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Indigenous Approaches of Post Harvest Storage for NTFPS among Tribal Communities in Bastar, Chhattisgarh, India

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ABSTRACT

The present study was undertaken to identify the various indigenous NWFP storage structures and the methods of storing forest produces in the Dantewada district of Bastar division in Chhattisgarh state during the year 2018-19. The storage structures varied depending on the types and size of NWFPs, climatic conditions and rainfall etc. To fulfill the objectives of study, 60 households were selected randomly as a respondent. The findings of research indicated that most of the spoilage on NWFPs occurs due to improper storage techniques in the study area. It was also observed that NWFPs play a significant role in the economic empowerment of tribes by providing them with almost year-round income and employment. However, they do not get actual returns due to insufficient storage techniques. It is of economic value at the village level, especially for forest-fringed areas tribe, providing a significant source of income the whole year. Apart from this process providing cash income, it also plays an essential role in food security. Even today, in rural areas, forest produce is stored in traditional ways like bamboo bins, sacks made of jute, and plastic sack etc. With the passage of time, storage methods have also changed; this is why people now keep forest produce in plastic drums. But for this, the forest produce should be cleaned and dried thoroughly before storing it, so there is no problem to store. There is still need to invent more methods regarding storage so that the villagers can benefit from it in future.

Key words: Post harvest storage, Physical factor, Storehouse, Spoilage, NTFPs, and Tribal etc.

Introduction

Non-wood forest products (NWFPs) play a key role in the life and economy of communities living in and around forests. NWFPs have a tremendous potential to create large scale employment opportunity thereby helping in reducing poverty and increasing empowerment particularly in tribal population. They depend upon forests for their existence in several ways; their degree of dependence varies with several factors including availability of NTFPs, col-

lection and storage technique, socio-economic conditions, distribution, cultural and religious norms, literacy etc. The people, mainly tribal living within or in the margin of forest areas collect NWFPs in their daily life. Whereas, the primitive tribes, who are living inside dense forests whose very poor and depend entirely on forests for meeting most of their needs. So after the collection of NWFPs from the forest, processing and storage techniques are most important to avoid the losses during the post harvest such as weight loss, insect infestation and pathologi-

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cal decay at the time of storage. Due to unhygienic collection, processing and storage the overall quality of produces was deteriorate. Therefore a survey study was conducted during the year 2018-19 among the tribal people in Bastar division of Chhattisgarh to get information and facts related to traditional knowledge on the storage of NTFPs.

As per the (SFR, 2019), forest and tree cover is 71.22 million hectares, 24.56 per cent of the geographical area in the country. It includes forest cover (21.67 %) and tree cover (2.89 %). Amongst all the Indian States, Madhya Pradesh has the maximum forest cover area, followed by Arunachal Pradesh, and Chhattisgarh stands in the third position. As per the record, the forest area in the State is 55,621 km², which is 41.14% of its geographical area (SFR, 2019). In Chhattisgarh, 11,185 villages out of 19,720 are forest-fringed and tribal-populated. The tribal population of the State is 78.22 lakhs, which is 30.62 per cent of total population (Census, 2011).

Non-timber forest products like fuel wood, grass, fodder, food, medicinal herbs and house building materials are very important contributors to the well being or livelihood of villagers (Basu, 2009; Sarmah, 2006; Shit and Pati, 2012). Major non wood forest products are available in Chhattisgarh are Mahua, tamarind, amla, Behara, Harra, Tendu Patta, Mahul Patta, Cashew nut, number of medicinal and aromatic plants, Mango, Neem, Silk cotton, Honey, Bees wax, Shikakai, and other edible fruits, seeds, barks and vegetable leaves were collect, process, stored and used them as per need by the tribal community of Bastar division of the state.

In Chhattisgarh there are two types of NTFPs based on existing marketing strategies Nationalized and Non-nationalized. The forest-dependent communities are free to collect Tendu patta, Sal seed, Harra and Gum (Khair, Dhawara, Kullu and Babool) from the state's forest areas and sell these products to the notified purchase centres of Chhattisgarh Minor Forest Produce Cooperative Ltd. at the predetermined rate decided by the Federation. Because of this, establish the CGMFP Federation to promote trade and development of these minor forest produces (MFPs) in the interest of MFP collectors, these are mostly tribal. The registered collectors of Tendu patta are entitled to a bonus on the profits and group insurance facilities. The remaining other MFPs were left free for trade because their distribution and production varied concerning time and space. As a result, villagers would get as-

sured minimum prices for nationalized NTFPs, but low collection prices and often exploitation by intermediaries for the non-nationalized NTFPs due to inadequate market facility development in the remote rural areas. The forest-dependent communities are entitled to collect non-nationalized non-wood forest products, including medicinal plants, by non-destructive means and sell them in the open market anywhere at any time.

The present study was conducted at Dantewada district a South part Bastar division of state, The forest cover of the Dantewada district is 4,463.15 sq. km. which is 53.79 % of the total geographical area (SFR, 2019), and the tribal population is 37.1% of the total population of Dantewada district (Census, 2011). This population predominantly lives in and around the forest for their sustainable livelihood; they mostly depend upon agriculture and daily wage earning. Nevertheless, due to the predominance of mono-cropping and rain-fed farming, the income generated through agriculture is not adequate for their sustainable livelihood. Consequently, the tribal population also depends upon other alternative sources of income like forest produce (especially NWFPs), non-agricultural activities like business and animal husbandry, and government or private jobs. Among these alternative sources of income, NWFPs play a significant role in their sustainable livelihood by providing them with self-employment and a source of income. Due to the lack of proper scientific investigation and post harvest processing technologies, the flowers are collected and subjected to open yard sun drying before storage (Patel and Naik, 2008). Spoilage during postharvest storage is a major limiting factor for many plants and their products. It directly influences food availability and the economic conditions of inhabitants of many nations. Spoilage or rotting is the most significant form of wastage that accounts for 20–25% of post-harvest losses in Mahula flowers, which become unsuitable only for the liquor distillation units and as cattle feed (Behera *et al.*, 2011; Patel *et al.*, 2011). Under extreme temperature (<400C) and relative humidity (<85%) during summer months (April to June) in the tropics, mahua flowers suffer post-harvest losses such as weight loss, insect infestation and pathological decay during transportation from forest to local market and in storage (Sidhu *et al.*, 2009). Then their storage methods of potential NWFPs were studied as one of the objective among the tribal communities. Keeping in view

the importance of non-wood forest products storage techniques and other post harvest techniques, the present study was carried out among the tribes of Bastar division of the Chhattisgarh.

Materials and Methods

Chhattisgarh is located in the central part of India between the latitudes of 17° 46' N - 24° 5' N and the longitudes of 80° 15' E - 84° 20' E. The Bastar plateau comprises Dantewada, Bastar, Narayanpur, Bijapur and a part of Kanker but excludes Charama, Narharpur and Kanker blocks of the Kanker district. In this area, the tribal population of Gond, Halba and, Bhatra, Maria & Muria are present, predominantly depend on NTFPs, and conventional farming for livelihood. Dantewada, also called Dakshin Bastar, was carved out of the former Bastar district on 25th May 1998. The district was further bifurcated in 2007 and 2012, resulting in two new districts, Bijapur and Sukma, respectively. Dantewada is inhabited by tribal communities, such as Maria, Muria, Dhurwa, Halba, Bhatra, and Gonds etc. Dantewada is located at 18.899 °N 81.347 ° E. It has an average elevation of 351 meters (1154 ft). Its geographical area is 3,410.50 km² having 283,479 Population as per Census, 2011. Dantewada has an average literacy rate of 42.12%, lower than the national average of 59.5%. Here the forest area is spread over 4,463.15 km², in which *Shorea robusta* is the dominant tree species, followed by *Madhuca indica*, *Buchanania lanzan*, *Diospyros melanoxylon*, *Schleichera oleosa*, *Syzygium cumini*, *Mangifera indica* and other tropical moist and dry deciduous species.

To fulfill the objectives of the present study Dantewada district was selected reason behind it, the maximum tribal population resides in or around the forested areas. The study deals with the different facts of NWFPs viz; collection strategies of selected NTFPs, processing methods, primitive storehouse structure and storing method and marketing possibilities in and around the forest villages. The present study was conducted in six forest villages (i.e., Awrabhata, Balpet, Badekameli, Faraspal, Bhatpal, and Alnar, etc) of Dantewada district, Chhattisgarh. These villages are forest-fringed and the villager's livelihood partially depends upon the collection of NTFPs and by sale in local weekly markets or Haat/ Bazaars. The study area was surveyed purposively through a planned household survey with the help of a well-prepared questionnaire.

To fulfill the objectives of the study we selected two-block randomly from the Dantewada district. After that, three villages from each block were chosen randomly. Finally, ten respondents (tribal NTFPs gatherers) were selected randomly from each of the selected villages. Thus 60 respondents were selected from the desired district/state to assess the collection strategies and indigenous approaches of post harvest storage of NTFPs, and each farmer in these villages was interviewed personally, and information on the different items was collected *i. e.*, collection method and strategies, processing of NTFPs and traditional storage method.



Fig. 1. Geographical Map of study area Dantewada district of Chhattisgarh

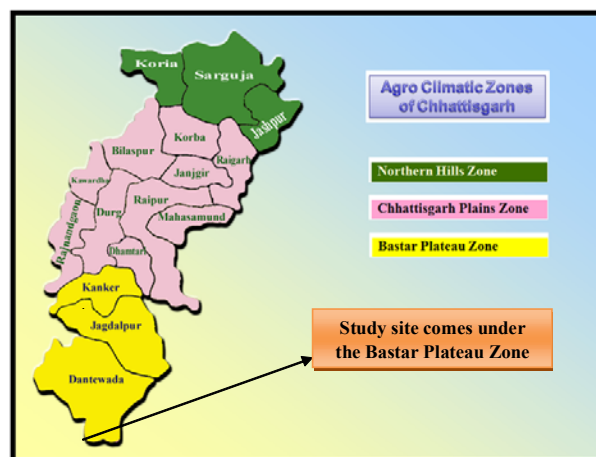


Fig. 2. The study site comes under the Bastar plateau

Results and Discussion

The study was entitled **Indigenous approaches of post-harvest storage for NTFPs among tribal communities of Bastar division of Chhattisgarh**. The results relevant to availability of NTFPs, primitive storehouse structure and storage method and influences on the NTFPs market are presented with the help of appropriate tables and figures along with the discussion. The results and discussion were elaborated in the following heads.

Availability and Collection strategies of NTFPs in Dantewada District

The important NTFPs in the Dantewada district are Mahua, Tendu leaves, Chironji, Bhelwa seed, Imali, Dhawai, Karanji, Harra, Behda, etc. During the collection season, local tribal households, including males, females and children, collect the NTFPs from surrounding and inside the forest. Still, the involvement of women in the collection of NTFPs is more significant than others. For a collection of NTFPs, tribal, including women and their children, go inside the forests and distances travelled from 1-10 km. Different family members are engaged in different forest produce collection as per choice and availability such as the women and small children of the house go for Mahua collection reason behind it mostly Mahua tree is around the agricultural farm/house/near the forest or in the fields. In contrast, the elder members, including males and females, are involved in Tendu leaf collection because they must go away for collection. The availability and potential NTFPs collected by tribal community in study area presented in the Table 1.

Collection method of different NTFPs

Mostly rural and tribal people of the Dantewada district were found to collect various forest products from the forest areas for their livelihood as shown in (Table 1). In present study, four potential and major forest products were observed to be collected by tribal from both the blocks of the Dantewada dis-

trict. According to respondents, in the old days, a variety of NTFPs was found in hug amounts in forest-fringed areas, but now we are facing a scarcity regarding NTFPs in the study area. Results also revealed NTFPs collection differ person to person and also changed from time to time; it depends on availability, market value and sometime need basis for their own use. They do not go for the Bhelwa fruit collection but Mahua flower & seed, Char fruit and Tendu leaves collections they like mostly. The collection period of NTFPs were found to be differing as per the phenology of that particular tree. Result showed maximum number of plant products were found to be collected in the summer season. In contrast, some NTFPs were collected during winter, like January and February. Normally, collection work is only done during the summer season, while in the rainy season, no NTFPs were found to collect except medicinal plants and rhizomes. Reason behind, it the maximum NTFPs found available in forests during the summer season for harvesting and collection in maximum and best quality.

The traditional collection method of NTFPs by the villagers is shown in Table 2. According to this, they collect improperly and prematurely to collect more and have to bear the brunt when they sell it and get less income in return.

Rural and tribal people depend on conventional farming systems and NTFPs collection for their livelihood. In the present study, we found that NTFPs are a secondary source of livelihood, and primarily they depend on traditional agriculture farming, but landless people totally depends on NTFPs collection and labourer work. Mostly, people are used to destructive harvesting; they collect NTFP through traditional harvesting methods, like people putting fire to clean floor below the tree before Mahua collection, which may cause a forest fire; it is very dangerous to destroy the forest ecosystem reported in present study. They wanted to do this because the clean surface makes the mahua flower visible. Thus, in the case of Chironji, people collected fruit from March-April when, it was immature; they used to

Table 1. Availability of potential and selected NTFPs in Dantewada district area

Local name	Scientific name	Month of availability	Involvement
Mahua	<i>Madhuca indica</i>	March to April	Female & children
Char	<i>Buchanania lanzan</i>	April to May	Female
Tendu	<i>Diospyrous melanoxylon</i>	April to May	Male & female
Bhelwa	<i>Semecarpus anacardium</i>	May to June	Male

cut their branches to collect fruits which affected the next year's fruit production.

In contrast, completely ripened black-coloured fruit should be collected for healthy seeds and use a leader to climb up to a tree or use the sickled bamboo stick. During the collection of Tendu leaves, branches were also cut, which affected the leaves production of the next year. Every year people should start pruning Tendu bushes of 2-4 cm circumference at ground level to increase the leaf surface area. In case of Bhelwa seed collection, people started the collection before the complete ripening of the fruit; therefore, unripe fruits were also collected.

Processing and storehouse structure of NWFPs in Dantewada district

Product-to-product and place-to-place processing

and storage techniques were differed to NTFPs. In general, rudimentary processing methods are used by tribal, drying the NTFP in many ways, such as the sun or shed drying method; for some plants, produce using rinsing with water to clean the produce, and another method is the boiling method. Gwinner *et al.*, 1990 revealed that storage practices differ; there are small or big storehouses, indoor or outdoor, temporary or permanent, and individual or community storage designs. These structures have open, semi-open, and closed storage systems. Mahua flowers are traditionally stored with cow dung for further use, soil, and paddy straw mix well before applying them in a bamboo bin or basket, then sun-dried for 2-3 days, depending on the intensity of the sunlight. Tribal believe that cow dung possesses pesticidal properties to protect such plant

Table 2. Methods of collection of Potential NTFPs in Dantewada District

Sl. No.	Scientific name	Local name	Traditional method of collection	Scientific method of collection
1	<i>Madhuca indica</i>	Mahua flower & Seed	<ul style="list-style-type: none"> • People put fire to clean floor below the tree, which may cause a forest fire. • Mahua seed collection done at night or day time. 	<ul style="list-style-type: none"> • Brooms should be used to clean the floor. • The tarpaulin is put on the floor so that soil or dust will not stick with the flower, or a mosquito net may be used to tie in the tree's trunk. • Fallen seed collected by people manually.
2	<i>Buchanania lanzan</i>	Chironji	<ul style="list-style-type: none"> • People collected fruit from March-April when it is immature. • People used to cut their branches for collection of seeds. 	<ul style="list-style-type: none"> • Completely ripened black-colored fruit should be collected for good quality of Chironji. • Sickled bamboo sticks should be used for the collection of fruits. • As a possible leader should be used to prick the tree's fruit.
3	<i>Diospyrous melanoxylon</i>	Tendu Patta & Fruit	<ul style="list-style-type: none"> • During collection of Tendu leaves branches were also cut which affects the leaves production of next year. Leaves, which are not suitable for the purpose, were also collected. • Branches were cut to collect fruits from the tree or big stone throw in the bole of the tree to damage bark. 	<ul style="list-style-type: none"> • Only undamaged and disease free leaves should be collected. • All diseased and damaged leaves should be removed before drying. • Every year pruning of Tendu bushes of 2-4 cm girth at ground level increased the leaf surface area.
4	<i>Semecarpus anacardium</i>	Bhelwa	<ul style="list-style-type: none"> • Before complete ripening the fruit people starts the collection therefore, unripe fruits were also collected. 	<ul style="list-style-type: none"> • Collection done with the help of bamboo sticks when tree has maximum ripen fruits.

products from insect infestation. Karthikeyan *et al.*, 2009 studied cow dung immune-stimulant properties increase viability of any seeds.

Preparation of a plastic bag depository is a common method for storing plant produce; this bag is situated on a paddy straw to avoid bottom moisture of the surface, and in the case of mahua flower, the inner part of the bag is also slightly filled by paddy straw all around the plastic bag then plant- produce stored in another plastic bag and put into the bigger plastic bag. In this type of storage, forest produce can be kept safe only for 2-3 months. Short-duration storage of food grains in sacks is widely used in farms, villages and commercial storage centres. Sacks are made of woven Jute, Sisal, local grass, and cotton and depending on the materials that are available in the area. These are earlier used widely in Nigeria and India until the introduction of polypropylene bags; however, farmers still use Jute or Sisal bags. They usually come in sizes ranging from 25 kg to 100 kg bags. Polyethene storage bags create a highly efficient, hermetic storage environment for all NTFPs including agricultural crops. Polyethene bag is placed inside ordinary storage bags for an additional layer of protection to form multi-layer polyethene storage bags to ensure water-resistant and completely air-tight storage condition (Ng'ang'a *et al.*, 2016). With the passage of time, storage methods have also changed; this is why people now keep forest produce in plastic drums, but one major disadvantage of grain storage in a drum is that the drum must remain sealed for it to be effective because the insect is prone to resume physiological activity at the slightest inlet of oxygen

when opened indiscriminately (Hall, 1980; Murdock *et al.*, 1997; Makalle, 2012).

In the study area NTFPs were also stored in earthen pot/structure. In this *practice* involves pouring of NTFPS dry fruits or seeds into the structure and placing a layer of dry sand or cow dung and clay mix at the top to a thickness of 20 cm. The dry fruits or seeds to be stored in this practice need to be dried before storage to reduce the moisture content to safe storage level. Even little excess moisture will spoil the fruits or seeds in this storage practice. The enclosed storage structure provides complete protection to the stored dry fruits or seeds from external pests and insects infestation. Traditional practice of protecting the NTFPs fruits or seeds from the storage pests and insects *Mixing of different plant materials with NTFPs fruit or seeds* practices were also recored in the study area, in this method any one of wood ash, cow dung ash, soap nut leaves, *neem* leaves or *pungam* leaves are mixed and then stored in bins or bags or earthen pot or poly bag. This practice is also used in storage of pulse grain reported by the Reddy, (2006). The rural or farmers believe that these substances act as insect repellents, antifeedant and oviposition deterrents. This practice protects the grains up to few months from pests and insects. Once the effectiveness of plant materials is lost, the infestation spreads very quickly.

During the study we noted the information among the tribal communities in the study area used traditional seed storage methods along with improved seed. These methods have been followed for a very long time and have not changed but improved over the years. These methods were in line



Bamboo bin storage structure for NTFPs



Plastic bag for storage of NTFPs



Plastic drum for storage of NTFPs

with traditional history and songs which are scientific. The methods were scientifically true and logical. The available literature shows the scientific base, cost-effective and viable in poor tribal/rural people situations in forested area and can be used as alternative ways for nonchemical short-term seed storage.

Conclusion

Based on stipulated questionnaires and interviews made of tribal people about the storage technique of NTFPs (*viz.*, Mahua flower and Seed, Chironji and Bhelwa etc), the following conclusion has been derived. NTFPs play an important role in tribal daily life, especially in lean agriculture, *i.e.* April to June when most rainfed tribal farmers remain unemployed. These days, forest produce is the only source of income, which can be sold as per requirement and fulfill their needs, and they can also take onion or salt in exchange for forest produce. But for all this, it is necessary to store the forest produce safely. We need to improve the way of storage for long time use of NTFPs by the rural people as per need basis, especially in scared period.

Even today, in rural areas, forest produce is stored in traditional ways like bamboo bins, sacks made of Jute, plastic sack etc. With the passage of time, storage methods have also changed; this is why people now keep forest produce in plastic drums. But for this, the forest produce should be cleaned and dried thoroughly before storing it, so there is no problem storing it. But for this, first of all, before storing the forest produce, it should be cleaned and dried properly, so there is no problem storing it. There is still a need to invent more methods regarding storage so that the villagers can benefit from it in future.

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