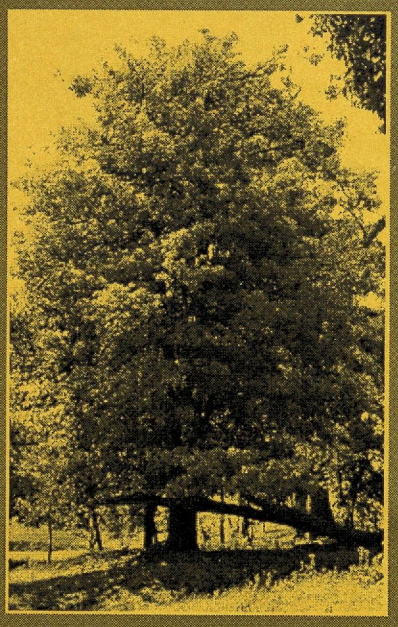
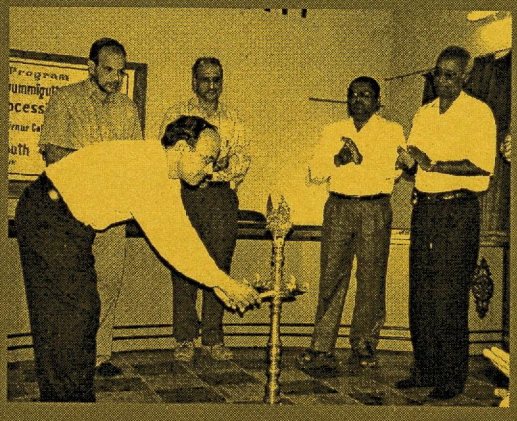






Proceedings of the Consultative Workshop

Participatory Approach to the Domestication of *Garcinia sp.* and Fruit Processing Techniques

Editors
R. Vasudeva
Narasimha Hegde

With Financial Assistance from
UNDP-GEF Small Grants Program

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Participatory Approach to the Domestication of *Garcinia sp.* and Fruit Processing Techniques

Editors
R. Vasudeva
Narasimha Hegde

Held at College of Forestry, Sirsi on 25 November, 2005

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Summary

A one-day workshop was organized at the **College of Forestry, Sirsi** on 25th November 2005 on the domestication of *Garcinia* sp. The objectives of the workshop were to take stock of the studies done on issues related to biology, ecology and economy of the focal species, as well as to evolve a strategy for domestication, improved processing skills and suggest policy changes. The representatives of most of the stakeholders of *Garcinia* attended the workshop. Scientists from Indian Institute of Science, University of Agricultural Sciences, Dharwad and Bangalore, local conservation enthusiasts, representatives of Forest Department, NGOs, farmers, students, representatives of industries attended the workshop. The programme was inaugurated by the Director of Instructions (Forestry), College of Forestry, Sirsi. The program was scheduled into four sessions *viz.* a) Biology, ecology and propagation, b) Policy and marketing c) Experiences from the stakeholders d) Plenary session.

In his keynote address, the Director of Instruction (Forestry) identified several important challenges to domestication of *Garcinia* and wished that the deliberations addressed these issues. Mr. Pandurang Hegde Director of Programmes, Prakruti in his introductory speech highlighted the development and conservation of NTFPs, viewed as an alternate to the conventional development activities such as construction of big dams, railway tracks and logging in forests. He said that it is estimated that 40 to 60 percent of the income come from the NTFP to the poor forest dwelling communities. Among other species, *Garcinia* is an important cash earning NTFP in recent years. However, due to industrial and export demand, the non-native people of the forests are practicing destructive harvesting methods. In the past only the edible butter was extracted from the seeds and used locally in recipes. However, the trend has been reversed today and only fruit rinds are being collected extensively. Finally he emphasized the need for quick domestication of this species and to evolve sustainable harvesting methods. He called for a greater cooperation from Forest Department to bring policy change for the existing tender system of marketing and for afforestation work.

Sketching a detailed domestication strategy fro *Gacinias*, Dr. R. Vasudeva of College of Forestry, Sirsi, suggested to employ the plus tree selection method followed by vegetative propagation. Dr. G. O. Manjunath and Dr Ramakrishna Hegde presented their work on vegetative propagation and provenance variation in *Garcinia indica* and *G. gummi-gutta*. Detailed versions of the papers presented in this session are appended. Mr. Shivanand Kalave, a freelance journalist worked on *Garcinia* species highlighted that *Adike Patrike* a monthly journal related to agriculture and forest products has explored the reasons for price raise for the rind of Uppage during 1996. He observed that due to the newly identified product pharmaceutical property has been a major cause for the price hike. Further he noted that price of fruit rind during 1978-79 was just 15 paise per kg, which jumped nearly Rs 150 per kg during 1993-94. During seventies, state Forest Department earned just Rs. 1115 (one thousand one hundred fifteen) by tendering the rind in Sirsi Forest Division. However, in 1993-94 it went up to Rs.25,00,00 (Twenty five

lakh rupees). He mentioned that large quantity of fuel wood is required to dry the rind, which might not be sustainable on a long run. Alternate ovens and low cost drier have to be evolved for drying purpose.

Mr Umesh Shastri, Assistant Conservator of Forests, Sirsi, emphasized that Forest Department has made efforts to identify superior types and to cultivate in forestland. These are also efforts of grafting of *Garcinia gummi-gutta* and the results are not so encouraging. However, he said there is lack of documenting all these initiatives and assured cooperation and keen interest in the work of Prakruti for the domestication and fruit processing.

Mr. Ganapati Hegde president of Muregar VFC explained about joint venture by Prakruti and Muregar VFC for evolving community based sustainable harvesting and management of the *Garcinia gummi-gutta*. Restricting harvesting level by allowing certain quantity of fruit in the trees and putting time limit to allow the fruit to become mature are the few examples. VFC has planted few seedlings of the species, however, intensive work should be done for domestication of the species.

Important Research, Policy and Marketing Priorities for *Garcinia* sp., identified in the Workshop

1. *Garcinia* is an important genus to be focused for domestication.
2. *Garcinia indica, Garcinia gummi-gutta, Garcinia morella* are important spices to be focused for domestication and further work.
3. Domestication strategy should address Agroforestry system approach specifically for *bettalands* (a kind of usufruct forest lands legally provided to the arecanut growers to harvest green manure and NTFP, although the ownership remains with the Forest Department).
4. Individual tree selection is the best for seed selection for propagation.
5. Provenance variation in the species must be studied by comparing samples from diverse geographic regions.
6. Traits for indirect selection of yield should be recognized.
7. Large-scale selection of plus tree should be attempted.
8. Performance of inter-specific grafts between *G. indica* and *G. gummi-gutta* should be evaluated for the purpose of extending the growing areas of G. gummi-gutta.
9. Concerted efforts to conserve the genetic resources of the Western Ghats should be attempted from University of Agriculture Sciences, Dharwad (UASD) and UAS Bangalore.
10. Experiment for alternative processing of fruit rind should be initiated.
11. Emphasis to improve existing nursery techniques and seed germinating techniques shall be given. Importance for research should be given.
12. Silviculture needs of the *Garcinia gummi-gutta* and *Garcinia indica* should be addressed.
13. Study has to be undertaken to know what could be the performance of these trees under high input agriculture.
14. Nutritional value of *Garcinia* should be addressed and further confirmed.
15. Orthotropic branches have to be concentrated while selecting the scions.

16. *In situ* grafting techniques should be tried and practiced (grafting of superior types on the already existing young plants).
17. Market channels have to be transparent.
18. Tenurial rights have role to play with respect to sustainable harvesting of the products. For example trees around the areca nut garden and surrounding areas.
19. Variation and price fluctuation in the market have to be checked.
20. Introduce products from *Garcinia* species locally and at regional level in regular diets. Efforts shall be made to create awareness on health consciousness in the society by using these products.
21. Policy issues on marketing, empowering the community organizations in dealing with these species should be viewed by taking *Garcinia* as a model system.
22. Alternate use of fruits to reduce fuel wood requirement and that would promote sustainable harvesting. Kokum cola: carbonated drink from *Garcinia* indica. Winemaking, alcohol extraction also could be tried from the fruits in that case only quality fruits have to be harvested thus preventing harvesting of unripe fruits leaving seeds for regeneration.
23. Establishment of *Uppage* foundation in line with that of Kokum foundation was emphasized.
24. Medicinal applications of kokum/ *Garcinia* butter for skin care needs to be researched.
25. Land suitability assessment for the cultivation of *Garcinia gummi-gutta* in farmers' field. There is scope for the arecanut growers to cultivate the *Garcinia* species on the strips adjacent to their farms.

Some Thoughts on Domestication of *Garcinia* and other NTFP Species*

S.K. Patil
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** Keynote address of the Workshop*

G. gummi-gutta is a evergreen and semi-ever green forests of central and southern Western Ghats, that yield a delicate non-dessert fruit of commercial importance. The fruits of *Garcinia gummi-gutta* are too acidic to be eaten raw, traditionally people of high rainfall tracts of Karnataka and Kerala use the pulp of the fruit in culinary preparations as flavoring agent, and the seeds are also rich source (31 per cent) of an edible fat. The decoction of the fruit rind is administered to reduce rheumatism and to cure improper bowel complaints. It is also employed as a rinse for diseases of the mouth in cattle.

In the recent years '*Garcinia*' has become one of the major NTFP species because of its newly identified pharmaceutical property. (-) 'Hydroxy-Citric-Acid' (- HCA), a chemical that is believed to reduce fat accumulation in humans when consumed, is extracted from the dried fruit rind (a marketable product). The concentration of HCA is reported to be as high as 30 per cent in dried fruit-rind; of which 90 per cent is non-volatile and also possess antiseptic properties. In recent years, increased commercialization of processed *Garcinia* fruit has pushed this local, subsistence level enterprise into a business involving international export market. Consequently, all the ill effects of globalization have set in to this species. Since the species is in commerce for over a decade, and in traditional use since several centuries, the species can be prioritized for further domestication.

In general domestication of Non-Timber Forest Product (NTFP) yielding species offers following challenges to the biologists: These challenges have social and economic angles. Hence it is necessary to involve all the stakeholders.

Some of challenges are:

1) The biology of most of the NTFP species is poorly understood. We don't even have idea of exact time and duration of flowering fruiting *etc.*

2) Their amenability for genetic manipulation is largely unknown since no earlier work has been attempted

3) Majority of NTFP species of the tropics are of importance only to rural households and communities but rarely reach world markets. Hence extension of market is a big problem

4) Further, the commercial viability and availability of channels for the marketable products are based on imperfect knowledge.

5) The scenario is further complicated by unpredictable consumer/industrial preference both at the level of species as well as for specific traits of commercial interest within a species.

6) Many of the NTFP species are harvested from the forests to get seasonal and extra cash income. A farmer would adopt domesticated product, in most instances, only if it can be grown on a marginal or wastelands without much care.

All these issues would have a bearing on the direction, success and rapidity of domestication process. From the viewpoint this background, we should evaluate the domestication strategy of *Garcinia gummi-gutta* and other species I wish the deliberations of this workshop would address these issues. I wish the workshop a grand success.

Strategies for Domestication of *Garcinia gummi-gutta,* an Important Non-Timber Forest Product (NTFP) Yielding Species of the Central Western Ghats

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The species and its importance

Garcinia gummi-gutta is a dioecious tree found in the evergreen and semi-ever green forests of central and southern Western Ghats that yield a delicate non-dessert fruit of commercial importance. The fruits of *Garcinia gummi-gutta* are too acidic to be eaten raw, traditionally people of high rainfall tracts of Karnataka and Kerala use the pulp of the fruit in culinary preparations as flavoring agent, and the seeds are also rich source (31 per cent) of an edible fat. The decoction of the fruit rind is administered to reduce rheumatism and to cure improper bowel complaints. It is also employed as a rinse for diseases of the mouth in cattle. In the recent years '*Garcinia*' has become one of the major NTFP species because of its newly identified pharmaceutical property. (-) 'Hydroxy-Citric-Acid' (- HCA), a chemical that is believed to reduce fat accumulation in humans when consumed, is extracted from the dried fruit rind (a marketable product). The concentration of HCA is reported to be as high as 30 per cent in dried fruit-rind; of which 90 per cent is non-volatile and also possess antiseptic properties.

Domestication as tool for utilization and conservation of NTFP species

Domestication of Non-Timber Forest Product (NTFP) yielding species such as *Garcinia gummi-gutta* offers several challenges to the biologists, which often have a social and/or an economic angle. Firstly the biology of *Garcinia gummi-gutta* is poorly understood. Secondly its amenability for genetic manipulation is largely unknown. Thirdly, the commercial viability and availability of channels for the marketable products are not transparent and also based on imperfect knowledge. Fourthly the scenario is further complicated by unpredictable industrial demand and vagaries of price commanded by the product. All these issues would have a bearing on the direction, success and rapidity of domestication process of *Garcinia*. In general, five logical steps could be identified in the modern-day domestication process of a typical NTFP species, which are as follows:

1) Prioritization of species
2) Characterization of the species and adoption of a domestication strategy
3) Commercialization of the product
4) Redesigning agroforestry systems

5) Maintenance of biological and gene diversity of domesticated NTFP species

From the viewpoint of these general principles, we evaluate the domestication strategy of *Garcinia gummi-gutta*.

Prioritization of species

It is the process of zeroing-in on a set of species to be domesticated based a sound decision-making framework. Since there are several candidate species available in any given eco-region, it is essential to select the species most suitable for domestication. Such priority setting exercise is the fundamental and most crucial step in the process of domestication of NTFP tree species since most of them are perennial in habit and hence their genetic manipulation is time/resource consuming.

***American adipose and the Indian* Garcinia**

In the recent years 'Garcinia' has become one of the major NTFP species because of its newly identified pharmaceutical property. (-) 'Hydroxy-Citric-Acid' (- HCA), a chemical that is believed to reduce fat accumulation in humans when consumed, is extracted from the dried fruit rind (a marketable product). The concentration of HCA is reported to be as high as 30 per cent in dried fruit-rind; of which 90 per cent is non-volatile and also possess antiseptic properties. In recent years, increased commercialization of processed Garcinia fruit has pushed this local, subsistence level enterprise into a business involving international export market. Consequently, all the ill effects of globalization have set in to this species. Since the species is in commerce for over a decade, and in traditional use since several centuries, the species can be prioritized for further domestication.

Characterization of the species with respect to its biology, use and to adoption of an appropriate strategy for domestication:

At this stage, the level and distribution of genetic diversity as well as rate of change in genetic diversity associated with the process of domestication are to be focused. Many of the NTFP species are harvested from the forests to get seasonal and extra cash income. A farmer would adopt domesticated product, in most instances, only if it can be grown on a marginal or wastelands without much care. However, a few species could also be adopted for an intensive cultivation. Hence domestication strategy should very clearly focus on traits that are appropriate for such diverse situations. G. gummi-gutta is suitable for high-rain fall area of the southern and central Western Ghats, it may be domesticated for growing on home-stead gardens, waste/marginal lands within its natural distributional range. Hence it can be developed into a 'niche crop' for the horti-silvi-pastoral systems of the high rainfall region of the Western Ghats. Recently an improved variety of *G. indica*, a closely related species of G. gummi-gutta, has been developed through selection and released for cultivation in Maharastra and Gujarath, which can be considered as a model system for G. gummi-gutta. However, the most important aspect of domestication of an NTFP species is to firstly document its response to cultivation. Several examples suggest that phenotype of a species might transform with the change in the growing conditions.

Fruit collection, traditional processing of fruits and seeds

The ripe Garcinia fruits are collected from naturally grown trees during the months of June-August. Since the fruits are highly acidic, they are highly susceptible to fungal infestation. Hence the fruits are processed immediately following their collection. The raw fruits are cut into two halves and are spread out on a raised platform after the seeds inside are separated from the pulp. Drying is done until the fruit gets a charcoal black color and obtains a smoky smell (which takes roughly 30 to 40 h). The ratio of raw fruits to dried rinds is 10:1 (Saibaba et al., 1996). Further processing of the fruit rinds will be done at industrial scale, wherein calcium and potassium salts of the HCA are produced. At this stage, processing cost could be reduced if the wax content of the fruit rind is low and if the fruits are completely ripened. Seeds are processed to get edible clarified butter.

Domestication strategy

Adopting an appropriate domestication methodology is also use-specific and trait-specific. To focus on specific traits for improvement, it is essential to characterize steps involved in utilization of an NTFP species. The ripe fruits of *G. gummi-gutta* are collected from naturally grown trees during the months of June-August. Since the fruits are highly acidic, they are highly susceptible to fungal infestation. Hence the fruits are processed immediately following their collection. The raw fruits are cut into two halves and are spread out on a raised mesh platform after the seeds inside are separated from the pulp and a fire is set beneath. Drying is done until the fruit gets a charcoal black color and obtains a smoky smell (which takes roughly 30 to 40 h). The ratio of raw fruits to dried rinds is 10:1. Further processing of the fruit rinds will be done at industrial scale, wherein calcium and potassium salts of the HCA are produced. At this stage, processing cost could be reduced if the wax content of the fruit rind is low and if the fruits are completely ripened. Seeds are processed in a traditional method to get edible clarified butter.

Since the species is dioecious, genetically their population would be extremely heterozygous and sexual reproduction yields a multitude of mostly undesirable types. Vegetative reproduction is simple and outstanding individuals can be probably selected to initiate clones. A shift from sexual to vegetative reproduction is a rapid and effective way of establishing a domesticate. But virtually no concerted efforts are done to evaluate the provenance level genetic variation for economic traits in this species. Fortunately, a few farmers have identified interesting variation for size and shape of fruits as well as for fruit bearing nature. Since the species is dioecious, female trees can be preferentially multiplied through the use of standard horticultural techniques of grafting, air layering, and rooted cuttings. In this way, important characteristics such as fruit quality, yield, etc. can become fixed and adopted as the standard for domesticated races.

Traits that needs to be focused while selecting the superior clone are:

1. Monoecious types
2. Early flowering types
3. Regular bearing types
4. Higher fruit yield
5. Higher fruit rind to seed ratio
6. Higher HCA content

7. Better shelf-life of fruits
8. Low wax content in the fruit rinds
9. Uniform ripening of the fruits within a tree.

Methodology

1. To identify superior genotypes with desirable traits within the distributional range
   In this part, correlations of HCA content with marker traits will be established so that quick and reliable phenotypes can be identified.
2. To develop vegetative and micro-propagation protocols.
   Vegetative propagation techniques such as stem cuttings, grafting, etc., will be adopted. Tissue culture protocols will be standardized to multiply super clones for mass multiplication.

Genetic engineering

The range of applications of genetic engineering is continuously extending. Marker-assisted breeding in forest trees presents a unique and interesting challenge, because inbreeding is generally not possible, multi-generation pedigrees are rare, generation times are long and resources are limited. The high heterogeneity that exists in most forest trees can be used to great advantage in mapping since it a rich source of genetic diversity.

Commercialization

Domestication has a strong economic basis hence it is very essential to understand and amend the aspects of commercial importance of a domesticated product. Domestication and commercialization sometimes would overlap for some species. For a few others, establishment of reliable market channels and genuine buy-back system would reinforce the continued utilization of species by farmers. This is an essential step to prevent wastage of efforts of domestication. It is believed that about 3000 metric tons of dried rinds of G. gummi-gutta were produced during 1995 in Canara forest circle of Karnataka, of which more than 1000 metric tons were derived from private lands. Further, Garcinia fruits command high whole-sale and retail prices and were sold at Rs. 70-80 a kg during 1998-1999, the price has however, decreased drastically to Rs.30 a kg during 2000. It is essential to amend policies to avoid such high fluctuations.

Redesigning agroforestry systems

In this step, issues related to redesigning agroforestry systems to incorporate these domesticated races of NTFP tree species are addressed. This helps in tapping the environmental services offered by NTFP species (such as mitigating deforestation and soil conservation) is clubbed with ensuring cash-income to the farmers. In case of *Garcinia*, a substantial portion of the product is originated from the private lands called *betta* lands (a kind of usufruct forests given to individual farmers to aid in cultivation of beetle nut). However, currently no specific species components of this horti-silvi-pastoral system are

followed in these lands. Hence it is essential to address recommendations for a sound management of *betta* lands.

Maintenance of biological and gene diversity of domesticated NTFP species

Domestication invariably leads to a decrease in genetic variability and results in uniformity of populations, which is not a desirable outcome. Improvement in yield is obtained at the cost of genetic variability depending on the improvement strategy. Hence conservation of genetic resources should always be a part of the domestication program. To conserve genetic variation in these species through an ex situ approach. A clonal garden of the elite germplasm will be established through the standardized techniques.

Acknowledgement

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Studies on Seed Germination and Grafting Techniques in *Garcinia indica* L. Choisy

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ABSTRACT

The fruits of *Garcinia indica* are important source for Hydroxy Citric Acid (HCA) and known for anti acidic and nutritional value. The present study was under taken at college of Forestry, Sirsi during 2004 - 05 to reveal pre seed treatments on seed germination and effect of different grafting techniques in *Garcinia indica*, the results indicated that, storage of seeds reduces the germination percent significantly, so seeds should be sown when they are fresh to obtain higher and uniform germination. Among the seed pre-treatments given maximum germination per cent was in hand scarified seeds treated with GA3 50ppm. Among the Grafting techniques tried cleft grafting showed highest success (92.5) which could be used for commercial propagation purpose.

Introduction

The genus *Garcinia* L belongs to the family Clusiaceae, earlier known as Guttiferae having approximately two hundred species distributed in Asia. Thirty-six species are found in India (Abraham *et al.,* 1999) among them *Garcinia gummi-gutta* and *Garcinia indica* are more important ones. *Garcinia indica* is found in tropical rain forests of Western Ghats, from Konkan southwards in Mysore, Coorg and Wayanad. In Karnataka, occurs along the wind ward side of the Western Ghats in Dakshina Kannada, Coorg, Chickmagalore, Shimoga and Uttara Kannada districts (Ravikumar and Ved, 2000). *G. indica* is called as 'Kokum' in English but the local names vary from region to region in India. It is known as 'Brindon' to portuguese in Goa, 'Bhirand' or 'Amsol' to Marathis and Konkanigas, 'Murugalu' to Kannadigas and 'Punampuli' to Malayalis (Subhash Chandran, 1996). It is an evergreen, tree with 10-12 meters or even more height. It's drooping branches and erect main terminal growing shoot offers good choice for avenue plantation in cities and can be choice plant for cultivation on either side of the railway tract passing through Konkan belt (Shripadre, 2001).

In this tree fruits and seeds are the economically important parts having medicinal and nutritive value. The fruits contain 10% malic acid and a little citric/ tartaric acid. Recently industries have started extracting Hydroxy Citric Acid (HCA) from kokum rind.

Kokum fruit as a medicine is prescribed for heart ailments, dysentery, piles, diabetics, tumors and to reduce cholesterol. Seeds of fruits yield edible fat known commercially as "kokum butter". This is used to treat backaches, muscle pulls and also in candle and soap manufacturing and as confectionery butter. The cake left after extraction of oil is used as manure (Yasodharan, 2002). Due to the increased utility with respect to medicinal and nutritive value of the tree, the demand for the fruits is increasing in India and abroad rapidly. Fruits from natural forests are extracted in large scale as an important NWFP in parts of Uttara Kannada, Kerala and Maharastra. A few farmers have started commercial cultivation of kokum. Even then demand far outstrips the supply. It has been reported that Japan imports nearly 50-60 tons of kokum seeds every year (Sirodkar, 2003).

The commercial cultivation of kokum is hindered by lack of standardized nursery practices and feasible propagation techniques. Kokum tree being dioecious in nature needs to be propagated vegetatively. Vegetative propagation also helps to achieve early fruit set and to overcome the problem of sex identification at seedling stage. Standardization of seed germination and grafting technique are pre-requisites for domestication and commercial cultivation of any tree species. Grafting is an important vegetative propagation technique followed in kokum. However the knowledge about type of grafting, season of grafting and the compatibility with rootstocks of different species is still lacking. Therefore, considering these facts, the main aim of the present study was to reveal the effect of different pre seed treatments on germination and to know the effect of different grafting techniques.

Material and methods

The present study was carried out at the College of Forestry Sirsi (14^0 26"N latitude, $74^0$50"E longitude) of Uttara Kannada district of Karnataka, located in hilly zone (zone-9) of Karnataka state.

Totally eight different pre-sowing treatments were given at two different intervals. First as soon as after collection of seeds and second after storing in room condition for 30 days. The treatments are as follows

T_1 – Removal of seed coat by hand

T_2 – Mechanically damaging the seed coat by rubbing with sand

T_3 – Chemical scarification (dipping in conc. H_2SO_4 for three minutes followed by thorough washing with tap water)

T_4 – Removal of seed by hand and treating with Gibbarlic Acid (GA_3) of 50ppm for 12 hours

T_5 – Mechanically damaging seed coat by rubbing with sand and treating with GA_3 of 50ppm for 12 hours

T_6 - Chemical scarification with conc. H_2SO_4 and treating with GA_3 of 50ppm for 12 hours

T_7 – Alternate wetting in cow dung slurry and drying (12 hours each) for three days

T_8 – Control (without any treatments)

Design and lay out

The experiment was laid out in Completely Randomized Design (CRD). The treatments were replicated thrice. Fully matured fruits were collected from the trees and seeds were extracted from them. The uniform sized bold seeds were chosen for the

germination trial. After pre treatment, seeds were sown in germination trays containing sand. The whole experiment was carried out in laboratory condition during April and May. For each replication 50 seeds were sown. Watering was done daily using rose can.

Grafting

In this experiment four types of grafting were tried in the month of May, namely cleft grafting, whip grafting, whip and tongue grafting and epicotyl grafting. For first three types of grafting root stock of eight-month-old *G. indica* was taken, where as for epicotyl grafting one-month-old *G. indica* seedlings were selected. Present season sprouts of about 5-8 cm length were selected as a scion from female trees. Two months after grafting observations were taken on number of grafts survived, number of sprouts and number of leaves were taken in Completely Randomized Design (CRD).

Results

There was significant difference in germination per cent between fresh seeds and 30days stored seeds. Germination was maximum (77.66 per cent) in fresh seeds compared to 30 days stored seeds (59.33 per cent). 30 days storage of seeds led to 30 per cent decrease in the germination (Table 1).

All presowing treatments showed significant deference in germination per cent over control. Among various presowing treatments, hand scarification followed by treatment with Gibberlic acid (50ppm) for 12 hours showed highest (80 per cent) germination per cent (T_4). This was on par with hand scarified seeds (79.33 per cent) (T_1). The lowest germination (51.33 per cent) was observed in control. The extent of germination due to treating hand-scarified seeds with GA_3 (50ppm) for 12 hours was 55.8 per cent over control. Interaction due to storage and pretreatment did not influence the germination significantly. However maximum germination per cent (90 per cent) due to effect of interaction was observed in fresh, hand-scarified treatment and lowest (44.67 per cent) was observed in 30 days stored, untreated seeds. Mean daily germination differed significantly with storage. Fresh seeds showed higher (2.86) mean daily germination compared to thirty days stored seeds (1.85). There was 35.31 per cent decrease in mean daily germination in 30days stored seeds. The highest mean daily germination (2.90) was observed in hand scarified seeds (T_1), which was followed by hand scarified seeds treated with GA_3 (50ppm) for 12 hours (T_4). Control showed the lowest (1.56) mean daily germination, which was 46.2 per cent decrease over hand scarified seeds. All the parameters in Hand, mechanical and chemical scarified seeds were on par with the respective Gibberlic acid treatments. This shows treating with GA_3 (50ppm) for 12 hours did not influence any of the parameters.

There was significant difference in peak value between fresh and 30 days stored seeds. The higher peak value (2.92) was observed in fresh seeds, and was 53.6 per cent higher than 30 days stored seeds. The lowest (1.90) was observed in 30 days stored seeds. Hand scarified seeds showed the highest peak value (3.07), which was on par with hand scarified seeds treated with GA_3 (50ppm) for twelve hours (3.03). Control (T_8) recorded the lowest (1.55) peak value. Increase in peak value due to hand scarification was 98.06 per cent control.

There was significant difference in germination value due to presowing treatments. The maximum germination value (9.45) was observed in hand scarified seeds and which was followed by hand scarified seeds, treated with Gibberlic acid for 12 hours (9.21) but the seeds without any treatment showed lowest germination value (2.56). The hand scarified seeds showed 265 per cent increase in germination value over control. Seed pretreatment increased the germination rate significantly. Hand scarified seeds treated with GA_3 (50ppm) for 12 hours showed the highest (1.98) germination rate. This was on par with hand scarified seeds (1.92). The lowest (1.03) germination rate was recorded in control (T_1). The extent of increase in germination rate due to hand scarified seeds treated with GA_3 (50ppm) for 12 hours was 92.2 per cent over control.

The different types of grafting carried in *G. indica* showed significant increase in survival per cent, number of sprouts and number of leaves. The maximum survival per cent (92.5) was observed in cleft grafting and this was on par with whip grafting (87.5) and whip and tongue grafting (82.5). Lowest survival per cent (47.5) was observed in epicotyl grafting (table 2).

Number of sprouts per graft were maximum in cleft grafting (5.07) which was followed by whip and tongue grafting (5.04) and whip grafting (3.99). The lowest number of sprouts (2.97) were observed in epicotyl grafting. The cleft grafting showed 70 per cent increase in number of sprouts per graft over epicotyl grafting.

Number of leaves per graft was maximum (12.02) in cleft grafting and this was on par with number of leaves produced per graft in whip and tongue grafting. Epicotyl grafting showed the lowest number of leaves (5.81) per graft.

Discussion

Commercialization of forest products is getting accelerated in recent years. Kokum with high medicinal value has a great potential of commercialization but at the present stage lacuna of standardized nursery techniques hinders the attempts to popularizing the plant. The germination per cent due to seed storage varied significantly. The highest germination percentage was observed in fresh seeds. *Garcinia indica* seeds are of recalcitrant nature. It is well known fact that in recalcitrant seeds as the moisture content reduces below certain level the germination goes on reducing. This recalcitrant nature of the seeds may have reduced the germination per cent significantly in 30 days stored seeds. Similar observations were also made by Jindal *et al.,* (1990) who reported the reduction in germination of *Tecomella undulata* from 82 per cent in fresh seeds to 63.3 per cent in one-year-old seeds. Chacko and Pillai, (1997) also have reported the reduction in germination with decrease of moisture content in *Garcinia gummi-gutta.*

Mean daily germination is the measure showing average number of seeds germinated per day. The maximum mean daily germination was in fresh seeds (2.92) which significantly varied in 30 days stored seeds. *Garcinia indica* seeds have gummy layered seed coat, which get hardened in storage due to loss of moisture. This hardening of seeds coat might be the responsible factor for delaying and prolonging the germination period. The prolonged germination period reduced the mean daily germination in 30 days stored seeds. Peak value indicates the maximum mean daily germination reached at any time during the period of test. Peak value in 30 days stored seeds reduced significantly

over fresh seeds. The reduced germination per cent and prolonged germination period might have led to reduced peak value in 30 days stored seeds.

Germination value also differed significantly due to storage of seeds. Germination value is an integral measure of seed quality. It aims to combine in a single figure, an expression of total germination at the end of the test period with an expression of germination energy or speed of germination. The germination value in 30 days stored seeds has drastically reduced, this is mainly due to reduced mean daily germination and peak value. (GV = MDG X PV). Thirty days stored seeds showed significantly reduced germination rate. This is mainly due to reduced germination per cent and prolonged germination period in 30 days stored seeds. Among Various pre-sowing treatments showed significant difference in germination per cent, Mean daily germination, peak value, and germination value and germination rate. All the treatments showed significant difference over control in all parameters. Increased germination in all the treatments might be due to either damaging or removing of seed coat, which made the easy permeability of water to cotyledons. Thus increased imbibition led to the higher germination per cent.

The maximum germination per cent (80 per cent) was in seed coat removed seeds, which were treated with GA_3 50 ppm. This treatment was on par with only seed coat removed treatment. Even mechanically scarified seeds and chemically scarified treatments are on par with the Gibberlic acid treated treatments. This clearly shows that Gibberlic acid did not influence much on germination but the treatments, which allowed easy permeability of water to cotyledons increased the germination per cent. So it can be concluded that the reduced germination in kokum is mainly due to impermeable seed coat. These results are in conformity with that of Chacko and Pillai (1997) who reported the increased germination and reduced period of germination in de coated seeds of *Garcinia gummi-gutta* compared to control.).

In the experiment of different grafting techniques tried, survival per cent number of sprouts per graft and number of leaves per graft varied significantly in different types of grafting techniques. Cleft, whip, whip and tongue grafting were on par with each other for survival per cent. Number of sprouts per cutting and number of leaves per graft but all of them varied significantly over Epicotyl grafting. The lesser survival percent, number of sprouts and number of leaves per graft in epicotyl grafting may be due to young nature of rootstock. The smaller area at the joining point of root stock and scion might have reduced the chances of joining root stock and scion thus ultimately reducing the survival per cent. In cleft and whip and tongue grafting there is a provision for better locking of rootstock and scion thus leading to better contact with cambium. This might has led to faster union of root stock and scion and thus further leading to higher number of sprouts and number of leaves per graft. These finding are in conformity with Haldankar *et al.,* (1992), who have reported 86 per cent survival in *G. indica* soft wood grafting carried on its own rootstock. Senarathe *et al.,* (1981) also have recorded 87 per cent success in both whip and cleft grafting in *Madhuca longifolia*.

Conclusions

1) On the whole, present study showed that, the fresh seeds have shown significantly higher germination percent mean daily germination, peak value, germination value and germination rate compared to 30 days stored seeds. This suggests that storage of seeds reduces the germination percent significantly, so seeds should be sown when they are fresh to obtain higher and uniform germination.

2) Among the seed pre-treatments given maximum germination per cent was in hand scarified seeds treated with GA3 50ppm, which was followed by only hand scarified seeds. However this method is very laborious and difficult, so chemical scarification with concentrated H_2SO_4 for 3 minutes can be followed for large-scale treatment, as it also gives significantly higher germination over control.

3) In case of different grafting techniques tried cleft, whip and whip and tongue grafting were equally successful. However cleft grafting which showed highest (92.5) success could be used for commercial propagation purpose.

Table1.Effect of various treatments on germination parameters of *Garcinia indica*

Treatment	Ger. Per cent	MDG	PV	GV	GR
Main treatments					
S_0- No storage	77.66 (62.41)	2.86	2.92	8.68	1.90
S_{30}- 30 days storage	59.33 (50.47)	1.85	1.90	3.53	1.24
Sem	0.67	0.04	0.06	0.24	0.03
CD@1%	2.42	0.15	0.23	0.81	0.12
Sub-treatments					
T_1- Hand scarification	79.33 (63.90)	2.90	3.07	9.45	1.92
T_2- Mechanical scarification	71.00 (57.73)	2.46	2.53	6.55	1.65
T_3- Chemical scarification	71.00 (57.70)	2.39	2.29	5.16	1.60
T_4- Hand scarification+GA_3(50ppm)	80.00 (64.32)	2.90	3.03	9.21	1.98
T_5- Mech. scarification + GA_3(50ppm)	68.00 (55.81)	2.41	2.44	6.20	1.57
T_6 - Chem. scarification + GA_3(50ppm)	66.00 (54.56)	2.23	2.30	5.41	1.50
T_7- Cow dung treatment	61.33 (51.74)	2.00	2.03	4.31	1.34
T_8 – Control	51.33 (45.78)	1.56	1.55	2.56	1.03
SEm±	1.35	0.08	0.12	0.49	0.06
CD@1%	4.25	0.29	0.45	1.80	0.23

MDG- Mean Daily Germination; PV- Peak value; GV-Germination value;

GR – Germination rate; Figures in parentheses are arcsine-transformed values

Table 2. Influence of grafting techniques on survival percent, number of sprouts and number of leaves per graft in *Garcinia indica*

Grafting type	Survival (%)	No. of sprouts	No. of leaves
Cleft	92.5 (77.58)	5.07	12.02
Whip	87.5 (71.58)	3.99	8.59
Whip and Tongue	82.5 (67.86)	5.04	11.72
Epicotyl	47.5 (43.55)	2.97	5.81
Mean	77.50	4.27	9.53
Sem±	4.78	0.19	0.52
CD @ 1%	17.43	0.80	2.14

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Monitoring the Yield for Improved Management of *Garcinia gummi-gutta* in Central Western Ghats of Karnataka , India.

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Garcinia gummi-gutta is an important species in the composition of evergreen and semi evergreen forests of Uttara Kannada. This species also contributes towards the income of communities living in the vicinity of forests. People collect a substantial quantity of fruits and seeds from trees of this species. Fruits also serve as an important food for many wild animals. Local people extract an important edible fat from seeds of fully ripened fruits. People consume this fat as a substitute for ghee and also use it for frying. Hence a portion of this fat is consumed at the household level and remaining is sold in the local market. In recent years, fruits generated a lot of interest in the commercial market because of HCA content in the fruit. Thus, this species is of high utility value and it forms an important tree species in generating additional income for the poor people. Therefore, protection, conservation, and promotion of this species would motivate local people to conserve forests as a whole. There is a lot of interest for further study on the biology and ecology of this species in the forests of Uttara Kannada and also promotion of this species by way of domestication.

Effort is required to conserve and promote this species in its natural habitat as well as domestication/cultivation in private lands. Following are some of the areas that could be looked in to for this purpose.

1. Conservation of gene pool in the natural habitat
2. Regeneration level of this species in the forests
3. Sustainable extraction of fruits from the trees
4. Understanding of fruit productivity of trees in natural forests

A study is being carried out in Uttara Kannada with an objective of generating information on fruit yield pattern of G. gummi-gutta to understand the variation in fruit yield from year to year and to understand the relationship between fruit yield and other tree attributes.

About a hundred trees have been identified and numbers of fruits are estimated on each of these trees every year during the harvest season by counting fruits on sample branches. The preliminary result of this study shows that there is a high variation in fruit yield among all trees. To understand yearly variation in the fruit yield, fruit yield per tree was computed for each year and compared between years. When average yield of all trees during two consecutive years is considered there is a significant difference showing supra annual fruit yield cycles in these trees. Also, there exists variation in fruiting

patterns among individual trees, wherein some have regular fruiting, while others have irregular fruiting patterns.

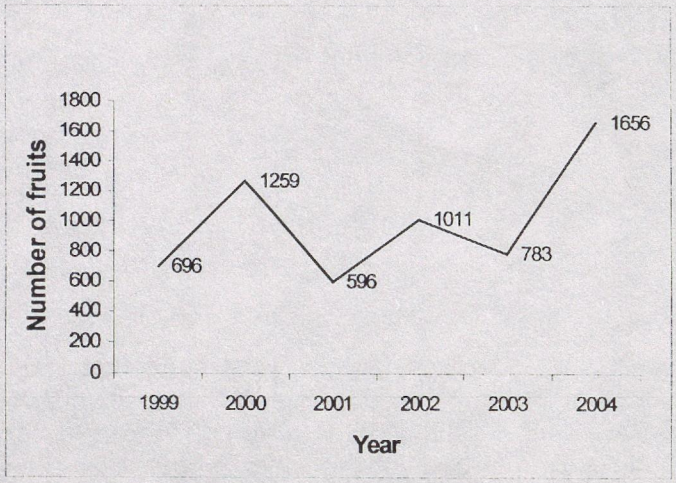


Figure 1. Annual variation in fruit yield from trees of *Garcinia gummi-gutta*

It would be quite useful to understand the fruit productivity level of *G. gummi-gutta* trees from the management point of view. It has many applications. It would be interesting to understand whether any correlation exists between the fruit yield and tree attributes such as girth, height and canopy size etc.

Promoting more extensive/intensive cultivation of trees on private lands to meet the growing market demand. Since this species has generated so much interest and also demand in the local and commercial markets it would become essential to cultivate the trees of this species on a larger scale. This would help the farmers to produce quantity of fruits required to meet the market demand. This would help in protecting and conserving the natural population of individuals of this species. Thus, there is a need to promote domestication of *Garcinia gummi-gutta*.

Social and Ecological Impact of Harvesting Uppage *(Garcinia gummi-gutta)* in Uttara Kannada district of Karnataka

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Introduction

Garcinia gummi-gutta is an important NTFP in the central Western Ghats. Traditionally, the seeds were collected for extracting butter. And in some regions the dry rind was stored for years to use it as tamarind substitute and as vinegar. Recently the rinds are attracting market, for HCA, (Hydroxy Citric Acid) content in the fruit rind said to have obesity control property and is exported. Due to increase in industrial all unscientific harvesting practices were set in. Study explains harvesting, processing methods of *G. gummi-gutta* and marketing, consequences of the change in harvest due to increased price.

Importance of the species in terms of income generation to local people, labor returns per day and out turn of product and revenue obtained by Forest Department is also discussed.

Impact assessment of harvesting on regeneration of the populations have studied which revealed that regeneration was almost nil during period of high industrial demand. Finally efforts of Prakruti an NGO dedicated for the cause of conservation of tropical forests through promoting sustainable harvesting, popularizing domestication and cultivation etc are also discussed in this paper. Field observations, standard vegetation analysis techniques, PRAs, series of workshops on sustainable harvesting were carried out involving NTFP harvesters, Village Forest Committees, State Forest Department and NGOs. Suggestions were made to facilitate policy changes towards sustainable harvesting.

General description

Garcinia gummi-gutta is an evergreen tree, which can grow 8 to 12 meters, at evergreen patches. Tree grows in cone shape and branched perpendicular to stem. The fruits, which grows up to a size of orange, with ridges ranging from 8-12, contains, approximately same number of seeds. Green fruits turn orange after maturation. Tree starts to give yield after 8-10 years of age. Recently, an attempt of grafting also tried to get the yield early with promising success rate. The importance to this plant came recently. Traditionally, the seeds were collected by Havyak Brahmins community, for extracting butter. And in some regions the dry rind was stored for years to use it as

tamarind substitute. But, recently, from last 15 years, the rinds are attracting market, for HCA, (Hydroxy Citric Acid) content in the fruit rind.

Collection practices

Harvesting season starts from first week of June and ends with 2nd week of August. Since trees can be found in deep evergreen forests, mainly in crest line of Western Ghats, with the pouring rain, slippery forest slopes, and tenacious leeches, it is really a challenging job to collect these fruits. Usually women collect the fallen fruits and separate the seeds from the fruit and bring it to home. These seeds were mixed with ash dried and then de husked.

Processing

Fruits, after bringing to home yard, are sliced to separate seeds and rinds. Normally the fruit rinds are dried in open fire method. Rinds are dried on trays, meshed size, using firewood. However, the rind can be processed through dryer. But this is bit costlier and a common collector cannot afford this. Seeds are mixed with ash, to remove gum jelly component around the seeds and dried. Seeds are roasted, crushed, and boiled with water and kept stable for hours. The low-density oily content floats on the top, and slowly extracted from the mixture.
This butter (oil) is used at specific occasions like in festivals to prepare sweet dishes.

Changed scenario

Since last ten fifteen years the product has gained commercial importance because of Hydroxy Citric Acid (HCA) in it. Now only the rind of the fruit is collected and not the seed as it was done previously. HCA is extracted from the rind and is exported to many countries (including USA and Japan). Ultimately there is high industrial demand for the rind.

Consequences of the change

The product is being over harvested and there is pressure on the forest for the resource. The returns per Labour Day attracted even outsiders, (those who are non-residents of the area mainly from sub urban places) thus resulting in the unsustainable harvesting practices. Harvesting of unripe fruits, cutting of branches and some times entire tree is being done in the process. This has made the species vulnerable of extinction.

Uses

1) The sour rinds are used as a tamarind substitute, mainly in Kerala State, Andhra Pradesh and in part of Karnataka, with beef and fish curries.
2) Oil (edible clarified butter) is used for all culinary purposes. The fried sweet dishes, from oil of *Garcinia gummi-gutta* last longer than others, increases shelf life of fried food products.
3) The oil is used for medicinal purposes for joint pains.

4) Hydroxy Citric Acid, (HCA) which is available at about 30% in *Garcinia gummi-gutta* rinds, used for obesity, reducing fats, and is exported.

Market

Forest Department auctions the products once in two years. The highest bidder gets the permission to collect the fruits. Contractor appoints sub agents or middlemen to collect the product from the harvesters. The contractor himself solely decides the price of the product. Therefore it is believed that there is big gap between the actual quantity harvested and the quantity reported by the contractor to the Government. It is also believed that the Government records always under estimate the quantity of any NTFP. There are other channels of marketing through Village Forest Committees and LAMPS (Large Scale Adivasi Multipurpose Societies). However, their role in the marketing of the fruit is negligible compared to tendering system to the contractors.

Recent Trend

Due to the industrial demand and hence high price for the product has forced to collect more and more rind. In the process unripe fruits are also collected as explained earlier. More over adulteration is carried out to the product. Because of adulteration the price for the rind in the export market dropped. During 1997-98 the price of rind went up to Rs. 100 per kilogram when the price was just Rs. 5 in 1985-86 (Figure 1) (45 Indian Rupees is about one US$).

The quantity and revenue from the *Garcinia* was rising initially and highest during 1997-98 and then started decreasing (Figure 2).

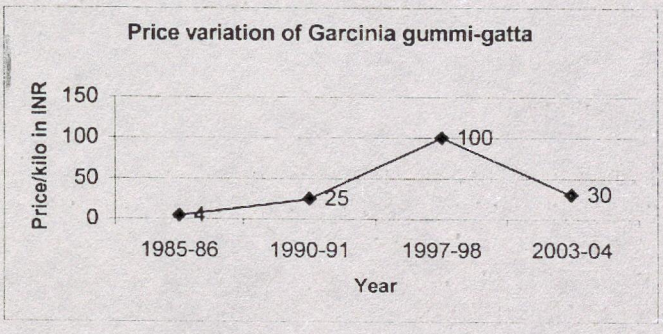


Figure 1: Price variation for the rind of *Garcinia gummi-gatta* over the years.
(Source:PRAKRUTI field data 2000 to 2004)

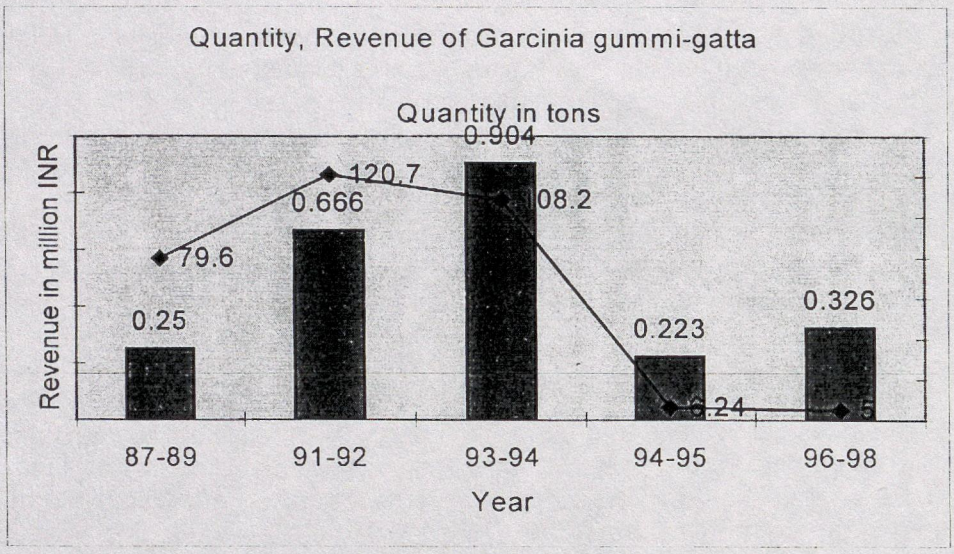


Figure 2: Quantity harvested and revenue earned from the *Garcinia gummi-gutta* is reducing. (Source: Karnataka Forest Department Data 1985-1999)

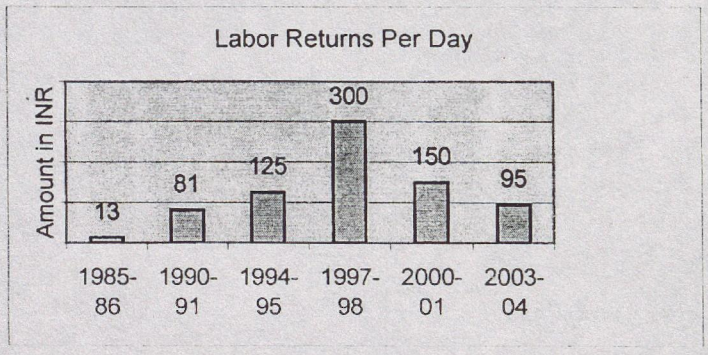


Figure 3: Labor returns Per Day from harvesting the *Garcinia gummi-gutta* to primary collector. (Source: Field Data – PRAKRUTI 2000-04).

Labour returns per day are almost in accordance with the quantity harvested and price for the *Garcinia* rind. The product started to market during 1978 when the dried rind was sold in Kerala from Uttara Kannada district. During that time price of rind per kilogram was just 0.15 rupees (personal communication with journalist Mr. Shivanand Kalave). Price was Rs 13 during 1985-86. In this period resource availability was high, however, people were not interested to collect the resource because the price were not attractive. The price that went up to Rs. 100 per kilogram during the year 1997-98 and then stabilized to rupees 20 during 2004-05.

Actions

Workshop on sustainable harvesting:

We have organized workshops on sustainable harvesting of NTFP in various places, Anshi, Muregar, Achave and Bandala are few to name. In some of the villages the collectors decided to bring restriction to harvest the product until maximum fruit ripens (as in Muregar village). Monitoring the harvesting by local people and Village Forest Committees (VFC) to check the early harvesting, to avoid chopping of branches or cutting of trees.

Discussions with Forest Officials and distribution of Brochures:

We have circulated brochures in Sirsi Forest Divisions through the Forest Department explaining why sustainable harvesting is needed to conserve the resource and urging the collectors, contractors and sub contractors to practice sustainable harvesting. Discussions were held with various Forest Officials to arrive at sustainable practice and to suggest bringing change the policy.

Encouraging propagation and Domestication:

This has to be done by propagation of the species in VFC (Village Forest Committees) areas through planting and encouraging the farmers to cultivate in their land. And allowing the regeneration of the species in the natural forest. In several VFCs planting of the *Garcinia gummi-gutta* has been done and several farmers also have grown in their agriculture land. However, these efforts were done in pockets and more concentrated work has to be done for domestication of the species. There are reports that fruits from the domesticated trees or which is in the privately owned land are harvested in sustainable methods.

Table 1. Size Class Distribution of *Uppage* trees in HH and LH

GBH GROUP	HH	LH	*Probability*	T value
	Average±SD.	Average±SD.		
1 to10	114.8± 44.81	295±24.34	0.000	6.06
11 to 30	43.5±18.51	56.8±20.70	0.316	1.06
31 to 50	14.2±9.52	13.4±10.16	0.901	0.13
51 to 70	5.4±2.30	9.9±5.00	0.121	1.71
71 to 90	5.4±3.44	5.4±3.51	1.000	0.00
91 to 110	4.1±4.56	5.2±3.27	0.674	0.43
111 to 130	6±4.69	3.4±1.52	0.293	1.12
150 and above	3.1±2.97	5.2±2.17	0.240	1.26
All individuals above 10 GBH	81.7±19.73	99.3±30.87	0.319	1.05

Collection practices and ecological impact

Fifty trees were identified in different tenurial systems. Ten each in *betta*, encroached forestland, five in distant forest (lightly disturbed forest), and twenty-five in Reserved forest. Each tree was observed before harvesting. Information about expected yield in each tree was noted with the help of two local collectors. Later each tree was visited every alternative day and percentage of ripe and unripe fruits was noted. The tree was harvested, then percentage of fruits left in the tree, the method of harvesting, and the number of branches cut etc. were noted. Approximate quantity and quality collected by collector was estimated with the help of data from the previous day's observation. Besides, wherever possible, actual harvesting by collectors was observed. To cross check the data all outlets and markets, viz. intermediaries, agents dealing in the village were asked to give the actual quantity and quality of *Uppage* rinds.

Method of harvesting

Open access area: This is the region in the Reserve Forest where villagers frequently collect NTFP. This area is near the village and hence easily accessible. This region has considerably high density of *Uppage* trees. Harvesting in open access areas near the village was more destructive compared to other areas. Collection from this region starts much before the other regions. Out of 25 trees observed, 32% of trees were harvested before any fruits in the trees were ripe. Another 44% of trees were harvested when hardly 10% of fruits were ripe. 16% of fruits were harvested with only 20% of fruits were ripe. All trees were harvested before 30% of fruits were ripe. As harvesting of fruits in the open access region was nearing completion, people started collecting fruits from the distant forests. By that time, about 20% of fruits was ripe in most of the trees.

In the case of encroached forest land, the owner of the land harvests the fruits. In case of such land, it was observed that no fruits were harvested only when ripe. The maximum quantity of fruits harvested was with 40% of ripe fruits (70%).

However, in case of *betta* no fruits were harvested before 30% of fruits in trees had ripened. Most of the fruits were harvested (60%) when there were 40% of ripe fruits in the tree. Some trees (10%) in fact, were harvested after the fruits were ripe.
On an average, almost 88 % of total fruits in *Uppage* were harvested before 40% of fruits in a tree were ripe. More unripe fruits are harvested from open access areas followed by distant forests (non-tenure regime). Trees in *betta* and encroached lands are harvested with more ripe fruits. (With tenurial security)

Table 2 *Uppage*: harvesting patterns

Region	Total Branches	Branches cut	Total	% of damage
Tenure	521	0	521	0
No Tenure	749	200	949	21%
Total	1270	200	1470	13.6%

Chi-square = 127, $p<0.001$

Region	Total Fruits	Fruits remaining	Total	% Fruits remained
Tenure	11506	200	11706	1.7%
No Tenure	28031	749	28780	2.6%
Total	39537	949	40486	2.3%

Chi-square = 38, $p<0.001$

Harvesting method

The above tables show the details about the branches cut in tenure and non-tenure regions. Also, it shows details of fruits remaining in the trees after harvesting. It is observed that out of 25 trees in the open access area, about 11 trees were badly damaged with cutting of more than 20 % of branches. Another four were partially damaged, with cutting of one or two branches. In the case of distant areas, out of five trees observed, three trees were damaged severely (more than fifty percent of branches were cut.). In the case of the encroached area, fruits were harvested when 90% of fruits were ripe. However, in the case of betta land no trees were damaged. In fact, out of ten trees regularly observed, from two trees, fruits were collected only after they naturally fell on the ground. In both the regimes very small number of fruits remained on the trees leaving minimal chance for natural regeneration.

Conclusions

Tenural security plays an important role in deciding the harvesting method of trees. Trees in open access areas are harvested first, followed by trees in reserved forests far away from villages. Encroached lands and *betta lands* are harvested much later. In other words, trees in open access areas were harvested with maximum unripe fruits compared to trees on encroached land and *betta lands*. In addition, it was found that harvesting methods were most destructive in open access areas. However, in *betta* and encroached lands, there was always fear of theft. Therefore, some of the *betta*

landholders and encroached landholders harvest the crop/fruit before they are completely ripe.

Acknowledgement

We thank communities in the villages and Village Forest Committees for their active cooperation during the study. We thank the Netherlands Committee for IUCN for providing partial financial assistance to undertake the study.

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Domestication Considerations for *Garcinia gummi-gutta* (L.) Robson

Ramakrishna Hegde
College of Forestry, Ponnampet-571 216, Karnataka, India

Introduction

The use of synthetic medicines and subsequent cumulative derogatory effects of such synthetics in the recent past lead to tremendous growth of interest in plant based drugs, pharmaceuticals and natural colours in the world. Except for a few cultivated crops, the availability of plant based materials is mainly from the natural sources like forests and wastelands. Due to deforestation and concurrent unscrupulous exploitation of these plants lead to decline in their population. Often the quality of these materials is not up to the international standard. On the other hand, the demand for internal use and for export has been increasing necessitating the introduction of these plants in to the cropping system. The cultivation of these plants as crops can meet the demand of the industry and help to maintain the standards on quality, potency and chemical composition.

Garcinina gummi-gutta (L.) Robson is a pyramid shaped evergreen dioceous tree with drooping branches naturally found in the Western Ghats of India. The species is gaining world wide attention for its newly identified medicinal property Hydroxy-citric-acid (HCA) a chemical extracted from the dried fruit rind is understood to reduce fat content in human body when consumed (Hasegawa, 2001). The dried fruit rind yields excellent vinegar, which is rich in vitamins and also used as a condiment to flavor curries in places of tamarind (Joy, *et.al.*1999). Edible oil extracted from seeds is used for cooking and medicine.

Domestication is the naturalization of a species to improve its cultivation and use for humankind. Basically domestication improves the ability of people to grow and utilize trees either for products or services. Strategies of domestication will be depending on the value of the products, the extent of genetic variation with in a species and many other functions. The classic stages of domestication strategies should be exploration, evaluation, conservation and utilization (Davidson, 1992). The present paper deals with some of the important consideration for domestication of *G. gummi-gutta.*

Exploration of genetic resources

Exploration involves a number of steps following the discovery of a new species or the recognition that a species already known to be of value in natural forest should be domesticated for planting. Variations within a species develop in response to evolutionary forces such as natural selection that vary in different parts of the natural range of a species. Study of variability and exploitation of variability by understanding the genetic

diversity of the population is the first step in domestication of any species. The first step in exploration is mapping the natural range of the species followed by the description of the environment within the range and an account of the phenotypic variation observed within the species through out the range. Presently, the species is found along the Western Ghats in certain patches. Identification of population whose progeny will have desirable traits is greatly facilitated by recognition of patterns of variation through exploration studies. Existence of variability between populations and within populations was reported in several studies (Naveenkumar, 2003: Hegde, *et al.*, 2006). It is important to consider the natural variability between the populations and within the population for domestication and further improvement.

Evaluation of genetic resources

This stage involves determination of the genetic component of the variation observed during exploration. Comparative replicated experiments capable of statistically sound assessment should be established to examine the performance of as many as natural populations as possible when planted together in one or preferably several field site types over time series. One of the main advantages of having multilocation field studies is the ability to determine the extent of genotype –environment interaction effects in addition to mean genotypic values.

Conservation of genetic resources

Conservation of genetic resources for both present and future use is essential. Conservation measures will be required to protect valuable genetic resources from encroachment, destructive harvesting methods, damage and even by destruction by clearing forests for agriculture and settlements. The main danger for threat for the species is unscrupulous and over zealous harvesting.

Imminent loss of valuable genetic resources in a geographical location can be approached by *in-situ* or *ex-situ* conservation. *In-situ* conservation requires technical knowledge for appropriate management system to ensure sustainability and political will to ensure protection. *In-situ* conservation can be persuaded by declaring the area as parks or reserves because in many areas of its natural distribution human pressures on land increase for agriculture and livestock grazing. The second approach for conservation is *ex-situ.* It can be accomplished in various forms from cryopreservation of seed and pollen to tissue cultures kept in archives. Arboreta and research planting and specially planted seed producing conservation stands also serve the ex-situ conservation goals. It is pertinent to mention that ex-situ conservation strategy is less effective than *in –situ* conservation in the long term, since the genetic make up of the *ex-situ* stand would change over time as result of the *ex-situ* environment.

Utilization of genetic resources

Utilization of genetic resources refers to the deliberate inclusion of samples of population genotypes in selective breeding programme and in turn in plantation trees for production. In using genetic resources and effecting change two stages each containing

several levels. The fist stage is called species introduction and testing and the second stage being tree improvement and breeding.

The first stage involves development of proper nursery techniques, planting techniques, tending operations and sustainable harvesting strategies. Generally, the seeds of G. *gummi-gutta* take very long period for germination after sowing. Treating of seeds with hydrochloric acid for 5-10 minutes could increase the seed germination *(Uttaiah, B.C. Personal communication)*. In the initial stage of seedling development seedlings grow slowly, the growth could be boosted by following improved nursery practices such as improved potting mixture, exposure of seedlings for elevated CO2 concentration supplemented with higher doses of nutrients etc. Fruit is the commercially important part; efforts on vegetative propagation for early bearing could be the better way of mass propagation. Among the different grafting techniques, wedge grafting at seedling stage could be the easiest way of mass propagation for large scale planting.

It is one of the slow growing tree species which requires partial shade in the initial stage of development, the development of appropriate planting technique is must. Efforts should be concentrated on introducing tree species as part of enrichment planting and silvicultural techniques. Generally, fruiting is observed during rainy season and it is difficult to harvest the fruits by climbing large trees development of sustainable harvesting technique is must for the species.

In many tree species, the yield is often governed by factors associated with the genotype, environment and interaction between genotype x environment. Efforts should be made to identify site specific genotypes for commercial exploitation through tree improvement and breeding techniques.

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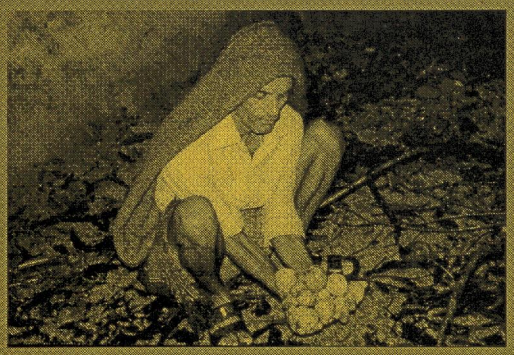
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Harvester collecting the fruits of *Garcinia gummigutta*



Women are processing the harvested fruits of *Garcinia gummigutta*.



Traditional method of extracting the butter from the seed of *Garcinia gummigutta* fruit.

'Prakruti' is a non-profit non-government organisation established in 1991, working for the conservation of tropical forests in the Western Ghats, Karnataka through evolving community lead sustainable management practises for natural resources.

Activities:

- Research on NTFP, Wild foods and Honeybees with emphasis on economics and ecology of the resources.
- Alternate energy sources.
- Save honeybees campaign to conserve local bee species.
- Promoting sustainable harvest and rational utilisation of forest species through organising workshops, awareness programmes and publications.
- Empowering women through improved harvesting, value addition and marketing of NTFPs.
- Efforts to domesticate important NTFP species through identifying superior types and vegetative propagation.
- Support to the people's movement, and strengthening Village Forest Committees under Joint Forest Management.

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

Telephone/ Fax/ Email: **08384-225139/ 08384-235450/** appiko@sancharnet.in, hegdenrm@yahoo.com

Person in charge of Progress Report: **Narasimha Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* and Fruit Processing**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttara Kannada district, Karnataka State India**

Project Start and End Sates (as in the MoA): **1st October 2005 to 31st March 2008**

Changes (if any) in Start or End dates: **Nil**

Period covered by the Report: **1st January 2006 to 31st March 2006**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	4,65,372
SGP Funds spent to date	253068.50
SGP Grant disbursement requested	We have received the first installment, the remaining grants shall be released according the schedule mentioned in the agreement.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	9500
Organisation	In-kind and cash	5000

5.Progress Report

a. Detailed Summary of Activities*(Increase rows as required)*

(Guidance Notes: Give details on each the activities performed, as specified in the MoA)

Sl.No.	Activity as approved in MoA	Progress as on date	Remark
1.	Preliminary meetings with people	Meetings were held in Kakkali, Shirasgaon, Attisavalu, Mandoor, Golimakki, Mattighatta and Mabgi villages.	Local community organisations were informed about the project and they assured their involvement in the project.
2.	Organising workshop	One workshop was organised in Kakkalli village.	Workshop was organised to build rapport with the villagers and to make them aware regarding the project activities. to include local people in identifying the superior types of *G gummigutta* and in domestication effort. A community lead management committee is established.
3.	Consulting scientists, technicians and industries.	Consultations with Scientists in CoF, Processing industries. Technicians to establish dryers and ovens.	To reduce huge requirement of fuel wood from forest to process the fruit rind.
4.	Working with FDA and VFCs Rapport building with various stakeholders.	Discussions with VFCs in Muregar, Shirasgaon, Shigehalli, Kakkalli and Swarnagadde. Meeting with president of district federation of VFCs and Sirsi taluk federation of VFCs. Discussion with Youth club and Women self-help group in Gonsar village.	VFC federation of Uttara Kannada district and individual VFCs have agreed to collaborate in the project.
5.	Discussions with Forest Department	Several round of consultations with Conservator of Forests Canara Circle, DCF Sirsi division and with Range Forest Officers.	Letter from Conservator of Forests to Principal Chief Conservator of Forests Karnataka and expressed Karnata Forest Department's keen interest in the

			project activity.
6.	Linking other institutions and individuals.	The project details are discussed with local Member of Legislative Assembly and he participated in the workshop. He assured to help implementing the project activity and asked to give specific issues if any so that he could follow up. Individual farmers who have field experience in cultivation aspects of *Garcinia gummigutta* were identified. Researchers journalists and scientists working in this aspect were identified.	Project objectives and implementation plans were discussed.
7	Publication	Proceedings of the workshop on domestication and fruit processing of *Garcinia sp.* have been brought out.	It helped to archive the already existing data and work on *Garcinia*, list of individuals and institutions involved in the related aspects.
8	Establishing the dryers and setting up a management committee.	Installations of dryers have been started in Kakkalli and Gonsar village. Efficiency of dryers in saving huge quantity of fuel wood during processing of fruit and need to establish a management committee for effective functioning of the dryers and ovens are discussed in Muregar and Manadoor villages.	These dryers will reduce considerable amount of fuel wood that is required for drying the fruit rind. Earlier these fuel woods are taken from the forest, which includes huge cost and impact on forest ecology.
9	Establishing nurseries of *Garcinia gummigutta*	New technical skills in nursery techniques and vegetative propagation methods have been evolved. Seeds were put in seedbed and have germinated.	Shall be used for planting and grafting with superior types. Help to mitigate the problem related to biological aspects of the species.

b. Results *(Use as much space as required)*

(Guidance Notes: The extent to which the objectives specified in the MoA, were accomplished; Unplanned achievements; Shortfalls in targets; Describe immediate benefits received by participants and/ or recipient communities in qualitative and quantitative parameters)

- Women self help groups in villages like Shirasgaon, Mattighatta, Gonsar, Kakkalli and Golimakki have taken keen interest in the project. Project activities including construction of dryers and ovens were taking place in these villages.
- Community lead management committees are being set up in these villages. It includes members of VFCs, Women self-help groups, youth club, Forest Department, community leaders, local administration authorities like village Panchayat, scientists Center for Ecological sciences and technicians.
- Participation of VFCs and FDA in the project activities is assured and already undertaken through the meetings with president of district VFC federation and Sirsi taluk federation.
- Conservator of forests Canara circle and Deputy Conservator of Forests Sirsi Forest Division expressed their keen interest in the project and assured their collaborations.
- Workshop proceedings and other documents shall enhance the existing knowledge on the species.
- Consultations with scientists, small-scale industries and individuals worked in processing of the rind is on going and we are going to start establishing the ovens and dryers using new fuel-efficient techniques.

c. New Developments, Unexpected difficulties/ problems & Action taken to solve them

(Use as much space as required)

- New technical skills with respect to establishing nurseries and vegetative propagation have been suggested. For example orthotropic branches have to be concentrated while selecting scions. *In situ* grafting techniques should be tried and practised(grafting of superior types on the already existing young plants).
- Management committee involving local people, VFCs, youth and women self-help groups, institutions and Forest Department has been set up for the proper management of assets created through the project.

d. Lessons Learned: *(Use as much space as required)*

(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Domestication efforts and identifying the superior types of *Garcinia gummigutta* has been done in pockets and in small scale. However, due to lack of documentation and follow up activities desired results were not achieved.
- The project could be implemented on a pilot basis and based on the out put and confirmation of the results the *Garcinia gummigutta* could be used as a model for other species and sites.

e. Requested for Project Revisions, if any *(Use as much space as required)*

(Guidance Note: nature of proposed revision(s); Reason for proposed change in project compilation date; Proposed budget revision. Please indicate here if you would like authorization for increasing any budget line and which line(s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

f. Additional Information: ***(Use as much space as required)***

(Guidance Notes: Provide information on the points given below and add more points if necessary)

- Project output indicators to monitor and evaluate progress in activities.
  - Functioning of the new dryers and efficiency to reduce huge requirement of fuel wood that reduces enormous pressure on forest.
  - Functioning of the management committees set up to monitor the assets created by the project activities.
  - Number of local people involved in the project activities and their contribution to the project.
  - Linkages made with other institutions/department/organizations and other stakeholders to the project.
  - List of personalities identified through reviewing the secondary data and during workshops and meetings.
  - Different types of fruit yielding trees of *Garcinia gummigutta* identified in Kakkalli, Shirasgaon, Muregar and Analebail, Attisavlu village.
  - Sites (villages in the midst of tropical forests of the Western Ghats) identified for alternate eco-friendly processing techniques.
- Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.

Links has been made with Village Forest Committees and FDA, Federation of VFCs, with College of Forestry, Karnataka Forest Department, small-scale industries and research organisations like ATREE (Bangalore), FRLHT (Bangalore). Women self-help groups, youth club, farmers who have been involved in domestication process of the species, researchers and journalists worked on these aspects were contacted and shall be linked to the project implementation.

- Impacts of the project in terms of Policy/Advocacy/ Sustainability and Replicability of the project purpose/strategy, etc.

Still we are in the initial stage of rapport building with various institutions/organistions and individuals involved in the project. However, these interactions and workshops revealed that project would have greater impact in terms of Policy (on marketing, domestication

strategy and alternate processing) Advocacy (awareness building and improving the skills on biological aspects of the species) sustainability and replicability of the project.

- Press/ Media coverage/links established in the project to other similar initiatives/networking with other NGOs.

Press/media coverage given on launching of the project and for the two workshops and workshop outcomes. Links were established with community and youth organizations and women self-help Groups in several villages.

- Details how the project is enhancing and creating institutional sustainability for project.

Enhanced the skills of staff in communicating with different stakeholders and with scientific community to work more effectively towards community based natural resources management.

- Note: Please send photos on activities in original at the earliest.

5. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
- Column (4) should be used for indicating cumulative expenditures incurred since the beginning of the project, including the amount reported in column (3) for this reporting period.
- Column (5) should reflect the balance of project funds, which results from subtracting the amounts of column (4) from these entered in column (2).
- Column (6) if the NGOs or communities have accessed funds as co-Financing from other Sources. This is essential as it creates how GEF is leveraging on other sources.

Report Submitted By:

Name: **Narasimha Hegde**

Designation: Research Director

Signature:

Date: 1st April 2006

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

Telephone/ Fax/ Email: **08384-225139/ 08384-235450/** appiko@sancharnet.in, hegdenrm@yahoo.com

Person in charge of Progress Report: **Narasimha Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* and Fruit Processing.**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttara Kannada district, Karnataka State India**

Project Start and End Sates (as in the MoA): **1st October 2005 to 31st March 2008**

Changes (if any) in Start or End dates: **Nil**

Period covered by the Report: **1st April 2006 to 30th June 2006**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	4,65,372
SGP Funds spent to date	3,75,892.62
SGP Grant disbursement requested	We have received the first installment; the remaining grants shall be released according the schedule mentioned in the agreement.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	7,500
NGO	In cash	10,000

5. Progress Report

a. Detailed Summary of Activities *(Increase rows as required)*

(Guidance Notes: Give details on each the activities performed, as specified in the MoA)

Sl.No.	Activity as approved in MoA	Progress as on date	Remark
1.	Identifying the superior types of *Garcinia gummigutta* through participatory approach. Developing methods for identification of superior types.	Twenty-five villages were selected in the entire district representing all forest types and ecozones. The ecozones being coast, foothills of the Western Ghats, mid ghat and crests of the Western Ghats.	Village Forest Committees, women self help groups and other local institutions were consulted and identification of the superior types has been done jointly.
2.	Construction of alternate fuel wood saving devices.	Four dryers and twenty-five ovens were constructed. It is estimated that drying of one kilogram of fruit requires twenty-five kilograms of fuel wood. Now with these dryers it is hoped that one-kilogram of fruit can be dried with only four kilogram of fuel wood.	From the four dryers and ten ovens it is estimated seventy tons of fruits will be dried in one year. Thus saving1470 tons of fuel wood.
3.	Vegetative propagation	Nurseries of *Garcinia gummigutta* and *Garcinia indica* have been established.	Grafting and other propagation method shall be experimented.
4.	Study on harvesting method and promoting sustainable harvest.	Present harvesting methods, identifying crucial limitations in harvesting and mitigating methods have been studied.	Impacts of these harvesting methods have to be assessed.
5.	Workshops and meetings	One workshop has been organized in this reporting period.	Four workshops proposed in this year have been completed and awareness on need of domestication of fruit and alternate ecofriendly processing was done.
6.	Alternate eco-friendly processing of *Garcinia* fruit.	Instead of drying the fruit rind juice will be extracted from the fruit it is then concentrated and possibility of extraction of HCA shall be examined.	We are in the process of testing the extraction of HCA.

7	Educate and encourage participation of farmers to adopt 'community – processing' of the fruits.	This has been done through the workshops and meetings at various villages.	

b. Results *(Use as much space as required)*

(Guidance Notes: The extent to which the objectives specified in the MoA, were accomplished; Unplanned achievements; Shortfalls in targets; Describe immediate benefits received by participants and/ or recipient communities in qualitative and quantitative parameters)

- Identification of superior types in collaboration with community, College of Forestry Sirsi, and with Forest Department. Eighteen villages were selected; VFCs, NTFP harvesters and Forest Department staff were consulted for identification of plus trees.
- Four workshops were organized as mentioned in the project activity. Several meetings and group discussions were also conducted to ensure the community participation.
- Installation of driers and ovens were done in different places. These shall reduce the fuel wood requirement for processing the rind.

c. New Developments, Unexpected difficulties/ problems & Action taken to solve them

(Use as much space as required)

- We observed that *Garcinia gummigutta* is an important NTFP in the district and resource is found in evergreen and semi-evergreen forest tracks. In the eighteen villages that we have selected for the identification of superior type more than ninety percent of families are involved in harvesting of fruit. They harvested from few kilograms to three tons and in previous year maximum income obtained from *Garcinia gumigutta* by a family were rupees fifty five thousand. Women of forest dwelling community involved in processing of the fruit.
- Domestication started in very small scale, however, it is observed that people are not concentrating on better quality of plants. They are cultivating the plants, which do not yield regularly, low production and fever rind quality. Now we are concentrating on fruit size, rind thickness, regular bearing and high yielding and crown density and other criteria for identification f plus trees and this will be cultivated through vegetative and other propagation methods.
- Management committee involving local people, VFCs, youth and women self-help groups, institutions and Forest Department has been set up for the proper management of assets created through the project.

d. Lessons Learned: *(Use as much space as required)*

(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Domestication efforts and identifying the superior types of *Garcinia gummigutta* has been done in pockets and in small scale. However, due to lack of documentation and follow up activities desired results were not achieved.
- There are large variations in fruits of *Garcinia gummigutta*

e. Requested for Project Revisions, if any *(Use as much space as required)*

(Guidance Note: nature of proposed revision(s); Reason for proposed change in project compilation date; Proposed budget revision. Please indicate here if you would like authorization for increasing any budget line and which line(s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

f. Additional Information: *(Use as much space as required)*

(Guidance Notes: Provide information on the points given below and add more points if necessary)

- Project output indicators to monitor and evaluate progress in activities.
  - Superior types of trees identified in the entire district of Uttara Kannada.
  - Quality of fruits, yield and thickness of rind, number of seeds present, size of seed, oil content in the seed and any other better quality of identified plus trees.
  - Functioning of the management committees set up to monitor the assets created by the project activities.
  - Number of local people involved in the project activities and their contribution to the project.
  - Linkages made with other institutions/department/organizations and other stakeholders to the project.
  - Extent of awareness created on domestication of the species, alternate processing and on sustainable harvest of fruit.
- Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.

Links has been made in more than with Village Forest Committees and FDA, Federation of VFCs, with College of Forestry, Karnataka Forest Department, small-scale industries and research organisations like ATREE (Bangalore), FRLHT (Bangalore). Women self-help groups, youth club, farmers who have been involved in domestication process of the species, researchers and journalists worked on these aspects were contacted and shall be linked to the project implementation.

- Impacts of the project in terms of Policy/Advocacy/ Sustainability and Replicability of the project purpose/strategy, etc.

We understand that there is no clear policy regarding harvesting/marketing and cultivation of *Garcinia* in the area. Now due to interactions with various stakeholders (Forest Department, Harvesters, NGOs, research institutions) we could able to bring this issue into fore front.

Member of Legislative Assembly participated in the workshop and assured to help bring changes in policy/advocacy if any.

- Press/ Media coverage/links established in the project to other similar initiatives/networking with other NGOs.

Press/media coverage given on launching of the project and for the four workshops and workshop outcomes. Links were established with community and youth organizations and women self-help Groups in several villages. NTFP harvesters

- Details how the project is enhancing and creating institutional sustainability for project.

Enhanced the skills of staff in communicating with different stakeholders and with scientific community to work more effectively towards community based natural resources management.

- Note: Please send photos on activities in original at the earliest.

6. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
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- Column (6) if the NGOs or communities have accessed funds as co-Financing from other Sources. This is essential as it creates that how GEF is leveraging on other sources.

Report Submitted By:

Name: **Narasimha Hegde**

Designation: Research Director

Signature:

Date: 1st July 2006

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

Telephone/ Fax/ Email: **08384-225139/ 08384-235450/** appiko@sancharnet.in, hegdenrm@yahoo.com

Person in charge of Progress Report: **Narasimha Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* and Fruit Processing.**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttara Kannada district, Karnataka State India**

Project Start and End Sates (as in the MoA): **1st October 2005 to March 2008.**

Changes (if any) in Start or End dates: **Nil**

Period covered by the Report: **1st April 2007 to 30th June 2007**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	9,10,521
SGP Funds spent to date	5,86,090.25
SGP Grant disbursement requested	We have received the second installment; the remaining grants shall be released according the schedule mentioned in the agreement.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	2,500
NGO	In cash	6,000

5. Progress Report

a. Detailed Summary of Activities *(Increase rows as required)*

(Guidance Notes: Give details on each the activities performed, as specified in the MoA)

Sl.No.	Activity as approved in MoA	Progress as on date	Remark
1.	Identifying the superior types of *Garcinia gummigutta* through participatory approach.	The trees identified in different villages are visited to check the fruit bearing. Few twigs of trees are cut get the orthotropic braches (to get the erected shoots) for grafting purpose.	An experienced farmer in grafting is appointed to do the grafting work. We have got the demand from the communities, Forest Department NGOs from Karwar, Anshi and Agumbe for the superior types.
2.	Construction of alternate fuel wood saving devices.	Identification of few more groups especially women self help group and Village Forest Committees was done through organizing discussion and meetings with them.	
3.	Vegetative propagation of the species.	Nurseries of *Garcinia gummigutta* and *Garcinia indica* have been established.	We have raised three thousand seedlings of *Garcinia indica* and two thousand seedlings of *Garcinia gummigutta.*
4.	Study on harvesting method and promoting sustainable harvest.	Present harvesting methods, identifying crucial limitations in harvesting and mitigating methods have been studied.	Impacts of these harvesting methods have to be assessed.
5.	Workshops and meetings	Different stakeholders were met and meeting held in various locations to organize the workshops.	Preliminary visits were done to the villages were workshops are planned. We shall organize the work shops once the monsoon period ends.
6.	Alternate eco-friendly processing of *Garcinia* fruit.	Instead of drying the fruit rind juice will be extracted from the fruit it is then concentrated and possibility of extraction of HCA shall be examined.	We are in the process of testing the extraction of HCA.
7	Educate and encourage participation of farmers to adopt 'community – processing' of the fruits.	This has been done through the workshops and meetings at various villages.	

b. Results ***(Use as much space as required)***

(Guidance Notes: The extent to which the objectives specified in the MoA, were accomplished; Unplanned achievements; Shortfalls in targets; Describe immediate benefits received by participants and/ or recipient communities in qualitative and quantitative parameters)

- Identification of superior types in collaboration with community, College of Forestry Sirsi, and with Forest Department. Eighteen villages were selected; VFCs, NTFP harvesters and Forest Department staff were consulted for identification of plus trees.
- Preliminary visits were made to the villages to organize the workshops. However, due to the onset of monsoon and because we would like to organize the workshops in the crest line part of the Western Ghats we have to wait another three months to organize these workshops.
- Meetings and consultation were organized in ten villages with Uppage collectors, SHGs, VFCs regarding installation of driers, ovens, awareness on domestication aspects and sustainable harvest. These provided opportunity to make the project activities participatory and educate the people about objectives/goals of the project.
- Cultivation of plants in community land and education centers: we have provided plants of *Garcinia* to College in Sirsi for education purpose and to conserve different varieties. Cultivation was done at individual farmer and collector level to promote domestication of the species.
- Identified locations to install driers and ovens are rich in *Garcinia gummigutta* similar as previous locations and maximum use of these units is envisaged.

c. **New Developments, Unexpected difficulties/ problems & Action taken to solve them** ***(Use as much space as required)***

- Because of monsoon period we could not able to transport the materials for driers and ovens. The cost of steel and other accessories was increased and the bricks (pressed hollow blocks) for construction of drier were not available. Our consultant and contractor for drier construction have ordered for the steel (to desired length, welding, cutting mesh making, steel plates and other accessories). These materials shall be transported to the villages only after monsoon period.
- Bringing erected shoots for grafting from different regions where superior types of trees exist is difficult, as we have to travel a long distance in remote forest area. These locations are distributed in entire Uttara Kannada so as to ensure representation of different geographical area. Our team had to visit four times after identifying the superior types to study the regular bearing, quantity and quality of fruits, to get the fruits for raising seeds and to collect the cuttings for grafting.

d. Lessons Learned: ***(Use as much space as required)***

(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Large quantity of fuel wood could be saved by drying the fruit rind in driers and installed ovens.
- Community could be involved in the management of natural resources through providing units like driers and ovens.

e. Requested for Project Revisions, if any ***(Use as much space as required)***

(Guidance Note: nature of proposed revision(s); Reason for proposed change in project compilation date; Proposed budget revision. Please indicate here if you would like authorization for increasing any budget line and which line(s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

f. Additional Information: ***(Use as much space as required)***

(Guidance Notes: Provide information on the points given below and add more points if necessary)

- Project output indicators to monitor and evaluate progress in activities.
  - Number of seedlings raised through seeds and other vegetative propagation methods from the superior types.
  - Response from community, organization and departments to cultivate these types.
  - Number of plants cultivated, location and community involved in cultivation and survival rate of the plants.
  - Functioning of the management committees set up to monitor the assets created by the project activities.
  - Quantity and quality of products dried in the installed drying units.
  - Linkages made with other institutions/department/organizations and other stakeholders to the project.
  - Extent of awareness created on domestication of the species, alternate processing and on sustainable harvest of fruit.
- Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.

Link established with five more women groups, three youth club and five Village Forest Committees. Several individual NTFP collector's families were met during project activities.

- Impacts of the project in terms of Policy/Advocacy/ Sustainability and Replicability of the project purpose/strategy, etc.
- Press/ Media coverage/links established in the project to other similar initiatives/networking with other NGOs.
- Details how the project is enhancing and creating institutional sustainability for project.

- In identifying the species, superior types, to involve community in the management of natural resources through providing drying units etc. Capacity of staff increased to train the women groups and VFC members to keep records on drying of products.
- Meet with various stakeholders, other NGOs, research organizations helped to understand the activities undertaken by these agencies for rural development and environment sustainability.
- Project activities and results till the reporting period were presented and discussed in various forums by the project staff.
- Enhanced skill in nursery raising and management of the nursery.

- Note: Please send photos on activities in original at the earliest.

6. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
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Report Submitted By:

Name: **Narasimha Hegde**

Designation: Research Director

Signature:

Date: 6 July 2007

UNDP GEF/ CCF Small Grants programme –India

Mid Term Review Report of the Project Implementing Institution
(To be sent to CEE Regional Coordinator and GEF SGP NC Sectt.by Partner Institution)

1. Grantee Partner

Name of local NGO/CBO.....

Grant Recipient/ Address.....

Telephone/ Fax/ Email.....

Person Incharge of Mid-term Report.....

2. Identification of the Project.

Project Name.....

Project Number.....

GEF Thematic Area.....

Location of Project.....

Project Start and End Sates (as in the MoA).....

Changes (if any) in Start or End dates:.....

Period covered by the Report.....1st oct to 31st Dec 2005.....

3. Financial Summary:

Fund Utilisation & Disbursement Request	**Amount (Rs.)**
SGP Grant amount	
SGP Funds received to date for this grant	
Funds balance	
SGP Grant disbursement requested	

4. **Project Co-financing Received:** ***(increase number of rows as required)***

Source(s)	Type (In –kind or Cash)	Amount (Rs.)

5. Progress Report

a. Project Goal and Purpose: (Use as much space as required)

- .....

** for one year

Notes:

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- Column (6) if the NGOs or communities have accessed funds as co-Financing from other Sources. This is essential as it creates that how GEF is leveraging on other sources.

Report Submitted By:

Name: **Narasimha Hegde**

Designation: Research Director

Signature:

Date: 1st January 2006

e. Requested for Project Revisions, if any ***(Use as much space as required)***

(Guidance Note: nature of proposed revision(s); Reason for proposed change in project compilation date; Proposed budget revision. Please indicate here if you would like authorization for increasing any budget line and which line(s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

f. Additional Information: ***(Use as much space as required)***

(Guidance Notes: Provide information on the points given below and add more points if necessary)

- Project output indicators to monitor and evaluate progress in activities.
  - Number of local people involved in the project activities and their contribution to the project.
  - Linkages made with other institutions/department/organizations and other stakeholders to the project.
  - List of personalities identified through reviewing the secondary data and during workshops and meetings.
  - Different types of fruit yielding trees of *Garcinia gummigutta* identified in Gonsar village.
  - Sites (villages in the midst of tropical forests of the Western Ghats) identified for alternate eco-friendly processing techniques.
- Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.

Links has been made with Village Forest Committees and FDA, Federation of VFCs, with College of Forestry, Karnataka Forest Department, small-scale industries and research organisations like ATREE (Bangalore), FRLHT (Bangalore). Women self-help groups, youth club, farmers who have been involved in domestication process of the species, researchers and journalists worked on these aspects were contacted and shall be linked to the project implementation.

- Impacts of the project in terms of Policy/Advocacy/ Sustainability and Replicability of the project purpose/strategy, etc.

Still we are in the initial stage of rapport building with various institutions/organistions and individuals involved in the project. However, these interactions and workshops revealed that project would have greater impact in terms of Policy (on marketing, domestication strategy and alternate processing) Advocacy (awareness building and improving the skills on biological aspects of the species) sustainability and replicability of the project.

b. Results *(Use as much space as required)*

(Guidance Notes: The extent to which the objectives specified in the MoA, were accomplished; Unplanned achievements; Shortfalls in targets; Describe immediate benefits received by participants and/ or recipient communities in qualitative and quantitative parameters)

- Participation of communities through various meetings and workshops and because of existing rapport with communities since many years.
- Participation of VFCs and FDA in the project activities is assured and already undertaken through the meetings with president of district VFC federation and Sirsi taluk federation.
- Conservator of forests Canara circle and Deputy Conservator of Forests Sirsi Forest Division expressed their keen interest in the project and assured their collaborations.
- Out come of the workshop in Gonsar village and in College of Forestry Sirsi gave us a directive step to implement the project activities.
- Consultations with scientists, small-scale industries and individuals worked in processing of the rind is on going and we are going to start establishing the ovens and dryers using new fuel-efficient techniques.

c. New Developments, Unexpected difficulties/ problems & Action taken to solve them

(Use as much space as required)

- Identification of sites to establish dryers and ovens. The project aims to undertake the construction of dryers and ovens in the community land. However, these assets have to be created in the area where there is substantial amount of fruits. These are the remote forest belts of the Western Ghats with sparsely distributed houses. The fruits would perish in a day after harvesting and women are involved in processing in larger numbers. They cannot carry to a longer distance.
- Community management plan has to be created through establishing a management committee involving local people, VFCs, youth and women self-help groups.
- These aspects have been discussed with the VFCs, youth club, women self-help groups, local people and with Forest Department staff.

d. Lessons Learned: *(Use as much space as required)*

(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Domestication efforts and identifying the superior types of *Garcinia gummigutta* has been done in pockets and in small scale. However, due to lack of documentation and follow up activities desired results were not achieved.
- The project could be implemented on a pilot basis and based on the out put and confirmation of the results the *Garcinia gummigutta* could be used as a model for other species and sites.

21. 13.12.05	Workshop kits, Xerox, stationery, pens, note books	Workshop	2100
22. 26.12.05	Xerox	Workshop	12
23. 25.11.05	Travelling expense to workshop participants from villages	Workshop	950
24. 27.12.05	Travelling expense and accommodation	Travel cost	4700
25. 28.12.05	Travelling (hiring of vehicle)	Travel cost	2800
26. 20.12.05	Salary to Computer operator	Reporting and documentation	6000
27. 27.12.05	Conslultancy for establishing nursery, alternate processing, grafting	Consultancy	9900
28. 28.12.05	Consultancy for alternate processing	Consultancy	5000
29.28.12.05	Labor expense (advance to technician)	Project activities	5000
30. 22.12.05	Establishing nursery	Contingency	5300
31. 27.12.05	Office rent, telephone, electricity bill.	Administration	7000
32. 03.12.2005	Nursery bags	Contingency	655
33. 09.12.05	Bank exchange commission	Contingency	1158
Total (Rs)			1,19,095

b. Cumulative Expenditure Report

(1) Budget Head	(2) Approved Budget (Rs.) **	(3) Expenditure in this period (from above) (Rs.)	(4) Cumulative Expenditures (Rs.)	(5) Balance (Rs.)	(6) Co-Financing accessed
Man power/labor	1,08,480	27120	Nil	81,360	
Training/seminar/workshops	56,000	24,962	Nil	31,038	6500
Contracts/consultants	40,000	14,900	Nil	25,100	
Project activities	1,10,000	25,500	Nil	84,500	
Travel cost	30,000	7500	Nil	22,500	
Communication and administration	28,000	7000	Nil	21,000	
Documentation and reporting	50,000	6000	Nil	44,000	2000
Contingency	22,000	7113	Nil	14,887	

Format revised as on 1st Oct 2005

- Press/ Media coverage/links established in the project to other similar initiatives/networking with other NGOs.

Press/media coverage given on launching of the project and for the two workshops and workshop outcomes. Links were established with community and youth organizations and women self-help Groups in several villages.

- Details how the project is enhancing and creating institutional sustainability for project.

Enhanced the skills of staff in communicating with different stakeholders and with scientific community to work more effectively towards community based natural resources management.

- Note: Please send photos on activities in original at the earliest.

6. Financial Report

a. Expenditure Report

Number and date of Invoice/ Receipt	Description of Expenditure	Budget Head	Cost (Rs.)
1. 20.12.05	Salary to field assistant	Man power	24,000
2. 20.12.05	House rent	Man power	3120
3. 20.12.05	Purchase of materials for dryers and ovens	Project activities	15,400
4. 20.12.05	Purchase of bricks and blocks	Project activities	5100
5. 22.10.05	Hiring of vehicle	Workshop	1500
6. 15.11.05	Hiring of vehicle	Workshop	2500
7. 25.11.05	Hiring of vehicle	Workshop	
8. 25.11.05	Honorarium to resource person	Workshop	1000
9. 22.10.05	Food, Snacks, local communication paid to youth club Gonsar	Workshop	5000
10. 25.11.05	Honorarium to resource person	Workshop	1200
11. 25.11.05	Honorarium to resource person	Workshop	750
12. 21.12.05	Volunteer support	Workshop	1000
13. 20.12.05	Volunteer support	Workshop	1200
14. 26.11.05	Travelling expense of resource person from Ponnampet	Workshop	700
15. 26.11.05	Accommodation of resource person	Workshop	100
16. 24.11.05	Banners	Workshop	400
17. 25.11.05	Food, tea, coffee and snacks for 65 people in College of Forestry	Workshop	2400
18. 25.11.05	Honorarium to resource person	Workshop	1000
19. 10.12.05	Data collection, preparing workshop kit, communication	Workshop	3000
20. 24.12.05	Xerox and stationery	Workshop	150

Proceedings

of the Consultative Workshop on

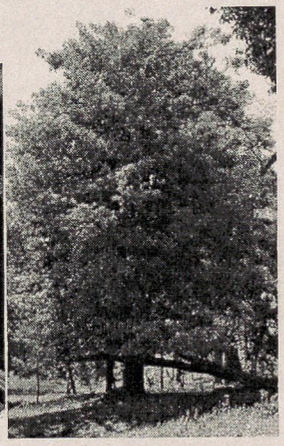
Participatory Approach to Domestication of *Garcinia* and Fruit Processing

Abstracts and Papers

Compiled and Edited
by

R. Vasudeva
Narasimha Hegde





Prakruti
Basavaraj Nilay, Chowkimath
Sirsi-581401
Uttara Kannada, Karnataka

February 2006

With Financial Assistance from UNDP-GEF Small Grant Program

Acknowledgements

We would like to express our sincere thanks to UNDP-GEF Small Grants Program for providing us financial support to undertake work on ***"A participatory approach to Domestication of Garcinia and fruit processing".*** This workshop was held at the College of Forestry as a part of the on going project activity. We express our sincere gratitude to Dr. S. K. Patil, Director of Instruction (For), College of Forestry, and staff for their help in organising the workshop. We also thank Prof. S.T Naik, Professor and Head, Department of Forest Protection, Dr. Ramkrishna Hegde, Assistant Professor (Forestry) and Dr. G. O. Manjunath, Assistant Professor (Horticulture) and Dr. Prabhakar Bhat, Research Scientist, Indian Institute of Science, Sirsi field station, for chairing different sessions as well as for their excellent presentations on the topic. We thank Mr. Pandurang Hegde, Mr. Balachandra Hegde, Mr. Shivanad Kalave, and Mr. Ganapati Hegde Muregar for their useful contributions. Sincere thanks to Mr. Satish, Conservator of Forests, Canara Circle, Mr. Vijay Mohan Raj Deputy Conservator of Forests Sirsi, Mr. Umesh Shastri, Assistant Conservator of Forests Sirsi, and Dr. Ishawar Pujar of CEE, Bangalore and other staff of Bangalore and CEE, Delhi their interest in the workshop and encouragement. We would like to thank those Non Timber Forest Product harvesters for their contributions to the deliberations of the workshop.

UNDP-GEF-SGP " A PARTICIPATORY APPROACH TO DOMESTICATION OF "*GARCINIA GUMMIGUTTA*" AND FRUIT PROCESSING.

CONSULTATIVE WORKSHOP ON DOMESTICATION OF GARCINIA AND FRUIT PROCESSING.

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UNDP-GEF-SGP " A Participatory approach to Domestication of "*Garcinia gummigutta*" and fruit Processing.

WORKSHOP SUMMARY AND MAJOR OUTCOMES OF THE WORKSHOP.

A one-day workshop was organized at the **College of Forestry, Sirsi** on 25th November 2005. The objectives of the workshop were to take stock of the studies done on issues related to biology, ecology and economy of the focal species. As well as to evolve a strategy for domestication, improved processing skills and suggest for any policy change. The representatives of most of the stakeholders of *Garcinia* attended the workshop. Scientists from Indian Institute of Science, University of Agricultural Sciences, Dharwad and Bangalore, local conservation enthusiasts, representatives of Forest Department, NGOs, Farmers, Students, representatives of industries attended the workshop. The programme was inaugurated by the Director of Instructions (Forestry), College of Forestry, Sirsi. The program was scheduled into four sessions on a) Biology, ecology and propagation, b) Policy and marketing c) Experiences from the stakeholders d) Plenary session.

In his keynote address, the Director of Instruction (Forestry) identified several important challenges to domestication of *Garcinia* and wished that the deliberations addressed these issues. Mr. Pandurang Hegde Director of Programmes, Prakruti in his introductory speech highlighted the development and conservation of NTFPs, viewed as an alternate to the conventional development activities such as construction of big dams, railway tracks and logging in forests. He said that it is estimated that 40 to 60 percent of the income come from the NTFP to the poor forest dwelling communities. Among other species, *Garcinia* is an important cash earning NTFP in recent years. However, due to industrial and export demand, the non-native people of the forests are following destructive harvesting methods. In the past only the edible butter was extracted from the seeds and used locally in recipes, However, the trend has been reversed today and only fruit rinds are being harvested. Finally he emphasized the need for quick domestication of this species and to evolve sustainable harvesting methods. He called for a greater cooperation from Forest Department to bring policy change for the existing tender system of marketing and for afforestation work. Sketching a detailed domestication strategy fro *Gacinias*, Dr. R. Vasudeva of College of Forestry suggested to employ the plus tree selection followed by vegetative propagation. Dr. G. O. Manjunath and Dr Ramkrishna Hegde presented their work on vegetative propagation and provenance variation. Detailed versions of the papers presented in this session are appended. Mr. Shivanand Kalave, a freelance journalist worked on *Garcinia* species highlighted that *Adike Patrike* a monthly journal related to agriculture and forest products has explored the reasons for price raise for the rind of Uppage during 1996. He observed that due to the newly identified product pharmaceutical property has been a major cause for the price hike. Further he noted

that price of fruit rind during 1978-79 was just 15 paise per kilogram, which jumped nearly Rs 150 per Kilo during 1993-94. During seventies, state Forest Department earned just Rs. 1115 (one thousand one hundred fifteen) by tendering the rind in Sirsi Forest Division. However, in 1993-94 it went up to Rs.25, 00,00-00(Twenty-Five lakh rupees). He mentioned that large quantity of fuel wood is required to dry the rind, which might not be sustainable on a long run. Alternate ovens and low cost drier have to be evolved for drying purpose.

Mr Umesh Shastri, Assistant Conservator of Forests in his speech said that Forest Department has made effort to identify superior types and to cultivate in forestland. These are also efforts of grafting of *Garcinia gummigutta* and the results are not so encouraging. However, he said there is lack of documenting all these initiatives and assured Forest Departments full cooperation and keen interest in the work of Prakruti for the Domestication and fruit processing.

Mr. Ganapati Hegde president of Muregar VFC explained about joint venture by Prakruti and Muregar VFC for evolving community based sustainable harvesting and management of the *Garcinia gummigutta*. Restricting harvesting level by allowing certain quantity of fruit in the trees and putting time limit to allow the fruit to become mature are the few examples. VFC has planted few seedlings of the species, however, intensive work should be done for domestication of the species.

Major outcomes of the workshop

1. *Garcinia* is an important genus to be focused for domestication.
2. *Garcinia indica, Garcinia gummi-gutta, Garcinia morella* are important spices to be focused fo domestication and further work.
3. Domestication strategy should address Agroforestry system approach specifically for *bettalands* (a kind of usufruct forest lands legally provided to the arecanut growers to harvest green manure and NTFP, however, the ownership remains with the Forest Department).
4. Individual tree selection is the best for seed selection for propagation.
5. Provenance variation in the species must be studied by comparing samples from diverse geographic regions.
6. Traits for indirect selection of yield should be recognized.
7. Large-scale selection of plus tree should be attempted.
8. Performance of cross species grafting should be considered.
9. Concerted efforts to conserve the genetic resources of the Western Ghats should be attempted from University of Agriculture Science Dharwad and UAS Bangalore.
10. Experiment for alternative processing of fruit rind should be done.
11. Emphasis to improve existing nursery techniques and seed germinating techniques shall be given. Importance for research should be given.
12. Market channels have to be transparent.

13. Silviculture needs of the *Garcinia gummigutta* and *Garcinia indica* should be addressed.
14. Study has to be undertaken to know what could be the performance of these trees for high input agriculture.
15. Introduce products from *Garcinia* species locally and at regional level in regular diets. Efforts shall be made to create awareness on health consciousness in the society by using these products.
16. Tenurial rights have role to play with respect to sustainable harvesting of the products. For example trees around the areca nut garden and surrounding areas.
17. Variation and price fluctuation in the market have to be checked.
18. Nutritional value of *Garcinia* should be addressed and further confirmed.
19. Policy issues on marketing, empowering the community organizations in dealing with these species should be viewed by taking *Garcinia* as a model system.
20. Orthotropic branches have to be concentrated while selecting the scions.
21. Create greater awareness on domestication needs to the local communities through pamphlets and brochures.
22. *In situ* grafting techniques should be tried and practiced (grafting of superior types on the already existing young plants).
23. Alternate use of fruits to reduce fuel wood requirement and that would promote sustainable harvesting. Kokum cola: carbonated drink from *Garcinia* indica. Winemaking, alcohol extraction also could be tried from the fruits in that case only quality fruits have to be harvested thus preventing harvesting of unripe fruits leaving seeds for regeneration.
24. Kokum foundation – wine from *Garcinia indica*
25. Medicinal application of kokum/ *Garcinia* butter could be revealed.
26. Land suitability assessment for the cultivation of *Garcinia gummi-gutta* in farmers' field. There is scope for the arecanut growers to cultivate the *Garcinia* species on the strips adjacent to their farms.

Key note address

SOME THOUGHTS ON DOMESTICATION OF *GARCINIA* AND OTHER NTFP SPECIES*

S.K. Patil
Director of Instruction (For), College of Forestry,
University of Agricultural Sciences, Dharwad, ***SIRSI campus 581 401***
Karnataka, India.

* *Key note address presented at the "**Consultative workshop on Garcinia**" held at College of Forestry, Sirsi 581401 on 25th November, 2005*

G. gummigutta is a evergreen and semi-ever green forests of central and southern Western Ghats, that yield a delicate non-dessert fruit of commercial importance. The fruits of *Garcinia gummi-gutta* are too acidic to be eaten raw, traditionally people of high rainfall tracts of Karnataka and Kerala use the pulp of the fruit in culinary preparations as flavoring agent, and the seeds are also rich source (31 per cent) of an edible fat. The decoction of the fruit rind is administered to reduce rheumatism and to cure improper bowel complaints. It is also employed as a rinse for diseases of the mouth in cattle.

In the recent years '*Garcinia'* has become one of the major NTFP species because of its newly identified pharmaceutical property. (-) 'Hydroxy-Citric-Acid' (- HCA), a chemical that is believed to reduce fat accumulation in humans when consumed, is extracted from the dried fruit rind (a marketable product). The concentration of HCA is reported to be as high as 30 per cent in dried fruit-rind; of which 90 per cent is non-volatile and also possess antiseptic properties. In recent years, increased commercialization of processed *Garcinia* fruit has pushed this local, subsistence level enterprise into a business involving international export market. Consequently, all the ill effects of globalization have set in to this species. Since the species is in commerce for over a decade, and in traditional use since several centuries, the species can be prioritized for further domestication.

In general domestication of Non-Timber Forest Product (NTFP) yielding species offers following challenges to the biologists: These challenges have social and economic angles. Hence it is necessary to involve all the stakeholders.

Some of challenges are:

1) The biology of most of the NTFP species is poorly understood. We don't even have idea of exact time and duration of flowering fruiting *etc.*
2) Their amenability for genetic manipulation is largely unknown since no earlier work has been attempted
3) Majority of NTFP species of the tropics are of importance only to rural households and communities but rarely reach world markets. Hence extension of market is a big problem
4) Further, the commercial viability and availability of channels for the marketable products are based on imperfect knowledge.
5) The scenario is further complicated by unpredictable consumer/industrial preference both at the level of species as well as for specific traits of commercial interest within a species.
6) Many of the NTFP species are harvested from the forests to get seasonal and extra cash income. A farmer would adopt domesticated product, in most instances, only if it can be grown on a marginal or wastelands without much care.

All these issues would have a bearing on the direction, success and rapidity of domestication process. From the viewpoint this background, we should evaluate the domestication strategy of *Garcinia gummi-gutta* and other species I wish the deliberations of this workshop would address these issues. I wish the workshop a grand success.

STRATEGIES FOR DOMESTICATION OF *GARCINIA GUMMI-GUTTA*, AN IMPORTANT NON-TIMBER FOREST PRODUCT (NTFP) YIELDING SPECIES OF THE CENTRAL WESTERN GHATS

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The species and its importance

Garcinia gummi-gutta is a dioecious tree found in the evergreen and semi-ever green forests of central and southern Western Ghats that yield a delicate non-dessert fruit of commercial importance. The fruits of *Garcinia gummi-gutta* are too acidic to be eaten raw, traditionally people of high rainfall tracts of Karnataka and Kerala use the pulp of the fruit in culinary preparations as flavoring agent, and the seeds are also rich source (31 per cent) of an edible fat. The decoction of the fruit rind is administered to reduce rheumatism and to cure improper bowel complaints. It is also employed as a rinse for diseases of the mouth in cattle. In the recent years '*Garcinia*' has become one of the major NTFP species because of its newly identified pharmaceutical property. (-) 'Hydroxy-Citric-Acid' (- HCA), a chemical that is believed to reduce fat accumulation in humans when consumed, is extracted from the dried fruit rind (a marketable product). The concentration of HCA is reported to be as high as 30 per cent in dried fruit-rind; of which 90 per cent is non-volatile and also possess antiseptic properties.

Domestication as tool for utilization and conservation of NTFP species

Domestication of Non-Timber Forest Product (NTFP) yielding species such as *Garcinia gummi-gutta* offers several challenges to the biologists, which often have a social and/or an economic angle. Firstly the biology of *Garcinia gummi-gutta* is poorly understood. Secondly its amenability for genetic manipulation is largely unknown. Thirdly, the commercial viability and availability of channels for the marketable products are not transparent and also based on imperfect knowledge. Fourthly the scenario is further complicated by unpredictable industrial demand and vagaries of price commanded by the product. All these issues would have a bearing on the direction, success and rapidity of domestication process of *Garcinia*. In general, five logical steps could be identified in the modern-day domestication process of a typical NTFP species, which are as follows:

1) Prioritization of species
2) Characterization of the species and adoption of a domestication strategy
3) Commercialization of the product

4) Redesigning agroforestry systems
5) Maintenance of biological and gene diversity of domesticated NTFP species

From the viewpoint of these general principles, we evaluate the domestication strategy of *Garcinia gummi-gutta.*

Prioritization of species

It is the process of zeroing-in on a set of species to be domesticated based a sound decision-making framework. Since there are several candidate species available in any given eco-region, it is essential to select the species most suitable for domestication. Such priority setting exercise is the fundamental and most crucial step in the process of domestication of NTFP tree species since most of them are perennial in habit and hence their genetic manipulation is time/resource consuming.

***American adipose and the Indian* Garcinia**

In the recent years 'Garcinia' has become one of the major NTFP species because of its newly identified pharmaceutical property. (-) 'Hydroxy-Citric-Acid' (- HCA), a chemical that is believed to reduce fat accumulation in humans when consumed, is extracted from the dried fruit rind (a marketable product). The concentration of HCA is reported to be as high as 30 per cent in dried fruit-rind; of which 90 per cent is non-volatile and also possess antiseptic properties. In recent years, increased commercialization of processed Garcinia fruit has pushed this local, subsistence level enterprise into a business involving international export market. Consequently, all the ill effects of globalization have set in to this species. Since the species is in commerce for over a decade, and in traditional use since several centuries, the species can be prioritized for further domestication.

***Characterization of the species with respect to its biology, use and to adoption of an appropriate strategy for domestication*:**

At this stage, the level and distribution of genetic diversity as well as rate of change in genetic diversity associated with the process of domestication are to be focused. Many of the NTFP species are harvested from the forests to get seasonal and extra cash income. A farmer would adopt domesticated product, in most instances, only if it can be grown on a marginal or wastelands without much care. However, a few species could also be adopted for an intensive cultivation. Hence domestication strategy should very clearly focus on traits that are appropriate for such diverse situations. G. gummi-gutta is suitable for high-rain fall area of the southern and central Western Ghats, it may be domesticated for growing on home-stead gardens, waste/marginal lands within its natural distributional range. Hence it can be developed into a 'niche crop' for the horti-silvi-pastoral systems of the high rainfall region of the

Western Ghats. Recently an improved variety of *G. indica*, a closely related species of G. gummi-gutta, has been developed through selection and released for cultivation in Maharastra and Gujarath, which can be considered as a model system for G. gummi-gutta. However, the most important aspect of domestication of an NTFP species is to firstly document its response to cultivation. Several examples suggest that phenotype of a species might transform with the change in the growing conditions.

Fruit collection, traditional processing of fruits and seeds

The ripe Garcinia fruits are collected from naturally grown trees during the months of June-August. Since the fruits are highly acidic, they are highly susceptible to fungal infestation. Hence the fruits are processed immediately following their collection. The raw fruits are cut into two halves and are spread out on a raised platform after the seeds inside are separated from the pulp. Drying is done until the fruit gets a charcoal black color and obtains a smoky smell (which takes roughly 30 to 40 h). The ratio of raw fruits to dried rinds is 10:1 (Saibaba et al., 1996). Further processing of the fruit rinds will be done at industrial scale, wherein calcium and potassium salts of the HCA are produced. At this stage, processing cost could be reduced if the wax content of the fruit rind is low and if the fruits are completely ripened. Seeds are processed to get edible clarified butter.

Domestication strategy

Adopting an appropriate domestication methodology is also use-specific and trait-specific. To focus on specific traits for improvement, it is essential to characterize steps involved in utilization of an NTFP species. The ripe fruits of *G. gummi-gutta* are collected from naturally grown trees during the months of June-August. Since the fruits are highly acidic, they are highly susceptible to fungal infestation. Hence the fruits are processed immediately following their collection. The raw fruits are cut into two halves and are spread out on a raised mesh platform after the seeds inside are separated from the pulp and a fire is set beneath. Drying is done until the fruit gets a charcoal black color and obtains a smoky smell (which takes roughly 30 to 40 h). The ratio of raw fruits to dried rinds is 10:1. Further processing of the fruit rinds will be done at industrial scale, wherein calcium and potassium salts of the HCA are produced. At this stage, processing cost could be reduced if the wax content of the fruit rind is low and if the fruits are completely ripened. Seeds are processed in a traditional method to get edible clarified butter.

Since the species is dioecious, genetically their population would be extremely heterozygous and sexual reproduction yields a multitude of mostly undesirable types. Vegetative reproduction is simple and outstanding individuals can be probably selected to initiate clones. A shift from sexual to vegetative

reproduction is a rapid and effective way of establishing a domesticate. But virtually no concerted efforts are done to evaluate the provenance level genetic variation for economic traits in this species. Fortunately, a few farmers have identified interesting variation for size and shape of fruits as well as for fruit bearing nature. Since the species is dioecious, female trees can be preferentially multiplied through the use of standard horticultural techniques of grafting, air layering, and rooted cuttings. In this way, important characteristics such as fruit quality, yield, etc. can become fixed and adopted as the standard for domesticated races.

Traits that needs to be focused while selecting the superior clone are:

1. Monoecious types
2. Early flowering types
3. Regular bearing types
4. Higher fruit yield
5. Higher fruit rind to seed ratio
6. Higher HCA content
7. Better shelf-life of fruits
8. Low wax content in the fruit rinds
9. Uniform ripening of the fruits within a tree.

Methodology

1. To identify superior genotypes with desirable traits within the distributional range

   In this part, correlations of HCA content with marker traits will be established so that quick and reliable phenotypes can be identified.
2. To develop vegetative and micro-propagation protocols.

   Vegetative propagation techniques such as stem cuttings, grafting, etc., will be adopted. Tissue culture protocols will be standardized to multiply super clones for mass multiplication.

Genetic engineering

The range of applications of genetic engineering is continuously extending. Marker-assisted breeding in forest trees presents a unique and interesting challenge, because inbreeding is generally not possible, multi-generation pedigrees are rare, generation times are long and resources are limited. The high heterogeneity that exists in most forest trees can be used to great advantage in mapping since it a rich source of genetic diversity.

Commercialization

Domestication has a strong economic basis hence it is very essential to understand and amend the aspects of commercial importance of a domesticated product. Domestication and commercialization sometimes would overlap for some species. For a few others, establishment of reliable market channels and genuine buy-back system would reinforce the continued utilization of species by farmers. This is an essential step to prevent wastage of efforts of domestication. It is believed that about 3000 metric tons of dried rinds of G. gummi-gutta were produced during 1995 in Canara forest circle of Karnataka, of which more than 1000 metric tons were derived from private lands. Further, Garcinia fruits command high whole-sale and retail prices and were sold at Rs. 70-80 a kg during 1998-1999, the price has however, decreased drastically to Rs.30 a kg during 2000. It is essential to amend policies to avoid such high fluctuations.

Redesigning agroforestry systems

In this step, issues related to redesigning agroforestry systems to incorporate these domesticated races of NTFP tree species are addressed. This helps in tapping the environmental services offered by NTFP species (such as mitigating deforestation and soil conservation) is clubbed with ensuring cash-income to the farmers. In case of *Garcinia*, a substantial portion of the product is originated from the private lands called *betta* lands (a kind of usufruct forests given to individual farmers to aid in cultivation of beetle nut). However, currently no specific species components of this horti-silvi-pastoral system are followed in these lands. Hence it is essential to address recommendations for a sound management of *betta* lands.

Maintenance of biological and gene diversity of domesticated NTFP species

Domestication invariably leads to a decrease in genetic variability and results in uniformity of populations, which is not a desirable outcome. Improvement in yield is obtained at the cost of genetic variability depending on the improvement strategy. Hence conservation of genetic resources should always be a part of the domestication program. To conserve genetic variation in these species through an ex situ approach. A clonal garden of the elite germplasm will be established through the standardized techniques.

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STUDIES ON SEED GERMINATION AND GRAFTING TECHNIQUES IN *GARCINIA INDICA* L. CHOISY

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ABSTRACT

The fruits of *Garcinia indica* are important source for Hydroxy Citric Acid (HCA) and known for anti acidic and nutritional value. The present study was under taken at college of Forestry, Sirsi during 2004 -05 to reveal pre seed treatments on seed germination and effect of different grafting techniques in *Garcinia indica*, the results indicated that, storage of seeds reduces the germination percent significantly, so seeds should be sown when they are fresh to obtain higher and uniform germination. Among the seed pre-treatments given maximum germination per cent was in hand scarified seeds treated with GA3 50ppm. Among the Grafting techniques tried cleft grafting showed highest success (92.5) which could be used for commercial propagation purpose.

INTRODUCTION

The genus *Garcinia* L belongs to the family Clusiaceae, earlier known as Guttiferae having approximately two hundred species distributed in Asia. Thirty-six species are found in India (Abraham *et al.,* 1999) among them *Garcinia gummi-gutta* and *Garcinia indica* are more important ones. *Garcinia indica* is found in tropical rain forests of Western Ghats, from Konkan southwards in Mysore, Coorg and Wayanad. In Karnataka, occurs along the wind ward side of the Western Ghats in Dakshina Kannada, Coorg, Chickmagalore, Shimoga and Uttara Kannada districts (Ravikumar and Ved, 2000). *G. indica* is called as 'Kokum' in English but the local names vary from region to region in India. It is known as 'Brindon' to portuguese in Goa, 'Bhirand' or 'Amsol' to Marathis and Konkanigas, 'Murugalu' to Kannadigas and 'Punampuli' to Malayalis (Subhash Chandran, 1996). It is an evergreen, tree with 10-12 meters or even more height. It's drooping branches and erect main terminal growing shoot offers good choice for avenue plantation in cities and can be choice plant for cultivation on either side of the railway tract passing through Konkan belt (Shripadre, 2001).

In this tree fruits and seeds are the economically important parts having medicinal and nutritive value. The fruits contain 10% malic acid and a little citric/ tartaric acid. Recently industries have started extracting Hydroxy Citric Acid (HCA) from kokum rind. Kokum fruit as a medicine is prescribed for heart

ailments, dysentery, piles, diabetics, tumors and to reduce cholesterol. Seeds of fruits yield edible fat known commercially as "kokum butter". This is used to treat backaches, muscle pulls and also in candle and soap manufacturing and as confectionery butter. The cake left after extraction of oil is used as manure (Yasodharan, 2002). Due to the increased utility with respect to medicinal and nutritive value of the tree, the demand for the fruits is increasing in India and abroad rapidly. Fruits from natural forests are extracted in large scale as an important NWFP in parts of Uttara Kannada, Kerala and Maharastra. A few farmers have started commercial cultivation of kokum. Even then demand far outstrips the supply. It has been reported that Japan imports nearly 50-60 tons of kokum seeds every year (Sirodkar, 2003). The commercial cultivation of kokum is hindered by lack of standardized nursery practices and feasible propagation techniques. Kokum tree being dioecious in nature needs to be propagated vegetatively. Vegetative propagation also helps to achieve early fruit set and to overcome the problem of sex identification at seedling stage. Standardization of seed germination and grafting technique are pre-requisites for domestication and commercial cultivation of any tree species. Grafting is an important vegetative propagation technique followed in kokum. However the knowledge about type of grafting, season of grafting and the compatibility with rootstocks of different species is still lacking. Therefore, considering these facts, the main aim of the present study was to reveal the effect of different pre seed treatments on germination and to know the effect of different grafting techniques.

Material and methods

The present study was carried out at the College of Forestry Sirsi (14^0 26"N latitude, $74^0$50"E longitude) of Uttara Kannada district of Karnataka, located in hilly zone (zone-9) of Karnataka state.

Totally eight different pre-sowing treatments were given at two different intervals. First as soon as after collection of seeds and second after storing in room condition for 30 days. The treatments are as follows

T_1 – Removal of seed coat by hand

T_2 – Mechanically damaging the seed coat by rubbing with sand

T_3 – Chemical scarification (dipping in conc. H_2SO_4 for three minutes followed by thorough washing with tap water)

T_4 – Removal of seed by hand and treating with Gibbarlic Acid (GA_3) of 50ppm for 12 hours

T_5 – Mechanically damaging seed coat by rubbing with sand and treating with GA_3 of 50ppm for 12 hours

T_6 - Chemical scarification with conc. H_2SO_4 and treating with GA_3 of 50ppm for 12 hours

T_7 – Alternate wetting in cow dung slurry and drying (12 hours each) for three days

T_8 – Control (without any treatments)

Design and lay out

The experiment was laid out in Completely Randomized Design (CRD). The treatments were replicated thrice. Fully matured fruits were collected from the trees and seeds were extracted from them. The uniform sized bold seeds were chosen for the germination trial. After pre treatment, seeds were sown in germination trays containing sand. The whole experiment was carried out in laboratory condition during April and May. For each replication 50 seeds were sown. Watering was done daily using rose can.

Grafting

In this experiment four types of grafting were tried in the month of May, namely cleft grafting, whip grafting, whip and tongue grafting and epicotyl grafting. For first three types of grafting root stock of eight-month-old *G. indica* was taken, where as for epicotyl grafting one-month-old *G. indica* seedlings were selected. Present season sprouts of about 5-8 cm length were selected as a scion from female trees. Two months after grafting observations were taken on number of grafts survived, number of sprouts and number of leaves were taken in Completely Randomized Design (CRD).

Results

There was significant difference in germination per cent between fresh seeds and 30days stored seeds. Germination was maximum (77.66 per cent) in fresh seeds compared to 30 days stored seeds (59.33 per cent). 30 days storage of seeds led to 30 per cent decrease in the germination (Table 1).

All presowing treatments showed significant deference in germination per cent over control. Among various presowing treatments, hand scarification followed by treatment with Gibberlic acid (50ppm) for 12 hours showed highest (80 per cent) germination per cent (T_4). This was on par with hand scarified seeds (79.33 per cent) (T_1). The lowest germination (51.33 per cent) was observed in control. The extent of germination due to treating hand-scarified seeds with GA_3 (50ppm) for 12 hours was 55.8 per cent over control. Interaction due to storage and pretreatment did not influence the germination significantly. However maximum germination per cent (90 per cent) due to effect of interaction was observed in fresh, hand-scarified treatment and lowest (44.67 per cent) was observed in 30 days stored, untreated seeds. Mean daily germination differed significantly with storage. Fresh seeds showed higher (2.86) mean daily germination compared to thirty days stored seeds (1.85). There was 35.31 per cent decrease in mean daily germination in 30days stored seeds. The highest mean daily germination (2.90) was observed in hand scarified seeds (T_1), which was followed by hand scarified seeds treated with GA_3 (50ppm) for 12 hours (T_4). Control showed the lowest (1.56) mean daily germination, which was 46.2 per cent decrease over hand scarified seeds. All the parameters in Hand, mechanical and chemical scarified seeds were on par with the respective Gibberlic acid treatments. This shows treating with GA_3 (50ppm) for 12 hours did not influence any of the parameters.

There was significant difference in peak value between fresh and 30 days stored seeds. The higher peak value (2.92) was observed in fresh seeds, and was 53.6 per cent higher than 30 days stored

seeds. The lowest (1.90) was observed in 30 days stored seeds. Hand scarified seeds showed the highest peak value (3.07), which was on par with hand scarified seeds treated with GA_3 (50ppm) for twelve hours (3.03). Control (T_8) recorded the lowest (1.55) peak value. Increase in peak value due to hand scarification was 98.06 per cent control.

There was significant difference in germination value due to presowing treatments. The maximum germination value (9.45) was observed in hand scarified seeds and which was followed by hand scarified seeds, treated with Gibberlic acid for 12 hours (9.21) but the seeds without any treatment showed lowest germination value (2.56). The hand scarified seeds showed 265 per cent increase in germination value over control. Seed pretreatment increased the germination rate significantly. Hand scarified seeds treated with GA_3 (50ppm) for 12 hours showed the highest (1.98) germination rate. This was on par with hand scarified seeds (1.92). The lowest (1.03) germination rate was recorded in control (T_1). The extent of increase in germination rate due to hand scarified seeds treated with GA_3 (50ppm) for 12 hours was 92.2 per cent over control.

The different types of grafting carried in *G. indica* showed significant increase in survival per cent, number of sprouts and number of leaves. The maximum survival per cent (92.5) was observed in cleft grafting and this was on par with whip grafting (87.5) and whip and tongue grafting (82.5). Lowest survival per cent (47.5) was observed in epicotyl grafting (table 2).

Number of sprouts per graft were maximum in cleft grafting (5.07) which was followed by whip and tongue grafting (5.04) and whip grafting (3.99). The lowest number of sprouts (2.97) were observed in epicotyl grafting. The cleft grafting showed 70 per cent increase in number of sprouts per graft over epicotyl grafting.

Number of leaves per graft was maximum (12.02) in cleft grafting and this was on par with number of leaves produced per graft in whip and tongue grafting. Epicotyl grafting showed the lowest number of leaves (5.81) per graft.

Discussion

Commercialization of forest products is getting accelerated in recent years. Kokum with high medicinal value has a great potential of commercialization but at the present stage lacuna of standardized nursery techniques hinders the attempts to popularizing the plant. The germination per cent due to seed storage varied significantly. The highest germination percentage was observed in fresh seeds. *Garcinia indica* seeds are of recalcitrant nature. It is well known fact that in recalcitrant seeds as the moisture content reduces below certain level the germination goes on reducing. This recalcitrant nature of the seeds may have reduced the germination per cent significantly in 30 days stored seeds. Similar observations were also made by Jindal *et al.*, (1990) who reported the reduction in germination of *Tecomella undulata* from 82 per cent in fresh seeds to 63.3 per cent in one-year-old seeds. Chacko and Pillai, (1997) also have reported the reduction in germination with decrease of moisture content in *Garcinia gummigutta.*

Mean daily germination is the measure showing average number of seeds germinated per day. The maximum mean daily germination was in fresh seeds (2.92) which significantly varied in 30 days stored seeds. *Garcinia indica* seeds have gummy layered seed coat, which get hardened in storage due to loss of moisture. This hardening of seeds coat might be the responsible factor for delaying and prolonging the germination period. The prolonged germination period reduced the mean daily germination in 30 days stored seeds. Peak value indicates the maximum mean daily germination reached at any time during the period of test. Peak value in 30 days stored seeds reduced significantly over fresh seeds. The reduced germination per cent and prolonged germination period might have led to reduced peak value in 30 days stored seeds.

Germination value also differed significantly due to storage of seeds. Germination value is an integral measure of seed quality. It aims to combine in a single figure, an expression of total germination at the end of the test period with an expression of germination energy or speed of germination. The germination value in 30 days stored seeds has drastically reduced, this is mainly due to reduced mean daily germination and peak value. (GV = MDG X PV). Thirty days stored seeds showed significantly reduced germination rate. This is mainly due to reduced germination per cent and prolonged germination period in 30 days stored seeds. Among Various pre-sowing treatments showed significant difference in germination per cent, Mean daily germination, peak value, and germination value and germination rate. All the treatments showed significant difference over control in all parameters. Increased germination in all the treatments might be due to either damaging or removing of seed coat, which made the easy permeability of water to cotyledons. Thus increased imbibition led to the higher germination per cent. The maximum germination per cent (80 per cent) was in seed coat removed seeds, which were treated with GA_3 50 ppm. This treatment was on par with only seed coat removed treatment. Even mechanically scarified seeds and chemically scarified treatments are on par with the Gibberlic acid treated treatments. This clearly shows that Gibberlic acid did not influence much on germination but the treatments, which allowed easy permeability of water to cotyledons increased the germination per cent. So it can be concluded that the reduced germination in kokum is mainly due to impermeable seed coat. These results are in conformity with that of Chacko and Pillai (1997) who reported the increased germination and reduced period of germination in de coated seeds of *Garcinia gummigutta* compared to control.).

In the experiment of different grafting techniques tried, survival per cent number of sprouts per graft and number of leaves per graft varied significantly in different types of grafting techniques. Cleft, whip, whip and tongue grafting were on par with each other for survival per cent. Number of sprouts per cutting and number of leaves per graft but all of them varied significantly over Epicotyl grafting. The lesser survival percent, number of sprouts and number of leaves per graft in epicotyl grafting may be due to young nature of rootstock. The smaller area at the joining point of root stock and scion might have

reduced the chances of joining root stock and scion thus ultimately reducing the survival per cent. In cleft and whip and tongue grafting there is a provision for better locking of rootstock and scion thus leading to better contact with cambium. This might has led to faster union of root stock and scion and thus further leading to higher number of sprouts and number of leaves per graft. These finding are in conformity with Haldankar *et al.*, (1992), who have reported 86 per cent survival in *G. indica* soft wood grafting carried on its own rootstock. Senarathe *et al.*, (1981) also have recorded 87 per cent success in both whip and cleft grafting in *Madhuca longifolia*.

Conclusion

1) On the whole, present study showed that, the fresh seeds have shown significantly higher germination percent mean daily germination, peak value, germination value and germination rate compared to 30 days stored seeds. This suggests that storage of seeds reduces the germination percent significantly, so seeds should be sown when they are fresh to obtain higher and uniform germination.
2) Among the seed pre-treatments given maximum germination per cent was in hand scarified seeds treated with GA3 50ppm, which was followed by only hand scarified seeds. However this method is very laborious and difficult, so chemical scarification with concentrated H_2SO_4 for 3 minutes can be followed for large-scale treatment, as it also gives significantly higher germination over control.
3) In case of different grafting techniques tried cleft, whip and whip and tongue grafting were equally successful. However cleft grafting which showed highest (92.5) success could be used for commercial propagation purpose.

Table1.Effect of various treatments on germination parameters of *Garcinia indica*

Treatment	Ger. Per cent	MDG	PV	GV	GR
Main treatments					
S_0- No storage	77.66 (62.41)	2.86	2.92	8.68	1.90
S_{30}- 30 days storage	59.33 (50.47)	1.85	1.90	3.53	1.24
Sem	0.67	0.04	0.06	0.24	0.03
CD@1%	2.42	0.15	0.23	0.81	0.12
Sub-treatments					
T_1. Hand scarification	79.33 (63.90)	2.90	3.07	9.45	1.92
T_2. Mechanical scarification	71.00 (57.73)	2.46	2.53	6.55	1.65
T_3- Chemical scarification	71.00 (57.70)	2.39	2.29	5.16	1.60
T_4. Hand scarification+GA_3(50ppm)	80.00 (64.32)	2.90	3.03	9.21	1.98
T_5. Mech. scarification + GA_3(50ppm)	68.00 (55.81)	2.41	2.44	6.20	1.57
T_6 - Chem. scarification + GA_3(50ppm)	66.00 (54.56)	2.23	2.30	5.41	1.50
T_7. Cow dung treatment	61.33 (51.74)	2.00	2.03	4.31	1.34
T_8 - Control	51.33 (45.78)	1.56	1.55	2.56	1.03
SEm±	1.35	0.08	0.12	0.49	0.06
CD@1%	4.25	0.29	0.45	1.80	0.23

MDG- Mean Daily Germination; PV- Peak value; GV-Germination value;

GR – Germination rate; Figures in parentheses are arcsine-transformed values

Table3. Influence of grafting techniques on survival percent, number of sprouts and number of leaves per graft in *Garcinia indica*

Grafting type	Survival (%)	No. of sprouts	No. of leaves
Cleft	92.5 (77.58)	5.07	12.02
Whip	87.5 (71.58)	3.99	8.59
Whip and Tongue	82.5 (67.86)	5.04	11.72
Epicotyl	47.5 (43.55)	2.97	5.81
Mean	77.50	4.27	9.53
Sem±	4.78	0.19	0.52
CD @ 1%	17.43	0.80	2.14

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MONITORING THE YIELD FOR IMPROVED MANAGEMENT OF *GARCINIA GUMMI-GUTTA* IN CENTRAL WESTERN GHATS OF KARNATAKA , INDIA.

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ABSTRACT

Garcinia gummigutta is an important species in the composition of evergreen and semi evergreen forests of Uttara Kannada. This species also contributes towards the income of communities living in the vicinity of forests. People collect a substantial quantity of fruits and seeds from trees of this species. Fruits also serve as an important food for many wild animals. Local people extract an important edible fat from seeds of fully ripened fruits. People consume this fat as a substitute for ghee and also use it for frying. Hence a portion of this fat is consumed at the household level and remaining is sold in the local market. In recent years, fruits generated a lot of interest in the commercial market because of HCA content in the fruit. Thus, this species is of high utility value and it forms an important tree species in generating additional income for the poor people. Therefore, protection, conservation, and promotion of this species would motivate local people to conserve forests as a whole. There is a lot of interest for further study on the biology and ecology of this species in the forests of Uttara Kannada and also promotion of this species by way of domestication.

Effort is required to conserve and promote this species in its natural habitat as well as domestication/cultivation in private lands. Following are some of the areas that could be looked in to for this purpose.

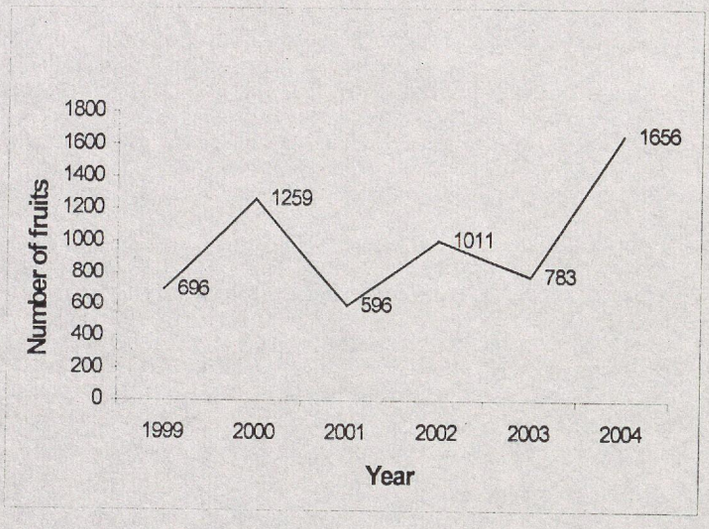
1. Conservation of gene pool in the natural habitat
2. Regeneration level of this species in the forests
3. Sustainable extraction of fruits from the trees
4. Understanding of fruit productivity of trees in natural forests

A study is being carried out in Uttara Kannada with an objective of generating information on fruit yield pattern of G. gummigutta to understand the variation in fruit yield from year to year and to understand the relationship between fruit yield and other tree attributes.

About a hundred trees have been identified and numbers of fruits are estimated on each of these trees every year during the harvest season by counting fruits on sample branches. The preliminary result of this study shows that there is a high variation in fruit yield among all trees. To understand yearly variation in the fruit yield, fruit yield per tree was computed for each year and compared between years. When average yield of all trees during two

consecutive years is considered there is a significant difference showing supra annual fruit yield cycles in these trees. Also, there exists variation in fruiting patterns among individual trees, wherein some have regular fruiting, while others have irregular fruiting patterns.

Figure 1. Annual variation in fruit yield from trees of *Garcinia gummigutta*



It would be quite useful to understand the fruit productivity level of G. gummigutta trees from the management point of view. It has many applications. It would be interesting to understand whether any correlation exists between the fruit yield and tree attributes such as girth, height and canopy size etc.

5. Promoting more extensive/intensive cultivation of trees on private lands to meet the growing market demand

Since this species has generated so much interest and also demand in the local and commercial markets it would become essential to cultivate the trees of this species on a larger scale. This would help the farmers to produce quantity of fruits required to meet the market demand. This would help in protecting and conserving the natural population of individuals of this species. Thus, there is a need to promote domestication of *Garcinia gummigutta*.

SOCIAL AND ECOLOGICAL IMPACT OF HARVESTING UPPAGE *(GARCINIA GUMMI-GUTTA)* IN UTTARA KANNADA DISTRICT OF KARNATAKA

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ABSTRACT

Garcinia gummigutta is an important NTFP in the central Western Ghats. Traditionally, the seeds were collected for extracting butter. And in some regions the dry rind was stored for years to use it as tamarind substitute and as vinegar. Recently the rinds are attracting market, for HCA, (Hydroxy Citric Acid) content in the fruit rind said to have obesity control property and is exported. Due to increase in industrial all unscientific harvesting practices were set in. Study explains harvesting, processing methods of *G. gummigutta* and marketing, consequences of the change in harvest due to increased price.

Importance of the species in terms of income generation to local people, labor returns per day and out turn of product and revenue obtained by Forest Department is also discussed.

Impact assessment of harvesting on regeneration of the populations have studied which revealed that regeneration was almost nil during period of high industrial demand.

Finally efforts of Prakruti an NGO dedicated for the cause of conservation of tropical forests through promoting sustainable harvesting, popularizing domestication and cultivation etc are also discussed in this paper. Field observations, standard vegetation analysis techniques, PRAs, series of workshops on sustainable harvesting were carried out involving NTFP harvesters, Village Forest Committees, State Forest Department and NGOs. Suggestions were made to facilitate policy changes towards sustainable harvesting.

General description: *Garcinia gummigutta* is an evergreen tree, which can grow 8 to 12 meters, at evergreen patches. Tree grows in cone shape and branched perpendicular to stem. The fruits, which grows up to a size of orange, with ridges ranging from 8-12, contains, approximately same number of seeds. Green fruits turn orange after maturation. Tree starts to give yield after 8-10 years of age. Recently, an attempt of grafting also tried to get the yield early with promising success rate. The importance to this plant came recently. Traditionally, the seeds were collected by Havyak Brahmins community, for extracting butter. And in some regions the dry rind was stored for years to use it as

tamarind substitute. But, recently, from last 15 years, the rinds are attracting market, for HCA, (Hydroxy Citric Acid) content in the fruit rind.

Collection practices:

Harvesting season starts from first week of June and ends with 2nd week of August. Since trees can be found in deep evergreen forests, mainly in crest line of Western Ghats, with the pouring rain, slippery forest slopes, and tenacious leeches, it is really a challenging job to collect these fruits. Usually women collect the fallen fruits and separate the seeds from the fruit and bring it to home. These seeds were mixed with ash dried and then de husked.

Processing:

Fruits, after bringing to home yard, are sliced to separate seeds and rinds. Normally the fruit rinds are dried in open fire method. Rinds are dried on trays, meshed size, using firewood. However, the rind can be processed through dryer. But this is bit costlier and a common collector cannot afford this. Seeds are mixed with ash, to remove gum jelly component around the seeds and dried. Seeds are roasted, crushed, and boiled with water and kept stable for hours. The low-density oily content floats on the top, and slowly extracted from the mixture.

This butter (oil) is used at specific occasions like in festivals to prepare sweet dishes.

Changed scenario:

Since last ten fifteen years the product has gained commercial importance because of Hydroxy Citric Acid (HCA) in it. Now only the rind of the fruit is collected and not the seed as it was done previously. HCA is extracted from the rind and is exported to many countries (including USA and Japan). Ultimately there is high industrial demand for the rind.

Consequences of the change:

The product is being over harvested and there is pressure on the forest for the resource. The returns per Labour Day attracted even outsiders, (those who are non-residents of the area mainly from sub urban places) thus resulting in the unsustainable harvesting practices. Harvesting of unripe fruits, cutting of branches and some times entire tree is being done in the process. This has made the species vulnerable of extinction.

Uses:

1) The sour rinds are used as a tamarind substitute, mainly in Kerala State, Andhra Pradesh and in part of Karnataka, with beef and fish curries.
2) Oil (edible clarified butter) is used for all culinary purposes. The fried sweet dishes, from oil of *Garcinia gummi-gutta* last longer than others, increases shelf life of fried food products.
3) The oil is used for medicinal purposes for joint pains.

4) Hydroxy Citric Acid, (HCA) which is available at about 30% in *Garcinia gummi-gutta* rinds, used for obesity, reducing fats, and is exported.

Market:

Forest Department auctions the products once in two years. The highest bidder gets the permission to collect the fruits. Contractor appoints sub agents or middlemen to collect the product from the harvesters. The contractor himself solely decides the price of the product. Therefore it is believed that there is big gap between the actual quantity harvested and the quantity reported by the contractor to the Government. It is also believed that the Government records always under estimate the quantity of any NTFP. There are other channels of marketing through Village Forest Committees and LAMPS (Large Scale Adivasi Multipurpose Societies). However, their role in the marketing of the fruit is negligible compared to tendering system to the contractors.

Recent Trend:

Due to the industrial demand and hence high price for the product has forced to collect more and more rind. In the process unripe fruits are also collected as explained earlier. More over adulteration is carried out to the product. Because of adulteration the price for the rind in the export market dropped. During 1997-98 the price of rind went up to Rs. 100 per kilogram when the price was just Rs. 5 in 1985-86 (Figure 1) (45 Indian Rupees is about one US$).

The quantity and revenue from the *Garcinia* was rising initially and highest during 1997-98 and then started decreasing (Figure 2).

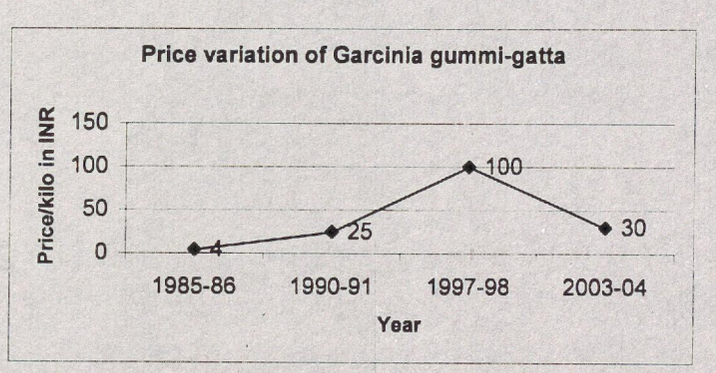


Figure 1: Price variation for the rind of *Garcinia gummi-gatta* over the years. (Source: PRAKRUTI field data 2000 to 2004)

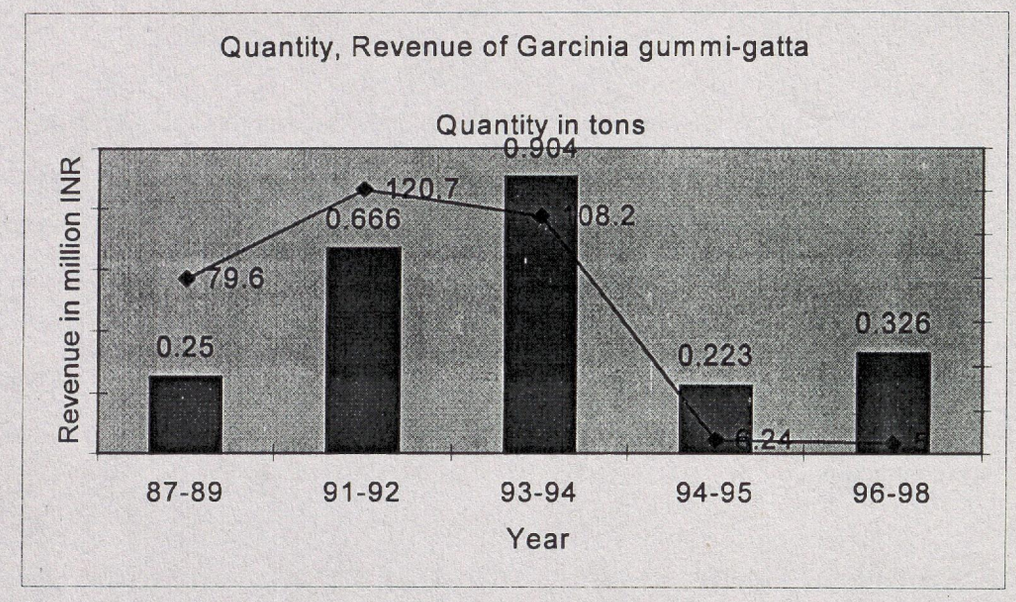


Figure 2: Quantity harvested and revenue earned from the *Garcinia gummi-gutta* is reducing. (Source: Karnataka Forest Department Data 1985-1999)

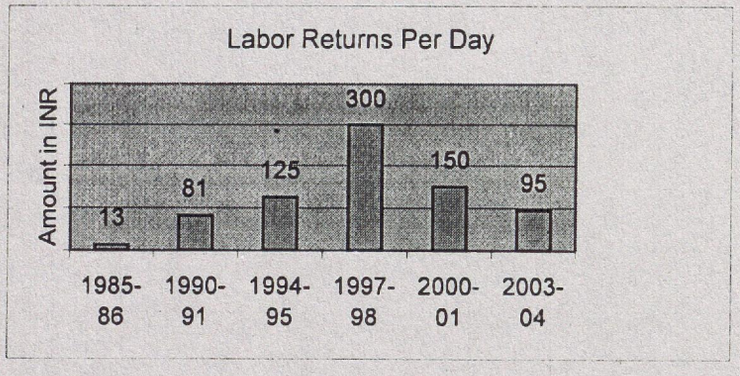


Figure 3: Labor returns Per Day from harvesting the *Garcinia gummi-gutta* to primary collector. (Source: Field Data – PRAKRUTI 2000-04).

Labor returns per day are almost in accordance with the quantity harvested and price for the *Garcinia* rind. The product started to market during 1978 when the dried rind was sold in Kerala from Uttara Kannada district. During that time price of rind per kilogram was just 0.15 rupees (personal communication with journalist Mr. Shivanand Kalave). Price was Rs 13 during 1985-86. In this period resource availability was high, however, people were not interested to collect the resource because the price were not attractive. The price that went up to Rs. 100 per kilogram during the year 1997-98 and then stabilized to rupees 20 during 2004-05.

Actions:

Workshop on sustainable harvesting:

We have organized workshops on sustainable harvesting of NTFP in various places, Anshi, Muregar, Achave and Bandala are few to name. In some of the villages the collectors decided to bring restriction to harvest the product until maximum fruit ripens (as in Muregar village). Monitoring the harvesting by local people and Village Forest Committees (VFC) to check the early harvesting, to avoid chopping of branches or cutting of trees.

Discussions with Forest Officials and distribution of Brochures:

We have circulated brochures in Sirsi Forest Divisions through the Forest Department explaining why sustainable harvesting is needed to conserve the resource and urging the collectors, contractors and sub contractors to practice sustainable harvesting. Discussions were held with various Forest Officials to arrive at sustainable practice and to suggest bringing change the policy.

Encouraging propagation and Domestication:

This has to be done by propagation of the species in VFC (Village Forest Committees) areas through planting and encouraging the farmers to cultivate in their land. And allowing the regeneration of the species in the natural forest. In several VFCs planting of the *Garcinia gummigutta* has been done and several farmers also have grown in their agriculture land. However, these efforts were done in pockets and more concentrated work has to be done for domestication of the species. There are reports that fruits from the domesticated trees or which is in the privately owned land are harvested in sustainable methods.

Size Class Distribution of *Uppage* trees in HH and LH

GBH GROUP	HH	LH	*Probability*	T value
	Average±SD.	Average±SD.		
1 to10	114.8± 44.81	295±24.34	0.000	6.06
11 to 30	43.5±18.51	56.8±20.70	0.316	1.06
31 to 50	14.2±9.52	13.4±10.16	0.901	0.13
51 to 70	5.4±2.30	9.9±5.00	0.121	1.71
71 to 90	5.4±3.44	5.4±3.51	1.000	0.00
91 to 110	4.1±4.56	5.2±3.27	0.674	0.43
111 to 130	6±4.69	3.4±1.52	0.293	1.12
150 and above	3.1±2.97	5.2±2.17	0.240	1.26
All individuals above 10 GBH	81.7±19.73	99.3±30.87	0.319	1.05

Collection practices and ecological impact: Fifty trees were identified in different tenurial systems. Ten each in *betta*, encroached forestland, five in distant forest (lightly disturbed forest), and twenty-five in Reserved forest. Each tree was observed before harvesting. Information about expected yield in each tree was noted with the help of two local collectors. Later each tree was visited every alternative day and

percentage of ripe and unripe fruits was noted. The tree was harvested, then percentage of fruits left in the tree, the method of harvesting, and the number of branches cut etc. were noted. Approximate quantity and quality collected by collector was estimated with the help of data from the previous day's observation. Besides, wherever possible, actual harvesting by collectors was observed.

To cross check the data all outlets and markets, viz. intermediaries, agents dealing in the village were asked to give the actual quantity and quality of *Uppage* rinds.

Method of harvesting:

Open access area: This is the region in the Reserve Forest where villagers frequently collect NTFP. This area is near the village and hence easily accessible. This region has considerably high density of *Uppage* trees.

Harvesting in open access areas near the village was more destructive compared to other areas. Collection from this region starts much before the other regions. Out of 25 trees observed, 32% of trees were harvested before any fruits in the trees were ripe. Another 44% of trees were harvested when hardly 10% of fruits were ripe. 16% of fruits were harvested with only 20% of fruits were ripe. All trees were harvested before 30% of fruits were ripe.

As harvesting of fruits in the open access region was nearing completion, people started collecting fruits from the distant forests. By that time, about 20% of fruits was ripe in most of the trees.

In the case of encroached forest land, the owner of the land harvests the fruits. In case of such land, it was observed that no fruits were harvested only when ripe. The maximum quantity of fruits harvested was with 40% of ripe fruits (70%).

However, in case of *betta* no fruits were harvested before 30% of fruits in trees had ripened. Most of the fruits were harvested (60%) when there were 40% of ripe fruits in the tree. Some trees (10%) in fact, were harvested after the fruits were ripe.

On an average, almost 88 % of total fruits in *Uppage* were harvested before 40% of fruits in a tree were ripe. More unripe fruits are harvested from open access areas followed by distant forests (non-tenure regime). Trees in *betta* and encroached lands are harvested with more ripe fruits. (With tenurial security)

Table No 7.5 Uppage: harvesting patterns

Region	Total Branches	Branches cut	Total	% of damage
Tenure	521	0	521	0
No Tenure	749	200	949	21%
Total	1270	200	1470	13.6%

Chi-square = 127, $p<0.001$

Region	Total Fruits	Fruits remaining	Total	% Fruits remained
Tenure	11506	200	11706	1.7%
No Tenure	28031	749	28780	2.6%

Total	39537	949	40486	2.3%

Chi-square = 38, $p<0.001$

Harvesting methods: The above tables show the details about the branches cut in tenure and non-tenure regions. Also, it shows details of fruits remaining in the trees after harvesting.

It is observed that out of 25 trees in the open access area, about 11 trees were badly damaged with cutting of more than 20 % of branches. Another four were partially damaged, with cutting of one or two branches. In the case of distant areas, out of five trees observed, three trees were damaged severely (more than fifty percent of branches were cut.). In the case of the encroached area, fruits were harvested when 90% of fruits were ripe.

However, in the case of *betta land* no trees were damaged. In fact, out of ten trees regularly observed, from two trees, fruits were collected only after they naturally fell on the ground.

In both the regimes very small number of fruits remained on the trees leaving minimal chance for natural regeneration.

Conclusions: Tenural security plays an important role in deciding the harvesting method of trees. Trees in open access areas are harvested first, followed by trees in reserved forests far away from villages. Encroached lands and *betta lands* are harvested much later. In other words, trees in open access areas were harvested with maximum unripe fruits compared to trees on encroached land and *betta lands*. In addition, it was found that harvesting methods were most destructive in open access areas. However, in *betta* and encroached lands, there was always fear of theft. Therefore, some of the *betta landholders* and encroached landholders harvest the crop/fruit before they are completely ripe.

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DOMESTICATION CONSIDERATIONS FOR *GARCININA GUMMIGUTTA* (L.) ROBSON

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The use of synthetic medicines and subsequent cumulative derogatory effects of such synthetics in the recent past lead to tremendous growth of interest in plant based drugs, pharmaceuticals and natural colours in the world. Except for a few cultivated crops, the availability of plant based materials is mainly from the natural sources like forests and wastelands. Due to deforestation and concurrent unscrupulous exploitation of these plants lead to decline in their population. Often the quality of these materials is not up to the international standard. On the other hand, the demand for internal use and for export has been increasing necessitating the introduction of these plants in to the cropping system. The cultivation of these plants as crops can meet the demand of the industry and help to maintain the standards on quality, potency and chemical composition.

Garcinina gummigutta (L.) Robson is a pyramid shaped evergreen dioceous tree with drooping branches naturally found in the Western Ghats of India. The species is gaining world wide attention for its newly identified medicinal property Hydroxy-citric-acid (HCA) a chemical extracted from the dried fruit rind is understood to reduce fat content in human body when consumed (Hasegawa, 2001). The dried fruit rind yields excellent vinegar, which is rich in vitamins and also used as a condiment to flavor curries in places of tamarind (Joy, *et.al.*1999). Edible oil extracted from seeds is used for cooking and medicine.

Domestication is the naturalization of a species to improve its cultivation and use for humankind. Basically domestication improves the ability of people to grow and utilize trees either for products or services. Strategies of domestication will be depending on the value of the products, the extent of genetic variation with in a species and many other functions. The classic stages of domestication strategies should be exploration, evaluation, conservation and utilization (Davidson, 1992). The present paper deals with some of the important consideration for domestication of *G. gummigutta*

Exploration of genetic resources: Exploration involves a number of steps following the discovery of a new species or the recognition that a species already known to be of value in natural forest should be domesticated for planting. Variations within a species develop in response to evolutionary forces such as natural selection that vary in different parts of the natural range of a species. Study of variability and exploitation of variability by understanding the genetic diversity of the population is the first step in domestication of any species. The first step in exploration is mapping the natural range of the species followed by the description of the environment within the range and an account of the phenotypic variation observed within the species through out the range. Presently, the species is found along the

Western Ghats in certain patches. Identification of population whose progeny will have desirable traits is greatly facilitated by recognition of patterns of variation through exploration studies. Existence of variability between populations and within populations was reported in several studies (Naveenkumar, 2003: Hegde, *et al*, 2006). It is important to consider the natural variability between the populations and within the population for domestication and further improvement.

Evaluation of genetic resources: This stage involves determination of the genetic component of the variation observed during exploration. Comparative replicated experiments capable of statistically sound assessment should be established to examine the performance of as many as natural populations as possible when planted together in one or preferably several field site types over time series. One of the main advantages of having multilocation field studies is the ability to determine the extent of genotype – environment interaction effects in addition to mean genotypic values.

Conservation of genetic resources: Conservation of genetic resources for both present and future use is essential. Conservation measures will be required to protect valuable genetic resources from encroachment, destructive harvesting methods, damage and even by destruction by clearing forests for agriculture and settlements. The main danger for threat for the species is unscrupulous and over zealous harvesting.

Imminent loss of valuable genetic resources in a geographical location can be approached by *in-situ* or *ex-situ* conservation. *In-situ* conservation requires technical knowledge for appropriate management system to ensure sustainability and political will to ensure protection. *In-situ* conservation can be persuaded by declaring the area as parks or reserves because in many areas of its natural distribution human pressures on land increase for agriculture and livestock grazing. The second approach for conservation is *ex-situ.* It can be accomplished in various forms from cryopreservation of seed and pollen to tissue cultures kept in archives. Arboreta and research planting and specially planted seed producing conservation stands also serve the ex-situ conservation goals. It is pertinent to mention that ex-situ conservation strategy is less effective than *in –situ* conservation in the long term, since the genetic make up of the *ex-situ* stand would change over time as result of the *ex-situ* environment.

Utilization of genetic resources: Utilization of genetic resources refers to the deliberate inclusion of samples of population genotypes in selective breeding programme and in turn in plantation trees for production. In using genetic resources and effecting change two stages each containing several levels. The fist stage is called species introduction and testing and the second stage being tree improvement and breeding.

The first stage involves development of proper nursery techniques, planting techniques, tending operations and sustainable harvesting strategies. Generally, the seeds of G. *gummigutta* take very long period for germination after sowing. Treating of seeds with hydrochloric acid for 5-10 minutes could increase the seed germination *(Uttaiah, B.C. Personal communication)*. In the initial stage of seedling development seedlings grow slowly, the growth could be boosted by following improved nursery practices such as improved potting mixture, exposure of seedlings for elevated CO2 concentration supplemented with higher doses of nutrients etc. Fruit is the commercially important part; efforts on vegetative propagation for early bearing could be the better way of mass propagation. Among the different grafting techniques, wedge grafting at seedling stage could be the easiest way of mass propagation for large scale planting.

It is one of the slow growing tree species which requires partial shade in the initial stage of development, the development of appropriate planting technique is must. Efforts should be concentrated on introducing tree species as part of enrichment planting and silvicultural techniques. Generally, fruiting is observed during rainy season and it is difficult to harvest the fruits by climbing large trees development of sustainable harvesting technique is must for the species.

In many tree species, the yield is often governed by factors associated with the genotype, environment and interaction between genotype X environment. Efforts should be made to identify site specific genotypes for commercial exploitation through tree improvement and breeding techniques.

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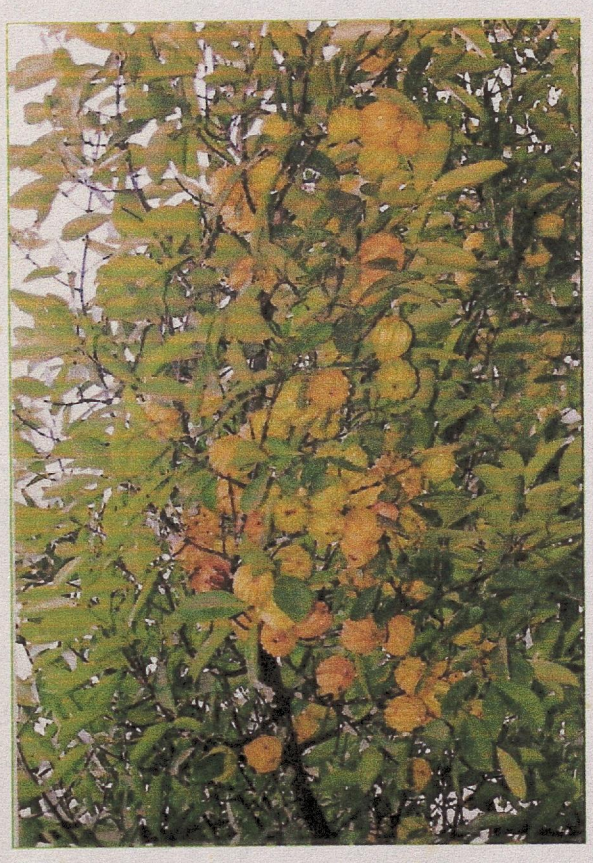
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GEF/CCF Small Grants Program- India
Project Progress Report (Quarterly)

A Participatory Approach to Domestication of *Garcinia gummigutta* and Fruit Processing. (Project Number: SGP/GEF/05/KAR/10)

Period covered by the Report: **1st October 2007 to 31st December 2007**



Implemented by:

Prakruti

Sirsi,-581401, Uttara Kannada

Karnataka, INDIA

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

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Person in charge of Progress Report: **Narasimha Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* and Fruit Processing.**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttara Kannada district, Karnataka State India**

Project Start and End Sates (as in the MoA): **1st October 2005 to March 2008.**

Changes (if any) in Start or End dates: **Change in end dates by September 2008 due to delay in release of second installment.**

Period covered by the Report: **1st October 2007 to 31st December 2007**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	9,10,521
SGP Funds spent to date	8,43,651
SGP Grant disbursement requested	We have received the second installment; the remaining grants shall be released according the schedule mentioned in the agreement.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	4,500
NGO	In cash	4,000

5. Progress Report

a. Detailed Summary of Activities *(Increase rows as required)*

(Guidance Notes: Give details on each the activities performed, as specified in the MoA)

Sl.No.	Activity as approved in MoA	Progress as on date	Remark
1.	Alternate products from the *Garcinia* fruit and seeds.	Vinegar is extracted from the fruit. Butter extracted from the seed is used in making of candles. Soap making have been tried from the butter.	Butter could be used for several years in good condition un like butter obtained form animal products.
2.	Construction of alternate fuel wood saving devices.	Two ovens are installed in the remote villages. Preparation for installation of one more drier is under progress. Discussion with scientists, Forest Department and *Garcinia* fruit collector is being done to develop model for the unit to extract the juice from fresh *Garcinia* fruits.	Village Forest Committees and women groups are associated with these units.
3.	Identification of superior types of *Garcinia gummigutta* for domestication.	Analysis of chemicals in the fruit rind of identified trees.	
4.	Workshops and meetings.	One workshop held at Mahime village. Preliminary visits were made to other villages where *Garcinia* resources are abundant and possibility of organizing workshops were discussed.	Workshop helped to identify groups to install the processing units, check possibility of domestication of superior types, alternate processing and marketing of wet fruit rind instead of dry fruit rind to extract the Hydroxy Citric Acid (HCA).
5.	Capacity building of local groups in management of the resources.	Strengthen and capacity building of women and youth groups to use the installed units, raising nursery, cultivation and record keeping.	Workshops, trainings and regular meetings were held to achieve the goals.
6	Promoting community management plans for natural resources.	Women groups, Village Forest Committees and other local groups were the driers, ovens and other units are installed we involved them in bringing community lead management initiatives.	Various stakeholders have been involved in arriving at community lead management plan.

b. Results *(Use as much space as required)*

(Guidance Notes: The extent to which the objectives specified in the MoA, were accomplished; Unplanned achievements; Shortfalls in targets; Describe immediate benefits received by participants and/ or recipient communities in qualitative and quantitative parameters)

- Alternate products developed with the species are eco-friendly and benefit to indigenous women groups. Candles prepared from these natural products are free of paraffin and promote use of local materials.
- Workshops and meetings at various places with fruit collectors revealed that collection and storage pattern has to be changed for new method of extracting Hydroxy Citric Acid (HCA) directly from the wet fruit.
- Need for change in policy issues at Government level like tendering of fresh fruit instead of fruit rind was discussed with the Forest Department officials.
- Installed processing units reduce the fuel wood requirement releasing the pressure on forests while improving the quality of product and minimizing the health hazards.
- Groups of *Garcinia* harvesters and Village Forest Committee were identified for domestication of the species.

c. **New Developments, Unexpected difficulties/ problems & Action taken to solve them** ***(Use as much space as required)***

- It has been difficult to reach and transport materials for processing units for certain villages like Manikkar in Honnavar Forest Division. We could able to go there only after post monsoon road repair work completes.
- We are planning to publish a book on *Garcinia* including;

Population, threats, physiology, and reproductive biology of *Garcinia* species. Resource augmentation: seed collection, propagation techniques, plantation possibilities, harvest methods and domestication. We are also planning to address the issue of sustainability and management issues related to *Garcinia* species.

Compilation of existing data and materials for publication of above mentioned book, consultation with other institutions that have done similar work in under progress.

d. Lessons Learned: ***(Use as much space as required)***

(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Harvesters are interested in harvesting of ripe fruits and marketing the wet fruit as it saves a large quantity of fuel wood requirement and which is laborious.
- Decentralized collection and storage and processing units are necessary to achieve the goal of procuring the fresh fruits in place of dry fruit rind.

- In several places *Garcinia gummigutta* plants raised from seeds are performing better than other plants raised through any other vegetative propagation methods. However, more study, observation and research are needed in this aspect.

e. Requested for Project Revisions, if any *(Use as much space as required)*

(Guidance Note: nature of proposed revision(s); Reason for proposed change in project compilation date; Proposed budget revision. Please indicate here if you would like authorization for increasing any budget line and which line(s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

f. Additional Information: *(Use as much space as required)*

(Guidance Notes: Provide information on the points given below and add more points if necessary)

- Project output indicators to monitor and evaluate progress in activities.
  - Area and groups selected for domestication/cultivation of the species. Number of seedlings planted and survival rate.
  - Response from community, organization and departments to cultivate the superior types.
  - Use of nursery techniques and alternate processing techniques to community to improve their livelihood and on the other hand reducing the pressure on forest resources.
  - Quantity and quality of products dried in the installed drying units. And fuel wood saved by these installed units and estimation of volume of fuel wood that could be saved should all the fruits are dried in the driers and ovens.
  - Use of newly developed oven mainly to dry the fruit of *Garcinia gummigutta* and response from the collectors to install these units.
  - Linkages made with other institutions/department/organizations and other stakeholders to the project.
  - Extent of awareness created on domestication of the species, alternate processing and on sustainable harvest of fruit.
- Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.

Link established with three more women groups, four Village Forest Committees and one youth club. Several individual NTFP collectors' families were met during project activities.

- Impacts of the project in terms of Policy/Advocacy/ Sustainability and Replicability of the project purpose/strategy, etc.

- Press/ Media coverage/links established in the project to other similar initiatives/networking with other NGOs.
- Details how the project is enhancing and creating institutional sustainability for project.
- Identification of superior types and domestication effort could be extended to entire central Western Ghats region.
- Fuel-efficient driers and ovens could be installed in several other groups.
- Results and lessons of sustainable harvesting practices and community management plans could be used in other regions and for other Non Timber Forest Producing species.
- We are planning to take up alternate processing method of extracting Hydroxy Citric Acid (HCA) from fresh fruit in one or two Village Forest Committees (VFCs) on a pilot basis in the coming season. This could be replicated in other VFCs in the following seasons.
- Results of workshops and meetings were covered in the regional and state level newspapers.
- Other NGOs in the district, College of Forestry Sirsi, Department of Forest, Indian Institute of Science were participated in the project activities.

- Note: Please send photos on activities in original at the earliest.

Report: Workshop at Mahime

Mahime village is situated in midst of evergreen tropical forest region in Western Ghats. It is a remote village in Honnavar Taluka, in Gersoppa forest Range. The Marathi community in the village is engaged in collection of Non Timber Forest Produce. Some of the major produces are, Uppage(garcinaia gummigutta), Honey, cane, cinnamon leaves and buds, and soap nuts.

The workshop was held in Mahime village with the following objective:

- To create awareness about sustainable harvesting of NTFPs
- To motivate the people towards installing fuel efficient driers
- To help the collectors to add value to their produce
- To expose them to the marketing chain

After the initial introduction of the NGO Prakruti, the overall picture of the forest and how NTFPs contribute towards the livelihood was discussed. The people also shared their experiences of how they used to collect numerous NTFPs and the decline of the resources due to the process of deforestation.

The exhibition of the posters and pictures on harvesting and processing of garcinia gummigutta evoked widespread response form the participants they were keen to know how the installation of dries would help them in processing the fruits during the harvesting season, especially in the monsoon. This would not only save the fuel wood but the quality of the produce will be higher fetching more price for their produce.

They showed keen interest in sustainable harvesting of the NTFPs including honey. They were also motivated to form their own group to improve the quality of honey and to initiate steps towards marketing of the produce.

Collection of NTFP is one of the main occupations of the local people. It provides them employment and cash income. However, the remoteness of the region is a hindrance for transportation of the produce. They also expressed concern about the contractors of NTFPs who bring external laborers to harvest cinnamon leaves and other NTFPs depriving them of the livelihood opportunity.

Outcome of the Workshop:

- The participants were exposed to the wider policy issue of NTFP
- They were keen to take actions towards sustainable harvesting practices
- They showed interest in forming their own groups to add value to the produce like honey and try to get better price though wider market exposure
- They showed interest in installation of fuel saving driers for processing of Uppage
- It was for the first time that the villagers were exposed to numerous alternatives that will help them to add value to the produce and further avenues for marketing their produce.

	Number and date of Invoice/ Receipt	Description of Expenditure	Budget Head	Cost (Rs.)
1	26.12.07	Materials purchase for Drier and Ovens	Project activities	33000
2	26.12.07	Consultancy for alternate processing	Consultancy	10000
3	26.12.07	Salary to Field Assistant	Manpower	18080
4	26.12.07	Expenses for maintaining the nursery	Contingency	6000
5	19.11.07	Photo Printing for poster	Documentation and Reporting	1250
6	26.12.07	Telephone bill	Communication and Administration	330
7	26.12.07	Travel Expenses	Travel cost	1805
8	26.12.07	organising workshop	workshop	6000
9	26.12.07	Traveling Expenses	Travel cost	963
10	26.12.07	Food and Snack for Workshop	Workshop	850
11		Ink cartage for printer	Documentation and reporting	2100
12	26.12.07	documentation	Documentation and reporting	3055
13	8.12.07	Computer entry Salary	Documentation and Reporting	1500
14	8.12.07	documentation	Documentation and reporting	1210
15	8.12.07	Salary of Field assistant	Manpower	9000
16	13.11.07	Travel Expenses	Travel cost	4775
17	12.11.07	Taxi hire for attending workshop	Workshop	1000
18	9.11.07	organising workshop	workshop	3117
19	31.10.07	Telephone bill	Communication Administration	1387
20	22.10.07	organising workshop	workshop	3000
21	17.10.07	Purchase of CDs	Documentation and reporting	220
22		Purchase of envelopes	Communication Administration	40
23	16.10.07	Purchase of bricks and sand	Project activities	1500
24	16.10.07	organising workshop	workshop	11993
25	12.11.07		communication administration	9180
26	12.11.07	Consultancy for value addition	Consultancy	1000
27	21.11.07	Expenses for maintaining the nursery	Contingency	2000
28	12.10.07	documentation	Documentation and reporting	7415
29	19.10.07	Salary to Field Assistant	Manpower	3070
			Total	**144840**

Cumulative Expenditure Report

1st October 2007 to 31st December 2007

Budget Head	Approved Budget(Rs.)	Expenditures this period (from above(Rs.)	Cumulative Expenditures(Rs.)	Balance (Rs.)	Co-financing accessed
Manpower/labor	108480	30150.00	68250.00	10080.00	0
Training/ Seminar/ Workshops etc.	56000	25960.00	19915.00	10125.00	4500
Contracts/ Consultant	40000	11000.00	20000.00	9000.00	0
Equipment/Furniture	0	0.00	0.00	0.00	0
Others (specify)			0.00		
Project Activities	110000	34500.00	54300.00	21200.00	4000
Travel Cost	30000	7543.00	21103.75	1353.25	0
Communication and Administration	28000	10937.00	14232.25	2830.75	0
Documentation and Reporting	50000	16750.00	26638.00	6612.00	0
Contingencies	22669	8000.00	9000.00	5669.00	
Total	**445149**	**144840.00**	**233439.00**	**66870.00**	**8500**

6. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
- Column (4) should be used for indicating cumulative expenditures incurred since the beginning of the project, including the amount reported in column (3) for this reporting period.
- Column (5) should reflect the balance of project funds, which results from subtracting the amounts of column (4) from these entered in column (2).
- Column (6) if the NGOs or communities have accessed funds as co-Financing from other Sources. This is essential as it creates that how GEF is leveraging on other sources.

Report Submitted By:

Name: **Pandurang Hegde**

Designation: Director Programs

Signature:

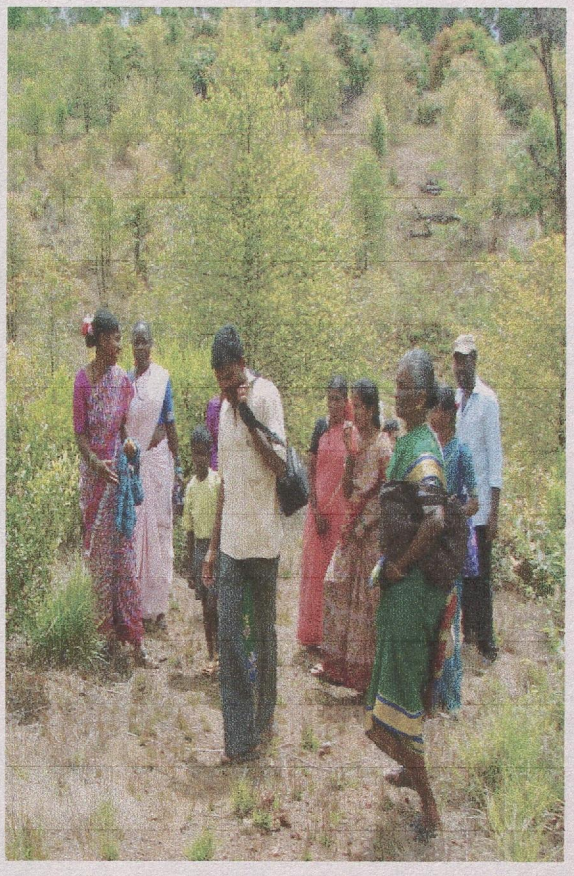
Date: 10 January 2008

GEF/CCF Small Grants Program- India
Project Progress Report (Quarterly)

A participatory Approach to Domestication of Garcinia gummigutta and Fruit Processing.

(Project Number: **SGP/GEF/05/KAR/10**)

Period covered by the Report: **1st January 2008 to 31st March 2008**



Implemented by:

Prakruti
Sirsi,-581401, Uttar Kannada
Karnataka, INDIA

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

Telephone/ Fax/ Email: **08384-225139,** appiko@sancharnet.in,

Person in charge of Progress Report: **Panduranga Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* And Fruit Processing**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttara Kannada district, Karnataka State India**

Project Start and End Sates (as in the MOA): **1st October 2005 to 31st March 2008**

Changes (if any) in Start or End dates: **Nil**

Period covered by the Report: **1st January 2008 to 31st March 2008**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	9,10,521
SGP Funds spent to date	9,10,521
SGP Grant disbursement requested	We have received the first installment; the remaining grants shall be released according the schedule mentioned in the agreement.

second.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	
NGO	In cash	20,671

→ 10,000

5. Progress Report

a. Detailed Summary of Activities (*Increase rows as required*)

(*Guidance Notes: Give details on each the activities performed, as specified in the MOA)*

Sl.No.	Activity as approved in MOA	Progress as on date	Remark
1	Developing alternate products from the *Garcinia* fruit and seeds.	Marketing of *Garcinia* butter through three primary co-operative societies. *Garcinia gnmmigutta* butter has been purchased from the collectors and packed in glass & plastic bottles. (1kg,1/2kg,250gm) We are developing the market for the product.	Response is moderate keeping quality & shelf life is long. We hope that during festival time there will be increased demand.
2	Construction of driers or alternate fuel wood saving devices.	The drier is constructed at Achieve cluster in Manikkar village. Preparation for evaluation of all the driers (processing units) constructed under the project has been made and actual evaluation will be taken up during harvesting season (July, August) Format for evolution has been prepared and expert will take up this work.	Manikkar is a remote village and hotspot of Garcinia , the drier would help to save fuel wood and reduce pressure on the forests.
3	Identification of superior types of *Garcinia gummigutta* for domestication.	Awaiting analysis of HCA content for 140 samples of rind. Scion collection from the identified tree is going on. Grafting of saplings for domestication is under progress.	College of Forestry has been given the responsibility to analyse the HCA content of Garcinina and they are trying there best to get the report.
4	Workshops and meetings.	-One exposure visits was done for *Garcinia* collectors. -Collectors were shown domestication of *Garcinia* of two types(plantation & regeneration type) -Awareness created among collectors to take up cultivation - *Garcinia* collectors were given training in grafting of *Garcinia*	Collectors got lot of information on Garcinia grafting, land suitability, cultivation practice, income & expenditure of domestication.

		saplings..	Grafting technique imparted and they are motivated to plant saplings under Village Forest Committees.
5	Capacity building of local groups in management of the resource.	-Nursery has raised *Garcinia* saplings -SHGs and women's groups have taken up responsibility of raising saplings.	Nursery technique learnt by SHG women. Grafting technique learnt. Plants are ready to plant during next monsoon season.
6	Promoting community management plans for natural resources.	Regular visits with women's group (Stree Shakti. SHG) is going on. Discussions & future plans were developed to take up management plan & maintenance of established community driers.	Hoping to reach more groups of *Garcinia* collectors who are keen to install the driers after UNDP GEF Small Grants programme.

b. **Results** ***(Use as much space as required)***

- The forgotten recipe of grand mother i.e. extraction of *Garcinia* butter has been re-established by continuous efforts of Prakruti with collectors. To enhance that Prakruti took up collection, production and marketing of this produce through co-operatives. This local venture it has great potential.
- Exposure visits to nurseries, domesticated NTFP plantations & grafting training was a big success. The Collectors were taken to the plots of *Garcinia* domestication where the experiences ranges form 40 to10 years. These practical experiences motivated the collector's group to extend the philosophy around their house and villages.
- Due to training they learnt how to graft superior varieties themselves. This will save the transportation cost.
- The construction of drier in Achve cluster, in the remote village was a tough task. To transport the drier material to the hill area was difficult. But it has been constructed and community participation is high. They are anxiously waiting to use drier in the coming season.

C. New Developments, unexpected difficulties/problem & Action taken to solve them *(use as much space as required)*

- Without actually being exposed to the truth, believing is difficult. So domestication, cultivation, grafting etc though we explained to the community, it was very difficult to convince them. In order to boast their confidence and train them we took them to the domesticated sites for exposure visit. This has produced good results. Now they have agreed to plant and cultivate *Garcinia* during the next monsoon.
- For grafting the superior type, to get the scion in large quantity is difficult task. As expected the cut branches did not give more scions. So we brought limited quantity available & grafted which will be distributed during monsoon.

D. Lessons Learned: *(Use as much space as required)*
(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Though it is very difficult to create community feeling for the project the end result is: they come together and do the work. Product development, processing units (driers) domestication etc will be successful if done with community feeling.
- Workshop, exposure visits helps in organizing people and to convince about the ongoing work elsewhere.
- Nursery raising and grafting techniques are knew to the staff and needs to be transferred to the community. This will give good results in the near future.

E . Requested for Project Revisions, if any *(Use as much space as required)*
(Guidance Note: nature of proposed revision(s); Reason for proposed change in project compilation date; Proposed budget revision. Please indicate here if you would like authorization for increasing any budget line and which line(s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

Nil

F. Additional Information

Exposure visit report (Enclosed separately)

- Project output indicators to monitor and evaluate progress in activities.
- Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.
- Impacts of the project in terms of Policy/ Advocacy / Sustainability and Replicability of the project purpose/strategy, etc.

- Press/Media coverage/ links established in the project to the similar initiatives/networking with other NGOs.
- Details how the project is enhancing and creating institutional sustainability for project.
- Identification of superior types and domestication effort could be extended to entire central Western Ghats region.
- Fuel-efficient driers and ovens could be installed in several other groups.
- Result and lessons of sustainable harvesting practices and community management plans could be used in other regions and for other Non Timber Forest Producing species.
- We are planning to take up alternate processing method of extracting Hydroxy Citric Acid (HCA) from fresh fruit in one or two Village Forest Committees (VFCs) on a pilot basis in the coming season. This could be replicated in other VFCs in the following seasons.
- Result of workshops and meeting were covered in the regional and state level newspapers.
- Other NGOs in the district, College of Forestry Sirsi, Department of Forest, India institute of Science were participated in the project activities.
- Note: please send photos on actives in original at the earliest.

Exposure visit Report

Date 21/03/08
Place – Tulanbail, Bhairimane, Amchimane, Yan.
Number of participants 13 (12 female/ 1 male)

On Friday March 22, 2008 we arranged an exposure visit for the ongoing NTFP Nursery and Domestication project. The participants were from the Shirsagoan village Stree Shakti Sangh. The objective of the visit was to exchange information on cultivation aspects and especially to give them information on cultivation of nine varieties of NTFP including *canarium strictum* (raldhoop) and wild pickle mango grafting.

The exposure visit began by visiting the Tulanbail village. Here a farmer has regenerated and conserved three acres with four types of NTFPs. The woman group saw the forty year old NTFP plantation and discussed about the conservation, harvesting and income & expenditure from these plants.

Then visit continued towards Dattatraya at Bhairimane farm where he has done plantation of nine varieties NTFPs. The women group saw numerous varities of grafted trees which are yielding. They are Uppage (grafted, *Garcinia gummigutta*) kokum (grafted, *Garcinia indica*) wild Mango (12 varieties) Vate(*Artocarpus lakoocha*), Amla(Phyallanthus emblica) Jackfruit (eight varieties) cinnamon, Soap nut (*Acacia conncinna)*. The farmer has ten years experience with domestication of NTFP species. A discussion was held on grafting techniques of Mango, uppage, and Kokum among other topics. The

participants were particularly impressed with the 12 wild mango varieties which Dattatraya explained gave profit after six years.

Then woman group visited Mundigehalla Nursery and got a first hand experience and training on grafting of wild mangoes by master graftsman V.G. Hedge. He gave a demonstration; following the demonstration each participant was given a mango sapling to graft which. The participants took their grafted plants home to plant. He also showed the Nursery and germination technique of *canarium strictum* and wild date palm seeds.

After eating the lunch at Hulekal the team proceeded towards Yan. The famous limestone formation and Shiva temple were visited by women first time. They also counted 140 Rock bee colonies on the formation. It was a long walk and they returned to there home in the might. The woman group decided to start two nurseries of 1000 plant each and decided to conduct a NTFP summer camp for school children and keep beehive boxes at their home.

office

UNDP Quarterly Expenditure Report
1st January 2008 to 31st March 2008

S.NO.	No.&Date of Invoice/Receipt	Description of Expenditure	Budget Head	Cost (Rs.)
1	18/1/2008	Telephone Bill	Communication and Administration	415.00
2	18/1/2008	Telephone Bill	Communication and Administration	1,493.00
3	18/1/2008	Purchase of CDs	Documentation and reporting	92.00
4	23/1/2008	Cloth cover	Documentation and reporting	45.00
5	24/1/2008	printing	Documentation and reporting	395.00
6	2/2/2008	office expenses	Communication and Administration	400.00
7	2/2/2008	Electricity bill	Communication and Administration	107.00
8	6/2/2008	Salary	Manpower	9,040.00
9	6/2/2008	Salary	Manpower	1,200.00
10	6/2/2008	Expenses for maintaining the nursery	contingency	5,000.00
11	19/2/2008	Expenses for maintaining the nursery	contingency	2,000.00
12	28/2/2008	Telephone Bill	Communication and Administration	1,112.00
13	28/2/2008	Telephone Bill	Communication and Administration	415.00
14	28/2/2008	Salary	Manpower	9,040.00
15	28/2/2008	Drier construction	Project activities	9,000.00
16	29/2/2008	Salary	Manpower	1,800.00
17	29/2/2008	Travel expenses	Travel cost	887.00
18	29/2/2008	Salary	Manpower	3,000.00
19	18/3/2008	Telephone Bill	Communication and Administration	415.00
20	18/3/2008	Telephone Bill	Communication and Administration	693.00
21	18/3/2008	Poster printing(Naveen printers Dhili)	Documentation and reporting	10,092.00
22	25/3/2008	Office Rent	Communication and Administration	4,010.00
23	25/3/2008	Garcinia poster printing	Documentation and reporting	4,150.00
24	25/3/2008	Exposure visit	Workshop	3,200.00
25	25/3/2008	Drier construction	Project activites	10,500.00
26	26/3/2008	Salary	Manpower	9,040.00
			Total	**87,541.00**

Cumulative Expenditure Report
1st January 2008 to 31st March 2008

	Budget Head	Approved Budget (Rs.)	Expenditures this period (from above (Rs)	Cumulative Expenditure (Rs)	Balance (Rs.)	Co-financing accessed
1	Man power/labor	1,08,480.00	33120.00	98400.00	-23040.00	
2	Training/Seminar/Workshops etc.	56000.00	3200.00	45875.00	6925.00	
3	Contraxts/Consultant	40000.00	Nil	31000.00	9000.00	
4	Equipment/Furniture	Nil	Nil	Nil	Nil	
	Others(specify)					
5	Project Activities	110000.00	19500.00	88800.00	1700.00	
6	Travel Cost	30000.00	887.00	28646.75	466.25	
7	Communication and Administration	28000.00	9060.00	25169.25	-6229.25	
8	Documentation and Reporting	50000.00	14774.00	43388.00	-8162.00	
9	Contingencies	22669.00	7000.00	17000.00	-1331.00	
	Total	**4,45,149.00**	**87541.00**	**378279.00**	**-20671.00**	

Note: There is a negative balance of Rs 20671.00 that has been incurred by Prakruti organisation

6. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
- Column (4) should be used for indicating cumulative expenditures incurred since the beginning of the project, including the amount reported in column (3) for this reporting period.
- Column (5) should reflect the balance of project funds, which result from subtracting the amounts of column (4) from these entered in column (2).
- Column (6) if the NGOs or communities have accessed funds as co- Financing from other Sources. This is essential as it creates that how GEF is leveraging on other sources.

Report Submitted By:

Name: Panduranga Hegde
Designation: Director Programs

Signature:
Date: 26 April 2008

GEF/CCF Small Grants Program- India
Project Progress Report (Quarterly)

A participatory Approach to Domestication of Garcinia gummigutta and Fruit Processing.

(Project Number: **SGP/GEF/05/KAR/10)**

Period covered by the Report: **1st April 2008 to 30th June 2008**



Implemented by:

Prakruti
Sirsi,-581401, Uttar Kannada
Karnataka, INDIA

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

Telephone/ Fax/ Email: **08384-225139,** appiko@sancharnet.in,

Person in charge of Progress Report: **Panduranga Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* And Fruit Processing**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttar Kannada district, Karnataka State India**

Project Start and End Sates (as in the MOA): **1st October 2005 to 31st March 2008**

Changes (if any) in Start or End dates: **Nil**

Period covered by the Report: **1st April 2008 to 30th June 2008**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	9,10,521
SGP Funds spent to date	9,10,521
SGP Grant disbursement requested	We have received the first and second installment; the remaining grants shall be released according the schedule mentioned in the agreement.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	3,000/-
NGO	In cash	20,000 /-

5. Progress Report

a. Detailed Summary of Activities (*Increase rows as required*)

(Guidance Notes: Give details on each the activities performed, as specified in the MOA)

Sl.No.	Activity as approved in MOA	Progress as on date	Remark
1	• Alternate products from the *Garcinia* fruit and seeds.	• Season of *Garcinia* fruit & harvesting has started. We will be sending fresh fruit to try for extraction of HCA. This year crop is abundant and people are busy with harvesting and processing of rind. The quantityof seed will be more and extraction of butter also will be more & prakruti is exploring market to sell in large quantity.	Enquiry is there from two traders for *Garcinia* butter. Organizing collectors to make more butter & to market it.
2	• Construction of alternate fuel wood saving devices.	• Two drier had been constructed in Shirsgoan village. The Siddi community (Nigroes) totally dependent on NTFPs were selected and constructed the fuel efficient driers to dry NTFPs in monsoon. • Collapsed old drier reconstructed in Shirsgoan village.	The remote village & hotspot of *Garcinia* got two driers.
3	• Identification of superior types of Garcinia gummigutta for domestication.	• Already Nursery has been raised from superior type tree scions. • People are planting these plants.	To create interest in planting Prakruti is organizing 'Green Festivals' in the village.
4	• Workshops and meetings.	• Exposure visit had been arranged for Karoor village. (report attached). Collectors were shown Domestication of Garcinia, Nursery. • Awareness programmes held at 3 villages whenever meeting took place.	Because of abundant crop this year to protect the tree from damage is needed. Through awareness programme it has been deciminated.

5	• Capacity building of local groups in management of the resources.	• Self help groups have taken up raising nursery and grafting.	Grafting training given. Grafting equipment like sicature, Knife etc were given to women who do nursery activity. Planting of the same is going on.
6	• Promoting community management plans for natural resources.	• Regular visits with women group (stree shakti, SHG) is going on. Discussions & future plans were made to take up management plan & maintenance of established community driers.	Hoping to reach more SHGS and SHG members asked to make a survey to put driers and take-up activities for eligible persons & villages.

b. **Results** ***(Use as much space as required)***

- Exposure visits to nurseries, domesticated NTFP plantations & grafting training was real success. The *Garcinia* domestication about 40 years back & 10 years back gave the collectors group confidence to do the same around their house and villages.
- Due to grafting training they learnt how to graft superior varieties themselves. Also transportation cost will be saved by this method.
- Two new Driers had been established in Shirsgosn & Kakkalli village which is inhabited with siddi families. This year because of more yield in *Garcinia* trees these driers are working in full swing.

C. New Developments, unexpected difficulties/problem & Action taken to solve them ***(use as much space as required)***

- Driers had been used by these collectors community innovatively. Because of early monsoon they could not dry their value added products like Kokam juice & jack fruit chips. They tried to dry these products in UNDP driers and it was fantastic success. They saved about 95 kg of Kokam syrup (made out of *Garcinia indica* fruit) from spoiling because of more moisture content. They reduced moisture content from 28 % to 20 % by using these driers.
  The Shirsgoan village : At the beginning of the project with much hope and real requirement of NTFP collectors Prakruti established one community drier in this village. The drier broke down and it was useless for last one year. With lot of

follow up they could not reconstruct it. Because of unawareness of these women one educated family took away the drier material after convincing them. But Prakruti intervened and brought it back to Siddi community and reconstructed the same.

- Without seeing believing is difficult. So domestication cultivation, grafting etc though we explained to the community very difficult to convince them. To solve that we took them to the already domesticated sites for exposure visit. That gave good results. Now they have agreed to plant cultivate during this season. For grafting the superior type to get the scion in large quantity is difficult task. As expected the cut branches did not give more scions. So we brought limited quantity available & grafted which will be distributed to community.

- **D. Lessons Learned:** ***(Use as much space as required)***

(Guidance Note: Lessons learnt during project implementation; request for additional technical assistance etc.)

- Because series of exposure visit and training program & meetings the women groups showing good result by raising nurseries, using processing units, doing sustainable harvesting.
- Because of Prakruti 's intervention in marketing, the collectors families are getting more income.

E. Requested for Project Revisions, if any (Use as much space as required)

(Guidance Note: nature of proposed revision (s) ; Reason for proposed change in project compilation date; proposed budget revision. Please indicate here if you would like authorization for increasing any budget; line and which line (s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

F. Additional Information: (Use as much space as required)

(Guidance Notes: *Provide information on the points given below and add more point if necessary)*

Que

1 • Project output indicators to monitor and evaluate progress in activities.
2 • Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.
3 • Impacts of the project in terms of Policy/ Advocacy / Sustainability and Replicability of the project purpose/strategy, etc.
4 • Press/Media coverage/ links established in the project to the similar initiatives/networking with other NGOs.
5 • Details how the project is enhancing and creating institutional sustainability for project.

Ans

1 • Identification of superior types and domestication effort could be extended to entire central Western Ghats region.
2 • Fuel-efficient driers and ovens could be installed in several other groups.

3

- Result and lessons of sustainable harvesting practices and community management plans could be used in other regions and for other Non Timber Forest Producing species.

4

- Result of workshops and meeting were covered in the regional and state level newspapers.

5

- Other NGOs in the district, College of Forestry Sirsi, Department of Forest, Indian institute of Science were participated in the project activities.



UNDP Quarterly Expenditure Report
1st April 2008 to 30th June 2008

S.NO.	No.&Date of Invoice/Receipt	Description of Expenditure	Budget Head	Cost (Rs.)
1	19/5/2008	UNDP+PRAKRUTI	Project activity	20,000.00
2	21/5/2008	Board for Drier	Communication and Administration	900.00
3	28/5/2008	Drier reconstruction (Shirsgoan)	Project Activity	10,000.00
4	2/6/2008	Traveling expenses(Apri&May)	Travel cost	5,000.00
5	2/6/2008	Stationery & xerox	Communication and Administration	2,000.00
6	2/6/2008	Salary (Apri&May)	Manpower	18,080.00
7	2/6/2008	Workshops & Training(Apri&May)	Workshop	9,000.00
8	20/6/2008	Traveling expenses	Travel cost	793.00
9	20/6/2008	Salary	Manpower	6000.00
10	23/6/2008	Office maintenance	Administration	800.00
11	23/6/2008	Stationery & xerox	Communication and Administration	2,000.00
12	23/6/2008	Drier construction	Project Activity	45,000.00
13	30/6/2008	Salary (June)	Manpower	9,040.00
14	30/6/2008	Stationery/priniting	Communication and Administration	2,000.00
15	30/6/2008	Traveling expenses	Travel cost	1,450.00
			Total	**132,063.00**

Cumulative Expenditure Report
1st April 2008 to 30th June 2008

Budget Head	Approved Budget (Rs.)	Expenditures this period (from above (Rs)	Cumulative Expenditure (Rs)	Balance (Rs.)	Co-financing accessed
Man power/labor	54,240.00	33,120.00	- 33,120.00	21,120.00	
Training/Seminar/ Workshops etc.	28,000.00	9,000.00	-9,000.00	19,000.00	
Contraxts/Consultant	20,000.00	Nil	Nil	20,000.00	
Equipment/Furniture	Nil	Nil	Nil	Nil	
Others(specify)					
Project Activities	55,000.00	75,000.00	-75,000.00	-20,000.00	3,000.00
Travel Cost	15,000.00	7,243.00	-7,243.00	7,757.00	
Communication and Administration	14,000.00	7,700.00	-7,700.00	6,300.00	
Documentation and Reporting	25,000.00	Nil	Nil	25,000.00	
Contingencies	11,000.00	Nil	Nil	11,000.00	
Total	**2,22,240.00**	**1,32,063.00**	**-1,32,063.00**	**90,177.00**	**3,000.00**

Note: Reason for spending more than budget head in project activity

a) Reconstruction

b) Rise in prices of iron, each drier cost Rs 5,500/- more than before.

6. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
- Column (4) should be used for indicating cumulative expenditures incurred since the beginning of the project, including the amount reported in column (3) for this reporting period.
- Column (5) should reflect the balance of project funds, which result from subtracting the amounts of column (4) from these entered in column (2).
- Column (6) if the NGOs or communities have accessed funds as co- Financing from other Sources. This is essential as it creates that how GEF is leveraging on other sources.

Report Submitted By:

Name: **Panduranga Hegde**
Designation: Director Programs

Signature:
Date: 2nd July 2008

Karoor Nursery & Domestication Exposure Visit

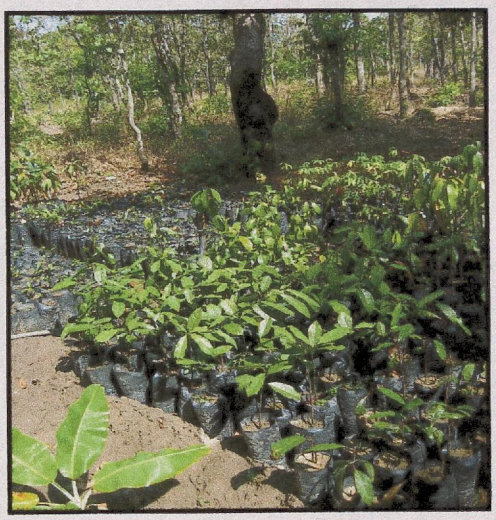
Place: Manajavalli, Mundigehalla, Dattatraya Farm,
Number of Participants: 19 (10 females/9 males)

On Saturday, April five, two thousand and eight, Prakruti arranged an exposure visit for the ongoing *Garcinia* domestication project. The participants were all from the Karoor village but most were from the Karoor women's Self-Help Group, which is already responsible for raising two nurseries in the village. The objective of the visit was to exchange information on cultivation aspects and especially to give mini-workshops on both cultivation and grafting of *Garcinia.*

The exposure visit began at one of three NTFP nurseries being tended by Prakruti itself in Manajavalli. Here the participants saw an example of a NTFP nursery in full swing. Notably, they were able to see rare plants, such as, red sandalwood, and unique varieties of surgi and wild mango. At this nursery, Prakruti team member, Satyanarayana, demonstrated the steps to germinating the difficult C. strictum seeds.



Then the visit continued onto Mundigehalla, where, assisted by Prakruti's team member and master graftsman, V.G. Hegde, the participants were given a grafting demonstration. Following the demonstration each participant was given a *Garcinia* and mango sapling to graft for which everyone was successful. The participants took their grafted plants home to plant!





From here, the exposure visit traveled to Dattatraya Hegde's farm, a Prakruti resource person. On this farm the participants had a chance to see a plantation style domestication of NTFP species. Dattatraya has some nine NTFP species growing: Uppage, Kokum, Wild Mango, Vate, Amla, Jackfruit, Cinnamon, and Soap Berry. Dattatraya, having more than 10 years experience with the domestication of NTFP species, led a discussion on the grafting techniques of mango, Uppage and Kokum, among other topics. The participants were particularly impressed with the 12 wild mango varieties which Dattatraya explained gave profit after only six years.



After eating lunch, the group was taken to the famous Shivaganga waterfalls, which the participants had never previously visited, to add an element of sightseeing to the exposure visit. The rains came and drenched everyone which brought an end to the trip. The participants were brought back to their village by evening time. The Karoor exposure visit was successful and will give way to many more to come with other villages.

GEF/CCF Small Grants Program- India
Project Progress Report (Quarterly)

A participatory Approach to Domestication of Garcinia gummigutta and Fruit Processing.

(Project Number: **SGP/GEF/05/KAR/10)**

Period covered by the Report: **1st July 2008 to 30th September 2008**



Implemented by:

Prakruti
Sirsi,-581401, Uttar Kannada
Karnataka, INDIA

GEF/CCF Small Grants Program- India

Project Progress Report (Quarterly)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Secretary by the Partner Institution)

1. Grantee Partner

Name of local NGO/CBO: **Prakruti**

Grant Recipient/ Address...**Prakruti, Hulemalgi Building, Chowkimath, Sirsi,-581401, Uttara Kannada, Karnataka INDIA**

Telephone/ Fax/ Email: **08384-225139,** appiko@sancharnet.in,

Person in charge of Progress Report: **Pandurang Hegde**

2. Identification of the Project

Project Name: **A Participatory Approach to Domestication of *Garcinia gummigutta* And Fruit Processing**

Project Number: **SGP/GEF/05/KAR/10**

GEF Thematic Area: **Biodiversity Conservation and Climate Change**

Location of Project: **Uttar Kannada district, Karnataka State India**

Project Start and End Sates (as in the MOA): **1st October 2005 to 31st March 2008**

Changes (if any) in Start or End dates: **End date 30th September 2008**

Period covered by the Report: **1st July 2008 to 30th September 2008**

3. Financial Summary:

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant amount	11,11,200
SGP Funds received to date	11,28,921
SGP Funds spent to date	11,22,637
SGP Grant disbursement requested	We have received the first, second and third and final installment.

4. Project Co-financing Received: *(increase number of rows as required)*

Source(s)	Type (In – kind or Cash)	Amount (Rs.)
Community	In-kind	Nil
NGO	In cash	Nil

5. Progress Report

a. Detailed Summary of Activities (*Increase rows as required*)

(Guidance Notes: Give details on each the activities performed, as specified in the MOA)

Sl.No.	Activity as approved in MOA	Progress as on date	Remark
1	• Alternate products from the *Garcinia* fruit and seeds.	• This year because of high fruit yield, there is more seed production, and the collectors have stocked the seeds for oil (butter) extraction. Prakruti established two oil expellers exclusively for *Garcinia* oil extraction at village level. It has already started working and people are extracting the butter.	Prakruti is involved in marketing of NTFPs at different places. *Garcinia* butter is also one of the product that is marketed
2	• Construction of alternate fuel wood saving devices.	• All the 10 dries constructed under UNDP-GEF-SGP project are working and this year it was utilized fully for two months because of heavy crop of *Garcinia* Fruits.	Thousands of tons of fuel wood saved and good quality rind produced.
3	• Identification of superior types of Garcinia gummigutta for domestication.	• In the Nursery we are experimenting the grafting of superior type and red variety *Garcinia gummigutta.*	Prakruti is maintaining Nursery with the community, in which we are raising of *Garcinia* seedling
4	• Workshops and meetings.	• One exposure visit had been arranged for 2nd group of Karoor Stree Shakti Sangh for second generation. (detailed report & photos attached) • Seventeen Journalists & T.V media people were taken to *Garcinia* Valley and they covered the activities around *Garcinia gummigutta* and also showed newly explored red variety of *Garcinia gummigutta* (details & photos attached) •	Training in Grafting of species & exposure visit gave the community broader out look towards what they are doing and the purpose of biodiversity conservation. Because of media coverage lot of people came to know

			about this issue.
5	• Capacity building of local groups in management of the resources.	• More self help groups showed interest in raising nursery & adoption of efficient processing methods and planting NTFP species around their village.	Because of ongoing activity SHG's of other village are also showing interest in the Project
6	• Promoting community management plans for natural resources.	• Regular meeting & interaction has been done. • The community needs small butter expeller units. (Hand driven without electricity). • Community driers are more welcomed by the people. • Wet rind for HCA extraction for experimental purpose could not be bone because of time constraint and that has been discussed with people to do it in future.	In Kerala in order to extract virgin coconut oil they have developed a hand driven machine. That can be tried for *Garcinia* seeds.

b. **Results** ***(Use as much space as required)***

- Due to remoteness of the villages NTFP Collectors could see the external world through exposure visits. This time the new group of Stree Shakti Sangh members of second generation got the opportunity to see the domestication of NNTP's, Nursery, grafting training. Immediately they started raising community nursery in their village with *Garcinina* and mango species.
- Till the last phase of the project 10 driers were established at different geographical regions.
- This year because of abundance of *Garcinia* fruit all the driers worked full time and collectors saved the fuel wood and got the quality product.
- The forgotten grand mother's recipe the *Garcinia* butter production has been promoted by 'Prakruti'. Due to more seed production and using the newly established oil expeller there is every possibility of more value added product of butter. This acts as extra savings for them as they do not need to purchase edible oil from the market.
- Through the Green Festivals Prakruti promoted planting of NTFP species in and around the edge of the villages. The villagers already fedup with the monoculture Acacia plantation by Karanataka Forest Department which has no relation to their livelihood.
- Because of extensive media coverage these villages have come into limelight all over the state. One of the daily wrote an editorial saying that these villagers have a solution to farmer's sucides to visit these villages to see sustainable living with meager income.
- Through the media only external world came to know about the rare variety of red *Gracinia gummigutta* variety. Otherwise up to now every body knew yellow variety only.

C. New Developments, unexpected difficulties/problem & Action taken to solve them ***(use as much space as required)***

- Through 'Prakruti' established 10 driers with the help GEF-SGP, we were not aware about the efficiency of these driers. In order to evaluate the performance of these driers a technically skilled, person was appointed during the rind drying season.

- He evaluated three driers. The results, recommendations in detail are attached with this report. This will help in planning the project for second stage.
- Prakruti decided to publish a booklet on NTFP's. The publication will include 10 priorities NTFP' species. This will contain detail information on *Garcinia* species. The publication will be with in local language Kannada, published and distributed by the end of October.

- **D. Lessons Learned:** ***(Use as much space as required)***

  - Exposure visits and training programmes are important tools for awareness in all the aspects of NTFP related activities.
  - Evaluation at every step is very important in getting the quality product and services. (e.g. evaluation of drier)
  - Frequent visit to the community and meetingm keeps the people motivated.
  - Nursery raising and planting is important activity which is done by women and they are keen on working on the issue.

E. Requested for Project Revisions, if any (Use as much space as required)
(Guidance Note: nature of proposed revision (s) ; Reason for proposed change in project compilation date; proposed budget revision. Please indicate here if you would like authorization for increasing any budget; line and which line (s) should be decreased as a result, considering that the total SGP project cost should be maintained at the same level)

- Nil

F. Additional Information: (Use as much space as required)
(Gu*idance Notes: Provide information on the points given below and add more point if necessary)*

1. **Project output indicators to monitor and evaluate progress in activities.**

   Identification of superior types and domestication effort needs to be extended to entire l Western Ghats region.

2. **Links and participation that has been accessed by NGOs from communities, Government departments and other institutions.**

   Fuel-efficient driers and ovens needs to be installed in several other groups.

3. **Impacts of the project in terms of Policy/ Advocacy / Sustainability and Replicability of the project purpose/strategy, etc.**

   Result and lessons of sustainable harvesting practices and community management plans could be used in other regions and for other Non Timber Forest Producing species.

4. **Press/Media coverage/ links established in the project to the similar initiatives/networking with other NGOs.**

   Result of workshops and meeting were covered in the regional and state level newspapers.

5. **Details how the project is enhancing and creating institutional sustainability for project.**

Other NGOs in the district, College of Forestry Sirsi, Forest Department, Indian Institute of Science have participated in the project activities.

UNDP Quarterly Expenditure Report
1st July 2008 to 30th September 2008

S.NO.	No.&Date of Invoice/Receipt	Description of Expenditure	Budget Head	Cost (Rs.)
1	4/7/08	Paper +Xerox + stationery	Communication & administration	2,000.00
2	29/7/08	Traveling expenses	Traveling cost	2,600.00
3	30/7/08	Salary (July 08)	Manpower	9,040.00
4	30/7/08	Traveling expenses	Travel cost	2,500.00
5	30/7/08	Xerox + Printing + Stationery	Communication and Administration	3,700.00
6	18/8/08	Phone bill	Communication and Administration	415.00
7	18/8/08	Phone bill	Communication and Administration	524.00
8	19/8/08	Evaluation report & travel	Contingency	11,000.00
9	27/8/08	Xerox + stationery + Box file	Communication and Administration	2,000.00
10	28/8/08	Traveling expenses	Traveling cost	1,430.00
11	29/8/08	Salary (Aug 08)	Manpower	9,040.00
12	16/9/08	Office Assistants Bus pass	Communication and Administration	461.00
13	16/9/08	Consultants fees + NTFP – Domestication person. Dattatraya Hegde	Consultancy	5,000.00
14	16/9/08	Consultants charges V.S.Sharma	Consultancy	15,000.00
15	16/9/08	Salary	Manpower	3,040.00
16	16/9/08	Traveling expenses	Traveling expenses	1,242.00

17	20/9/08	Raghavendra Bettakoppa (Writter Journalist)	Publication & Documentation	25,000.00
			Total	**48,743.00**

Cumulative Expenditure Report
1st July 2008 to 30th September 2008

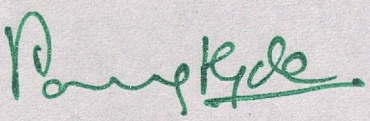
Budget Head	Approved Budget (Rs.)	Expenditures this period (from above (Rs)	Cumulative Expenditure (Rs)	Balance (Rs.)	Co-financing accessed
Man power/labor	54,240.00	21,120.00	54,240.00	Nil	
Training/Seminar/ Workshops etc.	28,000.00	Nil	9,000.00	19,000.00	
Contraxts/Consultant	20,000.00	20,000.00	20,000.00	Nil	
Equipment/Furniture	Nil	Nil	Nil	Nil	
Others(specify)					
Project Activities	55,000.00	Nil	75,000.00	-20,000.00	3,000.00
Travel Cost	15,000.00	7,772.00	15,015.00	-15.00	
Communication and Administration	14,000.00	8,161.00	15,861.00	-1861.00	
Documentation and Reporting	25,000.00	25,000.00	25,000.00	Nil	
Contingencies	11,000.00	11,000.00	11,000.00	Nil	
As per contract **Total**	**2,22,240.00**	**93,053.00**	**2,25,116.00**	**-1876.00**	**3,000.00**
Remitted amount	**2,18,400.00**	**93,053.00**	**2,25,116.00**	**-7,716**	**3,000.00**

6. Financial Report

Notes:

- Column (1) and (2) should present the budget as approved in the project document.
- Column (3) should be used for indicating actual expenditures incurred only during the reporting period.
- Column (4) should be used for indicating cumulative expenditures incurred since the beginning of the project, including the amount reported in column (3) for this reporting period.
- Column (5) should reflect the balance of project funds, which result from subtracting the amounts of column (4) from these entered in column (2).
- Column (6) if the NGOs or communities have accessed funds as co- Financing from other Sources. This is essential as it creates that how GEF is leveraging on other sources.

Report Submitted By:



Name: **Pandurang Hegde**
Designation: Director Programs

Signature:
Date: 10th October 2008

Karoor – Streeshakti exposure visit

- Participants : 16 Members (Girls & daughter in laws) of chowdeshwari stree shakti sangh.
- Place of visits --- Sirsi – Prakruti Nursery
- Bhairimane NTFP plantation
- Amchimane Nursery
- Tulanbail NTFP – reguneration Domestication
- Shivaganga

The outcome of the Green festival at Karoor is this exposure visit. Prakruti is only interacting and taking up activities with one Bharateshwar Self Helf Group which consists of middle aged women. The performance & Participation was very good. But the Stree Shakti Sangh consisting of young girls & daughter in laws were silent spectators up to now.

But after successful Green festival Stree Shakti Sanga members started complaining about Prakruti's negligence towards them. But Prakruti team convinced them that they were never neglected but they did not come forward. The problem has been resolved in a meeting and members agreed to participate. The first step & activity fixed with exposure visit and next plan Stree Shakti will raise a nursery of 2000 sappling.

So on July 12th 2008 Saturday started the exposure visit for Karoor Stree Shakti Sangha's 16 members. First visited Prakruti's manjuvalli Nursery, then proceeded towards Bhairimane NTFP Plantation. There they saw wild Mango, Kokum, Uppage, Vate, Soapnut Jackfruit etc. the group also discussed about the cost benefit of NTFP and maintenance of NTFPs with Mr. Dattatreya Hegde.

Then the group visited Prakruti's Amchimane Nursery and saw germination methods of mango, *Garcinia* & other seeds. Saw the Nursery of different sps and started demonstration of grafting. Then all the participants grafted the mangoes & *Garcinias.* Highlight of this training was Miss Laxmi Gouda with one hand (physically handicapped) grafting successfully . Then the group took lunch at Hulekal and proceeded towards Tulanbail Late Mahabaleshwar Hegde regeneration type domestication farm. There the group saw 40 year old Uppage, Vate,

Soapberry, Kokum etc with full crop. They discussed the history and yield of this farm with the son in law who is looking after the farm.

Then the group proceeded towards Shivaganga falls which is in full roaring due to mansoon. After sightseeing all the group members returned to their Karoor home.









Exploration of Red variety *Garcinia gummigutta*

As every body in the NTFP field know about the common yellow variety of *Garcinia gummigutta*. Prakruti members while collecting the seeds for their nursery came to know about red variety of *Garcinia gummigutta* near famous Unchalli falls in midst of the dense tropical forests. Mr. Satish Hegde showed the Varity and explained the quality and color variation of the fruit. The rare variety of this red color attracted the people and Prakruti arranged a trip to the place about 40kms from Sirsi town for media people.

Media team visited this place and documented and has written articles and telecasted in the TV.

The rare variety of this *Garcinia gummigutta* attracted lot of people and information has been given to people. Prakruti grafted this variety and next year it will be distributed within the community.



Publication

Book title: Priority NTFP

- Information on *Garcinia gummigutta* and *Garcinia indica* e.
    - Information on 12 NTFP Species.
    - Approximately 60 pages will be there in the book. Size 118, good quality paper.
    - Each variety will have photos

The priority Variety covered will be as follows

1. *Garcinia gummigutta*
2. *Garcinia indica*
3. *Myristica malbarica*
4. *Canarium strictum*
5. *Ailanthus tryphysa*
6. *Mangifera indica*
7. *Phyllanthus emblica*
8. *Phoenix sylvestris*
9. *Cinnamomum zeylanicum*
10. *Bamboo*
11. *Cane*
12. *Apis cerana indica*



EVALUATION REPORT OF DRIERS
(UNDP PROJECT)

September 2008

FOR: PRAKRUTI
BASAVARAJ NILAYA
CHOWKIMATH
SIRSI – 581401

BY: ENSUN TECHNOLOGIES (P) LTD
AT & PO. BHAIRUMBE
TQ. SIRSI – 581402
KARNATAKA
Email : ensuntech@gmail.com

Site: Venktraman Siddi, Shirasgaon, Tq. Sirsi (N. K.)

Case Study 1 (Drier) :

Site: Venktraman Siddi, Shirasgaon, Tq. Sirsi (N. K.)

Evaluation Date: 30/7/2008 to 31/7/2008

Drier Tray Area: 54 sq. ft.

Capacity: 50kg. Wet Uppage per batch

Material Loaded: 50Kg wet Uppage

Wood consumed for drying: 58 Kg.

Drying Time: 23 Hours

Dry out put: 8Kgs. Dry Uppage

Moisture removed in that Batch: 42 Kgs.

Fuel consumption to remove 1Kg. of Moisture: 1.38 Kg

Wood consumed Per Kg of Rind: 7.25 Kg

Quality of the produce is good.

Drier Efficiency: Mass of moisture removed x 600/mass of wood x 3800

(Formula is set by department of ASTRA, IISC Bangalore)

= 42Kg x 600 / 58Kg x 3800

= 0.11 = 11%

Site: Laksmi Siddi, Shirasgaon, Tq. Sirsi (N. K.)

Case Study 2 (Drier) :

Site: Laksmi Siddi, Shirasgaon, Tq. Sirsi (N. K.)

Evaluation Date: 1/8/2008 to 2/8/2008

Drier Tray Area: 54 sq. ft.

Capacity: 50kg. Wet Uppage per batch

Material Loaded: 52Kg wet Uppage

Wood consumed for drying : 44 Kg.

Drying Time: 22 Hours

Dry out put: 7Kgs. Dry Uppage

Moisture removed in that Batch: 43 Kgs.

Fuel consumption to remove 1Kg. of Moisture: 1.02 Kg

Wood consumed Per Kg of Rind: 6.28 Kg

Quality of the produce is good.

Drier Efficiency: Mass of moisture removed x 600/mass of wood x 3800
(Formula is set by department of ASTRA, IISC Bangalore)
= 45Kg x 600 / 44Kg x 3800
= 0.16 = 16%

Site: Mahadevi Ganapati Gouda, Karoor, Tq. Sirsi (N. K.)

Case Study 3 (Drier) :

Site: Mahadevi Ganapati Gouda, Karoor, Tq. Sirsi (N. K.)

Evaluation Date: 4/8/2008 to 5/8/2008

Drier Tray Area: 54 sq. ft.

Capacity: 50kg. Wet Uppage per batch

Material Loaded: 50Kg wet Uppage

Wood consumed for drying: 56 Kg.

Drying Time: 22.5 Hours

Dry out put: 7.5Kgs. Dry Uppage

Moisture removed in that Batch: 42.5 Kgs.
Fuel consumption to remove 1Kg. of Moisture: 1.31 Kg

Wood consumed Per Kg of Rind: 7.46 Kg

Quality of the produce is good.

Drier Efficiency: Mass of moisture removed x 600/mass of wood x 3800
(Formula is set by department of ASTRA, IISC Bangalore)

= 42.5Kg x 600 / 56Kg x 3800
= 0.119 = 12%

Site: Venktraman Siddi, Shirasgaon, Tq. Sirsi (N. K.)

Case Study 4 (Open Fire method) :

Site: Venktraman Siddi, Shirasgaon, Tq. Sirsi (N. K.)

Evaluation Date: 7/8/2008

Tray Area: 32 sq. ft.

Capacity: 50kg. Wet Uppage per batch

Material Loaded: 50Kg wet Uppage

Wood consumed for drying: 91Kg.

Drying Time: 16 Hours

Dry out put: 6Kgs. Dry Uppage

Moisture removed in that Batch: 44 Kgs.

Fuel consumption to remove 1Kg. of Moisture: 2.07 Kg

Wood consumed Per Kg of Rind: 15.16 Kg

Quality of the produce is good.

Drier Efficiency: Mass of moisture removed x 600/mass of wood x 3800
(Formula is set by department of ASTRA, IISC Bangalore)

= 44Kg x 600 / 91Kg x 3800

= 0.076 = 7.6%

Conclusion from the Study and Evaluation:

- Wood consumed Per Kg of Rind in open fire method: 15.16 Kg.
  Wood consumed Per Kg of Rind in Drier: 6.28 Kg
  So Fuel savings in Drier per Kg of Rind : 8.88 Kg

- Drier is used for drying of Uppage is almost 60days per year. So fuel savings from each drier per year is about 4 metric tones.

- The demerits of the open fire method of drying is as follows:
  1. It consumes more fuel wood.
  2. It emits more smoke. It is harmful to health and CO2 emission problem.
  3. Some times it catches fire to shed or home.
  4. Quality of dry rind (Uppage) is not good because it is directly exposed to flame so 20% of the rinds becomes charcoal. So Yield of rind is also less and HCA percentage is very less in the rind.

- The driers are established in those areas where Uppage is available in plenty

- These driers are being used by individuals because capacity of the drier is too small. It is not sufficient to dry the materials collected by one family. Also it is recommended to provide the driers to individuals because Drier handling and maintenance will be done properly.

- These driers are being used for total installed capacity. Capacity of the drier is too small. It is advised install 100Kg. wet Uppage drying capacity drier.

- These driers are being used for drying Uppage. Uppage season is only 60days in one year. Thus the drier will be idle for other ten months. So Prakruti should try to use drier efficiently for processing other crops during idle time. For example it can be used for drying of Jack fruits, Banana, Areca nut, Cardamom, Cinnamon bud, Suragi flowers, Nutmeg, Some medicinal leaves, to reduce moisture in Honey and Kokum Syrup. So that the community can get some income from these driers by the way renting or own use.

- Drying of Uppage has affected the G I Mesh trays. Corrosion of G I Mesh is a big problem. This problem can be solved by using Aluminum perforated sheets instead of G I mesh. Netted Cane sticks can be used as alternative. This is cost effective. Drier users itself can collect cane sticks and make nettings. By the way we can save about one and half thousand rupees in each drier.

- These driers are efficient than open fire method. We have tested the driers with jungle wood as fuel. Comparison with tested driers The drier which is installed in Lakshmi Siddi,s House (Case study 2 , 16%) is more fuel efficient than case study 1 & 3 (11%). These driers efficiency is not up to the mark. Further fuel efficiency can be increased by making some changes in existing drier design and using non corrosive metal body with Glass wool insulation. More than 25% efficiency driers are available in market.

- Quality of the dried Uppage is good. Capacity of the drier is not sufficient to meet even one family's requirement. 100Kg. wet Uppage drying capacity drier is suitable for the family requirement. This drier is costing more than Rs. 9000 the existing driers. Also it is more efficient than the existing driers. Cost benefit ratio is more in 100 Kg Uppage drying capacity drier compare with existing 50 Kg Uppage drying capacity drier.

- Quality of the dried Uppage is good. Drying is made easy. Users are getting higher yield than open fire method drying. Fuel wood requirement is very less so they need less time for fuel wood collection and they can utilize more time on other income generating activity.

- Community participation has given motivation on fuel savings and production of quality product by using driers. Handling and maintenance is difficult in community driers. People won't take responsibility in community driers. Also installed capacity is not sufficient for one family requirement. So it is advised to install driers in individual houses through community and assign the responsibility to those families.

Quality of Rind: In open fire method approximately 20% Uppage (Rind) will become charcoal because of direct contact with fire. The quality will be low and weight (Yield) also will be less. If these Uppage fruit is dried in drier, quality of the rind is good and weight (Yield) will be more. This has been observed in Drier evaluation case studies. Prakruti should try to convince traders to pay the premium price for drier dried products or they should be linked with pharmaceutical companies who use the rind.

Total dry Rind produced per year in Sirsi and Honnavar division as follows
Sirsi Forest Division
Year 2004 - 2005 - 2170.598 Metric Tonnes
Year 2005 - 2006 - 1362.887 Metric Tonnes

Honnavar Forest Division
Year 2004 - 2005 - 61.600 Metric Tonnes
Year 2005 - 2006 - 106.150 Metric Tonnes

Wood consumed to dry the Uppage (Rind) in both the divisions as follows

Year 2004 - 2005 - 2232.198 x 15.16 = 33840.122 Metric Tonnes
Year 2005 - 2006 - 1469.037 x 15.16 = 22270.601 Metric Tonnes

If these quantity could have been dried in drier, Fuel savings will be as follows

Year 2004 - 2005 - 2232.198 x 8.8 = 19643.342 Metric Tonnes
Year 2005 - 2006 - 1469.037 x 8.8 = 12927.526 Metric Tonnes

An Average Fuel savings per year is 16285 Metric Tonnes

Recommendation:

1. Prakruti should request the Forest Department to install more driers for processing the Uppage as it will save wood.
2. This savings form fuel wood burning would help in getting carbon credits

3. Model EDM 50 (100 Kg wet Uppage drying per Batch) is best option in terms of size and efficiency drier for this region

UNDP-GEF-SGP.

PRAKRUTI.

GARCINIA DOMESTICATION.

FINAL REPORT.

OCT 2008.

PRAKRUTI
Hulemalgi Bldg.
Chowkimath
SIRSI (Uttara Kannada)
Karnataka-581 401

GEF SGP The GEF Small Grants Programme www.undp.lt/sgp

CEE
Centre for Environment Education

Form: 5

Final Report

(To be completed by NGO/CBO grant recipient.)

(To be sent on Quarterly basis to CEE Regional Coordinator and GEF SGP NC Sectt. by the Partner Institution)

1. **Grantee Partner**

Name of local NGO/CBO:	***Prakruti***
Grant Recipient address	*Prakruti Hulemalgi Building, Chowkimath,Sirsi,581401,Uttara Kannada, Karnataka INDIA*
Telephone/Fax/Email:	*08384 – 225139,appiko@sancharnet.in,*
Person in charge of Final report	*Pandurang Hegde*

2. **Identification of the Project**

Project Name	*A Participatory Approach to Domestication of Garcinia gummigutta and Fruit Processing*
Project Number:	*SGP/GEF/05/KAR/10*
GEF Thematic Area	*Biodiversity Conservation and Climate Change*
Location of the project	*Uttar Kannada district, Karnataka State India*
Project Start and End dates (as in the MOA)	*1st October 2005 to 31st March 2008*
Changes (if any) in Start or End dates:	*End date September 2008*
Period covered by the Report:	*October 2005 to September 2008*

3. **Financial Summary:**

Fund Utilization & Disbursement Request	Amount (Rs.)
SGP Grant Amount:	*11,11,200/-*
SGP Funds received to date:	*11,28,921/-*
SGP Funds spent to date:	11,28,921/-
Funds balance as on	*Nil*
SGP Grant disbursement requested:	*Not applicable*

4. **Project Co-financing Received:**

Source (s)	**Type (In-kind or Cash)**	**Amount (Rs.)**
NGO		7000/-
NGO		
Community		30,000/-
Total Co-financing accessed in Rs.		37,000/-
Projected co-financing		

Note: For detailed break up of local contribution during the project period refer annexure-1.

5. Progress Report

a. Participants/Beneficiaries

- Number of females: 300
- Number of males: 125
- Number of children: 155

b. Capacity Building/Training

- Number of females: 250
- Number of males: 150
- Number of children: 59

c. Detailed Summary of Activities *(Increase rows as required)*

(Guidance Notes: Give details on each the activities performed, as specified in the MoA)

Sl NO	Activity as approved in MOA	Progress as on Date	Remarks
1	Alternate products from the *Garcinia* fruit and seeds.	• Promotion of butter extraction • Alternate processing	• Butter extraction from the seeds has been promoted. • HCA extraction from wet rind tried. • Quality rind produced from driers. • Vinegar extraction tried by collectors. • Pickle making tried from fresh rind. • Candle making tried from butter.
2	Construction of alternate fuel wood saving devices	Drier Construction Completed • Big-10 (100 quintal) • Small-4	• Fuel wood saved. • Collectors' time saved. • Smoke reduced • Quality rind produced. • Sustainable processing by community. • Appropriate Technology disseminated to remote area.
3	Identification of superior types of *Garcinia gummigutta* for domestication.	• Identification of plus trees (Collaboration with Forestry College) • Nursery – Grafting – Planting Superior	• Forestry College, Forest Dept, Collectors got idea about plus tress. • Superior types identified. • Superior types grafted. • Seedling from seeds also raised.

		types.	• Planted superior variety plants.
4	Workshops and meetings.	Workshops were held in following places; Forestry College Kakkalli Shirguni Saralagi Onikeri BastiKaikini Karoor Mahime Exposure visits to SHG Karoor Shirsgoan Stree Shakti Karoor – Streeshakti Green festival.	• Community participation in sustainable harvesting of the produce. • Community participation in superior types & plus tree identification. • Skills imparted to community for grafting. • Exposure visits gave idea of domestication (regeneration type & plantation types). • Awareness about planting & protecting.
5	Capacity building of local groups in management of the resources.		• Management plan evolved with community. • New variety of *Garcinia gummigutta* i.e. red explored. • Community bonds strengthened during the project activity.

d. Results *(Use as much space as required)*

(Guidance Notes: The extent to which the objectives specified in the MoA, were accomplished; unplanned achievements; Shortfalls in targets; Describe immediate benefits received by participants and/or recipient communities)

Alternate products:

1. Rind dried in the drier was good quality but the collectors did not get the premium price because the market is controlled by contractors.

2. The age old recipe of butter extraction from seed had been promoted during workshops, meetings and visits. It gave good results as people started producing butter once again.

3. Tried to make candles mixing with bee wax and *Garcinia indica butter* which are harder than uppage butter.

4. Sent samples of wet fruit to Laboratory in Bangalore and requested them to extract HCA from wet rind. But they gave the feed back that it is not possible.

5. Garcinia butter had been packed in glass bottles and kept in co-operative shops for sale.

Construction of alternate fuel wood saving device:

1. In the first phase 5 driers of 1 quintal wet rind capacity were constructed at different places.

2. During second and third phase another five driers have been constructed at different places. All these driers saved almost 70% fuel wood. The quantity of fuel wood saved is Forty tones per year.

3. Also small innovative ovens were constructed at five places which also gave good result almost saving 50% wood. The quantity of fuel wood saved is Ten tones per year.

Identification of superior types:

1. Identification of superior type of *Garcinia gummigutta* has been done with help of Forestry College SIRSI at different sites. We screened *120Garcinia gummigutta* Superior trees and after studying the yield for two seasons 12 trees were selected and scions were collected and grafted.

2. These plants were distributed and planted by Village Forest Communities, individuals and schools.
3. Nursery of *Garcinia gummigutta* and *Garcinia indica* were raised from the seeds. Some plants kept for grafting.

Workshops & Meetings:

Meetings and workshops are tool to create awareness among the people about the resource, sustainable harvesting practices, alternate processing etc. Exposure visit gave them good chance to see the domestication of NTFPs specially Garcinia at different places. After these meetings and workshops, and Exposure visits they took interest in raising nursery, planting, installing driers etc.

Unplanned achievements:

- Nurseries
- Exposure visits.

Shortfalls in targets:

Developing alternative products was difficult because of time constraint and difficult hill terrain and remote area. Garcinia fruit comes in rainy season, wet fruit collection for HCA extraction etc could not be completed. (Vinegar extraction).

Immediate benefit to Community:

- Awareness.
- Saving Fuel wood
- Saving labour costs.
- Quality rind production / Enhanced quality
- Smokeless drying.

e) New Developments, Unexpected difficulties/problems and action taken to solve them (use as much space as required)

During the project period we were able to implement the project with community participation. The Community Based organization like Stree Shakti Sanghs, Self Help Groups exist in most villages. But they are in learning stage. So to convince them to do all the activities with community feeling was difficult. In one of the Stree Shakti Sangh constructed the drier at community place collapsed during heavy monsoon rains. But members did not take any interest in solving this problem. With our follow up, we convinced the Stree Shakti Sangh member and reconstructed the drier.

The Coordinators sudden decision to quit the organization in the middle of the project contributed to the negative impact on the project. But alternate arrangements were made and we implemented the project successfully.

The project area is in the Crest line of Western Ghat and gets heavy rainfall dunning June, July, August. During this season the *Garcinia gummigutta* fruiting and harvesting takes place. So for the project staff to reach the place and project activity takes double the time. The project area and village where Prakruti works have no civil amenities like good roads, and phone connection. This remoteness and inaccessability consumed additional time in implementing the project.

Illiteracy of the people, where Prakruti works is also one of the major concern. It is difficult to communicate with people. Written material cannot be used for communication. So we have to use pictures, photos, films etc..

f. Lessons Learned: (Use as much space as required)

(Guidance Notes: Lessons learnt during project implementation; Request for additional technical assistance etc.)

- Organizing the collectors of *garcinia gummigutta*.
- Raising nursery and imparting technical skills.
- Community participation in construction of structures like driers, ovens etc.

g. Additional Information: *(Use as much space as required)*

(Guidance Notes: Provide information on the points given below and add more points if necessary)

- **What were the principal impacts, lessons learnt form the project?**
  - Interest created among the community about planting NTFP Species linked to their livelihood.
  - Wood savings, smokeless, driers are the main attraction for the community though we have established only (10 plus 5) 15 driers.

- Time is saved in collection of wood. The collector is able to get quality rind. Otherwise 20% of the rind is wasted as it becomes charcoal.
- Sustainable harvesting practices were disseminated through workshops.
- Training programme and exposure visits made strong impact on community to take up the above activities.

- **What were the principal deficiencies/ missing gaps in the project?**
  - To create community feeling is tough task. Because of distance, heavy rains etc follow up activities were difficult.
  - Decision to establish small driers, instead of larger size, made it difficult to use by the community.
  - Because of the delay in releasing the second installment, one year gap was there in implementing the project. This created also negative impact on the Project.

- **What are the products generated by the project: (ex: Publications, Brochures, Videos, CDs, educational materials, models, infrastructure, awards, marketable goods, etc.)**
  - Posters
  - NTFP Sample collection & Display.
  - Infrastructures – Driers & Ovens.
  - Marketable Goods – Candles, butter.

- **Assessment of impact of project in the GEF focal area:**

The project has initiated programs to restore the biodiversity of the tropical forest in Western Ghats. It has attempted to domesticate the endemic species, Uppage (*garcinia gummigutta*) through adoption of multiple strategies. The mother trees of superior varieties were identified in wild and the seeds from these superior varieties were used to establish plant nurseries involving community participation. The project also initiated programs for domestication of the species through regeneration techniques.

The community led action to install fuel efficient driers has established a model that consumes less fuel wood, with a direct impact on reducing pressure on existing natural forests. Thus, it has contributed positively towards reduction of global warming and climate change and carbon emission.

- **Press/ media coverage / links established in the project to other similar initiatives / networking with other NGOs**

Extensive media coverage has been done. All the workshops and seminars had been covered by local and state level papers. There were fourteen news paper representatives and three T.V. Journalists. These journalists have visited the community and interacted with them and covered the stories of there villages extensively.

Networking with other NGO's has been done. CEE itself has sent LAMPS members from Thirthalli, Karnataka to take a view of the ongoing activity of UNDP-GEF project.

LAMPS from Manchikeri – Yellapur visited the project and discussions done with Prakruti team. VFC Federation, NGO- Federation (Uttar Kannada) interacted at different stages of the project.

- **Future plans (if any) to continue, expand, or replicate project activities:**

As this project was implemented on a small scale with forest dwelling communities, it has successfully evolved a practical model that needs to be scaled up to have a major impact on forest resources conservation and generating sustainable livelihoods.

As there is spontaneous demand from the community to upscale the project, we would like to cater to their demand and have plan to establish hundred such drying units in the forest dwelling communities. This will have incrassated impact in the biodiversity conservation and livelihood opportunities for marginalized forest dwellers. Training, skill development and marketing linkage will be done for value added NTFP products.

- **Additional information if any in terms of awards and certificates of merit, etc:**

  Nil

- **What advice would you give to other organizations designing similar projects?**
  - Strong training programme exposure visit to similar activity to the community to motivate them for action.
  - Initial survey of the village before implementation of the project needs to done.

6. **<u>Assessment of lessons learnt during Project Implementation</u>** ***(Use as much space as required)***

(Use the questions given below as guidance questions and add more question/points if necessary. Also, substantiate the report with supportive documents, letters and evidences)

I. **Describe the effects of this project in relation to the GEF focal areas and operational programs. Explain how the project was able to have an effect on biodiversity, climate change, or international waters. Assess the potential global benefits of this project.**

- The local project of conserving endemic species of uppage *(gracinia gummigutta)* and improved processing techniques are going to have global benefits in two ways. Firstly it has helped to motivate forest dwelling communities to conserve the biodiversity hotspots of Western Ghats in India. Secondly it has proved that by involving local forest dwelling communities, it is possible to evolve a sustainable use of forest resource by adopting a technology that is with in the reach of people to help towards establishing sustainable livelihood opportunities. Similarly, it has the potential to mitigate the impact of climate change through conservation of tropical forests.

II .Did this project link the practice of sustainable livelihoods to a GEF focal area? Describe the strategies employed, indicating what works and what does not.

- Towards establishing sustainable livelihood we employed following strategies:
  - Initiated programme with the community based on their needs and requirements.
  - Community participation from the beginning.
  - Technical input given on time to assist community led actions.
  - Regular follow up and motivating community leaders.
  - Empowering women to own the community assets through CBOs (Community Based Organizations) like Stree Shakti Sangha (Women's Self Help Groups).
  - Linking products to markets.
  - Linkages with local institutions and forest bureaucracy.

III .Is this a community-driven project? How was community implementation and ownership of project achieved? How did this contribute to project success? Also, indicate pitfalls and tactics to be avoided. Explain issues regarding to community participation and ownership of roles and issues.

- This is very much community driven project. The community participation was achieved by:
  - The CBOs taking responsibility to implement the project.
  - The MOU was signed between CBOs and NGO to implement, manage new asset created by the project (Drier).
  - The project succeeded due to an over whelming support of the community and regular follow up by the implementing organization.

- At times people feel that they want to implement the project but they do not have the zeal to do it. Realizing this shortcoming with community, we need to change our strategy and be adaptive to reallocate the project to those in the community who are capable of delivering results with zeal.

IV Was there a capacity-building component in this project? How were local capacities enhanced? How did it contribute to project success? Also what links have been established for them to sustain this as a process

- Capacity building components are as under:
  - Exposure visits to "SEE and BELIVE" what is possible and what they can achieve.
  - Skill development.
  - Enhancing their confidence to deal with bureaucracy.
  - To interact with other stakeholders.
  - The links with local and state level institutions (Forest Department) has helped them to sustain the activity of the project.

V Has this project increased public awareness of local and global environmental problems? Describe how this was done, and whether people are making use of the new knowledge. With which concerned departments/ stakeholders links have been established?

- This project has increased awareness of local tropical forests and its fragile nature in contributing towards mitigating climate change. This awareness programme was carried out by a series of workshops and focused discussion with the community.

- The links were established with:
  - Local village based Institutions like Panchayat Raj Institutions.
  - Local Schools / Colleges
  - Administrative Departments
  - Forest Department
  - College of Forestry
  - VFC's (Village Forest Committees)
  - Federation of VFC's

VI How did women and men participate in planning, implementing, and evaluating the project? Did project proponents plan a gender focus? Or did it evolve in the course of project implementation? What are some of the issues that came up in this regard?

- Women and men participation during the planning was stages were taken. But during implementation of the project, Men were silent spectators. But later stages after seeing the benefits to the community, they also started participating. Definitely both of them participated and gave lot of suggestion during evaluation i.e. internal and external.

- Yes. Because the NTFP collection and processing is mostly done by women. We have to work with all of them.

- Though collection and processing done by women marketing, and utilization of money is always in the hands of men.

- During the project period Stree Shakti Sanghs, got skills and money. This has created problem with men dominated society.

VII Was this project run by indigenous people or involve significant participation by indigenous people? In this context, discuss ethnic, cultural, and historical factors that affected project design, implementation, and results. Discuss the impacts that the projects has made in the area

- Yes. Significant involvement of indigenous people was there in running the project. Some of the communities involved in this project were Siddi's (Negroes), Khare Vakkaliga, Marathis etc.

- The Siddi community has migrated from Portuguese colony from Goa. They are very shy nurtured people and also most totally dependent on forest products for there livelihood. This community is very tough in physical endurance to live and collect forest produce.

- The KhareVakkaliga community is the indigenous but they are half dependent on paddy cultivation for their food and half dependent on NTFP's for their cash income. This community has skills in different art and craft. Women are masters in using natural colors to paint different art on the walls. Men are very good in stick dance and folk songs.

- Marathis are migrants from Maharastra state but forest dwelling community. They are also half dependent on agriculture and on NTFP collection. Considering all the above said ethnic, cultural and historical factors project has been designed and implemented.

- The women who were involved in drying work were affected by smoke. This is stopped by these driers. They were totally unaware of sustainable harvesting, raising nursery, planting etc.These are positive impact on these people.

VIII How has the sustainability plan and/or prospects been addressed? What aspects of the project design, project implementation, or other factors enhanced sustainability? How could other projects or country programmes use this experience to promote sustainability?

- Nursery raising activity taken up by Prakruti to create awareness among the collectors, and sustainable harvesting is a very good example of how to continues this work. There will be a long term impact on resource base.

- The alternate processing activity has inbuilt capacity towards sustainability.

- The age old butter extraction technique from Garcinia seeds has been promoted and this will have positive impact on family budget of these communities.

IX How the project received co-financing? If so, indicate sources and amounts. Which project components did the co-financing support? How was the co-financing obtained? Describe how links to other donors or agencies were made, networking strategies, and negotiations. Also indicate pitfalls and tactics to be avoided.

- Community and CBO's the workshops and trainings were held in the villages People offered space, time tea and snacks.

- For drier construction the SHG and Stree Shakti Groups provided Soil, Sand, and labor. They also provided shed to protect the drier from rains.
- During identification of plus tress the local people have enough knowledge of high yielding trees and they guided and helped in identifying the plus tress.

X Is this project suitable for replication in other communities or regions? Could it be up-scaled to a medium-sized GEF project? Please indicate any plans in this regard. How would you like this to be addressed and financed?

- Yes.
- Yes.
- This has been written in the future plan. We request UNDP-GEF to give grant to Prakruti, Prakruti will mobilize the community in NTFP processing, nurseries, skill development for livelihood of the forest dwellers.

XI Were there links between this project and the overall GEF? How were these links achieved? How have they benefited the GEF/SGP? How have they benefited the GEF? How did GEF/SGP help the NGO/ Communities to 'leverage better resources from various other sources'

- The biodiversity conservation and climate change issues addressed in the project with positive outcome for GEF. Now the model has capacity to leverage for better resources from other sources.

XII Has this project influenced government policy? Explain what the government policy is, how it has been affected, and the role and nature of GEF/SGP influence.

- The present policy of the government is to auction / tender the Non Timber Forest Produce (NTFP) to the contractors. Thus, these contractors who get the highest bid gets right to collect the produce and market it.
- This has negative consequences on
  - Resource Base: As there is no control over extraction of the produce, it may lead to over harvesting, over extraction affecting the resource base.
  - The forest dwellers do not own the resource; the contractors get exclusive right of access, ignoring the claims of forest dwellers.
  - There is no attempt to conserve the resources as it is treated as 'free for all'

The NGO, while implementing the project has addressed the policy issue through:

- Dialogue with policy makers /officials to incorporate a clause in the tenders / auction demanding that they shall not destroy the resources or over extract the available resource.
- Provide tenurial / access rights to forest dwellers through VFC's over the portion of forest that is used traditionally by forest dwellers.
- Incorporate sustainable harvesting techniques while extracting the resource.

Thus, the NGO was able to leverage with Forest Department to address policy issues and its implementation in the field.

7. Financial report of expenditures (please attach audited utilization certificate)

1	2	3	4	5
Budget Head	Approved Budget (Rs.) SGP GRANT	Total Expenditure (Rs.)	Cumulative Expenditures (Rs.)	Balance (Rs.)