Our roots are our future

Root and tuber crops

By Dr Vincent Lebot

Introduction

I am telling you a story, it's the story of your roots, of the plants which feed you, and which have fed your ancestors ever since. They are also the oldest plants cultivated on earth. They are reliable, solid, adaptable, humans have transported and adjusted then accordingly to their wishes and tastes. This story is yours; you will decide what you want to do with it.

Part I. Our heritage.

1. Roots and tubers crops.

Root crops (such as cassava, sweet potato, yams, and taros) are mainly produced in tropical, least developed, countries. They are cultivates yearly on more than 25 million hectares and yielding around 415million tonnes of fresh harvest each year.

The available statistics are very much under-estimated due to the fact that these plants are more or less cultivated in small gardens and in remote areas. These factors contribute to non existing, or less reliable figures.

These plants have been included since thousands of years in traditional agro-forestry systems with other species such as bananas, island cabbage, sugar cane, breadfruit, papaya,

just to name a few.

They sometimes take up fringing spaces where other species couldn't be cultivated; like swamps or stiff slopes, for example.

Women are most likely to produce these plants for the rural and municipal markets and they therefore contribute directly to local development.

Five hundred millions people live on these plants for their daily use and they are consumed by more than 2 billions people on earth, especially in tropical humid areas where are concentrated a major part of the world's population. These species are essential for the world food security.

In Melanesia and in Vanuatu especially as well in all the humid tropical countries we can see that farmers practice "vegeculture". Vegeculture requires no machineries for planting and for labour because these terms determine "agriculture" a cropping system based on the use of fossil, non renewable, energy. Vegeculture is done with simple basic tools, which requires no fuel energy and is therefore very much environment friendly. These tools are of course, a bush knife, a pick, hoes and shovels.

Vegeculture deals with individual plants and manipulates generally clones and not seedlings. Here is another major difference with agriculture. These plants are planted out individually in plots by using vegetative propagation, never using seeds. That's why it is called "vegeculture"

Even though the people are mostly poor and deprived, their planting system is far from being primitive, it sometimes require sophisticated knowledge in agro-forestry and sometimes techniques of irrigation.

It has proven itself to be sustainable and the yields are impressive. Indeed, these plants allow farmers to gain manually, without machines and the use of fuel energy, a higher yield than what they would have, planting cereal with their poor means.

Even though, these plants belong to different botanical families, these root crops share the same biological characteristics. On the one hand, the useful organ/part is underground. We have root tubers for cassava and sweet potato, tubers for yams and corms or cormels for taros. On the other hand, these plants with vegetative propagation never flower or do so episodically. They, therefore, have quite a narrow genetic base and it is their only weakness nowadays in a world where changes are tremendous.

Thus, unfortunately, if we consider these plants as orphans from the International Agronomic Research System it is because very few scientists have worked on their genetic

improvements. Moreover, at the national level, they are mostly neglected from research even though they have in most countries an important cultural impact. They are food-producing crops and nowadays they are mostly crops of income.

Generally, the farmers always work with their traditional cultivars. The fast change of diet and the increase of wheat and cereals imports and other starches as well as climatic changes have a strong impact on the agrobiodiversity of these root crop species.

2. An amazing variation.

The morphological variability of these root crops is impressive even though they have been cloned by cuttings. People from some villages have more than a 100 different cultivars of the same species. One could count at least 10 to 15 or more different varieties per family.

The traditional knowledge on these plants is very much complete. A traditional cultivar and its cultural background such as its vernacular name, its history, colour, texture, its transformation, the taste, its planting methods, the type of soil … etc… are passed on from generation to generation and travels very easily.

Then…. where do all these varieties come from if the farmers don't use sexual reproduction and no seeds? How can cloning enables a wide spread of variety? Let's leave it to the farmers to tell us.

Heritage, exchanges, new introductions, mutations, discoveries, there is a wide range of ways to accumulate the visible diversity in root crop gardens. Vegeculture appears to be an extremely dynamic system which generates a certain form of diversity that farmers are eager to handle.

But this dynamic system is only maintained thanks to the socio-cultural weight of these plants. They are traditionally related to many forms of Cultural figures and meanings: the reputation or esteem of a clan, the exchange of an heritage, the preparation of a traditional dish which is highly regarded in custom, such as for marriage, religious feasts, gaining chiefly titles, burials, etc… These plants belong to a rich cultural environment which holds important gastronomic knowledge and maintains particular folklores.

However, if these traditional root crop species are indicators of the cultural wellbeing of nations, they nowadays have to face another challenge: being competitive with other imported products.

And this is far from being accomplished.

Part II. Threats to diversity.

1. The role of globalization.

The delicate balance in which we find the traditional varieties of most root crops is being disrupted by the intrusion of “globalization”. The diversity in gastronomy leaves place to the standardization of food flavour. Here and there we are fed by “modern agriculture” which manages to produce cheap starch …but for how many more years?

It’s a victory for rice and wheat over local products. Being fed with imported bread and rice, children adopt new diets from other civilizations very distant from what their parents could offer them by working their land.

It’s a dive in an infernal and vicious cycle where the importers become dream merchants who put on a pedestal the consumption of imported products: “consume and win!”

This raises however, a complex issue. Does it means that if developing countries want to offer the young generation the satisfaction of their new food flavours and diet, they will have to make the crucial choice to sacrifice their food crops to the benefit of export cash crops needed to buy cereals from large producing countries?

Is it a sign that small sustainable forms of agriculture are being threatened by products which totally depend on fuel energy for their production, packaging, as well as their transport? And what should be done with the waste cause by the use of these products?

The rise of fuel costs on which depends agricultural productions that float the world is intriguing. It should worried the leaders of least develop countries and lead them to debate on their future’s self reliability? What will happen when the imported products won’t make it to the dock and port due to the lack of fuel energy to produce and transport them? 4

What will happen when they will be so expensive that one has to export more cash crops in order to buy food supplies? This will drive to a pauperization or even proletarianization of farmers who, in some countries, stay ironically land owners? Why didn’t they see in time that this traditional vegeculture of long ago is the condition of their survival?

2. Changes in diets.

Eating habits are changing, but they disappear along with the pride feelings of independence and self sufficiency in food. Hence, it is how the competition of imported starch over local starch is present both in meals and in the gardens. Moreover, if some plants are no longer consumed then the producers won’t cultivate them anymore. The varieties of species vegetatively propagated that are not consumed neither used by human beings are not replanted and are rapidly disappearing from the rural areas.

The traditional varieties could be called “humanized plants”. They lived within the complicity of human beings for a long time, these varieties were modified by humans in order

to satisfy their needs which they are often depending on and are unable to survive without them. So, when a traditional variety disappears from a specific area, then it can disappear forever.

With the loss of these varieties, a lot of sections are disappearing from the local culture: the myths of the origin, legends that are associated to these plants, the methods of preparing some local dishes, and many things more…

The cultural wealth associated to the local produce is indeed directly linked with the presence and the use of their genetic diversity. For instance, if 50% of the daily need in starch is satisfied by imported food, it is probable that varieties which were, until then, used to vary the tastes and the dishes will be put aside.

It is by following this trend that the dynamism of the vegeculture cropping system could not evolve anymore. Some methods that worked for millennia and that have produced the diversity we are observing nowadays will be forgotten. The less we cultivate, the less we have chances to observe some mutants, or some spontaneous plants coming from seeds so ultimately, we have a tiny chance to capture the diversity.

Loosing one's plants is partly loosing one's culture. But the cultural erosion of men is also the main source of plant species genetic erosion. The cultural diversity and the conservation of agro-biodiversity appear being undividable. If you loose your Culture, you loose your food and your plants.

The genetic erosion of local food crops is revealing the cultural erosion of the people.

Part III. Proposed solutions.

1. More research needed.

In only one century, one-third of the traditional varieties of food plants that men have selected during millennia have disappeared.

In the case of roots crops, only the genetic resources of manioc, sweet potato and yam are kept in international centres. For all the other yam and taro species and their varieites, the genetic resources collections are very rare. Those which exist are being assembled and disappear along with erratic funds, budgetary restrictions and accidents of all sorts, either from the climate or the human side.

The conservation system for these plants seems to present serious constraints. It essentially aims at creating collections that are maintained in the field, sometimes by in vitro culture or by preservation at very low temperature. The concentration of these resources

requires a lot of financial and human means (farm workers, technicians, curators, and laboratory workers) and present certain risks as a result of its centralization (epidemics or diverse infections, mix or loss of ownership, natural disasters…etc).

Furthermore, the genetic improvement of particular trait, when it happens, is a very slow process. The crossing by reproduction between the best parents and the selection of improved varieties needs about ten years before producing a new selected variety.

Unfortunately, once the variety is selected, it couldn't be said that it will reach the highest number of producers. In fact, the seed industry which, for seed plants or potatoes for example, distribute wholesome and highly efficient seeds, don't exist in the case of tropical root crops. Root crops producers are not farmers, the increase of vegetatively propagated cuttings leads to a slow and very expensive distribution. Moreover, there are risks of distributing diseases and there is often a need to use quarantine centres of transit, for cleaning up and cultivating with in vitro methods. And this generates additional costs. Furthermore, the selection of a new variety in a specific environment can often be disappointing when evaluated elsewhere from its area of selection. Many varieties are mostly adapted to particular and local conditions.

In reality, producers are, for most of them, left alone with themselves with no assistance. As usual, they get rid of diseased plants then select healthy plants; they spot "extraordinary" plants which will become the new varieties of the future.

Except that nowadays, other constraints have appeared. The diets are changing and taking the farmers away from subsistence farming, the signs of climatic changes make the millennia plants, of which, the narrow genetic basis becomes more vulnerable. Besides, serious diseases are transmitted with the accidental insertions of insects, of bacteria, of fungi, and other "poisoned gifts" of globalization which are speeding up the exchanges and insertions.

We still remember the disasters due to the narrowness of genetic basis of potato in Ireland or more recently, to the one of taro in Western Samoa in 1993 which had destroyed this culture in less than a year. It is thus necessary to anticipate in order to avoid these kinds of situations.

2. A new approach for preserving and creating diversity.

It is too late to step backward. Globalization, changes in food habits, climatic disturbances, and the whole process have been engaged and are speeding up. If the people of the modern times are not ready to fight for the preservation of their ancestors food plants, if

the new tastes lead them to get rid of everything…. do we really need to submit ourselves to loose a diet heritage of several millennia?

The traditional varieties are not adaptable to the changes of both the society and the environment. When they disappear, it will be forever. What will then happen to the next generations when the imported food won't come in the country because of high costs of production and the transport?

No one can say if future farmers will have enough financial resources to pay for more and more cereals considering the cost in carbon and the volumes of copra, of cocoa and of coffee that they will have to produce in exchange to the consumption of imported goods. At the end, it is possible that the farmers will come back to "local".

So what can be concretely done for these farmers?

We have been thinking of a new approach to preserve the best traditional varieties: an approach based on an ancestral system of selection, but which tends to accelerate it. The farmers are given some "new blood", which means new exotic varieties or varieties coming from remote regions, very different genetically from those they already have, but they have the same taste so that they can be accepted by them.

Firstly, cuttings have been distributed but it is a long and expensive process considering the isolation of some villages. In order to be free from the transport constraints of the cuttings, farmers are offered some seeds and they are taught how to create diversity.

But these growers don't know anything about root crop species flowers, fruit or seeds. They must be taught how to cross breed their plants in order to create useful diversity for their descendants… that is to say, they have to learn how to manipulate plants, which they already knew since millennia but this time, by speeding up the process of manipulation… because in the end, there is still a hope: if some diversity could be injected in areas where food plants are cultivated, there is a chance that they will adapt to the rapidly changing environment.

The idea is simple: it a question of distributing geographically a wide diversity.

Contrary to the collections which are systems concentrating diversity in a specific area, our approach aims at spreading, at distributing diversity. In other words, to do exactly the opposite of what is usually done. It is a complementary approach which is particularly more adapted to plants for which no seed industry exist and where the actors have to handle the situation on their own.

It mainly aims at not putting all the eggs in one basket. The distribution of the new genes under new variety forms is the best means of preserving this diversity. Finally, genetic

diversity is really similar to Culture, the more it is distributed, bigger the chances we get to have something left from it. If the cultural erosion is the main cause of genetic erosion, then the spreading and distribution of the genetic diversity could easily recreate what is currently fading away.

CONCLUSION

It is you turn to act now. Do the same as these farmers, and dare to do it. It will take time, but by injecting the bases of the future cropping systems into isolated areas or fields, we are building the future.

It is too late to be pessimistic, in the islands and even in other parts of the planet.