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Agricultural Transformation in Maningamuwa, a Village in Dry-zone Sri Lanka

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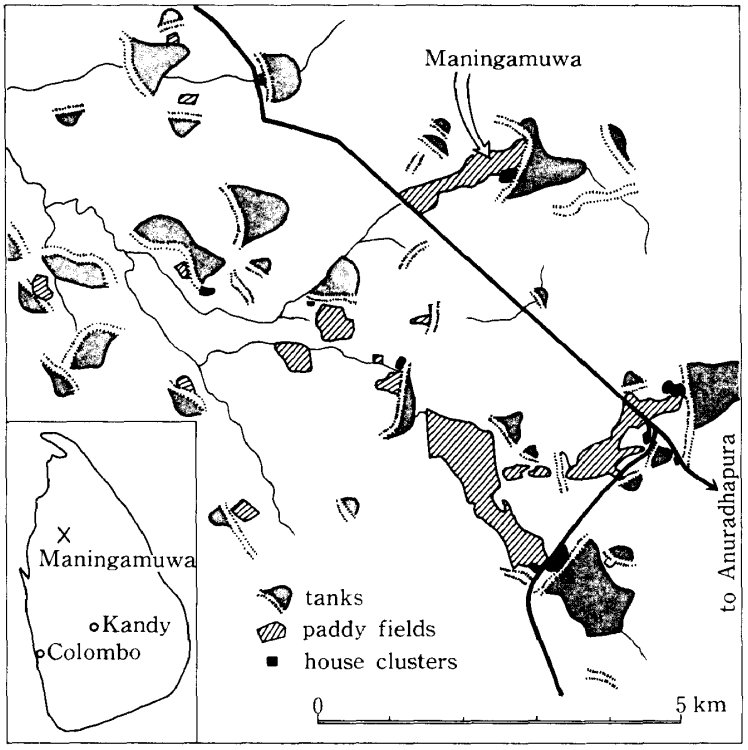

Fig. 1 Map Showing Maningamuwa (×), Village Studied

I The Village: Geographic Setting

Maningamuwa is a typical Sri Lankan dry-zone village consisting of 86 households, located 16 km northwest of Anuradhapura the famous historic city of the dry zone. The provincial road linking the city and the village passes through bushland and open forest with scattered patches of crude looking fields, which are called *hena* by the local people, and shabby looking paddy fields. The location of the village is shown in Fig. 1.

According to the Chief Extension Officer the province of Anuradhapura has 1.11 lakh acres of paddy field and 3,340 tanks, of which 2,229 are now in use. One tank irrigates about 50 acres of paddy field. Since there are about 1,000 villages in the province, an average village is calculated to have two such tanks and 100 acres of paddy fields. Maningamuwa fits this description.

Tanks are used to irrigate paddy fields but, more importantly, they supply water for all domestic purposes; bathing, washing clothes and, in the past, even drinking.

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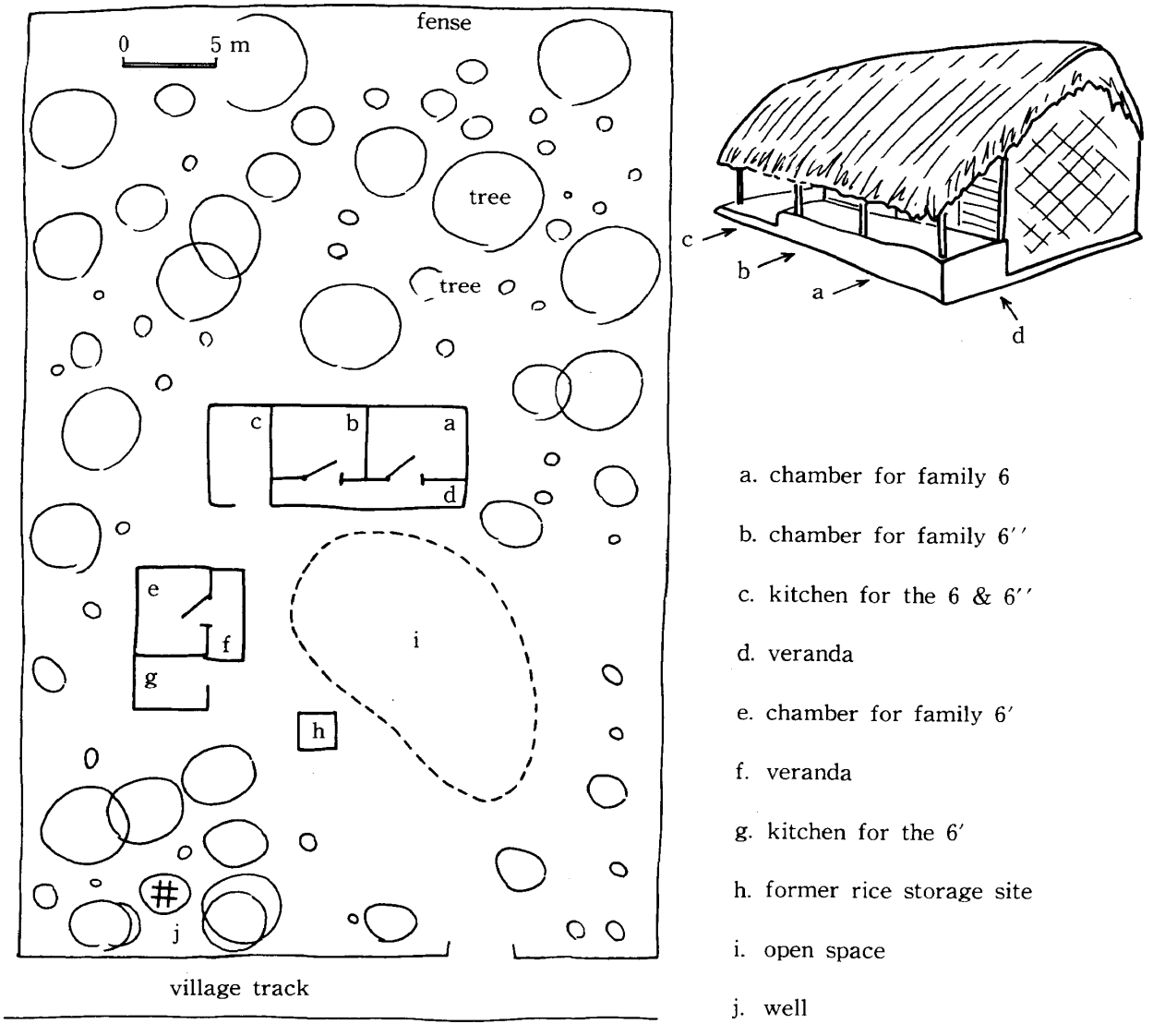
Tank water is indispensable for buffaloes and cattle too. Tanks are constructed by building an earthen dam, usually 2 to 4 m high and a half to one mile long, across a shallow valley. There are larger tanks but these are government-maintained and distinct from the so-called village tanks with which this paper deals.

Villages usually consist of a cluster of 10 to 20 houses close to the tank plus individual houses along village tracks. In Maningamuwa there are many such houses along the track linking the provincial road with the cluster of houses beside the tank. Each homestead in the cluster consists of a building for living in (occasionally two), a small open space for drying par-boiled rice, and a few garden trees, and is surrounded by a simple hedge. Most houses still follow the traditional pattern, particularly in this part of Anuradhapura Province. Three thick earthen walls called *warrichi* form two or



a. chamber for family 6
b. chamber for family 6′′
c. kitchen for the 6 & 6′′
d. veranda
e. chamber for family 6′
f. veranda
g. kitchen for the 6′
h. former rice storage site
i. open space
j. well

Fig. 2 An Example of Homestead. In this case families Nos. 6, 6′ & 6′′ live in the same homestead. Refer to Fig. 9 also.

three rooms as shown in Fig. 2, with a thatched roof of straw. The rooms are as small as 3 m^2 and open onto the front yard. The veranda is about 1 m wide, and is where visitors sit, talk, and sometimes pass the night. If a building has three rooms it is often shared by three families. Boys often have to sleep on the veranda to save room for other family members. These houses always have an additional small *warrichi* room, either attached or separate. This is the kitchen which is often shared by two or occasionally three families living in the same building. A well is commonly found in each homestead.

In Maningamuwa the isolated houses were all built quite recently and stand in the midst of fields planted to maize, cowpeas, etc., or occasionally surrounded by wild brush wood. The principal pattern of these houses is the same as those found in the cluster, but their finish is much cruder. Some new houses have tiled rooves.

II Paddy Growing

Paddy fields are all, directly or indirectly, tank irrigated. *Hena* (fields in forest or bushland) are rainfed.

II–i Three Kinds of Paddy Fields

Maningamuwa has three kinds of paddy fields; *puranawela, akkarawela* and *aswaddum.*

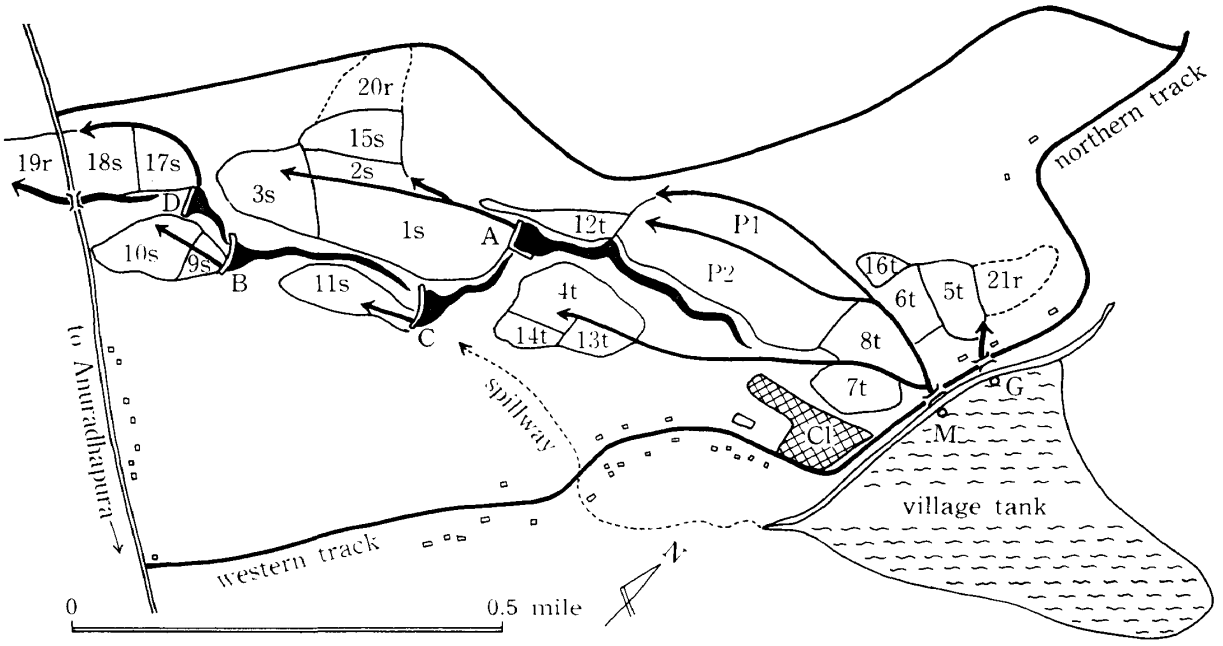
Puranawela are the oldest type and no one knows when they were constructed. They are elongated plots parallel to the tank bank and just below it. By definition these fields enjoy the sole rights to the tank water.

Akkarawela is translated "new paddy fields". The oldest in Maningamuwa is assumed to have been opened sometime in the 1930s, and many others are about 30 years old. *Akkarawela* fields are located either downstream of, or on the slopes beside, *puranawela.* Some *akkarawela* fields have the right to use tank water, but others do not. Legally speaking, what the people of Maningamuwa call *akkarawela* included *sinnakkarawela* (real *akkarawela*), privately owned paddy fields and *badu idam* or those with a lease title.

Fields called *aswaddum* are unregistered paddy fields. These are more recently reclaimed and more marginally located. The distribution of these three kinds of paddy fields is shown in Fig. 3.

Paddy fields in Maningamuwa are divided into parcels called *kotuwas.* As we can see from Fig. 3, there are 18 *kotuwas* in Maningamuwa, each of which has its own name. The *kotuwa* is the working unit for irrigation and fencing. The names of the 18 *kotuwas* are:

1s; *Maha akkara kotuwa*
2s; ?
3s; ?
4t; *Siyabala gaha k.*
5t; *Kudawewa godahorowwa akkara k.*
6t; *Wewalagaha akkara k.*
7t; do
8t; do
9s; *Gamsooriya gaha k.*
10s; *Dahaye kanuwa millagaha k.*
11s; ?
12t; *Puranawela pahala akkara k.*
13t; *Siyabala gaha k.* (2)
14t; *Siyabala gaha k.* (3)



P1, P2; *puranawela*, 1s–18s; *akkarawela*, 19r–21r; *aswaddum*, M; *madahorowwa*, G; *godahorowwa*, A–D; small dams, Cl; house cluster, ⟶; canals, □; houses

Fig. 3 Distribution of Paddy Fields with relation to the Village Tank, Canals and Streams

15s; *Athapattu k.*

16t; *Serisena k.*

17s; *Siyabala gaha k.*

18s; *Dahaye kanuwa k.*

II–ii Growing Methods

All the important decisions related to paddy cultivation in *puranawela* and *akkarawela* are decided at a village meeting (*kanna*) composed of all the farmers and presided by *welvidane*, the irrigation chief of the village. The 1982 meeting, which was held on November 16th, decided the following.

a) The date of the first issue of tank water would be December 16th.

b) Every man must clean the irrigation canals which pass through his field by December 15th.

c) Land preparation had to be done between December 16th and December 24th.

d) The *kotuwa* fence must be erected by December 25th.

e) Sowing was to be done between December 25th and January 1st, using seed of 4 to 4 1/2-month varieties, preferably BG 11–11.

Until five or six years ago the buffalo-drawn plow was the principal tillage method, but now the tractor is more popular. Fields are plowed twice and then levelled with a hand leveller. At this time the farmers trample weeds into the soil. Then drainage channels about 20 cm wide and 6 to 7 cm deep are cut into the levelled surface using a hoe. These allow excess water to drain as quickly as possible so that there is no standing water in the field at the time of sowing.

Germinated seed is almost always broadcast on well prepared fields. The farmers prefer 4 to 4 1/2-month varieties; they say that quick-growing varieties give poor yields.

Some farmers told us that three-month varieties are only economic on *hena* land. Everyone buys seed paddy from the cooperative, they never store it at home. After sowing at least one or two people stay in the field to scare away the parrots which come in hundreds and perch on fence awaiting a chance to steal the seed.

The fields are not weeded. In fact, because this is the busiest season in the *hena* fields, the people do not even stay in the village, only returning when harvest time approaches. The rice is reaped with sickles and piled, in bundles, on a small mound (about 1.5 m^2) in each field for two or three days. Meanwhile large threshing grounds are built here and there in the fields by groups of three or four families. Paddy is threshed by buffalo-trampling, winnowed, and then taken home and stored in gunny sacks.

II–iii Fencing and Guarding

The fields must be protected against wild boar, monkeys, deer, elephants, buffaloes, and cattle with strong fences during the growing season.

Kotuwa is treated as one unit. Each farmer whose fields border the forest, bushland or a track must build a fence along these borders. Thus the entire *kotuwa* is surrounded by a continuous fence. The work is done individually, using whatever materials are available. Some farmers use barbed-wire but many use sticks and poles collected from the forest. Then watch huts are built. These are usually built on stilts about 1.5 m off the ground and have a floor space of about 3 m^2. It is said that in the past some huts were built in large trees to provide a place to escape to if elephants attacked. Watch huts are built every year at fixed sites by the joint efforts of the farmers concerned. The *puranawela* has seven watch huts, *kotuwa* 4t two, *kotuwa* 1s three, *kotuwa* 11s one, *kotuwas* 9s and 10s two, *kotuwa* 17s one, and so forth. The fencing and hut building occur immediately before sowing.

When the paddy begins to ripen guard duty begins. A guard schedule is prepared, with day duty from 6 a.m. to 6 p.m. and night duty from 6 p.m. to 6 a.m. The former is usually done by women and children, while night duty is men's work. It is said that an average paddy-field owner has to spend about five nights in the watch hut per season.

II–iv Irrigation

The size of the Maningamuwa tank is about average for the area. Its embankment is 3 m high and about 1 km long. It has two sluice gates; the main one, called *madahorowwa* or lower sluice gate, and the other called *godahorowwa* or upper sluice gate which was built later. The difference in elevation between the two is 1 m.

In the past, there being no other paddy fields, tank water was used solely to irrigate the *puranawela*, but now this tank supplies water to some other *kotuwas* as shown in Fig. 3.

The *puranawela* is irrigated via two main canals, the northern and the central ones from the main sluice gate. The northern canal irrigates the northern half of the *puranawela*, and the central one the southern half.

Kotuwas 7t, 8t, 4t, 13t, and 14t are irrigated by the southern canal, which was built sometime in the 1930s primarily to supply

water to *kotuwa* 4t, and *kotuwas* 5t, 6t and 16t are irrigated by the canal from the upper sluice gate.

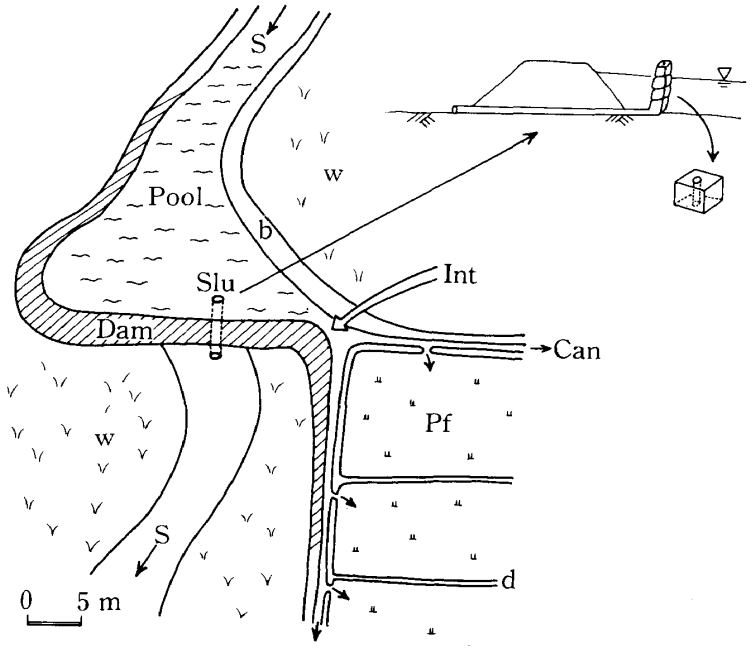
Kotuwa 12t gets the tail water of the *puranawela*.

Other *kotuwas* cannot receive water from the tank but have their own small pools built across the stream. *Kotuwas* 1s, 2s, 3s, and 15s are irrigated by canals carrying water from pool A. *Kotuwas* 9s and 10s receive water from pool B. *Kotuwa* 11s receives water from pool C and *kotuwas* 17s and 18s receive water from pool D.

The structure of the small pools mentioned above is shown schematically in Fig. 4. The stream is 6 or 7 m wide and an earthen dam about a meter high and 30 to 40 m long has been built across it. One corner of the dam is kept open and serves as an intake for canals below. There is no gate at this intake, so water flow depends on the water level. There is no open spillway to drain the water but instead, a six-inch diameter earthenware pipe is buried under the dam. The upstream side of this pipe is connected to a vertical pipe consisting of a series of cubes with connecting cylindrical holes. As long as the uppermost cube is above the water level, water cannot pass through this pipe. When people want to take water from the pool they remove the cube(s) which are above the water level and water then flows through the pipe.

Since there is insufficient water to irrigate all the fields water theft is common. People with downstream fields illegally remove the cube to get water to flow from the upper pool to their pool. Clashes between watchmen and water thieves are said to be not uncommon. It is the *welvidane*'s duty to settle this kind of dispute.

The *welvidane*'s most important job, besides presiding at the *kanna* meeting, is to operate the sluice gates of the village tank. According to the *welvidane*, it is an unwritten law that he opens the gate only when the water level of the tank has reached more than 6 ft. He said that in four of the last 10 years it had not done so and he had kept the gate closed. This meant that, in those years, no fields could be planted, including those irrigated by small pools, because they are also fed by seepage water from the tank.



Dam; small earthen dam, Int; intake, Can; canal, Slu; sluice, Pf; paddy fields, d; farm dike, S; stream, b; stream bank, w; waste land

Fig. 4 A Schematic Picture Showing the Make Up of the Small Dams to Irrigate *Akkarawela*

The *welvidane* gets two bushels of paddy per acre for the services he extends to the village. He said that he cannot collect this paddy, however, when paddy yields are low or crops fail.

II–v Rituals

Some people stick a stick with a coconut in the middle of newly prepared fields and pray for a bumper harvest, but ceremonies at the time of land preparation and sowing are neither sophisticated nor popularly observed.

The most important ritual is at harvest time. First a very small plot is harvested and a bundle of the ears hung on a pole in the field. The rest of the fields are then harvested. When a threshing floor has been made ready, a small hole, about 15 cm across and 15 cm deep, is dug in the middle of the floor and a piece of iron placed in it. Any iron is all right, a piece of a broken sickle or a nail, but it must be washed and purified with coconut milk before being put in the hole. Some people place a coconut shell and/or some herbs, which are supposed to have magical power, in the hole. The hole is called *harak* (cattle) *wala* (hole). When this is finished a man appears holding another bundle of rice, a fork, a broom, and a stick, all used for threshing, on his head, and circles the *harak wala* solemnly three times. He then puts the rice and tools in the middle of the floor and threshes the rice by rubbing it between his palms over the hole, so that the grain falls into the hole. It is strictly taboo to make any noise during this ceremony.

The remaining rice can now be threshed by buffalo trampling. When all the grain has been threshed, the bundle which has been hanging on the pole is carried to the threshing ground and threshed, like the ceremonial bundle, by rubbing between the palms. This ends the threshing operation. During the entire operation, not just the ceremonies, women are forbidden to come near the threshing ground. The last, ceremonially threshed, grain is taken home, mixed with other grain, and cooked immediately into milk rice. The first rice thus cooked must be first offered to the guardian gods, Bhuddha, and crows and other birds, and then eaten by family members. This ceremony is called *aluth bath danaya* (new rice offering).

Another ceremony is called *kiri ithirum* (boiling milk till the pot overflows). The timing varies from place to place, but it is celebrated in May in Maningamuwa. On this day people carry cooking pots, rice and milk to the bank of the village tank and cook milk rice. It is important to see the milk rice bubbling vigorously, which is supposed to be a good omen for a bumper crop in the coming season. This festival is very similar to the Tamil *pongal* festival.

III Upland Cultivation

III–i Hena Cultivation

The *hena* cropping season is slightly earlier than that of wet paddy. The cropping calendar adopted in Maningamuwa is shown below.

Hena cultivation is practiced either in the forest or on bushland. In the former such trees as *weera* (*Drypetes sepiaria*), *damba* (*Syzygium assimile*), *palu* (*Manilkara hexandra*), *kunumalla* (*Diospyros ovalifolia*),

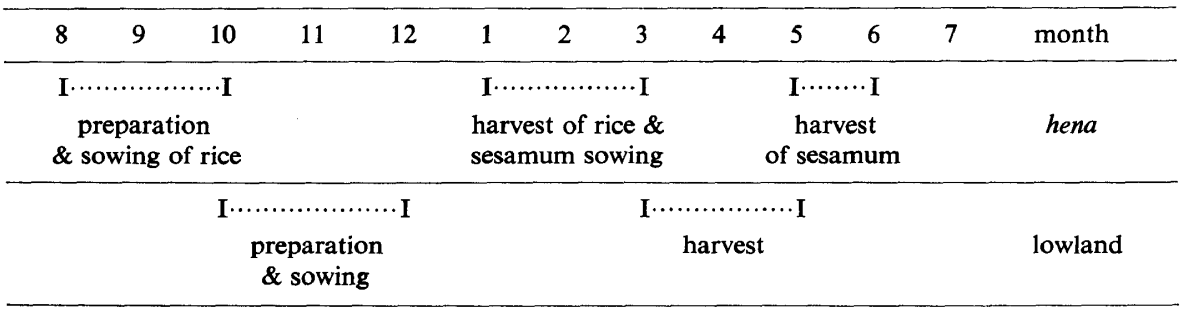


Fig. 5 The Cropping Calendar of *Hena* and Lowland in Maningamuwa

and *maila* (*Bauhinia racemosa*) are dominant, while in the latter *kuratiya* (*Memecylon rostratum*), *andera* (*Dichrostachys cinerea*), *maila, katupilla* (*Flueggea leucopyrus*) and *ela nitulla* (*Plumbago zeylanica*) dominate.

In August trees and bush are cut down and left to dry. Burning occurs before *nikini* (the eighth month) *palu* (destructive) *wassa* (rain) begins. Often two or three families work together, but not necessarily. The firing starts on the windward side of the field, no fire-break is cleared since the fire is said to die out when it reaches the other side of the cleared area. Next handy-sized sticks and poles which have escaped the burning, are collected and used to build a fence around the cleared plot. About a week after the first burning the field is fired again. This time all remaining vegetation is piled in to small heaps and set on fire.

Sometime in late September or early October, when the rain has set in, fields are prepared with *mammoty* (hoe) and sown. Traditionally maize is sown first, and when it is about a foot tall, or 15 to 20 days after the sowing, seeds of *kurakkan* (finger millet), mustard and chilli are broadcast among the standing maize plants. Weeding is done with a small hand hoe. About three months after sowing the maize is ready to harvest. *Kurakkan* is also a three-month crop, so it is harvested 15 to 20 days after the maize. The mustard and chilli ripen about 10 days later. Upland rice is occasionally planted in place of *kurakkan* or sometimes as a separate crop.

The most serious problem with *hena* cultivation is the hazard from wild animals. Wild boar like young maize stalks very much because they contain a sweet juice. One wild boar can eat as many as 60 plants in one night and they also attack cassava. Monkeys are a problem when maize and rice ripen and are very fond of chilli leaves also. Parrots attack rice and beans when they are sown and when ripe. The worst damage is, however, done by elephants. If this animal get into the field, crops are miserably crushed and devoured at any time of the year.

After the harvest of the *maha* season crops, stubble grazing is a popular practice, but a certain portion of the land is prepared for sesamum. Young shoots and weeds which have grown in the *maha* season are cut together with maize and *kurakkan* stubble and burned. Sesamum seed is sown in February or March and is ready for harvest in May or June.

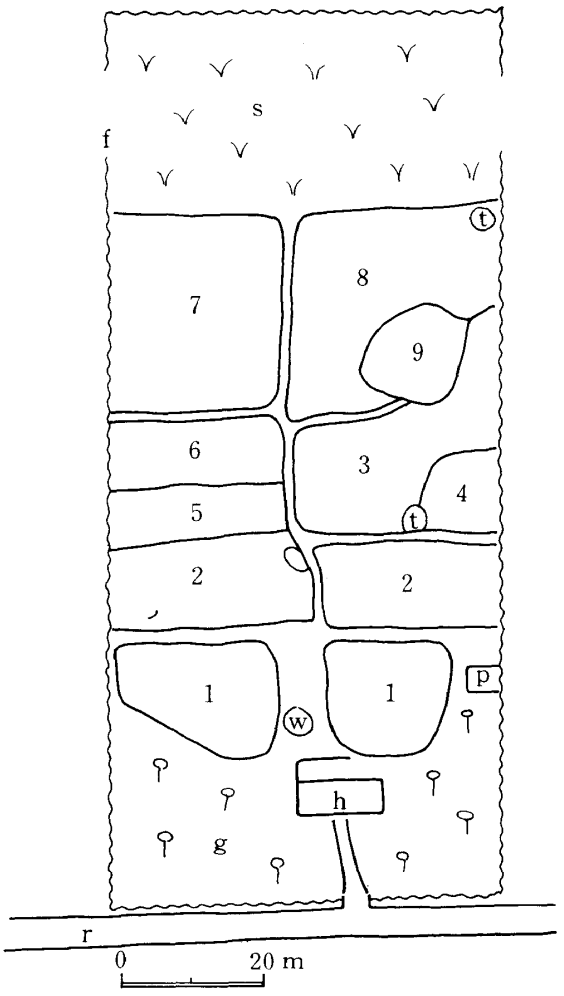
One plot is usually planted for two consecutive years (occasionally three years) and then abandoned.

Recently cash crops have become popular in *hena*. Chilli is the most important, but maize and cowpeas are also of commercial value. The chilli grown today is different from the traditional variety, which is called *wanni* (forest) *miris* (chilli). Unlike the old one, which was broadcast mixed with other crops, the new varieties, which were introduced to Maningamuwa in 1961, are sprouted in a nursery and transplanted into *hena* as a pure stand. One popular planting method for these cash crops is a sort of systematic intercropping. For instance, one row of maize alternates with four rows of cowpeas. People say that this row sowing is primarily used because it is easy to weed with hoes.

III–ii Homesteads

The houses built beside tracks and the road have large "gardens" which are often cultivated. Fig. 6 shows an example. Homestead No. 41, which is one acre, is fenced in with sticks and barbed wire. The front yard is planted with two mango trees, one jackfruit tree, two neam trees and several other trees. They are all still young.

Behind the house is the field, which is divided into two parts. One is a vegetable garden located close to the house. In November 1982, this was planted with egg plant, tomato, onion, rufa, flower amaranthus and other flowers, and passion fruit vines. The housewife said that she often watered these vegetables with water from the nearby well. The other, larger, part which is located further from the house, is used as dry fields in which maize, *kurakkan*, cowpeas, chilli and other crops were planted. They looked



1) mixture of egg plant, tomato, onion, rufa, various flowers, passion fruit vine and etc.
2) cowpea mixed with little maize and castor
3) maize inter-cropped with *kurakkan*; *kurakkan* is broadcast sown in the standing maize plants about 20 days after the sowing of the maize plants
4) maize inter-cropped with musterd; musterd is broadcast sown in the standing maize plants about 20 days after the sowing of the maize plants
5) mung beans 6) cowpea 7) chilli
8) *kurakkan* with a little pumpkins and musterd
9) upland rice
t) turmite mounds planted to chilli, pumpkins, yam and passion fruit vine
s) shrub w) well p) pig pen h) house
g) front garden f) fense r) road

Fig. 6 Homestead Field of Family No. 41, as of November 1982

just like *hena*. In fact cultivation methods differ little from those used in *hena*. At the beginning of the *maha* season, the housewife cuts the weeds and bush, burns them, hoes the soil and broadcasts seed, very often many kinds of seeds mixed together. On old termite mounds sugar cane, yams and passion fruit vines were planted. In swaly plots, whose soil was slightly moist at that time, we saw rice just at the beginning of the tillering stage.

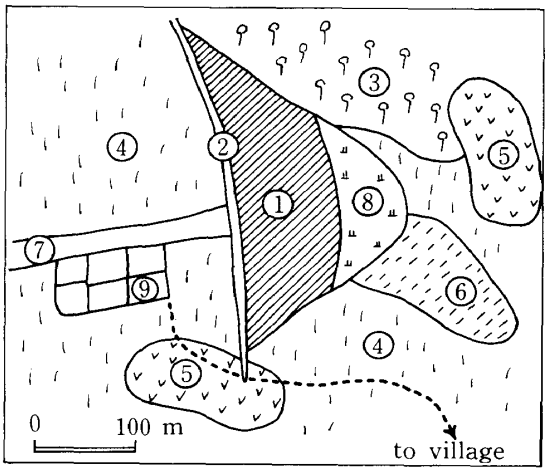
The housewife said that the most serious problem was white ants, which attack all sorts of woody crops. She tried to plant more coconut and mango trees but all were killed by this insect. Another problem is roaming buffaloes and cattle which sometimes stray into the homestead and destroy crops. She was anxious about soil deterioration also and said that after continuous cultivation of the plot for a few years she had noticed a remarkable drop in yields.

One characteristic of homestead farming is that most of the labor is provided by housewives rather than their husbands, partly because males prefer to work outside the home for cash. Some householders are full-time factory workers, and these families do not have *hena* fields. They rely on their homestead fields. Homestead fields are, in a sense, semistabilized *hena* fields located in the homestead and cultivated by housewives.

Number 41 is one of the well-maintained homesteads in this area, but others are also cultivated in a similar way, if not as extensively.

III–iii Newly Opened Paddy Fields

As we mentioned earlier, of 3,340 tanks in the Anuradhapura Province only 2,229 are in use. This means that there are more than 1,000 tanks left unused in the forest, bushland and sometimes in *hena*. Some of these are now being brought into use by local people. Fig. 7 shows an example found 2 km west northwest of the village.



(1) tank water (2) tank bank
(3) forest (4) bushland (5) *hena* field
(6) abandoned *hena* field
(7) scar made by breaching
(8) paddy fields in the tank
(9) newly reclaimed paddy field

Fig. 7 Newly Reclaimed Paddy Fields in Bushland

In early December 1982, we saw a tank (1) (see Fig. 7) surrounded by forest (3), bushland (4), *hena* (5) and newly abandoned *hena* (6). The embankment (2) of the tank was about 1.5 m high but it did not retain its original shape and was covered by bush and trees. Below the tank a scar (7) about 30 m wide was clearly recognizable. This was assumed to have been formed by a breaching of the embankment. Part of the tank (8) was securely fenced and planted to rice. The owner told us that he had been growing rice in this plot for the last four years. This

year he had broadcast the H4 variety in mid-October, when the soil was still dry. Inundation began from the beginning of December. He said that he was expecting 400 bushels (c. 14 m^3) of paddy from this five acre plot.

People do not call this type of field a wet paddy field, though it looks quite similar to normal wet paddy fields when it is flooded. People regard this as a sort of *hena*, because the field is not bunded or leveled, and thus not puddled. Sowing is at the same time as in *hena*.

Plot (9) was three acres of newly reclaimed paddy field. In 1980 four people from Maningamuwa worked together to repair the breached portion of the embankment and prepare the land for cultivation. When the 1981 rainy season began the tank repairs had been finished, but the plot was not made into paddy fields. Instead they planted maize and *kurakkan* as in normal *hena*. Later in 1981 they built field bunds and converted the plot into paddy fields. Then in early December when the tank began to overflow, they let water into the newly built fields to moisten the soil, and had eight buffaloes trample the soil. This trampling is called *addi* (hoof) *gahanawa* (trampling). For two whole days the buffaloes, supervised by two boys, walked around and trampled down weeds. Next more water was let into the fields which were left deeply inundated for a whole day. Then the water was drained off and the second trampling began.

The main purpose of the second trampling was to soften the soil rather than to kill weeds. This took eight buffaloes three days. Immediately after trampling, inter-drainage ditches were dug in the fields to drain excess water from the small, scattered depressions. Finally germinated seed was broadcast. In 1982, when we visited the site in early December, they were doing the same work as described for 1981.

The fields we saw looked very crude; there were still tree stumps and termite mounds in the fields and small pools forming in low spots here and there. According to the farmers working there, levelling was impossible because of tree roots just below the surface. The owners said that they would continue to use trampling for another three or four years and then change to buffalo plowing.

The fields described above are of course not yet registered at the land office. The local people would describe them as *aswaddum*. Since these fields do not use the village tank, they are not controlled by the *kanna* meeting; the owners can decide their own cropping calendar. Their main problem is shortage of water during the later stage of the growth period. The small and poorly maintained tank cannot hold water for a long period, and the rice plants often suffer from drought during the flowering and milking stages.

IV Hydrography for Cultivation

IV–i Rainfall

The water required for growing rice can be divided into three parts: consumptive use, irrigation losses, and water for special purposes. Consumptive use means water lost in evapotranspiration and the various metabolic activities of the plants themselves,

and constitutes the minimum water requirement for the plants to survive. If water management is poor, more water is needed. Irrigation losses occur due to overflow of surface water or percolation into deeper soil layers. Water required for special purposes includes activities such as land preparation, washing and so on.

Rasiah, who examined previous work on the Sri Lankan dry zone on this topic, says that consumptive use is about 20 inches (500 mm) for four-month varieties in the *maha* season [Rasiah 1980: 3]. If we simply divide this figure by four, the monthly value comes to 125 mm. On this basis the minimum water requirement for four-month varieties can be determined as follows:

1st month 250 mm, 2nd month 125 mm,
3rd month 125 mm, 4th month 125 mm

The figure of 250 mm for the first month is obtained by summing the 125 mm (five inches) which is the minimum required for land preparation and 125 mm needed for consumptive use.

Based on the rainfall record compiled by Yoshino, M. and Suppia, R. [1982], rainfall at Anuradhapura from 1870 to 1980 is summarized as Table 1. This table shows

Table 1 Rainfall at Anuradhapura from 1870 to 1980

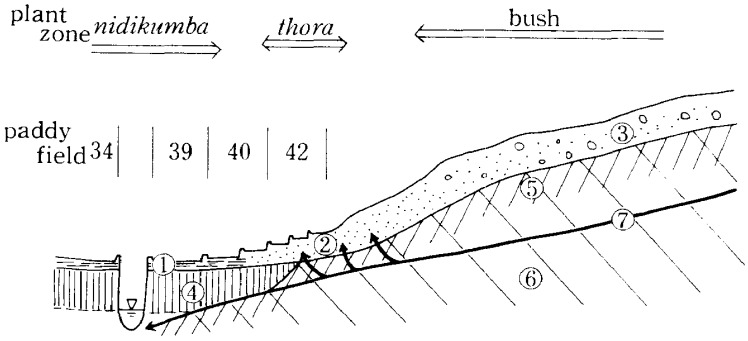
Month	Average Rainfall	Number of Years over 250 mm	Number of Years over 125 mm
Aug.	43.5	0	12
Sept.	74.4	4	24
Oct.	248.2	46	94
Nov.	257.9	55	101
Dec.	226.0	33	78
Jan.	98.0	9	33
Feb.	45.6	0	6

that the 250 mm of rainfall required for the first month are not available in August and September. In October the requisite 250 mm of water fell in 46 of the 111 years, making land preparation theoretically possible. We know, however, that the farmers never undertake land preparation in October for two reasons. One, the likelihood of sufficient rainfall (46/111) is too small, and two, October rainfall sinks very quickly down to deeper soil layers leaving only a little water near the surface. The best time for the land preparation thus falls in November, though even then 250 mm of rainfall is not certain.

If land is prepared in November, then monthly precipitation of at least 125 mm is required in December, January and February for the growth of the plants. Table 1 shows, however, that average rainfall is 226.0 mm, 98.0 mm, and 45.6 mm for December, January, and February respectively. Given the figures for January and February, irrigation is naturally unavoidable. Furthermore, actual water requirements are much greater than consumptive use. It is apparent that rain-fed wet rice growing is totally impossible under the condition of Sri Lankan dry zone. Farmers say that sowing is carried out without fail, by adjusting the time of land preparation according to the progress of rainy season, but the problem is whether or not they can secure tank water at the flowering stage.

IV–ii Soil Moisture

Fig. 8 is a north-south cross section through field No. 34 in the *puranawela*, Nos. 39 and 40 in *kotuwa* 4t, No. 42 in *kotuwa* 13t, and beyond to highland bushland. It clearly



(1) clayey facies of top set layer
(2) loamy facies of top set layer
(3) gravelly facies of top set layer
(4) stiff alluvial clay
(5) weathered and brecciated horizon of gneiss
(6) gneiss
(7) groundwater level

Fig. 8 A Cross-section through *Puranawela, Akkarawela* and Bushland, Showing Its Soil and Water Condition

shows that there are three different plant zones: the *nidikumba* (*Mimozae pudica*) zone, the *thora* (*Cassia tora*) zone, and the bush zone. The *nidikumba* zone includes all the *puranawela* and the lower part of the *akkarawela*. *Nidikumba* is the absolutely dominant plant, but the sedge-like *kudamatta* (*Fimbristylis miliacae*) also appears, especially in the *akkarawela*. The *thora* zone covers the upper part of the *akkarawela* and is exclusively composed of *thora*. The bush zone is highland. Maningamuwa villagers say that the *puranawela* has been cultivated for a long time and its soil is exhausted. This is why only such hardy plants as *nidikumba* thrive there.

The soil profile observed in fields Nos. 34, 39, 42 and the upland is as follows. All soil colors recorded below represent moist conditions.

No. 34

Ground surface–5 cm: Brownish gray (10YR4/1) soft loam with many bright brown (7.5YR5/6) fibrous mottlings.

5–20 cm: Grayish yellow brown (10YR5/2) and dull yellowish brown (10YR5/4) finely mixed sandy clay loam with few bright brown cloudy mottlings.

20–40 cm: Same sandy clay loam as above, but much more stiff, common to many bright brown cloudy mottlings and few manganese pisolitic concretions.

No. 39

Ground surface–7 cm: Brownish gray (10YR4/1) clay loam with few bright brown (7.5YR5/6) mottlings and few coarse grains (3 mm).

7–17 cm: Gray (N4 & N3) and grayish yellow brown (10YR4/2) mixed sandy clay loam with many coarse grains (3 mm).

17–20 cm: Grayish yellow brown (10YR4/2) clay loam with many iron and manganese concentrations.

20–30 cm+: Grayish yellow brown (10YR4/2) and dull yellowish brown (10YR5/4) stiff clay loam with common grayish brown (7.5YR5/6) cloudy mottlings and few manganese pisoliths.

From the soil profiles given above, the soil of the *nidikumba* zone may be summarized as follows:

a) Only thin top soil 5 to 7 cm thick is soft enough to allow free penetration of plant roots. This is suggested by the common occurrence of fibrous mottlings.

b) The deeper horizon more than 20 cm deep is made of stiff and practically

unpermeable clayey bed.

No. 42

Ground surface–10 cm: Brownish gray (10YR5/1) and dull yellowish brown (10YR5/3) mixed loose loamy sand.

10–40 cm+: Gray (10YR5/1), dull yellowish brown (10YR5/3) and dull brown (7.5YR6.3) mixed loose loamy sand with many grains (2–3 mm).

Thus the soil of the *thora* zone is made up of loose sandy materials of substantial thickness.

Upland

Ground surface–30 cm: White (10YR8/2) weakly cemented clayey sand with many angular to sub-rounded quartz grains (2–4 mm).

30–90 cm: Yellow (10YR7/6) sandy clay with common red (2.5YR5/8) cloudy mottlings and many quartz grains (2–50 mm).

90–200 cm: Brecciated gneiss.

The groundwater table, based on village wells is shown in Table 2. It is clear that the groundwater table during the dry season is around 4 to 6 m deep on the highland, but much shallower at its edge.

If we combine the information on groundwater and soil profile, a schematic cross-section showing the hydrographic condition of the soil during the dry season can be prepared, as in Fig. 8. This enables us to say:

a) Bush zone: The groundwater table (7) stays 4 to 6 m below the surface. The top soil (3) parches out.

b) *Thora* zone: The groundwater table as shallow as around 3 m. There is a possibility of the groundwater moving up by capillary force through the brecciated gneiss zone (5) into the loamy sand horizon (2). At limited number of places there is even the chance of the emergence of seepage water on the surface.

c) *Nidikumba* zone: Part of the water which has reached the loam horizon (2) moves into the top soil layer (1) of the *nidikumba* zone. But the amount cannot be large because the major part is consumed in the *thora* zone itself. The groundwater table may not be very deep, but its upward

Table 2 Groundwater Level on the Basis of Village Wells

No.	Date	Depth	Low	High	Bottom
15	Nov. 06, 82	2.9	3.1	0.0	
2	do	3.8	4.1	1.0	
govt.	do	4.0	5.2	3.0	
13	Nov. 11, 82	2.6	4.5	0.0	5.5
4	do	2.6	3.2	0.5	6.1
6	do	3.4	3.9	0.6	4.2
24	Nov. 13, 82	4.4	4.9	1.0	6.3
31	do	5.0	5.3	2.6	6.0
36	do	5.5	5.8	2.5	6.0
28	do	5.4	5.9	4.0	7.4
41	Nov. 06, 82	5.7	6.0	2.5	
43	Nov. 13, 82	4.0	5.3	3.0	5.6
44	do	3.7	3.9	1.5	4.7
11	Nov. 14, 82	3.5	?	0.5	6.0

No. : well number, corresponds to homestead number
Date : date on which examination was carried out
Depth : measured depth on that day (in meters)
Low : lowest level, given by well owner (in meters)
High : highest level, given by well owner (in meters)
Bottom: depth of the bottom of the well (in meters)

infiltration into the top soil layer (1) is impossible, because the subsoil (4) is stiff clay and impermeable. The top soil thus tends to be dry.

The *welvidane*, who is the owner of field No. 39, says that once the field is flooded with irrigation water, inundation lasts for five days, as opposed to one day in field No. 42. He also says, however that No. 39 is more susceptible to drought than No. 42. The *puranawela* or the *nidikumba* zone seems to be much more drought susceptible than it ought to be from its topography. This is probably due to the very thin soil layer capable of holding water effectively and the fact that the top soil is separated by an unpermeable clay layer from the underlying strata which are capable of retaining groundwater. On the other hand, some spots in the *akkarawela* or the *thora* zone, are in a better position thanks to the effective capillary movement of water from the lower layers.

IV–iii Dry Land Cultivation versus Wet Land Cultivation

Upland cultivation and lowland cultivation are quite different with respect to water management.

On upland, when the rains begin and the soil becomes moist, fields are plowed immediately and seed is sown without delay, usually in late September or October. The plants sprout during the first rain and, taking advantage of the whole rainy season, mature at the beginning of the dry season. Upland cultivation is, thus, rain-fed in the strict sense.

On lowland, early in the rainy season the soil becomes moist but the ground is not flooded even in low lying places. Inundation occurs only after the middle of the rainy season, usually in November or, in some years, after December. Wet rice cultivation starts at this time. Work cannot begin earlier because puddling is not possible without inundation. If we sow in late November we have only about one month of the pluvial period left after sowing. January is already dry. Thus, to grow wet rice, we need to irrigate the crop during the later stages of its growth.

Upland cultivation, which is free from the burden of irrigation, has its own disadvantage, weeding. Puddling helps to eradicate weeds, and since it is not done on upland, weeds appear in plenty and must be removed by hand.

To summarize, farmers sow seed in upland fields in September and October, move down to the wet rice fields for land preparation and sowing of germinated seed in November and December, and return to the upland fields for weeding in January. February is the time for the upland harvest and March for the wet rice harvest. In this way both water and human resources are most efficiently utilized. *Hena* cultivation and wet paddy cultivation are quite complementary.

V Maningamuwa in the Past

Maningamuwa is located on an ancient road linking Anuradhapura and South India via Mannar. The area along this road was probably well developed in the days of the Anuradhapura kingdom. The history of the village itself is, however, totally unknown. Even the situation in the late nineteenth

century is already very dim. In this section, the situation from the 1920s to World War II, as described by a snake-bite doctor born in 1908 and the present *welvidane*, born in 1931, is discussed.

V–i Village Life in the Mid-1920s

The village of the mid-1920s consisted of only a small cluster of 12 houses surrounded by a stockade. Houses were not separated by fences or hedges and there were no large homestead groves. Four or five coconut trees and five or six mango trees were the only trees of note. Thus it looked quite different from the village now, which is criss-crossed with hedges and fences and contains many garden trees. The site of the house cluster has not changed though.

The village of the 1920s was enclosed by a stockade around which an area about 60 m wide had been cleared. Beyond this was the forest and bush with scattered *hena*. According to the snake-bite doctor, this open space was very important for the security of the village. The many elephants in the forest and bushland were hesitant to cross it and so the village, particularly during the *hena* season when it was inhabited only by women and children, was much safer.

Hena cultivation was almost the same as now, except for the lack of cash crops. *Kurakkan* was the absolutely dominant crop. Forest and bushland were also utilized for buffalo and cattle grazing. Each family had at least three or four animals and some had more than 50. These animals spent most of the time in the bush. The villagers enjoyed buffalo curd every day for neither milk products nor meat were ever sold. The bush also supplied meat of wild boar, elk, and deer. Almost every day some one brought back game to the village where it was shared. Honey collecting was also important because it provided a good cash income. Beeswax was also sold. Sometimes tigers were hunted for their furs which was sold.

The villagers also grew wet rice. Since there was no *akkarawela* at that time, all the rice was cultivated in the *puranawela*. *Maha* was the main season, but a *yala* crop was also grown almost always following the *bethma* system, which is used when there is insufficient tank water to irrigate all the *ayacut* area. The area to be irrigated is decided by agreement and divided among all the land holders according to their total holdings. Many farmers are allocated other people's fields, but can cultivate them without paying rent.

According to the sanke-bite doctor, rice cultivation was similar to today's, except that, though the plow was used people depended more on buffalo trampling. The standard trampling practice was to use three teams, each of which consisted of four buffaloes led by a boy. The danger from animals, particularly elephants, was greater than today, but drought damage, which is quite common nowadays, was unusual. Thus rice harvests were quite satisfactory, if they could be successfully protected from wild beests.

In those days, every house stored its rice separately. There were two types of container. One, a large straw basket put on a stand about 6 ft high. People often cooked rice beneath this basket in order to

keep germs and insects away. This was for short term storage. The other was a bin made of *warrichi* (earthen wall with frame of twigs) 4 to 5 ft across and 6 to 7 ft high, put on stilts about 18 inches high and covered with coconut leaves. This was for more permanent storage, say two or three years. People always built these in their front yard, for they thought that to keep rice in their back yard was sacrilegious. Nowadays, however, no one builds this type of storage facilities. Even the largest producers like families Nos. 3 and 4 (whose holdings are 13 and eight acres respectively) do not have separate storage facilities. They pack rice in gunny bags which are kept in a corner of a living room. The reason that people stopped building separate storage facilities is, according to the villagers, that they are compelled to send the rice almost immediately after the harvest either to the government or to merchants to repay loans.

V–ii Ancestors

At the end of the nineteenth century there were nine families living in the village. At that time malaria was a constant threat and though women sometimes bore 10 to 12 children, usually only two or three survived. Thus the population stayed low. At the beginning of the twentieth century, there was a bad malaria epidemic and the village suffered badly. Several families, because the husbands were ill, failed to render service on government works, and were fined. But they did not have the money to pay either and so five of the nine families fled into the jungle. Only four families, those of the snake-bite doctor's mother and her siblings, remained.

In 1907, the current *welvidane*'s father's elder brother happened to visit Maningamuwa. He bought one of the vacant homesteads, on land now occupied by homestead No. 2. He married one of the village girls and soon after, his younger brother, the current *welvidane*'s father, also came to Maningamuwa. At first he lived with his elder brother, but soon bought four acres of homestead and three acres of *puranawela* for himself. He too married a village girl. Several years later, the *welvidane*'s father's eldest brother also joined the village. He married a daughter of house No. 7 and lived there.

The *welvidane*'s father had four sons and two daughters. In the early 1930s, his eldest son moved out of his father's house and built his own at the place now occupied by family No. 15. This was the first house built outside the original cluster and also the first time a separate homestead was surrounded by its own fence. Soon after other homesteads with their own fences were also built.

By the 1950s the father had divided his fortune among his children. The second son, the present *welvidane*, and our informant, inherited homestead No. 1. The third son married a daughter of household No. 13, and moved into her house. The fourth son obtained homestead No. 2. The eldest daughter received homestead No. 12, and the second daughter homestead No. 16. These siblings are still living in the properties they obtained from their father, except for the eldest son who is dead.

The *welvidane*'s father's elder brother had four sons. He also gave his children home-

steads. The eldest son got homestead No. 3, the second son No. 21. In this case three brothers inherited their father's properties in the cluster, but the youngest son had to move out of it.

The *welvidane*'s father's eldest brother, who married the daughter of house No. 7, had only one son and died. This son inherited homestead No. 7 and when he grew up, was elected *welvidane*. He kept this position for 22 years, until he died, and was succeeded by the present *welvidane*.

With this data, we can trace the development of the settlement as shown in Fig. 9. In the 1920s it was still a very small area surrounded by the stockade and the open space. By the 1950s, however, it had roughly doubled in size, and the present homestead pattern had emerged. The village stockade and the open space had, of course, been demolished by this time.

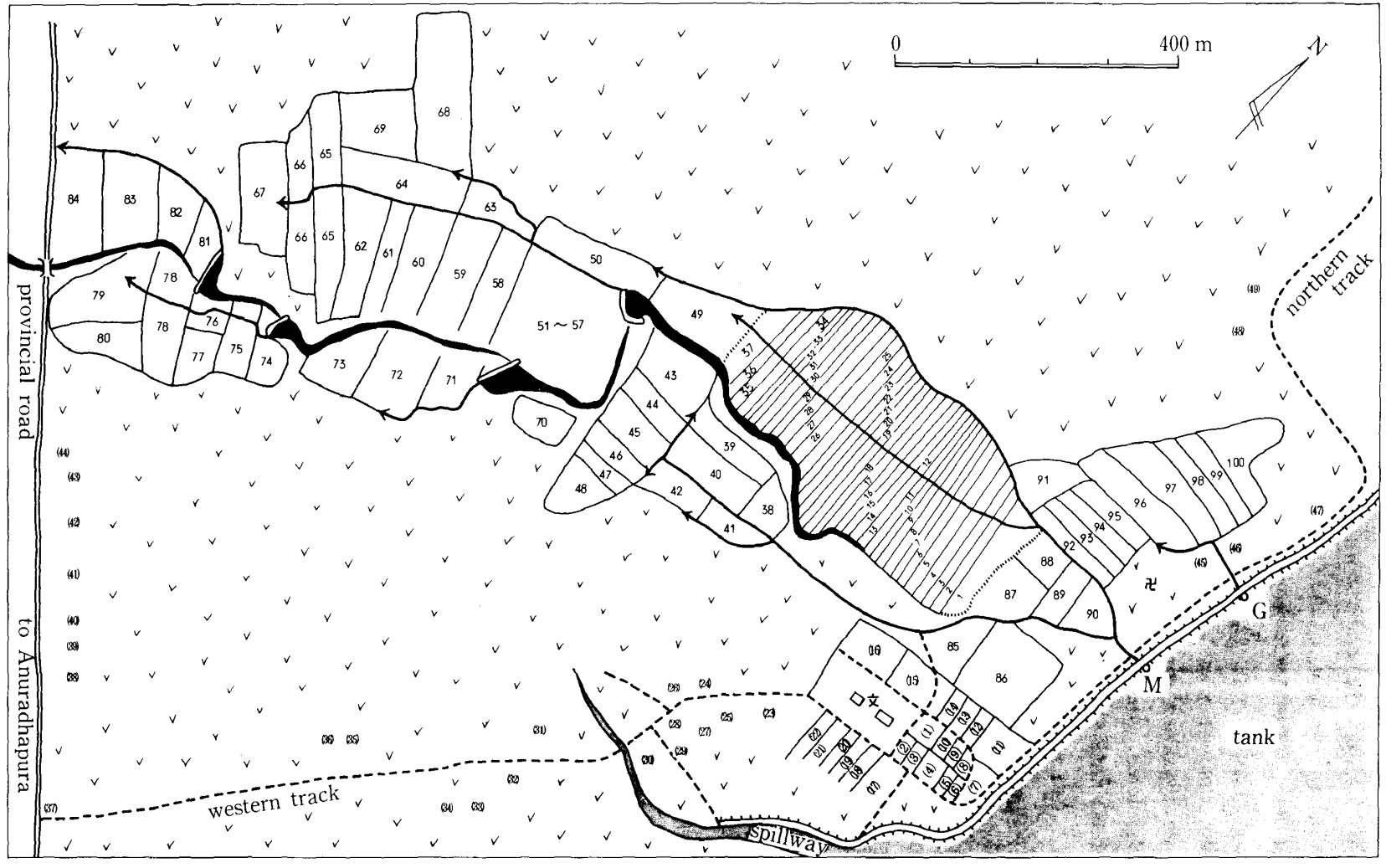
To add a little about the history of the *welvidane*'s ancestors, it is said that they originally came from Talawa, about 20 km south of Maningamuwa. The three brothers had hundreds of buffaloes and cattle but when the railway line reached this area in 1904, they found that Talawa was no longer a suitable place for grazing animals, as cattle robbery became a daily occurrence. It is said that professional cattle thieves systematically sent stolen cattle from this frontier area to Colombo market, taking advantage of the newly built railway. The brothers moved from Talawa to the north and settled at a small village called Nikawewa, about 5 km northwest of Maningamuwa. Their new life at Nikawewa was not satisfactory, so they moved to Maningamuwa and settled down there as rice growers.

We can see that, in the past, people's lives were quite unstable due to malaria, and that this instability was accelerated in the early 1900s, when the railway was extended to reach this area. In fact these types of social change had already started in the 1890s. Government Administration Reports suggest that rapid change began after 1892, when the *kaccheri* office was opened at Anuradhapura. Quite a number of immigrants from the south and the coastal zones arrived in this inland area and built towns along roads and tracks which were then extending rapidly.

V–iii Restoration of the Tank and the Emergence of Akkarawela

The snake-bite doctor remembers that the tank bank in the 1920s was so low that people could see the swans swimming in the tank from their verandas. At that time the tank outlet was a buried pipe made of a *kitul* (a kind of palm; *Caryota urens*) trunk with a plug made of rice straw. There was no well defined spillway.

In November 1926, the tank bund was breached and the fields were damaged. Repairs were made immediately by the villagers and rice cultivation was possible from the following year. In 1933 another breach occurred. An irrigation officer was dispatched from Anuradhapura, and under his direction the tank bottom was dredged, the embankment raised, and the *kitul* pipe replaced with an earthenware one. These repairs were done so well that no further breach occurred until 1954. The last breach was large. Sand spreaded over the fields and repairs were difficult. The villagers



1～37; *puranawela*, 38～100; *akkarawela*, ⟶; irrigation canals, M; *madahorowwa*, G; *godahorowwa*, (1)～(14); cluster core, (15)～(22); cluster periphery, (23)～(49); dispersed homesteads, 文; school, 卍; temple, ▽; bushland including *hena* fields

Fig. 9 Map Showing the Distribution of Paddy Fields and Homesteads of Maningamuwa (The map is made on pacing. It is subject to correction when surveyed exactly.). The acreages and owners of the paddy fields shown above are listed in the Appendix.

gave up cultivation for three years. When the breach was repaired the embankment was raised again, by one foot, so that the projected water level became 8 ft from the bottom and the earthenware pipe was replaced by the existing masonary structure. In addition the *godahorowwa*, or the upper sluice, was constructed. In the dry season of 1981, the embankment was again raised. This time the work was initiated by the government as a drought prevention measure. The projected water level was raised to 10 ft, but the actual water level in 1981 did not surpass 8 ft.

The first *akkarawela*, consisting of *kotuwas* 1s, 2s and 3s, was opened sometime around the time of the repairs after the 1933 breach. In the 1940s, *kotuwa* 4t was constructed and other *kotuwas* followed. Table 3 shows the rough dates of the reclamation of the *kotuwas*.

Table 3 is based on the memory of the *welvidane*. He says that the times of the reclamation may not be very accurate but the errors are not large. He also says that the land book kept at the Land Office is not correct either, because fields are usually registered some years after they are constructed.

As we see from Table 3, pre-war *akkarawelas* were constructed in two places, *kotuwas* 1s, 2s and 3s, and *kotuwa* 4t. For *kotuwas* 1s, 2s, and 3s, a new irrigation facility, the small dam A, was constructed. For *kotuwa* 4t, a new canal, the south canal, was extended from the central canal. As we will see later, in Fig. 9 and the Appendix, the 1s–2s–3s block was opened by the E.K.B. group, the *welvidane*'s father's elder brother and his dependants, while *kotuwa* 4t was opened by the E.B. group, the *welvidane*'s father and his dependants.

Table 3 Dates of the Reclamation of the *Kotuwas*

1s	sometime in the mid-1930s
2s	do
3s	do
4t	1940s
5t	mid-1950s
6t	do
7t	do
8t	1950s, but the portion very near the sluice was opened in 1968
9s	around 1960
10s	do
11s	around 1962
12t	around 1962, but the portion close to the *puranawela*, field No. 49 was opened in 1974
13t	mid-1960s
14t	do
15s	around 1968
16t	do
17s	around 1970
18s	do
19r	*aswaddum*, opened around 1977
20r	do
21r	do

The next substantial block of fields was opened in the mid-1950s, when the upper sluice was constructed. *Kotuwas* 5t and 6t were a by-product of the upper sluice. This block was opened by the group of householder No. 45 and its dependants. Householder No. 45 used to have his house where household No. 11 is now located, but moved to his present position, next to the newly opened *kotuwas*, in 1955, to be closer to his fields. His followers, families Nos. 46, 47 and 49, also moved to this area.

The opening of new fields continued after

the 1960s but these were fragmented and located in more marginal positions. Reclamation is still going on. The latest ones are what the villagers call *aswaddum*.

VI Transformation

The two remarkable changes in recent years are the deterioration of the *puranawela* and the rapid increase in isolated homesteads.

VI–i Deterioration of the Puranawela

Ievers [1899] and Leach [1961] describe the ideal type of *puranawela*. The Maningamuwa *puranawela* probably conformed to this pattern originally. The existing partitioning of plots, for instance, makes us believe that this was the case. As Fig. 8 shows, the Maningamuwa *puranawela* has wide strips at both ends. These are most probably the plots which the two authors called *hurulla paluwa* and *ihala elapata*.

The cultivation of the *puranawela* in the 1920s, as described by the snake-bite doctor, also shows features which remind us of the ideal type. The *puranawela* was cultivated every year in both the *maha* and *yala* seasons. In the *yala* season the *bethma* system was used. Collective effort was more popular, particularly for fence construction and look out duty.

Recently the condition of the *puranawela*, particularly its hydrography, has been deteriorated remarkably. This is because its cultivation has expanded too much beyond the capacity. Table 4 shows how seldom the *puranawela* has been cultivated during the last 12 years. The same table shows the situation of the *akkarawela* in the same period.

Table 4 Frequency of *Puranawela* and *Akkarawela* Cultivation 1971/72 to 1981/82

Year	*Puranawela*	*Akkarawela*
1971/72	×	×
72	×	×
73	×	×
74	○	○
75	×	○
76	×	○
77	○	×
78	×	○
79	×	○
80	×	○
81/82	×	○

×: not cultivated
○: cultivated

The villagers have relied more on the *akkarawela* than the *puranawela*. They gave the following reasons for this:

(a) The recent expansion of the *akkarawela* means that there is a greater area than the tank can irrigate. The result is a serious struggle for irrigation water. The most important question at recent *kanna* meetings has been which fields, *puranawela* or *akkarawela*, should be irrigated. This has been decided by the votes of all the village farmers. The result very often favoured the *akkarawela*, which is owned by 27 farmers, as against 16 for the *puranawela*.

(b) Since the *akkarawela* is more fertile than the *puranawela*, to cultivate the former rather than the latter is thought reasonable. To prove the high fertility of the *akkarawela* the people point out the vigorous growth

of the *thora* plant there.

As early as 1975, the superiority of the *akkarawela* was already clear. In that year an acre of *akkarawela* was sold for Rs 4000/=, while an acre of *puranawela* was sold for only Rs 3000/=.

Though the allocation of water is decided by a vote, there is a sort of common understanding about the best way to optimize water usage. If the water level of the tank is more than 7 ft the *akkarawela* is irrigated, and if it is between 6 and 7 ft the *puranawela* is irrigated. The existing extents of the *puranawela* and *akkarawela* are 37.5 acres and 95.25 acres respectively. Everyone knows that the rice fields have been expanded too much and even in the wettest years there is not enough water to irrigate all their fields. A good water year means one in which they can cultivate the *akkarawela*.

Table 5 Land Holding by Family

(1) Homestead-owning Families

Group	Family Numbers	*Puranawela* (ac)	*Akkarawela* (ac)	Homestead (ac)	Coconut (trees)
Cluster Core	1	1	1.5	0.5	5
	2	2.25	2	0.25	12
	3[1]	0	13	0.25	7
	4[2]	4	4	0.75	6
	5[3]	0.75	2	0.25	10
	6	3	1.5	0.25	15
	7	0	2	0.5	10
	8	0.75	0	0.25	8
	9	0	0	0.25	7
	10	1.75	2	0.25	7
	11	0	3	1	25
	12	0	0	0.5	10
	13	1	6	0.25	6
	14	1.5	1	0.25	6
	Average	1.14	2.71	0.39	9.6
Cluster Periphery	15	1.25	3	1	30
	16	1.25	0	1.25	15
	17	0	1	1	0
	18	0	0	0.25	0
	19	0.75	0	0.5	0
	20	0	0	0.5	0
	21	0	8.5	1	2
	22	0	0.5	0.5	2
	Average	0.41	1.63	0.75	6.1
Northern Track	45[4]	1	3	0.5	20
	46	0	0	0.5	16
	47[5]	1	0	1.25	0
	48	0	0	1	0
	49	0	0	1	0
	Average	0.4	0.6	0.85	7.2
Western Track	23	0.75	4.5	1	0
	24[a]	0	1	2	0
	25[b]	0	0	1	0
	26	0	1.5	0.5	0
	27	0	0	1	0
	28	0	0	0.5	6
	29	0	0	0.5	0
	30	0	1	1	0
	31	0	1	1	0
	32	0	0	1.5	0
	33	0	1	2	0
	34	0	0	1	0
	35	0	0	1	0
	36	0	0	1	0
	Average	0.05	0.71	1.07	0.4

VI–ii Expansion of the Village

The village of the 1920s was a small cluster, as shown in Fig. 9. Let us call the part existing at that time the "cluster core". The village of 1950 was not much larger.

Group	Family Numbers	*Puranawela* (ac)	*Akkarawela* (ac)	Homestead (ac)	Coconut (trees)
Provincial Road	37	0	0	1	2
	38	0	0	1	0
	39	0	0	1	0
	40	0	0	1	0
	41[c]	0	0	1	0
	42	0	0	1	0
	43[d]	0	2	1.5	3
	44	0	0	1	0
	Average	0	0.25	1.06	0.6

(2) Homestead-less Families

Cluster Core	2′	1	1.5	0	—
	3′	0	0	0	—
	4′	0	0	0	—
	6′	0	0	0	—
	6″	0	2	0	—
	7′	0	0	0	—
	7″	0	0	0	—
	7‴	0	0	0	—
	10′	0.75	1.5	0	—
	11′	0	0	0	—
	13′	0	0.5	0	—
	50	0	1	0	—
	Average	0.15	0.54	0	—
Other Places	15′	0	0	0	—
	28′	0	1	0	—
	43′	0	0	0	—
	43″	0	0	0	—
	43‴	0	0	0	—
	43⁗	0	0	0	—
	45′	0	0	0	—
	45″	0	0	0	—
	45‴	0	0	0	—
	Average	0	0.11	0	—

Notes: Animal-holding 1) 4 buffaloes & 5 cattle, 2) 20 buffaloes & 10 cattle, 3) 13 cattle, 4) 15 cattle, 5) 1 cattle
Aswaddum-holding a) 1 ac, b) 1 ac, c) 1 ac, d) 1.5 ac
—: not available

The area added from the 1920s to 1950 is called the "cluster periphery". The village of 1982 is quite large. In fact, Figs. 3 and 9 do not cover the entire village; there are areas not shown there. Now in these figures, we can put the village families into five groups: (1) those in the cluster core, (2) those in the cluster periphery, (3) families scattered along the northern village track or the track going north from the village, (4) families scattered along the western track, and (5) those along the provincial road.

When we discuss families, one thing we have to bear in mind is that there are two types of family, the homestead-owning families and the homestead-less families. This occurs because one house building sometimes accomodates more than one family, particularly in the cluster core and cluster periphery.

Table 5 shows the land holdings of all the families. Families are divided into homestead-owning families and homestead-less families, and then further classified into five groups according to their geographical position. From Table 5, the following can be said.

a) The average holding of *puranawela* varies from group to group. The largest is 1.33 acre per family for homestead-owners in the cluster core. Then come the homestead-owners in the cluster periphery followed by those along the northern village track (0.41 and 0.40 acres per family respectively). Other groups have very little or no *puranawela*.

b) We can look at this from another angle. The homestead-owners in the cluster core, 16.3% of the village families (or 14 out of 86) own 60.4% of the *puranawela* (16.0 acres out of 26.5 acres). The concentration of *puranawela* in this group is quite distinctive.

c) As for *akkarawela*, homestead-owners in the cluster core have the largest holding, followed by homestead-owners in the cluster periphery. The other groups, however, also have considerable acreage, except the homestead-less along the tracks and the road.

d) With respect to homestead size there is apparently a different trend. Of the homestead-owners, those in the cluster core have the smallest acreage, 0.39 acre per family. The average acreage per family in the cluster periphery is 0.76 acres, along the northern track 0.85 acres, along the western track 1.07 acres, and along the provincial road 1.06 acres.

e) Most of the trees found in the homesteads in Maningamuwa are semi-wild, and coconut trees are the only ones planted intentionally with great care. Thus the number of coconut trees indicates the degree to which households have made an effort, not only to exploit available crops, but also to add to these by planting. The cluster core has 9.6 coconut trees per homestead, the northern track 7.2 trees, the cluster periphery 6.1, and the rest only 0.4 and 0.6. If we consider the small size of the homesteads in the cluster core, the density of coconut trees these must be regarded as quite high.

f) As mentioned earlier, the cluster core and the cluster periphery were formed before 1950. The oldest house along the northern track was built in 1955, but others on this track are much newer. Those along the western track were all built after 1965, and those along the provincial road were built after 1970.

g) The homestead-less families living outside the cluster are landless. They own neither *puranawela* nor *akkarawela*.

To summarize, the families of Maningamuwa today show great variety with two extremes; people living in the cluster core and those living along the tracks and road. The former still maintain the traditional way of life. Their houses are located near the village tank, their gardens contain many coconut trees, they own sufficient *puranawela* and *akkarawela* fields, and some of them keep a number of buffaloes and cattle. In contrast, those living along the tracks and road are far away from the tank, have no garden trees, and very little or no wet rice field. Most of them are *hena* cultivators only.

One new phenomenon found among these families is work in non-agricultural sectors. In Maningamuwa a newly built tile factory provides the opportunity. Householders commute to the factory while their wives cultivate their homestead fields, as described for family No. 41 above.

The homestead-less families in the cluster core are rather young. The average age of

these householders is 31, as against 55 for those who own homesteads. They are families of sons or daughters living with their parents. It is common, when two families live in the same house, for the son's (or daughter's) family to work the father's fields. The father provides seed paddy, fertilizer and chemicals, and takes one half of the harvest. If a father has two of his children's families living with him, takes one half and the other is divided between his children's families. Most of the homestead-less families in the cluster core seem to be potential inheritors of their father's property, though others in this situation have formed new households along the tracks, just like those who did so in the past.

VI–iii Current Problems

Recently the so-called Walagambahuwa concept has been proposed to intensify lowland landuse. As described in previous sections, one crop of paddy is grown annually, in the *maha* season. This is sown in late November or December and harvested in February or March. The aim of the new concept is to make double cropping of rice possible with better water management. Under this new regime land preparation and sowing must be done in late September or October, taking a chance that the first rain will come early enough. The crop is then solely rain-fed. Immediately after this first crop has been harvested, in December or January, the second crop is planted. The important thing is to dry sow the first crop so as to save tank water for the second crop. Experiments on this new cropping system have nearly finished, and the dissemination program has just started.

Whether or not this new cropping system will be adaptable to different parts of the dry zone is still controversial. Attitudes toward it now in Maningamuwa are negative, for two reasons. One is that the villagers are afraid of a dry spell right after the sprouting of the first crop. Rainfall is quite erratic at this period of the early rainy season. The second is that they do not have enough farm power for the land preparation. They say that paddy fields at the beginning of the rainy season are consolidated and cannot be plowed with hoes or traditional plows. They say that cultivation in the early rainy season is possible only on *hena* land where the soil is friable and quickly softened by the first rain.

But the villagers are not totally indifferent to the concept. They say that with powerful tractors available, double rice cropping might be feasible. According to them, even the soil itself is improved by a thorough tractor plowing; on very well plowed soil the plants have a better chance of survival even in an unexpected dry spell, because well prepared soil has a larger water holding capacity.

The villagers are already aware of the importance of quick growing varieties of rice. They know that for water economy, quick growing varieties are indispensable. As mentioned earlier, at the present moment, people plant 4 1/2-month varieties, but at least they know that one day quick growing varieties will have to be introduced to this village for the more effective use of water.

After talking about the Walagambahuwa concept, our *welvidane* expressed his opinion on the subject. He would dare to try this

new method if enough farm power and a good quick growing variety of rice were provided.

The signs of stabilization of *hena* are seen here and there, but there are problems to be solved if this is to be promoted.

For instance, household No. 16 has three acres of *hena* fields. They divide them into three one acre plots and use a rotation. One plot is used for three consecutive years in both the *maha* and *yala* seasons, and then left idle for six years. It is then used again in the same manner. The *maha* season crops are maize, chilli, cowpeas, etc., and the *yala* crop is sesamum. The householder claims this is the beginning of his *hena* stabilization and argues that to go to the next stage he needs a tractor, because, once continuous cultivation started, weeds would become a serious problem, which he could only cope with a tractor. He says weeds can only be eradicated by deep plowing with a tractor.

A slightly more advanced example is found in family No. 32. This family owns 1.5 acres of *hena* land, which they divide into two parts cultivated every other year alternately. They have done this for the last eight years. For land preparation, they burn the bush and weeds and hoe the ground. The householder says that unless a powerful cultivating tool is available every-year-cultivation is impossible because of the weed problem. This gentleman added that he had already noticed soil deterioration due to too short an interval for fallow. He grows *kurakkan*, rice, and cowpeas. On the crops he grows, he commented that he intentionally avoided chilli because his soil was already too poor for them.

Some families which live outside the cluster area and have large homesteads are successful in establishing a good home garden around their house. An example is homestead No. 36. This homestead has a well 2 m across and 6.3 m deep in front of the house. The young householder is a tile factory worker, but he manages to keep this garden nicely with the help of his wife. The house is surrounded by a thick growth of maize, mung beans, cassava, chilli, egg plant, okra, rufa, pumpkins, and passion fruit vines. There are also several young mango and coconut trees. He says that he intends to convert all his one-acre homestead into this type of home garden. He also says that in the course of continuous cultivation, soil fertility may drop. In order to cope with this problem, he is thinking of planting more tree crops than annual crops, because deep rooted trees are more adaptable to the situation. The water table of his well was 5.5 m below the ground on Nov. 13th, 1982, and he was drawing water in buckets by hand bucket to sprinkle over the crops. As we can see in Table 2, most wells in the village are more or less of similar dimensions to that found at No. 36.

After the Maningamuwa study, we made a brief study tour through Tamil Nadu. One thing that surprised us there was the fact that this area featured more intensive landuse than the dry zone of Sri Lanka, despite its scarcer rainfall. The main reason for this intensive landuse is the energetic exploitation of groundwater via dug wells. The water tables of most of the wells in Tamil Nadu were deeper than 6 or 7 m and some were deeper than 15 m. Yet we saw well

water eagerly lifted for irrigation.

Whenever Maningamuwa villagers talked about the intensification of agriculture, they always argued that tractors were necessary. Tractors sounded like the all mighty. More powerful tools will certainly help the farmers to cultivate the cemented ground, and this will induce much intensification of the village agriculture. But it appeared to us that the exploitation of shallow groundwater could be more essential, at least for increasing the agricultural potential of the region. The establishment of useful trees, with the help of small wells, both in homesteads and around *hena* huts, may be a good start for the stabilization of *hena*. Digging shallow wells in wet paddy fields may also be worth a try. These could be used for the supplementary irrigation of the main crop as well as for the introduction of dry season crops.

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Appendix List of Paddy Field Holdings

Field Number	Acreage (ac)	Owner's Number	Field Number	Acreage (ac)	Owner's Number	Field Number	Acreage (ac)	Owner's Number
1	1	10	33	0.25	temple	71	1.5	°
2	1	2	34	0.75	16	72	2	13
3	1	1	35	0.75	°	73	2	6′′
4	1	°	36	0.5	16	74	0.5	30
5	1	45	37	1	2	75	1	°
6	1	4	38	1	23	76	1	24
7	0.75	4	39	1.5	1	77	0.5	23
8	0.75	4	40	2	23	78	2	43
9	0.75	°	41	1	14	79	3	3
10	0.75	°	42	1	2′	80	1.5	°
11	0.75	19	43	2	3	81	1	13
12	0.25	2	44	1	23	82	0.5	2′
13	0.25	13	45	2	2	83	3	13
14	0.75	8	46	1	°	84	3	°
15	0.75	10	47	0.5	13′	85	1	4
16	0.75	6	48	1.5	26	86	3	11
17	0.75	°	49	3	3	87	1.5	10′
18	0.75	4	50	2	°	88	1	4
19	0.75	4	51–57	4	4	89	1	45
20	0.75	6	58	1.5	6	90	1	33
21	0.75	10′	59	2	3	91	1	31
22	0.75	6	60	2	21	92	1	17
23	0.75	15	61	0.5	30	93	1	28′
24	0.75	14	62	2	5	94	1	50
25	1	2′	63	1	3	95	1	°
26	0.5	15	64	2.5	21	96	2.75	°
27	1	47	65	2	10	97	3	°
28	0.75	23	66	2	7	98	1.5	°
29	0.75	6	67	3	15	99	1.5	°
30	0.75	5	68	4	21	100	2	45
31	0.75	13	69	2	°	′		
32	0.25	°	70	0.5	22			

* Those owners who have dot stands for homestead-less families. For instance 6′ and 6′′ are lodger families of family 6.

** ° marks stand for those who live outside of the area shown in Fig. 9.

*** The acreage given in the table is the acreage reported to the *welvidane*'s office. Field survey done by us suggests that there is discrepancy between the reported acreage and actual acreage.