On the Banks of the River

Opportunistic Cultivation in South India

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From time immemorial river floodplains have been an attractive environment for human exploitation, particularly through agriculture and pastoralism. Well-known examples, prehistoric and historic, range from the Mississippi and the Amazon in the New World, to the Danube, Nile, Tigris, Euphrates, Indus, and Huang Ho in the Old World. But river floodplains are dynamic and each is unique in its nature. This article presents one such floodplain in South India and its exploitation through a specific form of agricultural practice called here 'opportunistic cultivation,' an extensive form of cultivation exploiting the annual flooding of the river. Ethnographic research of this nature can be called "agricultural ethnogenesis." Although it is a topic of recent interest, it has enormous implications for archaeological research. Just knowing what crops were recovered at a site is not as informative as knowing, for example, if they were grown at the site or brought in from elsewhere, if they were grown elsewhere but processed for consumption at the site, or if there were particular loci for certain crop processing stages. Such insights into ancient agriculture can be effectively developed through studies of contemporary traditional agricultural practices. Of particular importance is the isolation of the variables that distinguish different crop processing activities, be it through plant part compositions or the tools used. With this in mind, this study specifically addresses traditional cultivation and processing of one type of millet crop in South India.

A Village and a Town on the Banks of a River

Located in the northern part of the state of Andhra Pradesh, the two study areas are set on the banks of the river Pranitha, a tributary of the river Godavari (Fig. 2a). Alongside the river lie fields of crops such as sorghum, legumes, and occasionally maize. The predominant agricultural system is dry farming, which is dependent on the seasonal monsoon rains rather than irrigation. Occasionally well irrigation is utilized, but this is a luxury shared only by a select few. Fishing is an important subsistence activity for some social groups during the dry season. The area was once densely forested but over the years it has been depleted and now only a thorn and scrub forest with some heavy foliage remains.

The two study areas are quite distinct, even though they lie opposite each other on either side of the river. The village of Rapapalli, on the north side of the river, is small and nucleated, while the town of Sironcha, on the south side, is larger and more dispersed. The distance from the village to the river is approximately 2 km, while the town lies directly along the river's bank (Fig. 2b). Agricultural fields surround the village, but not the town, since the river runs along one side. Because of this variation in the distance between home bases and fields, the logistics of agriculture vary considerably between the two communities.

Social organization in both the village and the town reflects the classical Hindu tradition, wherein society is divided into four ritually ranked caste categories (varnas): Brahmans (priests), Khatriyas (warriors), Vaisyas (merchants) and Sudras (laborers). The two social groups whose farming is studied here, the Harijans and the Kapus, are outside the varna ideology and are commonly referred to as 'untouchables.' They own land, but it is poor land. It should be noted, however, that with modernization has come a general decrease in the importance of the caste system. Even though the ritual hierarchy is honored, political status and economic class are increasingly more relevant in the social organization. Landowners who are economically independent are quite often the ones who exercise decision-making within the community.
Little Millet

*Panicum miliaceum* or little millet is an annual grass with a thin leafy stem, which tillers (ends out shoots) profusely and attains a height of about 0.5 to 1.2 m, depending on the variety. The panicle inflorescence is about 20-25 cm in length and droops to one side. It is a highly drought resistant, and matures quickly, generally in approximately 80 days (Aiyer 1982). Little millet occurs wild in northern India and southeastern Asia, but its origin is debated.

Little millet cultivation in this study area requires only one eighth of the effort of sorghum cultivation in terms of the time invested, yet its yield is one quarter the yield of sorghum in seed. The comparative low nutritive value of little millet grain and its non-storability make it a less attractive crop than others to grow primarily for human consumption, but it is ideal as a short-term supplement when grown in an opportunistic manner. The husked grain of little millet is cooked in the same way as rice, and it is also made into flour. The straw of the plant is palatable to cattle, and the plant makes a popular, quick-growing fodder.

Opportunistic Cultivation

In both settlements, 'opportunistic cultivation' is practiced in the clayey deposits of the active river floodplain (Fig. 1); the crop cultivated is *Panicum miliaceum*, commonly called samali in Telugu and "little millet" in English (see box). The farming communities involved in this specialized cultivation are the economically poorer sections of each settlement. There is a long history of such opportunistic cultivation in the study area. How long it has been an activity specific to the lower castes and poor landowners is not known.

This kind of cultivation is a chronic activity, with the profit and the labor investment being shared equally. The floodplain is public land, and the only initial investment is the sowing time and the cost of the starting seed. Activities are not restricted to any single family; instead a number of individuals from different families participate in the sowing, tending, and crop processing. Opportunistic cultivation is practiced to supplement other crops grown on the higher land, such as legumes, maize, and vegetables. It often contributes significantly to the subsistence base, given the low investment in comparison to cultivation on the upper banks, where land preparation and weeding are costly.

During and after monsoon rains, from July through October, the river water recedes (often a slow process), and clay is left behind on the floodplains as a thick deposit which gradually thins from the river to the edge of the bank. It stretches along the river course, and its presence is determined by the slope of the floodplain, the velocity of the river, the amount of flooding every year, and the rate of water recession after the monsoons. The thickness of the clay deposit varies considerably from year to year. It has to be at least 60 cm thick for *Panicum miliaceum* cultivation. At the time of this study, the inundation deposit was 1.1-1.2 m thick closest to the river and extended 28 m out from the river.

The clay is virtually sterile, with almost no sand inclusion. Little millet seems to be the only crop that can grow in such heavy clay soils. Sorghum, a millet grown on the upper banks, will not grow in this thick clay deposit, nor will any other locally known crop. Typically, sorghum can only be grown in the sandy clay deposits near the edge of the floodplain.

During the sowing of the little millet crop, the clay is of a viscous nature, but as it dries up it breaks into well demarcated blocks (Fig. 3). Since, the most important characteristics of these clay deposits is that they are barren of any type of weed seeds, thereby making the deposit in which the millet is sown essentially a sterile clay bed. The significance of this for agricultural ethnoscience will become evident later in the article.

Sowing

Little millet is sown in October when the flood water has receded, but the clay is still very moist and viscous. If the clay is dry, the seeds will not germinate. Sowing is done by hand; a pot is attached to the sower’s hand to hold the grain and to give the sower buoyancy while wading through the high-clay slush deposits. The sowing takes place in strips parallel to the river as the water recedes over a period of time. Therefore the strips furthermost from the river are the first to be sown and the first to mature. This is an optimal strategy for labor investment, since only portions of the field are ready for harvesting at one time. Once sown, the crop is not given any other attention in terms of weeding and tending.

Harvesting

The crops are harvested with an iron sickle, a bunch of plants being cut all at one time (Fig. 5). Both men and women harvest. The stubble left behind on the ground is about 12 cm high. The cut plants are heaped in a pile until after harvesting is completed, and then they are tied into manageable bundles using a stem. In the study units on the Sironcha bank, even though weeds were present in the fields (owing to erosion), they did not become incorporated into the harvest products or by-products since they grew below the level of the sickle cut on the millet (see box on Standing Crop Study).

Harvest timing has a direct influence on yield. Little millet is preferentially harvested while slightly green. If the crop is well matured and dry, there is a significant loss of grain during the harvest because of the brittle nature of the panicle (see box on little millet). For a crop like sorghum, on the other hand, a riper state provides a higher yield. The seeds from the panicle heads in a green sorghum crop will not dislodge as effectively as in a dry one, and fewer seeds will be recovered in threshing.

After harvest, a crop is processed through a number of stages before it is consumed. In a traditional agricultural system, the little millet crop has five to six main processing steps. These are threshing, sorting, a first winnowing (by wind and/or by shaking), a first pounding, a second winnowing (by shaking), and a second pounding.

Threshing

Threshing takes place in the fields, away from the house base. The aim is to release the seed, along with its attached appendages, from the plant. This is accomplished by beating with a stick, rubbing and stamping with feet, and/or trampling by cattle. Threshing with a stick and the use of cattle is done predominantly by men, while threshing with feet is most often done by women. In each method, the crop plants are laid in a heap on the threshing floor, which is often prepared a few days in advance by cleaning the area, and then plastering it with cow dung. Plastering insures minimal loss of grain into the sediment, making it easy to gather the threshed products through hand sorting. It produces a very distinct activity floor. However, threshing floors are very rarely found archaeologically because they are most often located outside the habitation area and are unlikely to be preserved or discovered.

In this study, the little millet crop was threshed differently in the two settlements (Figs. 6, 7). The crop from the Rappanpalli bank, which was dried, was threshed through beating with a stick, while the crop on the Sironcha bank, which was air-dried and rubbed and stamped on by the feet. The choice of method aims to optimize the amount of grain retrieved and the time invested for the amount of crop and, most importantly, to suit the type of crop. For example, the seeds of *Panicum miliaceum* are very small, and using cattle for threshing would lead to considerable loss in the process.

The subsequent analysis of the threshing products showed that the proportion of threshing with a stick had more straw and panicles. It then did the product of threshing with rubbing and stamping of the feet.

![Figure 3. Little millet field in the clay deposit. The crop plants fall over when fully ripe due to the weight of the grain. The clay deposit is about 10 cm thick, and it becomes almost sterile like in this hardened, dry state.](image-url)
Standing Crop Study

Two stretches of little millet along each side of the river Pranitha were the focus of a study to understand the dynamics of opportunistic floodplain cultivation (Fig. 4a.b). Two questions were of particular interest: (1) Is there any variation within and between the crop fields on each side? (2) Does the variability in the width of the floodplain on either side of the river create any observable differences in the fields?

First, a thorough reconnaissance was made to identify visual differences within each field and between fields on both banks. After careful study, it was evident that weeds were present only on the Sirnchah bank (Fig. 4e). This was due to the proximity of the field to the terrace bank, which brought in weed seeds through erosion. All the weeds were the low-growing, ground cover type and seemed to be an earlier stage of growth than the little millet crop. On the Rajapalli bank, however, there were no weeds in the fields (Fig. 4b). The fields on both banks showed no variability in the little millet crop distribution but considerable variability in the maturation of the crop. On both the banks, the plants closest to the water were still immature, while those furthest away were ready for harvest.

As a result of this survey, units on both banks were selected based on criteria such as least trampled, most isolated, closest to water, or matured/dried. Within each 25-m unit, the ratio of crop plants to weeds was calculated. (The parent plant and corresponding tillers were all counted as one, since they all grew out of a single parent.)

The results of this study indicate that even though weeds were present on the narrow Sirnchah bank, they did not get incorporated into the crop processing stages through harvesting. This is of considerable importance for agricultural ethnobotanists, who quite often use weeds to distinguish the different crop processing stages, as they are processed out at different stages depending on the type of weed and the stage of processing. Results from the study also show that the yield of the little millet crop is dependent on its level of maturity. The less mature it is, the higher the resulting yield. This is so because with increased maturity the seed-bearing panicle head of the crop becomes more brittle and a lot of grain is lost through shattering during the harvest process.

This is significant because the threshing product affects the first winnowing process, in terms of the amount of by-products to be separated out and the time invested in that activity. More importantly, there was also a significant difference in the absolute amount of grain retrieved through the two different threshings, with a greater loss of grain in thethreshing with a stick.

Sorting

Sorting, the separation of the crop from the by-products of threshing, is done essentially with the hands and is equivalent to the threshing stages in European crop processing. The by-products are gathered up from the top of the threshing heap and piled separately to be used as cattle fodder. Both men and women help in the sorting.

First Winnowing

After threshing and sorting, the crop is winnowed to separate the grain from chaff, straw, and spiclets. This usually takes place at the threshing site. However, if there are other pressing activities, the threshing product is taken home and processed there. Depending on when it is done, the quantity to be winnowed, the weather, the type of crop being processed, and the availability of labor, winnowing can be done in two ways: by wind or by shaking in a basket. The straw, chaff, and spiclets thus separated from the grain are added to the cattle fodder.

Winnowing by wind is a common method used in most parts of the world where traditional agriculture is practiced (Fig. 5). It essentially uses a gentle breeze to separate out the lighter components from the heavier grain. The threshing product is poured gently from a height while the container is waved in the wind. The grain falls in a heap directly below the person winnowing while the lighter material is blown aside where it is often collected to be used as cattle fodder. This type of winnowing is a rough separation, and quite often the grain has to be winnowed again by shaking before any further processing can take place. Wind winnowing is done predominantly by men.

Winnowing by shaking is done using the chaata, a woven rectangular wedge-shaped basket (Fig. 9). It is thin and smooth, and is often plastered with dung and turmeric (a disinfectant spice) to ensure a smoother surface. The grain is placed in it, and then by the rhythmic tossing of the grain, followed by the shaking of the chaata, it is separated from contaminants such as straw, chaff, and spiclets. This cleaning is repeated many times until there are no contaminants. It is a time-consuming and labor-intensive process, but there is very little loss of grain (unlike winnowing by wind) and very effective separation of grain from chaff. Chaata winnowing is done predominantly by women. If the grain is not used immediately, it is stored or taken to the market after this stage of processing.

First Pounding

The cleansed grain is next placed in the depression of a grinding stone and pounded repeatedly with a thick heavy wooden staff called roshi (in Telugu) to separate the seeds from their husks (Fig. 10). If the grain is partially ripe when harvested, quite often it is roasted over a fire before pounding to facilitate the efficient separation of the husks. If the grain is well ripened at the time of harvest, it is dried in the sun before pounding.

Second Winnowing

Since the seeds are freed from the husks through pounding, a second winnowing by shaking with the chaata is done to separate out the seeds. The fine chaff lost in the first stage is separated, locally called thuddu (in Telugu), is an attractive cattle fodder. Often the seeds are cooked like rice after this stage of processing.
Second Pounding

In some instances, the seeds are further pounded into a floor and then consumed as a porridge-meal. This second pounding process is similar to the first one. The difference between the two is that there are no by-products from the second pounding. Even though there is spillage, it is not significant in terms of quantity and archaeological preservation.

The floor can also be made using a rotary grinding method. This entails two circular stone slabs set one upon the other. The other stone is rotated by hand, ground flour flows out the sides.

Use of Little Millet By-Products

All the by-products from threshing and winnowing (including straw, panicles, chaff, and chaff dust) are used as fodder; they have no other use in this area. This material is not storabe for long periods, and nutritionally has its highest value when fed fresh after the crop processing. By-products of the sorghum crop, which is grown on the higher banks, are preferred by farmers to those of little millet because they can be stored for longer periods and are nutritionally of a higher quality. However, the farmers state that the cattle prefer the by-products of little millet to those of sorghum.

Archaeological Implications

The historical longevity of opportunistic cultivation in the area, and its particularity in terms of the clay deposit, type of crop cultivated, nature of cultivation, and the absence of weeds in the fields, make this case study an important example for the further understanding of floodplain agricultural systems (past and present), communal labor, and communal investment. Some of the issues that might be raised are sociological. The communities involved in this cultivation belong to the lowest castes who also happen to own the poor, irrigated land. It is interesting that only this sector of the rural society practices opportunistic cultivation; would they do so if their lands were irrigated and could provide high yields of sorghum? One would tend to predict a decline in opportunistic cultivation in such an instance. However, this cultivation might persist, just as the name 'opportunistic' suggests, if only to produce a crop for fodder.

The implications of opportunistic cultivation for the study of ancient floodplain or riverine agricultural systems are equally significant. Of particular interest is the absence of weeds in the floodplain deposits and in the subsequent crop fields. Ethnographic crop processing studies have been used to make inferences about the archaeological use of specific crops (Hillman 1984; Jones 1987; Reddy 1991) and to build 'causal-effect' models for archaeological interpretation. Such studies are based on the assumption that each step of crop husbandry and grain processing has a measurable effect on the composition of crop products and by-products. Samples of products and by-products are collected from each stage and analyzed for their plant part compositions (such as grains, rachis remains, glumes, glume bases, weeds, and so on). Typically, specific compositions of plant parts specify certain stages of processing. Weeds also serve as indicators of different stages of processing (Jones 1987). However, in this study of opportunistic cultivation, due to the sterile nature of the clay flood deposits, weeds are generally absent. Even when weeds are present they are not incorporated into the crop processing activities. This is significantly different from cultivation on plains and in valleys. Therefore, for little millet, plant parts such as spikelets (of different nature) and glumes are used as indicators of specific stages of processing rather than weeds. Processing tools discussed here such as the chata, rokal, and grinding stones, if found archaeologically, could also be positive indicators of the specific processing stage in which they are used.

This type of opportunistic cultivation is particularly relevant for reconstructing ancient agricultural systems along the Nile, the Congo, and the Indus rivers, all of which have seasonal flooding and a long history of riverine and floodplain agriculture. Agricultural production can be characterized through either intensive or extensive systems. Intensive agricultural systems involve increased agricultural production per unit area of utilized land, usually through increased investment of labor. Alternatively, extensive agricultural systems increase production by increasing area of utilized land rather than
increasing production per unit area. Bank cultivation of crops such as sorghum, legumes, and maize is more intensive than little millet opportunistic cultivation on the floodplain. More labor is involved in bank cultivation as opposed to floodplain cultivation; the former involves preparation of land before sowing, weeding, occasional irrigation in addition to harvesting, but in the latter sowing is the only task needed apart from harvesting.

Specifically, in a riverine system like the Indus where, during the Harappan period (2500-2000 B.C.), there were major urban centers and smaller non-urban settlements, such opportunistic, extensive cultivation was more likely to occur in the latter. In the urban environs, this type of cultivation, although practiced sporadically, would have contributed minimally to the overall subsistence economy. The low yields per acre and the heavy-time investment in crop processing would have made it less attractive in the urban centralized market economy where intensive agricultural systems were more successful. Opportunistic cultivation on the floodplains would be an attractive option in the rural settlements of the Harappan period, where there was a gradation between intensive and extensive agricultural systems. The degree of importance of animal husbandry would also be a contributing factor for the selection of such extensive opportunistic cultivation. In such cases, settlements optimally located near a floodplain could very well exploit the local floodplain opportunistically, thereby supplementing their subsistence resources for human consumption or animal fodder. Such cultivation would be particularly attractive for pastoralists who often grow quick maturing millet crops for both themselves and their animals.

Opportunistic cultivation, though observed specifically in one river floodplain in South India, has important ramifications for studies related to ancient agriculture, modern rural development, and communal economic activity. With modernization, many traditional practices of crop husbandry discussed here are slowly being replaced by the mechanized agriculture of the 20th century, thus making studies of traditional crop processing activities increasingly important for the further understanding of ancient agricultural and crop processing practices.

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Bibliography
Ayer, A.K. Yegna Narayan

Hillman, Gordon

Jones, G.E.M.

Reddy, Seetha N.

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