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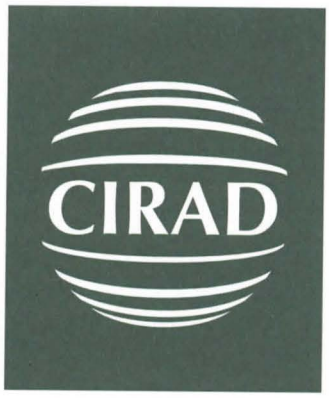

Report on the mission to Ghana

Oil palm seed production

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28 November to 5 December 2003

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CIRAD-CP

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Acknowledgements

At GOPDC, our sincere thanks to Messrs Inkumsah and Vandersmissen for preparing this mission, organizing contacts and for their hospitality, and for always having facilitated our visits and closely followed how our meetings proceeded.

At OPRI, we should like to thank Dr. Assamoah, Manager of the Kusi station, for his very warm hospitality.
We should also like to thank Dr. Georges Okyere-Boateng, head of genetic improvement, for freely giving up his time, and for the meaningful discussions we had with him.

At TOPP (Twifo Oil Palm Plantation), we thank Mr. Billy Ghansah, Estate Manager, and Mr David Nunoo, who agreed to see us despite the presence of numerous other visitors.

Contents

Mission schedule

Friday 28/11/03	Travel Lagos – Accra – Kwae (GOPDC) Meeting with the Managing Director, Mr Inkumsah, and tour of the Kwae nursery.
Saturday 29/11/03	Visit to meet smallholders around Kwae. Presentation to GOPDC staff of CIRAD's oil palm breeding activities.
Sunday 30/11/03	Tour of outgrower plantations around Kwae and the new Okumaning estate.
Monday 01/12/03	Visit to OPRI, introduction with DG and presentation of the OPRI breeding programme. Presentation to OPRI of CIRAD's oil palm breeding activities.
Tuesday 02/12/03	Tour of OPRI's seed production operations.
Wednesday 03/12/03	Visit to a nursery operating under contract in connection with the President's Special Initiative on Oil Palm, to a medium-capacity oil mill and to smallholdings.
Thursday 04/12/03	Travel Kwae – TOPP Tour of the plantation and of Unipalm seed activities.
Friday 05/12/03	Travel to Accra and departure for France.

I. Introduction

The CIRAD-CP mission to Ghana for oil palm seed production was undertaken at the request of SIAT, in connection with the President's Special Initiative to revive oil palm growing in Ghana. Necessarily involved in this programme through its local subsidiaries, SIAT wishes to make sure that the directives and programming set down in these projects are not in contradiction with its own objectives. If not, this context may provide an opportunity, which would have to be examined, for improving the availability of quality planting material in Ghana, notably by establishing mutually beneficial lines of cooperation between GOPDC, CIRAD and OPRI.

As planting material is a key element in developing an efficient oil palm commodity chain, it was notably a matter of making a general inventory of the oil palm breeding programme, assessing the genetic value of the material disseminated, gaining an idea of seed production conditions and the quality of those seeds and, lastly, studying the supply of seeds to producers.

The aim was to highlight the strong points and the weak points to be improved, but there was no question during such a short visit of carrying out a detailed assessment of the genetic improvement programme or the implementation of techniques specific to that discipline. We therefore endeavoured to draw up a list of assets and evaluate avenues for improvement and possible development.

II. Context

The Ghanaian presidential project, which is intended to make the oil palm commodity chain one of the driving forces of economic growth and development, envisages the planting of 100 000 ha of new oil palm plantings over the next five years, then an additional 300 000 ha over a more long-term period (10 to 15 years).

Intended first of all to meet the domestic requirements of the country, which has a deficit of 140 000 tons of CPO, this project aims eventually to export to other West African countries that also have deficits.

Eighty percent of areas planted to oil palm, i.e. an estimated 250 000 ha, are farmed by scattered smallholders lacking in organization and supervision. Action taken under the presidential project is intended to first of all improve this situation by distributing replanting material to those farmers and seeking to strengthen their links with existing agricultural structures of the Nucleus / Smallholder / Outgrower type.

To do this, OPRI has been assigned a production target of 2 000 000 seeds per year and a network of private nurseries has been set up working under contract to produce and distribute seedlings. Twelve nurserymen obtained contracts in the first year.

III.Information gathered

A. Visit to GOPDC

We shall only cover here those aspects relative to planting material.

GOPDC only uses imported material for its own requirements and those of smallholders attached to it under contract. In addition, the 1 140 ha of plantations farmed by those smallholders will gradually be reintegrated into the 3 596 ha of nucleus estate as the contracts, which were launched with World Bank funding and loans, expire. In fact, these plantations are less productive at a time when the GOPDC oil mill is not operating to capacity, despite an additional 12 800 ha of outgrowers. However, the outgrowers, whom the agroindustrial estate assists logistically, notably for inputs, are strongly tempted to sell their production to small–scale processors, who can afford to offer higher FFB prices, as they sell their oil production on local markets.

During our visit, 200 000 seedlings of CIRAD origin (La Mé) were being grown for planting requirements at Okumaning in 2004.

With that material, the cost of producing ready-to-plant material amounts to $ 2.5 / seedling. Whilst there are no particular limits or restrictions on importing seeds into Ghana, there are quite high taxes (25 %), as in Nigeria.

GOPDC's planting forecasts are 1 000 ha per year, meaning an imported seed requirement of around 250 000 dried seeds.

Along with that material, but for sale to outgrowers, GOPDC had a little over 13 000 seedlings from seed production at OPRI. As the price per germinated seed was 3 000 cedis, the sale price per ready-to-plant seedling was around $ 1 (8 500 cedis), including nursery costs, with fewer inputs than in the case of imported seeds, and a profit margin of 20%.

Worth noting is the relatively large number of palms affected by *Fusarium* wilt in the oldest plantings at Kwae, which means that tests to assess tolerance of that disease must be taken seriously in the breeding and seed production programmes.

B. Visit to OPRI

The Director of OPRI warmly welcomed us right away; highlighting cooperation already established with CIRAD for coconut, he expressed his wish to establish cooperation for oil palm too. We were able to spend three full days with the OPRI breeding team, who readily gave up their time for us. The first day was devoted to exchanging information on the breeding programme and on the progress made. On the second day, we took stock of seed production activities at the Kusi station. The third day was spent visiting a PSI programme nursery and some smallholdings.

The general impression gained from this visit to the Kusi station was its isolation and its lack of resources. There is no international partnership and the station has had virtually no outside funding in recent years. The researchers publish little, apart from a few extension advice notes locally; they have very few possibilities for taking part in seminars or conferences, or training courses. Analytical and information technology facilities are virtually nonexistent. There is no internet access at the station.

Aside this, the station seems to be well maintained, with a minimum of activities in terms of quantity and quality.

1. Genetic resources available at OPRI

We were given an inventory of the genetic resources available at OPRI. The material developed by WAIFOR (now NIFOR) is well represented at OPRI. The Aba and Calabar origins are well represented, but there are also other origins from Nigeria (Umuahia, Ufuma), Cameroon (Ekona), Ivory Coast (La Mé) or Angola. OPRI also has several sources of Deli material: Serdang Avenue, Ulu Bernham, Ulu Remis, SOCFIN Deli, Dabou Deli, etc. A small collection of *oleifera* material (Central America) has also been introduced via the ASD company, along with a palm from San Alberto.

More recently, some material has been exchanged with Dami, mostly Avros material, and OPRI also has pollen of that origin which should be used without delay.

Without being exceptional, the genetic resources at OPRI mean that a genetic improvement programme can be envisaged that will result in quality planting material.

2. Key stages in the OPRI breeding programme

The OPRI breeding programme benefited from the first cycle results obtained by NIFOR in the 1960s and the early 1970s. Some first cycle trials were planted at the Kusi station.

A total of 12 second cycle trials were planted between 1987 and 1994. Their purpose was to improve a few good Deli x Nigeria crosses. In conjunction with the University of Ghana, OPRI has carried out a statistical analysis of the trials. The analysis shows that the trials are very imprecise: LSD of 20 to 30% for oil as opposed to around 10% for trials conducted under good conditions. The reasons for this need to be examined in detail. For our part, we noticed that:

- the statistical designs are not always adapted to the heterogeneity of the land: for example, in the trial we visited (23-1), the control cross is only planted on slopes and is therefore disadvantaged compared with materials partly planted in bottomlands, which explains its classification (last) and the statistical analysis merely confirms that state of affairs.
- too few bunch analyses are carried out: sometimes only a small number of tenera (fewer than ten) have been analysed, whereas a minimum of forty analyses on around twenty tenera per progeny are required.
- there is also a problem with oil/mesocarp measurements: contents below 40% have often been found, yet such low contents are rare for oil palm; these need to be checked. Either the bunch analysed was not ripe, or Soxhlet extraction was insufficient.

In order to derive maximum benefit from these second cycle trials, the production data should be systematically verified, erroneous data should be eliminated, and only normal oil/mesocarp contents should be taken into account. Moreover, for numerous progenies, new analyses must be carried out.

Once this work has been completed, and after checking that the statistical design is right for the land in question, it will be possible to judge the true value of the second cycle results for drawing up an additional set of measurements to be carried out.

Comment: the virtual absence of computerized databases makes any analysis work lengthy and tedious. OPRI should therefore be given a modern data analysis and storage capacity.

3. Assessment of vascular wilt resistance in OPRI planting material

Unfortunately, assessing vascular wilt resistance is hefty and sometimes tedious work. The work carried out in Ivory Coast, and in connection with three STD projects, has shown the importance of choosing a sufficiently virulent and aggressive strain for revealing differences in susceptibility between materials. Moreover, despite that precaution, test accuracy is not good: for designs where each cross is represented by 8 replicates of 20 plants in series of more than 200 crosses, the index of a cross is estimated to have a confidence interval of around 40%. It is only the replication of tests that enables trends to be detected.

Work undertaken by OPRI has made it possible to identify strains with good aggressiveness and good virulence among those originating in Ghana. This initial result needs to be used as the basis for systematic testing of vascular wilt resistance in the commercial material produced by OPRI.

The results obtained to date by OPRI are not of sufficient scale to draw any precise conclusions. When characterizing strains from Ghana, sets of crosses, called "groups" were tested. Each represented one of the elements of the mating design for seed supplies. Once all the data obtained with low-aggressiveness strains have been eliminated, it may be possible to identify some tendencies for a limited number of groups.

The oil palm plantations in Ghana are now involved in replanting programmes. At the end of the cropping cycle, cases of vascular wilt can be seen. We feel it is important, and a priority, for OPRI to measure the vascular wilt resistance of all the groups of seeds it produces. This large-scale work will require a real effort on its part.

4. Seed production

a) Genetic value of the material

Seed production at OPRI is based on a mating design intended to reproduce more than 70 first cycle crosses. In the first cycle trials, all these crosses were better than or as good as the control. This material should therefore be slightly better than the average of the first cycle crosses.

Around 70 pisifera palms are used, but for the reproduction of some families only a small number is available (3 or 4). This is insufficient, particularly as a few pisifera palms regularly produce abundant amounts of pollen: they are used more than the others. This practice entails a risk when the agronomic value of the pisifera is not well known.

The material used for seed production is based on experimental results that are now old (25 to 35 years) and has not benefited from second cycle breeding work. Strict culling in the first cycle, followed by effective second cycle work, would probably have resulted in a 20 to 30% improvement in yield potential.

A new seed garden with around 3 000 parents has been prepared and is due to be planted in 2004. It is based on 7 1st cycle selfs from group A (female), but there are no plans to plant new group B material (male). We cannot judge whether this programme amounts to progress compared to the existing seed garden. It still involves first cycle material.

b) Production capacity

OPRI has a pool of around 1 200 female parents and around 70 male parents. Given the ecological conditions in the Kusi region, production capacities can be estimated at between 3.5 and 4 million dried seeds.
As OPRI has made an effort to equip its parents with fixed ladders (IRHO type) or scaffolding to facilitate their use, we consider that OPRI effectively has that potential.

The new pool of parents due to be planted in 2004 will make it possible to replace some of the old pool, which is becoming difficult to exploit due to its age, and to increase its production capacity. This programme will come into full effect in 2010.

c) Technical aspects

Without carrying out a systematic analysis of material derived from the OPRI station at Kusi, each time we were able to verify the tenera nature of the commercial material, the test was positive, indicating that there would not be any major technical problem during controlled pollinations in the seed gardens.

This has not always been the case in the past (cf. Mr Nouy's report), no doubt there have been improvements since then. However, our visit to the seed gardens showed that checking

procedures need to be improved or stepped up (blank labels, unpollinated flowers, "overlooked" bunch that could have been bagged, etc.).

C. Visit to nurseries and smallholdings

1. Nurseries

We were able to visit a nursery operating under contract in connection with the PSI. In fact, it belonged to a Ghanaian businessman who owns a medium-capacity oil mill (initial USAID loan), who took advantage of the opportunity provided by the PSI to embark upon a new activity, with total pre-financing by the government in the form of a loan to the businessman.

In the case of the nursery set up from scratch, which we saw, the production target assigned to it was 40 000 seedlings with credit calculated on a cost of 13 000 cedis per plant, including the cost of buying the seed for 1 800 cedis and reckoning on a profit margin of 1 000 cedis. Outlets for nursery production are already ensured, with demand from farmers two and half times greater than what the nursery can supply.

The farmers themselves receive a State loan intended to enable them to pre-finance setting up and maintaining their plantation during the unproductive phase. They are then required to supply their production, under contract, to a specified processor, for loan repayment. For nurseries not linked to an oil mill, seedling are supplied to farmers under a tripartite contract.

In the case of the enterprise visited, its interest is more in securing its FFB supplies and thereby improving the profitability of its mill, which is not operating to capacity at the moment, by increasing the quantities processed, rather than in the profit margin associated with seedling production. Moreover, profit margins are larger further downstream (oil marketing). Indeed, the price paid is 120 000 cedis / tonne of FFB, for a selling price of between 3.7 and 4.5 million cedis / tonne of CPO (as the extraction rate is 19%, FFB purchases amount to 14 to 17% of the oil price).

This nursery is satisfactorily run, with the minimum required installations (shading, watering) and at the time of our visit the seedlings were in a satisfactory condition. Around 50 000 seeds were supplied to obtain 40 000 ready-to-plant seedlings, which corresponds to theoretical norms, with no margin for error.

2. Independent smallholders

Our discussions with smallholders revealed a keen interest in oil palm growing. FFB production and sales guarantee a regular income, whilst exploiting a palm grove for palm wine production makes it possible to cover unforeseens. OPRI planting material has a good reputation, and we were told several times that its production was more evenly staggered throughout the year than GOPDC (CIRAD) material. Given the genetic base exploited by OPRI (large first cycle representation), that may be so, particularly as the highest yielding materials tend to have a more marked production peak.
In the region we visited, apparently little "unselected" material is planted: the fact that smallholders are well-informed is doubtless linked to the simultaneous presence of GOPDC

and OPRI. However, we were informed that, through lack of information, farmers in other regions were drawn to the cheapest planting material rather unscrupulously stamped "OPRI" or even "GOPDC".

D. Visit to TOPP

Operating within the periphery of Twifo Oil Palm Plantation (TOPP), UNIPALM stores and germinates material imported from the Congo, where that company's seed garden is located.

With an annual production capacity of 3 to 5 million seeds, the main vocation of that seed garden is to supply various estates attached to the Unilever group (2 in Ghana).
Beyond the specific requirements of the Unilever group, UNIPALM is also a seed and seedling distributor. In Ghana seeds are sold for 4 000 cedis each and ready-to-plant seedlings for 10 000 cedis each. TOPP (with BOPP) declared it was able to sell around 100 000 seedlings to smallholders in 2004.

According to managers, UNIPALM material is more resistant to vascular wilt than OPRI material. However, UNIPALM distributes "wilt resistant", "wilt standard" and standard seeds. There is no resistance test in Ghana. This knowledge is therefore based on old results obtained in the 1970s and early 1980s at Binga (DRC ex-Zaire).

We were able to visit the seed germination and storage installations, and the pre-nursery and nursery installations. They are perfectly adequate and maintained in perfect condition and do not call for any comments. However, it seemed to us that there were many poorly developed seedlings in the prenursery, giving the material a very heterogeneous appearance. The appearance was better in the nursery.

IV. Conclusions and proposed action

A. In general

There are currently two oil palm planting material distribution chains in Ghana.

First of all there is material derived from the breeding work carried out by OPRI and produced at its stations, whose users are independent smallholders, or outgrowers on the periphery of large agroindustrial estates.

Then, there are quite heavily taxed legal imports of planting material derived from other breeding programmes and production centres, reserved exclusively for agroindustrial estates given a much higher cost price. Moreover, these estates have established their supply chains, germination and nursery installations to cover their requirements and those of smallholders operating under contract to them.

The wish of political decision-makers in African countries to see their public research institutes distribute planting material as cheaply as possible is understandable. However, it is necessary to maintain a policy that enables adequate research funding. In our case, oil palm in Ghana, insufficient recouping of production costs has led to research on an inadequate scale, losing ground on what is done elsewhere. Today, these harmful effects are being felt and, as they cumulate, they are having a negative impact on the quality of planting material made available to the very farmers it was intended to "protect". Thus, the material produced by OPRI today has not benefited from either quality second cycle work, or true selection for vascular wilt resistance.

Overall, it was seen that the production potential of planting material distributed by OPRI is 20 to 30% less than it could have been after a new selection cycle. Even if it is decided right away to step up selection work at OPRI, the gap will persist for some time. At the very least, it would be necessary to wait for the results of a second selection cycle at OPRI to have an effect on its commercial seed production. In the meantime, things will probably have also progressed at other breeding centres.

Consequently, to meet the requirements of the agroindustrial estates which are obliged to optimize their profitability, it is essential to be able to maintain the possibility of importing the highest yielding planting material, which OPRI's material cannot compete with.

Nevertheless, what is done locally should be taken into account and attempts made to improve it. Indeed, seed supplies are insufficient given oil palm development prospects in all production zones, and the world deficit in fats and oils.

Even though the material distributed by OPRI has a lower production potential than the best material produced elsewhere, it is nonetheless worth using. For instance, the PSI secretariat itself states that the average production level on 80% of the areas planted to oil palm in Ghana is 4 tonnes FFB per hectare. Assuming that figure to be reliable, it has to be compared with the yield of 14 tonnes FFB/ha that can be achieved by smallholders associated with Estates, and shows to what extent other factors are involved that are more limiting than the genetic potential of the planting material.

Despite the shortcomings described above in the breeding programme and in vascular wilt resistance testing for seed production, it is nonetheless necessary to recognize and highlight what is positive, namely:

- The quality of OPRI seeds in terms of viability and the tenera criterion (which needs to be checked more systematically than we were able to do).
  The latter criterion is very important and for that reason alone using material from Kusi could lead to a notable improvement in smallholder yields, a fair share of which probably comes from dura type palms outside estate zones or the vicinity of Kusi.

- The merits of the PSI, even though it is ambitious, given the true economic stakes and targets that remain realistic. In addition, despite the limited time spent in Ghana, we saw strong activity in the oil palm commodity chain, a clear spirit of enterprise, technical skills, and a will to achieve quality work on the part of smallholders.
  Lastly, this project has now effectively become a reality, with the contractualization of nurseries, which are already producing, and with seedling distribution chains that have already been established for future seedlings.

- From the overall discussions we had with the Director of OPRI, we felt a willingness for openness and collaboration, and definite receptiveness for our proposals of possible training and technical support.

In this context, there is every reason to examine what and how it is possible to improve and strengthen ongoing actions, particularly at OPRI.

B. Concerning OPRI

1. Proposals for improving the OPRI varietal creation programme

From the previous comments, we have retained a few essential objectives that OPRI could set itself for the coming years:

1 – Carry out a critical synthesis of the **first cycle** results. Unless we are mistaken, it seemed to us that no such critical synthesis was available. Wherever possible, it should incorporate the results obtained by NIFOR for the material possessed by OPRI.

2 – Based on the first cycle results, a general programme could be proposed for **second cycle** genetic improvement. The second cycle trials planted from 1987 to 1994 already form part of that general programme. We have proposed that the analysis of those trials be fine-tuned, to determine whether any observations need to be redone (yields and bunch analyses, quality of the statistical designs).

3 – We feel it is paramount to significantly increase the number of **bunch analyses** carried out, whilst carefully checking their quality. We had useful discussions with Mr Georges Okyere-Boateng on this point, which should be gone into in more detail.

4 – A fair share of oil palm plantations in Ghana are now entering replanting phases. It is therefore necessary to embark resolutely upon a programme of selection for **vascular wilt resistance**. The preliminary work carried out by OPRI led to the characterization of strains for launching this work. A substantial quantitative effort now needs to be made to systematically test all the commercial material produced: allowance has to be made for a work load based on a minimum of 200 to 300 crosses, each represented by 160 seedlings.

2. Strengthening of skills and activities

a) Action required

As we have shown, OPRI researchers have virtually no contact with the outside (access to publications, internet, scientific exchanges, training sessions, international conferences, etc.). We could envisage fairly soon a short study period in Montpellier for the head of the OPRI breeding programme, with a view to increasing his awareness of what could be organized at Kusi. This two-week course would include visits, presentations of activities, discussions and resources provided for breeding teams (3 days), information technology (2 days), vascular wilt (2 days), marker-assisted selection, *in vitro* culture and miscellaneous (4 days).
Following this visit, Mr Okyere-Boateng would be able to draw up a valid project with long–term objectives.

CIRAD is in the process of drawing up a certification procedure for its entire marketing chain operating under the CIRAD® tradename. Funding should be sought for the Head of seed production at Kusi to take part.

Thereafter, though without delaying for too long given the time taken to obtain results, OPRI and GOPDC could consider working together to plant and observe a set of second cycle trials. Such trials, which would be a heavy task for a single research centre, would comprise high–yielding material for which the only extra cost entailed for an estate would be the individual observations. An initial programme of 10 to 15 trials could be scheduled. The trials would be planted in 5 to 7 years, with a view to having good quality second cycle material in 15 to 20 years, which would be exploited in seed form in 20 to 25 years.

In addition to all this, consideration could be given to strengthening the teams at Kusi by assigning a CIRAD technical assistance expert, whose activities would focus on the overall organization of a reinforced breeding and seed production programme. He would particularly be involved in drafting second cycle trial protocols, choosing the material to be tested, setting in place and organizing vascular wilt tests for both breeding and seed production, defining objectives and controlling seed quality. This can only be conceived within a long-term vision (20 years) which could be split into several periods of around 5 years corresponding to key stages.

b) Opportunities to be grasped

These proposals carry a cost and can only be justified if work facilities and data processing and analysis are also strengthened on site. However, we feel that it is worth it, provided a

partnership is established with an agroindustry to be the driving force, but also a technical and financial facilitator, to guarantee the reliability and longevity of the activities.

In addition, the context is propitious to such strengthening. Firstly, the presidential initiative to develop oil palm primarily centres on the results of OPRI activities, along with seeds that form the basis of the programme. OPRI should therefore be helped to clearly define its requirements, as befits the expectations, and it should be ensured that they are set in place. In addition, international donors currently have a good impression of Ghana. Moreover, they are currently revising their funding policy, which had totally left aside the large tropical industrial commodity chains in recent years. For instance, *Agence Française de Développement* is totally in favour of backing oil palm and rubber commodity chain development projects that incorporate adaptive research and seed production components, provided agroindustries exist which are in a position to eventually make optimum use of the efforts made, and which become involved project implementation, as a token of their success.

For an agroindustrial group, the merits of becoming involved in an initiative from which it will gain no direct returns for a long time must be carefully weighed in the balance.

If it is not a direct user of the material produced, it is still a factor of effective local insertion throughout the commodity chain, which might be felt desirable if only from a political point of view. It is also a means of ensuring that surrounding outgrowers are supplied with material possessing the best possible potential, thereby guaranteeing better oil yields for the group's oil mills.
In addition, if one can imagine a minimum of funding for the extra costs associated with this activity, through funds from State development aid, investment granted in this way is bound to be beneficial.

ANNEX

Recap of timetable

Timescale	Work	Expected result
0 - 3 years	- Synthesis of first cycle. - Revision of current seed production programme. - Computerization of all data available at OPRI. - Critical analysis of the first 9 second cycle trials. - Systematic testing of the vascular wilt resistance of commercial seeds, firstly by group then by parent. - Launch of a "quality" approach for seed production.	- Comparative quality of the material tested in the first cycles either at NIFOR or at Kusi. - General programme for a second cycle. - Critical analysis of the second cycle trials already planted; assessment of the opportunity for completing or redoing observations. - Vascular wilt resistant seeds available for replanting programmes.
3 to 10 years	- Planting of a set of second cycle trials on-station or in partnership. - Preparation of recombinations if necessary.	- Identification of good "second cycle" parents in 15 to 20 years. - Programme of 100% second cycle seed production in 20 to 25 years.
10 to 20 yrs	- Analysis of the second cycle. - Preparation of the corresponding seed gardens. - Preparation of recombinations.	
20 to 25 yrs	- Production of good quality second cycle seeds. - Preparation of the third cycle.	- Possibility of obtaining seeds locally that comply with international standards.