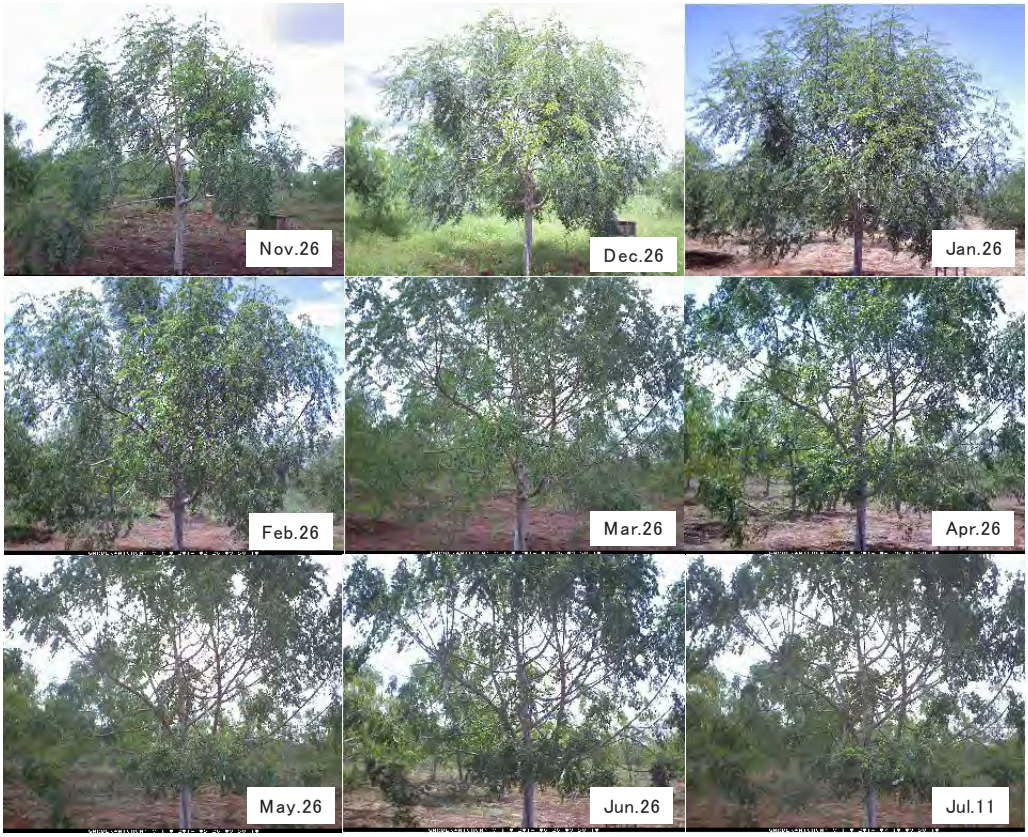
[Activities]

To reveal the physiological characteristics of superior and inferior clones, we started to measure the leaf and stem growth phenology of selected clones planted in Tiva seed orchard. Six sets of automatic camera and manual dendrometer were attached to target clones at 25th Nov. 2013. ID40, 44, 49 and ID31, 39, 54 were selected as suitable clones for our measurement in the view of their distributions in the orchard.

[**Results**]

Photos taken by automatic camera were shown in fig,5. Only photos of ID49 were available, because other cameras had changed their angles and then could not take continuous photos from same direction. ID49 did not fall its leaves even the dry period (from Feb. to Mar.). This time we could not detect the differences of leaf phenology between superior and inferior clones mainly because of camera troubles. However, as the cameras were repaired and reset in this time, I expect we can compare the differences in next dry season (from Jul. to Oct.).

Fig.5. Photos taken by automatic camera continuously from 26th Nov. 2013 to 11th Jul. 2014.



About the stem growth measurement, the growth was too fast to measure. We asked our C/P to record the manual dendrometer in 2 weeks interval, but it grew more than 10mm in one month. It went over the maximum ability (12mm) within a short period. So, we asked C/P to record them in everyday and reset them over 10mm reading in the next stage.

2.3. Growth ranking of plus trees planted in Tiva and KIbwezi seed orchard

[Activities]

Growth data collected in July 2013 and March 2014 were compared. The biggest tree (stem volume size (D2H) was used as an index of growth) of each clone in each block was used for this analysis. The ranking of each clone in each block was averaged and ranked from the top to the last.

Table 1. Averaged ranking of each clone in both seed orchard of Tiva and Kibwezi

Tiva seed orchard

year¥rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2013.7	49	29	52	27	44	18	40	28	58	12	34	51	16	53	6	8	45	22	7	48
2014.3	44	29	49	8	18	45	47	6	40	58	27	52	14	22	28	59	43	34	7	12

year¥rank	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
2013.7	11	37	30	32	42	50	36	4	57	56	2	46	33	21	23	1	39	19	54	31
2014.3	50	35	36	38	46	23	10	57	54	33	30	15	55	1	2	19	39	21	31	56

Kibwezi seed orchard

year¥rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
2013.7	40	49	18	27	60	44	59	37	29	48	47	8	51	52	34	6	13	43	5	19
2014.3	59	40	49	44	18	34	6	22	27	37	20	45	60	7	29	5	47	28	43	19

year¥rank	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
2013.7	41	31	7	28	35	24	11	39	54	21	42	9	23	33	46	55	4	17	36	3
2014.3	16	24	31	12	56	39	4	1	23	33	21	46	10	2	11	9	55	17	36	3

Superior clones selected from the 2014 data of Tiva seed orchard
Inferior clones selected from the 2014 data of Tiva seed orchard
Clones missing at least one of the block data

The ranks were calculated using the maximum stem volume of each clone in six blocks.

[**Results**]

There was not a remarkable change in the ranking of superior clones at Tiva seed orchard except ID-8. The ranking of ID-8 in 2014 increased to the 4th from the 18th in 2013. About the inferior clones, ID-56 changed its ranking from 50th to the last. Lots of trees died at Kibwezi seed orchard and in some clones all of the trees (five individual trees) planted in one block died (pink colored boxes in table 1), then it was difficult to compare the ranking of two sites directly. However the ranking of superior and inferior clones in both sites were similar, namely the superior clones at Tiva were superior at Kibwezi and the inferior clones at Tiva were inferior clones at Kibwezi. This result shows that the growth of superior and inferior clones selected here was determined mainly by genetic factors. Now, we can choose ID-49, 44, 18 as superior clones and ID-21, 31, 39, 56 as inferior clones taking account of the ranking of both sites.

2.4. Leaf water relations of Melia volkensii

[Activities]

Pressure volume curves of some trees were made and compared the water relations of *Melia volkensii* with those of other trees. Leaves of 5 tree species (*Eucalyptus camaldulensis, Acacia tortilis, Gmelina arborea, Melia volkensii, Melia azedarach*) planted at the nursery of Kitui center were used.

[**Results**]

Pressure-volume curves of five trees and some characteristics obtained from these curves were shown in fig. 6 and table 2. Eucalyptus, Acacia, and Melia a. decreased the water potential rapidly with a small water loss, whereas Gmelia and Melia v. decreased the water potential at a slow space. This result shows that Eucalyptus, Acacia, and Melia a. have a hard cell wall compared with Gmelia and Melia v..

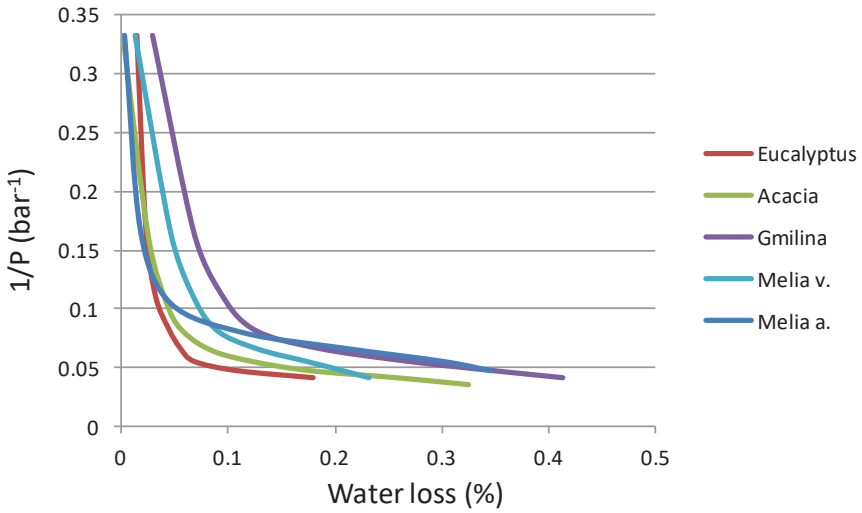


Fig.6 Pressure volume curves of 5 tree species

Table 2. Water related parameters of five trees

	wc(%)	Ψtlp(-Mpa)	Ψosm (-Mpa)
Eucalyptus	255	2.00	1.80
Acacia tortilis	263	1.80	1.52
Gmelina	377	1.50	1.12
Melia volkensii	599	1.50	1.04
Melia azedarach	612	1.25	1.05

The order of water potential at the turgor loss (Ψtlp) was *Eucalyptus<Acacia<Gmelia , Melia v.<Melia a.* , and that of osmotic potential at full water (Ψosm) was *Eucalyptus<Acacia<Gmelia<Melia a., Melia v.*. These data show that *Melia volkensii* has not special advantageous characteristics of drought tolerance compared with other planting tree species.

Appendix 4-3-5 Report of short term expert (Drought tolerance)

Expertise	Name	Term
Drought tolerance	Dr. Michito Tsuyama	13.7.2014 – 27.7.2014

Itinerary

	Date	AM	PM
1	13.7（Sun）		Departure(Fukuoka)
2	14.7（Mon）	Arrival(Nairobi), Move to Kitui	Maintenance of PAM chlorophyll fluorometer at Tiva seed orchard
3	15.7（Tue）	Meeting	chlorophyll fluorescence measurement of clone
4	16.7（Wed）	chlorophyll fluorescence measurement of clone	chlorophyll fluorescence measurement of clone
5	17.7（Thu）	chlorophyll fluorescence measurement of clone	chlorophyll fluorescence measurement of clone
6	18.7（Fri）	Move to kibwezi	Physiology analysis of clone
7	19.7（Sat）	chlorophyll fluorescence measurement of clone	Physiology analysis of clone and native tree species
8	20.7（Sun）	Data analysis	Move to Kitui
9	21.7（Mon）	Physiology analysis of clone and native tree species	Physiology analysis of clone and native tree species
10	22.7（Tue）	Physiology analysis of clone and native tree species	Physiology analysis of clone and native tree species
11	23.7（Wed）	Physiology analysis of clone and native tree species	Physiology analysis of clone and native tree species
12	24.7（Thu）	Physiology analysis of clone and native tree species	Report of activities at KEFRI
13	25.7（Fri）	Physiology analysis of clone and native tree species	Physiology analysis of clone and native tree species
14	26.7（Sat）	Move to Nairobi, Departure(Nairobi)	
15	27.7（Sun）	Arrival(Fukuoka)	

1.1. Maintenance of PAM chlorophyll fluorometer

[Activities]

The previously introduced chlorophyll fluorometer (PAM fluorometer) was set up for the purpose of analyses in Tiva orchard. In chlorophyll fluorescence experiment a leaf has to be dark-adapted for at least 30 min prior to experiment to remove pre-history of illumination to the leaf. A dark-room was made enabling such a sensitive physiological experiment in the orchard.

[Results]

Chlorophyll fluorescence measurements can be conducted in the orchard without returning back to the KEFRI center in Kitui. This would allow us to obtain exact data, which is close to those *in situ*.

1.2. Measurements of chlorophyll fluorescence

[Activities]

The chlorophyll fluorescence parameter Fv/Fm was measured and compared between leaves from superior and inferior clones. The parameter indicates the potential quantum yield of photosystem II, which reflects so called 'the degree of soundness' of photosynthesis of a leaf. The Fv/Fm value in a healthy leaf is normally from 0.8 to 0.85.

[Results]

As shown in Fig. 1, from the last November to this July, the values of Fv/Fm parameter were around 0.8 in young leaves in all the clones selected and there was no difference in the values between the superior and inferior clones. Somewhat small values were obtained in July in all the clones (Table 1).

During the visit this time, we found a difference in a leaf color between the superior clone no. 49 and the inferior clone no. 54 in July (compare Figs. 2A and 2B). In the inferior clone no. 54, aged leaves have turned to yellow (in Fig. 2C, yellow/green or all yellow). In the superior clone no. 49, the corresponding leaves are still green, whereas some yellow spots were observed on the leaf surface (Fig. 2C, green/yellow spot). These observations suggest that the aged leaves in the inferior clone no.54 were more severely damaged than those in the superior clone no. 49.

We will continue this monitoring. In August and September, a drought stress is the severest in the orchard area in a year. We may be able to obtain difference in Fv/Fm in young leaves between the superior and inferior clones, as we observed in leaf color in the aged leaves between the clones.

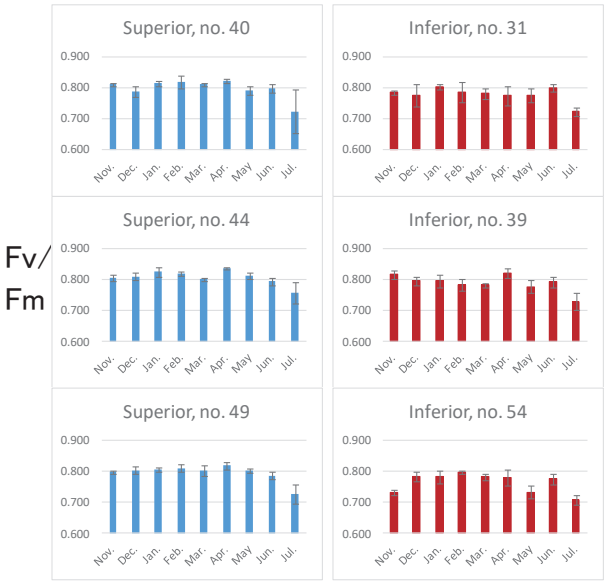


Fig. 1 Fv/Fm in leaves from the superior (No. 40, 44, and 49) and the inferior clones (No. 31, 39, and 54) of *Melia volkensii*

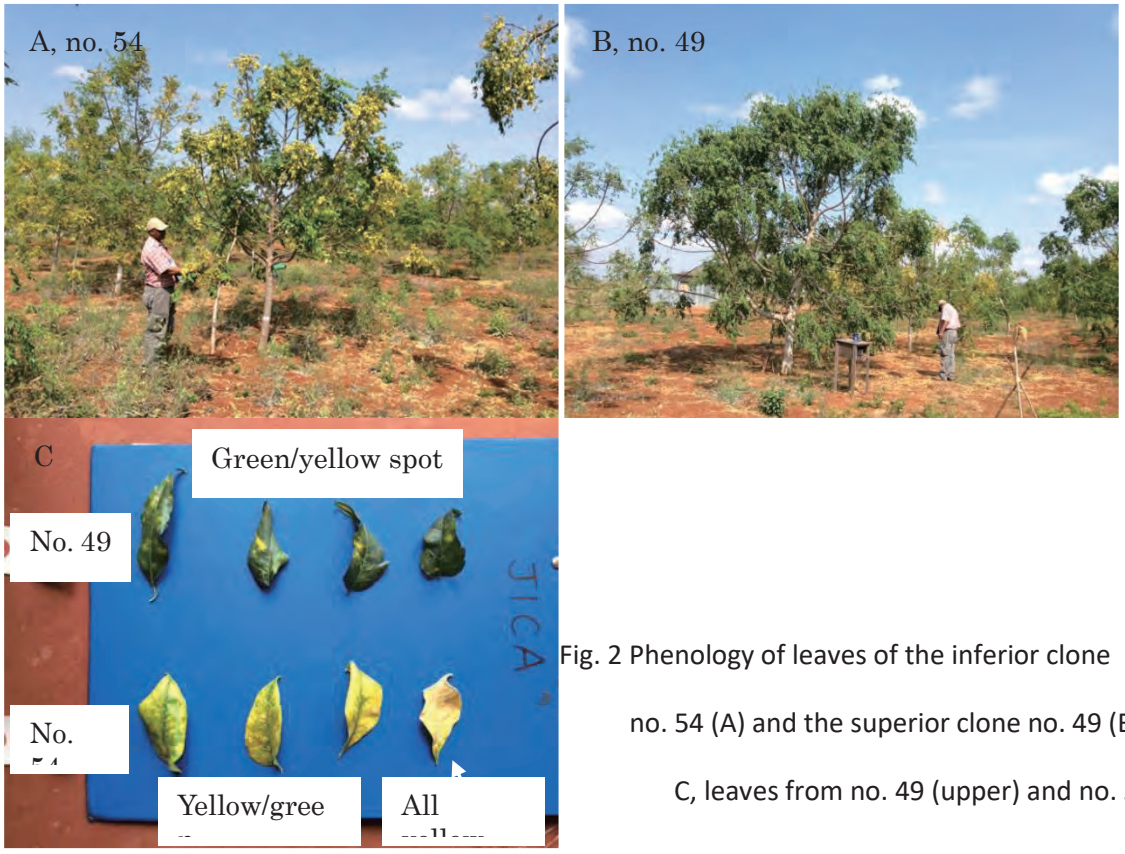


Fig. 2 Phenology of leaves of the inferior clone no. 54 (A) and the superior clone no. 49 (B). C, leaves from no. 49 (upper) and no. 54 (lower)

Appendix 4-3-6 Report of short term expert (Breeding, Nursery management)

Expertise	Name	Term
Breeding	Dr. Hisaya Miyashita	20.8.2014 – 29.8.2014
Nursery management	Mr. Kouji Hashimoto	20.8.2014 – 29.8.2014

Itinerary

Date	Activity
20–Aug	Depart Japan
21–Aug	Arrive to Nairobi
22–Aug	Move to Kitui, Meeting at Kitui Regional Research Center
23–Aug	Kitui Center, Tiva Pilot Forest
24–Aug	Move to Kibwezi,
25–Aug	Kibwezi Center, Move to Nairobi
26–Aug	Meeting Mr. Nellie at Forest Products Research Center (Karura)
27–Aug	Meeting Mr. Nellie at Forest Products Research Center (Karura)
28–Aug	Documentation, Depart Nairobi
29–Aug	Arrive to Japan

Result of major activities

● Progeny test trial in *Melia volkensii*

The seeds for seedlings to plant in the trial were sown on 26th August. Germination percentage will be measured at one month later after sowing.

● Wood property study of *M.volkensii*

Stem analysis method was instructed to the member of Karura Centre. As the sample wood has been dried, wood experiment will be start.

Photo 1-6 Activities at Kitui

Photo 1. Meeting in Kitui center

Photo 2. Kitui nursery

Photo 3. Progeny test site (Tiva)

Photo 4. Topsin Paste

Photo 5. Coating with Topsin Paste

Photo 6. 97% Polyvinyl acetate resin

Photo 7-14. Activities at Kibwezi

Photo 7. Progeny test site

Photo 8. Progeny test site

Photo 9. Instruction of vertex

Photo 10. Instruction of vertex

Photo 11. Seeds management

Photo 12. Pretreatment of seeds

Photo 13. Coating with Topsin Paste

Photo 14. Coating with Topsin Paste

Photo 15-18. Rootstock for grafting

Photo 15. Kitui

Photo 16. Kitui

Photo 17. Kibwezi

Photo 18. Kibwezi

Appendix 4-3-7 Report of short term expert (Drought tolerance)

Expertise	Name	Term
Drought tolerance	Dr. Michito Tsuyama	2.11.2014 – 12.11.2014

Itinerary

	Date	AM	PM
1	02.11 (Sun)		Departure(Fukuoka)
2	03.11 (Mon)	Arrival(Nairobi)	Move to Kitui Chlorophyll fluorescence measurement and analysis of native tree species
3	04.11 (Tue)	Meeting	Move to Kibwezi, Meeting
4	05.11 (Wed)	Survey about leaf phenology of native tree species at dry season	Survey about leaf phenology of Melia clone at dry season
5	06.11 (Thu)	Chlorophyll fluorescence measurement and analysis of Melia clone	Data analysis
6	07.11 (Fri)	Chlorophyll fluorescence measurement and analysis of native tree species	Data analysis Move to the Nairobi hospital (fever)
7	08.11 (Sat)	Recuperation	Recuperation
8	09.11 (Sun)	Recuperation	Recuperation
9	10.11 (Mon)	Meeting at KEFRI headquarter	Data analysis
10	11.11 (Tue)	Report of activities at JICA office	Departure(Nairobi)
11	12.11 (Wed)	Changing the return path by the aircraft delay(Nairobi→Doha→Shanghai→Fukuoka)	Arrival(Fukuoka)

1.1. Leaf phenology of Melia clones

[Activities]

In Tiva orchard at the beginning of dry season (July 2014), we noticed a tendency that leaves of inferior trees turn to yellow and become senescent, but not in superior trees. We attempted to confirm this difference by observing leaves of Melia clones at the end of the dry season.

[Results]

We compared superior (no. 40, 49, and 59) and inferior clones (no. 11, 17, and 36). As shown in Fig. 1, leaves were less in the inferior clone no. 17 than in the superior clone no. 59. In the no. 17 inferior clone, most of senescent leaves appeared to be shed in the dry season.

In the no. 59 superior clone, most leaves were remained in this dry season. This tendency appeared to roughly be applicable to many, not all, inferior and superior clones. The difference would explain, at least partly, rapid growth of superior clones, because carbon dioxide would be assimilated even in dry season in those leaves remained in the season.

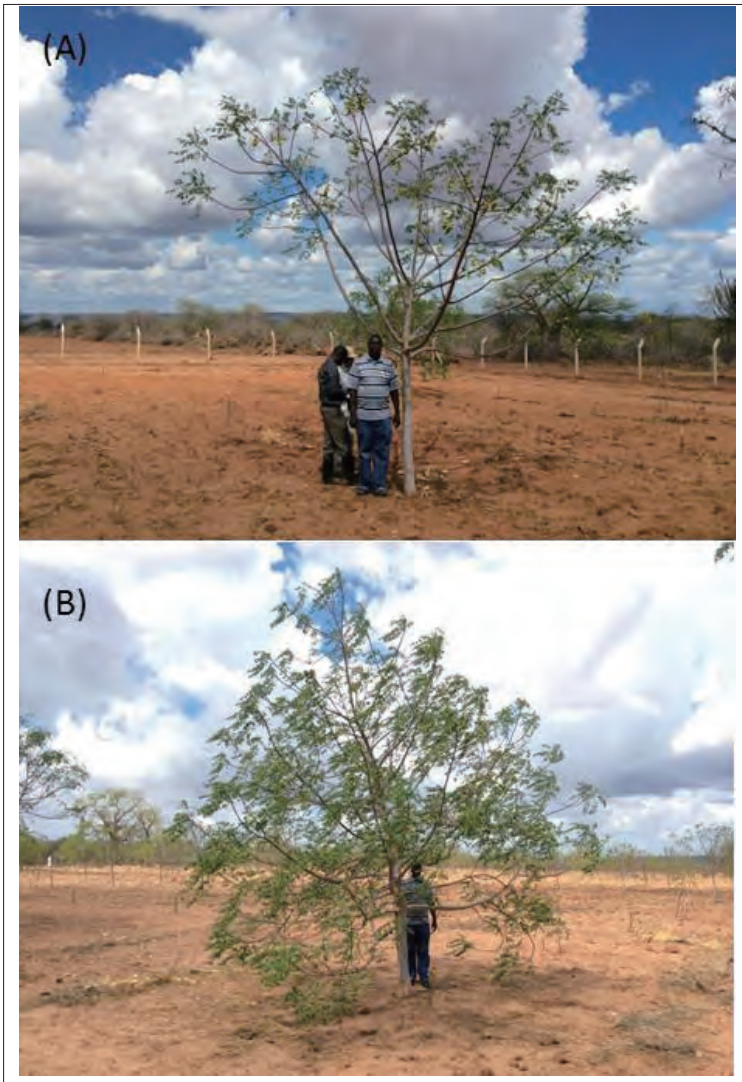


Fig. 1 Leaf phenology of Melia clones in Kibwezi orchard. Examples were shown for the inferior clone no. 17 (A) and for the superior clone no. 59 (B).

1.2. An analysis of drought tolerance of photosynthesis in Melia clones

[Activities]

Tolerance of photosynthesis to environmental stresses was analyzed by measuring chlorophyll fluorescence.

[Results]

Fig. 2 shows changes of chlorophyll fluorescence upon illumination of pulse of saturating light (Fig. 2). The decay of the fluorescence after switching off the pulse reflects a resistance of photosynthesis to environmental stresses, i.e., the capacity of electron drain to oxygen in electron transport chain in thylakoids. As shown in Fig. 2, the drop of fluorescence was faster in the superior clones (Fig. 2A) than in the inferior clones (Fig. 2B), suggesting that photosynthesis of the superior clones was more tolerant than that of the inferior clones. The superior clones tended not to shade leaves in the dry season in Kibwezi (Fig. 1). This trait may relate to the tolerance of photosynthesis. In addition, it would be worth noting that the decay in the superior clone no. 59 (Fig. 2A) was faster than many other indigenous plants in Kibwezi (data not shown), suggesting that the tolerance of photosynthesis in the clone is also relatively higher than those in other plans in there. This result supports the idea that the resistance of photosynthesis is responsible for Melia to adapt to dry conditions.

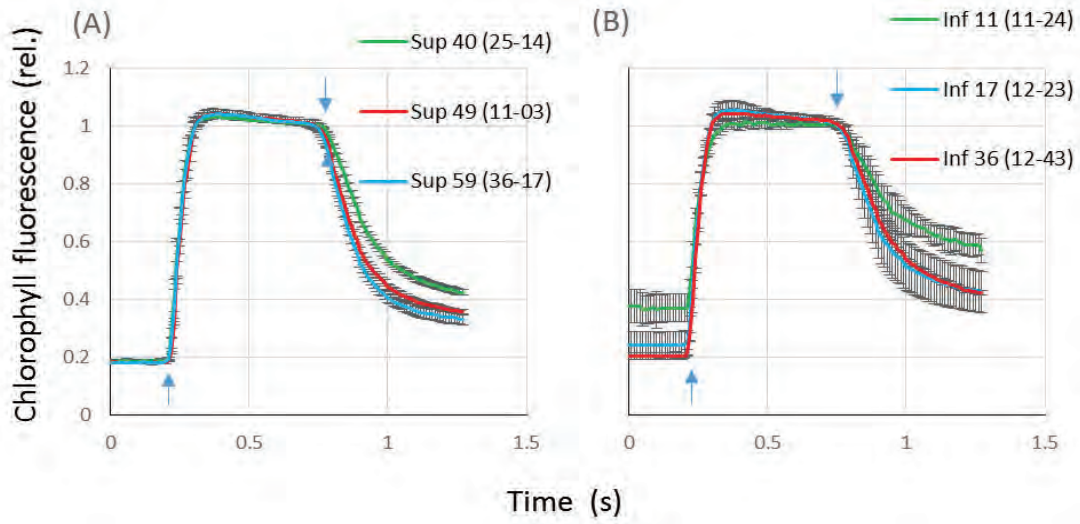


Fig. 2 Estimation of tolerance of photosynthesis to environmental stresses.
A leaf was dark adapted for at least 30 m before use, and was illuminated with a pulse of saturating light (1 s, > 5,000 μmol E $m^{-2}s^{-1}$) (arrows). Changes of chlorophyll fluorescence were analyzed in the superior clones (A, no. 40, 49, and 59) and the inferior clones (B, no. 11, 17, and 36). Numbers in parenthesis a location of each clone in the orchard.

Appendix 4-3-8 Report of short term expert (Project management)

Expertise	Name	Term
Project management	Mr. Shunji Shimizu	23.11.2014 – 30.11.2014
Project management	Dr. Michinari Matsushita	23.11.2014 – 30.11.2014

Itinerary

Date	Activities
Nov 23	Move to Haneda
Nov 24	Depart Tokyo/Haneda, arrive to Nairobi, move to Kitui
Nov 25	Survey at Tiva seed orchard, move to Kibwezi
Nov 26	Survey at Kibwezi seed orchard, move to Nairobi
Nov 27	Meeting Mr. Muturi at KEFRI center
Nov 28	Meeting Mr. Hurukawa at JICA office(Nairobi) Meeting Mr. Nellie at Forest Products Research Center (Karura) Meeting Mr. Yamana at Japanese Embassy(Nairobi) Depart Nairobi
Nov 29	Arrive to Tokyo/Haneda
Nov 30	Move to Hitachi

Major Activities

● General meeting for the Seed Distribution Guideline of *Melia volkensii*.
The experts proposed an idea for the overall structure of seed distribution guideline, and explained the Japanese case of corresponding distribution system of good seeds/seedlings of plus trees.

KEFRI counterparts and the experts agreed on the overall picture of the seed distribution guideline for *Melia volkensii*.

● Attendance to JCC and mid-term Workshop of this project
KEFRI counterparts and the experts discussed the schedule of next JCC, and confirmed the planning of mid-term Workshop of the project.

● Meeting with JICA Kenya / Japanese Embassy
The experts visited to JICA Kenya office and Japanese Embassy, and made reports for the progress of this project and agreement about the overview of seed distribution guideline.

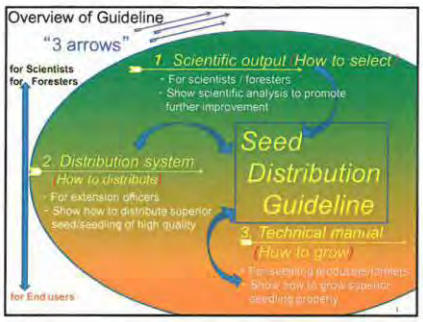
● Confirmation of the progress of seed orchards and test stands.
The experts get progress of seed orchards and test stands at Kitui and Kibwezi, and confirmed the schedule for the development of new test stands.

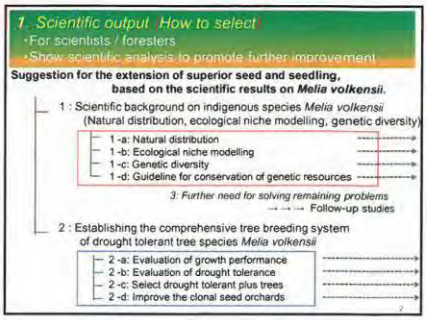
● Others

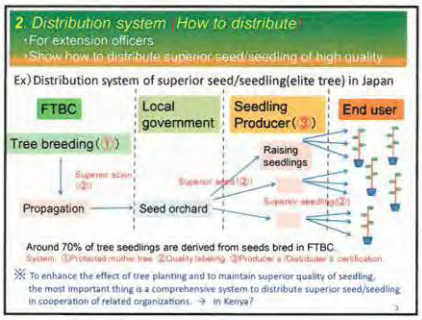
The experts visited to Forest Products Research Centre in Karura, and investigated working environment of wood property. The experts observed a plantation well-managed for *Meliavolkensii* by a leading local farmer.

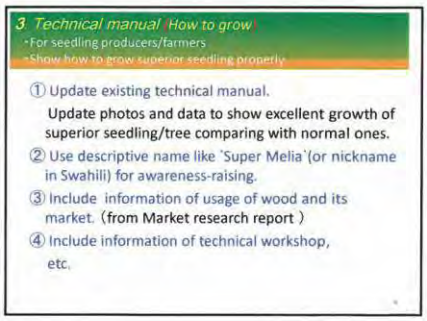
1：Documents of seed distribution guideline (Project management team)

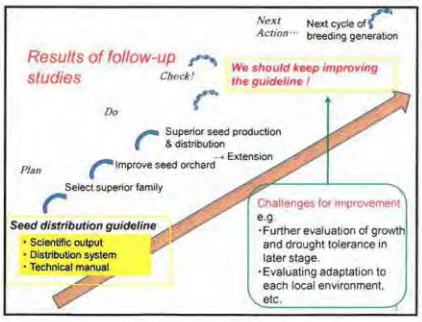
2014/12/4 資料1

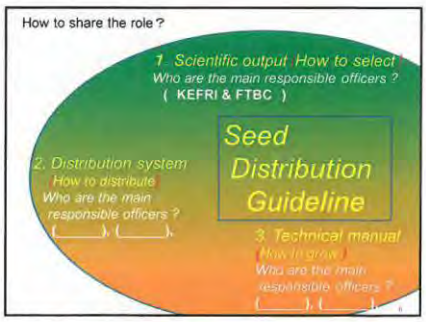












1

2：Schedule of activities for development of *Melia volkensii* guideline (KEFRI)

資料2

Min 5: Schedule of Activities for development of *Melia volkensii* guideline

November 2014: Editing of Market research report

November 2014: The content of extension guideline for securing quality seed and seedling will be discussed with short-term expert

December 2014: Structure of the guideline will be drawn up

February 2015: The Structure of the guideline will be presented to the Joint co-ordination Committee for approval

March to May 2015: The draft guideline will be developed

June-August 2015: Draft training materials will be drawn up

August – December 2015: Management and distribution of quality seeds and seedlings will be done based on the draft guideline

January-February 2016: Based on the trial implementation and the outcome, the draft guideline and training materials will be revised.

February –March 2016: Editorial committee will finalize on the guideline and the training materials

March 2016~: Training on propagation of quality melia seedlings will be held for extension staff and farmers among other stakeholders using revised guideline and training materials.

3：Documents of meeting KEFRI（JICA　long-term experts）

資料 3

27Novmber 2014

PROJECT ON DEVELOPMENT OF DROUGHT TOLERANT TREES FOR ADAPTATION TO CLIMATE CHANGE IN DRYLANDS OF KENYA

Progress of the project (Feb. 2014～)

DNA Analysis

-Obtaining geographic location for Acacia populations.

-Devloping DNA markers of *Melia volkensii* and *Acacia tortilis*.

-Collecting samples for genotyping of *Melia volkensii* and *Acacia tortilis*.

Tree breeding

-100 Melia plus trees were selected.

-Melia seed orchards will almost be completed in this year. (Kitui, Kibwezi)

-Melia progeny test sites will established. 4 sites will be established in this year (Kitui, Kibwezi, Marimanti, Kasigau).

-Continue research for analyzing drought tolerant characteristics of Melia plus trees.

-Anlyze wood properties data.

-Acacia seed stand will be established. Planting will start in next year.

Extension

-The market survey report for Melia was edited and will be published this year.

-Guideline for securing Melia quality seed and seedlings will be developed. The structure will be drawn in this year.

-Training materials, brochures will be developed next year.

-Trainings, seminars and trial extension activities will be implemented (Y2015～)

1

Schedule of JCC

1. Date and place:

19th February 2015, Kitui

Schedule and contents of Midterm Seminar

1. Date and place

17-18th February 2015, KEFRI Kitui Regional Center

17th Feb. pm: Presentation

18th Feb. am: Observation in Tiva Orchard and Progeny test site.

2. Contents

1) Overview of the Project

2) Activities and progress of DNA analysis (Acacia tortilis markers, Melia genotyping)

3) Activities and progress of tree breeding

4) Development of drought assessment criteria (Physiology wprk)

5) Market research report and structure of Guideline for securing Melia quality seed and seedlings

Challenging of the Project

- Variation of the flowering and fruiting season of Melia and Acacia.
- Very difficult to find a good condition bulldozer and its transportation because of increasing the infrastructure construction.
- Security problem in some regions.

Appendix 4-3-9 Report of short term expert (Drought tolerance)

Expertise	Name	Term
Drought tolerance	Dr. Koichiro Gyokusen	7.2.2015 – 15.2.2015

Short Term Experts (Feb. 2015)
2 : Drought tolerance

Duration 2015.02.07-02.15
9 DAYS
Member: Dr. Koichiro Gyokusen

	AM	PM
02.07 (Sat.)		Travel to Haneda
02.08 (Sun.)	Departure (TOKYO/HANEDA)	Arrival (NAIROBI)
02.09 (Mon.)	Travel to Kitui from Nairobi	Downloding dedro and weather data at Tiva
02.10 (Tue.)	Travel to Kibwezi	Downloading weather data at Kibwezi Travel to Kitui
02.11 (Wed.)	Analysis of dendro and weather data	Analysis of dendro and weather data
02.12 (Thu.)	Maintenance and repair of dendrometer at Tiva	Preparation for simposium with Mr. Muchiri
02.13 (Fri.)	Preparation for simposium with Mr. Muchiri	Travel to Nairobi from Tiva Departure (NAIROBI)
02.14 (Sat.)		Arrival (TOKYO/HANEDA)
02.15 (Sun.)	Travel to Fukuoka	

KEFRI staff
Mr. Kigwa
Mr. Muchiri
Dr. Ndufa

2. Activities and results

2.1. Download of data from both of weather station and soil water equipment

[Activities] Weather data collected from July 2014 to Feb.2015 at Tiva and Kibwezi orchard were downloaded, and soil water data collected for same length were downloaded.

[Results]

- The average temperature of Kibwezi was generally higher than that of Tiva by 10% (fig.1).
- Precipitation trends inTiva and Kibwezi were similar but that of kibwezi occurred in two peaks during the month of November (fig.2)
- Soil water status was better in Tiva than Kibwezi (fig.3)
- Soil water status at 50cm and 100cm depth at tiva was stable during dry and wet season while at kibwezi the soil dry during the dry season (fig.3).

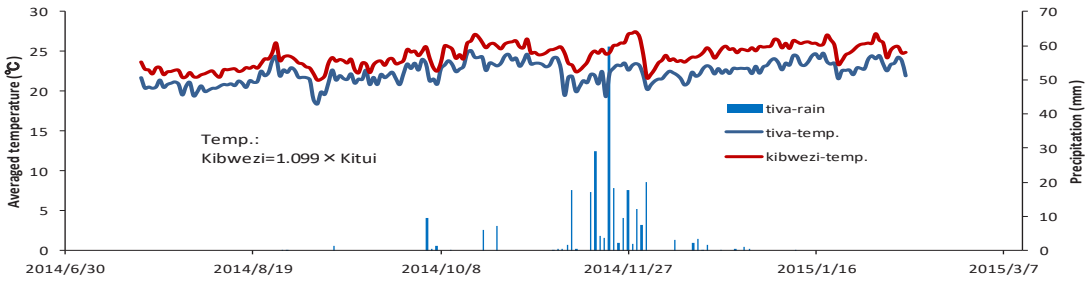


Fig.1 Trends of average air temperature at Tiva and Kibwezi and precipitation at Tiva.

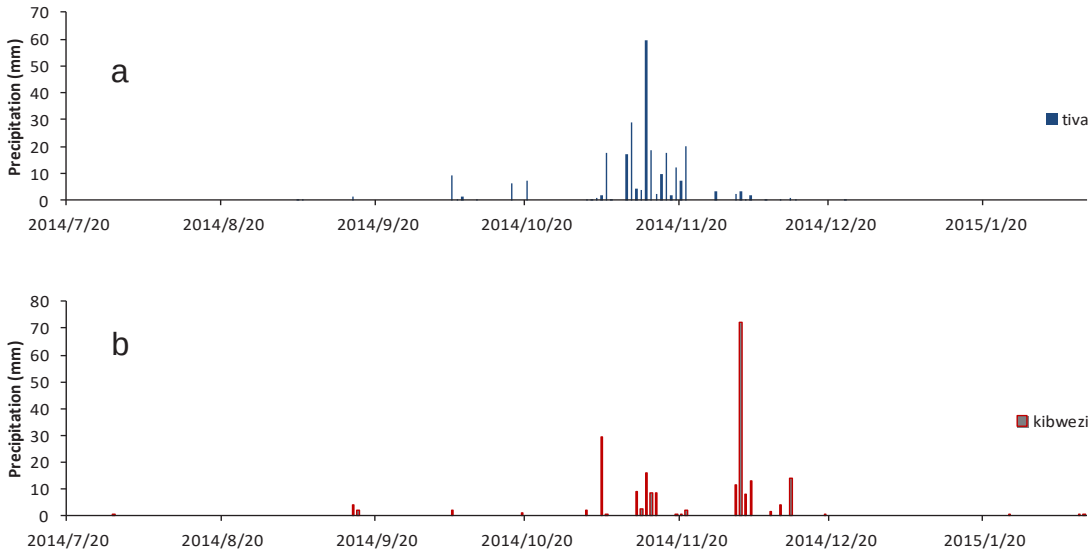


Fig.2 Trends of precipitation at Tiva and Kibwezi orchard. a:Tiva, b: Kibwezi

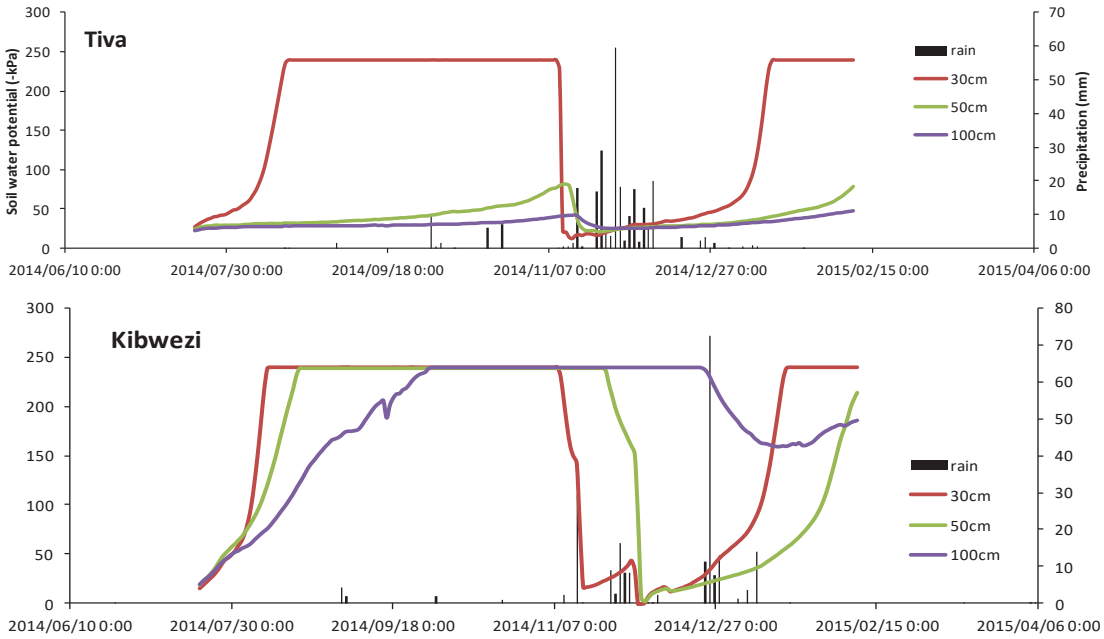


Fig.3 Trends of soil water potential in Tiva and Kibwezi orchards.

2.2 Download of data from the automatic-dendrometer at Tiva Pilot forest.

[Activities]

Stem growth data collected from July 2014 to Feb.2015 at Tiva-pilot-forest were downloaded, and the equipments were repaired.

[Results]

- The new data collected from Jul., 2014 to Feb.2015were added to the existing data collected from Oct.2012 to Jul., 2014 (fig.4).
- Stem radius growth occurred at onset of rainfalls. However, the tree growth began just later of the beginning of rainfall. It means that Melia need a some level of rainfall to start its growth (fig.4).
- There were two growth seasons for Melia volkensii in one year (fig.4).
- The growth rate in Nov. was a little higher than that of Apr. (fig.4).
- Two and a half growing patters were obtained until now. I think it better to continue the measurement for more a half year to sure this pattern is common.

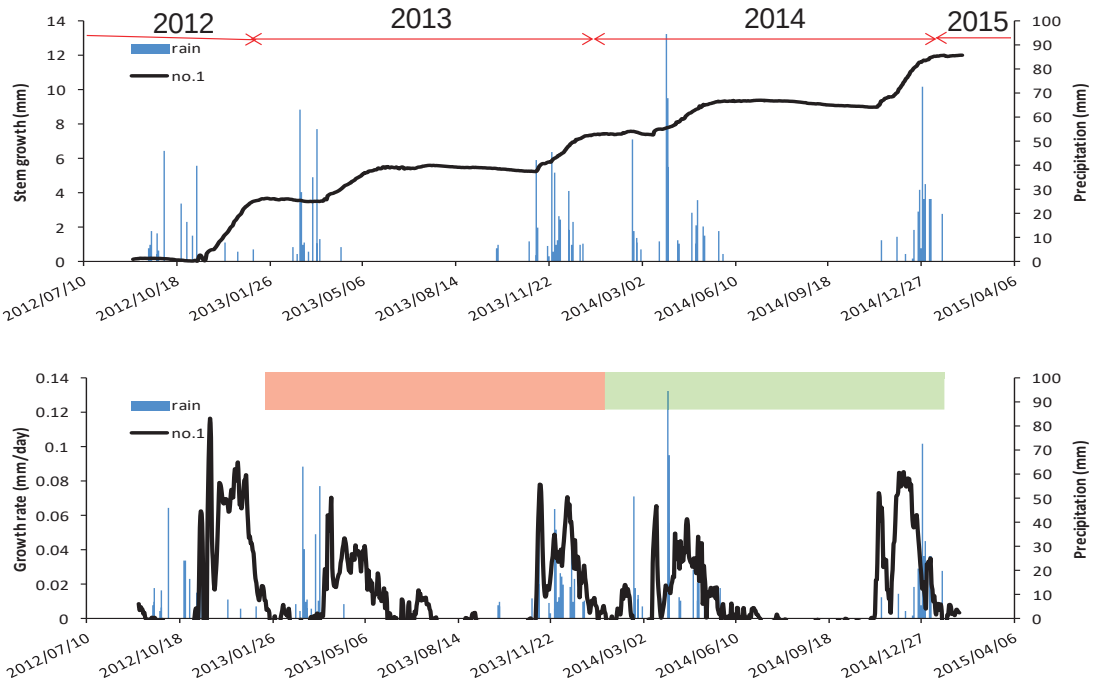


Fig.4 Stem growth (upper fig.) and stem growth rate (lower fig.) trends of Melia volkensii growing at Tiva-pilot forest.

2.3 Preparation and discussion for work shop being held in 18th Feb. 2015

Mr. Muchiri and I had prepared the materials for the work shop being held in 18th Feb. for one and half days. Mr. Muchiri was going to make a presentation about the result on Wednesday (18th, Feb.).

Appendix 4-3-10 Report of short term expert (Nursery management, Breeding)

Expertise	Name	Term
Nursery management	Mr. Shousei Sakamoto	10.2.2015 – 14.2.2015
Nursery management	Mr. Nobutaka Chiba	10.2.2015 – 14.2.2015
Breeding	Dr. Hisaya Miyashita	10.2.2015 – 20.2.2015

Itinerary

Date	Activity
10-Feb	Depart Japan, Arrive to Nairobi
11-Feb	Courtesy call to KEFRI, move to Kitui
12-Feb	Instruction in Kitui Regional Research Centre and Tiva seed orchard
13-Feb	Instruction in Kitui Regional Research Centre and Tiva seed orchard
14-Feb	Move to Kibwezi, Kibwezi seed orchard (Mr. Sakamoto & Mr. Chiba)
	Move to Nairobi, Depart Nairobi
	Kitui Regional Research Centre (Dr. Miyashita)
15-Feb	Kitui Regional Research Centre
16-Feb	Kitui Regional Research Centre
17-Feb	Workshop and field trip at Forest Products Research Centre
18-Feb	Workshop and JCC at Forest Products Research Centre
19-Feb	Tiva seed orchard, Move to Nairobi
20-Feb	Courtesy call to KEFRI, Depart Nairobi

Result of major activities

● Instruction of *Melia* seed orchard management

Melia seed orchard management techniques concerning topping and pruning were instructed. Ten KEFRI members participated in this course.

● Wood property research in *Melia*

The data of stem analysis was examined.

Photo 1. Training course of seed orchard management in Kitui

Photo 2. Training course of seed orchard management in Kitui

Photo 3. Demonstration of pruning

Photo 4. Demonstration of pruning

Photo 5. Demonstration of pruning

Photo 6. Demonstration of pruning

Photo 7. Before pruning

Photo 8. After pruning

Photo 9. Practice of pruning

Photo 10. Practice of pruning

Photo 11. Practice of pruning

Photo 12. Practice of pruning

Photo 13. Practice of pruning

Photo 14. Practice of pruning

Photo 15. Practice of pruning

Photo 16. Practice of pruning

Photo 17. Practice of pruning

Photo 18. Practice of pruning

Photo 19. Instruction of the application of fungicide, Topsin Paste,

Photo 20. Instruction of the application of fungicide, Topsin Paste,

Photo 21. Instruction of the hypsometer

Photo 22. Instruction of the hypsometer

Photo 23. Instruction of the hypsometer

Photo 24. Instruction of the hypsometer

Appendix 4-3-11 Report of short term expert (Project Management, DNA analysis)

Expertise	Name	Term
General issues	Dr. Masatoshi Ubukata	14.2.2015 – 22.2.2015
General issues	Mr. Toshizumi Sakai	14.2.2015 – 22.2.2015
DNA analysis	Dr. So Hanaoka	14.2.2015 – 22.2.2015

Itinerary

Date	Activity
14-Feb	Depart Japan
15-Feb	Arrive to Nairobi, JICA
16-Feb	Move to Kitui
17-Feb	Workshop
18-Feb	Workshop and JCC
19-Feb	Documentation
20-Feb	Move to Kibwezi and Nairobi, KEFRI (Dr. Ubukata & Mr. Sakai)
	Tiva seed orchard, Move to Nairobi, KEFRI (Dr. Hanaoka)
21-Feb	Depart Nairobi
22-Feb	Arrive to Japan

Result of major activities

● Workshop

Workshop of this project was held from 16th to 18th. About 50 members belonging to KEFRI, KFS, Ministry, local government, ICRAF, private enterprise, private forester NGO, JICA etc. participated. There were lively questions and answers.

● JCC

The most activities of the project were evaluated as satisfactory. The training program in Japan explained by Mr. Sakai was agreed.

● Kibwezi seed orchard

Water supply tank, management house were completed.

Photo 1. Workshop

Photo 2. Workshop

Photo 3. Workshop

Photo 4. Workshop

Photo 5. Workshop

Photo 6. Workshop

Photo 7. Workshop

Photo 8. Workshop

Photo 9. JCC

Photo 10. JCC

Photo 11. JCC

Photo 12. JCC

Photo 13. Kibwezi seed orchard

Photo 14. Kibwezi seed orchard

Photo 15. Plantation of private farmer (unimproved seedling)

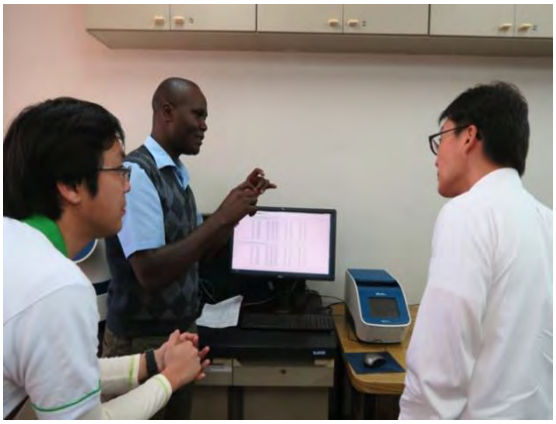


Photo 16. DNA analysis

Appendix 4-4 Achievement of short term expert in 2015

Appendix 4-4-1 Report of short term expert (Project management)

Expertise	Name	Term
Project Management	Dr. Masatoshi Ubukata Mr. Shizuo Kamizore	Jun.28 ～5 Jul. 2015

1. Schedule

Date	Activity
27 Jun.	Hitachi to Haneda
28 Jun.	Arrive at Nairobi Move to Kibwezi
29 Jun.	Observation of KEFRI Kibwezi Center, Seed orchard and Progeny test site Move to Voi
30 Jun.	Observation of Kasigau Progeny test site Move to Kitui
1 Jul.	Observation of Kitui seed orchard and Progeny test Meeting with Japanese experts
2 Jul.	Workshop for extension Project Technical Committee
3 Jul.	Report to JICA Kenya office Report to Embassy of Japan Move to Dubai
4 Jul.	Dubai to Haneda
5 Jul.	Haneda to Hitachi

2. Results of major activities

- Seed orchard
  Tiva and Kibwezi seed orchards have been managed well by KEFRI staff. Stem cut and branch pruning are necessary to keep good condition for seed production in Tiva seed orchard. Some clones are observed for higher production of seed in Kibwezi seed orchard.
- Extension workshop
  Participants- KEFRI 9 staff, KFS 8staff, staff of County government 5 (Kitui, Machacos, Mukueni)
  Subjects- Outline of the Project, Extension activity with Farmer Forestry Field School by KFS, The acts on Forestry seeds in Kenya, Decentralization of the government in Kenya, Outline of the guideline for improved Melia seeds

KEFRI staff introduced and explained the project activities and KFS staff explained progress of the decentralization.

- Meeting at JICA Kenya office

  Dr. Ubukata explained that the Project has progressed steadily and got some excellent results on Melia tree breeding. It could be developed that a term of cutting rotation for Melia will shorten through tree breeding techniques. Dr. Ubukata also suggested that development of the next generation should be important for a basic matter of tree breeding technology to make it sustainable.

Photo1 Kibwezi Seed Orchard

Photo2 Seeds of Melia

Photo3 Kibwezi Progeny Test Site

Photo4 Kasigau Progeny test site

Photo5 Introduction of branch pruning by Dr. Muturi in Kasigau progeny test site

Photo6 Tiva Seed Orchard (H:8m)

Photo7 Tiva Seed Orchard (Part of grafting)

Photo8 Site for Tiva Acacia Seed Stand (right side: Melia Seed Orchard)

Photo9 Tiva Progeny Test Site

Photo10 Fruit, core and seed of Melia from right

Photo11 Germination of Melia seeds

Appendix 4-4-2 Report of short term expert (Drought tolerant)

Expertise	Name	Term
Drought Tolerant	Dr. Koichiro Gyokusen	Jul.15 ～2 Aug. 2015

1. Schedule

	AM	PM	Accommodation
07.13 (Mon.)		20:00 JAL330 Fukuoka-Haneda 21:40	
07.14 (Tue.)	00:30 EK313 Departure (TOKYO/HANEDA)	14:45 EK719 Arrival (NAIROBI)	Nairobi
07.15 (Wed.)	Travel to Kitui (3hours)	Downloading of the automatic dendrometerdata in Tiva	Kitui
07.16 (Thr.)	Downloading of weather data in Tivva orchard	Analysis of dendrometer data and weather data	Kitui
07.17 (Fri.)	Preparation of manual dendrometer	Preparation of manual dendrometer	Kitui
07.18 (Sat.)	Travel to Kibwezi	Downloading of weather data in Tivva orchard	Kibwezi
07.19 (Sun.)	Selection of superior and inferior clones for dendrometer installation in Kibwezi seed orchard	Selectin of superiodr and inferior trees for temperature measurement in Kibzezi PTS	Kibwezi
07.20 (Mon.)	Installation of manual dendrometer	Installation of manual dendrometer	Kibwezi
07.21 (Tue.)	Installation of manual dendrometer	Measurement of temperature	Kibwezi
07.22 (Wed.)	Lesson to CP how to record the dendrometer data	Measurement of stomata characteristics	Kibwezi
07.23 (Thu.)	Travel to Kitui	Participation to the meeting for seed collection	Kitui
07.24 (Fri.)	Selection of superior and inferior clones for dendrometer installation in Tiva seed orchard	Preparation of manual dendrometer	Kitui
07.25 (Sat.)	Installation of manual dendrometer	Installation of manual dendrometer	Kitui
07.26 (Sun.)	Installation of automatic camera	Data analysis	Kitui
07.27 (Mon.)	Installation of automatic dendrometer in Kitui center	Stem disc sampling in Tiva nursery	Kitui
07.28 (Tue.)	Lesson to CP how to record the dendrometer data	Measurement of stomata characteristics	Kitui
07.29 (Wed.)	Travel to Marimanthi	Installation of soil waterpotential equipment in Marimanti	Kitui
07.30 (Thu.)	Travel to Boi	Travel to Boi	Boi
07.31 (Fri.)	Installation of soil waterpotential equipment in Kasigau	Trabel to Kitui	Kitui
08.01 (Sat.)	Travel to Nairobi (3hours)	16:40 EK720 Nairobi-Dubai 22:40	
08.02 (Sun.)	3:00 EK316 Dubai-Osaka 17:10	19:35 NH1709 Osaka-Fukuoka 20:45	

2. Activities and results

2.1. Download of weather data and installment of new equipments

[Activities] The weather data recorded from Feb. 2015 to Jul. 2015 in Tiva and Kibwezi, were downloaded and analyzed. Equipments for precipitation, air temperature and soil water potential were installed at Marimanti and Kasigau.

[Results]

- The average temperature and precipitation from Jul. 2014 to Jul. 2015 in Tiva seed orchard were 22.5℃ and 498mm, respectively (fig.1, upper). The soil water potential increased during rainy season and decreased during dry season (fig.1, below). The soil water potential of 10cm and 25cm depth decreased less than -0.2MPa in dry season, but that of 50cm and 100cm depth were kept above -0.1MPa.

- The average temperature and precipitation from Jul. 2014 to Jul. 2015 in Tiva seed orchard were 24.7℃ and 323mm, respectively (fig.2, upper). The soil water potential increased during rainy season and decreased during dry season. The soil water potential of all depths decreased less than -0.2MPa in dry season (fig.2, below).

- In consequence, the average air temperature in Tiva was 2.2℃ lower than that of Kibwezi, and had 175mm higher precipitation. Soil water potential of Tiva was higher than that of Kibwezi.

- Equipments for measurement of precipitation, temperature and soil water potential were installed at Marimanti and Kasigau progeny test sites (photo 1). The equipment for precipitation was put on a woody box with 70cm height. Depths of soil water potential sensor were 25cm, 50cm, and 100cm. respectively.

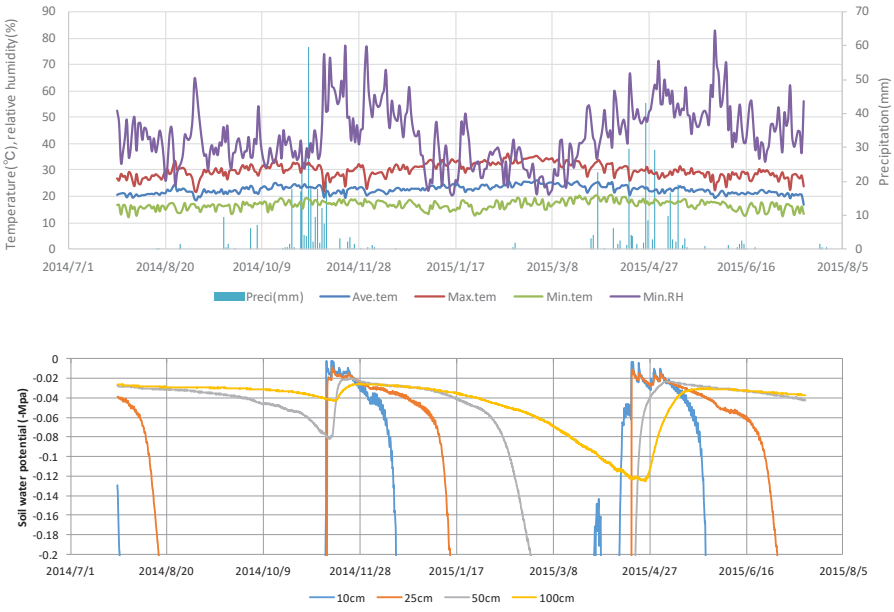


Fig.1 Trends of averaged air temperature, maximum air temperature, minimum air temperature, precipitation, and soil water potential at Tiva seed orchard from 2014.7 to 2015.7.

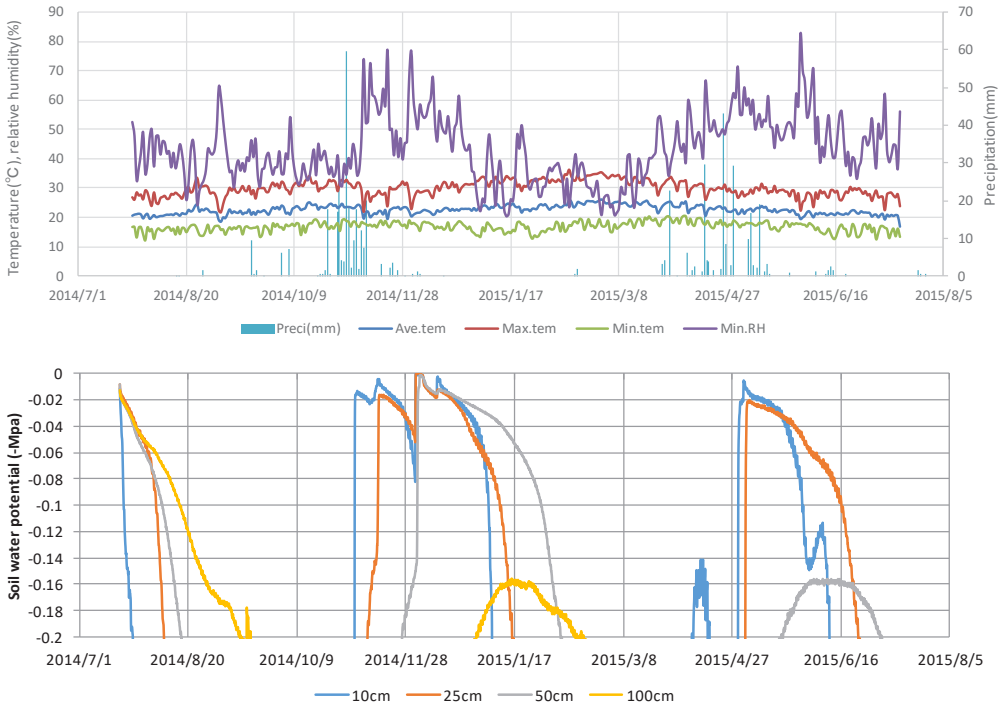


Fig.2 Trends of averaged air temperature, maximum air temperature, minimum air temperature, precipitation, and soil water potential at Kibwezi seed orchard from 2014.7 to 2015.7.

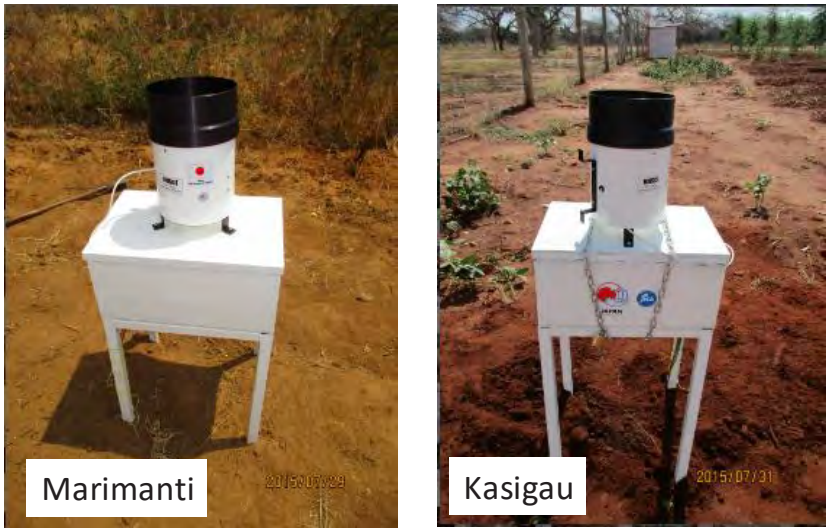


Photo1 Simplified weather equipments installed in Marimanti and Kasigau progeny sites

2.2 Download of automatic dendrometer attached to *Melia* trees growing in Tiva nursery and installment of manual dendrometer and automatic camera in Tiva seed orchard.

[Activities]

The dendrometer data from Feb. 2015 to Jul. 2015 in Tiva nursery were downloaded and analyzed.

To measure the stem growth of fast growth clones and slow growth clones, 40 manual dendrometers were installed in Tiva and Kibwezi seed orchards.

[Results]

- Stem growth pattern of matured *Melia* tree growing in Tiva nursery from Jul. 2014 to Jul. 2015 was shown in fig.3. There were two growing and dormant seasons in a year. The stem growth began after the rainfall of Nov. 2011 and Apr. 2015, but there is time lag between rainfall and stem growth, namely, the stem growth started after the few days later from the beginning of rainfall. This result indicates that the rainfall is the trigger of the start of stem growth, but trees wait until the water condition of deep depth of soil becomes wet.
- We had collected for three years data of stem growth pattern of matured *Melia* tree from Aug. 2012 to Jul. 2015. Then, the dendrometer was removed and the wood samples at measured position were taken. These samples would be used for the measurement of wood density.

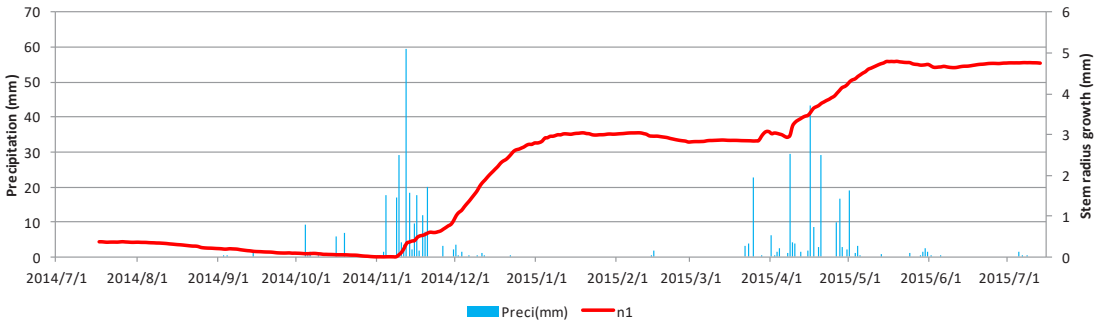


Fig.3 Stem growth pattern of *Melia volkensii* growing in Tiva nursery.

- To reveal growth patterns of fast growth clone (FGC) and slow growth clone (SGC), manual type of dendrometers were installed at Tiva and Kibwezi seed orchard in Jul. 2015. FGC and SGC were selected using the size data obtained in Jul. 2014. Clone numbers selected as the FGC and SGC were no.49, no.29, no.18, no.40 and no.54, no.39, no31, respectively. Three individual trees of each clone were selected for measurement and dendrometers were installed to the east direction at height from 50cm to 100cm (photo 2). The selected individual trees in Tiva were distributed in Block 3, and in Block5 and Block6 of Kibwezi. Records of dendrometer were conducted almost every day by stuffs working in the orchard.

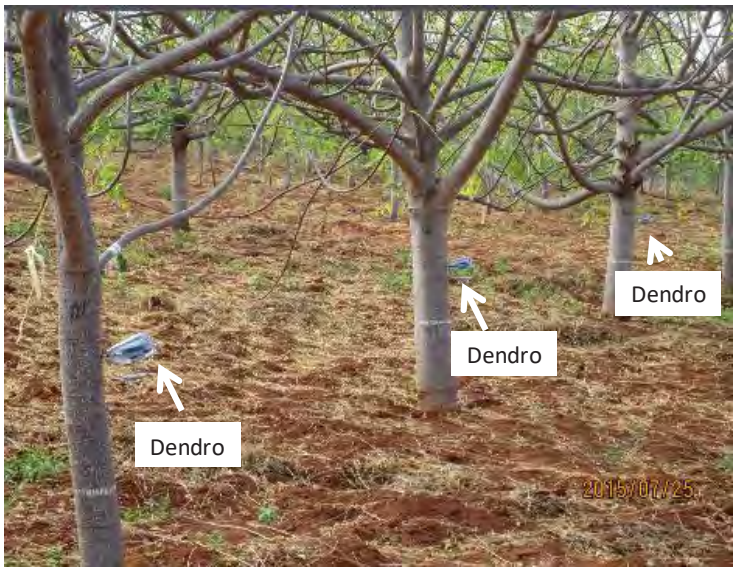


Photo2 Manual type of dendrometer installed to Melia clones at Tiva seed orchard.

- To reveal the difference of leaf phenology of FGC and SGC, automatic cameras were installed in Tiva seed orchard (photo3). One individual tree of each three FGC (no.49, 37, 18) and SGC (no.54, 39, 31) was selected and installed. Photo3 showed the leaf condition taken by automatic camera at almost the same time of the different year (2015 and 2014). We can know from these photos that leaves of 2015 felt earlier than 2o14

Photo3 Outline of the installed automatic camera and photos taken by it in Tiva seed orchard.

2.3. Tree growth and physiological features

[Activities]

To reveal the relationship between tree growth and physiological features, stem surface temperature was compared. Fast growth individual trees and slow growth individual trees were selected at Kibwezi progeny test site. The thermography was used for this measurement.

[Results]

- 3 individual trees were selected each for fast growth tree and slow growth tree. No1, no.2, and no.3 were selected as the fast growth tree and tno.4, no.5, and no.6 were selected as slow growth tree. The sizes of these trees were no.1 (110cm, 2.2cm; tree height, diameter at ground level) ,no.2 (100cm, 2.5cm), no.3 (110cm, 2.6cm), no.4 (196cm, 6.8cm), no.5 (228cm,6.2cm), and no.6 (254cm, 5.6cm).
  The stem temperature of fast growth was significantly higher than that of slow growth (fig.4). The stem surface temperature depends on the sap flow rate. Then, the sap flow of slow growth tree might be lower than that of fast growth tree.
  There is possibility that stem surface temperature can be used as an index of slow and fast growth tree.

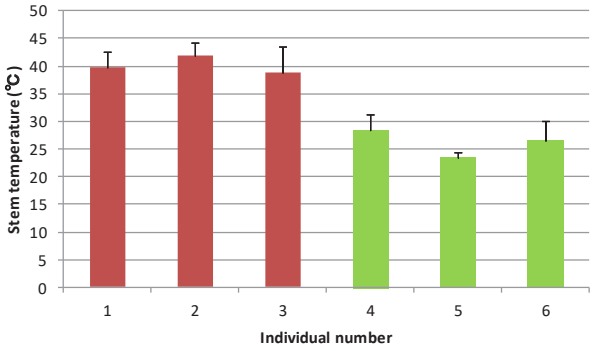


Fig.4 Stem temperature of fast (no.1.2.3) and slow (no.4,5,6) grow trees of *Melia volkensii* planted in Kibwezi seed orchard.

Appendix 4-4-3 Report of short term expert (Drought tolerant)

Expertise	Name	Term
Drought Tolerant	Dr. Michito Tsuyama	Jul.15 ～2 Aug. 2015

1. Activity

1.1. Selection of drought tolerant clone of Melia volkensii in Kibwezi orchard
[Activities]

Most clones shed leaves until the end of July 2015 in Kibwezi. However, in rare cases, I could find a tree which remained leaves. Based on the leaf phenology, it was attempted to select the strongest clone to drought.

[Results]

The orchard is divided into six parts from area 1 to area 6. In every area, 5 trees per each clone were planted. A surviving ratio was not necessary high, and all 5 trees survived in 9 clones out of 60 clones in area 6, i.e., no. 6, 18, 29, 34, 37, 39, 44, 54, and 59 (Table 1). The dry weather in Kibwezi would explain at least partly the death of many clones.

The 9 clones differ in their leaf phenology. For example, all trees of clone no. 29 were leafless (Figure 1). Inversely, trees of clone no. 44 kept relatively much leaves; the extent differed from tree to tree, but 3 out of 5 trees obviously had leaves (Figure 2). Other clones were intermediate between no. 29 and 44 clones.

To confirm results on no. 44 in area 6, the same observations were conducted using clones no. 44 in area 5. As shown in Table 1 and Figure 3, 4 out of 4 trees were alive, and 3 out of the 4 trees maintained leaves (Note that the total number of no. 44 clones in area 5 was 4. In 1-52 position, there was no. 42, although a map indicated no. 44 was planted in there.).

Though there was a no. 44 clone which did not attach leaves, the frequency appeared to be lower than other clones. I conclude that no. 44 is the strongest among the 60 clones to the dry conditions in Kibwezi.

Table 1. Surviving ratio and leaf conditions of clones of *Melia volkensii* in area 6 (and 5 for no. 44) in Kibwezi

No.	Surviving ratio	Trees with leaves
1	3/5	
2	1/5	
3	2/5	
4	0/5	
5	4/5	
6	5/5	1/5
7	1/5	
8	3/5	
9	0/5	
10	2/5	
11	0/5	
12	0/5	
13	4/5	
14	2/5	
15	0/5	
16	4/6	
17	1/5	
18	5/5	2/5
19	2/5	
20	4/5	
21	1/5	
22	0/5	
23	1/5	
24	0/5	

25	0/5	
26	3/5	
27	4/5	
28	3/5	
29	5/5	0/5
30	0/5	
31	3/5	
32	3/5	
33	0/5	
34	5/5	1/5
35	4/5	
36	0/5	
37	5/5	1/5
38	4/5	
39	5/5	1/5
40	4/5	
41	0/5	
42	1/5	
43	0/5	
44	5/5	3/5
(No. 44 in area 5)	(4/4)	(3/4)
45	0/5	
46	0/5	
47	2/5	
48	2/5	
49	3/5	

50	1/5	
51	1/5	
52	1/5	
53	1/5	
54	5/5	1/5
55	0/5	
56	1/5	
57	2/5	
58	1/5	
59	5/5	2/5
60	2/5	

Fig. 1 Clone no. 29. The numbers ##-## address in the orchard.

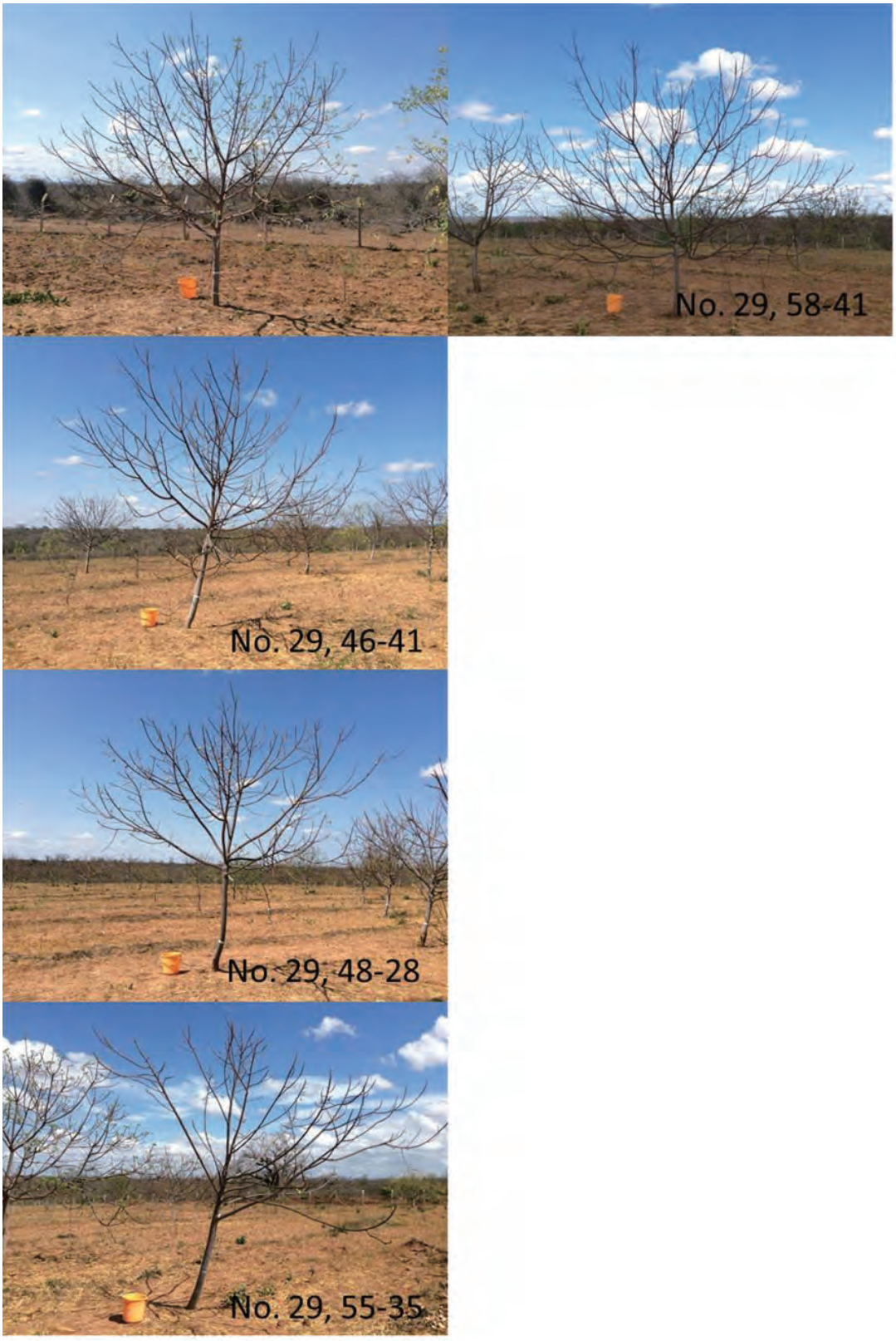


Fig. 2 Clone no. 44.

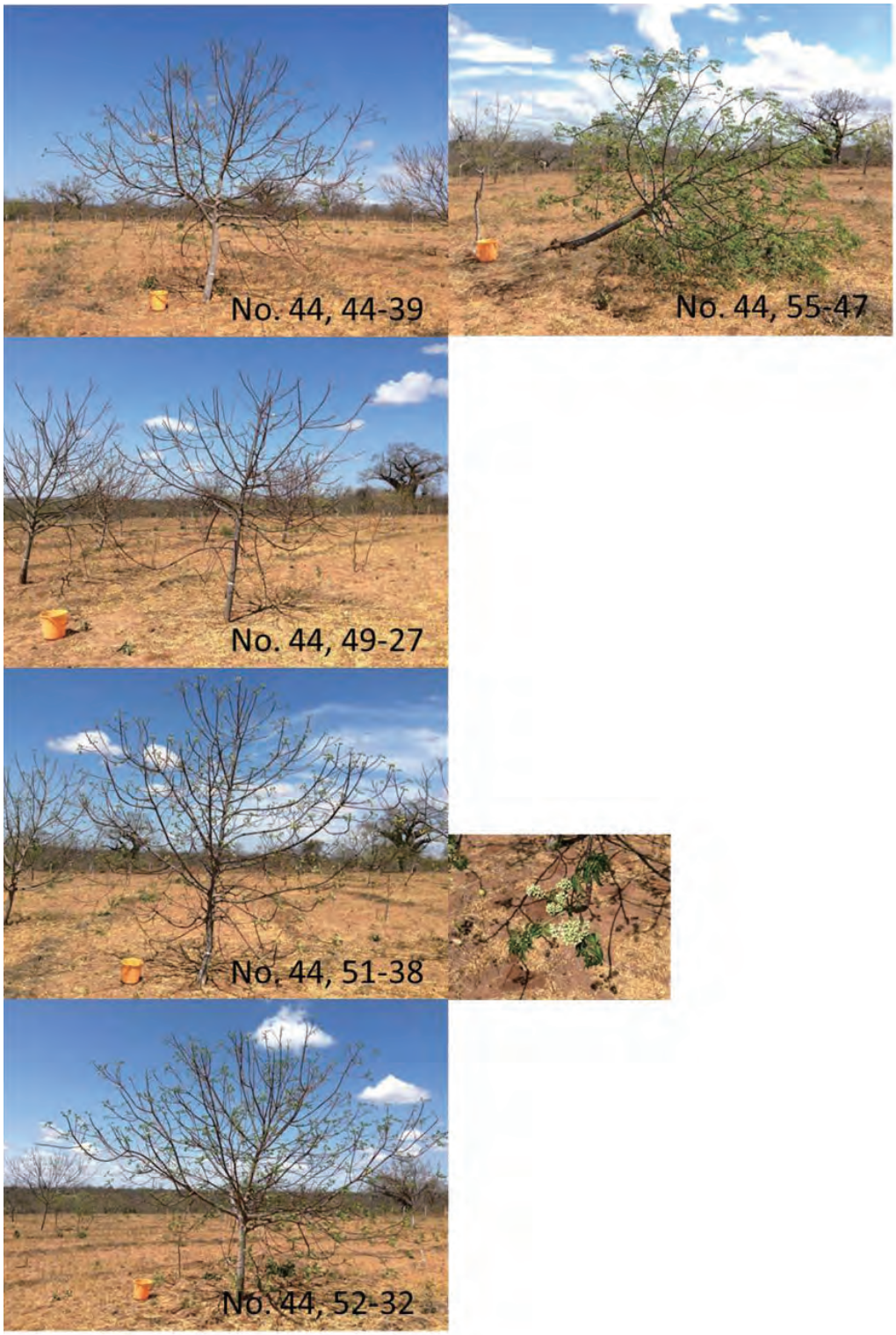
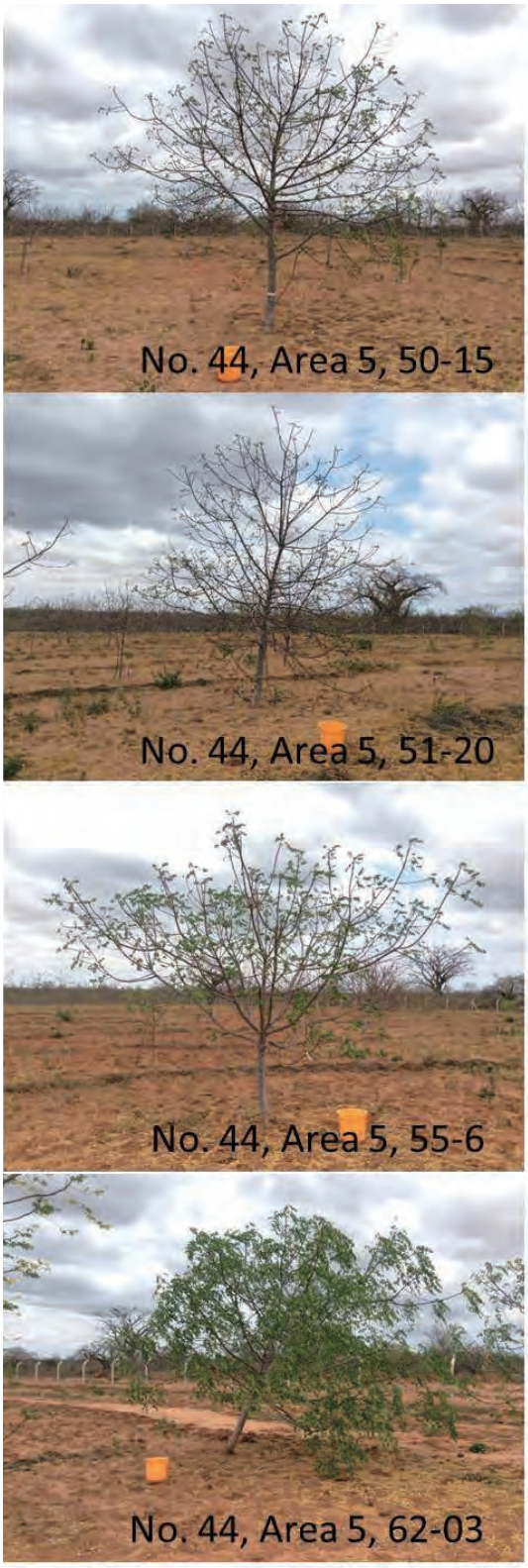


Fig. 3 Clone no. 44 in area 5



Appendix 4-4-4 Report of short term expert (Drought tolerant)

Expertise	Name	Term
Drought tolerant	Dr. Kotaro Sakuta	21 Jul.2015～2 Aug2015

1. Schedule

Date	Activities
21st July (Tue.)	Depart from Fukuoka
22nd July (Wed.)	Arrive to Nairobi, move to Kitui
23rd July (Thu.)	Visit Tiva seed orchard and progeny forest, adjust a porometer
24th July (Fri.)	Measure the *Melia* leaves photosynthesis and transpiration rates at Tiva progeny forest
25th July (Sat.)	Measure and analyze the *Melia* leaves photosynthesis and transpiration rates at Tiva progeny forest and Kitui station
26th July (Sun.)	Analyze the *Melia* leaves photosynthesis and transpiration rates at Kitui station
27th July (Mon.)	Investigate the *Melia* xylem of branches at Tiva orchard
28th July (Tue.)	Investigate the *Melia* xylem of branches at Tiva orchard and Kitui station
29th July (Wed.)	Investigate the *Melia* xylem of branches at Kitui station
30th July (Thu.)	Move to Kibwezi, visit orchard and progeny forest
31st July (Fri.)	Measure the *Melia* leaves transpiration rates, move to Kitui
1st Aug. (Sat.)	Move to and depart from Nairobi
2nd Aug (Sun.)	Arrive to Fukuoka

2. Result of major activities

2.1. Measurements of *Melia* leaves photosynthesis and transpiration rates, and analysis of collected data.

On 24th and 25th July, *Melia* leaves photosynthesis and transpiration rates were measured at Tiva progeny forest. Measurement of leaves photosynthesis and analysis of collected data were guided to a counterpart (Mr. Muchiri) in the field and laboratory with Dr. Gotoh. In

addition, *Melia* leaves transpiration rates were measured, simultaneously. On 31st July, *Melia* leaves transpiration rate were measure at Kibwezi progeny forest.

Fig. 2 Porometer.

Fig. 1 Aspect of guidance leaves photosynthesis at Tiva progeny forest.

2.2. Investigation the Melia xylem of branches at Tiva orchard

From 27th July to 29th July, *Melia* trees xylem of branch were stained with acid fuchsine at Tiva orchard to estimate the water transfer area. 10 trees were selected as the sample trees, and each 3 branches were collected from sample trees. Cut end of branches were immersed to stain solution (0.2% w/w acid fuchsine) in a plastic bucket. Stained branch samples were brought back to Japan, and scheduled to be observed.

Fig. 3 Aspect of staining branch samples at Tiva orchard. Fig. 4 Staining leaves with acid fuchsine.

Fig. 5 Status of samples completed staining.

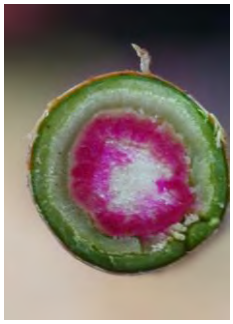


Fig. 6 Stained transverse section of a branch.

3. Results of *Melia* leaves transpiration rate

Results of leaves transpiration rates at Tiva and Kibwezi progeny forests were shown in Table 1. In both measuring day, leaves transpiration were measured from 10 to 13 o'clock. The weather were cloudy in both measuring day, and movements of clouds were fast. So, solar radiations changed rapidly. Various sizes of trees were selected for measuring samples. The mean value in Tiva is 3 times or more than in Kibwezi. And the mean values in Kibwezi were lower than the minimum values in Tiva.

Table 1 Leaves transpiration rate of *Melia* at Tiva and Kibwezi progeny forests.

Progeny forests	number of trees	mean value (mmol m-2 s-1)	maximum value (mmol m-2 s-1)	minimum value (mmol m-2 s-1)
Tiva	20	10.4	26.2	4.0
Kibwezi	20	3.3	7.0	0.5

Appendix 4-4-5 Report of short term expert (Drought tolerant)

Expertise	Name	Term
Drought tolerant	Dr. Eiji Goto	21 Jul. 2015～2 Aug. 2015

1. Schedule

Date	AM	PM	Stay
07.21 (Tue.)		Move to Haneda from Fukuoka	
07.22 (Wed.)	Move to Dubai	Arrive at Nairobii	
		Move to Kitui	Kitui
07.23 (Thu.)	Tiva Seed Ochrchard and progeny test site	Ckeck of polometer	Kitui
07.24 (Fri.)	Measurement of photosynthesis in progeny test site	Measurement of photosynthesis in progeny test site	Kitui
07.25 (Sat.)	Measurement of photosynthesis in progeny test site	Analysis of data	Kitui
07.26 (Sun.)	Analysis of data	Analysis of data	Kitui
07.27 (Mon.)	Study of Xylem specimen	Study of Xylem specimen	Kitui
07.28 (Tue.)	Study of Xylem specimen	Study of Xylem specimen	Kitui
07.29 (Wed.)	Study of Xylem specimen	Study of Xylem specimen	Kitui
07.30 (Thu.)	Move to Kibwezi	Observation of Kibwezi seed orchard and progeny test site	Kibwezi
07.31 (Fri.)	Measurement of evaporation	Move to Kitui	Kitui
08.01 (Sat.)	Move to Nairobi	Move to Dubai from Nairobi	
08.02 (Sun.)	Move to Kansai	Move to Fukuoka	

I. Lecture about a Li-6400

In this project, an open gas exchange system (Li-6400: LI-COR, Lincoln, NE, USA) is using for photosynthetic measurement. However, there is no one who knows about the system in KEFRI. Thus, I teach two counterparts about the way of using the Li-6400.

II. Measurement at orchard

To investigate a correlation between photosynthetic activity and plant growth, photosynthetic activity of two lines, superior line (no. 44) and inferior line (no. 39) in Tiva orchard, were measured (Fig. 1). No significant difference between two lines was observed. In addition, each 6 lines of taller and shorter lines in the orchard were using for photosynthetic activity. The shorter lines showed the smaller photosynthetic activity and revealed a correlation between plant height and photosynthetic activity. In contrast, the taller lines had no correlation of height and photosynthetic activity. Further analysis of photosynthetic activity throughout a year is required.

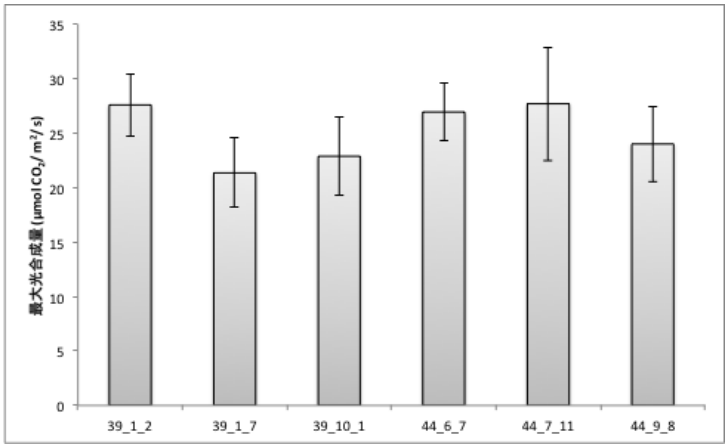


Fig.1 Max. photosynthesis of clone no.39 and 44 in Progeny test site

*Indication of individual is as ID__Position and photosynthesis speed on vertical line is measured by lighting (1200 μ mol/ m^2/ s) on 3 leaves of different age.

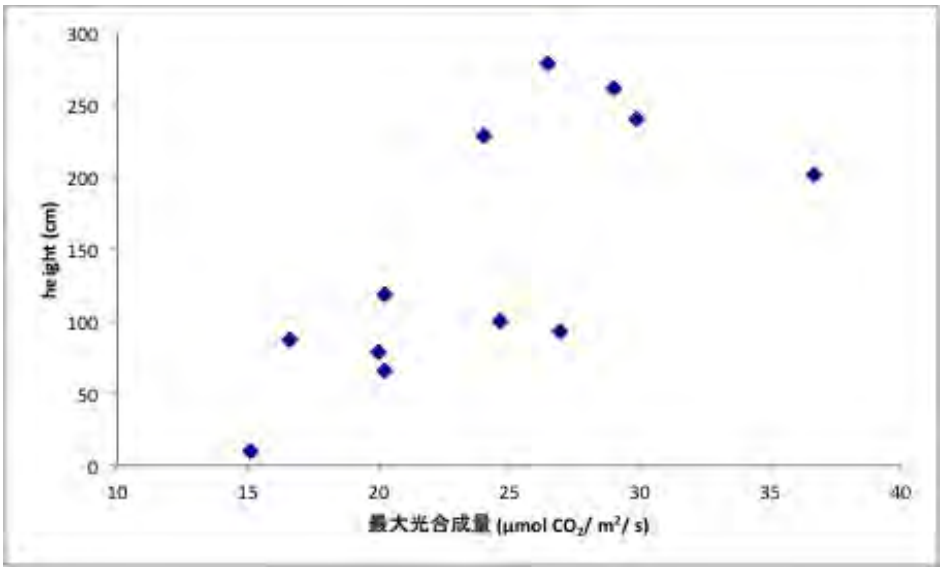


Fig.2　Relation between max. photosynthesis and tree height

*Photosynthesis is measured by the same method for Fig.1.

Appendix 4-4-6 Report of short term expert (Breeding/Nursery Management)

Expertise	Name	Term
Breeding	Dr. Hisaya Miyashita	21 Aug.～ 29 Aug. 2015
Nursery Management	Mr. Syousei Sakamoto	21 Aug.～ 29 Aug. 2015

1. Schedule

Date	Activity
21 Aug.	Arrive at Nairobi
22 Aug.	Move to Marimanti Investigation of Melia Progeny test site, move to Kitui
23 Aug.	Investigation of Seed orchard and Progeny test site in Tiva Preparation of tools and meeting
24 Aug.	Stem cutting and branch pruning in Tiva Seed orchard
25 Aug.	Stem cutting and branch pruning in Tiva Seed orchard Meeting for plantation of Acacia seed stand and Melia progeny test site in Tiva
26 Aug.	Move to Kibwezi Investigation of Melia Progeny test site and seed orchard in Kibwezi
27 Aug.	Stem cutting and branch pruning in Kibwezi Seed orchard (Mr. Sakamoto) Move to Kasigau Investigation of Melia Progeny test site in Kasigau Move to Nairobi (Dr. Miyashita)
28 Aug.	Stem cutting and branch pruning in Kibwezi Seed orchard Move to Nairobi (Mr. Sakamoto) Meeting with staff in KEFRI Forest Products Research Centre Karua (Dr. Miyashita)
29 Aug.	Meeting with Japanese experts in KEFRI Move to Dubai
30 Aug	Move to Haneda

2. Results of major activities

- Technical guidance for management of Melia Seed orchard

  Technical guidance of stem cutting and branch pruning of trees in Tiva and Kibwezi Melia Seed Orchards was implemented to 8 staffs in Kitui centre of KEFRI for 2 days. 4 blocks in each seed orchard were targeted and about 20% of all trees were treated by KEFRI staffs following the guidance by Mr. Sakamoto and Dr. Miyashita. It is considered that all

participants could obtain suitable techniques and understanding how to maintain the ability of Melia seed orchard for seed production.

- Plan for plantation of Acacia seed stand
  21 families of *Acacia tutlis* will be planted for seed stand in Tiva and Kibwezi on Dec. 2015. Other 36 families will be also planted on Apr. 2016. Additional 33 are sowed on Nov. 2015 for planting 2016.

- Melia progeny test site
  New Melia progeny test sites will be developed on the same sites, Marimanti, Tiva, Kibwezi and Kasigau, in which Melia progeny test sites have been already established. Additionally development of 4 progeny test sites is planned in Voi, Marimanti, Mutomo and Wote. Plantation in all new test sites will be implemented on Dec. 2015.
- Demonstration forest for comparing improved and ordinary Melia seedlings
  Demonstration forests will be established in Kitui and Kibwezi for comparing the growth between improved Melia and ordinary one.
- Research on wood property of Melia
  Basic research on wood property of Melia, which is including strength and chemicals in heart wood, is implemented in KEFRI Wood Research Centre, Karura.

Photo: Technical Guidance for management of Melia Seed Orchard

Explanation to KEFRI staffs

Explanation to workers

Introduction of the stem cutting

Sample with suitable shape

Work by KEFRI staffs

Melia tree with fruits

Photo: Progeny test site of Melia

Progeny test site in Marimanti

Protection fence against wild life

Drain to prevent flood

Progeny test site in Kitui

Site for new PTS

Melia after 8 month

Photo: Progeny test site of Melia

Progeny test site in Kibwezi

Site for Acacia seed stand in Kibwezi

Melia after 8 months

Progeny test site in Kasigau

Deep drain for heavy flood

Equipment for meteorological observation by Kyusyu Uni.

Appendix 4-4-7 Report of short term expert (DNA analysis)

Expertise	Name	Term
DNA analysis	Dr. So Hanaoka	Nov.24 ～ 4 Dec. 2015
DNA analysis	Dr. Michinari Matsushita	Nov.24 ～ 4 Dec. 2015

1. Schedule

Date	Activity
24 Nov.	Move to Abu Dhabi from Narita
25 Nov.	Arrive at Nairobi Move to Kitui
26 Nov.	Meeting with researchers of KEFRI Investigation of Melia seed orchard in Kitui and sampling
27 Nov.	Meeting with researchers of KEFRI Move to Nairobi
28 Nov.	Writing report
29 Nov.	Writing report
30 Nov.	Guidance of DNA analysis
1 Dec.	Guidance of DNA analysis Guidance of biological niche model
2 Dec.	Guidance of DNA analysis Meeting with researchers of KEFRI
3 Dec	Move to Abu Dhabi
4 Dec	Move to Narita from Abu Dhabi

2. Results of major activities

- Meeting with KEFRI researchers concerning breeding of Melia for improvement of seed orchard

  Outline of phenology study on Melia such as flowering, seed production and artificial crossing, was presented as Handout 1. The detailed study plan will be presented by KEFRI after checking the seed orchards in accordance with Handout 2.

  Dr. Matsushita will start statistical analysis of seed production data in Melia seed orchards in Tiva and Kibwezi and taking photos of flowering will be taken in Kibwezi seed orchard from Jan. 2016 as well as in Tiva.
- DNA analysis

  All electrophoresis data of DNA on Melia and Acacia were checked and improved by new analyzing software “GeneMapper”. More precise DNA data were established in this analysis.
- Biological niche model

  Biological niche models of Melia and Acacia were introduced and the technical training of statistical analysis on niche model was taken for KEFRI researchers.

Handout 1

To obtain scientific information about ….

1. Difference in the seed production ability among PTs?

and, correlation between the seed production and growth?

---- Faster growing PTs may show smaller flower production

⇒**Matsushita & Kamondo**

2. Difference in the Phenology of flowering among PTs?

---- PTs from different regions may show different Phenology.

⇒ **Kamondo, Kariuki & Matsushita**

3. The study for artificial crossing (… this is a new challenge)

for the purpose of the creation of next generation.

----- crossing faster growing mother ×faster growing father

⇒ **Kariuki & Matsushita**

4. Pollination patterns (gene flow) within seed orchard

⇒ **Omondi & Hanaoka**

Handout 2

1. Relationships between Seed production & Growth
How : Analyzing statistically the data of both data

When: from 2015 winter

2a. Flowering Phenology study1 (detailed study)

How: ・ Targeting … 5regions×4PTfamiles×2replicate tree/PT × 2Blocks

×3 Branches (1.5m long from shoot top)

・ 3 Branches per tree will be marked by color tapes

・ The no. of Inflorescences will be counted and checked 3~4time/month

When: from Jan 2016 ～

2b. Flowering Phenology study2 (photo based)

How: ・Targeting… all living trees in each orchard

・Take the photo of flowering tree code. and inflorescence, one by one trees.

When: from Aug. 2015 ~

Photo

Meeting with KEFRI staffs in

Melia seed orchard in Tiva

Existing Melia seed orchard produced by JICA social forestry project

Sampling Melia leaves for DNA analysis

Meeting for statistical analysis

Appendix 4-4-8 Report of short term expert (Project management)

Expertise	Name	Term
Drought Tolerant	Dr. Koichiro Gyokusen	Jul.15 ～2 Aug. 2015

1. Schedule

	AM	PM	Accommodation
02.01 (Mon.)		20:00 JAL330 Fukuoka-Haneda 21:40	
02.02 (Tue.)	00:30 EK313 Departure (TOKYO/HANEDA)	14:45 EK719 Arrival (NAIROBI)	Kitui
02.03 (Wed.)	Download of the weather data in Tiva	Mainrenance of dendrometer	Embu
02.04 (Thr.)	Download the weather data and in Marimanti	Inatallation of thermo-thgrometer at Marimanti and Makima	Masii
0205 (Fri.)	Inatallation of thermo-thgrometer at Ikituki	Download of the weather data in Kibwezi	Voi
0206 (Sat.)	Download of the weather data in Kasigau	Kasigau→Kibwezi	Kibwezi
0207 (Sun.)	Meetiing at Kibwezi seed orchard	Kibwezi→Kitui	Kitui
0208 (Mon.)	Meeting with Mr.Muchiri and data analysis	Repair of licor-6400	Kitui
02.09 (Tue.)	Sample collection at Tiva	Meeting with Dr. Muturi	Kitui
02.10 (Wed.)	Travel to Nairobi (3hours)	16:40 EK720 Nairobi-Dubai 22:40	
02.11 (Thu.)	3:00 EK316 Dubai-Osaka 17:10	19:35 NH1709 Osaka-Fukuoka 20:45	
02.12 (Fri.)	3:00 EK316 Dubai-Osaka 17:10	19:35 NH1709 Osaka-Fukuoka 20:45	

2. Activities and results

2.1. Download of the weather data and installment of thermo-hygrometer.

・ The weather data recorded from July, 2015 to January, 2016 in Tiva, Kibwezi, Marimanti, and Kasigau were downloaded.

・ Thermo-hygrometers were installed at Marimanti sub.PTS, Makima sub.PTS, Ikithuki sub.PTS, and Voi sub.PTS.

[Results]

・ The average temperature and precipitation of 2015 in Tiva seed orchard were 22.8℃ and 600mm, respectively (fig.1, upper). Meanwhile, the average temperature and precipitation of 2015 in Kibwezi were 24.8℃ and 441mm, respectively (fig.1, below). The average temperature in Tiva was 2℃ lower than that of Kibwezi, the precipitation was 159mm higher in Tiva, and the minimum air moisture was always lower in Kibwezi. These results show that Kibwezi seed orchard is drier than Tiva seed orchard.

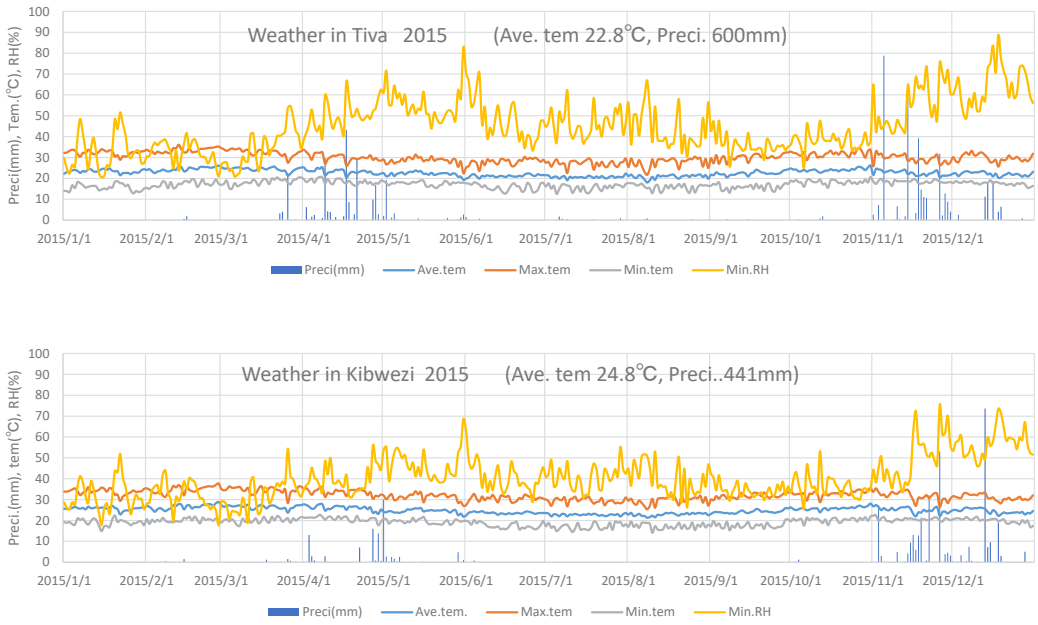


Fig.1 Trends of averaged air temperature, maximum air temperature, minimum air temperature, and precipitation in Tiva and Kibwezi seed orchard in 2015.

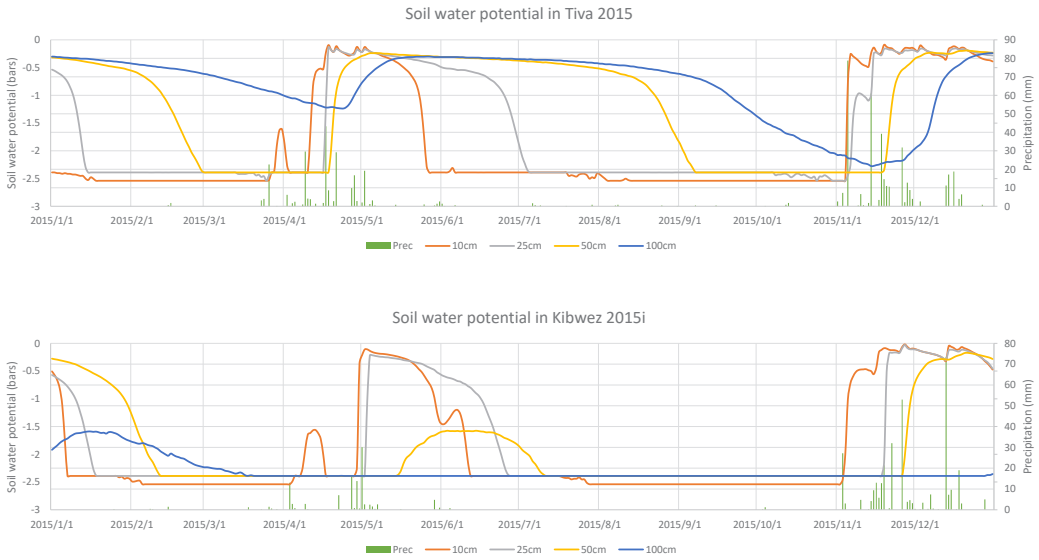


Fig.2 Trends of soil water potential at Tiva and Kibwezi seed orchard in 2015.

- Soil water potential was higher during rainy season and lower during dry season in both sites, but there were big differences between the two sites. The soil water potential at 100cm in Tiva maintained over -0.2MPa but that of Kibwezi was less than -0.2MPa even after the heavy rain in rainy season.
- Average temperature and precipitation from July, 2015 to Dec., 2015 in Marimannti and Kasigaua were 7.9℃, 892mm and 25.4℃, 258mm, respectively (fig.3). Marimannti was 2.4℃ hotter than Kasigau, and had 634mm higher precipitation.

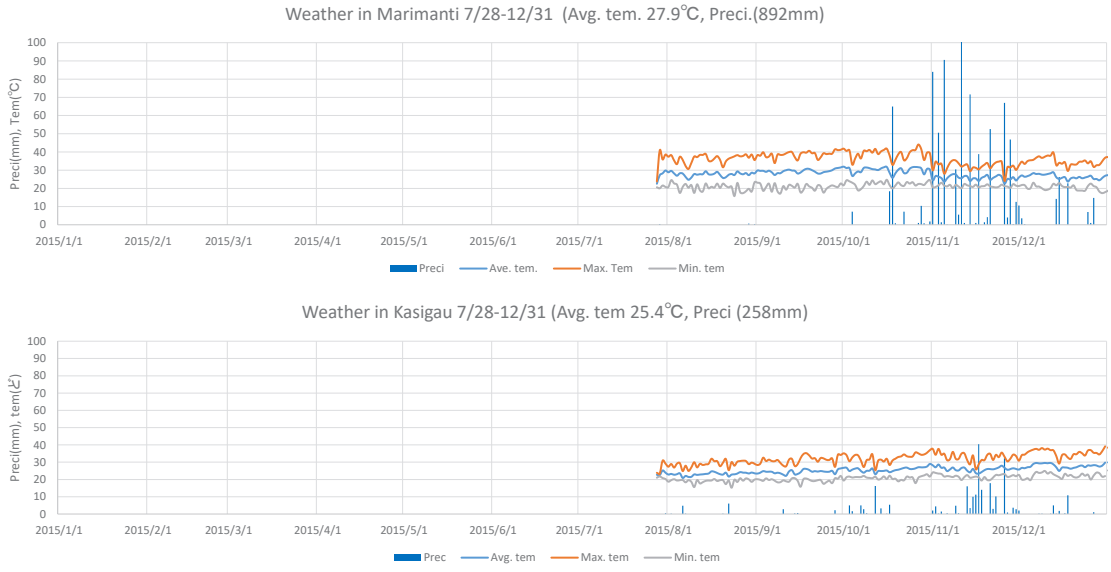


Fig.3 Trends of average air temperature, maximum air temperature, minimum air temperature, and precipitation in Marimanti and Kasigau in 2015.

- Soil water potential was higher in Kacigau than Marimanti in July, 2015, but Marimanti was wetter than Kasigau in Jan., 2015 because of lots of rainfall in Nov., 2014.

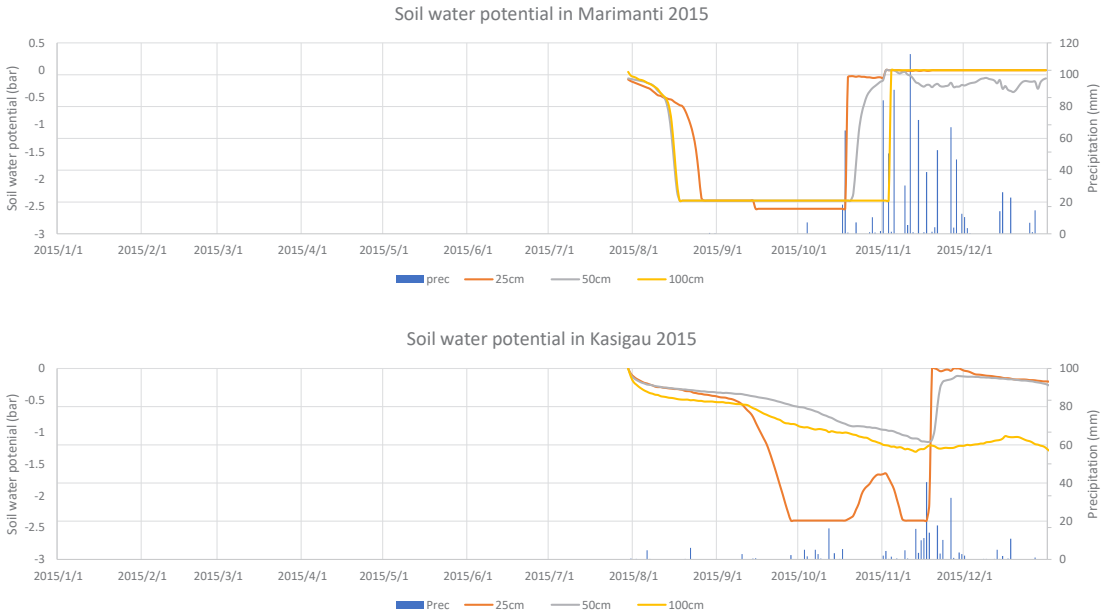


Fig.4 Trends of soil water potential at Tiva and Kibwezi seed orchard in 2015.

・Thermo-hygrometers were installed at Marimanti sub-PTS, Makima sub-PTS, Ikithuki sub-PTS, and Voi sub-PTS. These equipments were set at 1.2m height of piles (fig.5).

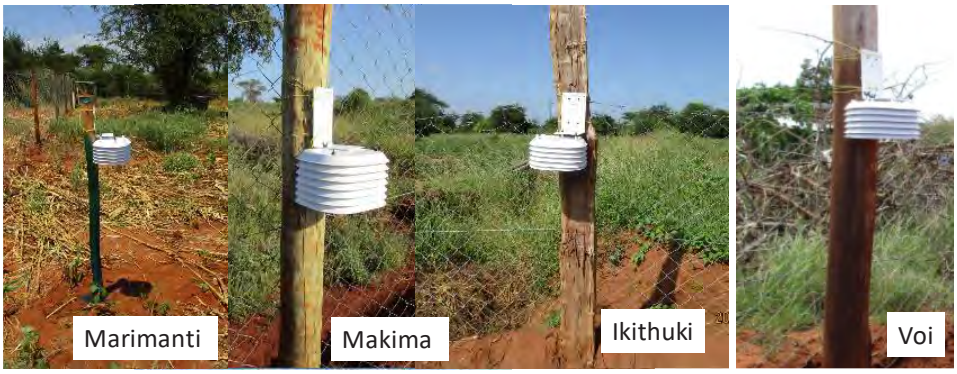


Fig.5　Thermo-Hygrometer sensor installed in 4 sub-PTS.

2.2 The comparison of growth phenology between fast growth and slow growth clones of *Melia volkensii*.

[Activities]

- To reveal the difference of growth pattern of fast growth clone (FGC) and slow growth clone (SGC), manual type of dendrometers were installed at Tiva and Kibwezi seed orchard in July, 2015. Clone numbers selected as the FGC and SGC were no.49, no.29, no.18, no.40 and no.54, no.39, no31, respectively. Three individual trees of each clone were selected for measurement and the dendrometer were installed to the east direction at height from 50cm to 100cm. Records of the dendrometer were conducted almost every day by stuffs working in the orchard.

[Results]

- **Comparison of stem growth pattern between FGC and SGC**
  Fig.6 showed the growth pattern of FGC and SGC at Tiva and Kibwezi seed orchard from July, 2015 to Dec., 2015. We started the measurement at July, 28 (dry season) and trees had no leaves on their crowns (see fig.7, photo 7/31), but we found that they could continue their growth without leaves. The growth of FGC was likely to continue for long time compared with SGC. This phenomenon that Melia volkensii can grow during the dry season without leaves seems to be one of the important strategy *Melia* can grow even in dry land. At the end of dry season, stem began to shrink gradually and swelled quickly after a heavy rain, the shrunk of SDC was larger than that of FGC. This result indicates that the water stress of SGC is larger than FGC in dry season.

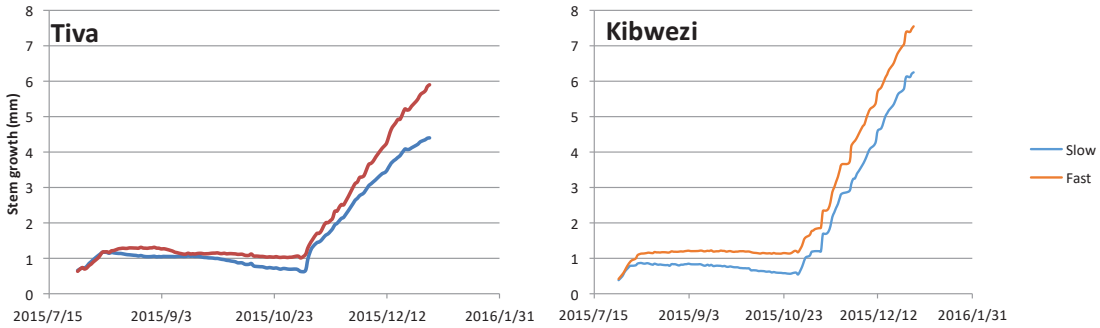


Fig.5 Stem growth pattern of FGC and SGC in Tiva and Kibwezi seed orchard from July to November in 2015.

- **Stem growth phenology and weather conditions**
  Fig.7 showed the trends of stem growth, precipitation, and soil water potential in Tiva seed orchard, and adding to above, leaf phenology of Jul. 31, Nov. 1, Nov.10, and Nov. 20 were shown together.

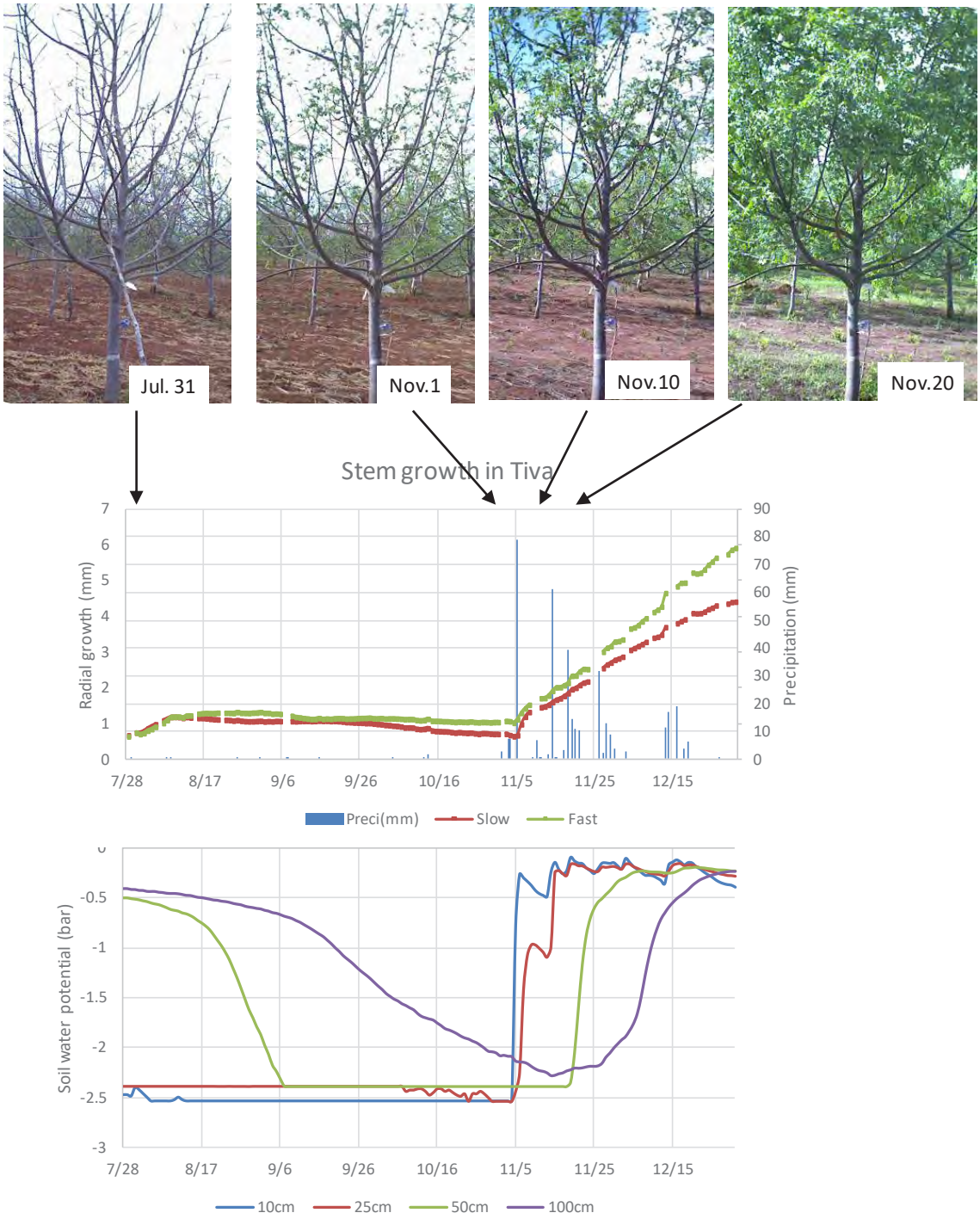


Fig.7 Trends of stem growth, precipitation, and soil water potential in Tiva orcharad.

Stems swelled quickly after the heavy rain in Nov. 5 and began to grow quickly. Trees had few leaves before Nov. 5, but after the rain, leaves flushed quickly (photos in fig.7). Similar results were obtained in Kibwezi (fig.8, upper). There was a heavy rain in Nov.3 in Kibwezi, and trees swelled quickly. However, tree growth could not start at this time because this

rain could not penetrate to the deep soil layer (fig.8, below). Tree growth in Kibwezi started around Nov. 15.

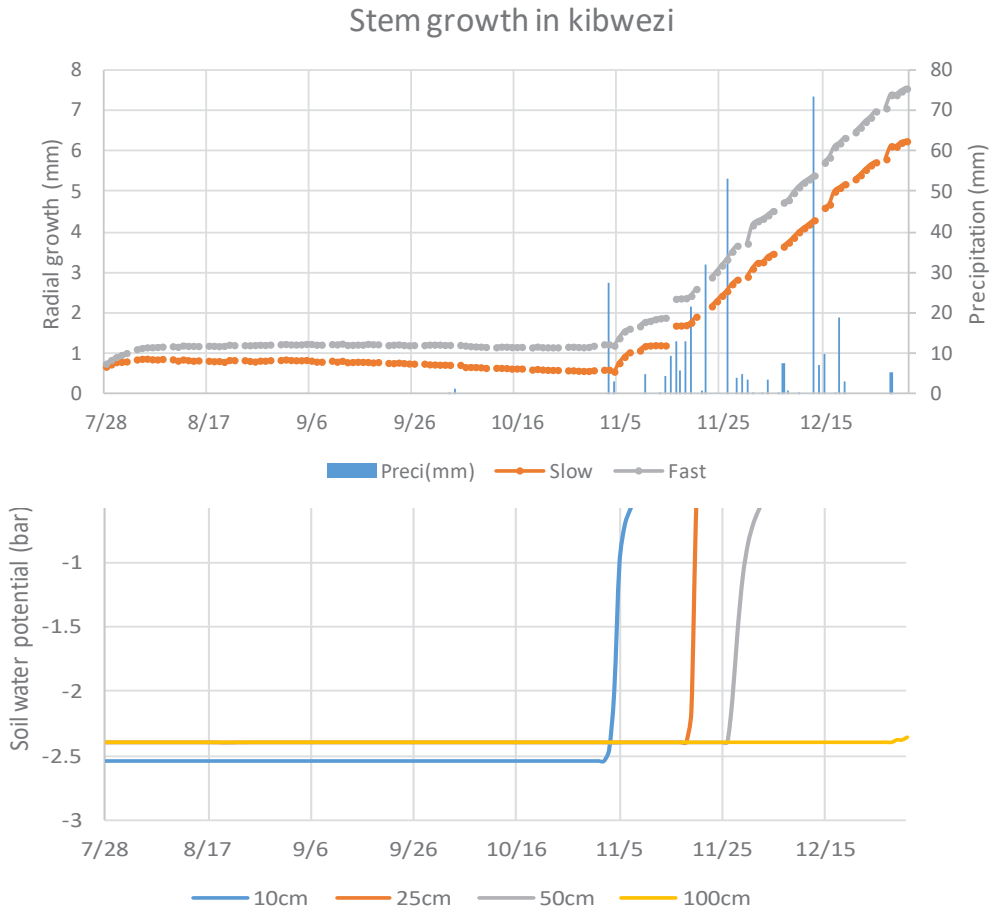


Fig.8 Trends of stem growth, precipitation, and soil water potential in Tiva orcharad.

Appendix 4-4-9 Report of short term expert (Project management/Nursery management)

Expertise	Name	Term
Project management	Mr. Toshizumi Sakai	Feb.8 ～ 18 Feb. 2016
Nursery management	Mr. Nobutaka Chiba	Feb.8 ～ 18 Feb. 2016

1. Schedule

Date	Activity
8 Feb.	Move to Haneda Airport
9 Feb.	Arrive at Nairobi Move to Kitui
10 Feb.	Technical guidance in Melia seed orchard and nursery in KEFRI Kitui centre
11 Feb.	Technical guidance in Melia seed orchard in Tiva
12 Feb.	Visit to KFS Kitui office Observation of Farm Forestry Field School and sub-progeny test site in Makima, move to Nairobi
13 Feb.	Writing report
14 Feb.	Organizing material and reports
15 Feb.	Meeting with Dr. Muturi and KEFRI staff Courtesy call to Dr. Chikamai. DG of KEFRI
16 Feb.	Project Joint Coordinating Committee Report to JICA Kenya Office Depart from Nairobi to Dubai
17 Feb	Move to Haneda from Dubai
18 Feb	Move to office from Haneda

2. Result of major activities

- Technical guidance in Melia seed orchard and nursery in KEFRI Kitui centre
  Mr. Chiba introduced cutting technique of Melia using plant hormones Auxin and sand soil. It is said in Kenya that cutting of Melia is difficult to produce seedlings, however, the cutting succeeded under special condition using Auxin, selected soil and suitable water supply in Japan. Cutting of Melia, therefore, should be considered as a important propagation technique that produces clonal seedlings for developing seed orchards.
- Conservation of Melia seeds
  As a suitable method to conserve Melia seed with germination ability, a special measure that seeds are stored in soil will be studied to keep stable supply of improved Melia seeds. Some factors such as character and depth of soil, covering or holder of seeds etc. should be considered to decide the suitable condition.
- Bud pruning of Melia in progeny test site
  Bud pruning is very important technique to obtain one straight stem with no knots for a Melia tree, and an appropriate method was introduced in Tiva progeny test site.
- Management of Acacia seed stand
  After observing Acacia seed stand in Tiva, it was discussed among the Japanese experts and KEFRI staff how to lead the main stem of Acacia straight up. Some seedlings have grown straight and others have spread over the ground. A pole that can sustain the stem, therefore, is suggested to keep a straight stem.
- Farm Forestry Field School (FFFS)
  Kenyan staff and Japanese experts observed a demonstration forest that has been developed for growth comparison between ordinal and improved Melia seedlings.
- Meeting with project manager and Japanese experts
  - Training of CP personnel in Japan on the next fiscal year 2016 will start 18 Jun. until 17 Jul. for “extension course”. 6 trainees will be dispatched.
  - Due to NAGOYA protocol on transfer of genetic resources, a new MOU should be considered between KEFRI and FTBC.
  - A side event for TICAD 6 is planned, and it is considered that an international seminar on measures for expanding of arid and semi-arid area will be held.
  - An international seminar will be held on the next JCC 2017 to present the outputs of the project activities from Kenyan and Japanese experts including FTBC researchers.
- Joint Coordination Committee (JCC)
  JCC meeting was held on 16 Feb. 2016 at Ministry of Environment, Water and Natural resources under chairing by Mr. Gathaara, Conservation Secretary. Main announcement is as follows;
  - Ms. Iizuka, who has been assigned as Miss Japan for Goddess of Green 2016, will be invited to the project for advertisement of the project activities to Japanese people. (Embassy of Japan in Kenya)
  - A new JICA forestry project, which has been authorized as “Capacity Development Project for Sustainable Forest Management in the Republic of Kenya”, will start from

May 2016. Counter budget and staff for the project are very important to implement the project. (JICA Kenya Office)

- APO and PO on the next year 2016 were explained by the project. Outline of C/P training course 2016 in Japan was also explained by the project.
- Forest tree breeding is one of the important activities in the new project, and FTBC will make efforts to accomplish the activities in cooperation with Kenyan organizations concerned. (FTBC)
- Some materials for extension and FFFS activity were introduced by Mr. Ogawa, short term expert “Extension”.
- It is not difficult to complete 400ha plantation of improved Melia, which is decided as a Objectively Verifiable Indicator on PDM, and it should be corrected to a suitable number or another indicator. (JICA Kenya Office)

Photo

Photo1:Teaching cutting of Melia by Mr. Chiba

Photo2:Cutting by Mr Kariuki

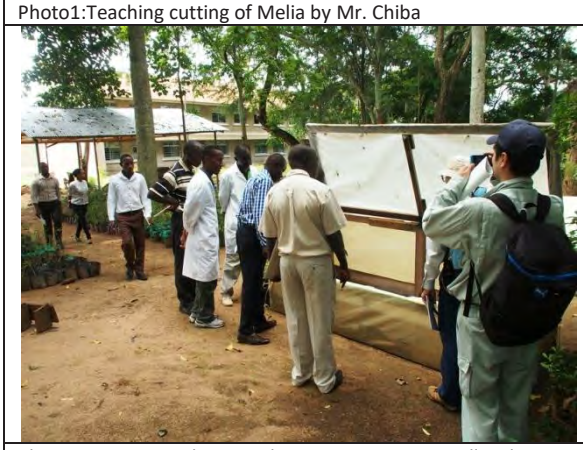


Photo3:Discussion about study on cutting using seedling box

Photo4:Discussion about simple conservation method of Melia seed

Photo5:Tiva Melia progeny test site planted Dec. 2014

Photo6:Delay of bud pruning in the Tiva site

Photo7:Technical guidance of bud pruning in PTS planted Dec. 2015

Photo8:Working of bud pruning by all staff

Photo9:Guidance of maintenance for Acacia seed stand planted Dec. 2015

Photo10:Technical guidance of stem cutting and branch pruning in Melia seed orchard

Photo11:Farm Forestry Field School(FFFS)

Photo12:Growth of improved Melia seedling planted Dec. 2105 at FFFS

Photo13:Office of African Children Education Fund(ACEF)

Photo14: Melia plantation site by ACEF

Photo15: Makima sub progeny test site donated by ACEF

Photo16:4th JCC Meeting in Ministry of environment and natural resources