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## Documentation of post-harvest methods and value addition of different NTFPs in Dhamtari forest area

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### Abstract

Study entitled “Documentation of Post harvest methods and value addition of Different NTFPs in Dhamtari Forest Area.” The study was carried out in three study sites Dugli, Nagri and Sihawa range Dhamtari, district of Chhattisgarh. The study reveals that the total 41 plants were documented belongs to 16 Tree, 5 Shrubs, 7 herbs, 4 Grasses, 7 Climbers and 2 Bio – products species. People used processing technique and produce value added product like preserve, candy, jam, RTS, nectar squash, powder by *Aegle marmelos*, Herbal Oil, Nutraceutical Ingredients, Fruits Powder, and Vegetable Powder by *Bauhinia variegata*, Jams, jellies, tarts, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Embllica officinalis*, Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Tamarindus indica*, Aamchur, juices, nectars, concentrates, jams, jelly powders, flakes dried fruits pickle, candy by *Mangifera indica*. This product used by local people for its own purpose and they supplies market for money earning.

**Keywords:** NTFPs, Bio – product, processing technique, beverages

### Introduction

The forests provide timber and non timber forest products besides invaluable environmental services. Traditionally Non Timber Forest Products (NTFPs) refer to all biological materials other than timber extracted from natural forests for human and animal use and have both consumptive and exchange value. Globally NTFP / NWFP are defined as “forest products consisting of goods of biological origin other than wood, derived from forest, other wood land and trees outside forests”. Different terms like secondary, minor or non-timber forest products (NTFPs) are also being used by governments, institutions and academics.

The incorporation of socio-political considerations in NTFP studies, in addition to ecological considerations, allows communities, researchers and managers a more complete view of NTFP and how they fit into complex biophysical, historical and cultural landscapes that are relevant for sustainability and management. Here, we add to these literatures by examining a suite artisanal NTFP, Fruits Powder, and Vegetable Powder by *Bauhinia variegata*, Jams, jellies, tarts, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Embllica officinalis*, Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Tamarindus indica*, Aamchur, juices, nectars, concentrates, jams, jelly powders, fruit bars, flakes dried fruits pickle, candy by *Mangifera indica*, by Gond and Halba communities marketed in Dugli, Nagri and Sihawa market.

NWFP may be gathered from the wild, or produced in forest plantations, agro-forestry systems and from trees outside forests. Examples of NWFP include products used as food and additives (edible nuts, mushrooms, fruits, herbs, spices and condiments, aromatic plants, gums), fibres (used in construction, furniture, clothing or utensils), resins, plant and animal products used for medicinal, cosmetic or cultural purposes.

### Materials and Methods

The study three sites were selected and two villages in each site are selected in Dhamtari district of Chhattisgarh and data was collected on winter and summer season when the NTFPs are extracted from forests and sold in the market. The data was collected on the basis of questionnaire developed for this experiment regarding, processing of the harvested NTFP before storage and marketing of the produce. Out of total tribal families residing in each selected village, a representative sample of 20 percent respondents were selected by purposive sample. Conservation practices of tribal’s was also observed and recorded during the study.

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## Results and Discussion

The collected 41 plants as NTFPs in which 16 Tree, 5 Shrubs, 7 herbs, 4 Grasses, 7 Climbers and 2 Bio – products were collected processing technique used and sold in the market as well as their own use. As evident from Table 01 mostly fruits were collected and processing technique Sun dryer, Air dryer and Electric dryer are used. The fruit processing technique was carried out of *Syzygium cumuni*, *Diospyros melanoxylon*, *Aegle marmelos*, *Tamarindus indica*, *Semecarpus anacardium*, *Schleichera oleosa*, *Emblica officinalis*, *Buchanania lanzan*, *Mangifera indica*, *Terminalia chebula*, *Terminalia bellirica* and *Azadirachta indica* etc. The medicinal plants Kalmegh were kept 2-3 days in sunlight for drying. The most of the trees, shrubs, herbs and grasses were used for medicinal purposes. People used processing technique and produce value added product like preserve,

candy, jam, RTS, nectar squash/leather/slab, powder by *Aegle marmelos*, Herbal Oil, Nutraceutical Ingredients, Fruits Powder, and Vegetable Powder by *Bauhinia variegata*, Jams, jellies, tarts, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Emblica officinalis*, Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Tamarindus indica*, Aamchur, juices, nectars, concentrates, jams, jelly powders, fruit bars, flakes dried fruits pickle, candy by *Mangifera indica*. And many types of value added product made by people.

The collected material like leaves, flowers, seeds, fruits, and rhizomes are processed and making a plates, rope, broom, medicines and many type of value added products. The collection of produce and its post-harvest technique is playing a positive role to preserve quality material for longer duration.

**Table 1:** Processing, Storage techniques and Value addition of NTFPs used by local inhabitants and scientific methods for sustainable utilization

### Trees

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Bel ( <i>Aegle marmelos</i> )	i) Collected fruits kept in clean place in sunlight for 5-6 days for drying. ii) After drying its fruit skull automatically crack down.	i) After drying people sold it immediately.	i) Collected fruits should be kept for 3-4 days on clean cloth or tarpolean or polysheet for sun drying. ii) Fruits are put in extremely hot water for few minutes then remove. This process is repeated for 2-3 times for removing its hard cover. iii) The pulp of fruit should be cut in four parts then pulp spread on clean cloth or bamboo mats for drying. Fruits completely dry in 15-25 days.	i) The dry orange colour and spotless pulp should be packed in plastic bags.	i) After extraction of bel pulp used for the preparation of various fruit products viz., preserve, candy, jam, RTS, nectar squash/leather/slab, powder etc., which can be commercially exploited.
2.	Char ( <i>Buchanania lanzan</i> )	i) Collected fruit kept for 2-3 days in sunlight for drying after removing its pulp from fruit.	i) Dried seed kept in an open room before selling.	i) Collected fruits should be put in a tank which is filled with fresh water than fruits rubbed under water so that pulp come out and flot, which could be removed by decantation and seeds settled down on the bottom. ii) To test healthy seeds for storage seeds are put in a tank full of water, seed settled in bottom would be considered as sound seed.	i) Well-dried seeds should be packed in jute bags for storage.	i) Roasted seeds are used as dry fruit. Seeds are used as condiment and to increase flavor in various sweets.
3.	Kachnar ( <i>Bauhinia variegata</i> )	i) Fresh flower buds and leaves were used as vegetable. ii) Sometimes the leaves are dried for 2-3 days in sunlight to use in lean period.	i) Dried leaves were stored in any moisture proof container or plastic bag.	Not commercialized.	-	i) The product range consists of Herbal Extract, Herbal Oil, Nutraceutical Ingredients, Fruits Powder, Vegetable Powder and many more.
4.	Bahera ( <i>Terminalia bellirica</i> )	i) Selected fruits spread in clean place to dry in sunlight for 4 -5 days.	i) Well-dried brown fruits were stored in simple jute bags.	i) Collected fruits should be spread on clean cloth for 10-15 days then its hard portion should be separated from mingi (seeds). ii) This separate hard cover/pulp again keeps it for 4-5 days to dry.	i) Completely dried pulp should be packed in Jute bag, which has plastic cover in inner part.	Triphala churn.
5.	Aonla ( <i>Emblica</i> )	i) Collected fruits were boiled 10	i) Dried fruits were kept in	i) Collected fruits washed in plenty of running water	i) Completely dried reddish	i) Jams, jellies, tarts, chutneys, beverages (nectar,

	<i>officinalis</i> )	min. for removing seeds.  ii) Then seeds are removed and kept for 4-5 days in sunlight for drying.  iii) Its colour should be reddish brown after drying.	jute bags or clay pot.	properly. ii) For commercial production, rotary washers, or fitted with moving conveyor belt and soft roller brushes are generally employed. iii) Blower fan, solar dryer or pressure less dehydration process is used for drying. iv) Vacuum dehydration process is used at commercial level to maintain its original value.	brown coloured fruits should be packed in plastic bags for storage.  ii) During packing time mouth of bags should be kept little open to avoid smell.	squash and syrup) Pickle and candy etc.
6.	Tendu leaves ( <i>Diospyros melanoxylon</i> )  Tendu fruit	i) Collected leaves were kept in sunlight for 3-4 days to dry. i) Fresh fruits are sold in market thus no need of any process.	i) For storage leaves were tied in bundles. No need of storage.	i) The collected leaves should be dried in partial shade. ii) 20-40°C temperature is good to dry the leaves.	i) Well-dried leaves of same size should be tied with soft rope in bundles then stored.	Bidi, cigarettes. Cigar for export.
7.	Bhelwa ( <i>Semecarpus anacardium</i> )	i) Generally people used the fruits as it is, but sometimes they dry in sunlight for storage and separates from seed.	i) Dried fruits were stored in bamboo baskets or clay pots.	Not commercialized.	-	i) Ink and medicines.
8.	Mahua Flower ( <i>Madhuca latifolia</i> )	i) Collected flowers are spread in clean place evenly for 3-4 days in sunlight for drying.	i) Dried flower were kept in bamboo basket before selling.	i) Collected flowers should be spread as thin layer on polythene sheet for drying in sunlight.	i) Well-dried flowers should be packed in jute or plastic bags immediately after last drying.	i) Food material (laddu, kismis), bio diesel and wine.
10.	Jamun ( <i>Syzygium cumuni</i> )	i) Fresh fruits are sold in market.	i) No need of storage.	Not commercialized	-	-
11.	Kusum ( <i>Schleichera oleosa</i> )	i) Collected fruits kept as it is for 6-7 days and then it could be uncovered. ii) After collection of fruits pulp is removed and seeds were separated. iii) Seed were kept in sunlight for drying.	Dried seeds were stored openly in room.	i) First uncover the collected fruits then crushed by means of fluted wooden roller or crushers are used to remove its pulp. ii) Collected seed evenly spread on clean cloth or polythene sheet for 4-5 days for drying.	i) Dried seeds should be packed in jute bags for storage.	i) Oil is used for soap making purpose.
12.	Imli ( <i>Tamarindus indica</i> )	i) Collected fruits were spread for 2-3 days in room then uncovered.	Uncovered fruits were kept in bamboo baskets.	i) Collected fruits were spread on polythene sheet for 2-3 days to dry then uncovered. ii) Uncovered fruits fiber and seed should be removed, which is called seed less Imli. iii) Imli with seeds and fiber called auti Imli.	i) Phool Imli should be packed in plastic bags and Auti Imli packed in Jute bags for storage.	i) Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy etc.
13.	Mango ( <i>Mangifera indica</i> )	i) Fresh fruit are collected and sold in the market. ii) Damaged fruit are cut into small pieces and dried in the sun light and sold in the market.	i) Seeds kernels and dry fruits are stored in small container.	i) Fresh fruit are collect for aamchur preparation. ii) Fruits are chopped, and seeds are dried in sunlight	i) Aamchur should be packed in plastic bags. ii) Dried seed and fruits packed in Jute bags for storage.	i) Aamchur, juices, nectars, concentrated, jams, jelly powders, fruit bars, flakes dried fruits pickle, candy.
14.	Sal	i) Gum is	i) Gum stored	i) Gum is collected from	i) Gum should	i) Soap, sal butter which is

	<i>(Shorea robusta)</i>	collected from the cut part of the plant with plant debris. ii) Fire used then collecting the seeds and sold in the market.	in bamboo basket.	the cut part of the plant and dried in the sunlight known as dhoop.	be stored in aluminum and steel container	used for cooking, sal seed cakes are used as feedstuffs. Vanaspati Ghee is prepared from sal seed.
15.	Harra ( <i>Terminalia chebula</i> )	i) Selected fruits spread in clean place to dry in sunlight for 4 -5 days.	i) Fruits stored in dry place. Well-dried fruits were stored in simple jute bags.	i) Collected fruits should be spread on clean cloth for 10-15 days then its hard portion should be separated from mingi (seeds).	i) Completely dried fruit should be packed in Jute bag, which has plastic cover in inner part.	i) One main ingredient of Triphala churn.
16.	Kumbhi ( <i>Careya arborea</i> )	i) Flowers are collected and dried in sun light.	i) Dried flower packed in Jute bags.	i) Flowers are collected from the forest then dried in shed and sold in market.	i) Dried flower packed in Jute bags for storage.	-

**Shrubs**

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Ainthe ( <i>Helicteres isora</i> )	i) Fruit and twig were used for medicine purpose.	i) Fruits were dried in sunlight one week.	i) Fresh fruits are collected and dried in sunlight.	i) Dried fruits should be packed in jute bags for storage.	i) Medicine, ropes and cloth.
2.	Ber ( <i>Zizyphus mauritiana</i> )	i) Fruits were kept 3-4 days in sunlight. ii) Ber fruit were generally sold fresh in market. iii) Sun dried fruits also sold in market.	i) Dried fruits were kept in jute bags or bamboo basket.	i) Undamaged and disease free fruits are selected then washed in plenty of water and spread on clean cloth or polythene sheet for drying in sunlight for 5-6 days. ii) Dried fruit pulp should be grinded to get powder form.	i) The fruit pulp powder should be packed in plastic packets for safe storage.	i) Chhuhara, jam, candy, beverages ber roti etc.
3.	Chhind ( <i>Phoenix acaulis</i> )	i) Leaves were properly dried 2-3 days in sun for making broom or other items.	i) Leaves are stored in dry place.	Not commercialized.	-	Juice
4.	Karonda ( <i>Carissa carandus</i> )	i) Fresh fruits and flower are used and sold in the market.	i) No need of storage.	Not commercialized.	-	Pickle, chutneys.
5.	Chameli ( <i>Jasminum arborescens</i> )	i) Fresh fruits and leaves were used as medicine.	i) No need of storage.	Not commercialized.	-	Cosmetic perfume, oil, soap.

**Herbs**

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Charota ( <i>Cassia tora</i> )	i) Its leaves were dried in sunlight for 2-3 days. ii) The collected pods of charota are kept in sun light to crack the pods for easy separation of seeds. iii) Separated seeds are again kept 1 day in sunlight for drying.	i) Dried leaves and seeds were kept separately in bamboo baskets or any other container.	i) Tray drier or electric drier should be used for drying seeds.	i) Leaves and seeds should be stored separately in plastic bags.	i) <i>Cassia tora</i> tea is a herbal, pure, natural and non-polluted green health beverage (coffee-tea), substitute for coffee and sodas.
2.	Mushroom	i) Fresh mushroom used as vegetable and sold in market. ii) Some types of mushroom are sun dried for storage.	i) Dried mushroom are kept in any container such as clay pot or bamboo basket.	Not commercialized.	-	i) Pickle, papad, health power powder, and use as a vegetable.

3.	Kalmegh ( <i>Andrographis paniculata</i> )	i) Collected leaves, fruits or whole plant were kept 2-3 days in sunlight for drying.	i) Dried leaves, fruits and stems were placed in open room.	i) Fresh plants are collected and cleaned with water, chopped into large pieces then dried in the sunlight.	-	Medicine.
4.	Tikhur ( <i>Curcuma angustifolia</i> )	i) Rhizomes are collected and sold in market.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Rhizomes are collected and cut it into small pieces and grind, Five to Ten-time rinsed in water, then dried in sunlight white solid powder is obtained as known as Tikhur.	i) Powder should be packed in plastic bags.	i) Food material Barfi, sweets.
5.	Safed musli ( <i>Chlorophytum tuberosum</i> )	i) Collected tubers are cleaned and dried.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Collected tubers are cleaned and dried.	i) Powder should be packed in plastic bags.	i) Allopathic medicines, sex tonic, Immunity-improving drug, main use to improve the vigour and vitality in men and women.
6.	Kali musli ( <i>Curculigo orchoides</i> )	i) Collected tubers are cleaned and dried.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Collected tubers are cleaned and dried	i) Powder should be packed in plastic bags.	Medicines
7.	Gengi ( <i>Curcuma zedoaria</i> )	i) Rhizomes are collected and sold in market.	i) Dried rhizomes were kept in jute bags or bamboo basket in dry place.	i) Rhizomes are collected and cut it into small pieces and grind, Five to Ten-times rinsed in water, then dried in sunlight.	i) Powder should be packed in plastic bags.	Medicines

**Grasses**

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Munsel ( <i>Iseilema nervosum</i> )	i) Fresh leave are use.	i) No need of storage.	Not commercialized.	-	-
2.	Kans ( <i>Saceharum spoutaneum</i> )	i) Collected spikes kept 3-4 days in sunlight for drying.	i) Dried spikes tied in bundles and broom manufactured during rainy season.	Not commercialized.	-	Broom.
3.	Phulbahari ( <i>Thysanolacons maxima</i> )	i) Collected spikes kept for 3-4 days in sunlight to dry.	i) Dried spikes tide in bundles and Broom manufactured.	Not commercialized.	-	Broom.
4.	Bans ( <i>Dendrocalamus strictus</i> )	i) Harvested bamboo culms keep in sunlight for drying it may cause cracks.	i) Dried bamboo stored only for few days before selling.	i) Seasoning process is used for its long life and strength. Air seasoning is generally used. ii) The bans loachan is extracted from bamboo.	i) Bamboo stored in such a way that equal length and thick stem stored in grade basis for sale. Stored in container.	i) Making bamboo box, bamboo container and other bamboo product. Medicinal value to remove the calcium deficiency in human being and animal.

**Climbers**

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Mahul ( <i>Bauhinia vahlii</i> )	i) Collected leaves tide in bundles of 100 leaves.	i) Collected leaves kept in closed room before selling.	i) Collected leaves kept in a well-closed room before making plate. ii) With the help of machine leaves are joint or stitched. iii) Molding machine is used for press the Dona and Plates.	i) Plates and Donas tied separately in bundles and packed in thin polythene bags carefully for storage	i) Making Plates, donas and rope.
2.	Ramdatoon ( <i>Smilax zeylanica</i> )	i) Harvested twig beaten by wooden rollers then removed its fiber and kept 2-3 days for drying.	i) Dried fiber rolled in bundles for storage.	Not commercialized.	-	Rope.
3.	Baichandi	i) Fresh rhizomes are	i) No need of	i) The thin slices are cut	i) Packed in poly bag	i) Used to fry

	( <i>Dioscorea hispida</i> )	used for medicinal purpose.	storage.	boiling the rhizome.		in oil as a chips with salt and peper.
4.	Karukand ( <i>Dioscorea bulbifera</i> )	i) Rhizomes are collected from soil and cleaned with water and sold in market as a vegetable.	i) Rhizome stored only for few days before selling.	i) Rhizomes are collected from soil and cleaned with water then the upper surface is removed and dried in the sunlight.	i) Rhizome should be packed in jute bags for storage.	i) Use as a vegetable. and medicine.
5.	Bodal ( <i>Cucumis melo agrestis</i> )	i) Fruits are collected and cut into small pieces and dried in the sunlight.	i) Dried material stored in plastic container.	Not commercialized.	-	i) Food material (chips).
6.	Amarbel ( <i>Cuscuta reflexa</i> )	i) Collected climbers kept 2-3 days in sunlight for drying. ii) Fresh climber used as medicine.	i) Dried climbers tied in bundles for storage.	Not commercialized.	-	i) Use as a medicine for skin diseases.
7.	Anantmool ( <i>Hemidesmus Indicus</i> )	i) Roots are collected from soil and cleaned.	i) Dried root should be packed in jute bag for storage.	i) Roots are collected from soil and cleaned with water then dried in the sunlight and made powder.	i) Powder should be packed in plastic bags for storage.	i) Medicine tablet.

### Bio- product

S. No.	Local name	Traditional method		Scientific method		Value addition
		Processing	Storage	Processing	Storage	
1.	Honey	i) Collected honey extracted from honeycomb.	i) Collected honey kept in container like clay pot.	i) All dirt and unwanted material removed from honey with the help of machine to clean the wax, dirt and water.	i) Well-processed honey should be stored in bottles.	i) It has attractive chemical properties for baking and a distinctive flavor when used as a sweetener.
2.	Kosa ( <i>Cocoon</i> )	i) Cocoon are collected and sold in the market.	i) Should be stored in open room.	i) <i>Cocoons</i> are boiled in water; then, Kosa fibres are extracted by rupturing the cocoon.	i) After processing cocoon should be packed in jute bags for storage.	i) Silk saris, highly commercial value of kosa silk.

### Conclusion

It is concluded that total 41 plants were documented belongs to 16 Tree, 5 Shrubs, 7 herbs, 4 Grasses, 7 Climbers and 2 Bio – products species. People used processing technique and produce value added product like preserve, candy, jam, RTS, nectar squash, powder by *Aegle marmelos*, Herbal Oil, Nutraceutical Ingredients, Fruits Powder, and Vegetable Powder by *Bauhinia variegata*, Jams, jellies, tarts, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Emblica officinalis*, Jellies, chutneys, beverages (nectar, squash and syrup) Pickle and candy by *Tamarindus indica*, Aamchur, juices, nectars, concentrates, jams, jelly powders, flakes dried fruits pickle, candy by *Mangifera indica*. This product used by local people for its own purpose and they supplies market for money earning. NTFPs are major source to generate employment in the study area.

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