RESEARCH ARTICLE

Cropping Pattern and Farming Practices in Palakurichi Village, 1918–2004

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Abstract: This paper discusses changes in agricultural production conditions over the last nine decades in Palakurichi village. The village is in the Thanjavur region of the Cauvery delta, and is historically known for its prosperous rice production systems. The specific focus of the paper is on how developments in irrigation facilities and technology resulted in changes in farming practices, input use, and yield levels in rice cultivation. The period 1918–2004 covers three distinct phases of agricultural development in India. This period encompasses the transition from traditional low-input use agriculture during the earlier part of the century, to a modern input-intensive agriculture using high-yielding varieties after the 1960s, and then a phase of declining yield levels from the late 1980s, when, with the withdrawal of the State from agricultural development programmes, the earlier gains began to wither away. In this most recent period, deterioration in irrigation water availability has restricted rice cultivation to a single-crop, direct-sown system, characterized by yields that have fallen to pre-green-revolution levels. The current situation is thus one that reflects a serious crisis of agricultural production, with the benefits of the "Green Revolution" having petered out and having been replaced by a regime of low and uncertain yields.

Keywords: Thanjavur/Cauvery delta, Palakurichi, irrigation, green revolution, mechanization, rice cultivation, farming practices.

INTRODUCTION

This paper describes changes in rice cultivation over the last nine decades in a village in the old Thanjavur region. Palakurichi, now in Nagapattinam district, was one of the villages that Professor Gilbert Slater and his students studied when Slater initiated village studies in the Madras Presidency in the early twentieth century.[1] The village was first studied in 1916, and the study was conducted by K. Soundara Rajalu. Thereafter, Palakurichi village was studied by P. J. Thomas and K. C. Ramakrishnan

1 For more on the Slater village surveys, see Slater (1918), and Thomas and Ramakrishnan (1940).

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in 1936, M. R. Haswell in 1961 and S. Guhan in 1983 (Rajalu 1918; Tirumalai 1940; Haswell 1967; Guhan 1983). Combining information from all these studies with data I collected in 2004 and 2005, I have examined changes in the agricultural economy over the last 90 years.[2] The specific focus of this paper is on changes in cultivation practices of rice in response to the expansion of irrigation facilities and technological changes over the last nine decades.

For purposes of this article, I have divided the period 1918–2004 into three broad phases in terms of agricultural production conditions in the region. The first phase, characterized by traditional agricultural production with low levels of input use and yields, was from the early part of the twentieth century to the early 1960s. The second phase, which began in the mid- to late 1960s, was characterized by the introduction of high-yielding varieties that were highly input-intensive and by the spread of improved methods of cultivation. The introduction of the new technology was supported by state intervention. The third phase, from the late 1980s through the 2000s, was one where the impact of the new technology waned and the policy environment accelerated a process of decline in yield levels and incomes.

THE VILLAGE

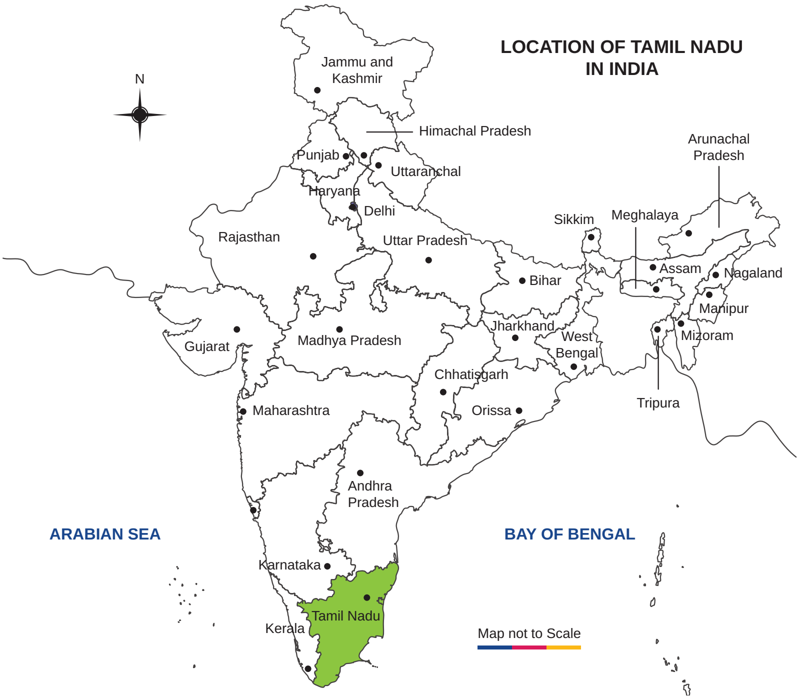
Palakurichi village belongs to Kilvelur taluk in Nagapattinam district, in the Thanjavur region of Tamil Nadu. Palakurichi is located in the Old Delta Coastal zone, at the tail end of the Cauvery delta, where the river Cauvery empties into the Bay of Bengal.[3]

The Thanjavur region has historically been known as the "rice bowl of south India," on account of its thriving rice production system. The importance of this region in terms of its contribution to rice production in the country has been widely noted in the literature (Gough 1981; Schendel 1991; Swenson 1973; S. Menon 1983). According to Ramiah (1937), in the early decades of the twentieth century, the proportion of net sown area under rice cultivation (70 to 80 per cent) was the highest in Thanjavur among all districts of the Madras Presidency.

2 The data were collected for my doctoral research (see Surjit 2008).

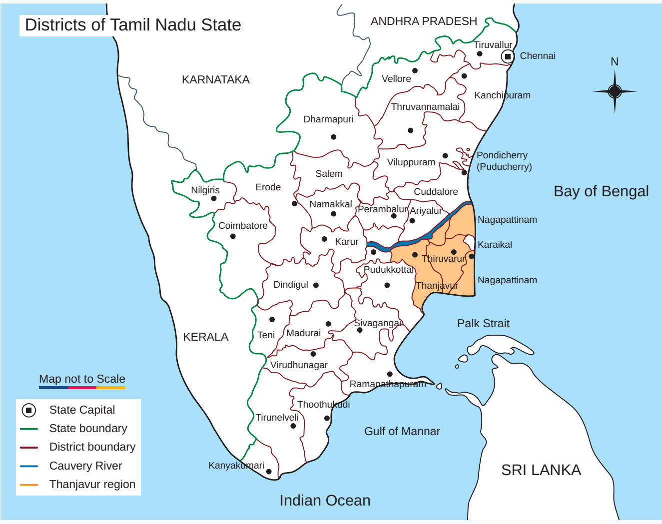
3 Marshall M. Bouton classified the Thanjavur region into five different zones based on two major criteria, the nature of irrigation facilities, and the nature and composition of the agricultural work force. To characterize the nature of irrigation facilities, Bouton examined (a) whether there is irrigation at all or not; (b) the "pervasiveness" of canal irrigation; and (c) the quality and dependability of water delivered through the irrigation system. For characterizing differences in the composition of the agricultural work force, Bouton looked at the share of agricultural labourers and cultivators in the agricultural work force and in total population, as well as the agrarian density, defined as the number of agricultural workers per unit area of land. The five agro-ecological zones identified by Bouton (1985) are (1) the Old Delta Cauvery zone, (2) the Old Delta Central zone, (3) the Old Delta Coastal zone, (4) the New Delta CMP (Cauvery–Mettur Project) zone, and (5) the Dry Area Upland zone. For more details, see Chapter 5 in Bouton (1985).

Figure 1 *Map of India showing location of Tamil Nadu*



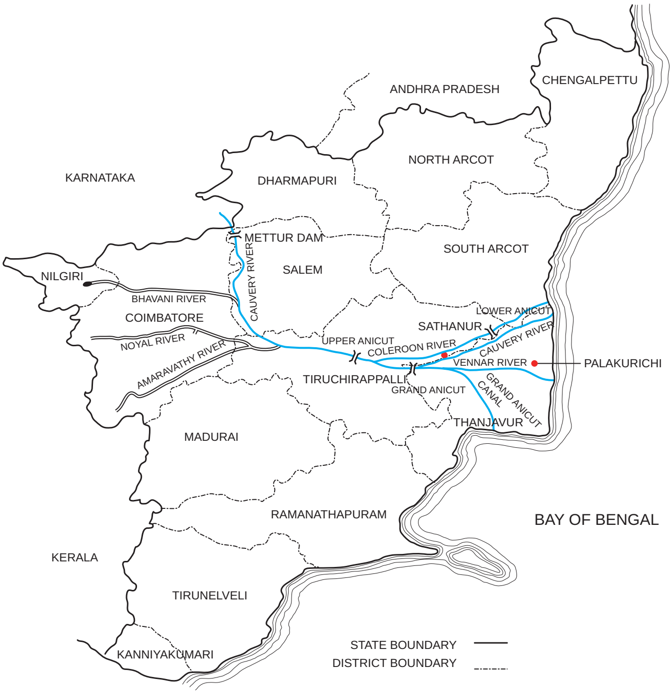
Source: Maps of India.

Figure 2 *Map showing the erstwhile Thanjavur district, comprising the present districts of Thanjavur, Thiruvarur, and Nagapattinam*



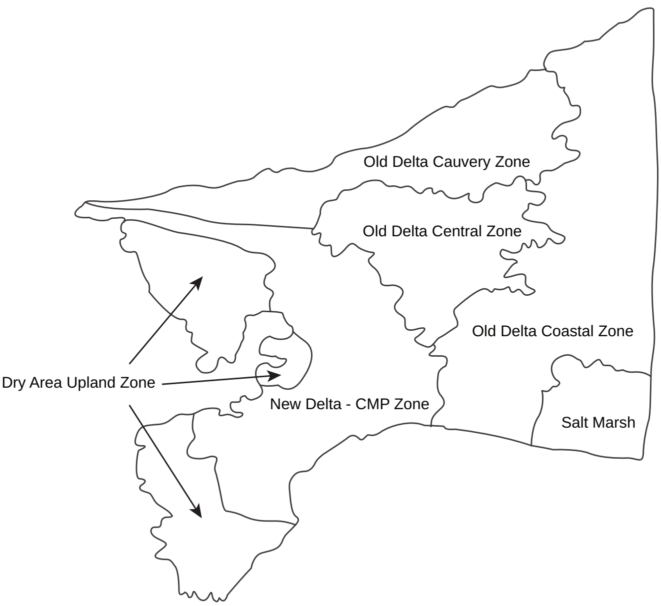
Source: Maps of India.

Figure 3 *Map showing the course of the Cauvery river in Tamil Nadu*



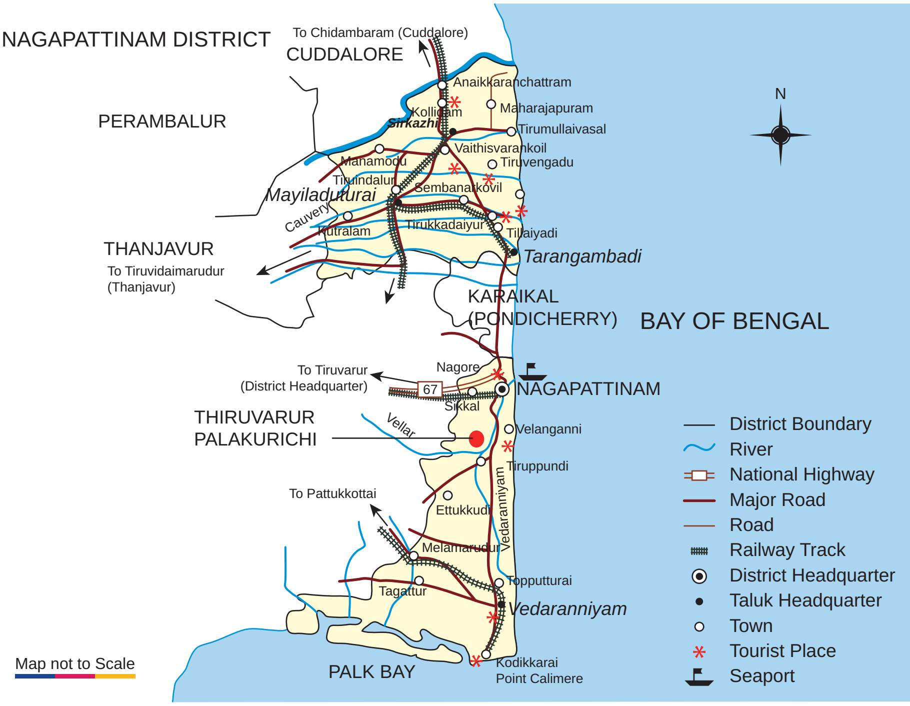
Source: Bouton (1985).

Figure 4 *Map of Thanjavur region showing various agro-ecological zones*



Source: Bouton (1985).

Figure 5 *Map of Nagapattinam district showing Palakurichi village*



Source: Maps of India.

The region falls within the Cauvery delta. The alluvial soils of the delta are very good for wet rice cultivation. The irrigation system in the Cauvery delta is one of the oldest water-control facilities in India and dates back to the Chola period of the second century AD (Bouton 1985). In the last 10 to 15 years, however, there have been problems of inadequate water as well as irregular supply of water in the Cauvery irrigation system. The lack of adequate irrigation water in the Cauvery delta, and Nagapattinam district in particular, has been because of low levels of inflow into the Cauvery irrigation system due to low rainfall, and a reduction in the supply of water to the lower reaches of the command area in recent years.[4] There has been a consistent decline in the availability of irrigation water from the Grand Anicut – from which Palakurichi gets irrigation water – over the last five decades. The average annual outflow from the Grand Anicut from 1950 to 1970 was 273 tmc feet. This declined to 201 tmc feet in 1970 to 1990, and further declined to the very low level of

4 For a historical account of the Cauvery river water dispute and problems of the availability of irrigation water in the Cauvery delta, see Guhan (1993). The Cauvery Water Disputes Tribunal, set up in 1990 to address the issue of sharing of Cauvery river water between the riparian States of Karnataka, Tamil Nadu, Kerala, and Union Territory of Pondichery, gave its verdict in 2007. According to the verdict, the State of Tamil Nadu is to get 419 tmc feet of the Cauvery water (GOI 2007). For a discussion of the verdict and its implications, see Parvathi Menon (2007).

154 tmc feet from 1990 to 2006. In 2003–04, the reference year of my village study, the outflow from the Grand Anicut was only 23 tmc feet, the lowest ever in the previous five decades.

Table 1 *Mean flow of irrigation water from the Grand Anicut during different periods from 1950–51 to 2006–07* in tmc feet

Period	Mean	Period	Mean
1950s	301	1950–70	273
1960s	252	1970–90	201
1970s	251	1990–2006	154
1980s	141		
1990s	178		
2000–06	100		

Sources: For data from 1950–51 to 1979–80, records of the Superintending Engineer, Public Works Department, Thanjavur Circle, cited in TNAU (1985); for data from 1980–81 to 2006–07, records at the office of the Executive Engineer, Public Works Department, Cauvery Division.

Since the 1940s, Thanjavur has benefited from many government programmes aimed at augmenting rice production. These include the Grow More Food Campaign (1942), the Intensive Agricultural Area Programme (IAAP) (1960–61), and the High Yielding Variety Programme (HYVP) (1966–67) (Rukmani 1993). Thanjavur was one among the seven districts selected for implementation of the Intensive Agricultural District Programme (IADP) in 1962.[5]

By my survey of 2004, the population of Palakurichi was 427 households and 1,647 persons.[6] Two major features of the population of the village are noteworthy.[7] First, a large share of the work force has been dependent on agriculture throughout the twentieth century. In 2004, the primary occupations of about 78 per cent of the workers in Palakurichi continued to remain agriculture-based. Secondly, the village (and region) has a large number and proportion of Dalit or Scheduled Caste households, who comprise the bulk of the agricultural labour force. In 2004, 58 per cent of a total of 427 households in Palakurichi were Dalit households, and 83 per cent of all agricultural labourers were Dalits.

5 The major criteria used for selection of districts for the IADP programme were "a well-organized and operating Community Development Programme; successfully functioning credit supply and marketing co-operatives; assured rainfall and irrigation facilities; and a readily available local agrarian leadership receptive to change" (Brown 1971).

6 The total number of households, according to the Census of India 2001, was 424, with a population of 1,649 (PCA Census 2001).

7 For a detailed discussion of these issues, see Guhan (1983) and Surjit (2008).

A striking feature of the agricultural economy of the village is high inequality in the ownership of land. In 2004, 80 per cent of all households were landless and the Gini coefficient of distribution of ownership holdings in the village was 0.92. Landlessness was acute among Dalit households: 93 per cent of Dalit households did not own agricultural land. The incidence of tenancy has risen in the village over the last two decades, and the rise was accompanied by a change in the form of tenancy from sharecropping to fixed-rent tenancy. The increase in uncertainty of irrigation led to land being leased out by several large landowners. The spread of tenancy was also related, in part, to the migration of young, educated members of landowning households to urban areas in search of salaried employment.

CHANGES IN CULTIVATION PRACTICES IN PALAKURICHI VILLAGE 1917–2004

Changes in Cropping Pattern

The earliest account of cropping pattern and cultivation practices in Palakurichi is given in Rajalu (1918). He reported that the major crop cultivated in the village was a single crop of rice, followed sometimes by pulses (mainly black gram and cowpea). The villagers grew coconut, plantain, lime and mango trees on garden land, and some vegetables (chilli, brinjal, and drumstick) on homestead land (*ibid.*). In 1922–23, some land was cultivated with oilseed crops such as sesamum and castor (Tirumalai 1940, p. 128). By 1935–36, the area under oilseeds declined but arecanut, palmyra palms, and turmeric were cultivated (*ibid.*). In the 1930s, although only one crop of rice was cultivated on any single plot of land, there were three different seasons in which rice was cultivated in the village. They were *samba* (September–October to February), *kar* (August to January) and *kuruvai* (August to October) (Guhan 1983). The three crops of rice were of different durations and were grown in different seasons. No land in the village was double-cropped during this period (*ibid.*, p. 42).[8] Even Margaret Haswell, who studied Palakurichi in 1961, does not mention a second crop of rice.

By the early 1960s, Palakurichi was selected as a "package village" for implementation of the Intensive Agricultural District Programme (IADP). This meant that a package of improved seeds, chemical fertilizers, and easy credit support were provided to cultivators in order to increase productivity levels (Haswell 1967, p. 29). Guhan (1983) notes that it was in 1963–64 that cultivators began to raise a second crop (*thaladi*) of rice, from October–November to February–March. This was made possible mainly by the introduction of short-duration varieties of rice, which were suited to a limited

8 Rajalu wrote that "about half of the land can yield two crops per annum but many cultivators are too indolent to grow two crops" (Rajalu 1918, p. 78). Tirumalai made a similar observation in 1940. He wrote that "more than 50 per cent of the lands can bear a second crop" (Tirumalai 1940, p. 128).

amount of water available for a short period of time.[9] In Thanjavur, it was the introduction of ADT-27, a locally developed, short-duration hybrid rice variety, that dramatically transformed rice production – not the "wonder" hybrid IR-8, which was a success in other rice-growing areas (Frankel 1971). In connection with the introduction of a second crop of rice in Palakurichi in the early 1960s, Guhan (1983) notes:

> Being at the tail-end of the delta, water is received in the canal only about mid-July, delaying the commencement of agricultural operations. The north-east monsoon sets in late October–early November and the rains are particularly heavy in this coastal taluk ... and the availability of water gets restricted beyond February. Under these circumstances, the first crop or *kuruvai* has to be of sufficiently short duration so as to be ready for harvest before the onset of the north-east monsoon. Thereafter, the transplanting of the second *thaladi* crop can take place only after the rains cease in December but if the *thaladi* stays too long on the ground, it cannot get a final wetting before the channels dry up in March. This means that for both *kuruvai* and *thaladi* short-duration varieties and agricultural practices that promote early maturing are a necessity. It was the popularization of such seed varieties combined with the package of chemical fertilizers, credit and extension in the IADP that finally persuaded farmers in Palakurichi, and in Nagapattinam taluk generally, to take to a second crop of paddy in the 1960s. (Guhan 1983, pp. 42–43).

From the early 1960s, cultivators began to grow either a single long-duration *samba* crop or two short-duration crops, *kuruvai* followed by *thaladi*. "Taking the average of the last five years, the net sown area for paddy in Palakurichi consists of 307 acres of kuruvai and 688 acres of samba, with most of the kuruvai being replanted again with thaladi in a normal year" (Guhan 1983, p. 43). Guhan reported that oilseeds were not grown in Palakurichi in the late 1970s (Table 2). A comparison of information available for 1935–37 and 1974–78 shows that there was some increase, from 4 acres in 1935–37 to 11 acres in 1974–78, in the area cultivated with pulses (black gram and cowpea) over this period. Pulses were cultivated as a second crop after the harvest of *samba* rice.

The most recent data from 2004 and 2005 show the following. First, the cropping pattern in Palakurichi was characterized by the dominance of a single crop, i.e. rice, over a period of nine decades. In 2003–04, the year with the lowest availability of

9 Frankel wrote that "the availability of I.R. 8 and other exotic paddy varieties could do little to change the dim prospect for the agricultural economy of Thanjavur. The short-duration imported strains were higher yielding than the short-term local variety, ADT-20, but significantly inferior in their ability to withstand flooding and heavy rains during the northeast monsoon. Nevertheless, in 1964 a breakthrough by local researchers in evolving the japonica-indica hybrid ADT-27, unexpectedly transformed the public image of Thanjavur from one of stagnation and failure to dynamism and success as the vanguard district of Green Revolution in the rice areas. ADT-27 is not as high-yielding as the exotic varieties. ... Yet it has other striking advantages: it gives reliable yield increases; is relatively disease-resistant; and produces fine grain that fetches the highest procurement price" (Frankel 1971, p. 90).

Table 2 *Cropping pattern in Palakurichi village, 1922–23 to 2005–06* in acres

Crop	1922–23	1935–37[1]	1974–78[2]	2003–04	2004–05	2005–06
Rice	879	942	995	957	968	948
Millets and Pulses	2	4	11	0	244	244
Oilseeds	2	0.1	0	0	0	0
Other Crops and Trees	7	13	0	4	4	4
Total[3]	890	959	1,006	961	1,215	1,195

Notes: [1]Average value for the period 1935–37.
[2]Average value for the period 1974–78.
[3]Includes total of nanjai, punjai, and poramboke land.
Source: Tirumalai (1940); Guhan (1983); Palakurichi village records (2003–04, 2004–05, 2005–06).

water in the last five decades, rice was the only major crop grown in the village. Secondly, in 2004 and 2005, only one crop of rice (*samba*) was cultivated. From the late 1980s and early 1990s, as the Cauvery river water crisis intensified, cultivators in Palakurichi increasingly shifted from multiple crops to growing a single crop of rice a year. Thirdly, follow-up visits in 2005 and 2006 showed that cultivators had increased the area sown to pulses. For example, in 2004–05, pulses were grown on 244 acres of land (nearly one-fourth of the area under rice) after the *samba* crop of rice.

Briefly put, the crop cycle in Palakurichi changed from a single crop of rice during the early part of the twentieth century (1910s) to a double crop of rice with the introduction of HYVs from the mid-1960s through the 1980s. By the 1990s, the crop cycle had reverted to a single crop of rice because water from the Cauvery irrigation system was not available to cultivation.[10] To a visitor in 2005, the cropping pattern would not have looked very different from what it would have to a visitor a century earlier. It is of note that though there has been a substantial reduction in the water available through the Cauvery irrigation system (which is the only source of irrigation in Palakurichi), the land use and cropping pattern has remained almost the same. This has resulted in continuously low yields of rice in the village.

Changes in Crop Operations in Rice Cultivation

Cultivation practices in rice cultivation in Palakurichi, however, have undergone major changes between 1917 and 2005 on account of fluctuations in the availability of irrigation water as well as other socio-economic factors.

10 However, on one of my visits to the study village I learnt that in 2006–07, water was released at the proper time from Mettur dam, as a result of which, after a gap of 15 to 20 years, some cultivators raised two short-duration crops of rice (*kuruvai* followed by *thaladi*).

In Palakurichi today, the *samba* crop of rice is sown in August and harvested in January and February. The timing of various operations in rice cultivation depends largely on the availability of canal water from the Cauvery river. In a normal year, water is released from the Mettur dam in the beginning of June. It reaches the tail-end of the delta, where Palakurichi is situated, only by the second week of July. Cultivators begin field preparation and ploughing depending on the arrival of water from the Cauvery. There have been unprecedented delays in the release of adequate water from the Mettur dam over the last two decades. On several occasions, water was not available for a period of time long enough to raise a crop. Under such circumstances, cultivation practices had to be modified to make optimum use of the limited amount of irrigation water in the short period of time for which it was available.

Land Preparation and Ploughing

Field preparation for rice cultivation starts with clearing stubble in the field, trimming and strengthening bunds, and clearing irrigation channels, and is followed by ploughing.

In the 1930s, when irrigation water was plentiful, wet ploughing of fields was the common practice (Tirumalai 1940).[11] In 2003–04, cultivators ploughed dry fields so as to utilize water for critical stages of plant growth.

In 2004, all the ploughing was done by tractors. Records show that bullock labour was used for ploughing in Palakurichi till the early 1970s. Haswell (1967) notes that in 1961, cultivators in Palakurichi faced difficulties in getting sufficient feed for their cattle. "Clearly the level of production in Palakurichi is still low for the maintenance of livestock at even moderate levels of efficiency..." (*ibid.*, p. 31). Tractors were introduced in Palakurichi for ploughing in the early 1970s (Guhan 1983). Guhan notes that, during his survey in the early 1980s there were nine tractors in the village, of which seven were owned by Naidu households. He suggests two factors that resulted in the increased use of tractors for land preparation in Palakurichi. First, a shift from single- to double-cropping resulted in an increase in demand for draught power. In view of the limited availability of irrigation water, land preparation had to be done quickly. Cultivators started using tractors in order to ensure that fields were ploughed and prepared for sowing as soon as water arrived.[12] Secondly, landlords

11 Tirumalai observed that "ploughing begins in July and generally lasts up to the middle of October, which can be taken as the ploughing season. ... After ploughing till the land becomes even and is in a puddle state, seed is sown, which takes three hours" (Tirumalai 1940, p. 129).

12 According to Guhan, "The use of tractors for first ploughing has become universal because it helps to overcome the constraints imposed by the short span available for Kuruvai and Thaladi. ... In terms of rental cost, they are competitive with that involved in the use of bullocks at the prevailing wage rate" (Guhan 1983, p. 47).

shifted to tractors in order to reduce their dependence on human labour, particularly in the wake of wage-related agitations in Thanjavur (*ibid.*).[13]

The substitution of animal power with machine power resulted in a substantial decline in the population of draught animals in the village. The number of draught animals in Palakurichi declined from 327 in 1970 to 76 in 1983 (Guhan 1983, p. 59). In 2003–04, among 55 cultivator households surveyed, only one Naidu household had draught animals, and no household used draught animals for land preparation.[14]

In my survey year of 2004, three or four rounds of dry ploughing were done by tractor. After the first round of ploughing, farmyard manure was placed on the field in small mounds. This was mixed with the soil during the next round of ploughing. In some cases, cultivators fertilized their fields through *kidai*, a practice of folding cattle, goat, or sheep on the fields for one or two nights.

Sowing

In 1940, cultivators in Palakurichi would normally raise a nursery of seedlings and transplant them to the main field after one to one-and-a-half months (Tirumalai 1940).[15] Haswell (1967) found that some cultivators even followed the "Japanese method" of cultivation, in which seedlings were transplanted in lines (*ibid.*, p. 30). Sowing a nursery and then transplanting the seedlings was also the general practice in 1983 (Guhan 1983).

In 2003–04, by contrast, broadcasting seeds in the main field was the common practice among cultivators in Palakurichi. According to my interviews in the village, because of the scarcity of water, cultivators shifted from transplanting seedlings to direct sowing in the late 1980s. In 2003–04, seeds were broadcast in the field by male agricultural labourers after three or four rounds of ploughing. This was followed by one last round of ploughing using a tractor to cover the seed with top soil, so as to save on the water that would have been required to maintain a nursery for a month. An important effect of the shift from transplanting to direct sowing has been a decline in the use of human labour, female labour in particular, for preparing the nursery, maintaining it, and transplanting the seedlings to the main field.[16] The decline in female labour use was compensated, in part, by an increase in the number of weedings. As the crop is directly sown, two to three rounds of weeding

13 Guhan noted that tractors were used from the mid-1970s. He also observed that the wage agitation at the time of ploughing in 1978 was a factor that encouraged large cultivators to mechanize cultivation (Guhan 1983, p. 47).

14 The only household that owned a pair of bullocks used them for transportation.

15 There were few households who broadcasted the seed and allowed it to grow for three months (Tirumalai 1940, p. 129)

16 Though transplanting in rice cultivation is done predominantly by female labour, picking the seedlings from the nursery for transplanting in the main field is mainly done by male labourers.

are required for proper growth.[17] The first round of weeding was done by female workers about one month after sowing. The second round of weeding was done just before the emergence of the panicle. Although not usual, a third round of weeding was also done if needed.

Application of Fertilizers and Plant Protection Chemicals

In 1917, only farmyard manure and some green manure were used as plant nutrients (Rajalu 1918). Rajalu noted that

> very nearly 40 per cent of the manure used is cattle dung. Much of the cattle urine is wasted; but in the summer when there is no cultivation cattle are made to lie down in the fields. And recently people have come to understand the value of cattle urine and they have devised means to direct it to the dung pit or dung hill. Green manure is obtained from trees, and avarai, wild castor and adutudai are grown for green manure. (*Ibid.,* p. 79).

Tirumalai (1940) found two families who had tried using chemical fertilizers, but had discontinued the practice because they believed it was not profitable Commenting on agricultural practices in 1940, Tirumalai wrote, "there have been no recent improvements in the methods of cultivation, and the villagers being very conservative, it will be a difficult task to induce a majority of them to new methods" (*ibid.,* p. 129). However, he also noted that there were a few who were interested in improving the methods of cultivation and, with proper training, would adopt modern methods of cultivation (*ibid.,* p. 129).

It was during the period of IADP in the early 1960s that cultivators began to use chemical fertilizers. According to Haswell (1967, p. 29), "since Palakurichi cultivators had already been applying fertilizers for two or three years before the village was selected under the scheme, their introduction as a part of the package deal was not difficult since the demonstration effect had already made its impact." She further notes that fertilizer coupons were distributed to cultivators and adequate measures were taken to ensure the availability of required quantities of fertilizer (*ibid.,* p. 29). This resulted in an increase in fertilizer use for rice cultivation.[18] She also notes that tenant cultivators, who cultivated small areas of land, sold most of the "package fertilizer" to large landowners. The large landowners applied these fertilizers in excessive doses and suffered losses from lodging of the plant, as the straw was not strong enough to hold the ear-head. In estimates of the cost of cultivation of rice in East Thanjavur district from 1964–65 to 1968–69 provided by the Ganapatia Pillai commission, "chemical fertilizers" was the largest category of expenses after

17 The growth of weeds is higher with broadcasted rice than with transplanted rice.

18 According to Haswell (1967), the average amount of ammonium sulphate used per hectare increased from 21 kilograms per hectare in 1958 to 68.9 kilograms per hectare in 1961, while that of super phosphate increased from 27.9 kilograms per hectare to 103 kilograms per hectare during the same period.

hired human labour (Pillai 1969). Guhan's estimate for costs and returns from rice cultivation in the village shows that in the early 1980s, nearly 20 per cent of the total cost of cultivation was spent on chemical fertilizers and pesticides (Guhan 1983).

In 2003–04, the use of chemical fertilizers to provide nutrients for plant growth was widespread. The common chemical fertilizers used were urea, di-ammonium phosphate (DAP), muriate of potash (MOP) and super phosphate. Some cultivators used gypsum as a soil conditioner and a few used neem. The average nutrient applied (in kilograms per hectare of cultivated area) was 95:28:40 of nitrogen, phosphorus, and potassium (N:P:K) respectively, which is much higher (except in the case of phosphorus) than the dose of 75:50:37.5 of N:P:K for semi-dry (dry-seeded, irrigated, un-puddled, lowland rice with supplemental irrigation) rice cultivation recommended by the Agricultural Department and State Agricultural University (GOT and TNAU 2005, pp. 25–26).

Fertilizers were usually applied in three doses. The first dose was applied two or three weeks after sowing, the second after the first weeding (one month after sowing), and the third just before the emergence of the panicle. Most of the fertilizers used in the village were provided by the Primary Agricultural Cooperative Bank (PACB) in Palakurichi. Short-term credit for cultivation was given in both cash and kind.[19] The component in kind was mainly in the form of chemical fertilizers, insecticides, and pesticides. Provision of fertilizers and plant protection chemicals by the PACB ensured that inputs of good quality were available on time and at reasonable prices.

During his first study of Palakurichi in 1917, Rajalu recorded that cultivators were unaware of methods to control pests and diseases. He stated, "for insect pests and plants diseases no remedy is possible or conceivable to the villagers; many look upon the havoc wrought as punishment from Heaven" (Rajalu 1918, p. 79). At the resurvey of 1936, Tirumalai noted that two pests that had infected the *samba* crop were sent to the Agricultural Demonstrator's Office (ADO). The ADO recommended cultivating a different variety of rice, but the advice was not followed by cultivators (Tirumalai 1940, p. 130). By the early 1960s, with the introduction of IADP in the village, people began to use short-duration varieties of seeds, chemical fertilizers, and, to a limited extent, plant protection chemicals (Haswell 1967).

By 2004, conditions had changed dramatically and the use of plant protection chemicals was universal. After panicle initiation, irrigating the crop and spraying plant protection chemicals in the event of an insect or pest attack were the only crop-care activities. Cultivators were instrumental in the timely application of insecticides and pesticides as prophylactic measures. In 2003–04, I found cultivators spraying fungicides like Benlate in advance as a precautionary measure against leaf blight disease. Some cultivators also used weedicides like 2,4-D (2,4-Dichloro Phenoxy Acetic Acid) to prevent the growth of broad-leaved weeds in the early stages of crop growth.

19 The PACB gets its supply of fertilizer from government agencies or other cooperative institutions.

Irrigation

Palakurichi is located at the tail-end of the Cauvery delta. Three streams from the Cauvery irrigation network flow near the village: the Odampokkiyar, the Kaduvayar, and the Vellayar. From 1934, Palakurichi has been irrigated by two canals: the Kudirai Sevaganar canal, which branches out from the Odampokkiyar, and the Terkodi canal, which branches out from the Kaduvayar. Most of the land in Palakurichi is irrigated by the Kudirai Sevagnar canal. This canal enters the village at its northern end and flows southwards before emptying into the Vellayar river, which flows along the southern boundary of the village.[20] The Terkodi canal also enters the village at its northern end, flows southward through the western side, and empties into the Vellayar, which serves as a drainage channel for the village. Irrigation water is carried to individual fields through field channels, as well as from field to field.

An important event in the irrigation history of the village was the construction of the Cauvery Mettur Project in 1934. Guhan (1983) describes its impact on Palakurichi thus:

> Prior to the construction of the Cauvery–Mettur scheme in 1934, Palakurichi was frequently subjected to floods. The waters of Odampokki, the Kaduvayar, the Vellayar and a stream called the old Yedaiyar (now abandoned) used to combine and form one sheet of water at the time of heavy floods or rains. With greater regulation and a more intensive use of water in the last five decades, the problem now is one of too little water arriving too late and being withdrawn too soon in the agricultural season. Being at the tail-end of the delta, the village receives water in a normal year three weeks after the Mettur Dam is opened for irrigation, which is normally in mid-June. At the other end of the season, the channels are not plentiful. Besides, some of the fields are situated at a higher level than the vaikals (canals). For both these reasons, bailing has to be resorted to in order to secure adequate irrigation. The poor drainage impedes field-to-field flow. Salinity has made it impossible to have wells to supplement the unsatisfactory surface irrigation on which the village is entirely dependent. (*Ibid.,* pp. 39–40).

The situation with respect to irrigation and water control in the village has deteriorated from the time of Guhan's study in 1983. Discussions with cultivators in the village indicated that access to irrigation has worsened in terms of adequacy, timeliness, and reliability in the availability of water. At the time of Guhan's study, a substantial part of the village land was double-cropped. In 2004, almost all the land in the village was mono-cropped, with a single crop of long-duration rice (*samba*) grown between July–August and January–February. Cultivating two short-duration *kuruvai* and *thaladi* crops had almost completely stopped because of lack of access

20 In 1983, the Kudirai Sevagnar canal irrigated a net area of around 800 acres and the Terkodi canal irrigated a net area of 150 acres (Guhan 1983, p. 39). Though the regularity of irrigation has deteriorated over the years, these two canals form the major sources of irrigation for the village.

to adequate and timely irrigation. Even in the *samba* season, transplanting was often delayed on account of a delay in the arrival of irrigation water. In October and November, village land was often flooded by heavy north-east monsoon rains.

At the time of the first study of the village in 1917, there were two tanks in the village that always contained water, and no land was irrigated by wells. Rajalu makes no mention of constraints in the availability of irrigation water for cultivation. In 1940, Tirumalai found that the only source of irrigation for the village were channels branching out from the Kaduvayar river. He mentions that three methods of irrigation existed: (a) by flow directly from the channels to the fields; (b) by bailing where fields were at a higher level and water could not flow by force of gravity; and (c) by percolation (Tirumalai 1940, p. 122).[21] These methods of irrigation required a substantial amount of labour.

Haswell observed a change when she studied Palakurichi in the early 1960s. She noted that "scarcity of labour at peak seasons of demand has recently been mitigated by the installation with grants-in-aid of six wells fitted with oil engines, which supply water for nursery beds in advance of the natural flow of water each season into irrigation channel..." (Haswell 1967, p. 27). In the areas irrigated by these wells, cultivators transplanted and harvested rice earlier than others and were able to get a better price for their produce (*ibid.*). In the 1970s, most of the manual methods of bailing were replaced by diesel pumps (Guhan 1983).[22] The pace of replacing manual methods of bailing with diesel pumps increased as the availability of water in the Cauvery river decreased.

Most cultivators in the village now use diesel pumps (either own or hired) for bailing water from irrigation channels into their fields. Bailing water is necessary because the canals carry only a limited amount of water and that too for a very short duration. On account of the need to lift water using diesel pumps, expenditure on irrigation among cultivators in Palakurichi has increased substantially.

Harvesting and Threshing

In Palakurichi, the normal time for harvesting the *samba* crop is in January and February. However, in the last few years, the delay in arrival of irrigation water resulted in delayed sowing and, as a result, the harvesting period was extended to the first week of March. Harvesting the crop, transporting it from the field to the

21 Tirumalai reported that where the field was higher than the channel, cultivators arranged to lift water on remission of one rupee per acre, a charge known as "bailing remission." A further charge was made for percolation (Tirumalai 1940, p. 122).

22 Guhan observed that "in terms of mechanization, another development has been the replacement of manual methods of bailing diesel pumps in the last ten years or so. Twenty-five diesel pump sets are owned in the village and they are used for bailing water from the two irrigation channels, particularly at the beginning and end of season" (Guhan 1983, p. 47).

threshing floor, threshing, cleaning, and finally packing it into gunny bags, were all done by piece-rated labour, paid in kind. The rice was harvested by male and female labourers working in pairs, using sickles. The harvested crop was spread on the field for some time to dry and was then tied into large bundles. Unlike the other operations in rice cultivation, harvesting started early in the morning, at about 6 am, and continued till dusk. In between, at about noon, the workers took a two-hour break. After tying the crop into bundles, they carried it on their heads to the threshing floor. Cultivators who did not own threshing floors either used threshing floors belonging to others or spread the grain for threshing on the tarred road in the village. Threshing was done by running a tractor several times over the harvested crop. Prior to the use of tractors, bullocks used to be made to trample over the harvested crop to separate grain from panicle. In 2003–04, no bullocks were used for threshing. After threshing, the hay and the grain were collected separately. Stubble and other waste were removed from the grain by winnowing. The cleaned grain was then measured, and wages were paid to the workers in kind, in proportion to the produce. In some cases, the cultivator bought back the produce paid as wages to the agricultural workers at the threshing floor itself and paid for it in cash.[23]

In 2003–04 and 2004–05, years in which the yields of rice were very low, workers hired for harvesting and post-harvest operations were paid daily-rated cash wages instead of piece-rated wages in kind. Because of the low yields, there was not enough produce to pay the harvesting charges in kind. Therefore, in several cases, harvesting was done by casual labour at normal, daily wage rates. Agricultural labourers also insisted on daily wage payments, as yield levels were low, and the grain was not of good quality and would have fetched a low price. Since wages were paid in kind in proportion to the produce harvested, in 2003–04, workers received lower wages than in a normal crop year.

YIELD LEVELS IN PALAKURICHI VILLAGE 1917–2004

A critical factor affecting rice cultivation in Palakurichi, and one that determines yield levels, is the availability of irrigation water.

In 1918, rice yields in Palakurichi averaged 1.13 tonnes of rough rice per hectare. The village rice yield was lower than the average for the district and State (Table 3). By 1938, Palakurichi had better access to irrigation because of the construction of the Mettur dam in 1934. Rice yield in the village that year rose to 2.32 tonnes per hectare, and was higher than the yields reported at the district and State level. Rice yields were even higher in 1967–68 (2.7 tonnes per hectare) and 1983–84 (3.1 tonnes per hectare). In both 1967 and 1983, the village reported a higher level of yield than the average for Tamil Nadu.

23 The price paid was slightly less than the rate at which rice of similar quality was procured in the State-sponsored Direct Procurement Centre (DPC) in the village.

Table 3 *Yields of rice in Tamil Nadu, Thanjavur and Palakurichi village, 1918 to 2003–04* in tonnes of rough rice per hectare

Year	Palakurichi	Thanjavur	Tamil Nadu
1918	1.13	1.6	2.2
1938	2.32	1.8	2.6
1961-62	not available	2.4	2.2
1967-68	2.72*	2.1	2.3
1983-84	3.16	2.7	2.9
2003-04	1.24	4.3	3.5

Notes: *Yield level for rice cultivated by improved methods.
Source: Slater (1918); Haswell (1967); Guhan (1983); survey data, 2004; *Season and Crop Report for Tamil Nadu*, various years.

A striking finding of my survey of 2003–04 was the extremely low yield, 1.24 tonnes per hectare. The yield recorded in Palakurichi in 2003–04 was the lowest recorded in the village since 1918 (Table 3). In 2003–04, the average yields in Nagapattinam district (2.9 tonnes per hectare) and the neighbouring district of Thiruvarur (2.1 tonnes per hectare) were lower than the average yield in the State as a whole (3.5 tonnes per hectare), but the average yield of rice in Palakurichi was even lower than that of Nagapattinam district.

CONCLUDING REMARKS

Palakurichi village in the Thanjavur region of Tamil Nadu is unique in having been studied by means of detailed socio-economic surveys for nearly a century. The first study was conducted in 1918 by students of Professor Gilbert Slater at the University of Madras. I conducted the most recent study of the village, between 2003 and 2005. In the interim, the village was studied by Thomas and Ramakrishnan in 1936, Margaret Haswell in 1961, and S. Guhan in 1983. The examination in this paper of cropping pattern and farming practices from the early twentieth century to the early twenty-first century is based on these studies.

Palakurichi is located at the tail-end of the Cauvery irrigation system and receives water from two canals of the system. The major event of the last hundred years in respect of irrigation in the village was the construction of the Mettur dam in 1934. Problems of flooding, salinity, and shortages of water on the other hand, were controlled after the completion of the Mettur Project. Over the last 20 years, however, water flow in the Cauvery irrigation system has declined steeply and has also become irregular. Indeed, in 2003–04, one of my survey years, Palakurichi received only 23 tmc feet of water, the lowest level in five decades.

Palakurichi has remained a rice-growing village over these nine decades. From 1918 till the early 1960s, only one crop of rice was sown (although there were three rice-crop seasons). From 1963–64, with the introduction of short-duration, high-yielding variety seeds, it became possible to raise a second crop of rice. On account of the deterioration in the irrigation system, by the end of the century, cultivators had returned to a single crop of paddy.

The "stability" of the cropping pattern was accompanied, however, by major changes in cultivation practices. First, tractors, introduced in the 1970s, have completely replaced the use of draught animals for ploughing. Secondly, transplanting paddy seedlings has been replaced by broadcasting seeds, a change related to the shortage of water over the last 10 to 15 years. Thirdly, there is near-universal application of chemical fertilizers and pesticides during crop cultivation. Fourthly, utilization of water from the canal irrigation system, which requires the use of diesel-fuelled pumps, has increased the costs of irrigation. Lastly, while harvesting is done manually, the harvested produce is now transported and threshed using tractors instead of bullocks.

On account of the deterioration in the irrigation system – in terms of adequacy, reliability, and timeliness – agricultural production has suffered. In contrast to a yield of 3.16 tonnes of rice per hectare reported by Guhan in 1983, the average reported yield in 2004–04 was 1.24 tonnes per hectare, the lowest recorded level since 1918.

In conclusion, we see aspects of both continuity and change in agricultural practices over the last century in Palakurichi village. The current situation, however, is one that reflects a serious crisis of agricultural production, with the benefits of the "Green Revolution" having petered out and having been replaced by a regime of low and uncertain yields.

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GLOSSARY

anicut	Masonry barrage
avarai	*Cassia auriculata*
black gram	*Vigna mungo*
brinjal	*Solanum melongena*
chilli	*Capsicum annum*
coconut	*Cocos nucifera*
cowpea	*Vigna ungiculata*
cumbu	*Pennisetum americanum*
drumstick	*Moringa oleifera*

kidai	Practice of stabling livestock over field for manure
kar	Short-duration variety of rice mostly grown as first crop
kuruvai	Short-duration crop of rice cultivated from June–July to September–October
lime	*Citrus sp.*
mango	*Mangifera indica*
nanjai	Wet land
oilseeds	Crops grown primarily for the production of edible oils. They include crops such as sesamum, sunflower, castor, etc.
panchayat	Institutions of local government at the village level
poramboke	Land owned by the Government, generally not assessed and used for public purposes or for the common use of the people of a village
samba	Long-duration crop of rice cultivated from July–August to January–February
sesamum	*Sesamum indicum*
taluk	Administrative sub-division in the revenue administration, below a district and comprising contiguous villages
thaladi	Short-duration crop of rice cultivated from October–November to February–March
vaikal	Canal that regulates the flow of irrigation water from river to agricultural land
2-4-D	2-4, Dichloro Phenoxy Acetic Acid, a herbicide that destroys broad-leafed weeds in rice fields