ZERO ENERGY GENE –SEED BANKS

Suman Sahai

Recognizing the importance of agro biodiversity to ensuring viable agriculture under difficult situations like that predicted by global warming and climate change, Gene Campaign began a few years ago to collect, characterize and conserve the agro biodiversity of local crops like rice, millets, legumes, vegetables and oilseeds, chiefly in Jharkhand and Uttaranchal. The focus of Gene Campaign's conservation exercise is rice because it is an important staple food and because India is the Center of Origin and the greatest genetic diversity of rice is found here. The Eastern Indian region consisting of Orissa, Jharkhand and Chattisgarh constitute the primary Center of Origin of rice, in other words, its birthplace. This is the region where several thousand years ago, rural and tribal communities bred rice from wild grasses and where large umbers of land races and farmers' varieties are found. Gene Campaign decided that in order to prepare for the challenges that will confront rice cultivation, conservation efforts must be focused in areas where the largest number of genes can be identified and saved for future use.

Our approach to conservation is to set up community managed, field level Gene-Seed Banks. These Banks are simple rooms, which are moisture and light proof and well aired. The seeds of traditional varieties of rice, and other crops like legumes, oilseeds and vegetables are collected from the fields of farmers who are still cultivating them, usually in remote areas. At the time of collection information is recorded about the properties of each variety. This knowledge held by the farming community is extensive and detailed and documenting it faithfully provides a wealth of information about the genetic properties of crop varieties. It is farmers who reveal whether the variety performs well under drought conditions, is resistant to disease or has a short or long duration to maturity. This valuable information tells the scientists which traits to look for in which varieties.

The seed samples collected from the field are scientifically processed to reduce moisture level and stored in glass jars for medium term storage and in baskets for short-term storage. The properties of the traditional varieties are characterized, and their genetic features are documented for use by scientists in research institutions. Gene Campaign collaborates with agriculture research institutions , to test the agro biodiversity in the Banks for desirable traits like

drought tolerance and disease resistance. So far five drought tolerant rice varieties have been identified and are being tested at the Birsa Agriculture University in Ranchi. In addition to this, two new genes conferring resistance to Bacterial Leaf Blight have been identified in traditional rice varieties being tested in the Indian Agriculture Research Institute in Delhi.

Cold Gene Banks vs Zero Energy Gene Banks

The international network of Gene Banks consists of cold Gene Banks which are very different from farmer level field gene banks. The former is an energy intensive bank maintained at low temperature, for long-term storage of genetic material. The latter, a model promoted by Gene Campaign, is a labor-intensive bank with no energy costs. Both are for *ex situ* conservation of agro biodiversity. The monthly electricity bill of the National Gene Bank in Delhi is over 20 lakh rupees (approx $ 45,000) a month. It is not possible to set up many such Gene Banks both for reasons of cost and their large carbon footprint. The Zero Energy Gene-Seed Banks being set up by Gene Campaign have no carbon footprint and they are located within the community, which administers and uses the bank.

Multiplication and renewal of the seed samples is done by a cycle of growing out each sample every alternate year so that the seed retains its viability. The routine growing out of the seed samples exposes the crop varieties to the prevailing weather and climate conditions, helping them to adjust and adapt. The seed material that is returned to the bank after every grow-out season is adapted to the environment, which includes the climate as well as pests and disease. The material frozen in the cold Gene Bank does not get a chance to adapt to the local climate and when it is taken out at a time of crisis, it may or may not have the adaptive capacity to provide an efficient crop under the prevailing conditions.

Because Gene Campaign's Zero Energy Banks are located in the village , they are owned by the people. Village youth committees supervised by village elders run the Banks.. The seed in the Bank is accessed every season by the farmers who return three times the seed they take when their harvest comes in. The core collection is multiplied in carefully designed plots in farmers' fields, monitored by trained village youth and Gene Campaign staff. The material that is returned to the Bank after renewal is taken from the center of the plot to avoid mixing.

Ultra desiccation for long-term seed storage.

A more scientific approach called ultra desiccation is being tried out for longer duration storage at ambient temperature. Here, following sun drying, the seed samples are dried in a drying chamber at 37 degrees C till the seed moisture is reduced to about 6 degrees C. This is tested with a moisture meter as well as by a more practical test . The seed is cracked between the teeth, if it breaks easily without sticking to the teeth, then it is dry enough to store.

We are conducting a five-year storage experiment with ultra desiccated seed stored at ambient temperature, growing out the seed every year, to test how long the seed remains viable. The season 2008-2009 was the third year of testing and the seed was still viable. If the method of ultradessication proves to be successful, then long term storage of seed at ambient temperature will become possible, reducing the dependence on high energy use Cold Gene Banks for germplasm storage.

Village level Zero Energy Gene- Seed Bank

Gene Campaign

Farmers taking Seed from Bank

Gene Campaign

Farmers returning seed to the bank

Gene Campaign

Zero Energy Gene- Seed Bank

Gene Campaign

Seed samples stored in Banks

Gene Campaign

Seed Banks

Gene Campaign

Traditional Rice Varieties

Maina Phanki – Jharkhand
Flood tolerant, Disease resistant

Gene Campaign

Traditional Rice Varieties

Tulsi Masa – Orissa,
Aromatic, Flood Tolerant, Disease resistant

Gene Campaign

Traditional Rice Varieties

Karhaini – Jharkhand
Drought tolerant, Disease resistant

Gene Campaign

Traditional Rice Varieties

Anuda – Chhatisgarh
Drought tolerant

Gene Campaign