PN-ABA-544
PN-ABA-544-A
PN-ABA-544 B

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

DATE: 8/4/88

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. 5. 2/3
PR #1

Attachment

PN-ABA-544

5.2.4.3

PROGRESS REPORT

PROGRESS REPORT NO. 1

(MAY - OCTOBER , 1986)

COLLECTION AND UTILIZATION OF TAMARIND GERMPLASM

A RESEARCH PROJECT

GRANT NO. 936-5542-G-00-6026-00

SUBMITTED BY

DR.SUMRIT FEUNGCHAN

PROJECT LEADER

FACULTY OF AGRICULTURE

KHON KAEN UNIVERSITY

KHON KAEN 40002. THAILAND.

Rec'd in Sci. DEC 30 1986

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Project Profile

Country : Thailand

Grant No. : 936-5542-G-00-6026-00

Program : Program on Science and Technology Cooperation

Project Title :"Collection and Utilization of Tamarind Germplasm."

Project Leader : Dr.Sumrit Feungchan

Organization : Department of Plant Science

Faculty of Agriculture

Khon Kaen University

Khon Kaen 40002. Thailand.

Co-investigators : Mr.Taweekiat Yimsawat

Mr.Sorot Chindaprasert

Mr.Pitool Kitpewsong

Project Consultants :

Authorized Officer : Dr.Somporn Bothinam MD.

Total Project Budget : US $ 150,000.

Project Duration : 3 years.

Reporting Period : May-October, 1986.

Budget Allocation for This Period : B 510,198.

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1. Background/Introductions

Tamarind (Tamarindus indica L.) is a native to the dry savannas of tropical Africa but was introduced to Asia in ancient times by Arab traders. It was readily accepted due to its pleasant acidic tasting fruit, particularly in India (Bueso, 1980).

The specy also reached the new world long ago , and now generally grows in most tropical countries. Throughout most of the tropics the tree grows untended along road sides, in backyards or on wasteland. However, nature plantations do exist in India which harvested over 250,000 tons of fruit pulp annually (NAS, 1979), and in Mexico where 37,000 tons of pulp were harvested in 1979 from 1,143 ha. of plantations in six states (Hernandez-Unzon and Lakshminarayana, 1982 A). In Thailand, most of the production come from untended trees and wild types eventhough a few small scale sweet tamarind units have been established recently.

2. Objectives

The specific objectives of this Project are to :

1) comprehensively collect *Tamarindus indica* L. germplasm from tamarind trees of known variability in quantity and quality of fruit (both sweet and sour) and quantity of biomass (size of tree and quantity of leaves) ;

2) evaluate the comprehensive collection of tamarind for genetic variability in rate and extent of growth and production of food and biomass, under comparable condition (accomplished by grafting on rootstocks) ;

3) clone fast growing,early producing,sweet and sour tamarind types to propagate superior cultivars that yield large amounts of high quality fruit pulp and important sources of biomass for food,fuel or soil conditioning uses ;

4) select and develop dwarf rootstock to be used for grafting and exploiting the selected cultivar,through improved yield per hectare and better cultural management (production and harvesting) ;

5) develop efficient means for culturing the improved rootstock ; and

6) establish demonstration plots and suitable cultural practices for tamarind plantations ;

3. Materials and methods

3.1 Germplasm Collection

Most of the tamarind types, both sour and sweet, are grown untended in different parts of Thailand, therefore it will be necessary to collect germplasm by various means. Gernerai germplasm collection can be made through collaboration with provincial agriculture extention officers, and also by randomized selection from different location. Apart from the collection in Thailand, germplasm of both sour and sweet tamarind types can be obtained from other countries, i.e., India, Pakistan, Bangladesh, Sri Lanka, Burma, Malaysia, Indonesia, Papua New Guinea, the Philippines, Central Africa (Senegal to Sudan), Mauritius, Mexico (plantations in 6 states) and Puerto Rico, through the Internatonal Board for Plant Genetic Resources-Sourtheast Asia Regional Committee, FAO Regional Office, Bangkok, Thailand.

After collection of germplasm for a period of 6-12 months, it is anticipated that the enormous amounts of gerplasm collected will be ready for experimentation. Moreover, the excess amount of germplasm can be shared with those interested collaborators in other countries with descriptions of the characteristics of the individual germplasm. The germplasm collected can be in the form of seed, and scions of individual trees needed for grafting purposes. For germplasm collected from

other overseas cooperators, the characteristics of the germplasm as either seed or grafted materials, must accompany the gerplasm being sent, using data sheets described by the International Tropical Fruit Descriptors (1979) with some slight modifications.

3.1.1 Study of pod specimens

Collection of pod specimens of sour tamarind will be done in The Northeast. Pod specimens are studied in various items based on the Tamarind Pod Data Sheet (see Annex I). The obtained data from Annex I will be analysed for grouping the frequencies of the pulp weight , percentage of pulp weight , number of pods per kilogram and real value of pulp for specimen ranking.

3.2 Rootstock study

3.2.1 The Search for Rootstock other than Tamarind Rootstock

- Collection of other closely related species to tamarind in the search for dwarf rootstocks viz. Manila tamarind (Pithecellobium dulce) , Raintree (Samanea saman Merr.) have been carried out.

- Producing the seedling of the above mentioned species in 4" x 6" PVC. bags.

3.3 Cultural Practices and Demonstration Plots

- The experiment includes two site of demonstration plots, one on the Khon Kaen University campus and the other in the private orchard. The grafted plant of sweet tamarind type will be planted in the demonstration plot with the spacing of 6 x 6 meters.

4. Results / Discussion / Tables :

4.1 Germplasm collection

4.1.1 Study of pod specimen

From Fig. 1,2,3 and 4 had shown that the frequencies of number of pods per kilogram, pulp weight, percentage of pulp weight and a real value of pulp (R.V.*) may be used to determine the mode of these items which modified to be criteria in selecting the accessions (see table 1).

From table 1 the real value of pulp is used as the main criterion in specimen ranking. Based on the level of real value of pulp from 10-21, the 23 specimens were selected as accessions. The level of real value of pulp of 10 is proposed to be the minimum standard of this selection with the following reasons : 1) the frequencies from real value of pulp of 10 and upward has shown constant curve, 2) the other criteria such as number or

Fig. 1 Study of pod specimens

(689 specimens from 9 provinces in the Northeast, 1986)

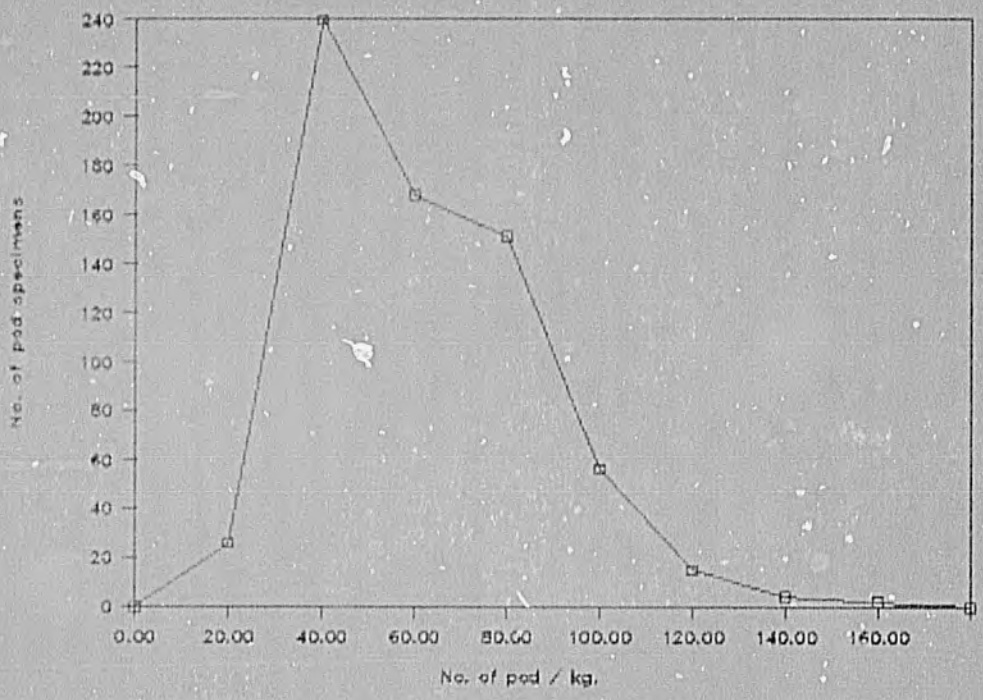

Fig.2 Study of pod specimens

(689 specimens from 9 provinces in the Northeast, 1986)

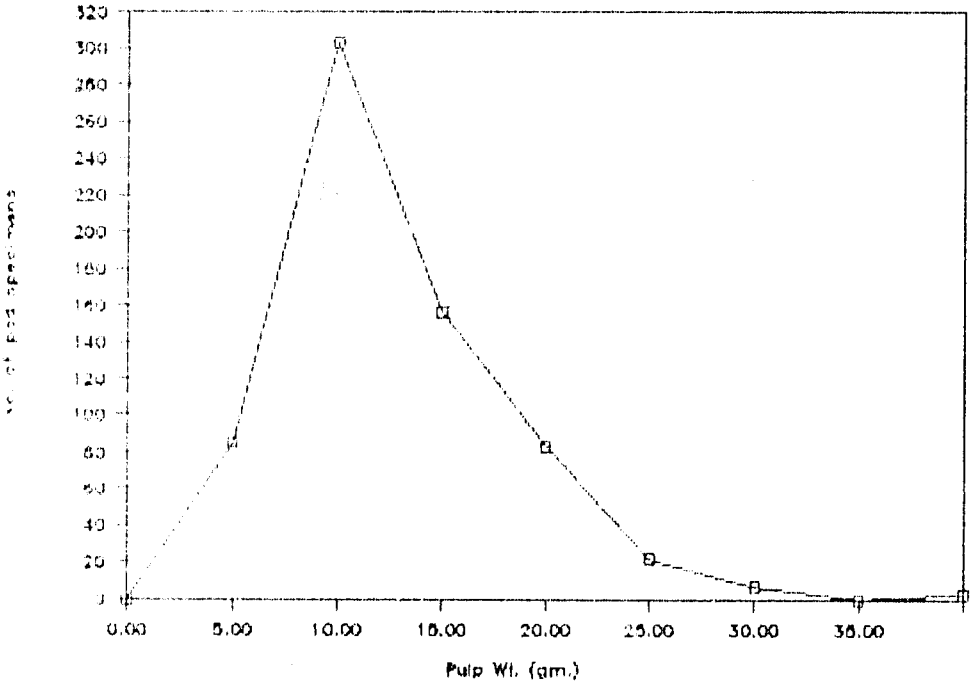

Fig. 3 Study of pod specimens
(689 specimens from 9 provinces in the Northeast, 1986)

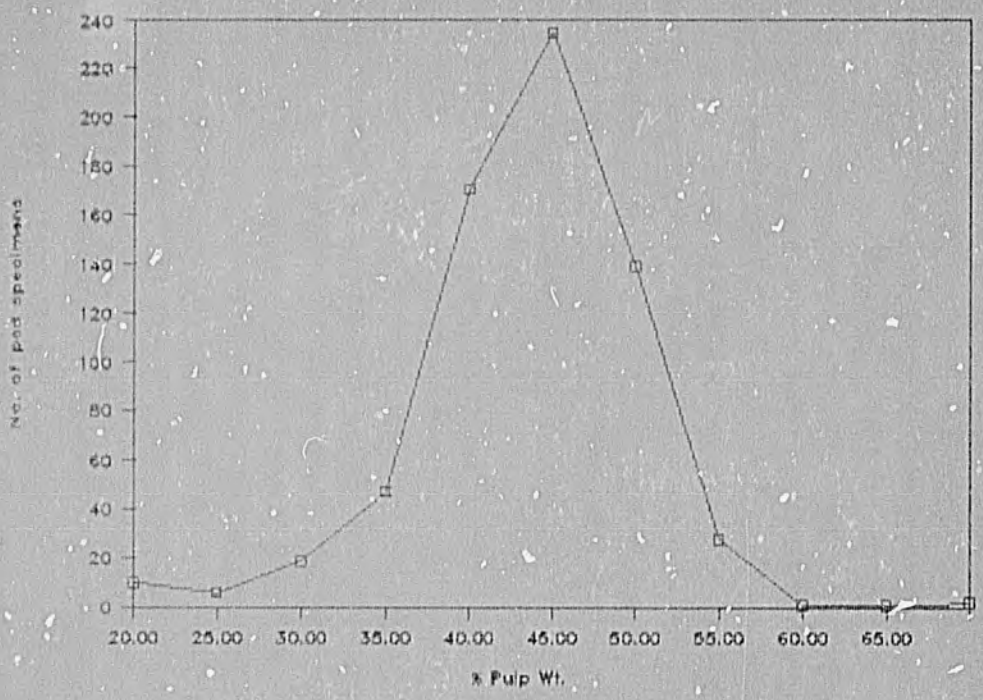

Fig. 4 Study of pod specimens
(689 specimens from 9 provinces in the Northeast, 1986)

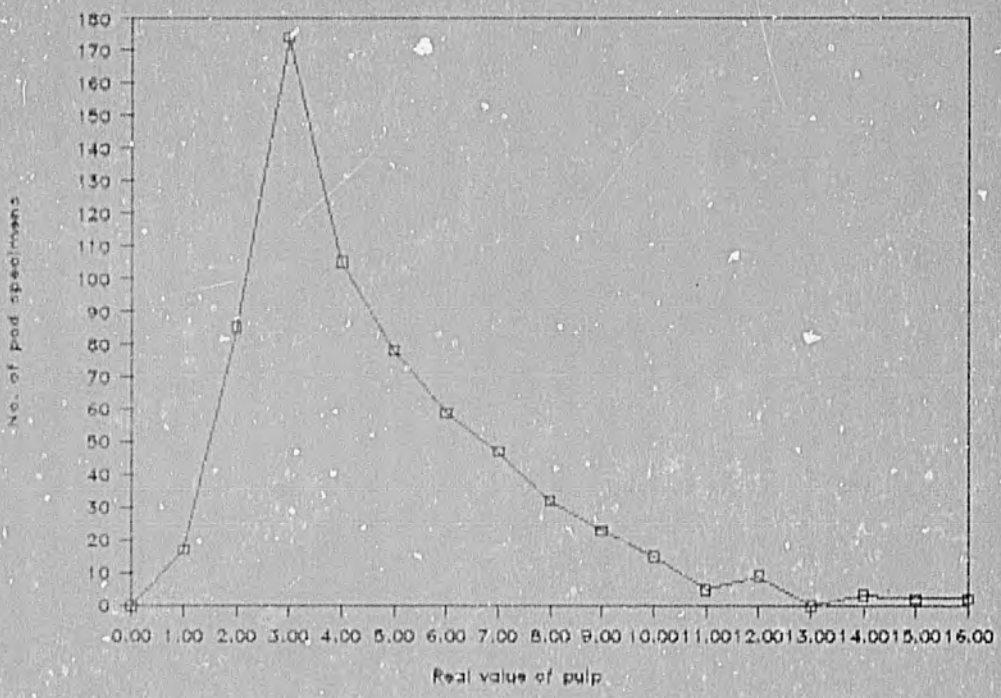

Table 1 Ranking of sour tamarind specimens

(689 specimens from 9 provinces in the Northeast , 1986)

Code	Ave. Wt. of pod (gm)	No. of pod/kg.	Pulp Wt. (gm)	% Pulp Wt.	Real value* of pulp	Rank
86-2-13-001	77.83	12.85	40.80	52.4250	21.3894	1
86-2-13-019	83.18	12.02	36.70	44.1210	16.1924	2
86-2-13-018	78.86	12.68	35.51	45.0360	15.9941	3
86-2-08-095	32.92	30.38	22.31	67.7700	15.1195	4
86-2-13-020	58.03	17.23	29.21	50.3461	14.7061	5
86-2-08-038	22.92	43.63	18.20	79.4070	14.4521	6
86-2-13-015	57.98	17.25	28.13	48.5240	13.6513	7
86-2-13-008	50.59	19.77	26.17	51.7360	13.5398	8
86-2-13-002	53.33	18.75	26.70	50.0700	13.3687	9
86-2-13-009	61.73	16.20	27.03	43.7900	11.8378	10
86-2-08-077	41.69	23.99	22.19	53.2200	11.8095	11
86-2-13-017	53.40	18.73	24.93	46.6760	11.6340	12
86-2-13-011	54.84	18.23	25.20	45.9520	11.5799	13
86-2-08-028	50.78	19.69	24.18	47.6120	11.5120	14
86-2-13-004	51.19	19.54	24.21	47.2940	11.4199	15
86-2-08-008	51.73	19.33	29.28	46.9310	11.3925	16
86-2-08-047	45.40	22.03	22.68	49.9560	11.3300	17
86-2-13-005	38.72	25.83	20.73	53.5380	11.0984	18
86-2-08-178	47.15	21.21	22.40	47.5080	10.6418	19
86-2-08-083	43.71	22.88	21.38	48.9090	10.4558	20
86-2-08-183	38.42	26.03	19.96	51.9520	10.3686	21
86-2-08-016	47.54	21.03	21.93	46.1290	10.1161	22
86-2-13-014	73.68	13.57	27.20	36.9190	10.0420	23

R.V.* = % Pulp Wt. x Pulp Wt. / 100

pods per kilogram, pulp weight and percentage of pulp weight have shown in the same trend (Fig 1 , 2 and 3)

R.V.* = Pulp weight x % Pulp weight / 100

4.2 Rootstock study

The Search for Rootstock other than Tamarind

- Manila tamarind (Pithecellobium dulce) and Raintree (Samanea saman Merr.) have been produced about 5,000 seedlings. When the seedling is 6-8 months old or the diameter of seedling stem is about 5 mm. it will be used as the rootstock for intergeneric grafting with tamarind.

4.3 Cultural Practices and Demonstration Plots

The 415 grafted plants of sweet tamarind type have been planted in the demonstration plot at the university campus.

5. Conclusion / Remark :

5.1 Germ collection

5.1.1 Study of pod specimen

The 689 pod specimens of sour tamarind from 9 provinces in the Northeast were analysed and brought about the criteria for selection the accessions viz. number of pods per

kilogram , pulp weight , percentage of pulp weight and real value of pulp. Finally , the 23 specimens were selected as for further study and evalution.

6 Workplan for the Next Period :

6.1 Germplasm collection

- To collect of pod specimens of tamarind in regions other than the Northeast and abroad.

6.2 Testing of Germplasm

6.2.1 Biomass study

- To study the growth of plant both in the field and containers.

6.2.2 Fruit study

- To observe the accession mother plants at the original sites.

6.3 Rootstock study

6.3.1 The search for dwarf rootstock

- To search the untended dwarf phenotypic expression.

6.3.2 - To search for rootstock plants other than tamarind rootstock.

- To collect the other closely related species to tamarind for rootstock studies including nodulation leguminous plants.

6.3.3 Chemical treament for the production of dwarf rootstock.

6.4 Rhizobium studies

- To study the inocluation and isolation of Rhizobium from tamarind.

7. References :

Bueso, C.E. 1980. Soursop, Tamarind and Chironja. In: Tropical and Subtropical Fruits. p.375-460, edited by Nagy, S. and P.E. shaw. AVI , Westport , Conn.

Hernandez-Unzon, N.Y. and S.L. Lakshminarayan. 1982 A.A Development Physiology of Tamarind Fruit (Tamarind indica L.) Hort. Science. 17(6) : 983-940.

National Academy of Science. 1979. Tamarind. p.117-122. In Tropical Legumes : Resources for the future. Washington, D.C., 331 p.

Annex / Picture

Tamarind Pod Data Sheet (Sweet/Sour Type)

No.	Name and Address of specimen's owner	Pod shape	Pod shell character			Wt.of 10 pod (gm.)	Av. Wt. of pod	Pod dimension				Character of pod												RV.*	Rank of specimen
			Colour	Thickness	Texture			Length (cm.)	Width (cm.)	Thickness (cm.)	Volume (cm^3)	Wt. of shell	% Wt. of shell	Wt. of vein (gm.)	% Wt. of vein	No. of seed	Wt. of seed	% Wt. of seed	Pulp Wt. (gm.)	% Wt. of pulp	Pulp co-lour	Pulp tex-ture	Tight-ness of pulp		

* Real value of pulp (RV.) = $\frac{\text{Pulp weight} \times \text{\% Pulp weight}}{100}$

Sour Tamarind Scorecard

Evaluator's Name ..... Position.....

Signature..... Office.....

No.	Name and Address of specimen's owner	Pod shape				No of pod/kg.					Pulp wt. (gm.)					% Pulp wt.					Pulp texture			Pulp colour			Total mark	* RV.	Rank No.
		Straight	Slightly curved	Half circular	Circular	< 20	21 - 30	31 - 40	41 - 50	> 50	> 25	20 - 24	15 - 19	10 - 14	5 - 9	> 55	50 - 54	45 - 49	40 - 44	35 - 39	Moist	Wet	Dry	Light brown	Dark brown	Yellow			
						10	8	6	4	2	10	8	6	4	2	10	8	6	4	2	10	6	2	10	6	2			

* Real value of pulp (RV.) = $\frac{\text{Pulp weight} \times \text{\% Pulp weight}}{100}$

Sweet Tamarind Scorecard

Evaluator's Name..... Position.....

Signature..... Office.....

No.	Name and Address of specimen's owner	Pod shape				No of pod/kg.					Pulp wt.(gm.)					% Pulp wt.					Sweetness (% Brix)				Palatability			Pulp texture			Pulp colour			Total mark	* RV.	Rank No.
		Straight	Slightly curved	Half circular	Circular	< 20	21 - 30	31 - 40	41 - 50	> 50	> 25	20 - 24	15 - 19	10 - 14	5 - 9	> 55	50 - 54	45 - 49	40 - 44	35 - 39	> 16	11 - 15	6 - 10	0 - 5	Very palatable	Palatable	Non-palatable	Moist	Wet	Dry	Light brown	Dark brown	Yellow			
						10	8	6	4	2	10	8	6	4	2	10	8	6	4	2	10	7.5	5.0	2.5	10	7.5	5.0	10	6	2	10	6	2			

* Real value of pulp (RV.) = $\frac{\text{Pulp weight} \times \text{\% Pulp weight}}{100}$

Criteria of scoring

1. No. of pod/kg. (10 marks)

< 20 pod/kg.	10	marks
21 - 30 "	8	"
31 - 40 "	6	"
41 - 50 "	4	"
> 50 "	2	"

2. Pulp weight (gram). (10 marks)

> 25 gm/pod	10	marks
20 - 24 "	8	"
15 - 19 "	6	"
10 - 14 "	4	"
5 - 9 "	2	"

3. % Pulp weight (10 marks)

> 55 %	10	marks
50 - 54 %	8	"
45 - 49 %	6	"
40 - 44 %	4	"
35 - 39 %	2	"

4. Pulp texture (10 marks)

1) Moist	10	marks
2) Wet	6	"
3) Dry	2	"

5. Pulp colour

1) Light brown	10	marks
2) Dark brown	6	"
3) Yellow brown	2	"

6. Sweetness (10 marks)

> 16 % Brix	10	marks
11 - 15 % Brix	7.5	"
6 - 10 % Brix	5.0	"
0 - 5 % Brix	2.5	"

7. Palatability (10 marks)

1) Very palatable	10	marks
2) Palatable	7.5	"
3) Non-palatable	5.0	"

Pod Descriptors

1. Pod shape

   The shape of mature pod.

   Options : 1. Straight

   2. Slightly curved

   3. Half circular

   4. Circular

2. Shell colour

   Colour of the mature shell

   Options : 1. Light brown

   2. Brown

   3. Dark brown

   4. Other

3. Shell texture

   The texture of the mature shell

   Options : 1. Fine

   2. Medium

   3. Coarse

4. Pulp colour

   Colour of the mature pulp

   Options : 1. Light brown

   2. Dark brown

   3. Yellow

5. Pulp texture

The texture of the mature pulp.

Options : 1. Moist

2. Wet

3. Dry

6. Tightness of pulp.

The degree of tightness of pulp

Options : 1. Loose

2. Tight

Fig. 1 Tamarind seedlings for Biomass study.

Fig. 2 Manila tamarind (Pithecellobium dulce)

seedlings for rootstock study.

Fig. 3 General view of tamarind demonstration plot.

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HOI-87 (55 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness (cm)	Volume** (cm)	Character of pod Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	Wt. of seed (gm)	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	%Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Half circular	-	-	378.22	37.82	26.43	21.58	3.18	1.81	124.06	7.00	18.5020	-	-	-	11.83	13.05	34.4340	16.03	42.3780	7.7945	-	-	-	-
2	Half circular	-	-	211.50	21.15	47.28	17.75	2.32	1.56	64.01	3.83	18.0850	-	-	-	9.25	8.19	38.2980	6.95	32.8610	2.2838	-	-	-	-
3	Straight	-	-	337.86	33.79	29.60	20.21	2.86	1.94	112.37	8.09	23.9220	-	-	-	9.42	9.57	28.3280	13.13	38.8590	5.1018	-	-	-	-
4	Half circular	-	-	156.14	15.61	64.05	13.51	1.54	1.51	30.54	4.14	26.5340	-	-	-	9.33	6.09	38.9780	5.76	36.8710	2.1227	-	-	-	-
5	Straight	-	-	222.20	22.22	45.00	13.10	2.86	1.75	65.38	4.76	21.4225	-	-	-	9.60	6.98	31.4130	9.22	41.5440	3.9092	-	-	-	-
6	Half circular	-	-	299.40	29.94	33.40	19.00	3.06	1.79	103.85	6.80	22.7120	-	-	-	9.20	9.90	33.0660	11.6[illegible]	38.8110	4.5098	-	-	-	-
7	Half circular	-	-	452.57	45.26	22.10	23.57	3.29	1.84	147.30	9.67	21.3690	-	-	-	10.43	11.10	24.5270	20.00	44.1920	8.8384	-	-	-	-
8	Half circular	-	-	187.1[illegible]	18.71	53.44	15.07	2.41	1.66	60.27	4.64	24.8100	-	-	-	8.57	6.[illegible]	35.9570	6.60	35.2680	2.3277	-	-	-	-
9	Straight	-	-	142.06	14.20	70.42	14.00	2.19	1.72	57.44	4.26	29.9790	-	-	-	7.57	6.13	43.1620	6.00	42.2540	2.5352	-	-	-	-
10	Half circular	-	-	217.[illegible]	21.76	45.96	16.14	2.65	1.51	64.61	4.37	20.0900	-	-	-	8.71	7.29	33.5480	9.30	42.7450	3.9753	-	-	-	-
11	Half circular	-	-	188.20	18.83	53.11	14.65	2.41	1.66	58.69	4.35	23.1019	-	-	-	7.80	7.12	37.8120	6.17	35.4220	2.3626	-	-	-	-
12	Straight	-	-	235.78	23.58	42.41	16.11	2.59	1.71	71.41	4.51	20.4050	-	-	-	8.67	9.12	38.6890	8.56	36.2860	3.1048	-	-	-	-
13	Half circular	-	-	221.10	22.11	45.23	17.80	2.58	1.47	67.15	4.52	20.4430	-	-	-	8.90	7.48	33.8310	9.23	41.7460	3.8522	-	-	-	-
14	Half circular	-	-	218.00	21.80	45.87	16.44	2.70	1.51	66.55	4.51	20.7010	-	-	-	8.38	7.45	34.1740	8.80	40.3670	3.5522	-	-	-	-
15	Half circular	-	-	256.71	25.67	38.95	15.64	2.80	1.73	75.60	5.31	23.0280	-	-	-	8.71	7.81	30.4290	10.99	42.7950	4.7015	-	-	-	-
16	Half circular	-	-	258.80	25.88	38.64	17.05	2.84	1.68	81.01	5.96	23.0290	-	-	-	10.10	8.03	31.0280	10.49	40.5320	4.2519	-	-	-	-
17	Half circular	-	-	315.00	31.50	31.75	19.29	2.92	1.72	96.56	6.96	22.0860	-	-	-	11.71	10.11	32.1080	12.52	39.7750	4.9834	-	-	-	-
18	Half circular	-	-	303.63	30.36	32.93	18.42	3.25	1.73	103.80	6.45	21.2430	-	-	-	7.50	8.33	27.4180	12.73	45.2030	6.2041	-	-	-	-
19	Straight	-	-	126.42	12.64	79.10	9.79	2.30	1.59	35.73	2.77	21.9170	-	-	-	5.00	4.17	32.9910	5.27	42.4820	2.2817	-	-	-	-
20	Half circular	-	-	225.29	22.53	44.39	14.50	2.90	1.91	80.23	4.90	21.7490	-	-	-	6.43	6.77	30.0550	9.63	43.1430	3.9617	-	-	-	-
21	Half circular	-	-	240.71	24.07	41.54	17.36	2.57	1.73	77.17	5.44	22.6120	-	-	-	9.29	7.09	25.4380	9.16	38.0410	3.4834	-	-	-	-
22	Straight	-	-	207.67	20.77	48.15	12.47	2.42	1.95	59.02	4.18	20.1430	-	-	-	7.83	6.73	23.4220	9.32	44.8640	4.1800	-	-	-	-
23	Straight	-	-	251.33	25.13	39.79	14.06	2.22	1.72	68.29	4.59	18.2590	-	-	-	7.11	7.67	30.5060	10.37	41.2490	4.2763	-	-	-	-
24	Half circular	-	-	180.00	18.00	55.56	13.50	2.51	1.52	51.33	4.16	23.1280	-	-	-	8.13	6.90	38.2330	6.20	34.4440	2.1355	-	-	-	-
25	Half circular	-	-	331.50	33.15	30.17	16.23	3.52	2.29	131.75	6.15	18.5520	-	-	-	7.33	8.92	26.8990	16.02	49.3170	7.7289	-	-	-	-
26	Half circular	-	-	249.17	24.92	40.13	19.00	3.04	1.70	97.90	5.28	21.2020	-	-	-	8.17	8.63	34.6470	9.42	37.7930	3.5590	-	-	-	-
27	Straight	-	-	205.63	20.56	48.63	13.56	2.26	1.70	52.73	3.78	18.4210	-	-	-	10.50	7.28	35.3790	8.06	39.2690	3.1710	-	-	-	-
28	Half circular	-	-	151.50	15.15	66.01	13.13	2.15	1.68	47.32	3.94	2.5380	-	-	-	6.88	5.35	34.4800	5.43	34.9700	1.8971	-	-	-	-
29	Half circular	-	-	304.22	30.42	32.87	20.78	2.68	1.76	97.99	7.06	23.1940	-	-	-	11.11	10.08	33.1270	10.64	34.9880	3.7241	-	-	-	-
30	Straight	-	-	170.38	17.04	58.69	12.50	2.22	1.60	46.57	3.46	20.3250	-	-	-	7.00	5.26	30.8890	6.80	29.9100	2.7139	-	-	-	-
31	Half circular	-	-	184.44	18.44	54.22	14.44	2.44	1.51	54.98	3.79	20.5430	-	-	-	8.11	5.60	30.3620	6.84	37.0910	2.5385	-	-	-	-
32	Half circular	-	-	218.22	21.82	45.83	15.63	2.55	1.68	63.03	3.73	17.1070	-	-	-	8.56	6.56	30.0430	8.61	36.7110	2.9405	-	-	-	-
33	Half circular	-	-	199.33	19.93	50.17	14.33	2.14	1.48	66.75	4.30	21.5720	-	-	-	6.00	6.57	32.4440	7.45	37.3750	2.7844	-	-	-	-
34	Half circular	-	-	310.00	31.00	32.26	19.17	2.90	1.76	97.64	5.68	18.3220	-	-	-	9.50	8.72	28.1190	12.28	39.3970	4.1067	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	Half circular	-	-	156.56	15.66	63.87	12.67	2.34	1.70	50.33	3.35	21.2080	-	-	-	6.67	4.63	29.5820	5.06	32.2940	1.6328	-	-	-	-
37	Half circular	-	-	309.56	30.96	32.41	20.56	2.12	1.72	110.64	5.69	18.4370	-	-	-	10.56	9.30	30.1400	11.26	36.5100	4.2027	-	-	-	-
38	Straight	-	-	313.43	31.34	31.91	17.64	3.10	1.92	104.66	5.57	17.7740	-	-	-	10.71	10.19	32.4980	12.64	40.3380	5.0995	-	-	-	-
39	Half circular	-	-	353.14	35.31	28.32	15.14	3.28	1.82	91.03	5.94	16.8290	-	-	-	11.71	11.76	33.2930	12.06	36.9740	4.8277	-	-	-	-
40	Half circular	-	-	184.33	18.43	54.25	13.09	2.96	1.71	66.18	3.32	21.2490	-	-	-	6.17	4.53	24.5920	7.90	42.8580	3.3858	-	-	-	-
41	Straight	-	-	180.25	18.03	55.48	14.81	2.43	1.47	52.88	3.49	19.3510	-	-	-	9.25	6.60	36.6160	6.21	34.4690	2.1416	-	-	-	-
42	Half circular	-	-	261.14	26.11	38.29	19.36	2.31	1.64	79.26	4.90	18.7540	-	-	-	10.43	8.47	32.4290	10.66	40.8090	4.2490	-	-	-	-
43	Half circular	-	-	225.75	22.58	43.53	15.46	2.77	1.73	76.52	4.21	18.7730	-	-	-	9.75	7.09	30.8510	10.00	43.5260	4.3525	-	-	-	-
44	Half circular	-	-	218.17	21.82	31.43	18.50	3.01	1.88	104.58	4.50	14.1420	-	-	-	10.33	10.55	32.1580	14.52	45.7270	6.6227	-	-	-	-
45	Half circular	-	-	260.00	26.00	28.46	15.20	2.70	1.81	74.08	5.04	19.3850	-	-	-	9.80	8.26	32.1570	10.24	39.3850	4.0330	-	-	-	-
46	Straight	-	-	205.25	20.53	48.72	14.50	2.74	1.61	64.08	3.68	17.9050	-	-	-	7.90	7.40	36.0540	8.18	39.8290	3.2569	-	-	-	-
47	Straight	-	-	208.25	[illegible]	48.02	14.62	2.28	1.55	54.06	4.68	22.4090	-	-	-	11.50	7.75	37.2150	6.88	33.0130	2.2696	-	-	-	-
48	Half circular	-	-	157.30	[illegible]	63.37	11.90	2.16	1.54	42.08	2.92	18.5040	-	-	-	8.60	5.62	29.6150	5.74	36.5750	2.0994	-	-	-	-
49	Half circular	-	-	240.20	24.02	41.63	16.40	2.74	1.65	74.34	4.08	16.9860	-	-	-	8.60	7.54	31.2810	5.64	40.1230	3.8688	-	-	-	-
50	Half circular	-	-	321.40	32.14	31.11	18.60	2.86	1.87	101.18	6.12	19.0420	-	-	-	8.60	8.12	25.2940	15.42	47.9780	7.3982	-	-	-	-
51	Half circular	-	-	266.67	26.67	37.50	18.58	2.79	1.57	81.27	5.98	22.4360	-	-	-	10.67	8.27	31.0010	10.70	40.1240	4.2933	-	-	-	-
52	Half circular	-	-	282.83	28.28	35.36	19.00	2.72	1.68	86.22	5.53	19.5170	-	-	-	9.83	8.55	30.2200	11.45	40.4940	4.6354	-	-	-	-
53	Half circular	-	-	347.80	34.78	28.75	19.40	3.08	1.82	108.83	6.26	18.2860	-	-	-	10.60	10.32	29.6720	14.74	42.3819	6.2470	-	-	-	-
54	Half circular	-	-	273.67	27.37	36.54	18.53	2.77	1.69	86.41	4.80	14.5390	-	-	-	9.50	8.05	29.4150	12.00	42.8680	5.2618	-	-	-	-
55	Half circular	-	-	275.17	27.52	36.34	16.58	2.78	1.53	85.01	5.63	20.4710	-	-	-	10.50	8.42	24.2220	9.62	34.3490	2.3610	-	-	-	-

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100

**Volume = Length x Width x Thickness

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22	Half circular	-	-	275.17	27.52	36.34	16.58	2.79	1.93	89.01	5.62	50.1710	-	-	-	10.50	9.42	[illegible]	9.62	34.9490	[illegible]	-	-	-

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
**Volume = Length x Width x Thickness

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BURIKAN (70 specimens)

No.	Pod shape	Pod shell colour	Pod shell Texture	Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness	Volume** (cm³)	Character of pod Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	% Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Half circular	-	-	185.86	19.59	53.00	12.86	2.49	1.81	57.87	3.99	21.4460	-	-	8.14	6.14	33.0520	7.69	41.3540	3.1785	-	-	-	
2	Straight	-	-	156.71	15.67	63.81	10.43	2.59	1.79	48.33	3.70	23.6100	-	-	6.57	5.30	33.8200	7.25	46.4940	3.3876	-	-	-	
3	Half circular	-	-	153.43	15.34	65.18	12.57	2.48	1.68	52.18	3.07	20.0160	-	-	7.14	6.17	40.2200	6.27	40.8720	2.5621	-	-	-	
4	Straight	-	-	153.00	15.30	65.36	13.62	2.06	1.54	43.20	4.09	26.7190	-	-	7.63	4.81	31.4580	5.89	38.4840	2.2659	-	-	-	
5	Half circular	-	-	236.43	23.64	42.30	17.86	2.63	1.69	79.35	4.57	19.3230	-	-	9.00	8.96	37.8940	9.14	38.6710	3.5357	-	-	-	
6	Half circular	-	-	428.75	42.88	22.79	22.00	3.54	2.03	162.15	8.70	19.8290	-	-	9.80	12.94	29.4930	18.20	41.4810	7.5495	-	-	-	
7	Straight	-	-	161.67	16.17	61.85	13.75	2.63	1.69	61.14	3.78	23.3990	-	-	6.67	5.97	36.2890	6.95	42.9890	2.8877	-	-	-	
8	Half circular	-	-	173.67	17.37	57.58	13.58	2.41	1.52	49.86	3.65	21.0170	-	-	7.83	6.25	35.9880	7.82	45.0110	3.5185	-	-	-	
9	Straight	-	-	112.57	11.26	88.82	9.93	2.27	1.55	37.21	2.67	23.7270	-	-	5.00	3.99	[illegible]	4.96	44.0350	2.1828	-	-	-	
10	Straight	-	-	152.00	15.20	65.36	13.13	2.17	1.48	42.10	3.28	21.4050	-	-	7.[illegible]	5.68	37.0920	6.[illegible]	39.2160	2.3530	-	-	-	
11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
12	Straight	-	-	199.38	19.94	50.16	16.06	2.52	1.66	67.42	4.10	20.5640	-	-	10.13	7.28	36.5530	8.18	41.[illegible]020	3.3519	-	-	-	
13	Straight	-	-	109.25	10.93	91.53	10.13	2.27	1.51	39.28	2.20	20.1370	-	-	5.50	5.23	47.8260	3.10	28.3750	0.8796	-	-	-	
14	Half circular	-	-	227.63	22.76	43.93	14.75	2.45	1.70	62.41	4.74	20.8140	-	-	9.00	8.68	38.1100	8.83	38.7160	3.4120	-	-	-	
15	Half circular	-	-	194.00	19.40	51.55	15.00	2.24	1.65	55.26	4.27	21.4790	-	-	8.33	6.02	31.0150	8.83	45.5310	4.0218	-	-	-	
16	Straight	-	-	181.00	18.10	55.25	15.52	2.54	1.75	51.34	4.[illegible]	23.1100	-	-	7.50	6.60	36.4640	6.85	37.8450	2.5924	-	-	-	
17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
18	Straight	-	-	190.75	19.08	52.42	12.31	2.29	1.74	48.95	3.73	19.5290	-	-	7.50	6.75	35.3870	7.[illegible]	38.3690	2.7936	-	-	-	
19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
20	Straight	-	-	164.33	16.43	60.85	11.25	2.84	1.68	53.69	3.28	19.9780	-	-	6.00	5.10	31.0250	7.42	45.1350	3.3477	-	-	-	
21	Half circular	-	-	162.75	16.28	61.44	15.19	2.60	1.56	61.67	3.48	21.3620	-	-	8.63	7.65	47.0000	6.89	42.3230	2.9152	-	-	-	
22	Half circular	-	-	289.33	28.93	34.56	16.67	3.02	1.86	93.73	6.97	17.1670	-	-	9.67	8.78	30.3560	11.87	41.0150	4.8672	-	-	-	
23	Straight	-	-	136.88	13.69	73.06	12.25	2.12	1.59	41.22	3.11	22.7430	-	-	7.25	5.01	36.6230	5.18	37.8070	1.9565	-	-	-	
24	Half circular	-	-	127.80	12.78	72.57	12.80	2.62	1.62	54.12	2.92	21.1900	-	-	5.60	5.30	38.4620	5.34	38.7520	2.0694	-	-	-	
25	Straight	-	-	273.80	27.38	36.52	16.00	2.68	1.68	72.01	5.00	18.2620	-	-	9.83	8.22	29.8110	11.12	40.6030	4.5138	-	-	-	
26	Half circular	-	-	157.33	15.73	63.56	12.58	2.32	1.54	47.92	3.65	23.1990	-	-	7.50	5.58	35.4860	5.96	37.1450	1.8276	-	-	-	
27	Straight	-	-	185.57	18.56	53.89	15.07	2.56	1.53	58.97	3.83	20.5340	-	-	7.43	6.22	33.5670	8.46	45.5730	3.8541	-	-	-	
28	Half circular	-	-	157.57	15.76	63.46	12.00	2.44	1.65	48.45	3.14	19.9470	-	-	6.62	5.58	35.4320	6.47	41.0420	2.6542	-	-	-	
29	Straight	-	-	217.50	21.75	45.98	15.32	2.50	1.66	63.62	5.02	23.0670	-	-	8.00	7.13	32.7950	8.57	39.2890	3.2745	-	-	-	
30	Straight	-	-	105.50	10.55	94.79	8.83	2.59	1.95	42.21	2.27	22.4360	-	-	3.17	3.22	30.4930	4.85	45.9720	2.2296	-	-	-	
31	Half circular	-	-	195.75	19.58	51.09	12.56	2.56	1.72	55.28	4.41	22.5140	-	-	7.25	5.94	30.3350	8.16	41.7010	3.4041	-	-	-	
32	Half circular	-	-	148.38	14.84	67.39	12.63	2.53	1.64	52.42	3.34	22.1960	-	-	7.13	5.43	36.5620	5.91	39.8500	2.3563	-	-	-	
33	Straight	-	-	198.57	19.86	50.36	14.06	2.74	1.65	63.21	3.69	18.5630	-	-	8.14	6.26	31.5100	9.11	45.8980	4.1821	-	-	-	
34	Half circular	-	-	189.38	18.94	52.80	12.63	2.65	1.75	58.54	5.42	28.6460	-	-	6.75	6.10	32.2100	6.20	32.7380	2.0298	-	-	-	
35	Half circular	-	-	154.00	15.40	54.94	13.50	2.35	1.50	47.53	3.67	23.8120	-	-	8.83	6.62	42.9680	6.23	40.4000	2.5121	-	-	-	
36	Straight	-	-	208.63	20.86	47.93	13.91	2.55	2.10	69.90	4.04	19.3550	-	-	6.63	6.36	30.4990	7.99	38.2880	3.0584	-	-	-	
37	Half circular	-	-	175.57	17.56	56.96	15.33	2.02	1.47	47.21	3.53	20.4250	-	-	9.29	6.34	36.1280	6.43	36.6160	2.3542	-	-	-	
38	Straight	-	-	106.57	10.66	93.84	10.07	2.22	1.56	35.02	1.90	17.8290	-	-	5.00	3.76	35.2540	3.79	35.5360	1.3450	-	-	-	
39	Half circular	-	-	205.00	20.50	48.78	16.33	2.35	1.74	66.57	2.87	13.9850	-	-	10.67	6.47	32.5220	9.77	47.6440	4.6534	-	-	-	
40	Straight	-	-	149.71	14.97	66.80	11.36	2.23	1.70	43.21	3.46	23.0910	-	-	7.43	5.20	34.7340	5.84	39.0290	2.2205	-	-	-	
41	Half circular	-	-	124.33	12.43	80.43	11.64	2.08	1.51	36.40	3.07	24.7000	-	-	6.57	6.23	33.2100	4.57	24.7650	1.6805	-	-	-	
42	Half circular	-	-	297.00	29.70	33.67	21.33	2.78	1.75	103.79	6.43	21.6590	-	-	9.00	8.67	29.1820	13.03	43.8820	5.7191	-	-	-	
43	Half circular	-	-	189.42	18.94	55.42	13.79	2.56	1.62	56.99	3.29	18.7660	-	-	6.86	6.19	34.2850	7.19	39.8270	2.8620	-	-	-	
44	Straight	-	-	141.23	14.12	70.76	12.75	2.06	1.57	41.16	2.90	20.2190	-	-	7.00	5.22	36.9140	5.22	36.9140	1.9258	-	-	-	
45	Half circular	-	-	249.80	24.98	40.03	16.83	2.87	1.75	84.25	5.26	21.0570	-	-	8.20	7.80	31.2250	9.32	37.3090	3.4772	-	-	-	
46	Half circular	-	-	209.29	20.93	47.78	13.25	2.79	1.89	70.12	4.13	19.7290	-	-	6.71	6.67	31.8740	9.00	42.0020	3.8703	-	-	-	
47	Half circular	-	-	173.63	17.36	57.59	12.53	2.47	1.66	54.42	3.43	19.7260	-	-	7.63	6.60	38.0120	6.74	38.8070	2.6149	-	-	-	
48	Straight	-	-	226.75	22.68	44.10	16.38	2.81	1.72	73.51	5.16	22.7690	-	-	7.50	7.54	33.2440	8.79	38.7360	3.4959	-	-	-	
49	Half circular	-	-	188.29	18.83	53.11	12.79	2.70	1.72	63.74	3.23	17.2220	-	-	7.57	5.56	29.5130	8.90	42.4380	3.7995	-	-	-	
50	Half circular	-	-	228.50	22.85	43.76	14.25	2.92	1.85	77.01	4.76	20.8450	-	-	6.25	6.15	26.9150	3.84	42.0550	4.2258	-	-	-	
51	Straight	-	-	151.63	15.16	65.95	12.34	2.15	1.52	41.67	2.89	19.0460	-	-	8.88	5.01	33.0610	5.34	35.2040	1.8792	-	-	-	
52	Half circular	-	-	161.20	16.12	62.03	13.70	2.31	1.58	50.08	3.50	21.7150	-	-	7.60	5.34	33.1270	6.34	39.4690	2.5631	-	-	-	
53	Half circular	-	-	130.50	13.05	76.63	10.81	2.23	1.52	36.62	2.40	18.0540	-	-	7.50	-	-	6.00	45.9770	2.7586	-	-	-	
54	Straight	-	-	125.88	12.09	82.73	11.87	2.30	1.59	[illegible]	[illegible]	[illegible]	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	-	-	

27

[illegible]	Half circular	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
53	Half circular	-	-	130.50	13.05	76.63	10.81	2.23	1.52	36.62	3.40	26.0540	-	-	7.50	-	-	6.00	45.9770	2.7586	-	-	-	
54	Straight	-	-	120.88	12.09	82.73	11.81	2.30	1.58	43.07	2.50	20.6820	-	-	5.00	5.16	42.7120	4.50	37.2270	1.6752	-	-	-	
55	Straight	-	-	65.00	6.50	153.85	6.43	2.19	1.61	22.66	1.53	23.5230	-	-	2.57	1.90	29.2310	2.27	49.4460	0.9177	-	-	-	
56	Straight	-	-	169.71	16.97	58.92	15.36	2.48	1.53	58.10	4.00	23.5630	-	-	7.71	4.00	23.5690	8.11	47.8110	3.8794	-	-	-	
57	Straight	-	-	170.75	17.08	58.57	14.06	2.40	1.67	56.49	3.62	21.2001	-	-	7.60	3.76	22.0200	6.36	37.2470	2.3689	-	-	-	
58	Half circular	-	-	132.25	13.23	75.61	12.25	2.43	1.48	44.04	2.18	16.4460	-	-	8.50	5.68	42.9110	4.60	34.7830	1.6000	-	-	-	
59	Half circular	-	-	229.86	22.99	43.50	17.57	2.79	1.73	84.67	5.07	22.0610	-	-	9.71	7.40	32.1940	11.90	51.7710	6.1607	-	-	-	
60	Straight	-	-	278.28	27.84	35.92	17.68	2.75	1.47	71.78	4.83	17.3320	-	-	10.13	9.80	35.2040	10.59	38.0340	4.0270	-	-	-	
61	Straight	-	-	206.14	20.61	48.51	14.14	2.79	1.78	70.09	4.18	20.2770	-	-	6.45	4.10	19.8890	7.76	37.6440	2.9212	-	-	-	
62	Straight	-	-	78.00	7.80	128.21	8.50	2.06	1.63	28.61	1.71	21.9740	-	-	3.57	2.64	33.8650	2.76	35.3460	0.9745	-	-	-	
63	Half circular	-	-	211.00	21.10	47.39	14.38	2.81	1.62	65.37	4.08	19.3130	-	-	8.13	6.64	31.4590	9.25	43.8390	4.0551	-	-	-	
64	Half circular	-	-	134.86	13.49	74.15	13.93	2.45	1.65	56.22	-	-	-	-	-	-	-	-	-	-	-	-	-	
65	Straight	-	-	111.13	11.11	89.98	10.88	2.15	1.53	35.73	2.83	25.4210	-	-	5.50	3.18	28.5700	4.63	41.6180	1.9248	-	-	-	
66	Half circular	-	-	198.25	19.83	50.44	15.88	2.65	1.53	64.18	3.58	18.0330	-	-	5.00	6.63	33.4170	8.85	44.6410	3.9507	-	-	-	
67	Straight	-	-	145.17	14.52	68.88	12.25	2.29	1.71	47.80	2.77	19.0600	-	-	6.67	5.53	38.1140	5.62	38.6930	2.1734	-	-	-	
68	Half circular	-	-	136.00	13.60	72.53	12.86	2.34	1.56	46.84	2.79	20.4850	-	-	6.43	4.50	32.8240	5.40	39.7060	2.1441	-	-	-	
69	Half circular	-	-	117.14	11.71	85.37	10.86	2.29	1.66	41.06	2.54	21.7090	-	-	4.71	4.06	34.6340	4.51	38.5350	1.7395	-	-	-	
70	Half circular	-	-	147.29	14.73	67.89	14.29	3.21	1.66	52.45	2.62	17.8490	-	-	7.00	4.83	32.7860	6.14	41.7070	2.5621	-	-	-	

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100

**Volume = Length x Width x Thickness

CHAIYAPHUM (41 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave. Wt. of pods (gm)	No. of pod/kg.	Pod Dimension: Length (cm)	Width (cm)	Thickness (cm)	Volume** (cm³)	Character of pod: Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	%Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Slightly curved	Brown	Fine	130.60	13.06	76.57	9.43	2.59	1.89	36.93	2.47	18.9130	0.77	5.8960	52.00	3.00	22.2710	6.52	50.6890	3.3556	Brown	Brown	Loose	
2	Slightly curved	Light brown	Coarse	149.90	14.99	66.71	12.50	2.33	1.75	12.33	3.52	23.4820	1.41	9.4060	64.00	4.27	28.4860	5.18	34.5560	1.7900	Brown	Brown	Loose	
3	Slightly curved	Brown	Coarse	116.70	11.67	85.69	10.10	2.75	1.74	19.67	2.91	24.9360	0.77	6.5980	42.00	2.54	21.7650	4.96	42.5020	2.1081	Brown	Brown	Loose	
4	Slightly curved	Light brown	Fine	98.30	9.83	101.73	9.21	2.37	1.76	14.00	2.55	25.9410	0.[illegible]7	5.7960	32.00	[illegible].92	19.5320	4.19	42.6250	1.7960	Brown	Brown	Loose	
5	Slightly curved	Brown	Coarse	167.40	16.74	59.74	14.30	2.43	1.71	28.00	4.01	23.9550	1.11	6.6310	64.00	4.22	25.2090	6.53	39.0080	2.5472	Dark brown	Dark brown	Loose	
6	Slightly curved	Brown	Coarse	120.00	12.00	83.33	10.08	2.60	1.76	22.00	3.46	28.8330	0.56	4.6670	40.00	3.28	27.3330	4.29	36.5830	1.6060	Brown	Brown	Loose	
7	Slightly curved	Brown	Fine	138.90	13.89	71.99	11.00	2.41	1.78	23.33	3.34	24.0460	0.26	1.8720	56.00	3.67	26.4220	6.26	45.0680	2.8213	Brown	Brown	Loose	
8	Slightly curved	Brown	Fine	138.30	13.83	72.31	11.10	2.74	1.83	18.00	3.86	27.9100	0.59	4.2560	39.00	2.62	18.9440	6.63	47.9390	3.1784	Dark brown	Dark brown	Loose	
9	Slightly curved	Brown	Coarse	146.20	14.62	68.40	12.50	2.45	1.71	18.00	3.03	20.7250	0.45	2.0780	61.00	4.73	32.3530	5.81	39.7400	2.3089	Brown	Brown	Loose	
10	Slightly curved	Brown	Coarse	231.10	23.11	43.27	14.45	2.78	1.91	22.67	4.98	21.5490	1.43	6.1880	85.00	7.06	30.5490	8.57	37.0840	3.1781	Dark brown	Dark brown	Tight	
11	Slightly curved	Brown	Coarse	150.90	15.09	66.27	11.60	2.52	1.83	19.67	3.72	24.6650	0.50	3.3130	66.00	4.43	29.2570	5.74	38.0650	2.1865	Dark brown	Dark brown	Loose	
12	Slightly curved	Brown	Coarse	132.30	13.23	75.59	11.50	2.47	1.95	12.00	3.47	26.2060	0.82	6.2130	59.00	2.49	18.9210	5.[illegible]	[illegible]	2.3890	Brown	Brown	Loose	
13	Slightly curved	Brown	Coarse	84.90	8.49	117.79	7.33	2.12	1.61	10.00	1.88	22.1449	0.38	4.4760	42.00	2.56	26.6190	3.[illegible]	[illegible]	[illegible].1539	Brown	Brown	Loose	
14	-	-	-	265.40	26.54	37.68	16.00	2.81	1.72	23.00	5.62	21.1760	1.44	5.4260	93.00	6.07	22.8710	12.[illegible]	[illegible]	[illegible]	Brown	Brown	Loose	
15	Slightly curved	Brown	Coarse	152.40	15.24	65.62	13.65	2.50	1.60	17.00	3.69	24.2130	0.94	6.1680	68.00	3.30	21.6540	7.04	[illegible]	[illegible].2521	Brown	Brown	Tight	
16	Half circular	Brown	Coarse	259.30	25.93	38.57	17.65	3.26	1.95	30.33	5.58	21.5190	2.58	10.3360	91.00	6.42	26.3400	10.59	40.8410	4.2251	Brown	Brown	Loose	
17	Slightly curved	Brown	Fine	139.10	13.[illegible]	[illegible]	11.05	2.54	1.72	13.67	3.33	23.9290	1.03	7.4050	64.00	3.49	25.0890	5.67	40.7620	2.3112	Dark brown	Dark brown	Loose	
18	Slightly curved	Light brown	Coarse	263.40	26.34	37.12	15.15	3.54	1.87	24.63	6.23	23.1250	2.66	9.8740	66.00	7.54	28.3590	10.00	37.1190	3.7119	Dark brown	Dark brown	Loose	
19	Slightly curved	Brown	Coarse	257.00	25.70	38.91	16.95	3.13	2.14	36.33	5.70	22.1790	2.33	9.0660	67.00	6.82	26.5370	10.36	49.2110	4.1762	Brown	Brown	Tight	
20	Slightly curved	Brown	Fine	179.60	17.96	55.68	12.60	2.98	1.76	22.33	4.53	25.2220	0.98	5.4570	55.00	5.79	32.2380	8.82	49.1650	4.3413	Dark brown	Dark Loose	Loose	
21	Slightly curved	Brown	Fine	227.40	22.74	43.98	14.55	2.85	1.64	21.00	5.06	22.2520	1.27	5.5850	84.00	7.65	33.2450	9.11	40.0620	3.6496	Brown	Brown	Loose	
22	Slightly curved	Brown	Fine	178.10	17.81	56.12	13.15	2.67	1.76	14.00	4.41	24.7610	0.89	4.3970	54.00	3.87	21.7290	8.34	46.9280	3.9055	Brown	Brown	Tight	
23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
24	Slightly curved	Brown	Coarse	187.10	19.71	50.74	12.65	3.02	1.92	19.67	5.20	25.3820	1.24	6.2910	64.00	5.44	27.6000	7.62	38.6610	2.9460	Brown	Brown	Loose	
25	Slightly curved	Brown	Fine	157.20	15.72	63.61	10.90	2.77	1.60	13.33	3.81	24.0270	0.90	5.7250	48.00	3.32	21.1190	6.31	40.1356	2.5328	Brown	Brown	Loose	
26	Slightly curved	Dark brown	Fine	110.80	11.08	90.25	9.67	2.08	1.51	10.33	2.17	18.5850	0.27	3.3290	63.00	3.76	33.9250	4.22	38.1770	1.6149	Brown	Brown	Loose	
27	Slightly curved	Light brown	Coarse	153.60	15.36	65.13	11.75	2.46	1.65	15.00	3.60	23.4380	0.63	4.1020	72.00	4.91	31.9660	5.99	38.9970	2.3359	Brown	Brown	Loose	
28	Slightly curved	Brown	Coarse	1[illegible].70	16.97	58.93	13.50	2.70	1.62	9.33	2.79	22.2[illegible]50	1.05	6.1870	66.00	4.72	27.8140	7.16	42.1920	3.0209	Brown	Brown	Loose	
29	Slightly curved	Brown	Coarse	91.70	5.17	109.05	67.55	2.23	1.66	5.33	2.62	29.2710	0.42	4.5800	67.00	2.75	29.9890	3.36	36.6410	1.2311	Brown	Brown	Loose	
30	Slightly curved	Brown	Coarse	162.70	16.27	61.46	12.30	2.32	1.78	11.00	3.39	24.5240	1.26	7.7449	74.00	5.02	30.8540	6.22	38.2910	2.3855	Brown	Brown	Loose	
31	Slightly curved	Brown	Fine	162.70	16.27	61.46	12.95	2.87	1.74	9.67	3.90	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
32	Slightly curved	Brown	Coarse	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

36	Slightly curved	Brown	Fine	126.79	12.67	78.92	10.35	2.44	1.74	11.33	2.87	22.6520	0.47	3.7090	62.00	3.17	25.0190	5.80	45.7770	2.6551	Brown	Brown	Loose
37	Slightly curved	Brown	Fine	139.40	13.94	71.74	8.60	2.71	1.86	5.33	3.61	25.8970	0.99	7.1020	59.00	3.67	26.3270	4.39	31.4920	1.3825	Brown	Brown	Loose
38	Slightly curved	Brown	Fine	116.10	11.61	86.13	11.35	2.24	1.41	8.67	2.76	23.7730	0.27	2.3260	68.00	3.57	30.7490	4.47	38.5010	1.7210	Brown	Light brown	Loose
39	Slightly curved	Brown	Fine	123.30	12.33	81.10	10.10	2.36	1.64	10.67	2.52	20.4280	0.42	3.4060	47.00	2.65	21.4920	5.96	4.8340	0.2881	Brown	Brown	Loose
40	Circular	Brown	Coarse	98.10	9.81	101.94	9.15	2.02	1.75	4.67	2.29	24.3630	0.47	4.7910	59.00	3.09	31.4980	3.52	35.9820	1.2630	Brown	Brown	Loose
41	Slightly curved	Brown	Fine	126.30	12.63	79.80	9.30	2.76	1.74	10.22	2.74	21.5920	0.47	3.7040	39.00	3.26	25.6890	5.65	44.5230	2.5155	Brown	Brown	Loose

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
*Volume = Water replacement

LOBI (96 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness (cm)	Volume* (cc)	Character of pod Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	%Pulp Wt.	Real Value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Slightly curved	Dark brown	Medium	125.90	12.59	79.42	9.35	2.22	1.58	13.67	3.28	26.0520	0.34	2.7000	60.00	4.69	37.2500	3.65	28.9910	1.0682	Brown	Brown	Loose	
2	Slightly curved	Light brown	Medium	107.50	10.75	93.02	8.20	2.31	1.52	16.67	2.13	18.8140	0.37	3.4420	51.00	2.89	26.8840	3.54	33.8600	1.2325	Brown	Brown	Loose	
3	Slightly curved	Light brown	Medium	112.80	11.28	88.65	9.85	2.08	1.26	11.67	1.98	17.5530	0.27	2.3940	61.00	4.24	37.5896	3.92	34.7520	1.3623	Brown	Brown	Loose	
4	Slightly curved	Light brown	Medium	238.20	23.82	41.98	17.40	2.67	1.69	25.33	4.76	19.9930	0.66	2.7710	73.00	8.12	34.0890	8.22	34.5090	2.8366	Brown	Brown	Loose	
5	Slightly curved	Light brown	Medium	212.70	21.27	47.01	12.65	2.82	1.80	25.33	3.97	18.6650	0.96	4.5140	50.00	4.93	23.1780	10.13	47.6260	4.8245	Brown	Brown	Loose	
6	Slightly curved	Light brown	Medium	125.10	12.51	79.94	10.30	2.15	1.51	13.00	2.47	19.7440	0.37	2.9560	55.00	3.87	30.9350	4.29	34.2930	1.4712	Brown	Brown	Loose	
7	Slightly curved	Light brown	Medium	200.70	20.07	49.83	15.35	2.32	1.60	23.67	4.17	20.7770	0.72	3.5870	82.00	6.04	30.0950	8.09	40.3090	3.2610	Brown	Brown	Loose	
8	Slightly curved	Light brown	Medium	111.90	11.19	89.37	9.45	2.22	1.48	14.33	2.49	22.2520	0.22	1.9660	43.00	3.18	28.4180	4.27	38.1590	1.6254	Brown	Brown	Loose	
9	Slightly curved	Light brown	Fine	150.70	15.07	66.36	14.55	2.19	1.22	15.33	2.69	17.8560	0.70	4.6450	83.00	4.18	27.7270	6.70	44.4590	2.9788	Brown	Brown	Loose	
10	Slightly curved	Light brown	Fine	107.50	10.75	93.02	12.35	2.16	1.26	8.00	2.09	19.4420	0.20	1.8600	62.00	4.40	40.9300	3.15	29.3020	0.9230	Dark brown	Dark brown	Loose	
11	Slightly curved	Light brown	Medium	156.90	15.69	63.40	11.50	2.92	1.49	25.33	5.29	25.2960	0.58	2.7900	70.00	5.06	24.2160	7.06	33.8130	2.3529	Brown	Brown	Loose	
12	Slightly curved	Light brown	Fine	100.00	10.00	100.00	11.10	2.10	1.67	11.33	2.85	18.6290	0.10	4.8000	63.00	5.80	23.0440	5.92	28.7180	2.2921	Dark brown	Dark brown	Loose	
13	Slightly curved	Dark brown	Fine	160.40	16.04	62.34	11.90	2.14	1.32	7.00	2.17	14.1920	0.26	1.7000	68.00	3.75	24.5260	3.04	19.5820	0.6044	Brown	Brown	Loose	
14	Slightly curved	Light brown	Fine	99.10	9.94	100.60	10.25	2.73	1.72	10.00	2.31	20.6260	0.51	3.1790	65.00	5.45	33.9870	5.87	36.5960	2.1482	Brown	Brown	Loose	
15	Slightly curved	Dark brown	Fine	120.70	12.07	75.51	11.80	1.91	1.46	8.00	1.61	16.1570	0.27	2.7160	69.00	3.71	37.3240	3.45	34.7080	1.1974	Brown	Brown	Loose	
16	Slightly curved	Dark brown	Coarse	82.10	8.21	121.80	8.55	2.49	1.21	2.00	2.17	16.6230	0.22	2.5250	61.00	3.38	25.8610	5.30	40.5510	2.1492	Dark brown	Dark brown	Loose	
17	Slightly curved	Dark brown	Coarse	245.60	24.56	40.72	14.55	1.77	1.47	6.67	1.62	19.8540	0.51	1.8270	58.00	3.24	39.4640	2.27	27.6490	0.5276	Brown	Brown	Loose	
18	Slightly curved	Dark brown	Medium	227.60	22.76	43.94	12.75	2.73	1.84	27.67	4.86	19.7880	0.65	2.6470	50.00	5.62	22.8830	10.43	42.4670	4.4293	Brown	Brown	Loose	
19	Slightly curved	Dark brown		133.30	13.33	75.02	12.15	2.65	1.60	18.67	3.01	13.2250	0.75	3.4710	70.00	6.92	30.4000	10.90	47.8910	5.2201	Dark brown	Dark brown	Tight	
20	Slightly curved	Dark brown	Fine	169.50	16.95	59.00	13.00	2.41	1.42	9.67	2.06	15.4540	0.46	3.4510	58.00	3.62	27.1570	6.02	45.1610	2.7187	Dark brown	Dark brown	Loose	
21	Slightly curved	Light brown	Coarse	166.[illegible]	16.65	60.06	9.30	2.29	1.52	8.00	2.53	14.9260	0.76	4.4840	72.00	6.02	35.5160	7.41	43.7170	3.2354	Brown	Brown	Loose	
22	Slightly curved	Light brown	Medium	190.00	19.00	52.63	14.35	2.84	1.93	19.33	3.62	21.7420	0.84	5.0500	51.00	4.03	24.2000	7.70	46.2460	3.5609	Dark brown	Dark brown	Loose	
23	Slightly curved	Dark brown	Medium	162.80	16.28	61.05	10.25	2.43	1.56	11.67	2.57	12.5260	0.81	4.3630	78.00	7.20	38.4210	7.73	40.5800	3.1446	Dark brown	Dark brown	Loose	
24	Slightly curved	Dark brown	Medium	145.90	14.59	68.54	9.90	2.44	1.50	10.33	2.48	15.1400	0.76	4.6400	64.00	4.93	30.0980	5.80	35.4100	2.0528	Brown	Brown	Loose	
25	Slightly curved	Dark brown	Medium	132.50	13.25	75.47	10.11	2.52	1.50	4.33	3.39	20.4930	0.57	3.9100	56.90	4.74	32.6880	6.69	45.8530	3.0676	Brown	Brown	Loose	
26	Slightly curved	Dark brown	Medium	122.30	12.23	81.77	10.00	2.26	1.57	10.00	2.49	18.7950	0.67	5.0300	52.00	3.65	27.5470	5.78	43.6200	2.5212	Brown	Brown	Loose	
27	Slightly curved	Dark brown	Coarse	227.50	22.75	43.96	14.60	2.56	1.54	6.33	2.36	19.1250	0.37	29.9840	46.00	2.71	21.9610	4.52	36.6290	1.6556	Dark brown	Dark brown	Loose	
28	Slightly curved	Light brown	Medium	93.70	9.37	106.72	8.95	2.28	1.94	38.33	5.31	22.3450	1.21	5.3210	53.00	5.02	22.0660	10.80	47.4730	5.1271	Dark brown	Dark brown	Tight	
29	Slightly curved	Dark brown	Medium	147.90	14.79	67.61	12.45	2.16	1.48	8.67	1.86	19.8500	0.27	2.9500	39.00	2.45	26.1470	3.91	41.7290	1.6315	Brown	Brown	Tight	
30	Slightly curved	Dark brown	Fine	73.70	7.37	135.69	7.50	1.88	1.50	15.33	2.75	18.3700	0.58	2.8700	72.00	5.52	36.8740	5.48	36.6100	2.0062	Brown	Brown	Loose	
31	Slightly curved	Light brown	Medium	159.90	15.99	62.54	10.80	1.41	1.41	6.67	1.72	23.2250	0.29	5.2900	37.00	1.66	22.5200	2.79	37.8600	1.0563	Brown	Brown	Loose	
32	Slightly curved	Light brown	Medium	173.50	17.35	57.64	12.30	0.35	1.83	17.67	3.06	19.1400	0.85	5.2300	50.00	4.43	27.7000	6.85	42.8400	2.9245	Dark brown	Dark brown	Loose	
33	Slightly curved	Dark brown	Medium	124.60	12.46	80.25	12.35	2.69	1.56	14.67	2.31	15.0900	0.79	4.5500	68.00	5.47	31.5100	7.15	41.2100	2.9465	Dark brown	Dark brown	Loose	
34	Half circular	Light brown	Medium					2.17	1.41	12.00	3.24	26.0000	0.56	4.4900	75.00	3.66	29.3700	4.56	36.1160	1.6252	Brown	Brown	Loose	
35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
36	Slightly curved	Light brown	Medium	128.70	12.87	77.70	10.45	2.25	1.40	9.33	2.21	17.1720	0.53	4.1180	57.00	4.59	35.6600	5.49	42.6600	2.3420	Dark brown	Dark brown	Loose	
37	Slightly curved	Light brown	Medium	133.50	13.35	51.68	12.65	2.72	1.55	23.67	4.22	21.7500	1.50	7.7500	62.00	6.27	32.9200	7.57	39.1200	2.9614	Dark brown	Dark brown	Loose	
38	Slightly curved	Dark brown	Medium	83.60	8.36	119.62	8.75	2.16	1.44	6.67	1.86	22.2500	0.42	5.0200	43.00	3.04	36.3600	2.87	33.6100	0.9444	Dark brown	Dark brown	Loose	
39	Slightly curved	Dark brown	Fine	190.90	19.09	52.38	13.20	2.86	1.95	30.33	4.06	21.2700	0.71	3.7200	46.00	4.25	22.4700	7.64	40.0200	3.0575	Dark brown	Dark brown	Loose	
40	Slightly curved	Light brown	Coarse	137.00	13.70	72.99	9.30	2.18	1.62	20.67	2.20	16.0600	0.51	3.7200	52.00	4.65	33.9400	5.68	41.4600	2.3549	Dark brown	Dark brown	Loose	
41	Slightly curved	Light brown	Medium	112.90	11.29	88.65	10.85	2.24	1.45	12.67	2.20	19.5000	0.59	5.2300	62.00	3.39	30.0500	4.82	42.8200	2.0682	Brown	Brown	Loose	
42	Slightly curved	Light brown	Coarse	196.00	19.60	51.02	14.85	2.92	1.95	21.33	4.86	24.7900	1.42	7.2400	45.00	3.91	19.9500	8.07	41.1700	3.2224	-	-	-	
43	Slightly curved	Dark brown	Medium	141.20	14.12	70.82	10.75	2.35	1.60	16.33	2.50	17.7050	0.56	3.9700	65.00	4.97	35.1940	6.16	43.7620	2.7045	Dark brown	Dark brown	Loose	
44	Slightly curved	Light brown	Medium	123.90	12.39	80.71	12.40	2.18	1.49	17.67	2.90	23.4060	0.44	3.55[illegible]	65.00	3.84	24.9600	5.71	46.0000	2.6317	Brown	Brown	Loose	
45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
46	Slightly curved	Light brown	Medium	109.80	10.98	91.07	9.10	[illegible]	[illegible]	[illegible]														
47	Slightly curved	[illegible]																						

29

48	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
49	Slightly curved	Dark brown	Coarse	194.30	19.43	51.47	13.35	2.41	1.78	14.00	4.36	22.4400	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
50	Slightly curved	Dark brown	Medium	147.60	14.76	67.75	11.40	2.29	1.48	10.67	2.89	19.5730	0.55	3.2750	65.00	4.39	29.7430	5.92	40.1000	2.3739	Dark brown	Dark brown	Loose
51	Half circular	Dark brown	Fine	274.50	27.45	36.43	20.05	2.64	1.44	54.33	4.94	17.9960	0.98	3.5700	113.00	8.28	30.1600	12.29	44.7700	5.5022	Dark brown	Dark brown	Loose
52	Slightly curved	Dark brown	Medium	159.40	15.94	62.74	14.20	2.49	1.62	25.00	3.64	22.8400	0.63	3.9520	72.00	4.11	25.7800	6.68	41.9100	2.7996	Dark brown	Dark brown	Loose
53	Slightly curved	Dark brown	Medium	250.90	25.09	39.86	15.65	3.00	1.79	42.00	5.17	20.6100	1.55	6.1770	71.00	5.76	22.9600	11.59	46.1900	5.3534	Brown	Brown	Loose
54	Slightly curved	Dark brown	Medium	271.40	27.14	36.85	15.50	3.15	1.36	33.00	6.10	22.4760	1.45	5.3430	96.00	7.31	26.9300	11.16	41.1120	4.5881	Dark brown	Dark brown	Tight
55	Slightly curved	Dark brown	Fine	148.70	14.87	67.25	10.90	2.53	1.77	21.66	3.07	20.6460	0.94	6.3200	52.00	3.67	24.6800	6.99	47.0000	3.2853	Dark brown	Dark brown	Tight
56	Slightly curved	Light brown	Medium	168.10	16.81	59.49	12.35	2.27	1.50	22.67	3.32	19.7500	0.70	4.1600	74.00	4.96	29.5100	6.85	40.7500	2.7914	Dark brown	Dark brown	Tight
57	Slightly curved	Dark brown	Coarse	256.30	25.63	39.02	15.80	3.03	1.77	37.00	5.25	20.4800	1.66	6.4760	92.00	7.29	28.4400	10.58	41.2800	4.3674	Brown	Brown	Tight
58	Slightly curved	Dark brown	Fine	195.50	19.55	51.15	13.80	2.55	1.58	24.00	4.02	20.5600	0.78	3.9800	59.00	8.10	41.4300	6.35	32.4800	2.0625	Dark brown	Dark brown	Tight
59	Slightly curved	-	-	129.10	12.91	77.46	13.60	2.10	1.44	12.33	3.27	25.3300	0.49	3.7900	73.00	3.66	28.3590	5.03	38.9600	1.9597	Dark brown	Dark brown	Tight
60	Half circular	Dark brown	Coarse	122.20	12.22	81.83	12.90	2.24	1.41	11.00	2.51	20.7200	0.61	4.9900	59.00	2.58	21.1130	4.81	39.3600	1.8932	Brown	Brown	Loose
61	Slightly curved	Dark brown	Fine	134.30	13.43	74.46	10.85	2.40	1.67	18.33	2.35	17.4990	0.47	3.4900	64.00	4.45	33.1300	5.64	41.5900	2.3682	Dark brown	Dark brown	Loose
62	Slightly curved	Dark brown	Fine	120.40	12.04	83.06	11.80	2.38	1.37	9.33	2.43	20.1830	0.53	4.4000	52.00	3.47	28.8200	4.76	39.5300	1.8816	Brown	Brown	Tight
63	Half circular	Dark brown	Medium	342.20	34.22	29.22	23.39	2.50	1.73	45.33	6.71	19.6100	2.63	7.6900	98.00	8.71	25.4500	16.35	47.7800	7.8120	Brown	Brown	Tight
64	Slightly curved	Light brown	Medium	154.70	15.47	64.64	13.35	2.46	1.49	11.33	3.90	25.2100	0.53	3.4260	81.00	4.00	25.8600	5.71	36.9100	2.1076	Brown	Brown	Loose
65	Slightly curved	Dark brown	Medium	124.20	12.42	80.52	11.25	2.45	1.36	8.33	2.14	17.2300	0.30	2.4200	63.90	4.40	35.4300	4.61	37.1200	1.7112	Brown	Brown	Loose
66	Half circular	Light brown	-	298.30	29.83	33.46	20.65	2.98	1.67	37.06	5.64	18.8700	2.52	8.4300	120.00	7.67	25.6600	12.67	42.3900	5.3708	Brown	Brown	Tight
67	Slightly curved	Light brown	Coarse	134.60	13.46	74.29	12.53	2.37	1.84	12.00	3.18	23.6300	0.53	3.9400	70.00	4.16	30.9100	5.48	40.7100	2.2305	Brown	Brown	Tight
68	Slightly curved	Dark brown	Coarse	114.20	11.42	87.57	9.66	2.39	1.52	9.33	2.87	25.1300	0.83	7.2700	50.00	2.55	22.3300	5.05	44.2200	2.2331	Brown	Brown	Loose
69	Half circular	Light brown	Coarse	262.60	26.26	38.08	6.55	2.81	1.90	33.00	5.55	21.1300	1.87	7.1200	76.00	6.74	25.6700	12.47	47.4900	5.9220	Dark brown	Dark brown	Loose
70	Slightly curved	Dark brown	Fine	210.40	21.04	47.53	14.68	2.49	1.80	18.67	3.32	18.6300	0.72	3.4200	90.00	6.11	29.0400	6.91	32.8400	2.2692	Brown	Brown	Loose
71	Slightly curved	Dark brown	Fine	139.20	13.92	71.84	10.85	2.50	1.70	21.67	2.74	19.6800	0.68	4.8900	49.00	3.18	22.8400	6.92	49.7200	3.4406	-	-	-
72	Slightly curved	Light brown	Coarse	166.40	16.64	60.10	12.28	2.90	1.62	[illegible]	4.06	24.2900	0.84	5.0500	70.00	4.67	28.0600	7.13	42.8500	3.0552	Brown	Brown	Loose
73	Half circular	Dark brown	Medium	142.20	14.22	70.32	10.35	2.54	[illegible]	7.20	3.88	27.2900	1.08	7.5900	47.00	3.48	24.4700	6.81	47.8900	3.2613	Brown	Brown	Loose
74	Half circular	Dark brown	Coarse	213.80	21.38	46.77	14.44	2.80	1.61	25.67	4.69	21.9400	1.42	6.6400	80.00	5.67	26.5200	8.78	41.0700	3.6059	Brown	Brown	Loose
75	Slightly curved	Dark brown	Medium	105.70	10.57	94.61	10.40	2.28	1.67	16.00	2.05	19.3950	0.49	4.6400	56.00	2.45	23.1800	5.19	49.1000	2.5483	Dark brown	Dark brown	Loose
76	Slightly curved	Dark brown	Medium	95.90	9.59	104.28	8.95	2.26	1.69	11.33	1.97	20.5400	0.46	4.7900	45.00	1.78	18.5600	4.82	50.2600	2.4225	Dark brown	Dark brown	Loose
77	Half circular	Light brown	Coarse	206.50	20.65	48.43	[illegible]	2.55	1.80	21.67	4.63	22.4200	1.08	5.2300	81.00	4.97	24.0700	8.77	42.4700	3.7246	Dark brown	-	-
78	Slightly curved	Dark brown	Coarse	88.30	8.83	[illegible]	7.88	2.25	1.63	10.67	2.30	26.0500	0.38	4.3000	39.00	2.08	23.5600	3.63	41.1000	1.4919	Brown	Brown	Loose
79	Half circular	Light brown	Medium	240.20	24.02	41.63	16.60	2.96	1.82	35.67	5.28	21.9800	1.25	5.2060	77.00	4.86	20.2300	12.23	50.9200	6.2275	Brown	Brown	Loose
80	Slightly curved	Dark brown	Coarse	133.40	13.34	71.74	13.21	2.66	1.57	15.00	2.49	17.8600	1.25	8.9700	59.00	3.36	24.1000	6.32	45.3400	2.8655	Brown	Brown	Loose
81	Slightly curved	Light brown	Medium	121.20	12.12	82.51	12.20	1.99	1.45	11.67	3.54	29.2100	0.44	3.6300	78.00	2.91	24.0000	5.14	42.4100	2.1799	Brown	Brown	Loose
82	Slightly curved	Light brown	Coarse	130.80	13.08	76.45	10.74	2.60	1.74	10.00	2.77	21.1800	0.90	6.8900	47.00	2.92	22.3200	6.27	48.7[illegible]	3.1022	Brown	Brown	Loose
83	Half circular	Light brown	Coarse	324.50	32.45	30.82	18.22	2.87	1.96	38.67	6.40	19.7200	2.51	7.7300	104.00	8.46	26.0700	14.40	44.3800	6.3907	Brown	Brown	Loose
84	Slightly curved	Dark brown	Medium	182.80	18.28	54.41	12.35	2.53	1.71	15.00	3.95	21.4900	0.74	4.0260	80.00	4.72	25.6800	8.81	47.3300	4.2226	Brown	Brown	Loose
85	Slightly curved	Dark brown	Fine	99.10	9.91	100.91	10.56	2.29	1.41	8.00	2.32	23.4100	0.42	4.2400	48.00	2.53	25.5300	4.19	42.2800	1.7715	Dark brown	Dark brown	Loose
86	Circular	Light brown	Coarse	125.40	12.54	79.74	9.85	2.12	1.69	12.33	3.46	27.5900	0.69	5.5000	61.00	3.08	24.5600	5.01	39.9500	2.0015	Brown	Brown	Loose
87	Half circular	Light brown	Fine	194.60	19.46	51.39	12.93	2.86	1.84	21.67	4.44	22.8200	1.02	5.2400	68.00	5.37	27.5900	7.99	41.0600	3.2807	Brown	Brown	Loose
88	Slightly curved	Light brown	Coarse	90.40	9.04	110.62	9.28	2.22	1.38	6.67	1.80	19.9100	0.39	4.3100	46.00	2.59	28.6500	3.87	42.8100	1.6567	Brown	Brown	Loose
89	Slightly curved	Light brown	Medium	140.10	14.01	71.36	12.22	2.09	1.60	10.67	3.12	22.2700	0.64	4.5700	90.00	4.09	29.1900	6.33	45.1800	2.8599	Light brown	Light brown	Loose
90	Slightly curved	Light brown	Fine	114.70	11.47	87.18	10.95	2.13	1.58	11.67	2.70	23.5400	0.47	4.0970	68.00	3.44	29.9900	5.06	44.1200	2.2325	Brown	Brown	Loose
91	Half circular	Dark brown	Fine	133.30	13.33	75.02	12.45	2.50	1.41	13.00	2.47	18.5300	1.00	7.5000	60.00	3.56	26.7100	6.16	46.2120	2.8467	Brown	Brown	Loose
92	Half circular	Dark brown	Coarse	218.10	21.81	45.85	15.70	2.77	1.80	34.00	5.25	24.0700	2.40	11.0040	77.00	5.68	26.0400	8.25	37.8300	3.1210	Brown	Brown	Loose
93	Slightly curved	Dark brown	Fine	163.10	16.31	61.31	11.47	2.53	1.68	22.00	3.41	20.9100	0.96	5.8900	66.00	4.43	27.1600	6.37	39.0600	2.4881	Brown	Brown	Loose
94	Slightly curved	Light brown	Fine	125.90	12.59	79.43	12.19	2.30	1.32	14.00	3.06	24.3100	0.74	5.8800	65.00	3.71	29.4700	4.50	35.7400	1.6083	Dark brown	Dark brown	Loose
95	Slightly curved	Light brown	Medium	224.80	22.48	44.48	15.08	2.73	1.76	20.00	4.62	20.5500	0.91	4.0500	93.00	7.41	32.9600	8.54	37.9900	3.2443	Brown	Brown	Tight
96	Slightly curved	Dark brown	Coarse	135.80	13.58	73.64	9.73	2.88	1.83	10.00	2.87	21.1340	0.76	5.5960	40.00	2.74	20.1770	6.64	48.9950	3.2456	Brown	Brown	Loose

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100

*Volume = Water replacement

WUKDABAN (203 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (g)	Ave. Wt. of pod (g)	No. of pod/kg.	Pod Dimension: Length (cm)	Width (cm)	Thickness (cm)	Volume* (cc)	Character of pod: Wt. of shell(g)	% Wt. of shell	Wt. of vein(g)	% Wt. of vein	No. of seed	Wt. of seed(g)	% Wt. of seed	Pulp Wt. (g)	%Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Leak of specimen
1	Slightly curved	Light brown	Fine	294.40	29.44	25.35	18.95	3.38	1.87	26.50	8.22	21.0950	2.95	7.4790	39.00	11.03	27.9660	18.36	46.5520	8.5469	Dark brown	Dark brown	Tight	
2	Slightly curved	Light brown	Fine	355.50	35.55	28.13	25.85	3.08	1.90	31.33	8.54	24.3240	0.83	2.3370	113.00	10.25	28.8570	15.59	43.8630	6.8229	Dark brown	Dark brown	Loose	
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5	Slightly curved	Light brown	Fine	321.40	32.14	31.11	14.17	3.11	1.71	26.33	7.03	21.8730	1.99	6.1920	70.00	9.33	29.0290	12.42	38.6430	4.7995	Brown	Brown	Tight	
6	Half circular	Light brown	Fine	381.30	38.13	26.23	22.75	[illegible]	1.69	39.93	7.22	18.9350	1.55	4.0650	111.00	11.86	31.1040	17.91	46.9710	8.4125	Brown	Brown	Tight	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.91	32.33	7.85	19.5740	1.58	4.1250	118.00	12.87	31.6030	15.71	41.0190	6.4429	Light brown	Light brown	Tight	

7	Slightly curved	Light brown	Fine	383.90	38.30	26.11	20.65	2.96	1.81	32.33	7.65	19.9740	1.58	4.1250	118.00	12.87	33.6030	15.71	41.0180	6.4439	Light brown	Light brown	Tight
8	Circular	Light brown	Medium	517.25	51.73	19.33	25.50	3.75	2.10	60.00	10.90	20.8790	2.82	5.4620	48.00	14.13	27.3180	24.28	46.9310	11.3925	Light brown	Light brown	Loose
9	Slightly curved	Light brown	Fine	418.60	41.86	23.89	23.88	3.11	1.50	40.33	7.56	18.0670	1.69	4.0320	83.00	11.76	28.0940	20.43	48.7940	9.9662	Light brown	Light brown	Tight
10	Slightly curved	Light brown	Medium	362.20	36.22	27.61	19.30	3.22	1.33	29.67	6.38	17.6150	1.52	4.1970	112.00	10.45	28.8510	17.67	48.7850	9.6203	Dark brown	Dark brown	Loose
11	Half circular	Light brown	Fine	378.00	37.80	26.46	21.85	3.04	1.66	24.00	7.22	19.1010	1.37	3.6240	97.00	9.77	25.8470	19.46	51.3230	9.9567	Brown	Brown	Loose
12	Slightly curved	Light brown	Fine	370.20	37.02	27.01	18.70	2.91	.90	40.67	6.59	17.8010	1.30	3.5120	111.00	10.38	28.0290	17.33	45.8130	8.1127	Light brown	Light brown	Tight
13	Half circular	Light brown	Medium	369.00	36.90	27.10	18.15	3.30	1.31	41.00	7.34	19.8920	2.49	6.7210	105.00	10.36	28.0760	15.94	43.1980	6.8858	Brown	Brown	Tight
14	Slightly curved	Light brown	Fine	431.50	43.15	23.17	20.15	3.63	1.95	59.33	7.99	18.5170	1.58	3.6570	82.00	10.93	25.3300	20.77	48.1270	9.9945	Light brown	Light brown	Tight
15	Straight	Brown	Medium	320.10	32.01	31.24	18.30	2.88	.67	26.00	6.28	18.6190	1.55	4.9420	99.00	9.35	29.2090	14.51	45.3290	6.5772	Brown	Brown	Loose
16	Straight	Light brown	Medium	475.40	47.54	21.03	23.25	3.49	1.74	76.33	9.45	19.8720	2.24	4.3220	123.00	13.19	27.7450	21.93	46.1290	10.1161	Brown	Brown	Loose
17	Slightly curved	Light brown	Medium	393.30	39.33	25.43	21.25	3.81	[illegible]	70.67	9.01	22.9110	1.53	3.8980	61.00	8.71	22.1460	19.43	49.4020	9.5988	Brown	Brown	Loose
18	Slightly curved	Light brown	Medium	330.80	33.08	30.23	22.55	3.19	.91	38.33	8.73	26.3910	1.66	5.0060	72.00	9.87	29.8370	12.51	37.8200	4.7317	Brown	Brown	Tight
19	Slightly curved	Light brown	Fine	331.30	33.13	30.18	20.45	2.80	.77	37.67	6.26	18.8950	0.97	2.8280	100.00	9.29	28.0410	16.36	49.3810	8.0787	Brown	Brown	Loose
20	Slightly curved	Light brown	Medium	368.00	36.80	27.17	17.65	3.02	.92	26.33	6.40	17.2910	1.20	3.2510	106.00	11.58	31.4670	15.87	43.1250	5.8439	Dark brown	Dark brown	Loose
21	Half circular	Light brown	Medium	280.70	28.07	35.63	18.60	3.09	[illegible]	27.67	5.36	19.0950	1.13	4.0260	97.00	8.30	29.5690	13.03	46.4190	6.0484	Light brown	Light brown	Tight
22	Slightly curved	Light brown	Coarse	397.00	39.70	25.19	22.10	3.29	1.79	40.00	8.47	21.3250	2.13	5.3650	104.00	10.53	26.6750	17.21	43.3500	7.4605	Brown	Brown	Loose
23	Half circular	Light brown	Medium	352.40	35.24	28.38	22.90	2.94	1.46	30.33	7.47	21.1980	2.16	6.1290	111.00	9.44	26.7880	16.12	45.7430	7.3738	Brown	Brown	Loose
24	Half circular	Brown	Medium	302.00	30.20	33.11	15.30	2.42	1.57	8.00	4.33	14.5360	1.11	3.6750	81.00	7.48	24.7680	6.93	22.9470	1.5902	Dark brown	Dark brown	Loose
25	Slightly curved	Brown	Fine	292.00	29.20	34.25	17.25	2.96	1.74	17.33	6.06	20.7530	0.92	3.1510	84.00	8.91	30.5140	12.95	44.2490	5.7432	Brown	Brown	Loose
26	Slightly curved	Light brown	Fine	346.40	34.64	28.87	23.55	2.71	1.57	56.00	7.24	20.9010	1.68	4.8490	117.00	11.66	33.6610	13.63	39.3480	5.3631	Brown	Brown	Loose
27	Slightly curved	Light brown	Medium	347.10	34.71	28.81	19.25	3.13	1.75	46.33	6.48	18.6690	1.38	3.9760	98.00	11.73	33.7940	14.54	41.8890	6.0907	Brown	Brown	Tight
28	Half circular	Light brown	Medium	507.75	50.78	19.69	24.94	3.54	.93	49.00	9.70	19.1040	2.65	5.2190	83.00	12.73	25.0620	24.18	47.6120	11.5102	Light brown	Light brown	Tight
29	Slightly curved	Brown	Fine	344.60	34.46	29.02	18.45	2.68	1.36	22.33	6.65	19.2590	1.57	4.8460	88.00	9.52	27.6260	15.25	44.2540	6.7487	Brown	Brown	Tight
30	Slightly curved	Brown	Fine	414.00	41.40	24.15	19.60	2.73	1.65	16.19	8.25	19.9280	1.85	4.4690	104.00	12.39	29.9280	18.65	45.0480	7.7015	Dark brown	Dark brown	Tight
31	Straight	Light brown	Fine	266.50	26.65	37.52	15.80	2.54	1.64	19.67	5.46	20.4880	0.87	3.2650	110.00	7.95	29.8310	11.97	44.9160	5.2764	Brown	Brown	Loose
32	Slightly curved	Brown	Medium	347.60	34.76	28.77	18.15	3.22	1.72	30.83	5.87	19.7540	1.60	4.5910	100.00	10.35	29.7760	15.46	44.4760	6.8760	Light brown	Light brown	Tight
33	Slightly curved	Light brown	Coarse	355.40	35.54	28.14	20.35	3.22	1.79	33.67	7.25	20.3990	1.77	4.9800	69.00	9.97	28.0530	16.55	44.5670	7.2758	Brown	Brown	Loose
34	Slightly curved	Light brown	Coarse	384.80	38.48	25.99	20.05	3.13	1.32	62.33	7.12	18.5030	1.28	3.3260	117.00	14.23	36.9800	14.74	38.3060	5.6463	Light brown	Light brown	Tight
35	Circular	Brown	Medium	326.50	32.65	30.63	15.15	2.94	2.10	0.67	6.96	21.3170	1.27	3.8890	90.00	9.00	27.5650	14.55	44.5640	6.4841	Dark brown	Dark brown	Loose
36	Half circular	Light brown	Medium	375.80	37.58	26.61	23.20	2.91	1.54	35.33	8.78	23.3630	2.39	6.5390	98.00	11.89	31.8390	13.83	36.8010	5.0896	Brown	Brown	Loose
37	Slightly curved	Light brown	Medium	299.00	29.90	33.44	18.69	2.96	1.56	22.50	5.50	18.2950	1.48	4.9490	105.00	10.85	36.2880	12.29	41.1040	5.0517	Light brown	Light brown	Loose
38	Half circular	Light brown	Coarse	229.20	22.32	43.63	22.50	3.63	1.75	44.67	9.02	29.3540	1.98	8.6290	57.00	15.30	66.7540	18.20	79.4070	14.4521	Brown	Brown	Loose
39	Half circular	Light brown	Medium	320.60	32.06	31.19	20.70	3.17	1.75	30.67	7.05	21.9900	1.59	4.9590	99.00	11.08	34.5600	12.32	38.4280	4.7343	Light brown	Light brown	Tight
40	Slightly curved	Light brown	Medium	270.00	27.00	37.04	15.40	2.70	1.72	19.67	4.67	17.2960	1.19	4.4070	90.00	8.80	32.5930	12.01	44.4810	5.3422	Dark brown	Dark brown	Loose
41	Slightly curved	Light brown	Coarse	308.40	30.84	32.43	16.70	3.30	1.76	31.33	6.95	22.5360	1.98	6.4200	88.00	9.59	31.0960	13.21	43.1580	5.7443	Light brown	Light brown	Loose
42	Slightly curved	Brown	Fine	238.90	23.89	41.86	16.65	2.89	1.45	23.67	4.20	17.5810	0.52	2.1770	83.00	9.22	39.0120	9.57	40.0590	3.8336	Brown	Brown	Loose
43	Slightly curved	Light brown	Medium	387.50	38.75	25.81	19.95	3.60	1.78	35.00	8.25	21.2900	2.03	5.2190	98.00	10.98	28.3350	16.04	41.2940	6.6296	Brown	Brown	Loose
44	Straight	Brown	Fine	276.70	27.67	36.14	15.65	2.54	1.57	11.00	4.93	17.8170	1.06	3.8210	115.00	9.29	33.3260	11.81	42.6820	5.0407	Dark brown	Dark brown	Loose
45	Slightly curved	Light brown	Medium	400.00	40.00	25.00	19.10	3.27	1.81	31.33	8.02	20.0500	2.45	6.1250	113.00	13.20	33.0000	15.67	39.1750	6.1387	Brown	Brown	Loose
46	Circular	Light brown	Medium	414.40	41.44	24.13	23.30	3.10	1.90	50.00	8.08	19.4980	1.91	4.6000	116.00	13.05	31.4910	19.29	46.5490	8.9792	Light brown	Light brown	Loose
47	Circular	Brown	Fine	454.00	45.40	22.03	26.75	3.40	1.67	44.00	9.22	20.3080	1.51	3.3260	106.00	11.90	26.2110	22.68	49.9560	11.3200	Light brown	Light brown	Tight
48	Half circular	Light brown	Fine	250.00	25.00	40.00	17.40	3.07	1.61	27.67	5.23	20.9200	1.47	5.8800	101.00	7.70	30.8000	10.17	40.6800	4.1372	Dark brown	Dark brown	Loose
49	Slightly curved	Light brown	Fine	388.00	38.80	25.77	17.85	3.51	2.11	52.00	7.07	18.2220	2.89	7.4490	76.00	9.85	25.4640	16.75	43.1700	7.2210	Light brown	Light brown	Tight
50	Half circular	Light brown	Medium	415.40	41.54	24.07	22.85	3.42	1.80	43.67	8.47	20.3890	1.64	3.9490	94.00	12.33	29.6820	16.88	40.6363	6.8594	Brown	Brown	Tight
51	Circular	Brown	Fine	192.70	19.27	51.89	15.85	2.06	1.46	18.33	4.01	20.8090	0.74	3.8400	105.00	7.70	39.9580	6.82	35.3920	2.4137	Brown	Brown	Loose
52	Slightly curved	Light brown	Medium	261.10	26.11	38.30	17.40	2.32	1.55	20.67	6.22	24.2050	0.88	3.2700	74.00	7.38	28.2650	11.53	44.1590	5.0915	Dark brown	Dark brown	Loose
53	Circular	Brown	Medium	268.50	26.85	37.24	17.50	2.77	1.59	25.33	5.16	19.2190	1.24	4.6190	88.00	8.01	29.8320	11.70	43.5750	5.0993	Brown	Brown	Tight
54	Circular	Brown	Medium	268.10	26.81	37.30	15.29	2.89	1.91	22.00	3.86	14.2820	1.34	3.8940	85.00	7.50	27.3750	13.72	51.1920	7.0232	Brown	Brown	Loose
55	Slightly curved	Brown	Coarse	272.20	27.22	36.74	8.35	2.89	1.72	24.67	6.28	3.0710	0.99	3.6440	77.00	7.35	27.0020	11.69	42.8260	4.3947	Brown	Brown	Loose
56	Half circular	Brown	Medium	240.50	24.05	41.58	15.05	2.24	1.87	14.50	4.77	19.8240	0.84	3.4930	34.00	7.17	29.8130	10.64	44.2410	4.7072	Dark brown	Dark brown	Loose
57	Half circular	Light brown	Medium	363.70	36.27	27.50	17.95	2.35	1.99	11.25	5.19	25.2680	1.56	4.2890	91.00	9.58	25.2490	15.71	47.2490	6.8031	Dark brown	Dark brown	Loose
58	Circular	Light brown	Medium	378.80	37.88	26.40	17.20	2.89	1.57	26.00	5.44	25.2680	1.65	4.9580	93.00	9.94	26.2410	9.36	27.3490	2.8274	Brown	Brown	Tight
59	Half circular	Light brown	Medium	421.50	42.15	23.72	21.50	3.66	1.81	32.67	8.82	20.9490	2.09	4.9580	79.00	10.54	25.0060	20.46	48.5410	9.9315	Light brown	Light brown	Tight
60	Half circular	Light brown	Medium	421.10	42.11	23.75	20.85	3.83	2.00	28.67	6.95	21.2540	2.74	6.5070	67.00	9.18	21.8000	20.47	48.4680	9.8923	Light brown	Light brown	Tight
61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
62	Slightly curved	Light brown	Medium	229.30	22.93	38.37	19.75	3.20	1.73	20.67	6.56	19.3210	1.62	4.8190	86.00	6.88	26.9660	15.61	47.4040	7.2998	Brown	Brown	Tight
63	Half circular	Brown	Medium	307.50	30.75	32.52	19.50	3.01	1.55	24.33	6.18	20.0990	1.71	5.5610	98.00	10.35	33.6590	11.88	38.6240	4.5897	Brown	Brown	Loose
64	Slightly curved	Light brown	Fine	313.00	31.30	31.95	19.12	2.77	1.57	21.67	7.24	23.1210	2.07	6.6130	97.00	9.91	1.6610	12.64	40.3820	5.1044	Brown	Brown	Loose
65	Slightly curved	Light brown	Medium	317.50	31.75	31.50	19.10	3.16	1.60	22.33	5.61	7.6690	2.12	6.6770	80.00	8.76	27.5910	15.12	47.6220	7.2004	Brown	Brown	Loose
66	Half circular	Light brown	Medium	283.00	28.30	35.34	19.30	2.44	1.63	18.00	5.28	18.6570	1.26	4.4520	101.00	7.63	24.8410	14.50	51.2270	7.4294	Brown	Brown	Loose
67	Circular	Dark brown	Fine	499.00	49.90	20.04	27.15	3.31	1.76	37.33	8.20	6.4330	2.67	5.2510	125.00	15.13	30.3210	22.95	0.9920	0.2277	Brown	Brown	Loose
68	Straight	Dark brown	Fine	374.40	37.44	26.71	18.67	2.95	1.72	39.06	7.29	19.4680	1.62	4.3620	79.00	10.50	28.0450	16.23	3.2570	0.5449	Brown	Brown	Tight
69	Slightly curved	Light brown	Fine	399.00	39.90	25.13	21.75	3.31	1.87	29.00	8.99	22.5880	1.67	4.1960	103.00	11.45	28.7690	15.92	40.0000	6.2080	Brown	Brown	Loose
70	Slightly curved	Dark brown	Medium	251.11	25.11	39.82	14.50	2.62	1.82	26.00	4.57	20.3040	[illegible]	5.7040	74.00	4.03	25.5440	11.33	49.7040	5.5833	Brown	Brown	Loose
71	Slightly curved	Dark brown	Fine	282.90	28.29	35.35	16.85	2.10	1.56	18.57	5.30	18.7250	1.12	3.9590	91.00	7.92	27.9960	12.17	43.0190	5.2254	Brown	Brown	Loose
72	Circular	Dark brown	Fine	138.30	13.83	72.31	8.10	2.43	2.24	12.00	2.73	19.7290	0.57	4.1210	47.00	4.38	31.6700	6.27	45.3360	2.9426	Brown	Brown	Loose
73	Slightly curved	Brown	Fine	266.60	26.60	37.53	17.60	2.81	1.52	29.00	4.65	17.4810	1.31	4.9250	108.00	4.40	32.0820	17.52	45.3360	5.2227	Brown	Brown	Loose
74	Circular	Light brown	Medium	372.90	37.29	26.88	21.50	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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63	Half circular	Brown	Medium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
64	Slightly curved	Light brown	Fine	313.00	31.30	31.95	18.40	2.77	1.57	21.67	7.24	23.1310	2.07	6.9130	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
65	Slightly curved	Light brown	Medium	317.50	31.75	31.50	19.10	3.16	1.60	22.33	5.61	7.6690	2.12	6.6170	80.00	8.76	27.5910	15.12	47.6220	7.2004	Brown	Brown	Loose	
66	Half circular	Light brown	Medium	283.00	28.30	35.34	18.30	2.44	1.63	18.00	5.28	18.6570	1.26	4.4520	101.00	7.03	24.8410	14.50	51.2370	7.4294	Brown	Brown	Loose	
67	Circular	Dark brown	Fine	199.00	19.90	20.04	27.15	3.31	1.76	37.33	8.20	6.4220	2.67	5.3510	125.00	15.12	30.3210	22.95	0.9920	0.2277	Brown	Brown	Loose	
68	Straight	Dark brown	Fine	174.40	17.44	26.71	18.67	2.95	1.72	30.00	7.29	19.4580	1.63	4.2620	78.00	10.50	28.0459	16.23	3.3570	0.5443	Brown	Brown	Tight	
69	Slightly curved	Light brown	Fine	198.00	19.80	25.13	21.75	3.31	1.87	25.00	8.99	22.5880	1.67	4.1960	103.00	11.45	25.7690	15.92	40.0000	6.3680	Brown	Brown	Loose	
70	Slightly curved	Dark brown	Medium	251.11	25.11	19.82	14.50	2.62	1.83	26.06	4.57	20.2009	1.23	5.7040	74.00	8.22	25.5443	11.23	49.7040	5.5833	Brown	Brown	Loose	
71	Slightly curved	Dark brown	Fine	282.90	28.29	17.25	16.85	3.10	1.55	18.67	5.30	18.7250	1.12	2.9590	91.00	7.92	27.9960	12.17	42.0190	5.2354	Brown	Brown	Loose	
72	Circular	Dark brown	Fine	128.20	12.82	72.31	8.10	2.43	2.24	12.00	2.73	19.7390	2.57	4.1210	47.00	4.38	31.6700	6.27	45.3360	2.8426	Brown	Brown	Loose	
73	Slightly curved	Brown	Fine	266.00	26.60	37.59	17.60	2.81	1.53	29.00	4.65	17.4810	1.31	4.9250	108.00	8.60	33.0830	11.52	45.2360	5.2227	Brown	Brown	Loose	
74	Circular	Light brown	Medium	272.00	27.20	26.88	21.00	3.73	1.32	27.17	6.86	18.4410	2.19	8.5750	87.00	13.50	36.2900	11.78	31.6670	3.7394	Brown	Brown	Loose	
75	Straight	Brown	Medium	239.60	23.96	33.28	15.30	3.26	1.87	27.33	6.30	21.0280	2.04	6.8090	81.00	8.49	28.3280	12.36	41.2550	5.0991	Brown	Brown	Loose	
76	Half circular	Light brown	Medium	392.70	39.27	25.46	21.25	3.65	2.02	32.33	6.17	15.7120	2.31	5.8820	95.00	12.79	32.5690	15.00	45.8370	8.2507	Brown	Brown	Tight	
77	Slightly curved	Light brown	Medium	416.90	41.69	22.99	20.15	3.17	2.09	48.00	7.81	18.9730	1.12	2.6860	91.00	9.58	22.9790	22.19	53.2200	11.8095	Brown	Brown	Loose	
78	Slightly curved	Brown	Medium	349.50	34.95	28.61	18.00	3.25	2.05	30.00	7.23	20.8560	1.97	5.6280	70.00	7.49	21.431	15.84	45.32	-	Brown	Brown	Tight	
79	Half circular	Light brown	Coarse	227.60	22.76	30.53	23.40	3.57	1.73	36.33	8.12	21.8280	2.83	7.6080	110.00	11.63	31.2636	14.11	37.9300	5.3519	Light brown	Light brown	Tight	
80	Slightly curved	Light brown	Medium	222.00	22.20	45.05	14.00	2.45	1.53	16.67	3.54	5.9460	0.99	0.4590	89.00	8.00	36.0360	9.37	42.2070	3.9548	Brown	Brown	Loose	
81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
82	Slightly curved	Light brown	Medium	353.80	35.38	27.79	17.30	3.45	1.74	54.33	6.70	18.6219	1.64	4.5580	88.50	8.35	23.2070	18.10	50.3060	9.1054	Dark brown	Dark brown	Loose	
83	Circular	Light brown	Medium	437.10	43.71	22.88	22.15	3.38	1.82	49.00	8.19	18.7350	2.07	4.7290	97.00	10.83	24.7770	21.28	48.9090	10.4558	Dark brown	Dark brown	Tight	
84	Straight	Dark brown	Medium	334.00	33.40	29.94	18.60	2.93	1.55	22.00	5.81	17.3950	0.75	2.2460	107.00	11.45	34.2810	14.07	42.1260	5.9271	Brown	Brown	Loose	
85	Half circular	Dark brown	Medium	358.50	35.85	27.89	22.25	2.96	1.71	29.33	6.26	17.4620	1.72	4.7980	105.00	10.70	29.8470	13.52	37.7130	5.0986	Brown	Brown	Tight	
86	Circular	Light brown	Medium	256.80	25.68	28.03	16.63	3.12	1.95	23.33	5.22	14.6440	1.63	4.5540	81.00	9.60	26.9060	16.85	47.2250	7.9574	Brown	Brown	Loose	
87	Straight	Light brown	Medium	315.90	31.59	31.56	15.72	3.37	1.79	40.50	5.80	18.3020	1.11	3.5060	72.00	8.00	25.2450	16.53	52.1710	8.6254	Dark brown	Dark brown	Loose	
88	Straight	Light brown	Fine	325.00	32.00	31.25	18.90	2.82	1.52	35.67	5.51	20.3440	1.17	3.6560	106.00	9.50	29.6680	10.41	32.5310	3.2865	Brown	Brown	Loose	
89	Slightly curved	Light brown	Medium	401.40	40.14	24.31	18.50	3.27	1.95	25.33	7.49	18.6590	2.60	6.4770	85.00	9.94	24.7630	18.81	46.8610	8.8146	Light brown	Light brown	Tight	
90	Half circular	Light brown	Medium	372.20	37.22	26.87	18.35	3.31	2.05	40.67	8.88	22.8580	1.56	4.1510	92.00	10.93	29.3660	15.04	40.4080	6.0774	Dark brown	Dark brown	Tight	
91	Slightly curved	Light brown	Medium	291.60	29.16	24.29	15.80	2.85	1.75	28.33	5.21	18.2090	1.04	2.5670	89.00	6.95	23.6240	12.37	42.4210	5.2475	Dark brown	Dark brown	Tight	
92	Half circular	Light brown	Medium	295.50	29.55	23.34	19.00	2.28	1.65	38.33	5.27	17.8240	1.47	4.9750	92.00	8.21	27.7820	12.57	45.9220	6.2216	Brown	Brown	Tight	
93	Circular	Light brown	Medium	300.50	30.06	33.27	21.45	2.37	1.39	26.00	5.74	19.0950	1.14	3.7920	90.00	8.55	28.4420	13.28	44.1780	5.8668	Brown	Brown	Tight	
94	Slightly curved	Light brown	Medium	329.20	32.92	30.38	20.50	3.01	1.79	46.67	6.07	18.4200	1.34	4.0700	96.00	10.96	32.6930	16.16	49.0890	7.9328	Light brown	Light brown	Loose	
95	Circular	Light brown	Coarse	329.20	32.92	30.38	24.40	3.57	1.91	55.33	8.78	26.6710	2.49	7.5640	111.00	9.24	28.2720	22.21	67.7700	15.1195	Dark brown	Dark brown	Tight	
96	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
97	Slightly curved	Brown	Medium	316.70	31.67	31.58	18.60	2.28	1.64	27.00	4.95	15.6290	1.06	3.3150	86.00	10.37	32.7440	11.82	37.3220	4.4115	Light brown	Light brown	Loose	
98	Slightly curved	Brown	Fine	276.60	27.66	36.15	14.10	3.01	1.73	31.33	5.19	18.4870	1.75	6.4710	90.00	9.05	32.7150	12.80	49.8920	6.8851	Light brown	Light brown	Tight	
99	Slightly curved	Light brown	Coarse	321.70	32.17	31.08	16.75	3.12	2.03	48.67	7.20	22.6920	1.48	4.6010	91.00	9.65	29.9970	12.18	40.7210	5.3245	Dark brown	Dark brown	Loose	
100	Slightly curved	Light brown	Coarse	300.10	30.01	33.32	16.60	3.25	2.07	45.00	5.56	18.5270	2.45	8.2970	82.00	8.11	27.0240	15.45	51.4830	7.9543	Brown	Brown	Loose	
101	Slightly curved	Light brown	Medium	229.40	22.94	42.59	18.00	2.75	1.55	24.33	4.75	20.7060	0.84	3.6620	84.00	7.06	30.7760	8.10	35.3096	2.9690	Brown	Brown	Loose	
102	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
103	Slightly curved	Light brown	Medium	253.50	25.35	39.45	14.20	2.56	1.89	24.00	5.33	21.0260	0.99	3.9050	120.00	7.67	30.2560	10.25	40.4240	4.1445	Dark brown	Dark brown	Loose	
104	Slightly curved	Light brown	Coarse	253.00	25.30	28.33	18.10	3.18	1.75	37.00	5.65	16.0060	1.24	3.5130	109.00	9.49	26.8840	18.41	52.1520	9.6014	Dark brown	Dark brown	Loose	
105	Slightly curved	Light brown	Medium	374.00	37.40	26.74	17.50	3.17	1.86	49.33	6.38	17.0530	1.49	3.9440	102.00	11.40	30.4810	15.90	42.5130	6.7596	Dark brown	Dark brown	Tight	
106	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
107	Straight	Brown	Fine	245.70	24.57	40.70	15.67	2.91	1.50	24.67	6.27	25.5070	1.56	6.3220	72.00	6.07	24.7050	10.12	41.1970	4.1700	Brown	Brown	Loose	
108	Half circular	Brown	Medium	282.10	28.21	35.32	16.50	3.03	1.87	27.67	4.72	16.6730	1.45	5.1220	99.00	7.54	26.6240	12.41	47.3680	6.3520	Dark brown	Dark brown	Tight	
109	Slightly curved	Brown	Medium	401.20	40.12	24.93	21.45	3.03	1.85	42.00	9.01	22.4580	2.58	6.4310	109.00	11.15	27.7520	14.96	37.0290	5.5040	Brown	Brown	Tight	
110	Half circular	Light brown	Medium	279.60	27.96	35.77	19.56	2.74	1.63	21.67	5.44	19.4710	1.29	4.5710	87.00	7.37	26.3590	11.19	40.0180	4.4776	Brown	Brown	Loose	
111	Circular	Light brown	Medium	346.70	34.67	28.84	20.65	2.97	1.75	42.33	6.32	18.2230	1.63	4.7010	110.00	10.60	29.5740	15.85	45.7170	7.2461	Brown	Brown	Loose	
112	Slightly curved	Light brown	Medium	366.90	36.69	27.26	17.85	3.16	1.73	33.67	6.50	17.7160	1.49	4.0140	96.00	8.95	24.3940	18.62	50.7490	9.4495	Brown	Brown	Tight	
113	Slightly curved	Light brown	Coarse	277.00	27.70	36.10	16.95	3.34	1.83	21.33	5.35	19.2140	1.16	4.1880	97.00	8.68	31.2360	11.86	42.8160	5.0740	Dark brown	Dark brown	Loose	
114	Slightly curved	Light brown	Fine	312.00	31.20	32.05	18.50	2.37	1.54	18.22	5.56	17.8210	1.20	3.8460	94.00	8.54	28.6540	15.00	48.0770	7.2116	Light brown	Light brown	Loose	
115	Slightly curved	Light brown	Coarse	229.50	22.95	43.57	12.15	2.81	1.92	9.70	5.22	22.7890	0.95	4.1290	74.00	5.95	25.9260	10.41	45.3590	4.7219	Brown	Brown	Loose	
116	Half circular	Light brown	Medium	393.70	39.37	25.40	19.81	3.53	1.94	73.00	7.76	19.7180	1.64	4.1610	69.00	8.38	21.2730	18.23	46.2520	8.4367	Dark brown	Dark brown	Tight	
117	Half circular	Light brown	Medium	340.00	34.00	29.41	19.65	2.73	1.92	32.33	6.41	20.0290	1.29	4.0890	126.00	9.58	29.1760	15.79	46.4410	7.2330	Dark brown	Dark brown	Tight	
118	Half circular	Light brown	Medium	330.80	33.08	30.23	24.40	2.97	1.45	54.67	6.35	19.1960	1.25	3.7790	117.00	10.28	31.0760	14.43	43.6220	6.2947	Dark brown	Dark brown	Loose	
119	Slightly curved	Light brown	Medium	356.00	35.60	28.09	18.20	2.18	1.78	55.33	6.72	18.9040	1.59	4.4660	92.00	8.12	22.8090	18.59	52.2150	9.7075	Brown	Brown	Tight	
120	Slightly curved	Light brown	Medium	344.50	34.45	29.03	13.25	2.95	1.83	22.67	5.10	14.8040	0.97	2.8160	72.00	6.83	19.8260	11.20	32.5110	3.6412	Dark brown	Dark brown	Loose	
121	Slightly curved	Light brown	Coarse	260.40	26.04	38.43	16.95	2.76	1.76	25.33	4.82	18.5090	1.77	6.7970	115.00	8.28	31.7370	10.03	38.5140	3.8634	Dark brown	Dark brown	Loose	
122	Slightly curved	Brown	Fine	259.60	25.96	38.52	17.10	2.81	1.57	26.00	5.50	21.1860	1.51	5.8170	91.00	7.66	29.5060	10.40	40.0620	4.2664	Dark brown	Dark brown	Tight	
123	Slightly curved	Brown	Medium	282.70	28.27	35.37	14.30	2.90	1.97	26.67	5.39	19.0660	1.45	5.1250	74.00	7.57	26.7780	13.20	3.7320	0.4576	Dark brown	Dark brown	Tight	
124	Slightly curved	Brown	Fine	394.20	39.42	35.37	21.20	2.96	1.76	41.00	6.98	17.7070	2.02	5.1240	101.00	11.02	27.9550	18.45	46.8040	8.6353	Dark brown	Dark brown	Loose	
125	Half circular	Brown	Medium	360.50	36.05	27.74	21.10	3.15	1.76	46.00	7.57	20.9990	1.53	4.2160	113.00	9.78	27.1290	6.011	44.4130	-	Dark brown	Dark brown	Loose	
126	Slightly curved	Brown	Medium	237.80	23.78	42.05	14.20	2.73	1.73	24.30	4.70	19.7650	0.70	2.9440	95.00	6.60	27.7540	10.95	46.0470	5.0421	Brown	Brown	Tight	
127	Slightly curved	Brown	Fine	325.50	32.55	30.72	17.30	2.99	1.78	22.22	5.70	17.5120	1.65	5.0630	115.00	8.25	25.3460	15.53	47.7110	7.4095	Dark brown	Dark brown	Tight	
128	Slightly curved	Light brown	Fine	354.30	35.43	28.18	13.70	3.10	1.94	44.00	6.43	22.5370	0.99	2.7890	91.00	9.57	26.9650	14.81	41.7200	6.1602	Light brown	Light brown	Tight	
129	Slightly curved	Light brown	Medium	268.20	26.82	37.29	14.15	2.91	1.66	27.33	5.18	19.6370	0.99	3.2810	84.00	7.75	26.8960	10.25	38.2180	3.9172	Brown	Brown	Tight	
130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	

122	Slightly curved	Brown	Fine	259.60	25.96	38.52	17.19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
123	Slightly curved	Brown	Medium	282.70	28.27	35.37	14.30	2.80	1.97	26.67	5.29	19.0660	1.45	5.1290	74.00	7.57	26.7780	13.20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
124	Slightly curved	Brown	Fine	394.20	39.42	25.37	21.20	2.96	1.76	41.00	6.38	17.7070	2.02	5.1240	101.00	11.02	27.9550	18.45	46.8040	8.6252	Dark Brown	Dark Brown	Loose				
125	Half circular	Brown	Medium	360.50	36.05	27.74	21.10	3.15	1.76	46.00	7.57	20.9990	1.52	4.2160	112.00	9.78	27.1290	6.011	44.4130	-	Dark Brown	Dark Brown	Loose				
126	Slightly curved	Brown	Medium	237.90	23.79	42.05	14.20	2.73	1.73	24.00	4.70	19.7650	0.70	2.9440	85.00	6.60	27.7540	10.35	46.0470	5.0421	Brown	Brown	Tight				
127	Slightly curved	Brown	Fine	325.50	32.55	30.72	17.30	2.98	1.78	22.33	5.70	17.5120	1.65	5.0690	115.00	8.25	25.2460	15.53	47.7110	7.4095	Dark Brown	Dark Brown	Tight				
128	Slightly curved	Light brown	Fine	354.30	[illegible]	28.19	16.70	3.20	1.94	44.00	8.41	23.6370	0.99	2.7850	97.00	9.57	26.9650	14.81	41.7300	6.1802	Light brown	Light brown	Tight				
129	Slightly curved	Light brown	Medium	268.20	26.82	37.29	14.15	2.91	1.66	27.33	5.28	19.6870	0.88	3.2810	84.00	7.75	28.8960	10.25	38.2190	3.8173	Brown	Brown	Tight				
130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
131	Slightly curved	Light brown	Medium	242.10	24.21	41.14	15.00	[illegible]	1.72	32.67	4.80	19.7450	1.12	4.6070	69.00	6.23	26.0290	10.59	43.5620	4.6132	Dark Brown	Dark Brown	Tight				
132	Half circular	Light brown	Medium	295.50	29.55	33.84	17.15	3.72	2.06	38.33	-	-	-	-	-	-	-	-	-	-	-	-	-				
133	Slightly curved	Brown	Fine	225.90	22.59	44.27	17.40	2.57	1.54	29.00	4.21	18.6370	0.34	1.5050	95.00	6.64	29.2940	9.67	42.8070	4.1254	Dark Brown	Dark Brown	Loose				
134	Slightly curved	Light brown	Medium	252.20	25.22	39.65	14.80	2.59	1.04	29.33	4.86	19.2700	1.35	5.3530	77.00	6.46	25.6150	12.00	47.5810	5.7097	Brown	Brown	Loose				
135	Slightly curved	Light brown	Medium	328.90	32.89	29.51	18.80	3.04	1.76	30.33	6.56	19.3570	1.42	4.1900	87.00	9.02	26.6160	14.62	43.1690	6.3156	Dark brown	Dark Brown	Loose				
136	Slightly curved	Light brown	Medium	337.50	33.75	29.63	19.70	2.9[illegible]	1.88	27.00	6.32	20.5310	1.52	4.8900	103.00	10.29	28.4890	13.43	39.3700	5.2920	Dark Brown	Dark Brown	Loose				
137	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
138	Half circular	Light brown	Medium	341.20	34.12	29.31	21.80	3.08	1.58	30.67	6.51	19.0790	1.14	3.3410	109.00	10.05	25.4550	15.30	44.8430	5.8608	Brown	Brown	Loose				
139	Slightly curved	Brown	Fine	254.80	25.48	39.25	17.10	2.44	1.75	26.00	4.76	18.6810	10.80	42.3860	113.00	8.26	32.4180	9.69	38.0290	3.6850	Dark Brown	Dark Brown	Loose				
140	Slightly curved	Brown	Fine	233.50	23.35	42.82	17.80	2.53	1.51	24.00	3.96	16.9590	0.38	4.1370	89.00	7.74	33.1460	9.33	39.9570	3.7280	Dark Brown	Dark Brown	Loose				
141	Circular	Brown	Medium	346.00	34.60	29.90	15.90	2.97	2.14	52.33	5.59	19.0460	1.58	4.5660	109.00	9.92	28.6710	15.13	43.7290	6.5160	Light brown	Light brown	Loose				
142	Slightly curved	Brown	Fine	347.50	34.75	28.78	21.90	2.62	1.62	57.33	6.73	19.3670	1.51	4.2450	105.00	11.40	32.8060	14.42	41.4960	5.9837	Light brown	Light brown	Loose				
143	Slightly curved	Brown	Medium	317.00	31.70	31.55	16.20	3.15	1.88	45.33	6.81	21.4820	1.64	5.1740	91.00	9.29	29.6210	11.54	36.4040	4.2010	Dark Brown	Dark Brown	Loose				
144	Straight	Brown	Fine	347.30	34.73	28.74	16.35	2.70	1.53	22.67	5.13	14.7460	0.38	2.8170	83.00	7.42	21.3570	9.74	27.9970	2.7269	Light brown	Light brown	Loose				
145	Straight	Brown	Medium	423.90	42.39	23.59	20.05	3.18	1.80	41.33	7.15	16.8670	3.27	7.7140	105.00	11.89	28.0490	16.58	39.1130	6.4949	Brown	Brown	Tight				
146	Slightly curved	Brown	Fine	321.10	32.11	31.14	21.20	3.24	1.41	31.67	6.82	21.2390	1.66	5.1693	97.00	8.77	27.2120	12.74	39.6760	5.0547	Dark Brown	Dark Brown	Loose				
147	Half circular	Light brown	Fine	268.70	26.87	37.22	19.30	2.56	1.51	40.00	4.19	15.5340	1.27	3.5820	104.00	9.14	34.0160	8.86	32.9740	2.9215	Dark Brown	Dark Brown	Loose				
148	Slightly curved	Brown	Fine	249.10	24.91	40.14	14.30	2.71	1.65	21.00	4.50	18.0650	1.45	5.8210	98.00	8.05	32.2160	9.94	39.3040	3.0685	Brown	Brown	Loose				
149	Slightly curved	Brown	Fine	227.00	22.70	42.19	16.30	2.38	1.74	34.67	5.47	22.0800	1.06	4.3570	100.00	5.95	25.1050	9.58	42.1090	4.2025	Brown	Brown	Loose				
150	Half circular	Light brown	Medium	390.20	39.02	25.63	19.40	2.58	2.01	47.67	7.95	20.4770	2.53	6.4340	95.00	9.07	23.2440	15.31	41.7990	6.8174	Brown	Brown	Tight				
151	Slightly curved	Brown	Medium	209.30	20.93	47.78	13.70	2.71	1.61	24.33	3.79	18.1080	0.87	4.1570	72.06	6.37	30.4250	8.76	41.8540	3.6664	Dark Brown	Dark Brown	Loose				
152	Slightly curved	Light brown	Fine	287.50	28.75	34.78	19.70	3.05	1.50	49.33	5.54	19.2690	0.97	3.3740	82.00	7.78	27.0610	12.73	44.2780	5.6266	Light brown	Light brown	Loose				
153	Slightly curved	Brown	Medium	374.00	37.40	26.74	19.30	3.64	1.90	39.67	7.52	20.1070	2.51	6.9790	93.00	9.66	25.8290	16.16	43.2090	6.9826	Dark Brown	Dark Brown	Loose				
154	Slightly curved	Brown	Fine	358.60	35.86	27.89	20.70	3.27	1.67	35.67	7.30	20.2570	1.96	5.4660	106.00	8.56	23.8710	16.32	45.5100	7.4272	Dark Brown	Dark Brown	Loose				
155	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
156	Slightly curved	Dark brown	Fine	431.60	43.16	23.17	22.30	3.50	1.71	46.33	7.37	18.4660	2.77	6.4180	92.00	11.81	27.3630	19.29	44.6340	8.6215	Light brown	Light brown	Loose				
157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
158	Half circular	Dark brown	Fine	433.30	43.33	23.08	25.00	3.27	1.69	32.33	7.67	17.7040	2.43	5.6060	75.00	11.92	27.4970	19.14	44.1790	8.4572	Light brown	Light brown	Loose				
159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
160	Slightly curved	Light brown	Fine	254.30	25.43	37.84	19.30	2.35	1.58	34.00	5.68	21.4910	1.05	3.3770	105.00	9.23	34.9225	9.71	36.7190	3.5874	Dark Brown	Dark Brown	Loose				
161	Half circular	Light brown	Fine	406.40	40.64	24.61	24.55	3.00	1.24	51.67	7.30	19.9620	2.22	5.4870	109.00	11.97	29.4540	18.23	44.8570	8.1774	Brown	Brown	Loose				
162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
163	Slightly curved	Light brown	Medium	219.30	21.93	45.60	6.7	2.90	1.63	26.00	4.21	19.1970	0.81	3.6940	60.00	5.16	23.5290	9.92	45.2800	4.4962	Brown	Brown	Loose				
164	Half circular	Dark brown	Fine	246.70	24.67	38.94	22.91	2.32	1.50	25.67	7.18	20.7090	1.53	4.4120	102.00	8.57	24.7190	16.42	47.2890	7.7860	Dark Brow	Dark Brown	Loose				
165	Slightly curved	Light brown	Medium	327.80	32.78	30.51	20.60	3.02	1.49	35.50	6.71	20.4630	1.41	4.3010	85.00	9.91	29.9270	13.36	42.5870	5.3451	Brown	Brown	Loose				
166	Slightly curved	Dark brown	Medium	374.30	37.43	25.72	15.75	3.02	1.75	29.67	6.64	12.3960	1.19	3.1790	102.00	9.25	24.7190	11.25	30.0560	3.2812	Dark Brown	Dark Brown	Loose				
167	Straight	Dark brown	Medium	328.20	32.82	30.47	18.30	3.09	1.87	41.00	6.84	20.8520	1.48	4.5020	85.00	8.49	25.5940	12.89	39.2720	5.0619	Dark Brown	Dark Brown	Loose				
168	Slightly curved	Light brown	Medium	308.00	30.80	32.47	18.45	3.18	1.79	35.00	5.46	17.7270	1.22	3.9610	93.00	8.00	23.8740	16.19	52.5650	8.5102	Brown	Brown	Loose				
169	Circular	Light brown	Fine	313.50	31.35	31.90	18.70	2.74	1.94	38.00	6.76	21.5630	1.36	4.3280	113.00	7.44	23.7320	14.38	45.[illegible]	7.1579	Dark Brown	Dark Brown	Tight				
170	Slightly curved	Dark brown	Medium	261.50	26.15	38.24	19.85	2.85	1.52	33.00	4.98	19.0440	0.87	3.3270	90.00	6.51	24.8950	12.89	49.2930	6.2529	Dark Brown	Dark Brown	Loose				
171	Slightly curved	Dark brown	Coarse	226.20	22.62	30.66	18.60	3.34	1.87	41.67	6.56	20.1100	1.43	4.3840	88.00	9.32	28.5710	14.29	43.8070	6.2600	Dark Brown	Dark Brown	Loose				
172	Slightly curved	Dark brown	Fine	342.50	34.25	29.20	15.20	3.06	1.95	37.00	6.18	18.0440	1.34	5.6640	87.00	9.51	27.7660	15.20	44.3790	6.7456	Dark Brown	Dark Brown	Tight				
173	Half circular	Dark brown	Medium	250.20	35.03	28.55	20.30	2.28	1.62	42.00	6.69	19.0980	1.35	5.5670	91.00	9.22	26.3450	13.72	39.1950	5.2815	Dark Brown	Dark Brown	Tight				
174	Slightly curved	Light brown	Medium	280.60	28.06	35.64	19.30	2.81	1.59	35.67	5.27	18.7810	1.14	4.0630	86.00	8.30	31.7180	11.49	40.5460	4.7043	Dark Brown	Dark Brown	Loose				
175	Circular	Dark brown	Fine	270.90	27.09	36.91	12.60	2.76	1.90	26.33	4.00	14.7560	1.24	4.9460	96.00	7.74	28.5710	13.19	48.6890	6.4221	Dark Brown	Dark Brown	Tight				
176	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
177	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
178	Half circular	Dark brown	Fine	471.50	47.15	21.21	22.90	3.42	1.84	76.33	8.39	19.0670	1.92	4.0720	94.00	12.89	27.2380	22.40	47.5080	10.6018	Brown	Brown	Loose				
179	Slightly curved	Dark brown	Medium	240.90	24.09	41.51	14.30	3.00	1.71	25.33	4.64	19.2610	1.08	4.4820	79.00	6.68	27.7290	10.66	45.0810	4.8958	Brown	Brown	Loose				
180	Straight	Light brown	Medium	324.90	32.49	29.86	20.80	2.95	1.46	41.67	6.02	17.3759	1.16	3.4640	112.00	8.86	25.4560	16.10	48.6710	7.5334	Brown	Brown	Loose				
181	Slightly curved	Dark brown	Fine	280.20	28.02	35.69	17.85	2.74	1.69	45.67	5.14	19.2440	0.85	3.0240	104.00	9.45	33.7260	11.88	42.3980	5.0369	Brown	Brown	Loose				
182	Slightly curved	Light brown	Coarse	292.90	29.29	34.02	17.15	3.02	1.68	25.67	6.35	21.6060	0.91	3.0950	95.00	8.43	28.6830	12.59	42.8286	5.3932	Brown	Brown	Loose				
183	Slightly curved	Dark brown	Fine	384.20	38.42	26.02	19.70	3.20	1.74	28.33	5.61	17.2060	1.21	3.1490	102.00	9.42	24.5180	19.96	51.9520	10.3696	Dark Brown	Dark Brown	Loose				
184	Slightly curved	Light brown	Medium	220.00	22.00	43.49	15.25	2.46	1.54	10.33	4.45	19.2910	0.86	3.7290	92.00	7.28	22.0870	9.96	43.3040	4.3131	Dark Brown	Dark Brown	Loose				
185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
186	Slightly curved	Light brown	Medium	358.30	35.83	27.91	22.80	2.91	1.94	31.00	8.17	22.8420	1.40	3.9070	101.00	10.73	29.9470	18.19	50.7640	9.2347	Dark Brown	Dark Brown	Tight				
187	Circular	Dark brown	Medium	411.40	41.14	24.31	24.25	3.00	1.87	39.67	7.46	19.1056	2.26	5.7370	96.00	9.51	23.1160	19.44	47.2530	9.1860	Brown	Brown	Loose				
188	Slightly curved	Light brown	Medium	313.40	31.34	31.91	15.70	3.23	1.87	29.00	5.30	16.3110	1.35	4.2980	95.00	8.22	26.5480	15.16	48.2730	7.1232	Dark Brown	Dark Brown	Loose				
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]				

188	Slightly curved	Light brown	Medium	313.40	31.34	31.91	15.70	3.23	1.87	29.00	5.30	16.9110	1.35	4.3000	95.00	8.32	26.5400	15.19	48.3130	7.3333	Dark Brown	Dark Brown	Loose
189	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
190	Slightly curved	Light brown	Medium	213.40	21.34	45.58	15.20	2.55	1.56	13.00	4.28	19.3640	0.73	3.3270	92.00	6.05	27.5750	16.09	45.9890	4.6403	Dark Brown	Dark Brown	Loose
191	Slightly curved	Light brown	Medium	431.20	43.12	23.19	19.70	3.52	2.08	44.67	6.73	15.6080	2.44	5.6590	114.00	12.57	29.1510	10.53	47.6110	5.0134	Dark Brown	Dark Brown	Loose
192	Half circular	Brown	Medium	474.60	47.46	21.07	25.40	3.42	2.35	13.60	9.36	19.7220	2.95	6.2160	98.00	14.30	30.1310	19.30	40.6660	7.3495	Dark Brown	Dark Brown	Tight
193	Slightly curved	Light brown	Fine	350.20	35.02	28.56	19.00	3.44	1.63	47.00	6.07	17.3330	1.37	3.9120	90.00	9.52	27.1840	16.76	47.8580	8.0210	Dark Brown	Dark Brown	Loose
194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
195	Half circular	Light brown	Medium	347.80	34.79	28.75	17.30	3.20	1.69	38.67	6.81	19.5800	1.89	5.4340	90.00	9.46	27.1990	15.96	45.8880	7.3237	Dark Brown	Dark Brown	Loose
196	Slightly curved	Brown	Medium	226.30	22.63	44.19	15.50	2.56	1.58	24.67	4.45	19.6640	0.59	2.6070	80.00	6.56	28.9880	10.39	45.8680	4.7611	Dark Brown	Dark Brown	Loose
197	Slightly curved	Light brown	Medium	212.40	21.24	47.08	13.50	2.85	1.51	28.33	4.11	19.3500	0.80	3.7660	67.00	5.64	26.5540	8.54	40.2070	3.4337	Dark Brown	Dark Brown	Loose
198	Half circular	Light brown	Medium	269.70	26.97	37.08	16.70	2.65	1.76	30.33	5.08	18.8360	0.91	3.3740	102.00	8.79	32.5920	11.50	42.6390	4.9035	Dark Brown	Dark Brown	Loose
199	Half circular	Light brown	Fine	376.40	37.64	26.57	19.40	3.54	1.56	52.67	9.01	23.9370	2.89	7.6780	76.00	7.55	20.0580	15.08	40.0640	6.0417	Brown	Brown	Tight
200	Half circular	Brown	Coarse	271.60	27.16	36.82	19.10	3.29	1.96	56.67	6.73	24.7790	2.61	9.6090	111.00	10.90	40.1330	13.58	50.0000	6.7900	Dark Brown	Dark Brown	Loose
201	Half circular	Brown	Medium	406.43	40.64	24.60	20.07	3.00	1.76	59.00	7.43	18.2790	1.77	4.3550	68.00	12.69	31.2230	19.83	48.7880	9.6742	Dark Brown	Dark Brown	Loose
202	Slightly curved	Light brown	Coarse	249.50	24.96	40.06	14.00	2.33	2.04	25.00	4.40	17.6280	[illegible]	4.3880	59.00	7.03	28.1550	11.40	45.6730	5.2067	Dark Brown	Dark Brown	Loose
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
*Volume = Water replacement

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NAKHON RATCHASIMA (35 specimens)

No.	Pod shape	Pod shell		Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension				Character of pod										Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
		colour	texture				Length (cm)	Width (cm)	Thickness (cm)	Volume* (cm³)	Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	%Pulp Wt.					
1	Slightly curved	Brown	Medium	111.00	11.10	90.05	8.50	2.36	1.59	7.67	2.25	20.2700	0.51	4.5950	38.00	3.55	31.9820	4.47	40.2700	1.8001	Dark brown	Dark brown	Loose	
2	Slightly curved	Light brown	Fine	164.20	16.42	60.90	12.10	2.51	1.74	19.00	2.36	14.0270	0.71	4.3240	60.00	5.62	34.2270	6.63	40.3780	2.6771	Dark brown	Dark brown	Loose
3	Slightly curved	Light brown	Coarse	[illegible]	15.77	63.41	11.45	2.15	1.70	14.67	3.86	24.4770	0.56	3.5510	72.00	3.96	25.2380	6.41	40.6470	[illegible]	Dark brown	Dark brown	Loose	
4	Slightly curved	Light brown	Coarse	[illegible]	16.51	60.57	10.95	2.35	1.74	10.67	5.48	33.1920	0.41	2.4920	57.00	4.42	26.7720	6.42	38.8860	2.4965	Dark brown	Dark brown	Loose	
5	Slightly curved	Brown	Medium	126.70	12.67	78.93	10.55	2.56	1.65	19.33	3.62	22.2570	0.56	4.4190	56.00	4.00	31.5710	5.64	44.5150	2.5106	Dark brown	Dark brown	Loose	
6	Slightly curved	Brown	Fine	155.70	15.57	64.22	10.55	2.63	1.88	11.67	3.08	19.7820	1.04	6.6790	52.00	4.11	26.3970	6.89	44.2520	3.0430	Dark brown	Dark brown	Loose	
7	Circular	Brown	Medium	319.10	31.91	31.34	22.40	2.73	1.84	28.67	5.79	18.1330	1.40	4.3850	116.00	9.84	30.8170	13.73	43.0000	5.9039	Dark brown	Dark brown	Loose	
8	Slightly curved	Brown	Fine	161.50	16.15	61.92	12.00	2.64	1.65	9.00	3.38	20.9290	0.77	4.7580	59.00	2.90	17.9570	8.74	54.1180	4.7299	Dark brown	Dark brown	Loose	
9	Slightly curved	Light brown	Fine	163.50	16.35	61.16	11.25	2.59	1.67	12.33	3.29	20.1220	0.90	5.5050	49.00	4.31	26.3610	7.18	43.9140	3.1530	Dark brown	Dark brown	Loose	
10	Slightly curved	Light brown	Medium	198.30	19.83	50.28	15.45	2.94	1.49	14.33	4.54	22.8260	1.09	5.4800	70.00	3.19	16.0380	8.95	44.9970	4.0272	Dark brown	Dark brown	Loose	
11	Slightly curved	Light brown	Coarse	146.90	14.69	68.07	9.80	2.40	1.78	21.33	4.49	30.5650	0.41	2.7910	48.00	4.25	28.9310	5.07	34.5130	1.7498	Dark brown	Dark brown	Loose	
12	Slightly curved	Brown	Medium	94.90	9.49	105.37	7.90	2.66	1.32	10.57	2.15	22.6550	0.49	5.1930	31.00	2.20	23.1820	4.39	46.2590	2.0308	Brown	Brown	Loose	
13	Slightly curved	Brown	Coarse	219.80	21.98	45.50	12.60	2.26	1.74	30.33	4.71	21.4290	1.44	6.5510	66.00	5.90	26.8430	10.56	48.0440	5.0734	Brown	Brown	Loose	
14	Slightly curved	Light brown	Medium	134.20	13.42	74.52	9.80	2.38	1.68	8.33	3.05	22.7270	0.43	3.2040	56.00	3.65	27.1980	5.83	43.4430	2.5327	Dark brown	Dark brown	Loose	
15	Slightly curved	Light brown	Fine	140.40	14.04	71.23	11.15	2.66	15.61	[illegible]	3.12	22.2220	0.41	2.9200	56.00	4.78	34.0460	5.60	39.8860	2.2336	Dark brown	Dark brown	Loose	
16	Slightly curved	Light brown	Coarse	300.60	30.06	33.27	13.60	2.65	1.94	14.30	5.28	17.5650	0.97	3.2270	57.00	5.06	16.8330	7.54	25.0830	1.8913	Dark brown	Dark brown	Loose	
17	Half circular	Light brown	Medium	308.10	30.81	32.46	19.35	2.67	1.75	37.67	7.01	[illegible]	1.55	5.0310	97.00	9.22	29.9250	12.55	40.7340	5.1121	Dark brown	Dark brown	Loose	
18	Slightly curved	Brown	Medium	230.40	23.04	43.40	15.60	2.89	1.94	25.67	4.58	19.8780	1.00	4.3400	78.00	6.72	29.1670	10.50	45.5730	4.7852	Dark brown	Dark brown	Loose	
19	Slightly curved	Brown	Coarse	183.70	18.37	54.44	13.00	2.31	1.76	23.00	3.31	18.0190	1.09	5.9340	58.00	6.35	34.5670	6.65	36.2000	2.4073	Dark brown	Dark brown	Loose	
20	Half circular	Brown	Fine	156.00	15.60	64.10	12.35	2.32	1.48	15.33	2.87	18.3970	0.37	2.3720	59.00	5.04	32.3080	6.59	42.2440	2.7839	Dark brown	Dark brown	Loose	
21	Slightly curved	Light brown	Fine	109.30	10.93	91.49	7.80	2.44	1.71	20.00	1.96	17.9320	0.33	3.0190	38.00	3.85	35.2240	4.16	38.0600	1.5833	Dark brown	Dark brown	Loose	
22	Slightly curved	Light brown	Medium	124.70	12.47	80.19	8.40	2.65	1.88	10.67	2.67	21.4110	0.26	2.0850	36.00	3.61	28.9490	4.91	39.3740	1.9333	Dark brown	Dark brown	Loose	
23	Slightly curved	Brown	Coarse	160.30	16.03	62.38	10.35	2.59	1.90	16.00	3.48	21.7090	0.55	3.4310	60.00	4.89	30.5050	5.32	36.3070	2.1131	Dark brown	Dark brown	Tight	
24	Slightly curved	Light brown	Coarse	264.20	26.42	37.85	16.40	3.24	1.97	51.67	6.40	24.2240	1.73	6.5480	86.00	7.01	26.5330	10.11	38.2660	3.9667	Dark brown	Dark brown	Loose	
25	Straight	Brown	Fine	113.20	11.32	88.34	10.40	2.24	1.57	16.67	[illegible]	24.2820	0.53	4.6820	52.00	2.77	24.4690	5.07	44.7880	2.2708	Dark brown	Dark brown	Loose	
26	Slightly curved	Brown	Coarse	170.50	17.05	58.65	10.65	2.54	1.91	[illegible]	3.78	22.1700	0.64	3.7540	70.00	5.29	31.0250	6.36	37.3020	2.3724	Dark brown	Dark brown	Tight	
27	Slightly curved	Light brown	Medium	153.20	15.32	[illegible]	10.90	2.41	1.64	16.67	3.59	22.5500	0.37	2.3249	64.00	5.13	32.2240	6.03	37.8770	2.2849	Dark brown	Dark brown	Loose	
28	Slightly curved	Light brown	Coarse	125.20	12.52	79.87	9.45	2.33	1.77	14.67	3.76	30.0320	0.27	2.1570	43.00	3.71	29.6330	3.44	27.4760	0.9452	Dark brown	Dark brown	Loose	
29	Slightly curved	Brown	Coarse	67.50	6.75	148.15	6.55	2.17	1.80	7.33	1.89	28.0000	0.22	3.2590	35.00	1.74	25.7780	2.20	32.5930	0.7170	Dark brown	Dark brown	Loose	
30	Slightly curved	Brown	Medium	122.40	12.24	81.70	9.10	2.55	1.57	7.33	2.76	22.5490	0.32	2.6140	43.00	4.25	34.7220	4.58	37.4180	1.7137	Dark brown	Dark brown	Loose	
31	Slightly curved	Brown	Coarse	169.20	16.92	59.10	12.20	2.52	1.64	15.00	3.39	20.0350	0.75	4.4330	55.00	5.28	31.2060	4.89	28.9010	1.4133	Dark brown	Dark brown	Loose	
32	Half circular	Light brown	Coarse	398.90	39.89	25.07	20.85	3.45	2.21	56.67	9.16	22.9630	2.21	5.5400	95.00	8.65	21.6850	17.29	43.3130	7.4855	Dark brown	Dark brown	Tight	
33	Slightly curved	Light brown	Medium	180.50	18.05	55.40	11.65	2.29	1.89	15.67	3.69	20.4430	0.45	2.4930	70.00	5.61	31.0800	5.95	32.5040	2.2285	Dark brown	Dark brown	Loose	
34	Slightly curved	Light brown	Coarse	133.30	13.33	71.79	12.00	2.47	1.61	14.00	3.11	22.3260	0.16	1.2920	53.00	3.29	23.6180	5.84	41.9240	2.4484	Dark brown	Dark brown	Loose	
35	Slightly curved	Brown	Medium	161.50	16.15	61.92	12.10	2.31	1.77	17.33	2.87	17.7710	0.46	2.8480	75.00	5.55	34.3650	5.08	31.4550	1.5979	Brown	Brown	Loose	

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
*Volume = Water replacement

30	Slightly curved	Light brown	Coarse	151.70	15.17	65.92	10.70	2.22	1.56	19.67	2.59	17.0730	0.59	4.5480	48.00	4.55	29.9930	6.23	41.0000	[illegible]	Brown	Brown	Loose
31	Slightly curved	Brown	Coarse	128.70	12.87	77.70	10.75	2.35	1.56	10.10	2.48	19.2690	0.58	4.5070	50.00	4.31	33.4890	4.81	37.3740	1.7977	Brown	Brown	Loose
32	Slightly curved	Brown	Coarse	124.80	12.48	80.13	10.25	2.20	1.58	17.67	2.71	21.1750	0.39	3.1250	80.00	3.83	30.6890	4.55	36.4580	1.6588	Brown	Brown	Loose
33	Slightly curved	Brown	Medium	153.20	15.32	65.27	10.20	2.28	1.75	21.33	2.74	17.8850	0.47	3.0680	56.00	4.74	30.9390	6.08	39.6870	2.4130	Brown	Brown	Loose
34	Slightly curved	Light brown	Medium	138.30	13.83	72.31	10.35	2.13	1.67	16.33	2.27	16.4140	0.36	2.6030	60.00	3.80	27.4770	6.41	46.3490	2.9710	Brown	Brown	Loose
35	Half circular	Light brown	Medium	181.80	18.18	55.01	15.05	2.41	1.49	25.00	3.76	20.6820	0.61	3.3550	74.00	5.82	32.0130	7.00	38.5040	2.6953	Brown	Brown	Loose
36	Half circular	Brown	Fine	183.30	18.33	54.38	10.35	2.40	1.94	30.00	[illegible]	[illegible]	0.55	2.9310	36.00	5.03	27.3520	8.36	45.4590	3.8004	Dark brown	Dark brown	Loose
37	Slightly curved	Brown	Medium	125.60	12.56	79.62	11.20	2.24	1.48	19.67	2.46	19.5860	0.38	3.0250	60.00	3.45	27.4690	5.54	44.1080	2.4436	Dark brown	Dark brown	Loose
38	Slightly curved	Brown	Medium	184.30	18.43	54.26	11.40	2.52	1.77	19.67	3.56	19.3160	0.94	5.1000	55.00	4.67	25.3390	7.75	42.0510	3.2590	Brown	Brown	Loose
39	Slightly curved	Light brown	Medium	194.80	19.48	51.33	13.50	2.23	1.68	[illegible]	4.40	22.5870	0.85	4.3630	80.00	4.96	25.4620	8.34	42.8130	3.5706	Dark brown	Dark brown	Loose
40	Slightly curved	Light brown	Coarse	102.30	10.23	97.75	8.15	2.15	1.72	7.00	2.26	22.0920	0.58	5.6470	36.00	2.91	28.4460	3.95	38.9120	1.5370	Brown	Brown	Loose
41	Slightly curved	Brown	Medium	145.30	14.53	68.82	11.25	2.22	1.66	9.90	3.16	21.7480	0.91	6.2630	50.00	4.49	30.9010	5.93	40.8120	2.4202	Dark brown	Dark brown	Loose
42	Slightly curved	Brown	Medium	139.30	13.93	71.79	11.15	2.04	1.49	10.00	2.51	18.0190	0.67	4.8090	78.00	4.17	29.9360	5.63	40.4160	2.2754	Dark brown	Dark brown	Loose
43	Slightly curved	Brown	Medium	154.40	15.44	64.77	11.40	2.42	1.64	11.00	2.84	18.3940	0.33	2.1370	62.00	5.52	35.7510	6.15	39.8320	2.4497	Brown	Brown	Loose
44	Slightly curved	Light brown	Coarse	137.30	13.73	50.68	12.95	2.30	1.79	21.67	4.14	26.9830	1.06	5.3730	67.00	5.05	25.5960	8.60	43.5880	3.7486	Dark brown	Dark brown	Loose
45	Slightly curved	Dark brown	Medium	159.90	15.99	62.54	10.70	2.59	1.52	9.33	3.45	21.5760	0.52	3.2520	51.00	4.27	26.7040	7.83	48.9680	3.8342	Dark brown	Dark brown	Loose
46	Slightly curved	Dark brown	Medium	195.40	19.54	51.18	12.05	2.31	1.76	12.33	3.21	16.4280	1.21	6.1920	66.00	5.51	28.1990	8.74	44.7290	3.9093	Dark brown	Dark brown	Loose
47	Slightly curved	Light brown	Medium	181.20	18.12	55.19	11.60	2.49	1.87	17.33	3.64	20.0880	0.58	3.2010	72.00	4.88	26.9320	9.33	51.4900	4.8040	Brown	Brown	Loose
48	Slightly curved	Brown	Medium	150.50	15.05	66.45	11.90	2.29	1.48	7.67	2.99	19.2590	0.37	2.4580	68.00	5.39	35.8140	6.38	42.3920	2.7046	Dark brown	Dark brown	Loose
49	Slightly curved	Light brown	Medium	133.50	13.35	74.91	11.80	2.23	1.44	8.33	3.19	23.8950	0.74	5.5430	70.00	3.96	29.6630	5.36	40.1490	2.1520	Brown	Brown	Loose
50	Slightly curved	Brown	Coarse	126.20	12.62	79.24	9.75	2.25	1.56	8.00	2.87	22.7420	0.48	3.8030	63.00	4.04	32.0130	5.55	43.9780	2.4408	Brown	Brown	Loose
51	Slightly curved	Brown	Medium	214.90	21.49	46.53	13.85	2.64	1.72	20.67	4.13	19.2180	1.78	8.2830	72.00	5.95	27.6870	9.90	46.0680	4.5607	Brown	Brown	Loose
52	Slightly curved	Light brown	Coarse	123.50	12.35	80.97	8.35	2.30	1.72	17.33	3.23	26.1540	0.54	4.3720	55.00	3.93	31.8220	5.15	41.7000	2.1476	Brown	Brown	Loose
53	Slightly curved	Light brown	Medium	109.30	10.93	91.49	9.15	2.02	1.57	10.33	2.21	20.2190	0.51	4.6660	61.00	4.40	40.2560	3.60	32.9370	1.1857	Brown	Brown	Loose
54	Slightly curved	Dark brown	Medium	89.30	8.93	111.98	6.10	2.22	1.68	9.00	1.94	21.7250	0.52	5.8230	36.00	3.00	33.5950	3.22	36.0580	1.1611	Brown	Brown	Loose
55	Slightly curved	Dark brown	Coarse	221.20	22.12	45.21	12.60	2.43	1.62	11.66	2.69	12.1610	1.73	7.8210	85.00	6.72	30.3790	7.79	35.2170	2.7434	Brown	Brown	Loose
56	Slightly curved	Light brown	Coarse	129.70	12.97	77.10	9.10	2.42	1.54	10.00	2.64	20.3350	0.32	2.4670	51.00	3.78	29.1440	5.46	42.0970	2.2985	Dark brown	Dark brown	Loose
57	Slightly curved	Light brown	Coarse	155.70	15.57	64.23	9.90	2.79	1.60	15.33	3.27	21.0020	0.52	3.3390	52.00	5.02	32.2410	6.22	39.9490	2.4848	Brown	Brown	Loose
58	Slightly curved	Dark brown	Medium	105.90	10.59	94.43	7.90	2.25	1.56	11.33	2.20	20.7740	0.21	1.9830	42.00	3.28	37.4770	4.30	49.1310	2.1126	Brown	Brown	Loose
59	Slightly curved	Dark brown	Medium	153.00	15.30	65.36	10.70	2.62	1.42	6.67	2.62	17.1240	0.47	3.0720	70.00	4.00	26.1440	6.87	44.9020	3.0849	Dark brown	Dark brown	Loose
60	Slightly curved	Light brown	Medium	163.70	16.37	61.09	12.10	2.42	1.57	11.67	3.09	18.8760	0.69	4.2150	75.00	6.14	37.5080	5.83	35.6140	2.0763	Brown	Brown	Loose
61	Slightly curved	Dark brown	Medium	103.60	10.36	96.53	8.35	2.11	1.53	6.57	2.32	22.3940	0.43	4.1510	64.00	3.56	34.3630	3.76	36.2930	1.3646	Brown	Brown	Loose
62	Slightly curved	Dark brown	Fine	171.90	17.19	58.17	11.05	2.60	1.53	15.67	2.79	22.0480	0.68	3.3560	61.00	4.81	27.9810	7.96	46.3060	3.6860	Dark brown	Dark brown	Loose
63	Slightly curved	Light brown	Medium	167.10	16.71	59.84	11.95	2.65	1.52	13.33	2.6[illegible]	15.9190	0.84	5.0270	62.00	5.17	30.9390	7.85	45.3620	3.5609	Dark brown	Dark brown	Loose
64	Slightly curved	Light brown	Coarse	141.40	14.14	70.72	10.65	2.19	1.58	12.67	2.62	18.5290	0.92	6.5060	69.00	5.16	36.4920	5.06	35.7850	1.8107	Brown	Brown	Loose
65	Slightly curved	Light brown	Medium	163.10	16.31	61.21	12.65	2.23	1.48	12.67	3.3[illegible]	20.2940	0.69	4.2310	73.00	5.55	34.0280	6.18	37.8910	2.3417	Dark brown	Dark brown	Loose
66	Slightly curved	Light brown	Medium	100.20	10.02	99.80	9.75	2.22	1.45	4.67	[illegible]	16.9650	0.36	3.5930	41.00	2.35	23.4530	4.58	45.7090	2.0935	Dark brown	Dark brown	Loose
67	Slightly curved	Dark brown	Medium	152.20	15.22	65.70	12.35	2.46	1.66	9.00	3.26	21.4190	1.13	7.4240	43.00	4.92	32.3260	6.03	39.6190	2.3890	Dark brown	Dark brown	Loose
68	Slightly curved	Dark brown	Coarse	146.10	14.61	68.45	10.25	2.40	1.70	14.67	2.64	18.0690	0.32	2.1900	58.00	4.19	28.6790	5.21	42.5050	2.6396	Dark brown	Dark brown	Loose
69	Slightly curved	Brown	Coarse	174.20	17.42	57.41	10.95	2.47	1.56	13.67	3.26	18.7140	0.59	3.3870	68.00	4.79	27.4970	6.16	35.3620	2.1783	Dark brown	Dark brown	Loose
70	Slightly curved	Dark brown	Medium	120.50	12.05	82.99	7.95	2.50	1.67	12.67	2.31	19.1700	0.44	3.6510	45.00	3.02	25.0620	5.51	45.7260	2.5195	Dark brown	Dark brown	Loose
71	Slightly curved	Dark brown	Coarse	132.10	13.21	75.70	9.60	2.12	1.57	14.33	2.72	20.5900	0.38	2.8770	60.00	4.49	33.9890	4.93	37.3200	1.8399	Brown	Brown	Loose
72	Slightly curved	Dark brown	Fine	195.70	19.57	51.10	13.50	2.57	1.74	15.33	4.03	20.5930	0.81	4.1390	78.00	5.61	28.6660	7.80	39.8570	3.1088	Dark brown	Dark brown	Loose
73	Slightly curved	Dark brown	Medium	109.20	10.92	91.58	6.00	2.28	2.15	8.33	2.03	18.5890	0.27	2.4730	21.00	2.96	27.1060	4.91	44.9630	2.2077	Brown	Brown	Loose
74	Slightly curved	Dark brown	Medium	245.40	24.54	40.75	14.75	2.65	1.77	14.33	5.00	20.3750	1.96	7.9870	72.00	6.50	26.4870	10.21	41.6[illegible]60	4.2480	Dark brown	Dark brown	Loose
75	Slightly curved	Light brown	Coarse	130.50	13.05	76.63	9.35	2.13	1.60	7.33	2.22	17.0110	0.77	5.9000	66.00	4.84	37.0890	4.60	35.2490	1.6215	Brown	Brown	Loose
76	Slightly curved	Dark brown	Medium	156.20	15.62	64.02	11.75	1.94	1.48	7.67	2.99	19.1420	0.54	3.4570	38.00	5.31	33.9950	6.63	42.4450	2.8142	Dark brown	Dark brown	Loose
77	Slightly curved	Dark brown	Medium	128.20	12.82	78.00	10.35	2.43	1.46	15.00	2.45	19.1110	0.31	2.4180	56.00	4.02	31.3570	5.51	42.9790	2.3681	Brown	Brown	Loose
78	Slightly curved	Dark brown	Coarse	91.10	9.11	109.77	5.65	2.23	1.94	5.33	1.59	17.4530	0.22	2.4150	35.00	2.69	29.5280	3.92	43.0290	1.6857	Dark brown	Dark brown	Loose
79	Slightly curved	Light brown	Coarse	162.50	16.25	61.54	12.40	2.39	1.53	13.00	2.95	18.1540	0.56	3.4460	74.00	6.02	37.0460	5.89	36.2460	2.1349	Brown	Brown	Loose
80	Slightly curved	Brown	Medium	116.20	11.62	85.98	9.60	2.43	1.47	[illegible]	2.75	23.6490	0.48	4.1270	60.00	3.28	28.2030	4.57	39.2950	1.7958	Dark brown	Dark brown	Loose
81	Slightly curved	Brown	Medium	125.60	12.56	79.62	10.95	1.97	1.38	14.33	2.46	19.5860	0.45	3.5830	67.00	4.13	32.8820	4.45	35.4290	1.5766	Dark brown	Dark brown	Loose
82	Slightly curved	Light brown	Coarse	148.30	14.83	67.43	11.40	2.10	1.40	17.00	3.09	20.8360	0.40	2.6970	67.00	4.62	31.1530	5.64	38.0310	2.1449	Brown	Brown	Loose
83	Slightly curved	Light brown	Coarse	203.20	20.32	49.21	12.95	2.47	1.83	23.00	3.85	18.9470	1.26	6.2010	56.00	5.21	25.6390	8.99	44.2420	3.9774	Dark brown	Dark brown	Loose
84	Slightly curved	Dark brown	Medium	189.50	18.95	52.77	13.05	2.49	1.73	13.67	3.19	16.8340	0.74	3.9050	54.00	5.32	28.0740	7.68	40.5280	3.1126	Dark brown	Dark brown	Loose
85	Slightly curved	Light brown	Coarse	160.50	16.05	62.31	11.75	2.17	1.48	16.00	2.77	[illegible]	0.51	3.1780	80.00	5.54	34.5170	6.77	42.1810	2.8557	Dark brown	Dark brown	Loose

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100

**Volume = Water replacement

SAENWAENGN (41 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (g)	Ave. Wt. of pod (g)	No. of pod/kg.	Pod Dimension: Length (cm)	Width (cm)	Thickness (cm)	Volume** (cc)	Character of pod: Wt. of shell (g)	% Wt. of shell	Wt. of vein(s) (g)	% Wt. of vein	No. of seed	Wt. of seed (g)	% Wt. of seed	Pulp Wt. (g)	%Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of species

74	Slightly curved	Dark brown	Medium	245.40	24.54	49.75	14.75	2.65	1.77	14.33	5.00	20.3759	0.27	2.4130	31.00	2.96	27.1060	4.91	44.9630	2.2077	Brown	Brown	Loose
75	Slightly curved	Light brown	Coarse	130.50	13.05	76.62	9.35	2.13	1.60	7.33	2.22	17.0110	1.36	7.9870	72.00	6.50	26.4870	10.21	41.6060	4.2490	Dark brown	Dark brown	Loose
76	Slightly curved	Dark brown	Medium	156.20	15.62	64.02	11.75	1.34	1.48	7.57	2.99	19.1420	0.54	3.4570	38.00	5.31	23.9950	6.63	42.4460	2.8142	Dark brown	Dark brown	Loose
77	Slightly curved	Dark brown	Medium	128.20	12.82	78.00	10.25	2.43	1.48	15.00	2.45	19.1110	0.31	2.4180	56.00	4.02	31.3570	5.51	42.9790	2.3581	Brown	Brown	Loose
78	Slightly curved	Dark brown	Coarse	91.10	9.11	109.77	5.65	2.23	1.84	5.33	1.59	17.4520	0.22	2.4150	32.00	2.69	29.5280	3.92	43.0230	1.5867	Dark brown	Dark brown	Loose
79	Slightly curved	Light brown	Coarse	162.50	16.25	61.54	12.40	2.39	1.53	12.00	5.95	18.1540	0.56	3.4460	74.00	6.02	37.0460	5.89	36.2460	2.1349	Brown	Brown	Loose
80	Slightly curved	Brown	Medium	116.30	11.63	85.98	9.50	2.43	1.47	17.33	2.75	23.6460	0.48	4.1270	60.00	3.28	28.2530	4.57	39.2950	1.7958	Dark brown	Dark brown	Loose
81	Slightly curved	Light brown	Coarse	148.30	14.83	67.43	11.40	2.10	1.48	17.00	3.09	20.8360	0.40	2.5970	67.00	4.13	32.8820	4.45	35.4290	1.5766	Dark brown	Dark brown	Loose
82	Slightly curved	Light brown	Coarse	203.20	20.32	49.21	12.95	2.47	1.83	23.00	3.85	18.9470	1.26	6.2010	56.00	5.21	25.6390	8.99	44.2420	3.9774	Dark brown	Dark brown	Loose
84	Slightly curved	Dark brown	Medium	189.50	18.95	52.77	13.05	2.49	1.73	13.67	3.19	16.8340	0.74	3.9050	64.00	5.22	28.0740	7.68	40.5280	3.1125	Dark brown	Dark brown	Loose
85	Slightly curved	Light brown	Coarse	160.50	16.05	62.31	11.75	2.17	1.48	16.00	2.73	17.0090	0.51	3.1700	80.00	5.54	34.5170	6.77	43.1810	2.8557	Dark brown	Dark brown	Loose

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100

**Volume = Water replacement

SABONNAERON (41 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness (cm)	Volume** (cm³)	Character of pod Wt. of shell (gm)	% Wt. of shell	Wt. of vein (gm)	% Wt. of vein	No. of seed	Wt. of seed (gm)	% Wt. of seed	Pulp Wt. (gm)	% Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Half circular	-	-	778.25	77.83	12.85	19.94	3.27	2.30	142.81	11.33	14.5520	-	-	11.13	19.34	24.8480	40.80	52.4250	21.3894	-	-	-	
2	Half circular	-	-	533.25	53.33	18.75	18.13	2.70	1.92	94.11	8.21	15.4020	-	-	10.25	12.59	23.6060	26.70	50.0700	11.2687	-	-	-	
3	Half circular	-	-	489.38	48.94	20.43	16.06	2.45	1.94	76.47	10.26	20.9710	-	-	8.75	10.95	22.3750	15.45	31.5710	6.8777	-	-	-	
4	Straight	-	-	511.90	51.19	19.54	15.30	2.70	1.98	82.02	14.90	29.1070	-	-	8.20	10.72	20.9420	24.21	47.2940	11.4499	-	-	-	
5	Half circular	-	-	387.20	38.72	25.83	14.70	2.21	1.89	64.19	6.42	16.5810	-	-	10.70	9.91	25.5940	20.72	53.5290	11.0984	-	-	-	
6	Half circular	-	-	494.00	49.40	20.24	19.75	2.26	1.59	102.50	15.15	30.7300	-	-	9.83	12.55	25.4560	20.55	[illegible].6940	8.5661	-	-	-	
7	Half circular	-	-	384.00	38.40	26.04	16.25	2.38	1.67	64.58	6.74	17.5620	-	-	10.10	11.96	31.1460	18.77	48.8890	9.1748	-	-	-	
8	Half circular	-	-	505.85	50.59	19.77	17.73	2.57	1.71	78.22	9.14	18.0680	-	-	10.57	13.06	25.8110	26.17	51.7360	13.5398	-	-	-	
9	Half circular	-	-	617.33	61.73	16.20	19.50	2.99	1.88	103.89	15.52	25.1360	-	-	10.17	15.06	24.3790	27.03	43.7900	11.8378	-	-	-	
10	Straight	-	-	457.67	45.77	21.85	17.50	2.58	1.61	70.51	9.12	19.9200	-	-	8.00	10.67	23.3070	19.38	42.3510	8.2069	-	-	-	
11	Half circular	-	-	548.40	54.84	18.23	18.00	2.72	1.84	90.10	10.39	20.0406	-	-	9.30	14.81	25.5470	25.20	[illegible].9520	11.5799	-	-	-	
12	Half circular	-	-	617.71	61.77	16.19	21.36	2.38	1.76	89.62	17.26	27.9370	-	-	11.43	17.50	28.3300	20.99	32.3740	7.1234	-	-	-	
13	Half circular	-	-	687.30	68.73	14.47	22.20	2.85	1.95	123.25	12.28	20.3210	-	-	10.40	16.96	27.9270	21.56	35.5810	7.6540	-	-	-	
14	Half circular	-	-	736.75	73.68	13.57	23.25	2.94	2.[illegible]	182.75	19.60	26.6020	-	-	11.25	18.23	24.8730	27.20	36.9190	10.0420	-	-	-	
15	Straight	-	-	579.78	57.98	17.25	21.94	2.72	1.68	200.15	10.37	17.8810	-	-	8.17	13.60	23.4570	28.13	48.5240	13.6513	-	-	-	
16	Half circular	-	-	344.88	34.49	29.00	15.75	1.92	1.92	59.41	11.95	34.6490	-	-	9.63	11.33	32.8380	11.99	34.7590	4.1663	-	-	-	
17	Straight	-	-	534.00	53.40	18.72	16.00	2.90	1.96	90.96	14.04	26.2980	-	-	8.13	8.79	16.4570	24.93	46.6760	11.0340	-	-	-	
18	Half circular	-	-	789.57	78.[illegible]	12.67	27.71	3.04	1.84	155.21	17.57	22.2920	-	-	12.14	16.54	20.9780	35.51	45.2260	15.9941	-	-	-	
19	Half circular	-	-	831.80	83.18	12.02	25.00	2.82	2.03	142.92	16.36	19.6680	-	-	11.80	18.86	22.6740	36.70	44.1210	16.1924	-	-	-	
20	Straight	-	-	580.25	58.03	17.23	19.25	3.10	1.79	100.7[illegible]	15.85	18.5390	-	-	9.12	11.81	20.2580	29.21	50.3460	14.7076	-	-	-	
21	Half circular	-	-	506.33	50.33	19.75	17.38	2.62	1.98	90.24	13.88	27.4030	-	-	9.00	13.78	27.2060	15.78	[illegible].1560	4.9149	-	-	-	
22	Straight	-	-	529.68	52.99	18.87	16.88	2.78	1.92	90.12	17.40	32.8382	-	-	9.50	11.33	21.3890	21.11	39.8450	8.4125	-	-	-	
23	Half circular	-	-	269.25	26.93	37.13	15.21	2.56	1.42	55.47	9.46	35.1180	-	-	7.14	7.17	26.6290	7.94	29.4960	2.3429	-	-	-	
24	Half circular	-	-	315.49	31.54	31.71	16.20	2.80	1.57	71.09	6.60	2[illegible].2610	-	-	8.20	10.42	23.0370	7.66	24.2870	1.8604	-	-	-	
25	Straight	-	-	271.80	27.18	36.79	16.30	2.47	1.50	60.24	7.12	26.1960	-	-	7.60	8.14	29.9480	5.68	20.8980	1.1870	-	-	-	
26	Half circular	-	-	382.40	38.24	26.15	18.40	2.58	1.52	76.38	10.64	27.8240	-	-	9.00	10.92	28.5560	9.72	25.4180	2.4706	-	-	-	
27	Straight	-	-	270.00	27.00	37.04	11.60	2.45	1.75	50.63	5.38	19.9260	-	-	4.40	3.62	13.4070	11.02	40.8150	4.4578	-	-	-	
28	Half circular	-	-	426.50	42.65	23.45	18.25	2.52	1.47	67.68	13.15	30.8320	-	-	7.75	10.50	24.6190	10.28	24.2260	2.5238	-	-	-	
29	Straight	-	-	346.25	34.63	28.88	16.71	2.47	1.54	63.24	11.51	33.2460	-	-	5.57	17.19	50.2060	4.63	13.3670	0.6188	-	-	-	
30	Straight	-	-	460.00	46.00	21.74	21.40	2.82	1.62	96.32	12.22	28.7290	-	-	5.40	13.58	30.3910	8.92	19.3910	1.7297	-	-	-	
31	Straight	-	-	347.95	34.79	28.75	14.50	2.58	1.67	62.44	10.54	30.3080	-	-	7.25	6.29	18.0700	10.41	29.9370	2.1176	-	-	-	
32	Half circular	-	-	585.50	58.55	17.08	20.67	3.20	1.84	125.54	18.05	30.8280	-	-	9.67	14.58	24.9070	11.68	19.9540	2.3312	-	-	-	
33	Straight	-	-	528.00	52.80	18.94	23.23	3.09	1.72	124.04	15.23	28.8500	-	-	11.00	18.28	34.6270	8.12	15.3720	1.2479	-	-	-	
34	Half circular	-	-	615.17	61.52	16.26	18.67	3.01	2.00	112.39	15.73	25.5750	-	-	8.83	14.47	23.5170	22.82	37.0910	8.4671	-	-	-	
35	Half circular	-	-	517.14	51.71	19.34	19.50	2.74	1.77	94.64	15.16	29.3090	-	-	9.62	11.50	22.2390	12.76	24.6680	3.1463	-	-	-	
36	Half circular	-	-	446.33	44.63	22.40	16.63	2.04	1.31	37.37	11.90	26.6620	-	-	7.67	7.85	17.5880	14.13	31.6650	4.4752	-	-	-	
37	Half circular	-	-	597.25	59.73	16.74	20.62	3.27	1.86	125.45	14.59	24.4250	-	-	11.28	22.28	37.3090	12.25	20.5110	2.5125	-	-	-	
38	Half circular	-	-	414.67	41.47	24.12	16.75	2.74	1.73	57.94	11.82	28.4970	-	-	9.67	10.37	25.4490	10.98	26.4960	2.9090	-	-	-	
39	Straight	-	-	521.00	52.10	19.12	22.40	2.92	1.82	109.10	13.14	25.1240	-	-	10.40	13.96	26.6920	14.30	27.3420	3.9091	-	-	-	
40	Half circular	-	-	441.25	44.12	20.36	17.12	2.91	2.00	39.52	16.75	34.0970	-	-	7.50	12.70	25.8520	12.71	27.3150	3.8280	-	-	-	
41	Straight	-	-	275.40	27.54	36.31	12.10	2.22	1.78	49.57	9.52	34.5640	-	-	7.00	6.54	24.1100	7.04	25.5630	1.7996	-	-	-	

**Volume = Length x Width x Thickness

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SAKONNAKHON (51 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness (cm)	Volume** (cm³)	Character of pod Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	%Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Slightly curved	Brown	Fine	170.30	17.03	58.72	12.40	2.43	1.48	11.67	3.55	20.8460	0.64	3.7580	81.00	4.62	27.4810	7.32	42.9830	3.1454	Brown	Brown	Loose	
2	Slightly curved	Brown	Fine	229.80	22.98	43.52	13.75	2.61	1.74	21.33	4.90	21.3220	1.30	5.6570	96.00	5.58	24.2820	10.32	44.9090	4.6346	Brown	Brown	Tight	
3	Slightly curved	Brown	Fine	265.10	26.51	37.72	15.55	2.96	1.30	14.67	6.34	23.9160	1.26	4.7530	80.00	8.27	31.1960	9.98	37.6460	3.7571	Brown	Brown	Loose	
4	Slightly curved	Brown	Fine	176.70	17.67	56.59	11.50	2.65	1.62	13.67	3.51	19.8640	0.98	5.5460	96.00	4.13	23.3730	8.28	46.8590	3.8799	Brown	Brown	Loose	
5	Slightly curved	Light brown	Fine	213.40	21.34	46.86	13.50	2.59	1.60	17.00	4.26	19.9630	0.77	3.6080	78.00	6.42	30.0840	9.23	43.2520	4.0014	Brown	Brown	Tight	
6	Slightly curved	Brown	Fine	183.60	18.36	54.47	11.38	2.57	1.58	13.00	3.25	17.7020	0.93	5.0650	93.00	5.74	31.2630	8.25	44.9250	3.7071	Brown	Brown	Loose	
7	Half circular	Brown	Coarse	276.70	27.67	36.14	18.75	2.63	1.95	18.00	4.13	14.9260	0.88	3.1800	84.00	5.46	19.7330	9.10	32.2880	2.9382	Brown	Brown	Tight	
8	Slightly curved	Brown	Fine	202.80	20.28	49.31	11.30	2.51	1.59	11.00	6.19	30.5230	1.72	8.4810	32.00	5.40	26.6270	12.80	63.1160	8.0788	Brown	Brown	Loose	
9	Slightly curved	Brown	Fine	138.80	13.88	72.05	10.50	2.18	1.55	5.00	3.10	22.3340	0.80	5.7640	76.00	4.37	31.4810	4.99	35.9510	1.7940	Brown	Brown	Loose	
10	Slightly curved	Brown	Fine	190.00	19.00	52.63	[illegible]	2.59	1.72	9.33	4.31	22.6840	1.05	5.5260	68.00	5.46	28.7370	7.89	41.5260	3.2764	Dark brown	Dark brown	Loose	
11	Slightly curved	Brown	Fine	281.30	28.13	35.55	14.55	3.55	1.72	18.67	6.05	21.5070	2.77	9.8470	68.00	4.14	14.7170	13.68	48.6310	6.6527	Brown	Brown	Loose	
12	Slightly curved	Brown	Coarse	178.90	17.89	55.90	14.15	2.35	1.51	9.06	3.73	20.8490	0.98	5.4780	92.00	5.45	30.4640	7.32	40.9170	2.9951	Dark brown	Dark brown	Loose	
13	Slightly curved	Brown	Fine	132.20	13.22	75.64	10.00	2.21	1.60	5.00	2.99	22.6170	0.61	4.6140	65.00	3.99	30.1820	4.51	34.1150	1.5386	Brown	Brown	Loose	
14	Slightly curved	Brown	Fine	163.10	16.31	61.31	11.70	2.58	1.75	7.67	3.75	22.9920	0.81	4.9660	56.00	4.25	26.2710	6.64	40.7110	2.7032	Dark brown	Dark brown	Loose	
15	Slightly curved	Brown	Fine	137.20	13.72	72.93	9.85	2.27	1.61	7.00	2.89	21.0640	0.58	4.2270	66.00	4.65	33.8920	5.07	36.5930	1.8553	Brown	Brown	Loose	
16	Slightly curved	Light brown	Fine	224.80	22.48	44.48	12.85	3.05	1.96	15.33	3.71	16.5040	1.60	7.1170	53.00	4.73	21.0410	11.22	49.9110	5.6000	Dark brown	Dark brown	Loose	
17	Slightly curved	Brown	Fine	199.10	19.91	50.23	14.15	2.72	1.91	28.33	5.11	25.6650	1.54	7.7350	67.00	3.99	20.0400	9.2[illegible]	46.6590	4.3346	Brown	Brown	Loose	
18	Slightly curved	Brown	Fine	208.70	20.87	47.92	13.23	2.67	1.80	14.00	4.86	23.28[illegible]	0.68	3.2580	6[illegible]	4.83	23.1430	9.50	45.5190	4.3243	Dark brown	Dark brown	Loose	
19	Slightly curved	Brown	Coarse	244.80	24.48	40.85	16.55	2.50	1.91	23.33	5.61	22.91[illegible]	1.53	6.2500	94.00	6.76	27.6140	9.71	39.6650	3.[illegible]	Dark brown	Dark brown	Loose	
20	Slightly curved	Brown	Fine	103.70	10.37	96.43	10.42	1.80	1.44	3.33	1.85	17.839[illegible]	0.55	5.3040	74.00	3.28	31.6290	4.30	41.4660	1.7[illegible]	Brown	Brown	Loose	
21	Slightly curved	Brown	Fine	200.70	20.07	49.83	12.60	2.39	1.69	14.00	4.33	21.5740	1.23	6.1290	97.00	4.96	23.3680	8.02	39.9600	3.2048	Brown	Brown	Loose	
22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
23	Slightly curved	Brown	Coarse	292.20	29.22	34.22	18.45	2.78	1.80	22.67	6.78	23.2030	1.47	5.0310	106.00	6.11	20.9100	10.70	36.6190	3.9182	Brown	Brown	Loose	
24	Slightly curved	Brown	Fine	248.60	24.86	40.22	17.10	2.80	2.25	20.67	4.71	18.9460	1.72	6.9190	76.00	4.09	16.4520	13.18	53.0170	6.9876	Dark brown	Dark brown	Loose	
25	Slightly curved	Brown	Fine	91.00	9.10	109.89	9.05	2.35	1.19	4.33	2.56	28.1320	0.49	5.3850	34.00	1.76	19.3410	3.96	43.5160	1.7232	Brown	Brown	Loose	
26	Slightly curved	Brown	Coarse	168.20	16.82	59.45	14.00	2.30	1.54	6.33	3.87	23.0080	0.68	4.0430	74.00	5.14	30.5590	6.07	36.0880	2.1905	Dark brown	Dark brown	Loose	
27	Slightly curved	Brown	Fine	178.90	17.89	55.90	13.30	2.54	1.68	11.33	4.13	23.0860	0.64	3.5770	75.00	3.53	19.7320	7.02	39.2390	2.7546	Dark brown	Dark brown	Loose	
28	Slightly curved	Brown	Fine	162.00	16.30	61.35	14.30	2.55	1.70	12.33	3.32	20.3680	0.73	4.4790	45.00	3.79	23.2520	6.18	37.9140	2.3431	Dark brown	Dark brown	Loose	
29	Slightly curved	Brown	Coarse	152.90	15.29	65.40	10.70	2.59	1.34	14.67	3.28	21.4520	0.42	2.7470	63.00	2.89	18.9010	7.54	49.3130	3.7182	Dark brown	Dark brown	Loose	
30	Slightly curved	Brown	Coarse	289.20	28.92	34.58	18.75	3.04	1.70	21.67	6.44	22.2680	2.36	8.1600	73.00	6.00	20.7470	12.87	44.5020	5.7274	Dark brown	Dark brown	Tight	
31	Slightly curved	Brown	Fine	208.70	20.87	47.92	14.35	2.71	1.83	14.00	1.21	5.7980	1.21	5.7980	76.00	4.51	21.6090	10.61	50.8390	5.3940	Dark brown	Dark brown	Loose	
32	Slightly curved	Brown	Fine	187.70	18.77	53.28	14.10	2.71	1.44	13.67	4.51	24.0270	0.73	3.8890	81.00	4.00	21.3110	7.75	41.2890	3.1995	Dark brown	Dark brown	Loose	
33	Slightly curved	Brown	Fine	316.30	31.63	31.62	20.57	2.89	1.75	23.67	6.43	20.3290	2.51	7.9360	110.00	8.02	25.3560	12.33	38.9820	4.8065	Brown	Brown	Loose	
34	Slightly curved	Brown	Fine	128.80	12.88	77.64	13.25	2.25	1.47	9.33	3.02	23.4470	0.56	4.3480	61.00	3.35	26.0090	5.16	40.0620	2.0672	Dark brown	Dark brown	Loose	
35	Slightly curved	Brown	Coarse	257.90	25.79	38.77	13.50	2.55	2.15	19.33	4.69	18.1850	1.07	4.1490	86.00	5.97	23.1490	11.86	45.9870	5.4541	Dark brown	Dark brown	Loose	
36	Slightly curved	Brown	Coarse	340.00	34.00	29.41	19.10	3.04	1.92	43.33	7.77	22.8530	1.94	5.7060	90.00	4.89	14.3820	16.09	47.3240	7.6144	Dark brown	Dark brown	Tight	
37	Slightly curved	Light brown	Coarse	188.30	18.83	53.11	12.45	2.86	1.77	20.33	4.25	22.5700	0.95	5.0450	57.00	4.16	22.0920	8.33	44.2280	3.5850	Dark brown	Dark brown	Tight	
38	Slightly curved	Brown	Fine	135.80	13.58	73.64	11.00	2.35	1.65	10.00	3.34	24.5950	0.56	4.1240	59.00	2.58	18.9990	6.08	44.7720	2.7221	Brown	Brown	Loose	
39	Slightly curved	Dark brown	Coarse	197.30	19.73	50.68	11.75	2.67	1.85	16.67	[illegible]	1[illegible].4120	0.76	3.8520	59.00	4.56	23.1120	9.54	48.3530	4.6125	Dark brown	Dark brown	Loose	
40	Slightly curved	Brown	Fine	197.20	19.72	60.68	14.30	2.41	1.62	12.33	4.75	24.0750	0.62	3.1420	86.00	4.82	24.4290	8.15	41.3080	3.3666	Dark brown	Dark brown	Loose	
41	Slightly curved	Brown	Fine	164.90	16.49	60.64	11.60	2.61	1.79	13.67	4.08	24.7420	0.58	3.5170	65.00	3.19	19.3450	6.63	40.2060	2.6657	Dark brown	Dark brown	Loose	
42	Slightly curved	Brown	Fine	153.60	15.36	65.10	11.86	2.44	1.92	10.67	4.52	29.4270	0.68	4.4320	52.00	2.62	17.0570	6.85	44.5960	3.0548	Dark brown	Dark brown	Loose	
43	Slightly curved	Brown	Fine	160.40	16.04	62.34	13.30	2.29	1.65	9.33	3.25	20.2620	0.83	5.1750	72.00	2.60	16.2090	8.83	55.0490	4.8608	Dark brown	Dark brown	Loose	
44	Slightly curved	Brown	Fine	143.60	14.36	69.64	13.30	2.15	1.63	15.67	3.55	24.7210	0.67	4.6660	89.00	3.71	25.8360	4.56	31.7550	1.4480	Brown	Brown	Loose	
45	Slightly curved	Brown	Fine	109.90	10.99	90.99	12.95	2.17	1.55	9.33	2.36	21.4740	0.43	3.9130	66.00	2.27	20.6550	4.63	42.1290	1.9506	Light brown	Light brown	Loose	
46	Slightly curved	Brown	Fine	183.90	18.39	54.38	14.90	2.77	1.55	22.00	4.30	23.3820	1.52	8.2650	64.00	3.40	18.4880	8.37	45.5140	[illegible]	Dark brown	Dark brown	Loose	
47	Slightly curved	Light brown	Fine	178.20	17.82	56.12	14.50	2.44	1.77	15.00	4.20	23.5690	0.92	5.1630	89.00	4.95	27.7780	6.91	38.7770	2.5795	Dark brown	Dark brown	Loose	
48	Slightly curved	Brown	Fine	127.90	12.79	78.19	12.00	2.22	1.37	12.00	3.12	24.3940	0.42	3.2840	75.00	4.33	33.8550	4.31	33.6990	1.4524	Dark brown	Dark brown	Loose	
49	Slightly curved	Brown	Coarse	259.50	25.95	38.54	17.55	2.51	1.66	24.33	5.19	20.0000	1.60	6.1660	99.00	6.51	25.0870	11.64	44.8550	5.2211	Dark brown	Dark brown	Tight	
50	Slightly curved	Brown	Coarse	148.40	14.84	67.39	12.60	2.52	1.57	13.67	2.95	19.8790	0.54	3.6390	72.00	4.16	28.0320	4.70	31.6710	1.4685	Dark brown	Dark brown	-	
51	Slightly curved	Brown	Fine	118.30	11.83	84.53	12.79	2.20	1.52	10.00	2.66	22.4850	0.53	4.4800	66.00	2.52	21.3020	5.36	45.3090	2.4286	Dark brown	Dark brown	Loose	

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100

**Volume = Water replacement

37

48	Slightly curved	Brown	Fine	127.90	12.79	78.19	12.00	2.22	1.37	12.00	3.12	24.3940	6.42	3.2840	75.00	4.33	33.8550	4.31	33.6980	1.4524	Dark brown	Dark brown	Loose
49	Slightly curved	Brown	Coarse	259.50	25.95	38.54	17.55	2.51	1.66	24.33	5.19	20.0000	1.60	6.1660	99.00	6.51	25.0870	11.64	44.8550	5.2211	Dark brown	Dark brown	Tight
50	Slightly curved	Brown	Coarse	148.40	14.84	67.39	12.60	2.52	1.57	13.57	2.95	19.8790	0.54	3.6230	72.00	4.16	28.0320	4.70	31.5710	1.4865	Dark brown	Dark brown	-
51	Slightly curved	Brown	Fine	118.30	11.83	84.53	12.70	2.10	1.52	10.00	2.66	22.4850	0.53	4.4800	66.00	2.52	21.3020	5.36	45.3090	2.4286	Dark brown	Dark brown	Loose

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
**Volume = Water replacement

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UDON THANI (5 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness (cm)	Volume** (cm^3)	Character of pod Wt. of shell(gm)	% Wt. of shell	Wt. of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	% Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Half circular	-	-	347.17	34.72	28.80	24.83	2.79	1.68	116.62	7.47	21.5080	-	-	11.33	10.67	30.7260	15.07	42.3990	6.5389	-	-	-	
2	Half circular	-	-	347.63	34.76	28.77	19.94	3.66	1.71	124.63	7.40	21.2870	-	-	10.00	11.13	32.0020	14.05	40.4170	5.6786	-	-	-	
3	Half circular	-	-	338.40	33.84	29.55	22.80	2.85	1.66	107.87	6.18	18.2620	-	-	12.00	11.88	35.1060	14.44	42.6710	6.1617	-	-	-	
4	Half circular	-	-	260.00	26.00	38.46	15.28	2.56	1.75	79.58	3.25	12.5000	-	-	9.50	7.48	28.7500	13.75	52.8850	7.2717	-	-	-	
5	Half circular	-	-	317.42	31.74	31.50	23.86	2.74	1.65	107.62	5.36	16.8760	-	-	10.00	9.02	28.4060	15.64	49.2800	7.7085	-	-	-	

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
**Volume = Length x Width x Thickness

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NAKHON RATCHASIMA (7 specimens)

No.	Pod shape	Pod shell colour	Pod shell texture	Wt. of 10 pods (gm)	Ave. Wt. of pod (gm)	No. of pod/kg.	Pod Dimension Length (cm)	Width (cm)	Thickness (cm)	Volume** (cm^3)	Character of pod Wt. of shell(gm)	% Wt. of shell	Wt of vein(gm)	% Wt. of vein	No. of seed	Wt. of seed(gm)	% Wt. of seed	Pulp Wt. (gm)	% Pulp Wt.	Real value* of pulp	Pulp colour	Pulp texture	Tightness of pulp	Rank of specimen
1	Half circular	-	-	505.89	50.59	19.77	12.08	2.80	2.06	69.79	11.91	23.5450	-	-	9.47	13.98	27.6320	21.36	42.2190	9.8171	-	-	-	
2	Half circular	-	-	561.19	56.12	17.82	18.30	2.67	1.78	86.76	13.19	23.4990	-	-	9.87	17.68	31.5120	18.40	32.7880	6.0330	-	-	-	
3	Half circular	-	-	225.20	22.52	44.40	17.92	2.64	1.59	75.15	5.08	22.5580	-	-	10.04	8.17	36.2880	7.33	32.5390	2.3845	-	-	-	
4	Half circular	-	-	205.20	20.52	48.73	15.19	2.59	1.55	61.15	4.54	22.2040	-	-	9.46	7.99	39.1040	9.82	48.0620	4.7211	-	-	-	
5	Straight	-	-	204.28	20.44	48.92	14.53	2.65	1.52	58.51	5.09	23.6820	-	-	9.30	8.67	40.3290	9.12	42.4460	3.8723	-	-	-	
6	Half circular	-	-	214.93	21.49	46.53	17.11	2.82	1.57	75.59	4.71	22.0270	-	-	7.89	8.51	40.2890	9.46	44.2220	4.1826	-	-	-	
7	Half circular	-	-	213.78	21.38	46.78	14.22	2.65	1.54	58.12	2.79	17.3950	-	-	6.00	5.21	32.5140	6.21	38.7750	2.4061	-	-	-	

*Real value of pulp = (% Pulp Wt. x Pulp Wt.) / 100
**Volume = Length x Width x Thickness

XN-ABA-544-A
5 1101

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

DATE: 7/29/88

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. 5, 243
PR #3 May-Oct 87 rec'd 7/29/88

Attachment

XN-ABA-544-A
5743
5.243

PROGRESS REPORT

PROGRESS REPORT NO.3

(MAY - OCTOBER, 1987)

COLLECTION AND UTILIZATION OF TAMARIND GERMPLASM

A RESEARCH PROJECT

GRANT NO. 936-5542-G-00-6026-00

SUBMITTED BY

DR.SUMRIT FEUNGCHAN
PROJECT LEADER

FACULTY OF AGRICULTURE
KHON KAEN UNIVERSITY
KHON KAEN 40002. THAILAND

3424

I Rec'd in SCI: JUL 29 1988

40

PROGRESS REPORT

PROGRESS REPORT NO.3

(MAY - OCTOBER, 1987)

COLLECTION AND UTILIZATION OF TAMARIND GERMPLASM

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PROJECT LEADER

FACULTY OF AGRICULTURE

KHON KAEN UNIVERSITY

KHON KAEN 40002, THAILAND

41

Project Profile

Country : Thailand

Grant No. : 936-5542-G-00-6026-00

Program : Program on Science and Technology Cooperation

Project Title : "Collection and Utilization of Tamarind Germplasm."

Progect Leader : Dr.Sumrit Feungchan

Organization : Department of Plant Science
Faculty of Agriculture
Khon Kaen University
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Total Project Budget : US $ 150,000.

Project Duration : 3 years.

Reporting Period : May-October, 1987

Budget Allocation for This Period : 623,027.36 Baht.

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1. Background/Introduction

The research work has been done in this period as mention in the second progress report such as a biomass study, collection of accessions in the form of grafted plants (sweet and sour types) in the different localities, rootstock study has been trying to find dwarf tamarind by vegetal propagation techniques from the seedlings of non-type dwarf mother plants, Rhizobium strain has been tried to proof the existence of the bacteria in tamarind root and the technology in tamarind production as well.

2. Objectives

1) To evaluate the accessions.

2) To select and develop rootstock.

3) To proof the existence of rhizobium in tamarind root.

4) To develop the technology of tamarind production.

3. Materials and Methods

3.1 Field collection

3.1.1 Collection of grafted plants from accessions

The number of 71 accessions of sour tamarind have been selected based on the Real Value of pulp from the different parts of the country. The accessions were carefully examined and only 12 accessions remained for further investigation. All these accessions were propagated by means of side approached grafting for further evaluation.

3.2 Testing of germplasm

3.2.1 Biomass study.

The number of 90 accessions were planted from seed in the field and containers, 24 seedlings of each accession are used in separated trial. The spacing of field experiment is 2x2 meters. The observation is carried out in the rate of growth, canopy performance, number of stomata etc.

3.3 Rootstock study

3.3.1 The search for dwarf rootstock

To search the untended dwarf phenotypic expression and collect the seeds from the plants mentioned above. The seedlings of the dwarf mother plants are identified by stomatal counting techniques. (Majumder et al, 1972)

3.3.2 The search for rootstock plants other than tamarind rootstock

To collect and test the other closely related species to tamarind for rootstock studies including nodulation leguminous plants.

3.3.3 Chemical treatment for the production of dwarf rootstock

To control canopy size for the production of dwarf tamarind rootstock by using a certain inhibiting substances namely SADH, CCC, MH, and Paclobutazol. The seeds are treated by prolonged soaking method in solution for 6 hours at various concentrations viz. 1000,2000,3000,4000, and 5000, ppm. The number of 25 seeds are soaked in the defferent rates of concentration and required 4 replications. The treated seeds are sown in the containers and growth rate, canopy size, number of stomata etc. will be investigated at seedling stage.

3.4 Rhizobium studies

3.4.1 To study the isolation of Rhizobium from tamarind.

Rhizobium associated with tamarind was isolated from the root samples. Forty three young seedlings with various ages were collected from experimental plot. The root samples were washed five times with sterile distilled water and immersed in 70% ethanol for 1 minute and 3 % sodiumhyperchlorite solution for 1-3 minutes respectively. After surface sterilization, the root samples were washed three times with sterile distilled water and chopped 4 cm. in length. Each piece of root was blended together with a small amount of sterile water. An aliquot of the solution was streaked over the surface of yeast extract mannitol congo red agar medium (YMCA) (Appendix I) in the sterile petridish for cultivation of Rhizobium, and smeared over the surface of glass slide for staining with carbol fuchsin dye (Appendix II). The morphology of rhizobium cells was observed by light microscope after staining, and the characteristics of white mucous colonies that did not absorb red colour from mannitol congo red agar medium which was the characteristics of rhizobium cultures were selected after incubation at 30 C or room temperature for 5-7 days.

3.5 Cultural practice and Demonstration

3.5.1 To study the effect of plant regulators on fruit setting.

Preliminary study on the effect of the different plant regulators and rates of concentration for the fruit setting of sweet tamarind as following :

4 - CPA	conc.	5,	10,	15	and	20 ppm.
GA_3	conc.	5,	10,	15	and	20 ppm.
NAA	conc.	50,	100,	150	and	200 ppm.
SADH	conc.	500,	1000,	1500	and	2000 ppm.

Each chemical concentration applied to the 5 plants at flowering stage and the number of fruit setting recorded

4. Results / Discussion / Tables :

4.1 Germplasm collection

From Table 1 showing the total number of 1191 grafted plants from 42 accessions. The remained accessions are unobtainable grafting due to defect of propagation techniques in some locations. However the grafted plants are still trying to solve the problems in the coming March.

Table 1 Number of grafted plants from accessions

Code of accessions	No.of grafted plants	Collection place (province)
86-2-13-001	4	Sakon Nakhon
86-2-13-019	-	ditto
86-2-13-018	-	ditto
86-2-13-020	-	ditto
86-2-13-015	-	ditto
86-2-13-008	5	ditto
86-2-13-002	4	ditto
86-2-13-009	11	ditto
86-2-13-017	-	ditto
86-2-13-001	6	ditto
86-2-13-004	14	ditto
86-2-13-005	2	ditto
86-2-13-014	18	ditto
86-2-08-038	2	Mukdahan
86-2-08-028	10	ditto
86-2-08-083	-	ditto
86-2-08-183	4	ditto
86-2-08-016	1	ditto

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Code of accessions	No.of grafted plants	Collection place (province)
86-2-08-095	-	ditto
87-2-08-003	12	ditto
87-2-08-027	7	ditto
87-2-08-025	8	ditto
87-2-08-014	5	ditto
87-2-08-023	9	ditto
87-2-08-005	-	ditto
87-2-17-021	57	Ubon Ratchathani
87-2-17-022	64	ditto
87-2-17-011	86	ditto
87-2-17-009	70	ditto
87-2-17-016	86	ditto
87-2-17-008	82	ditto
87-2-17-026	31	ditto
87-2-01-035	50	Nakhon Ratchasima
87-2-09-017	43	Yasothon
87-3-20-002	1	Samut Sakhon
87-4-13-003	10	Satun
87-2-01-005	95	Kalasin
87-1-02-001	99	Chiang Rai
87-1-02-002	49	ditto
87-1-02-003	57	ditto
87-1-02-004	100	ditto
87-1-02-005	87	dit
Total	1191	

4.2 Rootstock study

4.2.1 The search for dwarf rootstock

Table 2 showing the dwarf trait of rootstack and the stomata number at seedling stage are counted and classified for grouping of rootstock. (Table 3 and fig.1)

Table 2 Characteristics of rootstock mother plants

Rootstock No.	Canopy Height (m.)	Canopy Width (m.)	Canopy Length (m.)	Trunk-diameter (m.)	Estimated Age. (year)
1	11.00	13	11.00	1.10	50
2	10.00	10.70	8.00	0.95	30
3	7.00	7.00	6.60	0.65	40
4	7.00	9.30	9.00	0.70	40
5	7.00	6.50	5.00	0.50	40
6	7.00	4.00	3.70	0.20	40
7	7.00	6.90	5.80	0.45	40
8	8.00	7.00	6.00	0.55	40
9	7.00	9.30	7.50	1.00	40
10	6.00	7.50	8.00	0.90	40

Table 3. Grouping of tamarind rootstock based on number of stomata

Rootstock No.	Seedling No.	Number of stomata
2	2/25	3.92
2	2/30	4.34
3	3/5	4.82
2	2/12	4.90
2	2/20	4.92
2	2/6	4.98
2	2/44	5.00
2	2/50	5.00
2	2/46	5.00
6	6/28	5.00
2	2/48	5.02
6	6/6	5.02
7	7/2	5.00
3	3/3	5.08
4	4/31	5.08
3	3/10	5.10
10	10/8	5.12
3	3/1	5.12
7	7/48	5.15
2	2/19	5.18
5	5/6	5.18
7	7/21	5.18
7	7/39	5.18
8	8/16	5.18
7	7/43	5.20
7	7/37	5.20
8	8/37	5.22
8	8/29	5.22
1	1/19	5.24
3	3/24	5.24
7	7/40	5.24
1	1/18	5.26
2	2/2	5.26
2	2/9	5.26
6	6/3	5.26
9	9/32	5.26
9	9/38	5.26
10	10/35	5.28
8	8/20	5.28

Rootstock No.	Seedling No.	Number of stomata
8	8/50	5.28
5	5/20	5.32
7	7/16	5.32
6	6/27	5.33
2	2/8	5.34
7	7/32	5.34
2	2/14	5.36
9	9/41	5.36
2	2/1	5.38
8	8/25	5.38
9	9/28	5.38
2	2/21	5.40
4	4/42	5.40
6	6/2	5.40
9	9/16	5.40
7	7/35	5.44
6	6/15	5.46
7	7/30	5.46
2	2/41	5.48
3	3/16	5.48
4	4/23	5.48
3	3/45	5.50
7	7/5	5.50
7	7/28	5.50
7	7/42	5.50
9	9/33	5.50
1	1/10	5.52
2	2/31	5.52
2	2/4	5.52
4	4/20	5.54
4	4/32	5.54
4	4/38	5.54
7	7/3	5.54
8	8/22	5.54
9	9/25	5.54
1	1/15	5.56
1	1/40	5.56
5	5/41	5.56
5	5/9	5.56
7	7/15	5.56
8	8/24	5.56
9	9/6	5.56
8	8/38	5.57

Rootstock No.	Seedling No.	Number of stomata
10	10/7	5.74
10	10/19	5.74
3	3/12	5.74
4	4/1	5.74
5	5/17	5.74
9	9/36	5.74
9	9/46	5.75
3	3/20	5.76
3	3/15	5.78
4	4/39	5.78
5	5/50	5.78
6	6/9	5.78
7	7/12	5.78
3	3/47	5.80
3	3/42	5.80
4	4/36	5.80
5	5/47	5.80
8	8/42	5.80
8	8/32	5.80
1	1/1	5.82
2	2/38	5.82
3	3/29	5.82
4	4/10	5.82
7	7/29	5.82
7	7/22	5.83
2	2/12	5.84
3	3/37	5.84
3	3/41	5.84
5	5/7	5.84
8	8/39	5.85
2	2/39	5.86
4	4/29	5.86
7	7/18	5.86
10	10/11	5.88
4	4/44	5.88
5	5/3	5.88
5	5/2	5.88
6	6/5	5.88
8	8/18	5.88
9	9/5	5.88
9	9/29	5.88
2	2/36	5.90
2	2/7	5.90

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Rootstock No.	Seedling No.	Number of stomata
10	10/3	5.58
2	2/42	5.58
6	6/18	5.58
6	6/25	5.58
7	7/26	5.58
8	8/30	5.58
10	10/44	5.59
3	3/48	5.60
3	3/8	5.60
3	3/32	5.60
3	3/27	5.60
3	3/2	5.60
1	1/21	5.60
5	5/34	5.60
7	7/23	5.60
8	8/17	5.60
3	3/11	5.62
4	4/34	5.62
7	7/4	5.62
4	4/17	5.64
5	5/27	5.64
9	9/9	5.66
8	8/40	5.67
2	2/15	5.68
4	4/48	5.68
5	5/26	5.68
5	5/23	5.68
7	7/13	5.68
4	4/13	5.70
4	4/50	5.70
6	6/11	5.70
6	6/14	5.70
9	9/49	5.70
1	1/44	5.72
1	1/41	5.72
2	2/28	5.72
2	2/29	5.72
5	5/8	5.72
6	6/4	5.72
8	8/2	5.72
6	6/13	5.73
8	8/47	5.73
9	9/23	5.73

Rootstock No.	Seedling No.	Number of stomata
4	4/16	5.90
7	7/27	5.90
7	7/25	5.90
8	8/27	5.90
9	9/45	5.90
9	9/39	5.90
2	2/33	5.92
5	5/24	5.92
10	10/28	5.93
4	4/27	5.94
2	2/45	5.95
1	1/14	5.96
10	10/4	5.96
10	10/20	5.96
2	2/20	5.96
4	4/33	5.96
7	7/9	5.96
10	10/22	5.98
4	4/13	5.98
5	5/39	5.98
6	6/30	5.98
6	6/10	5.98
6	6/19	5.98
8	8/4	5.98
1	1/2	6.00
10	10/24	6.00
2	2/47	6.00
4	4/21	6.00
4	4/45	6.00
6	6/8	6.00
7	7/11	6.00
7	7/49	6.00
10	10/16	6.02
2	2/5	6.02
5	5/46	6.02
7	7/36	6.02
1	1/5	6.04
3	3/38	6.04
6	6/12	6.04
9	9/43	6.04
9	9/4	6.04
10	10/5	6.06
4	4/5	6.06

Rootstock No.	Seedling No.	Number of stomata
4	4/2	6.06
7	7/8	6.06
9	9/31	6.06
1	1/45	6.08
10	10/29	6.08
6	6/16	6.08
7	7/47	6.08
8	8/41	6.08
1	1/21	6.10
10	10/47	6.10
2	2/35	6.10
2	2/3	6.10
3	3/44	6.10
5	5/19	6.10
7	7/46	6.10
7	7/33	6.10
8	8/44	6.10
9	9/47	6.10
9	9/26	6.10
9	9/21	6.10
1	1/23	6.12
4	4/47	6.12
7	7/20	6.12
10	10/34	6.14
2	3/6	6.14
4	4/37	6.14
5	5/38	6.14
6	6/21	6.14
6	6/22	6.14
8	8/48	6.14
10	10/43	6.15
10	10/23	6.16
10	10/10	6.16
2	2/13	6.16
3	3/50	6.16
3	3/17	6.16
3	3/21	6.16
3	3/25	6.18
4	4/19	6.18
5	5/1	6.18
10	10/25	6.20
2	2/49	6.20
3	3/39	6.20

Rootstock No.	Seedling No.	Number of stomata
6	6/24	6.20
9	9/49	6.20
9	9/30	6.20
1	1/42	6.22
1	1/17	6.22
1	1/25	6.22
3	3/9	6.22
3	3/28	6.22
3	3/4	6.22
3	3/36	6.22
4	4/22	6.22
5	5/43	6.22
10	10/45	6.23
2	2/13	6.24
4	4/15	6.24
5	5/11	6.24
7	7/38	6.24
3	3/35	6.28
3	3/49	6.28
8	8/26	6.28
7	7/50	6.30
1	1/21	6.32
3	3/43	6.32
3	3/26	6.32
8	8/12	6.33
10	10/37	6.34
9	9/44	6.34
9	9/22	6.34
2	2/17	6.36
5	5/12	6.36
8	8/46	6.36
8	8/19	6.36
9	9/37	6.36
3	3/23	6.38
4	4/41	6.38
5	5/28	6.38
6	6/7	6.38
1	1/28	6.40
1	1/43	6.40
1	1/11	6.40
8	8/5	6.40
2	2/27	6.42
1	4/28	6.42

Rootstock No.	Seedling No.	Number of stomata
5	5/35	6.42
1	1/26	6.44
10	10/17	6.44
5	5/15	6.44
5	5/16	6.44
9	9/40	6.44
1	1/38	6.46
10	10/42	6.46
10	10/49	6.46
3	3/30	6.46
4	4/9	6.46
4	4/24	6.46
4	4/3	6.48
5	5/10	6.48
9	9/1	6.48
8	8/35	6.50
9	9/11	6.50
9	9/15	6.50
5	5/37	6.52
9	9/10	6.52
10	10/39	6.54
2	2/40	6.54
6	6/20	6.54
7	7/34	6.54
8	8/43	6.54
10	10/13	6.56
8	8/15	6.58
9	9/34	6.58
10	10/26	6.60
2	2/24	6.60
8	8/13	6.60
1	1/29	6.62
5	5/4	6.62
5	5/32	6.62
9	9/13	6.62
5	5/42	6.64
10	10/48	6.65
1	1/46	6.66
4	4/35	6.66
8	8/6	6.66
9	9/18	6.66
3	3/14	6.68
4	4/14	6.68

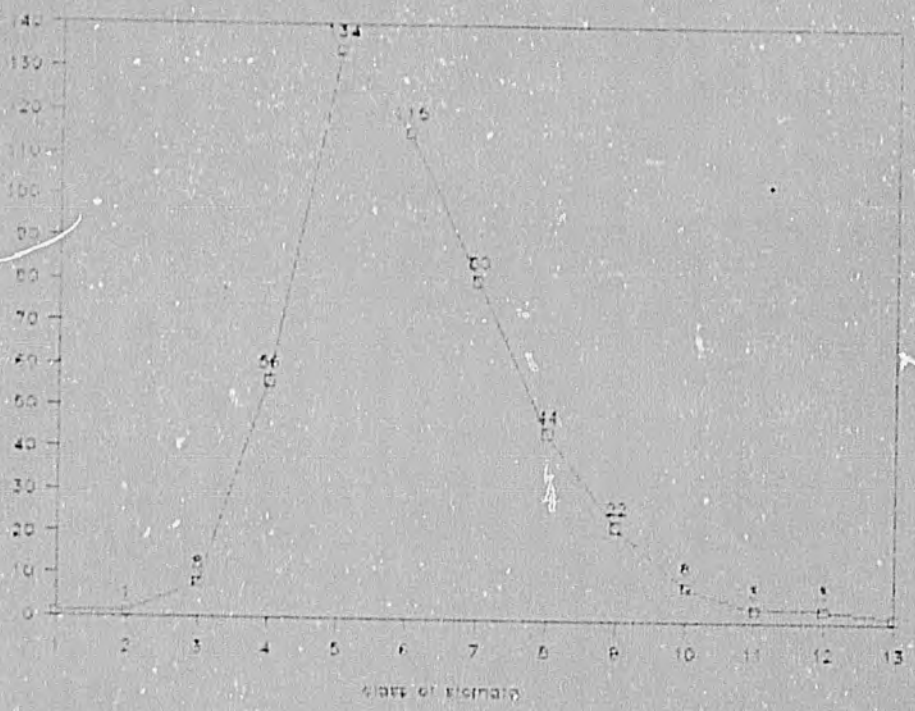
Rootstock No.	Seedling No.	Number of Stomata
4	4/4	6.68
5	5/30	6.68
5	5/45	6.68
8	8/25	6.68
10	10/14	6.70
5	5/25	6.70
1	1/22	6.72
3	3/40	6.72
5	5/31	6.72
5	5/5	6.72
8	8/31	6.72
1	1/31	6.74
5	5/13	6.74
3	3/16	6.76
9	9/42	6.76
9	9/35	6.76
3	3/13	6.78
8	8/19	6.78
10	10/38	6.80
7	7/17	6.80
8	8/33	6.80
8	8/11	6.80
9	9/12	6.80
3	3/33	6.82
5	5/40	6.82
2	2/22	6.83
6	6/1	6.84
9	9/7	6.84
9	9/3	6.85
2	2/23	6.86
2	2/11	6.86
7	7/10	6.86
9	9/8	6.88
10	10/6	6.88
3	3/7	6.88
5	5/48	6.88
1	1/37	6.90
10	10/50	6.90
6	6/23	6.90
10	10/9	6.92
3	3/18	6.92
4	1/18	6.92
4	4/25	6.92

Rootstock No.	Seedling No.	Number of stomata
5	5/14	6.92
4	4/7	6.93
9	9/17	6.94
8	8/34	6.95
10	10/12	6.96
1	1/47	6.98
5	5/29	6.98
8	8/45	6.98
4	4/12	7.00
5	5/11	7.00
5	5/18	7.00
8	8/1	7.00
2	2/34	7.02
4	4/6	7.02
4	4/40	7.02
8	8/21	7.02
3	3/19	7.04
4	4/11	7.04
9	9/20	7.04
9	9/50	7.05
4	4/26	7.06
4	4/8	7.06
10	10/46	7.09
1	1/16	7.10
5	5/49	7.10
5	5/33	7.12
8	8/10	7.13
5	5/22	7.14
4	4/30	7.16
6	6/23	7.16
10	10/2	7.20
1	1/19	7.22
10	10/45	7.23
1	1/4	7.26
10	10/33	7.26
8	8/3	7.26
10	10/1	7.28
10	10/31	7.30
3	3/31	7.30
6	6/17	7.30
7	7/1	7.32
1	1/33	7.34
5	5/21	7.36

Rootstock No.	Seedling No.	Number of stomata
7	7/31	7.36
2	2/16	7.38
3	3/34	7.38
2	2/10	7.39
1	1/8	7.40
10	10/32	7.42
9	9/27	7.42
1	1/12	7.46
4	4/46	7.46
2	2/17	7.48
7	7/14	7.48
8	8/28	7.48
8	8/7	7.50
3	3/22	7.52
5	5/36	7.52
1	1/27	7.54
10	10/41	7.55
1	1/36	7.56
1	1/3	7.60
1	1/34	7.60
8	8/8	7.60
8	8/9	7.60
7	7/7	7.62
8	8/36	7.63
7	7/24	7.65
7	7/6	7.68
6	6/26	7.72
10	10/21	7.76
2	2/27	7.76
10	10/26	7.78
1	1/50	7.80
1	1/20	7.80
8	8/14	7.94
1	1/9	8.00
10	10/15	8.00
10	10/50	8.02
1	1/39	8.10
9	9/2	8.10
10	10/27	8.15
1	1/30	8.18
1	1/6	8.26
10	10/18	8.34
9	9/14	8.36

Rootstock No.	Seedling No.	Number of stomata
1	1/35	8.51
1	1/32	8.54
9	9/19	8.86
1	1/13	9.08
1	1/7	9.22
1	1/49	9.48
1	1/48	9.84

Fig. 1 Classification of tamarind rootstocks based on the number of stomata



Note :

Class	Stomata range	class	stomata range
1	3.51 - 4.00	8	7.01 - 7.50
2	4.01 - 4.50	9	7.51 - 8.00
3	4.51 - 5.00	10	8.01 - 8.50
4	5.01 - 5.50	11	8.51 - 9.00
5	5.51 - 6.00	12	9.01 - 9.50
6	6.01 - 6.50	13	9.51 - 10.00
7	6.51 - 7.00		

4.2.2 The search for rootstock plants other than tamarind rootstock.

Table 4 showing the unsuccessful result of leguminous rootstock with tamarind due to the incompatibility of grafting union.

Table 4 Intergeneric grafting of tamarind

Rootstock species	No.of grafting	No.Of survival
Pithecellobium dulce	50	none
Sesbania sesban Merr.	50	none
Caesalpinia coriaria (Jacq) Wild	50	none
Sesbania grandiflora Desv.	50	none
Caesalpinia pulcherrima (L.) Swarty	50	none
Delonix regia	50	none
Cassia grandis	50	none

4.3 Rhizobium studies

4.3.1 To study the isolation of Rhizobium from tamarind.

For the isolation of Rhizobium from the root samples by streak plate techniques, twenty four among the 13 young tamarinds showed the mucous colonies that did not absorb red [illegible] from mannitol congo red agar medium. The number of tamarind samples from collection, samples with culture colonies like rhizobium cultures and age of these samples were shown in Table 5

Table 5 Number of tamarind samples with various ages used for isolation of Rhizobium.

Age of plants (month)	Number of Plants from collection	Number of Plants with Rhizobium like colonies
2	5	3
3	10	5
6	10	7
7	9	7
12	8	2

As a result shown in Table 5 around 50% of plants from collection had the cultures which was similar in cultural characteristics to rhizobium cultures. For further investigation, these cultures will be streaked several times for purification and then tested for some biochemical characteristics. The distinction between groups of Rhizobium and close proximity bacteria is likely possible on the basis of biochemical characteristics (Hamdi, 1982). The rhizobia will be inoculated in the seedlings of tamarind grown in sterile soil lacking or having a small amount of nitrogen.

In order to determine the rod or bacteroid-shaped of rhizobium cells from the root samples, it was very difficult to differentiate the shape of rhizobial bacteroid. There was a lot of cell debris from the crushed tamarind root which interfered our bacteroid inspection. However a number of rod shape and ovoid shape bacteria were observed.

4.4 Cultural practice and Demonstration

Table 6 showing the preliminary study on the effect of plant growth regulators on fruit setting has shown that 4-CPA 15 ppm, GA3 15ppm, NAA 100 ppm, SADH 2000 ppm gave the promising result. This experiment will be repeated in the next season.(1988)

Table 6 Effect of growth regulators on fruit setting of sweet tamarind

Growth Regulator	Rate of Concentration (ppm)	Experimental site I	Experimental site II
		No. of pod/ plant	No. of pod/plant
4-CPA	5	55.2	
	10	141.8	
	15	216.0	
	20	123.4	
GA3	5	93.6	55.0
	10	72.2	51.5
	15	103.0	61.3
	20	20.4	40.8
NAA	50	96.0	42.3
	100	117.0	93.0
	150	107.4	88.8
	200	83.2	51.0
SADH	500	80.0	21.0
	1000	15.4	3.3
	1500	80.0	53.3
	2000	99.4	56.5
Control	0	81.6	1.5

5. Conclusion / Remark :

1) A total number of 1191 grafted plants has been collected for testing.

2) Identification of tamarind rootstock by grouping based on stomatal counting techniques.

3) The intergeneric grafting of leguminous rootstock with tamarind is impracticable.

4) Rhizobium studies on isolation by streak plate techniques, found some microorganism resemble to Rhizobium.

5) The preliminary study on a certain concentrations of 4-CPA, GA_3, NAA, SADH for fruit setting gave a promising result.

6 Workplan for the Next Period :

6.1 Testing of Germplasm

6.1.1 Biomass study

- To study the growth of plant both in field and containers.

6.1.2 Fruit study.

- To observe the accession mother plants at the original sites.
- To test the accession grafted plants in the field and containers.
- To analyse the chemical composition of pulp and seed of accessions.

6.2 Rootstock study

6.2.1 The search for dwarf rootstock

- To search and test the untended dwarf phynotypic expression.

6.2.2 Chemical treatment for the production of dwarf rootstock.

6.3 Rhizobium studies

- To study the inoculation and isolation of Rhizobium from tamarind.

6.4 Cultural practice and Demonstration

- To study the effect of plant regulators of widening the crotch angles of tamarind.
- To study the effect of spacing on growth
- To study the production of young leaves.
- To study the changing of pulp colour in storage.

7. Reference :

Pennachun , S; T. Yimsawat ; S. Chindaprasert and P. Kittiwsong 1987. Collection and Utilization of Tamarind Germplasm. Progress report no. 2 (Nov. 1986 - Apr. 1987)

Hamdi, Y.A. 1982. Application of Nitrogen - Fixing Systems in Soil Improvement and Management. Rome: Food and Agriculture Organization of The United Nations.

Mazumder, P.K., B.P. Chakhaner and S.K. Mukherji. 1972. Selection and Classification of Mango Rootstocks in the Nursery stage. ACTA Horticultural Resources 24 : 101 -106

Microbiology Laboratory. 1985. Laboratory Manual for General Microbiology. Khon Kaen : Department of Biology. Faculty of Science. Khon Kaen Univ.

Annex / Picture

Table 1. Detailed data of tamarind rootstock

Rootstock No.	Seedling No.	Number of stomata
1	1/1	5.82
1	1/2	6.00
1	1/3	7.60
1	1/4	7.26
1	1/5	6.01
1	1/6	8.25
1	1/7	9.22
1	1/8	7.40
1	1/9	8.00
1	1/10	5.52
1	1/11	6.40
1	1/12	7.46
1	1/13	9.08
1	1/14	5.96
1	1/15	5.56
1	1/16	7.10
1	1/17	6.22
1	1/18	5.26
1	1/19	5.24
1	1/20	7.80
1	1/21	6.10
1	1/22	6.72
1	1/23	6.12
1	1/24	6.32
1	1/25	6.22
1	1/26	6.44
1	1/27	7.54
1	1/28	6.40
1	1/29	6.62
1	1/30	8.18
1	1/31	6.74
1	1/32	8.54
1	1/33	7.34
1	1/34	7.60
1	1/35	8.52
1	1/36	7.56
1	1/37	6.90
1	1/38	6.46

Rootstock No.	Seedling No.	Number of stomata
1	1/39	8.10
1	1/40	5.56
1	1/41	5.72
1	1/42	6.22
1	1/43	6.40
1	1/44	5.72
1	1/45	6.08
1	1/46	6.66
1	1/47	6.98
1	1/48	9.81
1	1/49	9.48
1	1/50	7.80
2	2/1	5.38
2	2/2	5.26
2	2/3	6.10
2	2/4	5.52
2	2/5	6.02
2	2/6	4.98
2	2/7	5.90
2	2/8	5.34
2	2/9	5.26
2	2/10	7.39
2	2/11	6.86
2	2/12	5.84
2	2/13	6.16
2	2/14	5.36
2	2/15	5.68
2	2/16	7.38
2	2/17	7.48
2	2/18	6.36
2	2/19	5.18
2	2/20	4.92
2	2/21	5.40
2	2/22	6.83
2	2/23	6.86
2	2/24	6.60
2	2/25	3.92
2	2/26	5.96
2	2/27	6.[illegible]
2	2/28	5.[illegible]
2	2/29	5.72
2	2/30	4.34
2	2/31	5.52

Rootstock No.	Seedling No.	Number of stomata
2	2/32	5.58
2	2/33	5.92
2	2/34	7.02
2	2/35	6.10
2	2/36	5.90
2	2/37	7.76
2	2/38	5.82
2	2/39	5.86
2	2/40	6.54
2	2/41	5.48
2	2/42	4.90
2	2/43	6.24
2	2/44	5.00
2	2/45	5.95
2	2/46	5.00
2	2/47	6.00
2	2/48	5.02
2	2/49	6.20
2	2/50	5.00
3	3/1	5.12
3	3/2	5.60
3	3/3	5.08
3	3/4	6.22
3	3/5	4.82
3	3/6	6.14
3	3/7	6.88
3	3/8	5.60
3	3/9	6.22
3	3/10	5.10
3	3/11	5.62
3	3/12	5.74
3	3/13	6.78
3	3/14	6.68
3	3/15	5.78
3	3/16	5.48
3	3/17	6.16
3	3/18	6.92
3	3/19	7.04
3	3/20	5.76
3	3/21	6.16
3	3/22	7.52
3	3/23	6.38
3	3/24	5.24

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Rootstock No.	Seedling No.	Number of stomata
3	3/25	6.18
3	3/26	6.32
3	3/27	5.60
3	3/28	6.22
3	3/29	5.82
3	3/30	6.46
3	3/31	7.30
3	3/32	5.60
3	3/33	6.82
3	3/34	7.36
3	3/35	6.28
3	3/36	6.22
3	3/37	5.84
3	3/38	6.04
3	3/39	6.20
3	3/40	6.72
3	3/41	5.84
3	3/42	5.86
3	3/43	6.32
3	3/44	6.10
3	3/45	5.50
3	3/46	6.76
3	3/47	5.80
3	3/48	5.60
3	3/49	6.28
3	3/50	6.16
4	4/1	5.74
4	4/2	6.06
4	4/3	6.48
4	4/4	6.68
4	4/5	6.06
4	4/6	7.02
4	4/7	6.94
4	4/8	7.06
4	4/9	6.46
4	4/10	5.82
4	4/11	7.04
4	4/12	7.00
4	4/13	5.98
4	4/14	6.68
4	4/15	6.24
4	4/16	5.90
4	4/17	5.64

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Rootstock No.	Seedling No.	Number of stomata
4	4/18	6.92
4	4/19	6.18
4	4/20	5.54
4	4/21	5.60
4	4/22	6.22
4	4/23	5.18
4	4/24	6.90
4	4/25	6.92
4	4/26	7.06
	4/27	5.94
4	4/28	6.12
4	4/29	5.86
4	4/30	7.16
4	4/31	5.08
4	4/32	5.54
4	4/33	5.96
4	4/34	5.62
4	4/35	6.66
4	4/36	5.80
4	4/37	6.14
4	4/38	5.54
4	4/39	5.78
4	4/40	7.02
4	4/41	6.38
4	4/42	5.40
4	4/43	5.70
4	4/44	5.88
4	4/45	6.00
4	4/46	7.46
4	4/47	6.12
4	4/48	5.68
4	4/49	7.22
4	4/50	5.70
5	5/1	6.18
5	5/2	5.88
5	5/3	5.88
5	5/4	6.62
5	5/5	6.72
5	5/6	5.18
5	5/7	5.84
5	5/8	5.72
5	5/9	5.56
5	5/10	6.48

Rootstock No.	Seedling No.	Number of stomata
5	5/11	6.24
5	5/12	6.36
5	5/13	6.74
5	5/14	6.92
5	5/15	6.41
5	5/16	6.11
5	5/17	5.74
5	5/18	7.00
5	5/19	6.10
5	5/20	5.32
5	5/21	7.30
5	5/22	7.11
5	5/23	5.68
5	5/24	5.92
5	5/25	6.70
5	5/26	5.68
5	5/27	5.64
5	5/28	6.38
5	5/29	6.98
5	5/30	6.68
5	5/31	6.72
5	5/32	6.62
5	5/33	7.12
5	5/34	5.60
5	5/35	6.42
5	5/36	7.52
5	5/37	6.52
5	5/38	6.14
5	5/39	5.98
5	5/40	6.82
5	5/41	5.56
5	5/42	6.64
5	5/43	6.22
5	5/44	7.30
5	5/45	6.68
5	5/46	6.02
5	5/47	5.80
5	5/48	6.88
5	5/49	7.10
5	5/50	5.78
6	6/1	6.84
6	6/2	5.40
6	6/3	5.26

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Rootstock No.	Seedling No.	Number of stomata
6	6/4	5.72
6	6/5	5.88
6	6/6	5.02
6	6/7	6.38
6	6/8	6.00
6	6/9	5.78
6	6/10	5.98
6	6/11	5.70
6	6/12	6.01
6	6/13	5.73
6	6/14	5.70
6	6/15	5.46
6	6/16	6.08
6	6/17	7.30
6	6/18	5.58
6	6/19	5.98
6	6/20	6.54
6	6/21	6.14
6	6/22	6.14
6	6/23	6.90
6	6/24	6.20
6	6/25	5.58
6	6/26	7.72
6	6/27	5.33
6	6/28	5.00
6	6/29	7.16
6	6/30	5.98
7	7/1	7.32
7	7/2	5.06
7	7/3	5.54
7	7/4	5.62
7	7/5	5.50
7	7/6	7.68
7	7/7	7.62
7	7/8	6.06
7	7/9	5.96
7	7/10	6.16
7	7/11	6.00
7	7/12	5.78
7	7/13	5.68
7	7/14	7.48
7	7/15	5.56
7	7/16	5.32

Rootstock No.	Seedling No.	Number of stomata
7	7/17	6.80
7	7/18	5.86
7	7/19	-
7	7/20	6.12
7	7/21	5.18
7	7/22	5.83
7	7/23	5.60
7	7/24	7.65
7	7/25	5.90
7	7/26	5.58
7	7/27	5.90
7	7/28	5.56
7	7/29	5.83
7	7/30	5.16
7	7/31	7.36
7	7/32	5.34
7	7/33	6.10
7	7/34	6.54
7	7/35	5.44
7	7/36	6.02
7	7/37	5.20
7	7/38	6.21
7	7/39	5.18
7	7/40	5.24
7	7/41	-
7	7/42	5.50
7	7/43	5.20
7	7/44	-
7	7/45	-
7	7/46	6.10
7	7/47	6.08
7	7/48	5.15
7	7/49	6.00
7	7/50	6.30
8	8/1	7.00
8	8/2	5.72
8	8/3	7.26
8	8/4	5.98
8	8/5	6.40
8	8/6	6.66
8	8/7	7.50
8	8/8	7.60
8	8/9	7.50

Rootstock No.	Seedling No.	Number of stomata
8	8/10	7.12
8	8/11	6.20
8	8/12	6.33
8	8/13	6.09
8	8/14	7.91
8	8/15	6.58
8	8/16	5.18
8	8/17	5.60
8	8/18	5.88
8	8/19	6.36
8	8/20	5.25
8	8/21	7.02
8	8/22	5.51
8	8/23	6.68
8	8/24	5.56
8	8/25	5.38
8	8/26	6.28
8	8/27	5.90
8	8/28	7.18
8	8/29	5.22
8	8/30	5.58
8	8/31	6.72
8	8/32	5.86
8	8/33	6.96
8	8/34	6.95
8	8/35	6.50
8	8/36	7.[illegible]
8	8/37	5.22
8	8/38	5.57
8	8/39	5.85
8	8/40	5.67
8	8/41	6.08
8	8/42	5.80
8	8/43	6.54
8	8/44	6.[illegible]0
8	8/45	6.98
8	8/46	6.36
8	8/47	5.73
8	8/48	6.14
8	8/49	6.78
8	8/50	5.28
9	9/1	6.48
9	9/2	8.10

Rootstock No.	Seedling No.	Number of stomata
9	9/4	6.04
9	9/5	5.60
9	9/6	5.56
9	9/7	6.84
9	9/8	6.80
9	9/9	5.66
9	9/10	6.52
9	9/11	6.50
9	9/12	6.80
9	9/13	6.62
9	9/14	8.36
9	9/15	6.50
9	9/16	5.40
9	9/17	6.94
9	9/18	6.66
9	9/19	8.86
9	9/20	7.04
9	9/21	6.10
9	9/22	6.34
9	9/23	5.73
9	9/24	6.46
9	9/25	5.51
9	9/26	6.10
9	9/27	7.42
9	9/28	5.38
9	9/29	5.88
9	9/30	6.20
9	9/31	6.06
9	9/32	5.20
9	9/33	5.50
9	9/34	6.58
9	9/35	6.76
9	9/36	5.74
9	9/37	6.36
9	9/38	5.26
9	9/39	5.90
9	9/40	6.44
9	9/41	5.36
9	9/42	6.76
9	9/43	6.04
9	9/44	6.34
9	9/45	5.90
9	9/46	5.75

Rootstock No.	Seedling No.	Number of stomata
9	9/47	6.10
9	9/48	6.26
9	9/49	5.70
9	9/50	7.05
10	10/1	7.28
10	10/2	7.20
10	10/3	5.53
10	10/4	5.96
10	10/5	6.00
10	10/6	6.05
10	10/7	5.74
10	10/8	5.12
10	10/9	6.52
10	10/10	6.16
10	10/11	5.88
10	10/12	6.96
10	10/13	6.56
10	10/14	6.70
10	10/15	8.00
10	10/16	6.02
10	10/17	6.44
10	10/18	8.31
10	10/19	5.74
10	10/20	5.36
10	10/21	7.76
10	10/22	5.93
10	10/23	6.16
10	10/24	6.00
10	10/25	6.20
10	10/26	7.78
10	10/27	8.15
10	10/28	5.03
10	10/29	6.05
10	10/30	8.62
10	10/31	7.30
10	10/32	7.42
10	10/33	7.26
10	10/34	6.11
10	10/35	5.28
10	10/36	6.60
10	10/37	6.34
10	10/38	6.80
10	10/39	6.54

Rootstock No.	Seedling No.	Number of stomata
10	10/40	7.09
10	10/41	7.55
10	10/42	6.40
10	10/43	6.15
10	10/44	5.59
10	10/45	6.23
10	10/46	7.23
10	10/47	6.10
10	10/48	6.05
10	10/49	6.10
10	10/50	6.90

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2. Yeast extract mannitol congo red agar medium (YMCA)

constituents

Yeast extract	3.0 g. (dehydrated)
$MgSO_4.7H_2O$	0.2 g.
K_2HPO_4	0.5 g.
Mannitol	10.0 g.
NaCl	0.1 g.
$CaCO_3$ (if used)	3.0 g.
Agar	15.0 g.
Congo red (1:400 aqueous solution)	10.0 ml.
Distilled water (pH 6.8)	1000.0 ml.

3. Carbol fuchsin dye

constituents

Basic fuchsin	0.3 g.
95% Ethanol	10.0 ml.
Mixed together and then added :	
Phenol (5% aqueous solution)	100.0 ml.

XD-AAA-544-B

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D.C. 20523

DATE: 8/4/88

MEMORANDUM

TO: AID/PPC/CDIE/DI, room 209 SA-18

FROM: AID/SCI, Victoria Ose

SUBJECT: Transmittal of AID/SCI Progress Report(s)

Attached for permanent retention/proper disposition is the following:

AID/SCI Progress Report No. 5.243
PP #4

Attachment

84

XN-ABA-544B 5.243

PROGRESS REPORT

PROGRESS REPORT NO. 4

(NOVEMBER, 1987 - APRIL, 1988)

COLLECTION AND UTILIZATION OF TAMARIND GERMPLASM

A RESEARCH PROJECT

GRANT NO. 936-5542-G-00-6026-00

SUBMITTED BY

DR.SUMRIT FEUNGCHAN
PROJECT LEADER

FACULTY OF AGRICULTURE
KHON KAEN UNIVERSITY
KHON KAEN 40002, THAILAND

AUG 03 1988

PROGRESS REPORT

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KHON KAEN UNIVERSITY

KHON KAEN 40002, THAILAND

Project Profile

Country : Thailand

Grant No. : 936-5542-G-00-6026-00

Program : Program on Science and Technology Cooperation

Project Title : "Collection and Utilization of Tamarind Germplasm."

Project Leader : Dr.Sumrit Feungchan

Organization : Department of Plant Science
Faculty of Agriculture
Khon Kaen University
Khon Kaen 40002, Thailand

Co-investigators : Mr.Taweekiet Yimsawat
Mr.Sorot Chindaprasert
Mr.Pitool Kitpowsong

Project Consultants :

Authorized Officer : Dr.Somporn Bothinam MD.

Total Project Budget : US $ 150,000.

Project Duration : 3 years.

Reporting Period : November, 1987 - April, 1988.

Budget Allocation for This Period : 494,299.50 Baht.

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1. Background / Introduction

The research in this period emphasizes on recording Tamarind Accession Data based on IBPGR Tropical Fruit Descriptors in order to know the detail of their characteristics. Pod yield data and chemical composition of accessions are required to be the criteria for evaluation.

For the selection of biomass accessions has been conducted both in the field and containers because it is the possible criteria. The search for dwarf rootstock is still continued because it is expected to find the untended dwarf rootstock which is very useful for density growing. The study of Rhizobium in tamarind roots is in progress. The appropriate technology in tamarind production is needed.

2. Objectives

1) To evaluate the accessions.
2) To select and develop rootstock.
3) To prove the existence of Rhizobium in tamarind root.
4) To develop the technology of tamarind production.

3. Materials and Methods.

3.1 Testing of Germplasm

3.1.1 Biomass study

- To study the growth of plant both in containers and field.

The study on growth of plants in containers consist of 6 replications with 90 treatments and each treatment composes of 4 plants thus the population is 6x90x4 = 2160 plants. The

observation has been done monthly interval on growth rate, diameter of stem at 10 centimeters above soil level, height of plant, measuring in centimeters and also the number of branches recorded. Finally, the measuring of root length by Root Length Scanner, fresh and dry weight of the whole plant will be done at the end of the experiment.

All tamarind seedling specimens for biomass accession selection derived from seeds collected in various parts over the country. By assumption that each specimen might be different characteristics due to environmental condition and genotype.

The field experiment with Completely Randomized Block Design consists of 6 replications, 30 treatments, each treatment composes of 4 plants totally 2160 plants at spacing 2x2 meters.

The data collection of the field experiment has been done as mentioned above and the container experiment as well. The data will be used as the primary criteria for biomass accessions selection.After biomass accession obtained, the stomatal counting technique, angle of branches and NPK composition in leaf will be confirmedly investigated.

3.1.2 Fruit study

3.1.2.1 To observe the accession mother plant at the original site.

To study the performance of accession mother plant in pod yield for the preliminary evaluation of accession related to the Real Value of Pulp, size and shape of canopy, age of plant etc. by using IBPGR Descriptors for Tropical Fruits.

3.1.2.2 To test the accession grafted plants in the field

The grafted accession plants have grown in the testing plot with the Completely Randomized Block Design consists of 6 replications with 4 plants for each treatment, 42 and 20 treatments for sour and sweet types, respectively.

3.1.2.3 To analyse the chemical composition of pulp and seed of sour type accession.

The chemical analysis of shell, pulp and seed of accession has been carried out by the method of AOAC for supporting as the mean of accession selection.

3.2 Rootstock study

3.2.1 The search for dwarf rootstock

To test the classified seedling rootstocks based on stomatal grouping (Progress report No.3 page.13) in relation to the canopy size.

To search the untended dwarf phenotypic expression rootstocks. Fortunately we found the potential dwarf rootstock which will be studied on the morphological characteristics such as the canopy size, internode length and leaf area etc.

3.2.2 Chemical treatment for the production of dwarf rootstock

To control canopy size for the production of dwarf tamarind rootstock by using a certain inhibiting substances namely SADH, CCC, MH, and Paclobutazol. The seeds are treated by prolonged soaking method in solution for 6 hours at various concentrations viz. 1000, 2000, 3000, 4000, and 5000 ppm. The

number of 25 seeds are soaked in the different rates of above concentration and required 4 replications. The treated seeds are sown in the containers, then growth rate, canopy size, number of stomata etc. will be investigated at seedling stage.

3.3 Rhizobium study

3.3.1 To differentiate groups of Rhizobium form close proximity bacteria by the basis of biochemical characteristics.

Fifty nine isolated bacteria cultures similar to rhizobium cultural characteristics which were tested for some biochemical characteristics, utilization of citrate and carbohydrate, to differentiate from close proximity bacteria. Each isolated bacteria was streaked on Simmon's citrate agar slant (Appendix) and incubate at 30° C for 48 hours. The bacterial growth was observed. To test the utilization of carbohydrate, each isolated one was inoculated in phenol red broth base (PRBB) with four kinds of carbohydrates contained in separate tubes (Appendix). Acid and gas production in the media were observed after incubation at 30° C for 48 hours.

3.3.2 To comfirm the Rhizobium strains by inoculating onto tamarind seedling.

Microorganism preparation

Thirteen strains of the test Rhizobium were cultured on manitol medium (Appendix II) for 36 hours. Then, they were centrifuged to separate cell and supernatant at 5000 rpm. for 10 minutes. The supernatant was discard and the cell obtained at

the bottom of the tube was washed three times with phosphate buffer pH 7. The final cell solution was adjusted to appropiate concentration with the same buffer.

Tamarind seedling preparation

Tamarind seeds were sown in the 6 inch clay pot contained sterile soil. The sterile water (without nitrogen) was applied to the pot twice a day. After one month, leave only two seedlings in one pot, then they were ready for Rhizobium inoculation.

Rhizobium inoculation

Twenty five millilitres of each Rhizobium inocuium was poured in to tamarind pot. Fifteen seed pots were used per one strain of microorganism. The control was treated by phosphate buffer only. The height of the tamarind seedlings was measured every fifteen day interval after inoculation to observe growth.

3.4 Cultural practice and Demonstration.

3.4.1 To study the effect of plant regulators on widening the crotch angles of tamarind.

- To control the angles in branching by using the chemical substances with TIBA and BA at various concentrations viz. 25, 50, 75 and 100 ppm. Hence, the wide angles in branching normally give long straight lumber and large girth which will be useful for wood utilization (ref. Teak Improvement Center, Ngao, Lampang, Thailand, in Project Proposal.)

3.4.2 To study the effect of spacing on growth.

- To study the effect of the different spacing in order to find out the basic data on branching of plant for asexual propagation purpose.

Completely Randomized Block Design will be used with 3 replications and 3 treatments at spacing of 2x1, 2x1.5 and 2x2 meters.

3.4.3 To study the young leaf production for human consumption.

By foliar application with the substances namely Thiourea, Urea, Potassium nitrate, Ethephon and 2,4-D at the rate of different concentrations eg. 50, 100, 150, 200 and 250 ppm.

Completely Randomized Block Design with 5 replications 6 treatments and 20 plants per treatment will be used.

3.4.4 To study the change of pulp colour in storage.

The pulp colour will gradually change from the natural one to black when store in the room temperature. From this effect, the pulp quality is inferior and price is reduced. Hence, the experiment will be tried to overcome this problem by using the several mears as follow :-

1. Powdered salt : 5, 10, 15, 20, 25 and 30 %
2. Steam : 15, 20 and 30 minutes.
3. Sodium metabisulphite 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 ppm.
4. Sun dry : 3 days.
5. Hot air incubation : 40°, 45°, 50°, 55°, 60°, 65° and 70° C for 24 hours.
6. Cold storage : 5° and 0° C.

4. Results/ Discussion/ Tables :

4.1 Testing of Germplasm

4.1.1 Biomass study

Table 1 Ranked Order of Biomass accessions in the field (Duncan's Multiple Range Test, α = 0.01)

Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
1.	7[illegible]	1	1	2	4
2.	81	4	3	1	8
3.	30	3	2	6	11
4.	20	8	4	4	16
5.	10	2	7	11	20
6.	11	5	8	13	26
6.	78	7	14	5	26
8.	31	6	9	12	27
9.	76	10	15	3	28
10.	16	9	5	15	29
11.	35	14	10	8	32
12.	15	17	11	17	35
13.	29	11	6	27	44
14.	9	13	13	26	52
14.	27	19	24	9	52
16.	18	18	18	17	53

Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
17.	17	21	12	22	55
17.	32	16	16	23	55
19.	25	29	17	14	60
20.	87	23	23	16	62
21.	83	26	28	10	64
22.	1	12	30	24	66
23.	41	15	19	33	67
24.	67	32	22	19	73
25.	37	28	33	18	79
26.	38	20	25	35	80
27.	14	36	20	31	87
27.	89	22	44	21	87
29.	8	33	26	29	88
30	40	27	21	42	90
31.	36	25	32	43	100
32.	79	35	27	40	102
33.	80	38	34	34	106
34.	84	45	39	25	109
35.	24	30	36	48	114
36.	42	24	37	59	120
37.	19	37	29	56	122
37.	43	50	42	30	122
39.	22	48	31	44	123

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Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
40.	12	41	40	46	127
40.	75	39	52	36	127
42.	45	49	45	37	131
43.	34	44	41	47	132
43.	71	66	38	28	132
45.	86	46	49	39	134
46.	26	52	35	52	139
47.	3	31	43	66	140
48.	21	43	50	53	146
48.	74	55	53	38	146
50.	39	54	48	54	156
51.	70	64	57	41	162
52.	5	51	51	62	164
53.	13	40	55	70	165
53.	33	56	59	50	165
55.	4	34	65	67	166
56.	85	63	46	58	167
57.	28	69	54	45	168
57.	62	65	71	32	168
57.	72	60	47	61	168
60.	56	61	60	49	170
61.	60	47	68	57	172
62.	57	62	63	51	176

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Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
63.	47	78	80	20	178
64.	23	59	62	60	181
65.	7	53	58	77	188
66.	2	42	67	81	190
67.	6	68	61	71	200
68.	61	82	56	64	202
69.	69	67	70	68	205
70.	49	58	73	75	206
71.	82	57	83	69	209
71.	88	72	72	65	209
73.	65	77	78	55	210
74.	54	73	66	72	211
75.	90	75	76	63	214
76.	44	70	74	76	220
76.	48	71	75	74	220
78.	53	76	69	82	227
78.	59	83	64	80	227
80.	52	74	77	79	230
81.	58	81	82	73	236
82.	46	80	79	78	237
83.	51	84	81	84	249
84.	68	79	84	89	252
85.	55	86	85	86	257

Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
85.	63	85	89	83	257
87.	50	87	88	87	262
87.	66	90	87	85	262
89.	64	89	86	88	263
90.	73	88	90	90	268

Table 2 Ranked order of Biomass accessions in the container (Duncan's Multiple Range Test, α = 0.01)

Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
1.	49	1	1	1	3
2.	47	7	3	4	14
3.	50	5	7	8	20
3.	74	2	9	9	20
5.	60	3	12	6	21
6.	58	8	10	10	28
7.	46	4	26	2	32
7.	79	9	8	15	32
9.	43	6	6	30	42
10.	51	19	11	17	47
11.	35	10	15	24	49
12.	40	13	36	3	52
13.	52	22	25	7	54
13.	57	16	22	16	54
15.	72	20	23	12	55
16.	37	17	29	14	60
17.	14	41	17	5	63
18.	33	36	16	13	65
19.	90	15	5	54	74
20.	18	45	13	18	76
20.	31	25	32	19	76

Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
20.	61	11	37	28	76
23.	84	46	20	11	77
24.	87	51	2	25	78
25.	44	18	39	23	80
26.	70	28	21	35	84
27.	32	30	30	26	86
28.	88	37	4	48	89
29.	66	43	14	36	93
30.	73	32	35	29	96
31.	59	49	28	20	97
32.	63	31	27	43	101
33.	86	12	33	58	103
34.	77	66	19	22	107
34.	45	33	53	21	107
36.	62	29	43	41	113
37.	75	23	38	55	116
38.	5	27	41	49	117
39.	36	26	61	31	118
40.	26	42	51	27	120
41.	78	63	18	42	123
42.	69	35	45	45	125
43.	6	47	31	50	128
44.	68	56	47	32	135

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Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
45.	65	50	40	46	136
46.	85	38	44	56	138
47.	12	21	79	44	144
48.	8	14	71	64	149
49.	24	44	74	34	152
50.	76	61	55	38	154
51.	71	53	46	57	156
52.	20	57	62	40	159
53.	54	24	50	57	161
54.	89	34	49	79	162
55.	1	52	60	51	163
56.	11	60	64	39	163
57.	41	64	42	61	167
58.	4	40	73	59	172
59.	42	65	58	53	176
60.	15	48	68	62	178
61.	25	54	65	60	179
62.	28	82	67	33	182
62.	48	55	57	70	182
64.	80	84	24	75	183
65.	30	39	77	68	184
66.	56	67	54	65	186
67.	53	78	59	52	189

Ranked order	Accession no.	Score			Total Score
		Height (cm)	Width (cm)	Length(cm)	
68.	21	59	70	63	192
69.	38	81	75	37	193
69.	83	79	14	80	193
71.	7	71	52	72	195
72.	19	74	76	47	197
73.	81	70	48	82	200
74.	16	72	63	67	202
75.	67	58	66	81	205
76.	29	69	78	71	218
76.	64	62	72	84	218
78.	10	68	84	69	221
78.	55	75	80	66	221
80.	39	77	82	74	233
81.	82	89	56	89	234
82.	17	85	69	83	237
83.	34	80	83	76	239
84.	9	83	81	78	242
85.	22	73	86	86	245
86.	2	87	88	73	248
86.	3	86	85	77	248
86	23	76	87	85	248
89.	13	88	89	88	265
90.	27	90	90	90	270

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All these samples will be packed in transparent and opaque containers and observed the change of pulp-colour with spectrophotometer Model. Shimazu UV - 240. The design of experiment is Completely Randomized Block Design with 3 replications, each treatment consists of the 6 samples and each sample weight is 250 grams.

From table 1 and 2 the classification of Biomass Accession based on Ranked Order, it was found that there is the great difference on total score which derived from the growth characters eg. height, width and length of canopy. The result showed that the low score represent the vigorous plant while the high score is dwarf one.

The result of field and container experiment is highly contrast on Ranked Order. Since the heredity and environmental factors might cause the variation from seed to seed. It is noticed that the Biomass accessions in containers which arranged in closed spacing that causes high competition in community such as the Biomass accession no. 49 may be suitable for closed planting in biomass production.

4.1.2 Fruit study

4.1.2.1 To observe the accession mother plant at the original site.

Table 3 Pod Yield of Sour type accession

Accession No.	Source of Collection	Yield (kg.)
86 - 2 - 13 - 001	Sakon Nakhon	1.250
86 - 2 - 13 - 019		53.000
86 - 2 - 13 - 018		65.000
86 - 2 - 13 - 020		5.000
86 - 2 - 13 - 015		120.000
86 - 2 - 13 - 008		30.000
86 - 2 - 13 - 002		0.500
86 - 2 - 13 - 009		27.000
86 - 2 - 13 - 017		73.000
86 - 2 - 13 - 001		731.000
86 - 2 - 13 - 004		51.500
86 - 2 - 13 - 005		1.000
86 - 2 - 13 - 014		39.000
86 - 2 - 08 - 038	Mukdaharn	3.500
86 - 2 - 08 - 028		0.200
86 - 2 - 08 - 083		13.000
86 - 2 - 08 - 183		15.000
86 - 2 - 08 - 016		316.000
86 - 2 - 08 - 095		15.000
87 - 2 - 08 - 003		14.000
87 - 2 - 08 - 027		2.000
87 - 2 - 08 - 025		20.000
87 - 2 - 08 - 014		0.800
87 - 2 - 08 - 023		2.000
87 - 2 - 08 - 005		8.500

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Accession No.	Source of Collection	Yield (kg.)
87 - 2 - 17 - 021	Ubon Ratchathani	36.000
87 - 2 - 17 - 022		56.000
87 - 2 - 17 - 011		16.280
87 - 2 - 17 - 009		5.400
87 - 2 - 17 - 016		0.720
87 - 2 - 17 - 008		84.450
87 - 2 - 17 - 026		226.000
87 - 2 - 01 - 035	Nakhon Ratchasima	2.200
87 - 2 - 09 - 017	Yasothon	60.000
87 - 3 - 20 - 002	Samut Sakhon	-
87 - 4 - 13 - 003	Satun	100.000
87 - 2 - 01 - 005	Kalasin	6.000
87 - 1 - 02 - 001	chiang Rai	80.000
87 - 1 - 02 - 002		-
87 - 1 - 02 - 003		95.000
87 - 1 - 02 - 004		120.000
87 - 1 - 02 - 005		100.000

From Table 3 showing the mature pod yield of accession that collected from the whole country in the year 1987-1988. The yield of each accession is quite different due to the climatic conditions and genetic factors. Therefore, the yield evaluation should be repeated in the same locallity

4.1.2.2 To test the accession grafted plants in the field.

The grafted accession plants already have been grown in the experimental plot for further observation.

4.1.2.3 To analyse the chemical composition of pulp and seed for sour type accession

Table 4 Chemical analysis of mature pod.

Accession No.	% Sugar			% Starch			% Tannin			% Tartaric acid			% Protein		
	Pulp	Shell	Seed	Pulp	Shell	Seed	Pulp	Shell	Seed	Pulp	Shell	Seed	Pulp	Shell	Seed
87-2- 7-021	1.7340	0.1275	0.0160	[illegible]	0.0168	0.0904	0.0054	0.0295	0.0023	[illegible]	1.0707	0.2119	[illegible]	3.8750	18.9040
87-2- 7-022	1.5450	0.1488	0.0131	0.0010	[illegible]	0.1003	0.0012	0.0035	0.0013	[illegible]	[illegible]	[illegible]	[illegible]	3.6310	17.6460
87-2- 7-011	1.2787	0.1021	[illegible]	[illegible]	[illegible]	0.1019	[illegible]	0.0014	0.0105	[illegible]	[illegible]	0.1343	[illegible]	3.0170	15.6650
87-2- 7-009	1.2663	0.1053	0.0432	0.0147	0.0329	0.1062	0.0014	0.0037	0.0014	[illegible]	0.9151	0.2415	[illegible]	3.6580	17.7110
87-2- 7-016	1.5621	0.1055	0.0111	[illegible]	0.0263	[illegible]	0.0078	0.0023	0.0014	[illegible]	[illegible]	0.1325	3.8640	5.0030	16.2540
87-2- 7-008	1.5024	0.2195	[illegible]	0.0191	0.0333	0.3971	0.0029	0.0023	0.0010	[illegible]	1.0177	0.2241	[illegible]	3.1380	15.7890
87-2- 7-026	0.9980	0.0979	0.0536	0.0503	0.0301	0.2570	0.0043	0.0074	0.0008	[illegible]	[illegible]	[illegible]	[illegible]	3.0330	16.2030

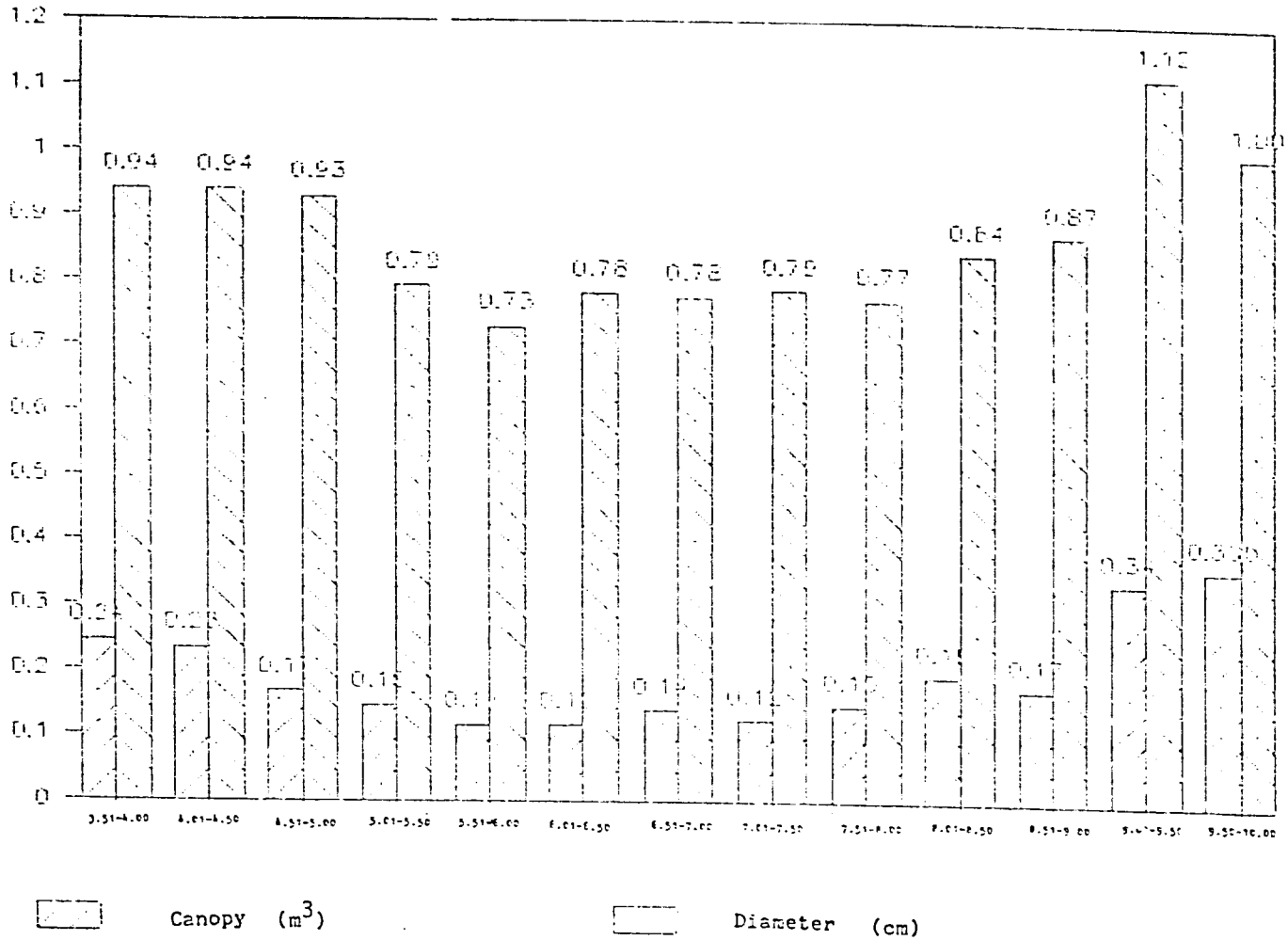
From table 4 showing the chemical composition of pulp, shell and seed of some accessions, the result has indicated a great variation in term of percentage of sugar, starch, tannin, tartaric acid and protein. This analysis will be used for supporting the selection of superior accession.

4.2 Rootstock study

4.2.1 The search for dwarf rootstock

4.2.1.1 To test the classified seedling rootstocks based on stomatal grouping in relation to the canopy size.

Fig 1 Canopy and diameter of rootstock.
in relation to number of stomata.
(10 months old plants)



From Fig.1 it has shown that there is no difference on growth characters eg. canopy and stem diameter of the rootstocks at early stage based on the number of stomata. However, the further observation should be done in the field.

4.2.1.2 To search the untended dwarf phenotypic expression rootocks.

Table 5 Comparison of Morphological Characteristics on Dwarf Rootstock and Accession

Plant No.	Girth (cm)	Canopy * (m3)	Age (yrs)	Internode Length ** (cm)	Leaf area/100 leaves*** (cm2)
87-2-17-021 Control	322	9180.00	45	1.705	110.82
Dwarf No 1	77	149.76	30	1.491	79.86
Dwarf No 2	73	274.40	20	1.833	95.28

* Measured at 100 centimetres above ground level

** Internode Length from an average of 10 shoots.

*** Automatic Areameter Model No. AAC-400 Hayashi Denkon Co., LTD.

From Table 5 showing the morphological characteristics of the Accession No. 87-2-021 plant as control to compare with the Dwarf Rootstock No. 1 and 2, the result indicated that canopy, internode length and leaf area of Dwarf No.1 are quite difference. However, the further study in anatomical characters eg. stomatal country, epidermall cell, palisade cell etc. in order to prove the unique dwarf rootstock characters.

4.2.2 Chemical treatment for the production of dwarf rootstock

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Table 6 Effect of Chemical Substances on Growth of Seedling*

Plant Growth Substances	Concentration (ppm)	Height (cm)	Width (cm)	Length (cm)	Canopy (cm^3)	Lenght of node (cm)	Diameter (cm)
Control	0	71.33 ABC	19.33 ABC	21.00 ABC	29121.33 ABC	1.21 ABCDE	0.64 ABC
SADH	1000	71.00 ABC	23.00 A	23.00 A	37634.67 A	1.29 ABC	0.61 ABCDE
	2000	75.00 AB	20.33 AB	22.00 AB	33646.67 AB	1.19 BCDE	0.64 ABC
	3000	65.67 ABCDE	19.67 AB	18.67 ABCD	25208.67 ABCDE	1.19 DEFG	0.60 ABCDE
	4000	66.33 ABCDE	20.00 AB	18.00 ABCDE	25228.67 ABCDE	1.21 ABCDE	0.64 ABCD
	5000	65.67 ABCDE	20.33 AB	17.33 ABCDE	23198.67 ABCDE	1.20 BCD	0.64 ABC
CCC	1000	62.67 BCDEF	16.00 BCDE	18.67 ABCDE	19161.67 BCDE	1.27 ABC	0.57 BCDEF
	2000	64.00 ABCDE	13.67 DE	12.67 D	11226.00 DE	1.27 ABC	0.56 DEFG
	3000	66.33 ABCDE	16.67 BCDE	17.00 ABCDE	18878.00 BCDE	1.29 ABC	0.55 EFG
	4000	61.33 CDEF	12.67 E	13.33 CD	10388.00 E	1.29 ABC	0.55 EFG
	5000	55.67 DEF	15.33 BCDE	14.33 BCD	15931.00 CDE	1.34 A	0.52 FG

Plant Growth Substances	Concentration (ppm)	Height (cm)	Width (cm)	Length (cm)	Canopy (cm^3)	Lenght of node (cm)	Diameter (cm)
MH	1000	77.00 A	18.67 ABCDE	18.67 ABCD	27714.00 ABCD	1.22 ABCD	0.64 ABCD
	2000	67.67 ABCD	14.00 CDE	15.67 ABCD	15007.67 CDE	1.16 CDEF	0.62 ABCDE
	3000	56.67 DEF	15.67 BCDE	18.00 ABCD	16012.33 CDE	1.19 BCDE	0.61 ABCDE
	4000	58.33 CDEF	17.00 BCDE	19.00 ABCD	18641.33 BCDE	1.33 AB	0.65 AB
	5000	56.00 DEF	16.33 BCDE	18.33 ABCD	17174.33 BCDE	1.15 CDEFG	0.57 CDEF
Pac	1000	53.67 EF	17.00 BCDE	19.33 ABCD	17596.00 BCDE	1.08 EFG	0.66 A
	2000	41.00 GH	20.67 AB	20.67 ABC	17546.67 BCDE	0.93 I	0.57 BCDEF
	3000	38.67 GH	19.00 ABCDE	19.67 ABCD	14862.00 CDE	0.94 HI	0.48 G
	4000	36.00 H	16.33 BCDE	15.67 ABCD	9419.00 E	0.06 FGH	0.50 FG
	5000	50.33 FG	17.33 BCDE	18.00 ABCD	15809.33 CDE	1.03 GHI	0.58 ABCDEF

* Duncan's Multiple Range Test, α = 0.01

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From Table 6 the chemical treatment for the production of dwarf rootstocks by using a certain inhibitors viz. SADH, CCC, MH and Paclobutrazol effected highly significant on growth characters. Especially both CCC and Paclobutrazol trend to induce dwarfness. However, the field experiment should be observed.

4.3 Rhizobium study

Table 7 The average heigth of tamarind seedling inoulated with test Rhizobium.

Microorganism	Average height of tamarind seedlings		Increasing heigth
	0 day (cm)	41 day (cm)	(cm)
1	15.41	23.05	7.64
2	16.00	23.26	7.26
3	15.82	22.89	7.07
4	16.44	23.02	6.58
5	16.24	23.82	7.58
6	15.33	22.17	6.84
7	16.09	23.26	7.17
8	17.02	23.80	6.78
9	16.70	22.45	5.75
10	16.32	23.22	6.90
11	15.50	21.72	6.22
12	16.12	23.44	7.32
13	14.89	21.93	7.04
Control	16.12	22.81	6.69

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Fifteen out of the 59 isolated of bacterial cultures could not utilize citrate but could produce acid with out gas in phenol red broth base medium containing glucose, sucrose, lactose or mannitol. These characteristics belong to the genus Rhizobium according to Bergey's Manual of Systematic Bacteriology (Krieg and Holt, 1984). As this result, only 25% of cultures isolated from the root samples had the biochemical characteristics which were similar to Rhizobium group. It was too low to consider that they were the Rhizobium associating with tamarind roots. Thus, the 15 isolated bacteria were inoculated into the tamarind seedling grown in sterile soil lacking or having small amount of nitrigen for confirmation of the result.

It was found that the increasing height of the tamarind seedlings of the thirteen test Rhizobium strains and the control was not significantly different as shown in table 7.

From this result there was trace amount of nitrogen left in the sterile soil. The seedlings could utilize this element for growth which we could observe from the control seedlings. There was no characteristic of lacking nitrogen in the control pots. Our next experiment will be focused on inoculating of test Rhizobium on tamarind seedling grown in washed sterile sand absolutely lacking of nitrogen to confirm whether there are any differents happened between the test strains and the control. We also try to prove our test Rhizobium by inoculating on various kinds of bean seedling cultured on washed sterile sand to observed whether there are any nodules occurred.

4.4 Cultural Practice and Demonstration

4.4.1 To study the effect of plant regulators on widening the crotch angles of tamarind.

Table 8 Effect of growth substances on angle of branches

Growth substance	Concentration (ppm)	Angle ( )
Control	0	70.909
TIBA	25	71.325
	50	72.851
	75	71.803
	100	72.942
BA	25	78.134
	50	76.060
	75	76.194
	100	74.856
test		NS
CV (%)		5.83

From Table 8 showing the effect of growth substances on the branch angle, found that there is no statistical difference in all kinds and concentrations of chemical. However, the treated plants should be transplanted from containers to the pot for further study on the angle of branches.

4.4.2 To Study the effect of spacing on growth

Table 9 The average number of branches, girth and height of plant 10 months after planting

Spacing (m)	No. of Branch	Height of Plants (cm)	Girth (cm)
2.0 x 1.0	6.920 [b]	37.980	1.86 [b]
2.0 x 1.5	10.260 [a]	41.970	2.15 [a]
2.0 x 2.0	9.700 [a]	38.320	1.93 [b]
Test		N.S	
CV (%)	9.87	6.07	4.39

From Table 9 the experiment on the different spacing of planting, it is found that the number of branches and girth of 2.0 x 1.5 meters spacing are highly significant from the others but there is no difference on height of plants.

5. Conclusion / Remark :

1. There is a great difference on growth characters of each biomass accession grown in the field and containers, might be utilized for biomass production in various planting systems
2. Soil and climatic condition influence to the pod yield of the mother plants at the original sites.
3. The chemical analysis of each accession indicates the difference.
4. One dwarf rootstock was found based on morphological characteristics that should be studied in other aspects to prove its dwarfness.
5. CCC and Paclobutrazol has tendency to control the canopy size.
6. No effect of chemical substances (TIBA and BA) on widening the crotch angles of tamarind at seedling stage.
7. The spacing of 2.0 x 1.5 meters produced more number of branches and larger girth.

6. Workplan for the Next Period:

6.1 Testing of Germplasm

6.1.1 Biomass study

- To study the growth of plant both in field and containers.

6.1.2 Fruit study.

- To observe the accession mother plants at the original sites.
- To test the accession grafted plants in the field.

- To analyse the chemical composition of leaf and pod of accessions.

6.2 Rootstock study

6.1.1 The search for dwarf rootstock.

- To search and test the untended dwarf phenotypic expression plant.

6.2.2 Chemical treatment for the production of dwarf rootstock.

6.3 Rhizobium study.

- To study the inoculation and isolation of Rhizobium from tamarind.
- To identify the Rhizobium from tamarind under Electron Microscope.

6.4 Cultural practice and Demonstration

- To study the effect of plant regulators on widening the crotch angles of tamarind.
- To study the effect of spacing on growth.
- To study the production of young leaf.
- To study the change of pulp colour in storage.
- To study the seed storage.

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Annex / Picture

Table 1 Detailed data of Biomass accessions in the field with statistical analysis (Duncan's Multiple Range Test, α = 0.01)

Ranked order	Accession no.	Height (cm)	Accession no.	width (cm)	Accession no.	Length (cm)
1.	77	76.04 A	77	69.83 A	81	64.50 A
2.	10	74.17 AB	30	68.83 AB	77	64.17 AB
3.	30	71.00 AB	81	68.83 AB	76	58.83 ABC
4.	81	71.00 ABC	20	68.00 AB	20	58.00 ABC
5.	11	68.50 ABCD	16	68.00 AB	78	57.50 ABCD
6.	31	68.33 ABCD	29	67.83 ABC	30	57.50 ABCD
7.	78	68.00 ABCD	10	67.17 ABC	15	56.17 ABCD
8.	20	67.83 ABCD	11	67.00 ABCD	35	54.67 ABCD
9.	16	67.67 ABCD	31	66.50 ABCDE	27	54.50 ABCD
10.	76	67.50 ABCD	35	65.17 ABCDE	83	53.00 ABCD
11.	29	67.00 ABCD	15	63.17 ABCDEF	10	52.83 ABCD
12.	1	66.83 ABCDE	17	63.00 ABCDEF	31	52.67 ABCD
13.	3	66.83 ABCDE	9	62.17 ABCDEFG	11	52.67 ABCD
14.	35	66.50 ABCDE	78	61.50 ABCDEFG	25	52.67 ABCD
15.	41	66.33 ABCDE	76	61.50 ABCDEFG	16	52.17 ABCD
16.	32	66.00 ABCDE	32	61.33 ABCDEFG	87	52.17 ABCD
17.	15	65.50 ABCDE	25	61.17 ABCDEFG	18	50.00 ABCD
18.	18	64.33 ABCDE	18	59.83 ABCDEFG	38	49.67 ABCD
19.	27	64.17 ABCDE	41	59.83 ABCDEFG	67	49.33 ABCD
20.	38	63.17 ABCDE	14	59.83 ABCDEFG	47	49.17 ABCD
21.	17	63.00 ABCDE	40	59.83 ABCDEFG	89	49.00 ABCD

Ranked order	Accession no.	Height (cm)	Accession no.	width (cm)	Accession no.	Length (cm)
22.	89	62.17 ABCDEF	67	59.33 ABCDEFG	17	47.33 ABCD
23.	87	62.00 ABCDEF	87	59.17 ABCDEFG	32	47.33 ABCD
24.	42	61.00 ABCDEF	27	58.33 ABCDEFG	1	47.17 ABCD
25.	36	60.33 ABCDEF	38	58.17 ABCDEFG	84	47.17 ABCD
26.	83	60.17 ABCDEF	8	57.17 ABCDEFG	9	47.00 ABCD
27.	40	59.83 ABCDEF	79	57.00 ABCDEFG	29	47.00 ABCD
28.	37	59.67 ABCDEF	83	56.83 ABCDEFG	71	46.17 ABCD
29.	25	59.33 ABCDEF	19	56.83 ABCDEFG	8	45.67 ABCD
30.	24	59.33 ABCDEF	1	56.67 ABCDEFG	43	45.67 ABCD
31.	9	58.83 ABCDEF	22	56.17 ABCDEFG	14	45.67 ABCD
32.	67	58.67 ABCDEF	36	56.00 ABCDEFG	62	45.33 ABCD
33.	8	58.33 ABCDEF	37	55.83 ABCDEFG	41	45.33 ABCD
34.	4	58.17 ABCDEF	80	55.67 ABCDEFG	80	45.17 ABCD
35.	79	58.00 ABCDEF	26	55.50 ABCDEFG	38	44.33 ABCD
36.	14	57.83 ABCDEF	24	54.67 ABCDEFG	75	44.33 ABCD
37.	19	57.67 ABCDEF	42	54.67 ABCDEFG	45	44.17 ABCD
38.	80	57.50 ABCDEF	71	53.83 ABCDEFG	74	44.17 ABCD
39.	75	57.00 ABCDEF	84	53.83 ABCDEFG	86	43.83 ABCD
40.	13	55.17 ABCDEF	12	53.33 ABCDEFG	79	43.83 ABCD
41.	12	56.17 ABCDEF	34	53.00 ABCDEFG	70	43.67 ABCD
42.	2	56.00 ABCDEF	43	51.67 ABCDEFG	40	42.83 ABCD
43.	21	56.00 ABCDEF	3	51.67 ABCDEFG	36	42.83 ABCD
44.	34	56.00 ABCDEF	89	51.50 ABCDEFG	22	42.50 ABCD
45.	84	56.00 ABCDEF	45	51.50 ABCDEFG	28	42.50 ABCD

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Ranked order	Accession no.	Height (cm)	Accession no.	Width (cm)	Accession no.	Length (cm)
46.	86	55.80 ABCDEF	85	51.50 ABCDEFG	12	42.33 ABCD
47.	60	55.50 ABCDEF	72	51.00 ABCDEFG	34	42.33 ABCD
48.	22	55.17 ABCDEF	39	50.17 ABCDEFG	24	42.17 ABCD
49.	45	55.17 ABCDEF	86	46.67 ABCDEFG	56	42.00 ABCD
50.	43	55.17 ABCDEF	21	49.17 ABCDEFG	33	40.50 ABCD
51.	5	54.50 ABCDEF	5	49.17 ABCDEFG	57	40.33 ABCD
52.	26	54.33 ABCDEF	75	48.50 ABCDEFG	26	40.00 ABCD
53.	7	54.33 ABCDEF	74	48.33 ABCDEFG	21	39.67 ABCD
54	39	54.17 ABCDEF	28	48.33 ABCDEFG	39	39.33 ABCD
55.	74	53.67 ABCDEF	13	48.00 ABCDEFG	65	39.17 ABCD
56.	33	53.50 ABCDEF	61	47.83 ABCDEFG	19	39.17 ABCD
57.	82	53.50 ABCDEF	70	47.83 ABCDEFG	60	39.17 ABCD
58.	49	53.17 ABCDEF	7	47.50 ABCDEFG	85	39.17 ABCD
59.	23	53.00 ABCDEF	33	47.50 ABCDEFG	42	39.17 ABCD
60.	72	53.00 ABCDEF	56	47.17 ABCDEFG	23	39.17 ABCD
61.	56	52.83 ABCDEF	6	47.17 ABCDEFG	72	39.00 ABCD
62.	57	52.50 ABCDEF	23	47.00 ABCDEFG	5	38.83 ABCD
63.	85	52.00 ABCDEF	57	46.67 ABCDEFG	90	38.67 ABCD
64.	70	51.83 ABCDEF	59	46.17 ABCDEFG	61	38.33 ABCD
65.	62	51.83 ABCDEF	4	46.00 ABCDEFG	88	37.83 ABCD
66.	71	51.67 ABCDEF	54	46.00 ABCDEFG	3	37.67 ABCD
67.	69	51.50 ABCDEF	2	45.67 ABCDEFG	4	37.33 ABCD
68.	6	51.25 ABCDEF	60	45.67 ABCDEFG	69	36.83 ABCD
69.	28	51.00 ABCDEF	53	45.67 ABCDEFG	82	36.83 ABCD

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Ranked order	Accession no.	Height (cm)	Accession no.	width (cm)	Accession no.	Length (cm)
70.	44	50.33 ABCDEF	69	45.50 ABCDEFG	13	36.67 ABCD
71.	48	50.00 ABCDEF	62	45.50 ABCDEFG	6	35.50 ABCD
72.	88	49.50 ABCDEF	88	44.83 ABCDEFG	54	35.50 ABCD
73.	54	49.50 ABCDEF	49	43.33 ABCDEFG	58	35.33 ABCD
74.	52	49.33 ABCDEF	44	43.50 ABCDEFG	48	35.00 ABCD
75.	90	48.83 ABCDEF	48	43.17 ABCDEFG	49	34.83 ABCD
76.	53	48.67 ABCDEF	90	42.83 ABCDEFG	44	34.00 ABCD
77.	65	48.33 BCDEF	52	42.33 ABCDEFG	7	34.00 ABCD
78.	47	47.67 BCDEF	65	42.33 ABCDEFG	46	33.83 ABCD
79.	68	47.50 BCDEF	46	41.83 ABCDEFG	52	32.67 BCD
80.	46	47.33 BCDEF	47	41.83 ABCDEFG	59	31.50 CD
81.	58	47.17 BCDEF	51	40.17 ABCDEFG	2	30.17 CD
82.	61	47.17 BCDEF	58	40.17 ABCDEFG	53	29.83 CD
83.	59	46.00 CDEF	82	39.83 ABCDEFG	63	29.83 CD
84.	51	45.17 CDEF	68	37.50 ABCDEFG	51	29.67 CD
85.	63	43.67 CDEF	55	36.67 BCDEFG	66	29.58 CD
86.	55	43.00 DEF	64	35.50 CDEFG	55	29.00 CD
87.	50	39.83 EF	66	34.33 DEFG	50	28.83 CD
88.	73	39.83 EF	50	33.83 EFG	64	28.17 CD
89.	64	39.50 EF	63	32.33 FG	68	28.17 CD
90.	66	35.42 F	73	30.00 G	73	26.00 D

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Table 2 Detailed data of Biomass accessions in the field on ranked order

Ranked order	Accession no. Height	Width	Length
1.	77	77	81
2.	10	30	77
3.	30	81	76
4.	81	20	20
5.	11	16	78
6.	31	29	30
7.	78	10	15
8.	20	11	35
9.	16	31	27
10.	76	35	83
11.	29	15	10
12.	1	17	31
13.	9	9	11
14.	35	78	25
15.	41	76	16
16.	32	32	87
17.	15	25	18
18.	18	18	38
19.	27	41	67
20.	38	14	47
21.	17	40	89

Ranked order	Accession no. Height	Width	Length
22.	89	67	17
23.	87	87	32
24.	42	27	1
25.	36	38	84
26.	83	8	9
27.	40	79	29
28.	37	83	71
29.	25	19	8
30.	24	1	43
31.	3	22	14
32.	67	36	62
33.	8	37	41
34.	4	80	80
35.	79	26	38
36.	14	24	75
37.	19	42	45
38.	80	71	74
39.	75	84	86
40.	13	12	79
41.	12	34	70
42.	2	43	40
43.	21	3	36
44.	34	89	22

Ranked order	Accession no. Height	Width	Length
45.	84	45	28
46.	86	85	12
47.	60	72	34
48.	22	39	24
49.	45	86	56
50.	43	21	33
51.	5	5	57
52.	26	75	26
53.	7	74	21
54	39	38	39
55.	74	13	65
56.	33	61	19
57.	82	70	60
58.	49	7	85
59.	23	33	42
60.	72	56	23
61.	56	6	72
62.	57	23	5
63.	85	57	90
64.	70	59	61
65.	62	4	88
66.	71	54	3
67.	69	2	4

Ranked order	Accession no.		
	Height	Width	Length
68.	6	60	69
69.	28	53	82
70.	44	69	13
71.	48	62	6
72.	88	88	4
73.	54	49	58
74.	52	44	48
75.	90	48	49
76.	53	90	44
77.	65	52	7
78.	47	65	46
79.	68	46	52
80.	46	47	59
81.	58	51	2
82.	61	58	53
83.	59	82	63
84.	51	68	51
85.	63	55	66
86.	55	64	55
87.	50	66	50
88.	73	50	64
89.	64	63	68
90.	66	73	73

Table 3 Detailed data of Biomass accession in the field on different growth characteristics

Accession no.	Height (cm)	Width (cm)	Length (cm)	Canopy (m3)
1.	66.83	56.67	47.17	0.18
2.	56.00	45.67	30.17	0.08
3.	58.83	51.67	37.67	0.12
4.	58.17	46.00	37.33	0.10
5.	54.50	49.17	38.83	0.11
6.	51.25	47.17	35.50	0.09
7.	54.33	47.50	34.00	0.09
8.	58.33	57.17	45.67	0.15
9.	66.03	62.17	47.00	0.20
10.	74.17	67.17	52.83	0.26
11.	68.50	67.00	52.67	0.25
12.	56.17	53.33	42.33	0.13
13.	56.17	48.00	36.67	0.10
14.	57.83	59.83	45.67	0.16
15.	65.50	63.17	56.17	0.23
16.	67.67	68.00	52.17	0.24
17.	63.00	63.00	47.83	0.19
18.	64.33	59.83	50.00	0.19
19.	57.67	56.83	39.17	1.30
20.	67.83	68.00	58.00	0.23
21.	56.00	49.17	39.67	0.11
22.	55.17	56.17	42.50	0.13

Accession no.	Height (cm)	Width (cm)	Length (cm)	Canopy (m3)
23.	53.00	47.00	39.17	0.10
24.	59.33	54.67	42.17	0.14
25.	59.33	61.17	52.67	0.19
26.	54.33	55.50	40.00	0.12
27.	64.17	58.33	54.50	0.20
28.	51.00	48.33	42.50	0.11
29.	67.00	67.83	47.00	0.21
30.	74.00	68.83	57.50	0.30
31.	68.33	66.50	52.67	0.24
32.	66.00	61.33	47.33	0.19
33.	53.50	47.50	40.50	0.11
34.	56.00	53.00	42.33	0.13
35.	66.50	65.17	54.67	0.24
36.	60.33	56.00	42.83	0.14
37.	59.67	55.83	49.67	0.17
38.	63.17	58.17	44.33	0.16
39.	54.17	50.17	39.33	0.11
40.	59.83	59.83	42.83	0.16
41.	66.33	59.83	45.33	0.18
42.	61.00	54.67	39.17	0.13
43.	55.17	51.67	45.67	0.13
44.	50.33	43.50	34.00	0.08
45.	55.17	51.50	44.17	0.13
46.	47.33	41.83	33.83	0.07

Accession no.	Height (cm)	Width (cm)	Length (cm)	Canopy (m3)
47.	47.67	41.83	49.17	0.10
48.	50.00	43.17	35.00	0.08
49.	53.17	43.83	34.83	0.08
50.	39.83	33.83	28.83	0.04
51.	45.17	40.17	29.67	0.05
52.	49.33	42.33	32.67	0.07
53.	48.67	45.67	29.83	0.07
54	49.50	46.00	35.50	0.08
55.	43.00	36.67	29.00	0.05
56.	52.83	47.17	42.00	0.11
57.	52.50	46.67	40.33	0.10
58.	47.17	40.17	35.33	0.07
59	46.00	46.17	31.50	0.07
60.	55.50	45.67	39.17	0.10
61.	47.17	47.83	38.33	0.09
62.	51.83	45.50	45.33	0.11
63.	43.67	32.33	29.83	0.04
64.	49.50	35.50	28.17	0.04
65.	48.33	42.33	39.17	0.08
66.	35.42	34.33	29.58	0.04
67.	58.67	59.33	49.33	0.17
68.	47.50	37.50	28.17	0.05
69.	51.50	45.50	36.83	0.09
70.	51.83	47.83	43.67	0.11

Accession no.	Height (cm)	Width (cm)	Length (cm)	Canopy (m3)
71.	51.67	53.83	46.17	0.13
72.	53.00	51.00	39.00	0.11
73.	39.83	30.00	26.00	0.03
74.	53.67	48.33	44.17	0.11
75.	57.00	48.50	44.33	0.12
76.	67.50	61.50	58.83	0.25
77.	76.04	69.83	64.17	0.34
78.	68.00	61.50	57.50	0.26
79.	58.00	57.00	43.83	0.15
80.	57.50	55.67	45.17	0.15
81.	71.00	68.83	64.50	0.32
82.	53.50	39.83	36.83	0.08
83.	60.17	56.83	53.00	0.18
84.	56.00	53.67	47.17	0.14
85.	52.00	51.00	39.17	0.10
86.	55.83	49.67	43.83	0.12
87.	62.00	59.17	52.17	0.19
88.	49.50	43.83	37.83	0.08
89.	62.17	51.50	49.00	0.16
90.	48.83	42.83	38.67	0.08

Table 4 Detailed data of Biomass accessions in the container with statistical analysis (Duncan's Multiple Range Test, α = 0.01)

Ranked order	Accession no.	Height (cm)	Accession no.	width (cm)	Accession No.	Lenght (cm)
1.	49	151.25 A	49	77.71 A	49	87.33 A
2.	74	140.63 AB	87	77.67 A	46	84.58 AB
3.	60	139.63 AB	47	74.58 AB	40	84.46 ABC
4.	46	138.63 AB	88	72.96 ABC	47	83.63 ABCD
5.	50	136.54 ABC	90	72.83 ABC	14	80.96 ABCDE
6.	43	136.13 ABC	43	71.13 ABCD	60	80.17 ABCDE
7.	47	136.00 ABCD	50	70.38 ABCDE	52	78.63 ABCDE
8.	58	135.96 ABCD	79	70.35 ABCDE	50	77.71 ABCDE
9.	79	135.72 ABCD	74	70.04 ABCDE	74	77.54 ABCDE
10.	35	135.58 ABCD	58	69.25 ABCDE	58	77.38 ABCDE
11.	61	135.17 ABCD	51	69.00 ABCDE	84	76.83 ABCDE
12.	86	135.17 ABCD	60	68.38 ABCDE	72	76.38 ABCDE
13.	40	134.67 ABCD	18	67.83 ABCDE	33	76.25 ABCDE
14.	8	134.29 ABCD	66	67.50 ABCDE	37	76.08 ABCDE
15.	90	134.21 ABCD	35	67.21 ABCDE	79	75.92 ABCDE
16.	57	133.92 ABCD	33	67.08 ABCDE	57	75.83 ABCDE
17.	37	133.63 ABCD	14	65.88 ABCDE	51	75.79 ABCDE
18.	44	133.38 ABCD	78	65.74 ABCDE	18	75.54 ABCDE
19.	51	133.33 ABCD	77	65.67 ABCDE	31	75.29 ABCDE
20	72	133.04 ABCD	84	65.55 ABCDE	59	74.83 ABCDE

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Panked order	Accession no.	Height (cm)	Accession no.	width (cm)	Accession No.	Lenght (cm)
21.	12	132.96 ABCD	70	65.00 ABCDE	45	74.71 ABCDE
22.	52	132.92 ABCD	57	64.88 ABCDE	77	74.47 ABCDE
23.	75	132.92 ABCD	72	64.88 ABCDE	44	74.46 ABCDE
24.	54	132.29 ABCD	80	64.86 ABCDE	35	74.29 ABCDE
25.	31	132.00 ABCD	52	64.75 ABCDE	87	74.21 ABCDE
26.	36	131.50 ABCD	46	64.71 ABCDE	32	74.00 ABCDE
27.	5	131.33 ABCD	63	64.64 ABCDE	26	73.75 ABCDE
28.	70	131.29 ABCD	59	64.54 ABCDE	61	73.63 ABCDE
29.	62	130.96 ABCD	37	64.50 ABCDE	73	72.79 ABCDEF
30.	32	130.79 ABCDE	32	64.25 ABCDE	43	72.75 ABCDEF
31.	63	130.40 ABCDE	6	64.13 ABCDE	36	72.71 ABCDEF
32.	73	130.38 ABCDE	31	64.13 ABCDE	68	72.33 ABCDEF
33.	45	129.92 ABCDE	86	63.83 ABCDE	28	72.25 ABCDEF
34.	89	129.67 ABCDE	83	63.75 ABCDE	24	72.17 ABCDEF
35.	69	129.54 ABCDE	73	63.29 ABCDE	70	72.13 ABCEDF
36.	33	129.38 ABCDE	40	62.88 ABCDE	66	72.00 ABCDEF
37.	88	129.38 ABCDE	61	61.86 ABCDE	38	71.71 ABCDEF
38.	85	128.46 ABCDE	75	61.71 ABCDE	76	71.38 ABCDEF
39.	30	128.38 ABCDE	44	61.67 ABCDE	11	71.00 ABCDEF
40.	4	128.29 ABCDE	65	61.33 ABCDE	20	70.83 ABCDEF
41.	14	128.08 ABCDE	5	61.33 ABCDE	62	70.83 ABCDEF
42.	26	127.38 ABCDE	41	61.29 ABCDE	78	70.78 ABCDEF
43.	66	126.71 ABCDE	62	61.21 ABCDE	63	70.56 ABCDEF
44.	24	126.65 ABCDE	85	60.83 ABCDE	12	70.21 ABCDEF

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Ranked order	Accession no.	Height (cm)	Accession no.	width (cm)	Accession No.	Lenght (cm)
45.	18	126.42 ABCDE	69	60.75 ABCDE	69	69.83 ABCDEF
46.	84	126.04 ABCDE	71	60.22 ABCDE	65	63.79 ABCDEF
47.	6	125.67 ABCDE	68	60.21 ABCDE	19	69.67 ABCDEF
48.	15	125.67 ABCDE	81	59.42 ABCDE	88	69.58 ABCDEF
49.	59	125.57 ABCDE	89	59.26 ABCDE	5	69.33 ABCDEF
50.	65	125.54 ABCDE	54	59.25 ABCDE	6	69.13 ABCDEF
51.	87	124.92 ABCDE	26	59.21 ABCDE	1	69.00 ABCDEF
52.	1	124.79 ABCDE	7	59.17 ABCDE	53	68.92 ABCDEF
53.	71	124.78 ABCDE	45	59.17 ABCDE	42	68.25 ABCDEF
54.	25	124.50 ABCDE	56	58.96 ABCDE	90	68.17 ABCDEF
55.	48	124.50 ABCDE	76	58.58 ABCDE	75	67.83 ABCDEF
56.	68	124.46 ABCDE	82	58.58 ABCDE	85	67.79 ABCDEF
57.	20	123.83 ABCDE	48	58.22 ABCDE	71	67.56 ABCDEF
58.	67	123.63 ABCDE	42	58.17 ABCDE	86	67.54 ABCDEF
59.	21	123.56 ABCDE	53	58.13 ABCDE	4	67.29 ABCDEF
60.	11	123.54 ABCDE	1	57.75 ABCDE	25	66.96 ABCDEF
61.	76	122.92 ABCDE	36	57.13 ABCDE	41	66.71 ABCDEF
62.	64	122.83 ABCDE	20	56.92 ABCDE	15	66.67 ABCDEF
63.	78	122.31 ABCDE	16	56.67 ABCDE	21	66.51 ABCDEF
64.	41	122.29 ABCDE	11	56.63 ABCDE	8	66.21 ABCDEF
65.	42	122.06 ABCDE	25	56.29 ABCDE	56	65.96 ABCDEF
66.	77	121.75 ABCDE	67	56.08 ABCDE	55	65.63 ABCDEF
67.	56	120.88 ABCDE	28	56.04 ABCDE	16	65.38 ABCDEF
68.	10	120.38 ABCDE	15	55.83 ABCDE	30	65.17 ABCDEF

Ranked order	Accession no.	Height (cm)		Accession no.	width (cm)		Accession No.	Lenght (cm)	
69.	29	120.38	ABCDE	17	55.63	ABCDE	10	64.92	ABCDEF
70.	81	119.97	ABCDE	21	55.43	ABCDE	48	64.90	ABCDEF
71.	7	119.88	ABCDE	8	55.42	ABCDE	29	64.42	ABCDEF
72	16	118.92	ABCDE	64	55.38	ABCDE	7	64.17	ABCDEF
73.	22	117.08	BCDE	4	55.33	ABCDE	2	63.75	ABCDEF
74.	19	116.04	BCDE	24	55.29	ABCDE	39	63.71	ABCDEF
75.	55	115.54	BCDE	38	55.13	ABCDE	80	63.13	ABCDEF
76.	23	115.17	BCDE	19	55.08	ABCDE	34	63.13	ABCDEF
77.	38	115.08	BCDE	30	54.92	ABCDE	3	62.88	ABCDEF
78.	53	115.08	BCDE	29	54.25	ABCDE	9	62.83	ABCDEF
79.	83	115.00	BCDE	12	54.13	ABCDE	89	62.54	ABCDEF
80	34	114.92	BCDE	55	54.00	ABCDE	83	62.25	ABCDEF
81.	38	144.75	BCDE	9	53.79	ABCDE	67	62.13	ABCDEF
82	28	114.54	BCDE	39	50.92	ABCDE	81	62.00	ABCDEF
83.	9	114.46	BCDE	34	50.88	ABCDE	17	60.00	BCDEF
84.	80	112.45	BCDE	10	50.83	ABCDE	64	59.88	BCDEF
85.	17	112.25	BCDE	3	49.67	BCDE	23	59.29	BCDEF
86.	3	110.17	BCDE	22	47.29	BCDE	22	57.83	CDEF
87.	2	108.58	BCDE	23	46.88	CDE	54	57.63	DEF
88.	13	105.25	CDE	2	46.17	CDE	13	54.92	EF
89.	82	103.17	DE	13	44.96	DE	82	54.25	EF
90	27	98.38	E	27	43.21	E	27	47.08	F

Table 5 Detailed data of Biomass accessions in the container on ranked order

Ranked order	Accession		
	Height	width	Lenght
1.	49	49	49
2.	74	87	46
3.	60	47	40
4.	46	88	47
5.	50	90	14
6.	43	43	60
7.	47	50	52
8.	58	79	50
9.	79	74	74
10.	35	58	58
11.	61	51	84
12.	86	60	72
13.	40	18	33
14.	8	66	37
15.	90	35	79
16.	57	33	57
17.	37	14	51
18.	44	78	18
19.	51	77	31
20.	72	84	59
21.	12	70	45

Ranked order	Accession		
	Height	width	Lenght
22.	52	57	77
23.	75	72	44
24.	54	80	35
25.	31	52	87
26.	36	46	32
27.	5	63	26
28.	70	59	61
29.	62	37	73
30.	32	32	43
31.	63	6	36
32.	73	31	68
33.	45	86	28
34.	89	83	24
35.	69	73	70
36.	33	40	66
37.	88	61	38
38.	85	75	76
39.	30	44	11
40.	4	65	20
41.	14	5	62
42.	26	41	78
43.	66	62	63
44.	24	85	12

Ranked order	Accession		
	Height	width	Lenght
45.	18	69	69
46.	84	71	65
47.	6	68	19
48.	15	81	88
49.	59	89	5
50.	65	54	6
51.	87	26	1
52.	1	7	53
53.	71	45	42
54.	25	56	90
55.	48	76	75
56.	68	82	65
57.	20	48	71
58.	67	42	86
59.	21	53	4
60.	11	1	25
61.	76	36	41
62.	64	20	15
63.	78	16	21
64.	41	11	8
65.	42	25	56
66.	77	67	55
67.	56	28	16

Ranked order	Accession		
	Height	width	Lenght
68.	10	15	30
69.	29	17	10
70.	81	21	48
71.	7	8	29
72.	16	64	7
73.	22	4	2
74.	19	24	39
75.	55	38	80
76.	23	19	34
77.	39	30	3
78.	53	29	9
79.	83	12	89
80	34	55	83
81.	38	9	67
82	28	39	81
83.	9	34	17
84.	80	10	64
85.	17	3	23
86.	3	22	22
87.	2	23	54
88.	13	2	13
89.	62	13	82
90.	27	27	27

Table 6 Detailed data of Biomass accessions in the container on different growth characteristics

Accession no.	Heigth (cm)	Width (cm)	Length (cm)	Canopy (m^3)
1.	124.79	57.75	69.00	0.50
2.	108.58	46.17	63.75	0.27
3.	110.17	49.67	62.88	0.25
4.	128.29	55.33	67.29	0.47
5.	131.33	61.33	69.33	0.56
6.	125.67	64.13	69.13	0.49
7.	119.88	59.17	64.17	0.45
8.	134.29	55.42	66 21	0.49
9.	114.46	53.79	62.83	0.50
10.	120.38	50.83	64.92	0.40
11.	123.54	56.63	71.00	0.50
12.	132.96	54.13	70.21	0.50
13.	105.25	44.96	54.92	0.26
14.	128.08	65.88	80.96	0.68
15.	125.67	55.83	66.67	0.45
16.	118.92	56.67	65.38	0.44
17.	112.25	55.63	60.00	0.38
18.	126.42	67.83	75.54	0.65
19.	116.04	55.08	69.67	0.45
20	123.83	56.92	70.83	0.50
21	123.56	55.43	66.51	0.46
22.	117.08	47.29	57.83	0.32

Accession no.	Heigth (cm)	Width (cm)	Length (cm)	Canopy (m^3)
23.	115.17	46.88	59.29	0.32
24.	126.65	55.29	72.17	0.46
25.	124.50	56.29	66.96	0.55
26.	127.38	59.21	73.75	0.56
27.	98.38	43.21	47.08	0.38
28.	114.54	56.04	72.25	0.46
29.	120.38	54.25	64.42	0.42
30.	128.38	54.92	65.17	0.46
31.	132.00	64.13	75.29	0.63
32.	130.79	64.25	74.00	0.62
33.	129.38	67.08	76.25	0.66
34.	114.92	50.88	63.13	0.37
35.	135.58	67.21	74.29	0.67
36.	131.50	57.13	72.71	0.55
37.	133.63	64.50	76.08	0.66
38.	114.75	55.13	71.71	0.46
39.	115.08	50.92	63.71	0.38
40.	134.67	62.88	84.46	0.71
41.	122.29	61.29	66.71	0.50
42.	122.08	58.17	68.25	0.48
43.	136.13	71.13	72.75	0.71
44.	133.38	61.67	74.46	0.61
45.	129.92	59.17	74.71	0.58
46.	138.63	64.71	84.58	0.77

Accession no.	Heigth (cm)	Width (cm)	Length (cm)	Canopy (m^3)
47.	136.00	74.58	83.63	0.86
48.	124.50	58.22	64.90	0.47
49.	151.25	77.71	87.33	1.03
50.	136.54	70.38	77.71	0.71
51.	133.33	69.00	75.79	0.70
52.	132.92	64.75	78.63	0.68
53.	115.08	58.13	68.92	0.46
54.	132.29	59.25	57.63	0.45
55.	115.54	54.00	65.63	0.41
56.	120.88	58.96	65.96	0.47
57.	133.92	64.88	75.83	0.66
58.	135.96	69.25	77.38	0.72
59.	125.57	64.54	74.83	0.61
60.	139.63	68.38	80.17	0.76
61.	135.17	61.88	73.63	0.62
62.	130.96	61.21	70.83	0.57
63.	130.40	64.64	70.56	0.60
64.	122.83	55.38	59.88	0.41
65.	125.54	61.33	69.79	0.54
66.	126.71	67.50	72.00	0.62
67.	123.63	56.08	62.13	0.43
68.	124.46	60.21	72.33	0.54
69.	129.54	60.75	69.83	0.56
70.	131.29	65.00	72.13	0.61

Accession no.	Heigth (cm)	Width (cm)	Length (cm)	Canopy (m^3)
71.	124.78	60.22	67.56	0.51
72.	133.04	64.88	76.38	0.66
73.	130.38	63.29	72.79	0.60
74.	140.63	70.04	77.54	0.77
75.	132.92	61.71	67.83	0.56
76.	122.92	58.58	71.38	0.52
77.	121.75	65.67	74.47	0.60
78.	122.31	65.74	70.78	0.57
79.	135.72	70.35	75.92	0.72
80.	112.45	64.86	63.13	0.46
81.	119.97	59.42	62.00	0.44
82.	103.17	58.58	54.25	0.33
83.	115.00	63.75	62.25	0.46
84	126.04	65.55	76.83	0.64
85.	128.46	60.83	67.79	0.53
86.	135.17	63.83	67.54	0.59
87.	124.92	77.67	74.21	0.72
88.	129.38	72.96	69.58	0.66
89.	129.67	59.26	62.54	0.48
90.	134.21	72.83	68.17	0.67

Table 7 canopy and diameter of rootstock in relation to number of stomata

Series No.	Stomatal Class	Canopy (m^3)	Diameter (cm)	number of Rootstock
1.	3.51 - 4.00	0.2438	0.940	1
2.	4.01 - 4.50	0.2338	0.940	1
3.	4.51 - 5.00	0.1673	0.933	6
4.	5.01 - 5.50	0.1151	0.793	51
5.	5.51 - 6.00	0.1146	0.730	127
6.	6.01 - 6.50	0.1152	0.782	107
7.	6.51 - 7.00	0.1384	0.776	81
8.	7.01 - 7.50	0.1237	0.787	39
9.	7.51 - 8.00	0.1458	0.772	18
10.	8.01 - 8.50	0.1909	0.844	8
11.	8.51 - 9.00	0.1722	0.873	3
12.	9.01 - 9.50	0.3366	1.120	2
13.	9.51 - 10.00	0.3600	1.000	1

Table 8 Detailed data of Dwarf No.1 Plant

Node No. / Terminal shoot No.	1	2	3	4	5	6	7	8	9	10	Total	Average
1	0.5	1.0	1.0	1.5	1.9	2.0	1.7	1.5	1.3	-	12.4	1.37
2	1.0	0.5	0.5	0.7	1.0	1.5	1.7	2.0	1.4	-	10.3	1.14
3	1.6	1.8	1.5	1.2	1.0	0.7	2.0	2.5	1.6	2.5	16.4	1.64
4	0.6	1.0	2.0	1.7	2.2	1.2	1.2	-	-	-	9.9	1.41
5	0.5	0.7	0.5	2.0	1.8	1.8	1.4	-	-	-	8.2	1.17
6	1.0	1.0	2.0	2.4	2.7	2.0	2.0	-	-	-	13.1	1.87
7	1.3	1.8	1.7	2.2	1.4	1.7	2.0	2.2	2.0	2.0	18.3	1.83
8	1.0	1.7	2.0	2.2	2.0	1.0	0.5	-	-	-	10.4	1.48
9	0.6	0.3	1.7	2.0	1.2	0.8	0.3	0.3	-	-	7.2	0.90
10	1.1	2.0	2.0	2.4	3.0	-	-	-	-	-	10.5	2.10
Total	8.2	11.8	14.9	18.3	18.2	12.7	12.8	8.5	6.3	4.5	116.7	14.91
											Average	1.491

Table 9 Detailed data of Dwarf No.2 Plant.

Node No. / Terminal shoot No.	1	2	3	4	5	6	7	8	9	10	Total	Average
1.	0.9	0.9	1.0	1.3	2.0	2.2	2.7	2.5	2.4	2.5	18.4	1.84
2.	1.2	2.0	1.8	2.0	2.0	2.3	2.4	2.6	1.9	1.9	20.1	2.01
3.	1.1	1.4	2.6	2.7	2.0	2.4	2.4	2.0	2.0	1.0	19.6	1.96
4.	0.5	0.8	1.2	1.5	1.9	2.0	2.0	2.4	2.3	2.5	17.1	1.71
5.	1.0	1.0	1.4	1.2	2.0	1.7	2.0	2.6	2.3	2.0	17.2	1.72
6.	0.6	0.6	1.0	1.0	1.6	1.7	1.9	2.0	2.4	2.0	14.8	1.48
7.	1.0	1.0	1.2	1.7	1.7	2.2	2.6	2.8	2.8	2.6	19.6	1.96
8.	0.5	0.4	1.8	1.6	2.0	2.4	2.6	2.5	3.0	2.6	19.4	1.94
9.	1.8	1.6	1.1	0.6	0.8	1.8	2.0	2.3	2.5	2.8	17.3	1.73
10.	1.0	1.2	1.7	1.8	1.5	2.2	3.0	2.6	2.5	2.3	19.8	1.98
Total	9.6	10.6	14.8	15.4	17.5	20.9	23.6	24.3	24.1	22.2	183.3	18.33
											Average	1.833

Table 10 Detailed data of No. 87-2-17-021 Plant.

Node No. / Terminal shoot No.	1	2	3	4	5	6	7	8	9	10	Total	Average
1.	2.0	2.0	3.0	3.2	3.2	3.0	2.0	2.0	-	-	20.4	2.55
2.	1.0	2.3	2.3	1.8	1.8	3.0	1.9	1.3	1.0	1.2	17.6	1.76
3.	1.5	2.5	2.0	2.0	1.8	2.3	1.6	2.0	1.5	1.2	18.4	1.84
4.	2.0	2.5	3.0	2.8	2.5	2.0	-	-	-	-	14.8	1.48
5.	1.0	1.0	1.4	2.3	3.2	3.7	4.0	3.5	2.0	0.8	22.8	2.29
6.	0.7	2.0	2.0	3.0	1.3	1.3	0.8	0.8	-	-	11.9	1.48
7.	1.4	1.0	1.0	0.6	0.8	2.3	2.0	3.3	2.3	2.3	17.0	1.70
8.	1.5	1.8	1.3	0.8	0.3	0.3	0.3	0.7	0.5	1.5	9.0	0.90
9.	1.5	1.5	1.0	0.7	1.5	2.0	2.3	1.8	1.7	0.5	14.5	1.45
10.	2.0	1.8	1.3	1.0	1.0	0.8	1.2	1.9	2.0	3.0	16.0	1.60
Total	14.6	18.4	18.3	18.2	17.4	20.7	16.1	16.3	11.0	10.5	162.4	17.05
							Average					1.705

Table 11 Culture for Rhizobium study

I. Phenol red broth base (PRBB) with carbohydrate.

Constituents

Beef extract	1.0	g
Proteose peptone No.3	10.0	g
$NaCl$	5.0	g
Phenol red	0.018	g
Carbohydrate	5.0	g
Distilled water	1000.0	ml

pH 7.4

Carbohydrate : glucose, sucrose, lactose or manitol.

II. Mannitol Medium.

Constituents

Yeast extract	30.0	g
$MgSO_4 7H_2O$	0.2	g
K_2HPO_4	0.5	g
Mannitol	10.0	g
Distilled water	1000.0	ml

pH 6.8

III. Simmon's citrate agar

Constituents

$MgSO_4 . 5 H_2O$	0.2	g
$NH_4H_2PO_4$	1.0	g
K_2HPO_4	1.0	g
Sodium citrate (dehydrate)	2.0	g
NaCL	5.0	g
Agar	15.0	g
Bromthymol blue	0.08	g
Distilled water	1000.0	ml

pH 6.9

Fig 1. A twin sweet-sour tamarind tree grown from different seeds in the same hill.

Fig. 2 A twin sweet-sour tamarind tree with owner (enlarged)

Fig. 3 Enlargement of the tamarind trunk indicates the bark pattern, left one is sweet type and right one is sour type.

Fig 4. A rare and valuable sour tamarind accession gives an amber pulp.

Fig. 5 A huge sour tamarind tree of sixty-six year old produces the highest pod yield.

Fig. 6 A dwarf tamarind tree (mango tree in background) of thirty year old with four metre height.

Fig. 7 The operation on Tamarind Accession Data collection and propagation by inarching.