

Preliminary Survey of Small Millets and Pulses Genetic Resources in Tamil Nadu State of India in 2007

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インド，タミル・ナドゥ州における雑穀類と豆類探索収集の事前調査，2007年

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Summary

NIAS and TNAU signed a Memorandum of Understanding (MOU) on Collaborative Research Project in Plant Genetic Resources. Based on the MOU, field surveys to mainly collect small millets and pulses in Tamil Nadu for three years were planned. This report describes the first visit from October 16 to November 2 in 2007. We mostly explored hilly areas and 42 samples were collected, which consisted of 20 millets, 21 pulses and one sample of sesame.

Introduction

A preliminary joint field survey was made based on a MOU on Collaborative Research Project in Plant Genetic Resources between TNAU, Coimbatore, Tamil Nadu, India and Genebank, NIAS, Tsukuba, Japan. The major purpose of this survey was focused on present status and recent changes of small millets cultivation in mainly hilly areas that have been suggested to possess traditional agro-pastoral culture complex with small millets cultivation. The visit also aimed to identify unique genetic resources for conservation, protection and sustainable use.

Geography and climate

Tamil Nadu is located on the south eastern India. West and North of the state is hilly while the East and South are coastal plains. The climate of Tamil Nadu is tropical. April and May are the hottest months with the temperature going above 40° C in the plains while temperatures

are moderate in hilly areas. Temperature becomes relatively low between November and February. During these months, minimum temperature in the plains rarely drops below 20° C, while the temperature may drop to 5° C or below in the hills. The rainy season are brought by the north-east monsoon between October and December. The average annual rainfall ranges between 635 and 1,905 mm a year of which more than 40 % is in the rainy season.

Methods

On-farm survey of crop genetic resources, mainly small millets and some pulses, was conducted in the Nilgiri hills (Mettupalayam in Coimbatore district, Coonoor, Wellington and Udagamandalam in the Nilgiris district), the Kolli hills in Namakkal district, the west mountain area of Krishnagiri district, the basin area in hills to the east of Harur in Dharmapuri district, the Yelagiri hills in Vellore district, and the plain area between Vriddhachalam in Cuddalore district and Attur in Salem district (Table 1, Fig. 1).

Result and discussion

We collected a total of 42 samples that included three samples of finger millet (*Eleusine coracana*), eight samples of foxtail millet (*Setaria italica*), six samples of little millet (*Panicum sumatrense*), one sample of common millet (*Panicum miliaceum*), one sample of kodo millet (*Paspalum scrobiculatum*), 13 samples of common bean (*Phaseolus vulgaris*), four samples of *Phaseolus coccineus*, one sample of *Vigna trilobata* and others as listed in Table 2. Passport data such as collection locality, cultivation practices, usage, and environmental conditions were recorded as far as possible together with collecting plant materials.

Since climate of Nilgiri hills is cooler and wetter, plants flourish more than other explored areas. Wild buckwheat (*Fagopyrum cymosum*) was found at Udagamandalam (Photo 1). At other hilly areas, we found mainly rainfed fields and some paddy fields. Finger millet, little millet, foxtail millet, rice and cassava were commonly cultivated and on some cases crops were interplanted (Photo 2). At Holly hill, we found slash-and-burn fields where foxtail millet was grown (Photo 3). In the plains, grass land and fields expanded and there were some palm trees on both sides of the road (Photo 4). Also, we could find many paddy fields (Photo 5). Kodo millet was widely cultivated in the plain area near Vriddachalam.

We found significant changes in millet farming in Tamil Nadu. The second author (Kawase) participated in an exploration team collecting millets organized by Dr. Sadao Sakamoto, Kyoto University in 1985, which was conducted in cooperation with the NBPGR, New Delhi and the UAS, Bangalore. Traditional cultivation of millets linked with animal husbandry was widely observed in Karnataka, Tamil Nadu and Andhra Pradesh, and there was a large diversity of finger millet, foxtail millet, little millet, kodo millet and others were successfully collected at that time. Rapid economic development has changed village life style and agriculture itself over the last two decades. Shortage of labors caused by increased population movement toward cities has accelerated mechanization of agriculture. Constructions of trunk roads and successful technology transfer through agricultural extension efforts have promoted commercialization of agriculture. Recently, the Indian government has started to subsidize the distribution of rice (2 rupees/kg) to people with low income, which has drastically changed local farmers' food habits.

Table 1. Itinerary of the preliminary survey in Tamil Nadu of India in 2007

Date	Day	Itinerary	Stay
16-Oct	Tue	Narita-Delhi	Delhi
17-Oct	Wed	Delhi-Coimbatore	Coimbatore
18-Oct	Thu	Coimbatore	Coimbatore
19-Oct	Fri	Coimbatore-Wellington	Wellington
20-Oct	Sat	Wellington-Coimbatore	Coimbatore
21-Oct	Sun	Coimbatore-Kolly hills-Rasipuram	Rasipuram
22-Oct	Mon	Rasipuram-Paiyur	Paiyur
23-Oct	Tue	Paiyur-Harur-Yelagiri-Vridhachallam	Vridhachallam
24-Oct	Wed	Vridhachallam-Tittakudi-Valappady	Valappady
25-Oct	Thu	Valappady-Coimbatore	Coimbatore
26-Oct	Fri	Coimbatore	Coimbatore
27-Oct	Sat	Coimbatore	Coimbatore
28-Oct	Sun	Coimbatore-Delhi	Delhi
29-Oct	Mon	Delhi	Delhi
30-Oct	Tue	Delhi	Delhi
31-Oct	Wed	Delhi	Delhi
1-Nov	Thu	Delhi-	in-flight
2-Nov	Fri	Narita	

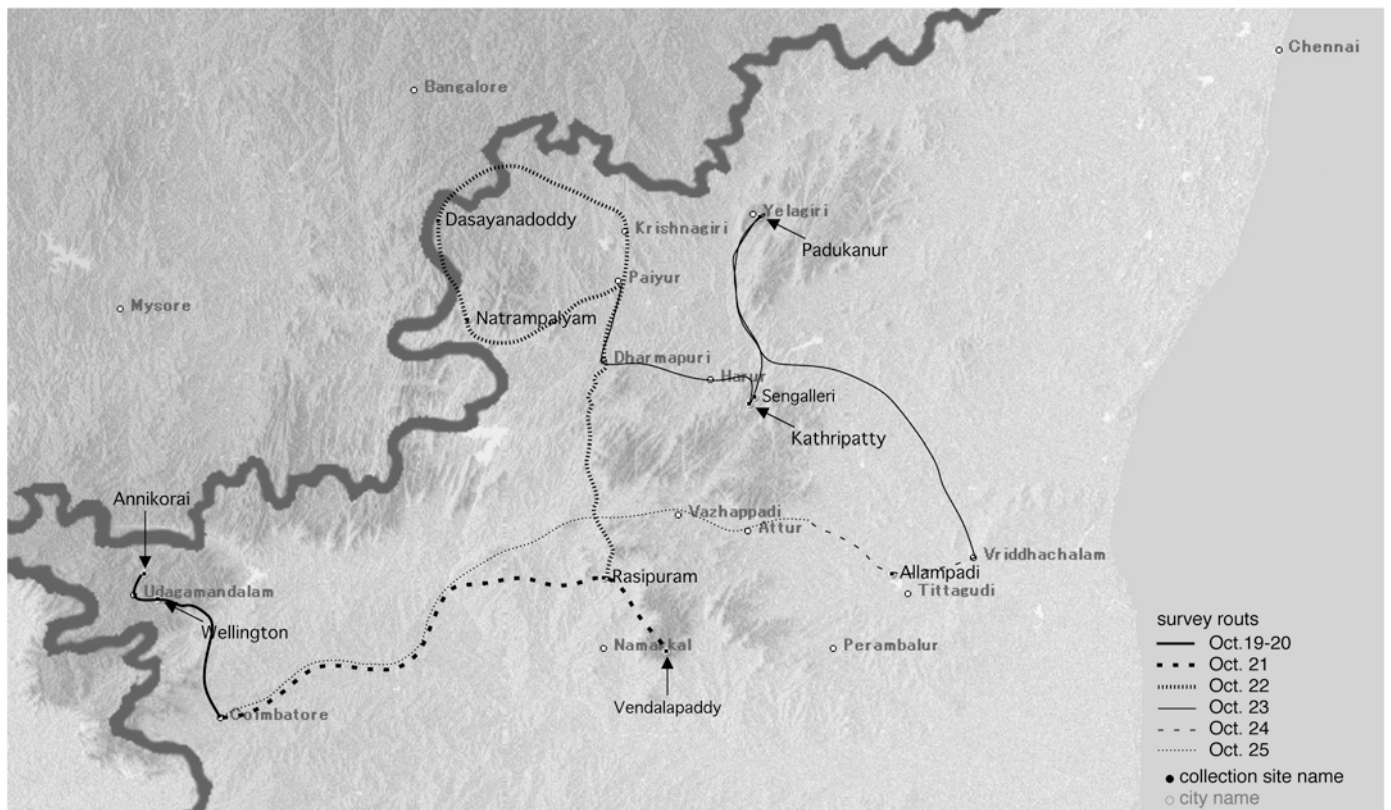


Fig. 1. Collection sites in the survey. The SRTM-3 map is used.

Most of the farmers in remote areas who were traditionally growing small millets abandoned the cultivation of millets even for home consumption, and shifted to other cash crops. Therefore, the renowned “traditional millets culture” in hilly areas and dry areas of Tamil Nadu has been declining. Based on the observation during this trip, we recommend that field studies should be conducted in areas where local landraces of millets are grown even if on a small scale. Although some collections were already conserved in the TNAU, the NBPGR, the NIAS Genebank and others, there are other yet to be explored places.

We would like to refer to the necessity of in-depth collection and analysis of *Vigna*, because wild *Vigna* species are important genetic resources in Tamil Nadu. Recent explorations carried out by Dr. Norihiko Tomooka, Genebank, NIAS and his co-researchers in Thailand, Myanmar, Laos, Sri Lanka and Bhutan followed by analyses of morphology as well as DNA polymorphism have solved taxonomic problems and described new Asian *Vigna* species. As the Western Ghats range is suggested to possess different wild *Vigna* species, hilly areas in the western part of Tamil Nadu may provide new findings on genetic diversity of *Vigna*. We found a few wild *Vigna* populations (probably *V. trilobata*) in this field study, although it was not the season for to collect seeds. In addition to the western part of Tamil Nadu, precise field studies are needed to understand crop and wild relative genetic.

和文摘要

生物研はインド・タミル-ナドゥ州立農業大学と同州における2007年から3年計画の植物遺伝資源共同探索調査のMOUを締結した。本報告はこのMOUに基づいて行われた事前調査についてとりまとめたものである。本調査は2007年10月に主に同州の丘陵地域で行われた。その結果、雑穀類20系統、豆類21系統等、合計42系統を収集した。経済発展に伴う農産物需要の変化・農業の機械化等によって、同州の農業は急速な変化の途上にあった。在来種の消失を防ぐために、早急な遺伝資源の探索収集が望まれる。

Table 2. Passport data of plant materials collected

No.	Local name	English name	Scientific Name	Date MM/dd	Place/village	Latitude		Longitude		Altitude (m)	Source	Status
						° ' "	° ' "					
1	MOCHAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
2	MOCHAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
3	KODIAVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
4	AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
5	AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
6	MOCHAI KOTTAI AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
7	MOCHAI KOTTAI AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
8		common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	improved		
9	PANDAM AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
10	MOCHAI KOTTAI AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
11	PANDAM AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
12	AVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
13	AVARAI	runner bean	<i>Phaseolus coccineus</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
14	AVARAI	runner bean	<i>Phaseolus coccineus</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
15	AVARAI	runner bean	<i>Phaseolus coccineus</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
16	AVARAI	runner bean	<i>Phaseolus coccineus</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
17	KODIAVARAI	common bean	<i>Phaseolus vulgaris</i> L.	10/19	Wellington	N 11 22 43.5	E 76 46 27.0	1809	farmstore	landrace		
18	(BEAN)	faba bean	<i>Vicia faba</i> L.	10/20	Annikorai	N 11 27 29.8	E 76 43 55.8	1929	farmstore	landrace		
19	SAMAI	little millet	<i>Panicum sumatrense</i> Roth ex Roem. et Schult.	10/20	Annikorai	N 11 27 29.8	E 76 43 55.8	1929	farmstore	landrace		
20	EREKI	finger millet	<i>Eleusine coracana</i> (L.) Gaertn.	10/20	Annikorai	N 11 27 29.8	E 76 43 55.8	1929	farmstore	landrace		
21	KORAN THENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/21	Vendalapaddy	N 11 13 3.8	E 78 21 36.9	1181	farmland	landrace		
22	MASURU THENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/21	Vendalapaddy	N 11 13 3.8	E 78 21 36.9	1181	farmland	landrace		
23	KARUPU THENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/21	Vendalapaddy	N 11 13 3.8	E 78 21 36.9	1181	farmland	landrace		
24	SIVAPPU THENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/21	Vendalapaddy	N 11 13 3.8	E 78 21 36.9	1181	farmland	landrace		
25	PILURUVI		<i>Panicum psilopodium</i> Trin.	10/21	Vendalapaddy	N 11 13 3.8	E 78 21 36.9	1181	farmland	wild		
26			<i>Vigna trilobata</i> (L.) Verdcourt	10/22	Rasipuram	N 11 26 50.5	E 78 9 45.8	230	wild	wild		
27	PICHAKADDI	finger millet	<i>Eleusine coracana</i> (L.) Gaertn.	10/22	Dasayana-doddy	N 12 33 27.2	E 77 38 49.0	916	farmstore	landrace		

No. of plant sampled	Cultural practices	Sowing Month	Harvest Month	Topography	Site	Stoniness	Soil Texture	Drainage	Farmer Name	Glutinous	Other Observations
population	irrigated	3-5	6-8	mountainous	slope	none	red loam	good			70 d** crop, determinate, annual, immature seeds boiled for food
population	irrigated	3-5	6-8	mountainous	slope	none	red loam	good			70 d crop, determinate, annual, immature seeds boiled for food
population	irrigated	3-5	10-	mountainous	slope	none	red loam	good			4 M*** crop, vining up to 8 ft, indeterminate
population	irrigated	3-5		mountainous	slope	none	red loam	good			perennial type, harvest except 11, 12 & 1
population	irrigated	3-5	6-8	mountainous	slope	none	red loam	good			perennial type, harvest except 11, 12 & 1
population	irrigated	3-5	6-8	mountainous	slope	none	red loam	good			annual, Vadukas tribe prefer to, for special preparation
population	irrigated	3-5	6-8	mountainous	slope	none	red loam	good			annual, Vadukas tribe prefer to, for special preparation
population	irrigated	5-9		mountainous	slope	none	red loam	good			dwarf, annual, 25 pods/plant, harvest after 70 d, as green vegetables
population	irrigated	3-5		mountainous	slope	none	red loam	good			perennial, house consumption, after 6 M harvest for 3 M except 11, 12 & 1
population	irrigated	3-5	6-8	mountainous	slope	none	red loam	good			annual, Vadukas tribe prefer to, for special preparation
population	irrigated	3-5		mountainous	slope	none	red loam	good			perennial, house consumption, after 6 M harvest for 3 M except 11, 12 & 1
population	irrigated	3-5	7-10	mountainous	slope	none	red loam	good			annual, 3 M crop
5 seeds	irrigated	3-5		mountainous	slope	none	red loam	good			perennial, 6 M crop, big seed size, for house consumption
8 seeds	irrigated	3-5		mountainous	slope	none	red loam	good			perennial, 6 M crop, big seed size, for house consumption, red flower
2 seeds	irrigated	3-5		mountainous	slope	none	red loam	good			perennial, 6 M crop, big seed size, for house consumption, red flower
1 seed	irrigated	3-5		mountainous	slope	none	red loam	good			perennial, 6 M crop, big seed size, for house consumption, red flower
population	irrigated	3-5	10-	mountainous	slope	none	red loam	good			perennial, 6 M crop, white flower
population	irrigated			mountainous	slope	low	red loam	good			3 M crop
population		4	7	mountainous	slope	low	red loam	good			3 M crop, cook like rice in the past, now for ceremony
population	rain-fed	4-5	8-9	mountainous	slope	low	red loam	good	low	red loam	
1 panicle	rain-fed	4-5	10	mountainous	slope	medium	red loam	good			yellow grain, cook like rice, sweets (upma, pongal, adoresum & payosum)
1 panicle	rain-fed	4-5	10	mountainous	slope	medium	red loam	good			yellow grain, bristle, cook like rice, sweets (upma, pongal, adoresum & payosum)
1 panicle	rain-fed	4-5	10	mountainous	slope	medium	red loam	good			black grain, cook like rice, sweets (upma, pongal, adoresum & payosum)
1 panicle	rain-fed	4-5	10	mountainous	slope	medium	red loam	good			orange-colored grain, cook like rice, sweets (upma, pongal, adoresum & payosum)
1 plant				mountainous	slope	medium	red loam	good			
population				plain level	level	low	sandy loam	moderate			
population	rain-fed	8	12	hilly	slope	low	red loam	good			resistant to drought

Table 2(continued).

No.	Local name	English name	Scientific Name	Date MM/dd	Place/village	Latitude		Longitude		Altitude (m)	Source	Status
						° ' "	° ' "					
28	KARUPPU SAMAI	little millet	<i>Panicum sumatrense</i> Roth ex Roem. et Schult.	10/22	Natrampalyam	N 12 15 7.1	E 77 44 13.5	527	farmstore	landrace		
29	NAVANE	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/22	Natrampalyam	N 12 15 7.1	E 77 44 13.5	527	farmstore	landrace		
30	ELLU	semame	<i>Sesamum indicum</i> L.	10/22	Natrampalyam	N 12 15 7.1	E 77 44 13.5	527	farmstore	landrace		
31	PILLU SAMAI	little millet	<i>Panicum sumatrense</i> Roth ex Roem. et Schult.	10/23	Sengalleri	N 12 0 28.1	E 78 38 0.0	374	farmstore	landrace		
32	SURUTTU KEVURU	finger millet	<i>Eleusine coracana</i> (L.) Gaertn.	10/23	Sengalleri	N 12 0 28.1	E 78 38 0.0	374	farmstore	landrace		
33	SENTHENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/23	Sengalleri	N 12 0 28.1	E 78 38 0.0	374	farmstore	landrace		
34	VELLAI TENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/23	Sengalleri	N 12 0 28.1	E 78 38 0.0	374	farmstore	landrace		
35	PILLU SAMAI	little millet	<i>Panicum sumatrense</i> Roth ex Roem. et Schult.	10/23	Kathripatty	N 11 59 11.3	E 78 37 5.7	399	farmstore	landrace		
36	TENAI	foxtail millet	<i>Setaria italica</i> (L.) P. Beauv.	10/23	Kathripatty	N 11 59 11.3	E 78 37 5.7	399	farmstore	landrace		
37	KARUN SAMAI	little millet	<i>Panicum sumatrense</i> Roth ex Roem. et Schult.	10/23	Padukanur	N 12 34 15.5	E 78 39 13.8	939	farmstore	landrace		
38	VELLAI SAMAI	little millet	<i>Panicum sumatrense</i> Roth ex Roem. et Schult.	10/23	Padukanur	N 12 34 15.5	E 78 39 13.8	939	farmstore	landrace		
39	MALAI THUVARAI	pigeon pea	<i>Cajanus cajan</i> (L.) Millsp.	10/23	Padukanur	N 12 34 15.5	E 78 39 13.8	939	farmstore	landrace		
40	VELLAI AVARAI	lablab bean	<i>Lablab purpurea</i> (L.) Sweet.	10/23	Padukanur	N 12 34 15.5	E 78 39 13.8	939	farmstore	landrace		
41	PANI VARAGU	common millet	<i>Panicum miliaceum</i> L.	10/23	Padukanur	N 12 34 15.5	E 78 39 13.8	939	farmstore	landrace		
42	VARAGU	kodo millet	<i>Paspalum scrobiculatum</i> L.	10/24	Allampadi	N 11 27 30.3	E 79 3 44.5	81	farmstore	landrace		

* Collection No. is designated as COL/INDIA/2007/TNAU-NIAS/(Sr. No.).

**d means days

***M means months

No. of plant sample	Cultural practices	Sowing Month	Harvest Month	Topography	Site	Stoniness	Soil Texture	Drainage	Farmer Name	Glutinous	Other Observations
population	rain-fed	6	9	hilly	slope	medium	red loam	good			semilooper, if sowing is delayed, cook as rice, semi-solid gruel (kanji)
population	rain-fed	6	9	hilly	slope	medium	red loam	good			cook as rice, semi-solid gruel (kanji)
population	rain-fed	4	7	hilly	slope	medium	red loam	good			
population	rain-fed	6-7	10	undulating	slope	medium	sandy loam	good			food & fodder, cook like rice
population	rain-fed	7-8	12	hilly	slope	medium	sandy loam	good			food (curry ball)
population	rain-fed	5-6	9-10	hilly	slope	medium	sandy loam	good			cook like rice
population	rain-fed	5-6	9-10	hilly	slope	medium	sandy loam	good			cook like rice
population	rain-fed	6-7	10-11	hilly	slope	medium	sandy loam	good			cook like rice
population	rain-fed	6-7	10-11	hilly	slope	medium	sandy loam	good			cook like rice
population	rain-fed	7-8	12-1	hilly	slope	none	sandy loam	good			cook like rice
population	rain-fed	7-8	10	hilly	slope	medium		good			cook like rice
population	rain-fed	6-7	1	hilly	slope	low	sandy loam	good			food
population	rain-fed	6-7	1	hilly	slope	low	sandy loam	good			grain for food
population	rain-fed	6-7	9	hilly	slope	medium	sandy loam	good			cook like rice
population	rain-fed	8-9	1	plain level	level	low	black cotton soil	poor			cook like rice (varagu sadham), sweets



Photo 1. Wild buckwheat at Udakamandalam.



Photo 2. Interplanted field of finger millet and sorghum.



Photo 3. Slash and burned field.



Photo 4. Landscape at plain area.



Photo 5. Paddy fields in the plain.