

MEGHALAYA THING RAI

Ching dan, enkawl le a suksuok dan dang danghai

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CHAPTER 1: THU HMA (INTRODUCTION)

1.1 THINGRAI INLANG DAN TLANGPUI :

Thingrai hna le kung hrim hrim hi a chingna ram lum a zirin a hring nuomin thing rim imnhnik tak le tangkaina tam tak nei a ni a. Hi thingrai ramlum a ching hlak hi a hming intanna tak chuh *Aquilaria*, *Gyrinops*, *Aetoxylon*,ti le *Gonystylis*, a inthawk a nih. Thymelaeaceae sungkuo a mi a ni a.India, New Guinea le China a inthawka ram chin lem Sunda thlierkara hai hmu a ni bawk. An ni lai hin, *Aquilaria* thingrai hi a pawimaw zuol ni a hriet a nih,

India rama thingrai chi hi Arunachal Pradesh, Assam, Manipur, Meghalaya, Tripura, Mizoram, Nagaland, Sikkim, le West Bengal hmar tieng le India simtieng ram Karnataka, Kerala, le Goa ah an ching bawk. A tlangpuiin thingrai kung hi Meghalaya (Shillong tlangzawla ti lova) hmun hrana hai an ching hlak bawk a. Chubakah *Aquilaria malaccensis*, thingrai hi India ram thenkhat khatah ching hlak a ni a *Aquilaria khasiana* thingrai ruok hi chu Meghalaya ram sung leu leuva mawng / insieng a nih.

Aquilaria, *Gyrinops*, *Aetoxylon*, le *Gonystylis*, thingrai thatna hi chi tum tuma hril a um bawk a. A chi a ching le chengna zirin a hmun le thil umhai zira laksuokin a hawng le thing chawkpawlin an siemna zir a enkawl that chun a rim inhnikna a vawng tha zing thei leiin a thaw dan hi tha taka inchuk le buoipui a tul hle a. Chuonga thaw thei chun hun sawttak khawm enkawl ngai lovin hmang tangkai thei a ni bawk. Chuonga buoipui tu hai chun a sik huna man tamtak tak a zawrsuok thei a ni leiin sumdawngtu hai ta dingin hmun hla deuva umhai dawr theina tha le hlu tak a siem thei bawk a. Chuleiin, a hming "**liquid gold**, an inbuk nghe nghe nih. Thingrai hi sumdawnghai ta dingin a hawng le a thing chi hran hranhai chawkpawl a thil tam taka siemsuok thei a ni bawk leiin a dawrtu ta ding khawmin a hlutna hi an sang hle leiin khawvel huopa sum dawngna hlawk tak a ni a, an hmusuok rawn dan an hriet rawn po leh an hlawk el a nih. A chingna le ram zirin a sik hun khawm a danga, a tlangpuiin kum sawm - sawm panga sung puitling a ni deu tak.a hriet a nih. Chun, Thingrai hi mamaw dungzuiin duthusamin tha zo naw sienkhawm a chi, a hriek (tel) le ahlutna chi tum tum enin ei ram suk vultu dinga thinghlu le ditum tak ei nei zing a ni ti hi ram hmang (Forest) enkawltuhai chun an hriet a. Ram thing hlu chi ti hiela inbuk a nih.



Figure 1: *Aquilaria malaccensis* Trees

Thingrai ching le fepui pei dan hi ei hriet a tul hle a. A thing le hawng le chitin reng sinthawtu hai inpui theilo pui ding khawpa tul le pawimaw hril ding a tam hle a. Chuongang peiin an sieng tir a, a dawng lai a inthawka phun hun chena a ching le enkawl that dan ding hi tlangrama chenghai ta ding lem chun a phun dan ding a hmun chenin chieng taka ei hrietfie a tul hle a. Phunna ding, enkawl dan, a sikna ding, a hlutna le adang danghai thangthar peihai kuoma hril sawng pei dinga ei chieng hle tul tak zet a, Tlangram papui le a hmuna cheng lo sinthawtuhai sin ropui le thaw ngei ngei chi a ni ti hi hre thar seng ei tiu.

Chipchier taka hril ninaw sienkhawm ei rama thing rai inchaw nuomtu hi an tam em leiin ei peksuok hne naw lem a nih. *Aquilaria malaccensis*, thingrai chie lem chu India rama hin Appenix 11 ti besan a an siem Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) hai ei pek suok hne naw zie chu thing rai riral theinaw a ngai ram le state ei nih. Chuleiin, thing rai mamaw ram le thawnsuokna phal pek ei nina dungzuiin CITES anga phalpek ei nina hi zawr suok theina permit ramhnuoi enkawltu officer Deputy Conservator of Forests neka inhnuoi lo in an mi pek suok thei zing a nih.

1.2 THINGRAI HRILFIENA :



Figure 2: *Aquilaria malaccensis*

***Aquilaria malaccensis* Lam** ti hi Aquilaria ti a, hming an tanna chu Latin tawng a na, 'Mupui' (eagle) ti na or Akkadiana ti khawmin an ko hlak a, chu umzie chu 'eklu' inthim ti na a nih. "Malaccensis" ti chu Malaysia rama Malacca tuipui panga State pakhat a kawk ti na a nih.

***Aquilaria malaccensis* Lam** thing hi intlep deu ruoi tuorsel deu el a na, a lienzie thinghna pangai le a seizie 20-40 m vel a nih. A thing hi a ni dan taka chun intluon zut el an khat tawkin a theihle ang deuvin dawt sinna nei niawm takin a um hlak a, a hnuoi tiengpangah a do na ni awm tak 2 meters velin a lien zie 60 cm a um hlak. Thil bawm siena ni awm takin a cher deu, rawng nei, ngar deu fak le tawk chi ni mang lovin a um. A thing hi a var ang vangin tawk inhawi deuva inlang le inkuo chapin a um bawk. A kawruok chu a sei deu zat el mit vun ang deuva innem deu chat in uoi hle dingin an lang hlak.



Figure 3: Leaves of *Aquilaria malaccensis*

Aquilaria malaccensis thing rai hi inlang naran deu el ni si an khat tawka changkar nei a inlang a ni. A chang inkar hi 4-5 mm a sa le sei a na. A hna phek hi a 4-6 mm a sa le sei a ni bawk. A hna hrim hrim le a kuong chu 4-6 mm a sei a ni bawk. A hna phek inkuo deu chip chepa inlang, cheng deu hlak 7.5 - 12 mm vel a sei, a khang 2.5 - 3.5 mmvela lien a nih.

Hna pui 7.5 - 12 cm a sei le a lien zie 2.5 -5.5 cm a lien a ni. A hna hrim hrim hi umzie nei bek lova lien deu hluk a ni a, innem deu el, hnuoi tieng inhmul a var tle deu a inlang 2 cm a sei a nih. A hna zung zam chu a mumal naw a, an khat tawkin a zie bovin a um a, a chung tieng an kuol deuva 12-16 inkawptuok le a chunga inzam chite te hmutheiin a um bawk.

A par bawr inlang dan chu mawi deu el a hran hran a um ni si, inkei khawm tet tutin a um a. A par bawra a hranin 2 -3 dam in kau peng a nei a. Chu " umbel" an tih. Chu umbel chun sawm bawr velin a par suok hlak. Chu a par kuong tlungpui chu 5-15 mm vela sei a ni a, intluon deu hlek 3-6 mm a sei a nih. A par a chun a chang sei deuvin hmurkuong

ang deu hlekin 5-6 mm a sei a rawng chu hringdeu zat el a um bawk a, rawng eng dam a lo um chun a tha naw a ni tiin an lak suok a an dehawn pei hlak. A par inkuo sei pang el chu a sung inkuo chip chep, entlang thei nisi lovin mihriem zangru ang deuvin a um bawk. A par kumum hi panga velin an siem a. 2-3 mm vel sei a ni bawk.,Chun, hi parte hin a chithlatu vengna khieng ngau el 1mm vela lien a nei bawk a, a awr hnuoi tienga dawta a inbuk a nih. A chi thlana ding vengtu 10 a nei hai hih a awr hnuoia umhai hi 1mm a lien a ni a. An inkuol thei naw leiin inthla sawngna sin a tlawl pek chang a um hlak. A awr hnuoi lai vel a dawt um patzaite 1.2-2.0 mm sei a um a. Chubakah, a chang 10 haiin zalen taka a dang le inkawp theina a um leiin awr hnuoia patzai chite te hai an hrat lem a, an hei intawk (inkawpa) pha chithla an ni pei hlak. A pui chi thlatu a parte sungrila um sienkhawm inpawl theina 1-1.5 mm pindan te (cell) vel an kawl leiin a tlangpuiin an pung hrat em em a hriet a nih. An umdan le chi thla danah mak danglam tak a lo nih.



Figure 4: Flowers of *Aquilaria malaccensis*



Figure 5: *Aquilaria malaccensis Thingrai thei ra capsul anga siem*



Figure 6: Capsule with seeds

1.3 CHENGNA / MAWNGNA RAM:

Thingrai hi ram hring dupna hmun hieng lung le phaiphin hai hnuoi thatna, le tlang zal hmuna hai hin a tha nuom em em a, tlang bulthuta hai chingin chutaka ram dum duoi naw sienkhawm a tha nuom em em tho, a tlangpuiin thingrai chingna ding chun ram ril deu hlek le phaiphin le chawkpawlna pil pangai le sukpawl khawmin a tha nuom a. Tlangram

lum deu hlek 0-1000 meters a dam, 1800 -3500 mm le temparature 20-28 degree celcius vela insang le khawmuol induop dea a hnawng dan 80% a hai hin ching hlak ding a ni.a, Thing rai (*Aquilaria sp)* chi tesep ei ti hai hi a tha thei beknaw leiin duthu a sam chienaw a, an thang hrat naw hle ni a hriet a nih.

1.3.1 Khawvel huopin :

Khawvel pumhuopin Thingrai (Aquilaria malaccensis) hi a tlangpuiin khawvel pumhuopin an ching nasa em em a, Asia ram hieng India, Bangladesh, Bhutan, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, le Thailand hai ah nasa takin an ching. A list a hin Iran an thangve nawh. CITIES 2003 a en thlitlai danin Iran a chi hi ching thei lo anga nam det/ngai a nih.



Figure 7: Global Distribution of *Aquilaria Species*

Table 1: Khawvel pumhuopa an sem dar dan tlangpui chu

Rambung	**Achihai**
India	*A. khasiana, A. malaccensis*
Nepal	*A. malaccensis*
Bhutan	*A. malaccensis*
Rambung	**Achihai**

Myanmar	*A. malaccensis*
China	*A. sinensis, A. yunnanensis*
Thailand	*A. crassna, A. hirta, A. malaccensis, A. rugosa, A. subintegra*
Laos	*A. crassna*
Cambodia	*A. baillonii, A. crassna*
Vietnam	*A. baillonii, A. banaensis, A. crassna, A. rugosa*
Malaysia	*A. beccariana, A. hirta, A. malaccensis, A. microcarpa, A. rostrata*
Singapore	*A. beccariana, A. hirta, A. malaccensis, A. microcarpa, A. rostrata*

1.3.2 India ram huopin :

Thing rai *Aquilaria malaccensis* hi India rama hmu dinga tam em em a, *A. malaccensis* hi a bikin Hmar sak ram tlang bulthut le West Bengal,hmun 1000 meters neka insanga hai an ching nasa em em bawk. Western Ghats ei ti Kerala le Karnataka an ching bawk a. Chun, Tamil Nadu, Telangana, Andhra Pradesh, Goa, Maharashtra, le Gujarat a khawm hmu ding a um.

India rama ei mithiem (Botanical Survey of India) thlaihna tiengpang inchukpawlhai chun an lo bi tuk kumhni sunga ding chun Girth at Breast height (GBH) dinga an beisei, India ram pumhuopin 10 cm neka lien chu a tlawm taka 139.69 million (13.989 crore vel thingrai a um.

Table 2: State-level an semdar dan

State hming	Thing rai an ching tam dan chu
Assam	11,43,00,000
Tripura	1,51,50,000
Manipur	32,00,000
Karnataka	24,20,000
Nagaland	22,80,000
Andhra Pradesh	10,00,000
Kerala	10,00,000
Maharashtra	3,00,000
Meghalaya	1,72,000
Arunachal Pradesh	25,000
Telangana	20,000
Mizoram	10,000
Tamil Nadu	10,000
West Bengal	5,500
Others	3,000
Total	13,98,90,000

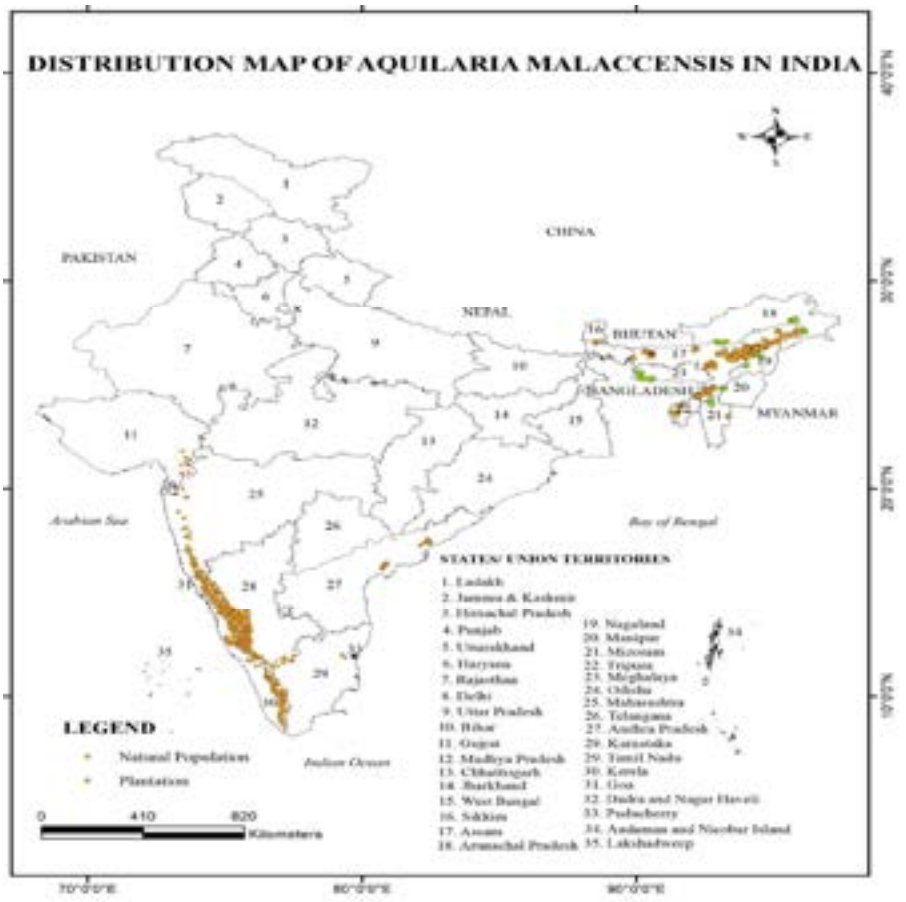


Figure 8: Thing rai (*Aquilaria malaccensis*) India rama an semdar dan

1.3.3 India Hmarsak ram :

India Hmarsak ram a Thingrai (*Aquilaria malaccensis*) hi tlang a bulthutna lai hin an chingna sa hle a, mipui khawmin hma an lak na sa bawk. Assam, Manipur, Meghalaya, Mizoram, Nagaland, le Tripura. Rama hai lei lungin a zir khawm ning a ta, a tha nuom em em a hriet a nih. Thingrai a tam lem chu hieng Assam le Tripura hmu a ni a. Assam rama an fak le dawn tam tak thar suoktu a nih, Golaghat, Jorhat, Sivasagar, le Karimganj districts a hai an thar suok na sa hle a. Golaghat district chau khawm 45 million thing rai an ching thei leiin sumdawng kawngah Thingrai chingna hmunpui ti hiel a nih. Tripura khawmin 15 million an phun ve a, a tlangpuiin sum hnara an nei a ni leiin North Tripura le a sevela um Umnakoti district a hai an ching na sa bawk leiin intin deu thawin an buoipui a, an fak le dawn nasa takin a thangpui a nih.

Thingrai hi Manipur Jiribam district a hin an uor nasa hle a, a chi lakna khawm into del takin an ching thei a nih. A man an sang em em a, a chi a ra suok a tam bawk leiin an uor hle nih. Mizoram le inrina lai vel vadung panga hai an ching uor zuol a, an fak le dawn hmu suokna tha taka hmang zing a nih. Nagaland, hieng Mokokchung le Mon a hai an ching ve.

1.3.4 Meghalaya ram :

Shillong thlangzawl (plateau) le Khasi pine thingkung mawngna ram ti lo chu, Meghalaya ram hin thingrai phun / ching na dingin a tha vawng. Amiruokchu, Brahmaputra phaizawl hnai tieng tui intingna hlak hmuna hai ruok a chu thingrai phun / ching chi ani nawh.



Figure 9: Areas suitable for Agar Plantation in Meghalaya

CHAPTER 2 : THING RAI INSIEMDAN

2.1 THINGRAI A FEPUI PEI DAN LE AN INSIEM DAN :

Thingrai insiem dan le a fepui dan tlangpui chu a thing a var rawng deu hlekin an langa. A thing kau le hawng hin nasa takin a hawng kawrin thu phur em em a, hmun induop deu hleka a chi le a hnuoi pil chawkpawlin a zir bawk chun nasa takin a suk hrisela, a kawl vela thing danghai angin an thang hrat hle hlak bawk a, Damdawi chi tum tum chawkpawl ngai bek bek lovin a danghai ang bawkin a ramthing tuom hne bawk lem chun an thang hrat em em bawk a nih. A hrik a hawngah a lut lem chun an thang thei rak naw a, chu zawr suma inchang tirin man to tak takiin an zawr suok thei tah a nih.



Figure 10: *Neurozerra conferta*

India Hmarsak ram a 135,14 million thingrai ching suok thei a nih. Figure 10 a thilhring hi thingrai vertu ana, Assam ram hieng Jorhat, Golaghat, Sivasagar le Karbi Anglong districts le Tripura rama atam leiin, hi hmuna thingrai hai hi a pangai in an inrai a nih. Chubakah, 2.5 million thing rai kung Simtieng India, hieng Karnataka, Tamil Nadu, le Kerala, a nge siemchawp an hmu suok nasa hle a. Ange chi siemchawpna hmuna hin sum tam tak tak lam suokin an khawsa a, fak zawngna tha tak a ni reng a nih.

2.2 THINGRAI PANGAI DAN :

Thingrai nge siemchawp ni lo hai reng reng chu an siem hrat naw em em a. A tlawmin a vang hlak bawk. Thingrai a pangaia insiem chuh a muongchang leiin a hawng a inthawk kum 20 hnunga dam hmusuok thei an ni chau bawk a. Siem chawp lo thing rai pangai chu a ram lei lung zirin an siem suok vang hle leiin a taksa kha an suk chieu rieu a, chuongchun an siemve thei chau hlak a, a awi a sawt bik hle nih.

2.3 SIEMCHAWP THING RAI :

2.3.1 **A taksa pumruo (Physical)** Thingrai nge siemchawp hi buoipuitu haiin




Figure 11: Agarwood formation under natural conditions

nasa takin an thiemna hmangin an vil nasa thei em em a, a chang a thing taksa kha verina nge an kap lut a, an tan bawng hmawk chang khawm a um hlak. Thing kha a sunga tui la suokin an buoipui a, a tawpa an rai el hlak a nih . Thing rai insiem dan chi tumtum hril ding a tam em em a, ei mithiemhaiin an zawngsuok pei a, a hlawtlingna chu a thuomhnaw nei nungna le a boruok zir a thaw pei el a nih. Meghalaya hieng Garo tlang rama nasa takin an buoipui a, ruo nge hai chen hmangin an rai thei dan ding zawngin an thaw hlak a. Hlawtling pawl khawm hmu le hriet a nih. A ram thing le ruo hmanga an siem dan chie lem hi chuh an rai thei el naw chun an sukfai vawng a,a bulah tan tharin an thaw nawk pei hlak a nih. Chuongchun, hmun thenkhata chun thil sakhat le damdawihai hmangin a man tlawm deu hleka zawr thei khawmin a siemchawp ve nawk a, man to tak takin an zawr thei ve tho a nih.



Figure 12: Different Physical Methods Employed for the Artificial Induction of Agarwood

2.3.2. Damdawi chawkpawl (Chemical)

Damdawi chawkpawl hmang khawmin thingrai siem suok thei dan hi a lo um pei a. A ram leilung hmang tangkai a damdawi le chawkpawl khawmin an buoipui nasa em em a, hieng damdawi le hormones (methyl jasmonate, soybean oil, jaggery, molasses, sodium chloride,etc.) hmang tangkaiin thingrai siem chawp an hmang nasa hle bawk a, Hieng ang hmangruo hmanghai reng reng fimkhur takin a thing kunga an kap lut a. An kap lutna hmun a khan hmun dang tieng an insawn kuol pei a, a sunga tuipai khan a lo semruol pei el a nih.

Thing duop le pil dang dang chawkpawl khawmin an buoipui thei bawk a. Hi an fepui dan method ruok hi chuh a danglam deu hlek a, a thing inrai theinaw khah a san zawng suokin a ram leilung nunphung dungzuiin damdawi kap lut ding an buoipui ve thung a, chu damdawi hmangin thingrai chu a hung insiem nawk thei a nih. A tlaichi a khan damdawi hmanga an hei kaplut pha hun iemani chen hnungah danglamin rai suokna ding an siemchawp pei el hlak.

2.3.3 Hnuoi ram le leilung chawkpawl :

ICFRE-RFRI hai chun thingrai nge pali tha deu deu el an hmusuok ve a, hi thil hmu suok hi dang nawk deuva, thing kung a kapna ding 2 cm inkuol deu pap a verin 5-6 mm a inthukin an awn dan 45^0. angle an siem a, chun an hei kap lut phawt a, thing khan a thaw hla deu leiin a hung danglam ve a, hun sawtnawte a hung inrai el a nih.



Figure 13: Different Chemical Methods Employed for Artificial Induction of Agarwood



Figure 14: Biological Methods Employed for Artificial Induction of Agarwood

Chun, a kuo (hole) hmasatak chu hnuoia inthawk meter khat vela insangin 30cm vela lien siemin, chun, a tlawm taka kuo 10 vel an siem nawk a, thingkunga khan thil inpum inbiel kar thlak deu (girth) 35-40 cm le an sang dan 15-20 meter siemin kuo inthawl deu hlekin a nge an kap lut a, an nuom ang anga an chet theina dingin an siem ve thung a nih.

Chun, a kuo chu a chungtieng an nuom ang anga a chet theina siem pekin a nge hrik inkawp kha 10 ml vel syringe an zuk kap lut nawk a. Tha taka enkawlin patchawn te (cotton) in an sukfai pei a duot taka an buoipui hnung chun a nge le hrika inthawk chun a thing kha a hung inrai nawk thei a nih. A thing inrai hun sung le an siem hi a tlangpuiin

thla khat vel a ngai a. A puitling ding hun thla 5-6 a ngai a, duthusam a ding chun kum 3-3.5, sung in sik thei a quality an sangin a tha taka hriet a nih.

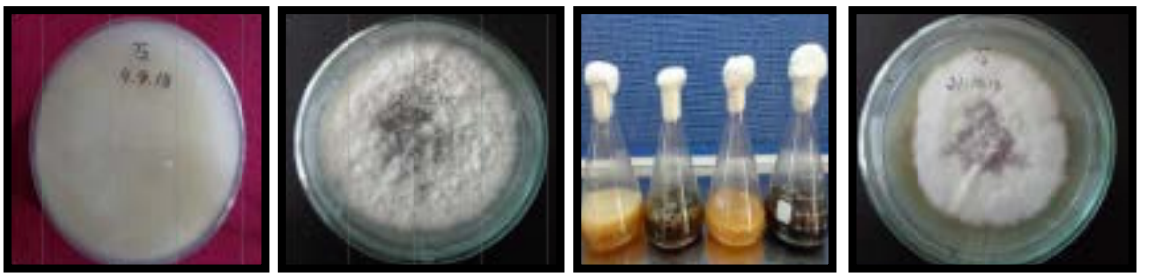


Figure 15: Different Fungal Cultures Developed by ICFRE-RFRI, Jorhat for Artificial Inoculation

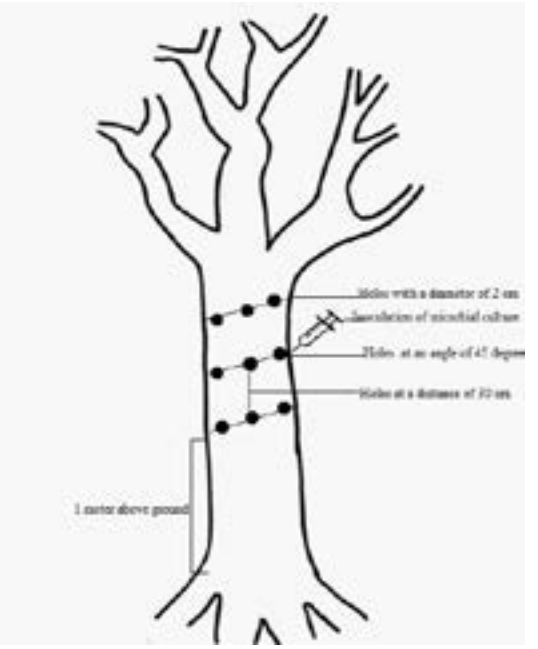


Figure 16: Layout for making holes in agar tree



Figure 17: "Sasi Inoculant" – A fungal inoculum for artificial agarwood inoculation in *Aquilaria malaccensis*

ICFRE-RFRI hai chun siemchawp kap lut hi hieng Assam, Meghalaya, Tripura le North Bengal ah an buoipui nasa em em a. Thingrai nge kap lut hi a hlaw tlingin result khawm atha tak ni'n an hriet.



Figure 18: Agarwood formation in artificially inoculated trees in Assam



Figure 19: Agarwood formation in artificially inoculated trees in Meghalaya



Figure 20: Agarwood formation in artificially inoculated trees in Tripura



Figure 21: Agarwood formation in artificially inoculated trees in North Bengal



Figure 22: Artificial inoculation using powder formulation

CHAPTER 3 : THING RAI A HMANG DAN

3.1 A TLANGPUIA HMANGNA :

A tlangpuiin thingrai hi hieng Asia le Middle East ah an hmang na sa em em el a. Gulf rambung ah United Arab Emirates le Saudi Arabia ah an ching na sa hle a, an zawrna ding le enkawlna ding a tha bawk leiin a zawr suokna ding market khawm a tha hle ni a hriet a nih. Chun, a thing rimtui em em el hi hieng China, Japan, le South Korea rambung hin an hmang nasa em em bawk a, an khawtlang damdawi chi tum tuma siem suokin khawtlang nunphung le sakhuo hun sera hai an hmang tangkai hle a, A mipui khawmin an ngai pawimaw hle a nih.



Figure 23 : Thing rai a siem suokna le an hmangna Map rambunghai

3.2 THING RAI SIEMSUOK DAN CHI TUM TUMHAI :

3.2.1 Sukphit, Sukdip le Sukdar :

Thingrai hi a hluin an ngaisangna rama chenghai chun khawtlang thil le sakhuona thila an nunphunga ding an ngai pawimaw em em a ni tlat leiin hi thing hi a pawimaw zuol bek bek el a nih. Ram pumhuopa thilthaw ni khuo a hai an hmang tangkai a, an mikhuollienhai tuokna ah hmang pawimaw em em el a nih. Kut themthiem, inzin mi haiin a rim inhnikna hi Agarbatti anga ngai a ni tlat leiin a thangnaw chun sin khawm an thaw tha thei nawh.. Thin rai powder hi zingkar an raw a, insunga an raw fai vawng hlak a, a riminhnikna hin insung a sukthieng hlim em em a, thil thanaw a rim hin a hnawt suok vawnga, damdawi pawimaw em em a an nei a ni bawk. Chubakah, khawtlang thenkhata lem chun mithi vuina ah an hmang ve nawk a, rambung Taiwan a umhai chun zu ah pawlin a rim hi ngai tha takin an dawn thei chau hlak.



Figure 24: Agarwood chips, powder, and incense

3.2.2 Thingrai tel (oil) :

Thingrai hi tel ah an hmang nasa hle bawk a, hieng a hming, '*Attar'* le '*Aguru*,' tui le chawpawlin a rim inhnikna an siem suok a, hausa le a nei nung deuhai an mimal thila ding khawmin an hmang tangkai nasa em em bawk a, taksa pang lum zutna le nunghak tlangvalhai incheina hmangruo le sabawn siemna chenin an hmang tang kaiin a pawimaw em em a nih. Rambung hieng Middle East a lem chun mi hausa inkhina takin an ngai a, in nei nikhuo a hai an hmang tangkai hle bawk.

3.2.3 Mimal thila hmang dan :

Thingrai tui hi mimal thila rim a thang chun ngai tha le muong deuvin an um el hlak leiin a tel hi taksa zutna le a dang dangah an hmang tangkai hle bawk. Kum upa hnung chen khawmin an hmang na sain an tangkai pui hle. Taksa sungrila thil tha naw tam takhai a that thei leiin an nitin nunah a pawimaw em em le an hmang tangkai em em a nih.



Figure 25: Agarwood Personal Care Products

3.2.4 Damdawia siemsuok (Medicinal Products) :

Thingrai (*Aquilaria malaccensis) a hin* a hna. kau le chang, an hmang nasa em em bawk a, a hawng ringawt khawm hi a thing kung sungril a venghim thei bawk a. A hna hih zunthlum damdawi, taksa sungril a taksa sukse theihai do daltu tha em em el a lo ni a, thisen insang vengtu le awrpuom damdawi le natna vengtu ropui taka ngai a ni bawk. A tel lak suokin na sawkna tha em em el sungril natna sa hal sukre na le phingpui natna vengtu le hadam taka hriselna siemtu, damna a ni bawk. Sungril taksa inthienglo sukfaina tha tak le taksa sunga chi le thil thur tam taluohai siemtha tu a ni bawk. Chuleiin, India le China mipui hai chun hi thing hlu hi khawtlang damdawi le vun sukfaina hmangruo a an hmang tangkai em em a nih. Thingrai hin thisen insang thut le thil dang danghai a veng him thei leiin an hmangin an tangkai pui hle nih. Tlangram thinghna hmanga damdawi enkawltuhai chun a kunga inthawk la suokin vun natna hrik tha nawhai la suokin taksa chi tum tumhai an sinthaw ding thaw theilo la suokin hi damdawi hi an hmang hlak a. Taksa bethar, ru inchuktuona hai kal tha naw le adang dang sungril inhawinaw le thluok natna chenah damdawi ah an hmang nasa hle a. Thing rai tel (oil) hin taksa na them thumhai a suk tha tho leiin an hmang nasa hle.A damdawi chawkpawl a tui (oil) hin taksa hratnaw invawihai ru natna hai a suk tha em em el hlak bawk leiin an dampuiin dam dawi tak taka hmang an tam hle nih. Chubakah, natna benvawn nei cancer hrik chen lo pai le invawi tam takin an that pui a, an tangkai pui hle nih.

3.2.5 Kut themthiem a suksuok/rasuokhai :

A hun le hmun zira an khawsakna suk changkangna dingin an hmang nasa hle a. Kut themthiemna nei hieng, paikawng, leikhawr, hnang le dang dang siem thiemhaiin nasa takin an tangkai pui hle a, puon khawng thiem, a zie mawi deu deua thiemna neihai a thangpui nasa hle bawk. Zie dang hieng Na be, Ban bun, mihriem lim chi tum tum chei le siem dan le insung cheimawina dinga parte chi mawi hran hran siem dan, puon zie mawi deu deuva ta thiemhaiin an tangkai pui hle bawk a hriet a nih.



Figure 26: Agarwood Handicrafts

3.2.6 Thingrai thinpui :



Figure 27: Agar Tea

Thingrai hi thingpui a ding khawmin an hmang nasa em em a. A hna la dawng deu hai arim innam hieuvin an hei pawl a chun thingpui a an siem a, a rim hin damdawi tha taka an chang nawk pei hlak. Taksa na them thum, ru na, pang lum them thum, boruokin a sukpawi thei natna hrik tam takhai a veng nasa hle a, Taksa hieng natna benvawn nei,

pangna themthum, natna hrik chi tum tum lo neihai vengtu a ni leiin le zunthlum nei hai chenin anthatpui nasa hle a hriet a ni bawk. Thingrai thingpui an hei indawn tir chang hin an that pui hle'n an hriet hlak a, phingpui natna nei chenin an that pui hle a hriet a ni bawk a. Hi thingpui lei bawk hin vun le hriselna tha taka siem theiin an hriet hlak a, thisen sugar neile zunthlum vengna tha takin an hmang hlak bawk a nih.

CHAPTER 4 : THING RAI CHING DAN

4.1 ACHI LAK KHAWM DING :

Kumkhat sung hin June - August thla ruotui thlak hun sung ngeiin a chi hring hi lak khawm ngei ding a nih. A chi le a ra kha lak khawm a, ni hni ni thum em tawl ding a na , a chi ding a ra ei siehai khan chi an pai thei nghal hlak a nih, A chi pakhat pei hin 29-135 mg a tak chang thei hai chu ning an tih. Ei hei tu pha ruok chun 80 mg a rik ni ngei a ta, chun, a hung to suok a tih, chuong an naw chun a chi rikna khah a tlawm taluo chun a to kha a puitling thei ngai naw a, a to tha thei naw bawk leiin a thi thut thei a nih. Hun tawite chau an hring sung (ni 2-5 sung ngei) a chi kha a huom ngei ngei ding a nih. A chi hi hun sung ngei a lak peng ding a na, Ni 2-5 sung ngei a a huom ngei ding a nih.

Chuong naw chun a chi hi a sie el naw a chuh a hunsung ngeia thaw hi a tha taka ngai a nih. Chuonga tha taka en kawl chun, duot bek bek khawm a tul nawh. Chun, a thing chi hi kum 6-7 velin an inthang thei bawk. Thing rai puitling hin chi a tlangpuiin 19,000 a hring suok thei a.

4.2 THINGRAI NURSERY SIEM DAN :

Thingrai chi (mu) hai hi 1-1.5 cm. inthuka inso ding a nih. Hienga enkawl sung hin tui chap le a umna thingzar hliep siem a enkawl ding a nih. A chi chu hnuoi a hung inthang pei a ta. A chi ni 10-12 zovin kak tan a ta, chawk buoitu um lova a ni chun thla khat chen hun lang a tih. Ni 40- 45 sungin a kak hai chu 3-5 cm. in insang an tih. Chun poly bag (9” x 6”) sunga pil, phaiphin hnuoi thatna in ang deu vawngin 1:1:1 siemin, a kak hai chu phun sawn ding a nih. Chun, an la dawng em leiin tui hu deu chapin the hlak in, tha taka enkawl ding a nih. Tui tam bek lovin pe ding, dei hlim hnuoiah thlo fai zing ding, chun hrisel takin an in thang ding a nih.

Akak hai kum hnia upa feet hni a insang/sei a tling pha i sawn chau ding a nih.



Figure 28: Seedling in Raised MotherBed





Figure 29: Seedling transferred to polybags

4.3 THING RAI PHUN DAN :

4:3:1 Inkawl hnai ah:

Thingrai chu a tlangpuiin inkawl hnai hmun awlna deu , School, Hospital le hmun dang public offices remchang deuva hai phun ding a nih. Ram or In cheina hmun remchanghai , huon le farm ram thing hliep hnuoi deu hlek thli le ruopuiin a mutnawna hmun deu a hai khawm ching thei bawk a tih.

4.3.2 Intel deu hlekin ramri umna hmuna ching ding :

Thingrai chu a tel deu hlekin inkawla chau ni lovin ram ri inhriet theina hmun le farmhmun awlna lai dam hmun remchangna , ram ruok umna le field a hai ching thei ni bawk a tih. A thing hi a ngar leiin kum 5-6 an ta chun hlingdai thang lokhawmin an hrat ta tho leiin dai inhuonna ding khawmin hmang thei ning a tih. A kau hai khawm hi huondai ding le a dang dangah hmang thei a ni bawk. Ram ri a ding ruok chun fancing post an suk siet el theina um thei a ni a fimkhur taka thaw ching ding a nih.



Figure 30: Agar In kawl

4.3.3 Block a phun ding :

Thingrai chi reng reng chu tlangram tlang insangna hmun,va dung tui umna va pang hmun a hai ching thei ning a ta, forest ram a ni le ni naw en felin ram thinga hmang a ching thei ning a ta. Amiruokchu, a hmun ruok hluobitna ding ri ngawta ram dang le inchawkpawl taluo chu a tha nawh. A ram pilin a zir vieu a ni ngawt naw chun a sik le sa zir a ching el ding ning a tih.

A chingna ding a hmun hluo dan ding chu hieng a hnuoi anghin.

- 2x3 meters inkarin, 1,700 per hectar khat pei ah thil dang le inchawk buoi lo dinginphun thei ning a ih.
- 2x2 metersinkari, 2,5000 hectar khat pei ah thil dang le inchawk buoi lo dinginphun thei ning a tih
- .5x1.5 meters inkarin, 4,400 per hectar phun thei ni bawk a tih.

A phuna ding hmuna hai 2x3 feet 10 meter dan pei a tuilam pui tha tak siem ding a nih. A thingkung chi hi phun a ni ding pha zantieng khuo a siet deu ni ngeiin khur 30-30 cm siem hmasa phawt la, Phun hmain pil le bawng ektawl chawkpawl 1-1.5 kgs khur tinah phul ding a nih.

Kum 8-10 years, a tling pha 40% a thing rai lak la suok ding, chun sik thei chau ding a nih. Chuonga thaw chun a thing kung a la dam hai khan inhawi taka an khawsa thei ding tina a ni chuh.





Figure 31: Plantation of Agar plant with other companion crops

4.4 THING RAI HRIETNA HMANGA CHING DAN :

Thingrai chi hi ram thing ngawpui le inpawl nel an ni leiin Meghalaya rama chingtu hai tadingin ram ngawpui (forestry) le ei thlaihna (horticulture) chinghai leh an inchawk buoiin a thanaw tieng hril ding bek bek a um naw leiin a hmaa ei hril angin agroforestry chikhata ngai tawp el a nih. Chuleiin, thing rai ching reng reng chuh thei zat zat chinga ei thlaihnahai leh sukpawl khawmin a pawina a um naw leiin a hmun ram tha zawnga suk suok rawn dan kha zawng el ding a nih.

Chubakah, hieng hmarcha, Zikhlum (Patchoul) le a dang dang thinga inzam chi (sarpagandha) hai leh khawm ching hmunkhat thei a nih. Thingrai chu a phunna sirvel huona thingpui thinghai le khawm an inhuot bek naw leiin an ching kawp thei bawk. Vangduoina lei a khuorel tuok pal khawmin vengtu sinthawtu lem an nih. Chubakah, hieng thlai dang Ai eng, Ai thing le dang dang hieng Rengthei hai leh khawm a phunna le karah 50 cm siemin an chingpawl thei bawk.



Figure 32: Agar with Pineapple



Figure 33: Agar with Tea Plantation



Figure 34: Agar with Pepper, Arecanut, and Tea




Figure 35: Agar-based plantation with Banana Plant

4.5 PILTHA LE HNUOI THATNA DANG DANGHAI:

Thingrai phun dan ding a la thienghlim (virgin) ramhnuoia phun ding chun piltha bek bek nawsien khawm hnuoi thatna pawl lo khawmin a tha thei em em a, A phun dan ding hmuna a chunga ei hril ang khin pil le bawng ektawl chawkpawl in, a ram leilung, hieng pil hang le pil tha thil dang chawkpawl lovin an ching theiin a tha hle bawk. A phunna ding kha cho inthuk a tul, chun, a hrisel le an thang tha theina dingin a zung tuomtu dingin pil sukphit le bawng ektawl phit chawkpawl ngei kha hmang a tul bawk

Phun hmain a khur cho la 30-30 cm lien 1-1.5 kg pil le bawng ektawl chawkpawl bawkla, chun phun rawh. A kum indawtin hieng a hnuoi a damdawi chawkpawl nitrogen (N), P_2O_5, le K_2O le 10:10:4 ratio i hmang bawk ding a nih. Chu zova hieng a hnuoia ang hin thingrai kung le chawkpawlin thaw rawh

- Kum hnina ah : 200 gm. thing pakhat peia
- Kum thum ah: 300 gm. thing thing pakhat peia
- Kumli na le a chung tieng chuh 500 gm. thing thing pakhat peia

A kum ruka inthawk chung tieng ruok chuh Nitrogenous hnuoi thatna 400-500 gm. thing pakhat peia the la kumkhata vawihni chawkpawl rawh, fur (monsoon) hma le fur hnung ah kum tin chawkpawlin enkawl ve ding a nih, Hienga i thaw chun a thing rai chua suknem ata, a chi suk burip bawk ding a na, chubakah, a hrik a fa se thei hai tha takin veng bawka tih.

Hienga thaw chun thingrai hai chu nasa takin suk hrisel a ta, a ra suok hlawtling takin sik thei ni bawk a tih.

4.6 A NATNA LE A THUNUN DAN :

4.6.1 Thingrai hna til natna :

4.6.1.1 A natna an lang suok dan :

A hna suktil le hmel suk hemtu pawimaw tak chu thing rai hrik / tuktulung (*Heortia vitessoides)* ti hi an nih. Hieng a nge an inlang pha chuh fimkhur taka enkawl a ngai hlak a, hieng a nge reng reng hi kumkhata vawihni May- June le August-September vela hai hin an che hlak a hriet a nih. Hieng ang hrik le nge ah inlang suok a ni chun suk rem vat a tul a. Khuo that pha March-May bawr vela hin an huong intau hlaka a, ruosur July -August vela hin chu an chau hlak a, an che thei bek naw leiin sukrem theina dinga sawisak hlak ding a nih. Hi tuktulung hin thingrai hawng a tanin a sung an lut hlak a, a thing kung in a thaw hla em em a nih. A hri hai hi a hrat em leiin an suksiet nasa hlak bawk leiin an thang hrat thei ngai nawh. A hna hung vuoi tlep a, a chau hle a ni chun tuktulung (*Heortia vitessoides)* lei a ni ti hrietsuok el ding a nih.

4.6.1.2 A natna thunun dan :



Figure 36: *Heortia vitessoides* in Agar Tree

A hrikhai hi kuta man a, lak khawmin a hna le thinga kawphai kha nitrogenous hnuoithatna tam deu hlekin chawkpawl la, a thinga raw annawleh that el ding a nih, Thil hrik sukse theitu hai kha (Biopesticides) a sunga chang deu el khal a na la suok la, chun, ni 7-14 an khat tawkin rannung damdawi kap bawk hlak rawh. Vate le hnuoia invak thei a puotienga inthawka hunghai veng tha la an hung chawkbuoi che chun hawl hmang pei rawh.

4.6.2 Thingrai kau tawl :



Figure 37: Branch Drying of *Aquilaria malaccensis*

4.6.2.1 A natna an lang suok dan :

A natna an langsung hin a zung tieng a tawk pawi hman a ti, chik takin en la an hringna san him thei tha tak la nei ngei i tih. A kau hung tawla, a hungin hriela, a tawpa a thingin a thi pui hlak. Chik taka lo en thlatuhai chun *Pratylenchus sp*. hin a zung tienga thang la in an suksiet nasa thei hle a, hi lei hin thingrai chun a thawhla hlea hriet a nih.

4.6.2.2 A natna thunun dan :

Biopesticides, damdawi hmangin Neem tui (3%) annawleh or neem seed rilmu (NSKE, 5%), siem la a zung kawl vel a phul khum la tha tak in thaw la kar khat vel hnungah a result chu hmu theiin hung dang lam pei el a tih ti hre zingin chik takin i en ngun hle ngai a tih. Chun damte ten a hrik hai hung tlawm tiel tiel an ta a tawpah bo vawng el an tih.

4.6.3 Thingrai sukhnawng natna :

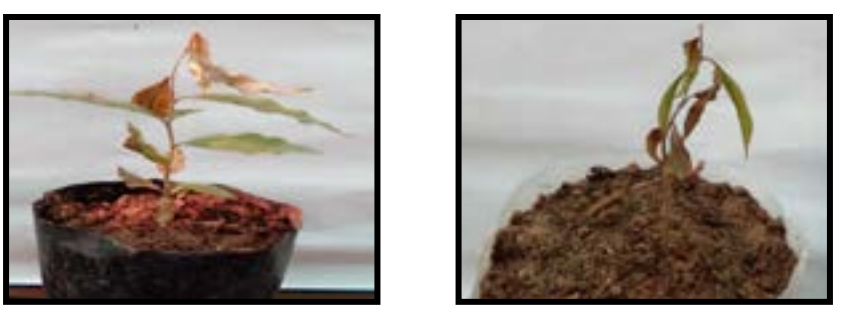


Figure 38: Damping off disease of *Aquilaria malaccensis*

4.6.3.1 Anatna an lang suok dan :

Thingrai naupang dawng lai an lang suok nuom. A hna rawng a hung danglam met a hriet a ni chun a hna buong deu hlek a ta , chun vut rawngin danglam nawk a tih, a tawpah a hna chu a rengin hung sen deu heu heu a ta,a zung zam a chen a tlung tah chun a thipui el hlak a nih. Hi natna hi Nursery ah tul lo baksaka tui tam taluo leia ring a nih.

4.6.3.2 A natna thunun dan :

Thingrai chi ching hma khan a chi naupang la ni hai kha duot takin enkawl la, damdawi chi khat rimse deu el Formaldehde in urla ,chun nursery bed ni 15 polythene sheet in inkhum rawh.

CHAPTER 5 : THINGRAI SIK DAN

5.1 ASIK HUN :

A sik hun chu a kungpui a rawng ah an lang dan a awlsam tak a hriet thei a ni. A kaule kungpui rawnghai chu duk/dum tieng rawngin hung um a ta. Hun sawtnawte a akungpui chu a dum rawngin hung danglam a tih.Sik el thei ding ani tah. Dan naranin kum 40 a tula, kaprai fawm ani chunk um 10-15 atul sikna dingin.

5.2 A SIK THLA (MONTHS) :

Khuo that hun January- May vel hi a sik hun a ngai a ni a, a tam lem chuh May thla sung an sik hlak a nih.





Figure 39: Larvae of stem borer found in naturally infected agar trees



Figure 40: Entry of borer into the holes



Figure 41: Oozing out of watery substances from fresh borer hole

5.3 A SIK LE A FE PUILEI DAN DING :

Sikzo pha thing rai chu tan bawng la, a phit khawmin I siem thei a. A sung ril a thinghluhai chu la suokla fimkhr takin chite te in kei dar la a hrik kaihai chu la suok vawng la, chun, i dit dan danin a i siem thei a ni.



Figure 42: Frass at the base of the tree



Figure 43: Natural closing of borer's hole



Figure 44: Cracking symptom



Figure 45: Formation of agarwood along the borer tunnels

CChubakah,thingrai tui kha la suok la, tui tlawmte leh chawkpawl la ni hni ni thum vel nghar ek mei mei lo dingin Dar bur (aluminium) bur ruokah sie la, chu tui thienghlimin tlit fai la chun det takin sin la, tha takin phaivang le thil dang dang suksiet thei lo dingin fimkhur takin sie la. Chu chu a quality tha tak dinga ngai a nih.



Figure 46: Harvested logs of agar trees



Figure 47: Chopping of agarwood into small pieces



Figure 48: Logs of infected agarwood along with tools used for making chips



Figure 49: Steam distillation unit



Figure 50: Manual extraction of agarwood



Figure 51: Agarwood chips



Figure 52: Soaking of agarwood chips before distillation



Figure 53: Agarwood oil

CHAPTER 6 : THINGRAI SIKNA LE SUMHLUTNA

6.1 A RAI SIKNA :

A ra hi kum 10-upa a ni chun a ra chi 3-4 kg phit a suok thei a. Chuong chu, ei tlitfim a tui a sukfai chun a suok zat chu 10-15 g tel a ni phak hlak.

6.2 SUMHLUTNA :

Thingrai hi zawr sum a inchang tir ding chun a hlutna chi thum hieng *Boya*, *Boha*, and *Khara* the dar ding a nih. A man hi a rai tel lem chuh a quality an sang hle a, Rs. 6 lakh – R s. 2 crore per kg zeta man tam a ni a, a tlangpuiin Rs. 10-30 lakh per kg. a zawr thei zing a nih. Chun a thing rai phit khawm ienglai khawmin Rs. 80,000 – Rs. 100,000 per kg a zawr thei zing a nih, Kum 2001 lai khan a rai tha tak (kung khata) Assam rama Hojai Forest Division hnuoia mi chu Rs. 1.10 crore neka tam khawmin an zawr thei a nih. Chuleiin, India Hmarsak rama hin a man a tha em em a, a rai hlutna hi Rs. 15-30 lakh a zawr suokthei zinga ngai a nih.

A man hi an inkhina tlangpui a chun thin rai chingna hmun hi hectar khat pei a kung 1700 phun hin 2x3 metre lo hluobit ta ang sien la kum 15 sunga an hluo rama chun hieng ahnuoia ang hin sum hmang tul a tih,

Table 3:

Sum hmangna lu tak	1st Year (Rs.)	2nd Year (Rs.)	3rd Year (Rs.)	4th Year (Rs.)	5th Year (Rs.)	6th – 8th Year (Rs.)	9th – 15th Year (Rs.)	Total
Huon dai siemna le repairna	16,000	3,000	5,000	18,000	5,000	5,000	-	52,000
Hnuoi siem le khur chona	85,000	-	-	-	-	-	-	85,000
A kak man	17,000	-	-	-	-	-	-	17,000
A kak phunna	5,100	-	-	-	-	-	-	5,100
Compost	10,000	10,000	9,000	10,000	10,000	-	-	49,000
Hnuoi thatna man	-	7,000	7,000	8,000	8,000	-	-	30,000
Hnuoi thatna buoipui man	5,100	5,100	5,100	5,100	5,100	-	-	25,500
Enkawlna man	1,25,000	1,25,000	1,25,000	1,25,000	1,25,000	3,75,000	8,75,000	10,00,000

A hrik kaplutna	-	-	-	-	-	4,76,000	4,76,000	4,76,000
Thil dang dang ahmangna	20,000	2,500	2,000	3,000	2,000	5,000	8,900	34,500
Total	2,83,200	1,52,600	1,53,100	1,69,100	1,55,100	8,61,000	13,59,900	31,34,000

A chunga ei hrilhai a hmun hluobitna le a chingna hisapin thingrai kung 1,700 pei a kum 15 a hring sung a khawsakna tlangpui chu a hnuoia Table 4 a hin hmu thei a nih.

Table 4 :

A suk suokna	**Thing rai kung zat**	**A thing pakhat pei ah (Kg)**	**Rate (Rs. / Kg)**	**Hmukir zat (Rs.)**
Boya*	250	25	10	62,500
Dum (Low Quality)	550	40	100	22,00,000
Dum (High Quality)	400	50	1,000	20,00,0000
Botali Mal	500	0.5	5,000	12,50,000
Total Gross Return				2,35,12,500

*Boya –After 7-8 years

A hlawk kum 15 hnunga sikin : **Rs. 2,03,78,500** (Rs. 2,35,12,500 - Rs. 31,34,000) annawleh round figure in Rs. 2 crore a nih hectare pakhat peia.

CHAPTER 7 : THINGRAI PHUR LE TAWL DAN

Meghalaya Tree Felling (Non-Forest Areas) Rules,2006 hnuoia thingrai phur ding a nih. Hi Dan dung zuiin, thingrai mimal annawleh khawtlang phun sawrkar sum thangpuina um lo chu Chief Forest Officer, Autonmous District Council a registeration thaw ding a nih. Sawrkar sum thangpui a thingrai phun hai ruok chu Divisional Forest Officer (Territorial) kuoma registration thaw ding a nih.

Hi Dan dungzuiin sawrkar sum thangpuina a thingrai phun hai chu kung 100 chen phurna permission chu Conservator of Forests (Territorial) an thawka lak thei ning a tih. Thingrai kung 100 chuong phurna permission chu Chief Conservator of Forests (Territorial) an thawka lak thei ning a tih. Sawrkar sum thanpuina umlo thingrai phun hai phurna permission chu Chief Forest Officer, Autonmous District Council an thawka lak thei ning a tih.

Achunga permission hai hmu hnunga a tawlna permission Transit Pass chu Divisional Forest Officer (Territorial) lak thei ning a tih.

CHAPTER 8 : THU SUKTAWPNA (CONCLUSION)

Hma thlir tha tak nei a thingrai a sum hmusuok tumin sawrkar chun thei tawpin hma a lak a. A hlawtling theina chu mipuia innghat a ni leiin theitawp suo tum seng ei ta, ram dang le sumdawngtuhai inhnar khawp ching dingin ei rama hin hma lak tak tak tum ei tiu.

Technology (thiemna le varna) in hma asawn ang peiin, thinrai siemchawp hin lukhawng a nei pung deu deu ding a nia, tlai ching mi, reserchers le sawrkar department hai inthlawppui hin thingrai in nasatakin khawsakna asuk chankang beisei a nih.

A chingna fak le dawn ei changkang zuol theina dingin Meghalaya sawrkar sum hnar ropuia in chang tir tum a sawrkarin hma a lak mek hi lo tlawp seng ei tiu. Taima taka thaw tuhai tlawp seng ding le ram siem thatna sin thaw seng dingin ei in fiel takzet a ni.



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