CAMBODIA:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCES

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Note by FAO

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CHAPTER 1
Introduction

Cambodia is a tropical climate and located between 102° to 108° E and 10° to 15° N in Southeast Asia. The country is bordered on northeast by Thailand, north by Laos, east by Vietnam and south by Gulf of Siam and covers a geographical areas of 181 035 km^2. The population of the country is 9 million inhabitants. The day length varies from 11 hours 29 minutes to 12 hours 48 minutes without twilight. Mean maximum and minimum temperature range among 30 to 36°C and 21 to 25°C respectively. Annual rainfall is 1,343 mm mostly during May to November. Cambodian soils are fallen under the FAO-UNESCO system of gleyic luvisols, gleyic acrosols, ferrolic cambisols and eutric leysols. Soils are low organic matter content, acidic, ancient alluvials, infertile, low pH buffering capacity, low CEC and poorly drained.

Cambodia has 74 percent of which is under forest, 17 percent under cultivation and 9 percent under pastureland.

The national economy of Cambodia similar to many other developing countries are largely based on agriculture and income-earning opportunities. 90% of Cambodian population makes its living from agriculture. Agricultural development becomes important not only for food and livelihood security of the rural families, but also as a support for industrial progress. Most of Cambodian farmers are poor and live under extreme agroecological, socio-economical constraints and fear of unrest of war. The poor farmers with small and scattered holdings are surviving on rainfed, mono cropped and rice based farming. Cambodia is rice exported country of mid 1960s has now annual shortage of about 50 000-70 000 tons. Out of exported rice, Cambodia has also exported many agricultural products such as timbers, fish, maize, rubbers, soybean, ground nuts, sesame, jute, cotton and tobacco. These products have been used very low by Cambodian people, because of lacking technology and facilities to improve qualities for food consumption.

As mention above, Cambodian ecogeographical areas are covered about 74 percent by forest. Flora of Cambodia showed that there are different types of forest such as mangrove. Bitter mangrove, flooded forest, bamboo forest, coniferous forest, dry deciduous forest, moist deciduous forest, rain forest or moist over green forest, moist maintain forest or dwarf evergreen forest. (Tran Thanh Canh, et al, 1994) scrub etc. These types of forests are grown on different ecotype and altitude. The altitude higher than 1000 m covered only 5 percent of the country. These areas are growing of dry deciduous, moist mountain, and dense forest. Due to highly investment and exploitation of timbers and by cutting down daily using land for crops growing, there are large areas of forest have been decreased and eroded from the Cambodian nature.

In the early 1970s, many countries of the world started using modern varieties to replace of traditional varieties. The rapid adoption of modern varieties in large areas has been a major factor in the erosion of plant genetic resources in farmers' field in those countries.

Crop's cultivation in Cambodia is largely dependent on traditional cultivars. The civil war unrest in the country for more than 20 years has been destroyed all infrastructure, research centers, research institution and blocked the flow in of modern technologies particularly modern varieties, developed in other parts of the world. The civil war contributed greatly to the loss of many traditional cultivars. Many crops' growing areas went out of cultivation. People continuously moved from one area to another and thus were not able to preserve the cultivars that they were familiar with.

Cambodia has been a very disturbed past over the last 20 years, when during that period the major break through in agricultural production has been taking place around the world. In general agriculture sector of seed industry in particular has seen major organization or reorganizations. Naturally then Cambodia has been passed by such an era. After the war, reconstruction advanced slowly with assistance from Eastern Block Nation such as the former Soviet Union, Bulgaria, Hungary, Cuba etc. In Cambodia, the seed procurement and distribution has been handled by the Company of Agricultural Material, Ministry of Agriculture, Forestry and Fishery. The company procures seed from the provincial farms, communes and farmers. The seeds are then transported to Phnom Penh and stored until demands are received by the Ministry from the provinces. It is then supplied in bulk without processing, treating or packing involved for such a seed. This is used as planting material. There are lacking of seed production system, field inspection, purity analysis germination test, processing or quality control. Due to these lacking, no wonder more than 80 percent of the areas are cultivated with local unimproved cultivars. Farmers have been using their own produce as seed without any change. It is due to gap of information and extension and also nonexistence of any organized seed multiplication in Cambodia. Most of varieties whether modern or traditional do degenerate due to developmental

variation, natural crossing, mutation, residual genetic variability, mechanical mixture and selection influence of environments and pests.

Rice is the main crop in Cambodia. Rice is cultivated approximately 1.8 million hectares (2.5 million hectares in 1967) (Table 1). It is the third highest rice consumer about 172 kg/head/annum (Chaudhary, 1993).

In Cambodia, no wonder then that for every 400 ha, there could be existed a cultivar of crops. The introduction of new modern varieties would set the worst of the irreplaceable loss of biological heritage of the native crops. In the country lack of storage facilities and war unrest over the last 20 years, most of cultivation areas went out of production. The worst was during 1975 to 1979 when people were moved from one to the other areas. Due to that farmers lost contact with their own varieties. With no storage facilities farmers maintain their varieties by growing annually. During 1975 to 1979 farmers could not grow any crop in their own areas, because of moving to new area and the varieties could not match the ecological diversity of the field. It is the main cause of loss the traditional cultivars and it lost for ever.

Natural disasters also contribute to genetic erosion. Many cultivation areas may be exposed to storms, flood and drought. In 1992-1994, storms, flood and drought damage many areas of the country where traditional cultivar are grown.

CHAPTER 2
Indigenous Plant Genetic Resources

2.1. FOREST GENETIC RESOURCES

Cambodia is one of the richest in terms of forest and crops genetic resources. Most of the forest is grown under natural condition. There are poor in management and less renewal plantation. All the forest types are wild species and under threaten, because of cutting down daily. There are lack of conservation system and exploration, lack of information about natural distribution of main native forest species (only some commercial importance species and under high erosion has been listed by department of forestry, 1994 in Table 3).

2.2. WILD SPECIES AND WILD RELATIVE OF CROP PLANTS

For wild species and wild relative of crop plant, there are lack of information. Most of the wild species and landrace varieties are under highly erosion. The introduction of modem varieties crops are the main cause of threatened and genetic erosion. All the crop varieties are unimproved and have never utilized in the development or improvement except rice crop. For rice crop, there were collaborated effort with the International Rice Research Institute (IRRI). The first collaborative effort between Cambodia and IRRI on rice genetic resources collection was from 1972 to 1973, a total collection was 500 accession. The next collaborative collection and preservation were done from 1989 up to date is 2201 accession of traditional rice cultivars in 17 provinces (Table 2). The collection of wild rice relative was conducted for first time in 1990 in 4 provinces (Vaughan, 1990). The species collected were *O. nivara, O. rufipogon and O. nivara x O rufipogon*. All seed samples both landraces and its wild relatives were brought to IRRI for characterization and conservation. For the other crops, there are lacking of information and still unexploited.

However, genetic erosion still took place in Cambodia. Many production areas were not cultivated. Land exploitation, new construction and moving people from one to the other area are also the main caused.

CHAPTER 3
National Conservation Activities

As one of the richest in terms of plant genetic resources, Cambodia is unfortunate and unlucky country. There are lack of facilities, man power to handle of plant genetic resources, and fund. Plant genetic resources are unexploited, lack of information. There are no documentation, evaluation, characterization and conservation system such as in situ, ex situ (except rice), in vitro and no storage facilities.

Due to collaborative effort between Department of Agronomy and IRRI, all rice germplasm collections have been preserved in gene bank maintained at Cambodia-IRRI Australia Project (CIAP) in Phnom Penh. For preservation of freshly harvested, the seeds were placed in cloth bags and dried in shade and sun for several weeks. Till the moisture content range in the samples was 12 to 14 percent, seeds then packed in coin envelops made of heavy brown paper. After further drying and moisture content range between 6 to 8 percent, seed samples were heat sealed in plastic lined aluminum envelopes. Germination of the sealed samples was also checked from the test samples and was found to be above 90%. The sealed envelopes were placed in 5 litre capacity screw cap Polythene jars, and sealed with sealing tape. These jars have been placed in deep freezers maintained at -20°C temperature. A duplicate set of this collection has also been sent to IRGC (International Rice Genetic Center) at IRRI, Los Banos, Philippines. There were two rice germplasm catalogs have been published and another still in the press.

Cambodia is war unrest and plant genetic resources are under threatened and highly eroded. The requirement of genebank or storage facilities and laboratory to work with PGR at National level is highly needed for long term run. The use of storage material will be in the next few years for crop improvement programmes.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

Due to no collection and conservation, there were not utilization of plant genetic resources. Except rice, which is using as donor parent in hybridization programmes and also for pure line selection for yield trials.

National plant breeding programmes have been introduced foreign germplasm for local need only. Most of foreign germplasm introduction are mainly used based on yield potential to meet national food needs. By the lack of plant breeding scientist, the scientific plant breeding programmes are low, inadequate to be met for national needs. However, the use of plant genetic resources are also low.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

5.1 NATIONAL PROGRAMMES

Very little has been published about the development of genetic resources activities in Cambodia. Ideas about collection, introduction and evaluation of plant genetic resources have involved in Cambodia just the beginning of this decade.

Plant genetic resources activities is the governmental programmes, but the government has no fund to support and no any international or non-governmental organization sponsored of this programme. PGR are still in the hand of farmers using annually for food consumption as well as use as a seed for crop growing.

5.2 TRAINING

Between 1975 and 1979, all scientists were killed. The equipment research centers, research institution were completely damaged. File and experimental document were burned. There is no scientist and staff, which can be a major contribution to the progress of plant genetic resources. Except one was training by IPGRI at Birmingham University in England on plant genetic resources conservation and used. Many agricultural graduates were trained in Royal Agricultural University, Phnom Penh, Cambodia and trained in various socialist countries such as former Soviet Union, Cuba, Bulgaria, Vietnam, East Germany, Poland etc. The major field is in B.Sc. level in agronomy only. The main constraints to obtaining good, well trained staff, there should be trained in all aspects concerned to plant genetic resources such as seed science, agronomy, collection evaluation documentation, rejuvenation, germplasm health, social and anthropological techniques etc. As one of the disturbed country by war, it is the knowledge of plant genetic resources has been flow to the Cambodia later just this decade.

However, the needs of international assistance is the main requirement to be run up of plant genetic resources system within the country. There is no any organization have been involved and developed a process of plant genetic resources, identification nor maintains a cohesive approach to overcome these problems. This requirement could be established at a national programme and developed institute, where it can be solved out the problem of plant genetic resources. The given constraints of training for future research on plant genetic resources needs urgent attention and it is the first priority of Cambodia.

5.3 NATIONAL LEGISLATION

Plant quarantine system in Cambodia is not complicated. There will not be affected the import or export of plant genetic resources accession. Before the import or export of the material, it should request a permission from crop protection office within the Department of Agronomy. The permission issue is depend on report of plant inspectors and it can be issued for all type of material related to plant organism. It will not have any restriction to planting out of imported genetic resources, if they are registered for a permission. The director of department of agronomy and chief of crop protection office decide a permit paper of export and import planting material.

The legislation of the sale and the distribution of seeds as mentioned in introduction part, it is no formal system of seed production, processing and distribution of seed. The Department of Material, Equipment and Transport, which is under the Ministry of Agriculture, Forestry and Fisheries has to procure transport and distribute seed to various provinces. There is no process of seed certification, purity analysis, germination test or seed treatment.

CHAPTER 6
International Collaboration

There has no any organization involved in plant genetic resources except rice crops, which is collaborated between IRRI and HEKS (Swiss International Aid collection and use for farming system only). For other crops there is no any involvement from international agencies to be collected and conserved.

Cambodia broke through of world isolation just early of this decade. It is not a country among those that adopted agenda 21 and also not a member of FAO global commission. There still not any programme of forest and plant genetic resources has collaborated and supported by FAO and CGIAR yet and also still no relation of regional intergovernmental initiatives.

CHAPTER 7
National Needs and Opportunities

Cambodia is strongly needed to improve crop production through natural resources. Landraces are grown and distributed extensively through out the country. There has rapid genetics erosion due to introduction of modern varieties, expansion of modern agriculture and other types of development such as roads, land exploitation and urbanization and other disturbances. This happened also threatens habitat for wild species and it will loss for ever.
To strengthening of the plant genetic resources within the country, there are requiring the following aspects:

International and Intergovernmental Collaboration

Need to collaborate closely with:

- UNCED and convention on biological diversity
- The FAO global system
- The CGIAR
- Non-government organization
- Regional Intergovernmental initiatives
- International trade and commercial agreements.

Training

Training manpower for technical work, and for degree are the first priority for national programme and urgent needed. The type of training needs notified as follows:

- Seed science and seed technology
- Germplasm exploration, collecting techniques
- Data management, documentation and characterization
- Core collection development
- Assessment of genetic diversity
- Germplasm utilization and evaluation for biotic and a biotic stress
- Genebank management, conservation and storage

- Creation of awareness
- In situ and on-farm conservation
- *Ex situ* conservation
- *In vitro* conservation
- Seed health
- Taxonomy
- Anthropology
- Ecogeography
- Plant geneticist

Creation of conservation systems

- *In situ* and on farm conservation is one of the major aspect to be urgent need for conserve especially for forest genetic resources.

Ex situ conservation

The country is strongly needed *ex situ* conservation for all the seed crops. It needs a special gene bank, which can be run for long term, medium term and also short term at national or regional level. This genebank, it should be well equipped with a long term uses. Within that, it should have a laboratory with all facilities such as computers, dryers, germinators or incubators, weight scales, seed dividers, seed counters etc.

In vitro conservation

To conserve of recalcitrant seeds, clone and tuber crop, it should have the type of *in vitro* laboratory and the storage room to maintain of the culture. This laboratory, it should also well equipped all the facilities to use for culturing of plant organism such as other culture, cell and tissue culture, DNA molecule culture etc. and also to do cryo preservation.

CHAPTER 8
Proposals for a Global Plan of Action

It will be extremely good, if Cambodia can be a Member of Global plant Genetic resources.

- Sharing PG material with other countries and with international organization, who involved with plant genetic resources. There also need to be storage seed outside of the country as a duplication set and it is the urgent need for Cambodia.

- Joint as a member and strongly collaborate with UNCED and FO Global system as a member of the Commission.

- Exchange of plant genetic material and new technology with other country within a global.

- International funding in plant genetic resources to established as part of the global system.

- International mission and exploration in Cambodia of PGR.

- To establish a national genebank by help of international funding.

- Exchange of information, documentation and attending international conference, work shops.

FIG. 1. PLACE OF RICE EXPLORATION IN CAMBODIA

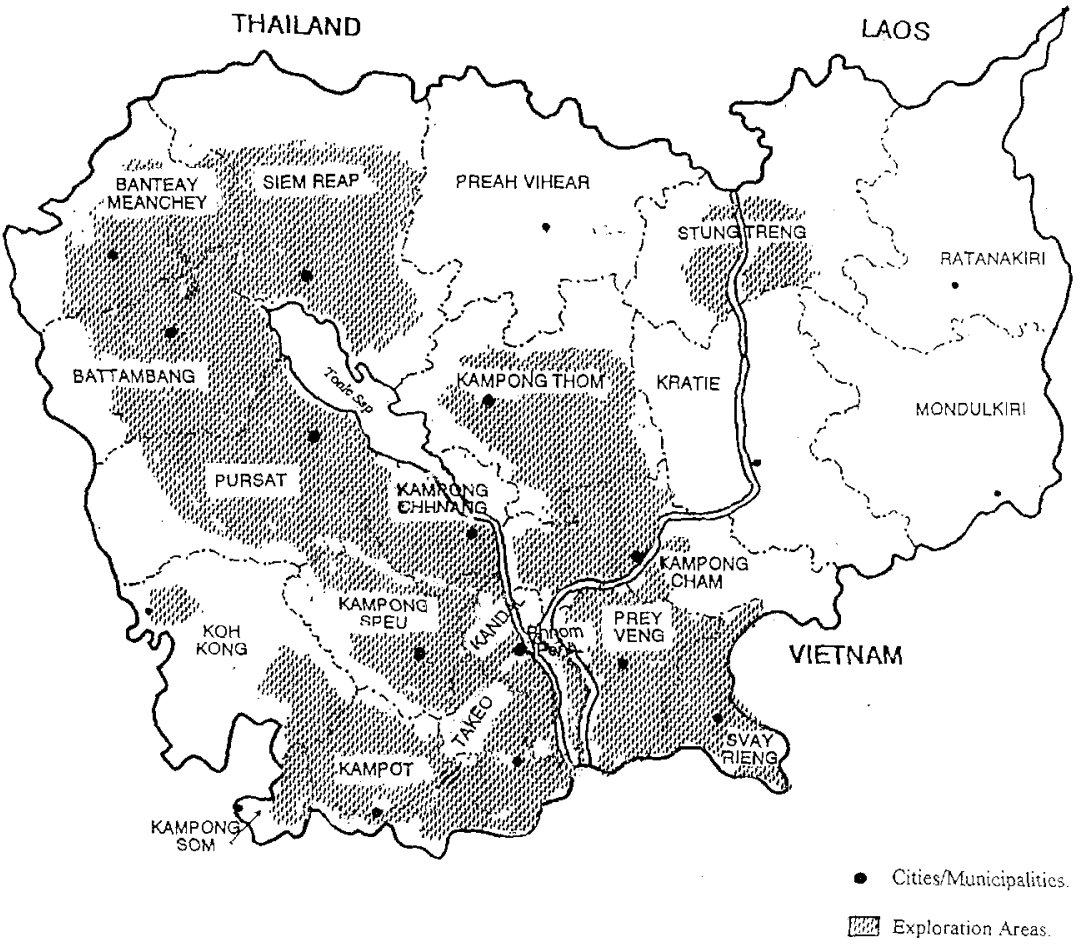

Table 1. The major area (ha) of agricultural crop production in Cambodia

Crops	1989	1990	1991	1992	1993	1994
Rice (Both season)	1615530	1451633	1571957	1718800	187156	
Maize	47485	37598	40905	514441	42212	46189
Manioc	9336	9779	9739	10153	7799	136
Sweet potatoes	14667	9779	8343	6488	4200	8516
Vegetable	25189	28642	27882	30546	20015	22388
Soybeans	13101	1469	14000	16000	16393	16393
Mongbeans	27176	41425	26649	24000	21165	
Peanuts	5035	5659	6101	7000	4870	7331
Sesame	12147	9239	12060	13000	10245	10505
Sugar cane	6544	6220	5702	5950	3841	6665
Jute	2132	1500	302	1872	2263	2348
Tobacco	23598	10833	200	200	15874	
Black pepper	111	61	260	270	-	

Table 2. Number of rice germplasm collected, evaluated and preserved from 1989-1994[1]

N°. Province	Year of collection					Total
	1989-90	1991	1992	1993	1994	
1 Banteay Meanchey	-	-	10	26	36	
2 Battambang	108	30	-	2	33	173
3 Kampong Cham	357	73	2	33	7	473
4 Kampong Chhnang	29	45	2	-	4	80
5 Kampong Speu	88	26	-	18	-	132
6 Kampong Thom	-	20	12	27	-	59
7 Kampot	-	12	7	57	40	116
8 Kandal	176	11	3	5	-	195
9 Koh Kong	-	-	-	-	27	27
10 Mondulkiri	-	-	1	-	-	1
11 Phnom Penh	15	6	-	-	-	21
12 Prey Veng	181	20	3	1	-	205
13 Pursat	43	31	-	23	23	120
14 Siem Reap	-		18	-	54	72
15 Sihanouk Ville	-		-	45	36	81
16 Stung Treng	5	13	7	-	31	56
17 Svay Rieng	224	48	5	9	-	286
18 Takeo	44	13	1	5	5	68
Totals	**1270[a]**	**348[a]**	**61[a]**	**236[b]**	**286[c]**	**2201**

a - Accessions preserved in genebanks at CIAP, Cambodia and IRGC, Philippines.
b - Collections evaluated, but not yet preserved in gene banks.
c - Collections not yet evaluated.

1. Data from Sovith Sin, 1994 presented to the workshop hold at IRRI, Los Banos, Philippines on 28 February-3 March 1994.

Table 3. List of some commercial forest species reported by Department of Forestry, 1994

Type of Forest	Species in Scientific Name
Mengrove along coastal areas	*Rhizophora mucronata*
	R. Conjugata
	Bruguiera caryophilloides
	B. gymnorhiza
	B. eriopetala
	Cerios roxburghiana
	C. candolleana
	Avicennia intermedia
	A. officinallis
	Somneratia griffithii
	Carapa obovalta
	C. moluccensis
	Lumnitzera coccinea
	L. racemasa
	Heritiera littoralis
	Excoeca agallocha
	Sindora agallocha
	Sindora maritina
	Hibiscus tiliaceus
	Phoenix paludosa
	Oncosperma
	Nipa fruticans
	Glochidion littorale
Mangrove of lakes and rivers or flooded forest	*Barringtonia acutangula*
	B. micrantha
	Coccoceras anisopodum
	Hydnocarpus authelminthica
	H. saigonensis
	Albizia lebekoides
	Crudia chrysantha
	Homalium brevidens
	H. griffithianum
	Terninalia cambodiana
	Lopapetalum fimbriatum
	Cryptacarza oblongifolia
	Diospyros cf. bejaudii
	Gaceinia cf. loureiri
	Cynometra dongnaiensis

Type of Forest	Species in Scientific Name
	C. inaequifolia
	Butea frondosa
	Samadura harmendii
	Elaeocarpus madopetalus
	E. griffithii
	Stephegene parvifolia
	S. diversifolia
	Bambasa arundinacea
Lianes	*Calamus godefroyi*
	Uncaria homomalla
	Combretum trifoliatum
	Calycopteris floribunda
	Acacia spirals
	Uvaria pierrei
	Parameria glandulifera
	Ipomoca chryseides
	Dalbergia entadioides
	Cudrinia cambodiana
Bamboo forest	*Arumdinaria spp.*
	Bambusa spp.
	Oxycanthera spp.
Most deciduous forest	*Shorea hypochra*
	Diospyros helferi
	Cratoxylon
	Memecylon laevigatum
	Peltophorum dasyrachis
	Corypha lecotei
	Vatica spp.
	D. intricatus
	Spondias spp.
	Payena elliptica
	Sindora
	Grewia paniculata
Rain forest	*Mangifera macrocarpa*
	Milusa velutina
	Terminalia corticosa

Type of Forest	Species in Scientific Name
Rain forest	*Lithocarpus farnulanta*
	Calophyllum thorelli
	Cinna momum iners
	Amoora gigantea
	Ficus maclellandii
	Knema globularia
	Nephelium pypoleucum
	Madhuca cochinchinensis
	Heritiera javanica
	Sterculia lychnophera

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