

## **SCIENCE COUNCIL COMMENTS ON GENERATION CHALLENGE PROGRAMME: CULTIVATING PLANT DIVERSITY FOR THE RESOURCE POOR MTP**

**SEPTEMBER 2004**

### **Progress**

The CP started in 2003 and was approved for the inception phase to September 2004. The first year work plan was assembled in August 2003. Work began in early in 2004.

First year plans were to establish the institutional structure, assemble essential genetic information on the CGIAR crops and establish the technical and scientific foundation for future activities.

There is clear progress in all these areas. The Steering Committee has appointed a Director, five sub-programme Leaders and paved the way for the Scientific Advisory Panel. Commissioned work in 2004 has been designed to assure that the basic technical platforms are in place, mainly in Sub-programmes 1 (Genetic Resources Characterisation) and 4 (Bioinformatics).

There is already evidence of increased collaboration between Centres and in the engagement of ARI and NARS. A US\$ 4.5 million call for competitive grants went out in April 2004. The competitive grants programme has apparently brought interest from 130 non-consortium institutions (although it is not clear how many of these are NARS and ARIs). Around half of the 25 consortia invited to provide full proposals will be successful in the call. These will be known in October. Further developments are on hold pending full approval of GCP by ExCo following the SC recommendation in SC2.

The SC notes that GCP 'cast the net wide' in the first competitive call. We caution on using the competitive grants process to set the priorities for the CP. Otherwise the CP will lose its focus on the application of the genomic platform and gene mining on drought tolerance. This would be extremely unfortunate. The pressure to broaden the CP through application of the platform to other abiotic and biotic stresses (some of which may suggest more easily-reached solutions) should be carefully managed through purposeful priority-setting. Drought-induced stress, while a difficult challenge, has been identified as the number one global stress hindering crop productivity, food security and human well-being.

The SC notes that while the GCP objectives clearly overlap with the core programmes of some involved Centres, the GCP activities in germplasm characterisation and bioinformatics aspects go far beyond any single Centre initiatives already ongoing. The CPG adds value through the collective programme. However some of the more specific stress related genomics and phenotyping work may be more difficult to disentangle from on going pre-CPG core. The GCP should use where ever possible these existing facilities and networks.

The main outputs of this CP will be enabling technologies to improve cultivars using new gene based marker assistance to conventional breeding. However to make full use of the new knowledge, new varieties, probably including transgenic cultivars, will be developed through the purposeful transfer of drought genes. The SC requests that the CP develops “business plans” for these latter products early in this process and involve the NARS for which compliance with the appropriate local regulatory and biosafety guidelines will be necessary for field release.

The SC considers overall that the CP has made good progress in establishing the instrumental structures and in establishing the technical and scientific basis for the next phase. The SC therefore recommends the continuation of the GCP.

## **Relevance and Quality of Science to Deliver Expected Outputs**

### *Relevance of Outputs*

The outputs from the GCP will most certainly enhance the objectives sought by the CGIAR. Particularly the in the enhancement of the value of the CGIAR plant genetic resources (PGR) collections by massively extending their genetic and phenotypic characterisation and by addressing a vital problem, drought, which is common across crops and across the System, and in seeking proof of concept of the comparative paradigm, which has massive potential application, not only for drought, but also across other target breeding traits in the future and across crop species and Centres.

The comparative approach also allows a realistic route by which results will flow to minor ‘orphan’ crop, several of which are among the CGIAR crops. Among the cereals, pearl millet is arguably the crop most grown on marginal (drought-prone) land in Africa and India and one that already has a limited genomics platform. SC was surprised that *Pennisetum* was not given a higher priority in the CP study.

### *Research Hypotheses*

The research hypotheses are excellent for the molecular work on Sub-programme 1 (Genetic Diversity on Global Genetic Resources). The hypotheses and organisation of comparative work on drought across crops is good (Sub-programme 2, Comparative Genomics for Gene Discovery). The breeding framework (Sub-programme 3) is more tentative as can be expected for this sub-programme as it depends to some extent on outputs from the other sub-programmes and for which the budget begins in 2006. The breeding work will be undertaken by a broad array of NARS partners, making it more diffuse. Bioinformatics (Sub-programme 4) has made good progress in a very complex area spread over most of the other sub-programmes. The NARS capacity building (Sub-programme 5) is not clear, mainly because the majority of NARS partners have yet to be identified through the competitive bidding process. There is an impression that the stronger NARS (those already considering the use of MAS in their breeding programmes) may get involved first. The role and capacity building of other (than the stronger ones) NARS will need careful monitoring after the start up from the competitive projects.

One area that is not clear is the level of focus on the target of drought stress genes for both proof of concept and for application. There will be important decisions to make between the interests of the ARI experts that the CP wishes to attract on proof-of-concept using traits other than drought (that may be less complex and therefore more scientifically appealing for proof of concept) and on the application of the technology for the major constraint of drought. The CP needs to choose carefully between these two objectives and ensure that there is not an overall loss of focus on the main target drought while advancing rapidly the major goal of the application of the concept of synteny across crops and centres and partners.

#### *Research Methodology*

The methodology used in this CP is rapidly moving. The GCP has maintained a high profile in several major scientific meetings and, through its ARI partners is able to use advances methodology. There is also a good level of relevant policy built into the GCP. However a clear philosophy on what level of capacity should be built into NARS programmes would be helpful. It seems impossible that all NARS or even ARI laboratories will have state-of-the-art high throughput marker analysis systems, for the practical application of marker-aided selection. Will there be a trend to contract such services to dedicated labs for the routine marker analyses leaving the geneticists to focus on the application of the results with practical plant breeders? This question is fundamental to the application of the gene technology in a routine manner and needs to be addressed by the GCP.

The core parties involved in this CP are globally well qualified. The leading Centres are involved, while the five ARIs are world leaders in molecular marker and genomics fields. The two NARS included, Brazil and China, are exceptionally advanced. A voice for the smaller NARS at the Steering Committee table would be useful.

As this is a very long-term project (yet with time bound outcomes) it is yet to be seen whether the fundamental science will “reach through” to application to produce high impact outcomes. Earliest impact will be through new varieties. The process involves first the ‘proof of concept’ gene pyramiding work, then drought tolerant lines, then breeding products facilitated by the increased characterisation of the CGIAR germplasm. Similarly enhanced germplasm from capacity-strengthened NARS facilities will follow even later.

Free and frequent international germplasm exchange is an essential component of the project. In recent years, following CBD and COP/MOP, these exchanges have been curtailed in some regions. Activity 1.1.5 (development of protocols to allow germplasm exchange and proper access and benefit sharing from the derivatives of the programme) deals specifically with this and aims in 2005 to have the appropriate clauses in an amended consortium agreement. This should be monitored to ensure that it is not a major limiting factor.

The relative balance between commissioned (foreseen) work and projects arising from a competitive grants programme (where new ideas should emerge) will be key to the progress towards application of the results. The CPG envisages the commissioned component to increase. SC should monitor this to ensure that creativity and involvement of external experts is not compromised while maintaining a focus on the major target.

### *Communications*

The logframe provides a communication plan and elements of it can be found among the indicators and milestones. Even before any publications arise from GCP, the CP itself intends to do a good job of self-publicity, thereby informing the relevant scientific community of CGIAR science.

The use of major international crop science meetings, e.g. Brisbane and PAG at San Diego, to hold project meetings is very helpful in increasing awareness. However, this may not be achieving the same success with NARS scientists, particularly those from less advanced countries. Moreover the same scientists are most likely to be overlooked by ARIs assembling consortia for competitive bids. One hopes that the inclusion of GFAR as a partner and access to their networks will help correct this potential gap. SC should also monitor the traffic through the GCP 'Helpdesk' and the proposed establishment of regional centres of excellence where scientists from weaker NARS can go to conduct parts of their research.

It is extremely important that the CP maintains transparency both in substance and appearance to the public, and to the many constituencies that concern themselves both with ownership of genetic materials and with the new molecular technologies. The web site is an extremely important venue for this. The SC commends the CP for its planning and use, and wishes to underline its importance.

### **Collaborative Arrangements and Unique Benefits**

It is hard to see how a project of this size and nature (exploiting the use of common genetic information across crops), over so many crops, bringing the best expertise in the world on gene analysis to bear on a vital trait for the CGIAR, drought tolerance, and linking to an enormous well established network for phenotyping could have been achieved any other way than through a CP-type effort.

The GCP also is producing time bound outputs that can be used by a larger group of practitioners to address the difficult problem of drought.

The CP is very likely to produce interactive outcomes. Already there is evidence of increased collaboration between Centres and there is the engagement of ARI. The SC will need to monitor carefully the effect of the competitive grants in broadening the partnership in ARI and particularly NARS. The evidence of sustained interest and collaboration not linked to funds will not be available for some years.

A clear desired component is the involvement of researchers over many disciplines. Clearly, and appropriately, the major emphasis is at present on genetics. Future monitoring should ensure the involvement of physiologists and agronomists and plant breeders actively engaged in the phenotyping and use of the traits in routine breeding programmes.

The CP needs to use the resources that are currently available through its partners before building new and different ones. For example the CPG plans to establish a network for phenotyping for drought tolerant rice lines in the rainfed rice systems. Such networks currently exist and are operated by the partners of the CPG. Thus the CPG should, where ever possible, use such resources, and maintain a careful boundary between the “added value” of the CP and the on going pre CPG activities of the members.

The CP currently purposefully involves an appropriate number of Centres. The exclusion of some key Centres, such as CIAT, CIP and ICRISAT, at the outset was probably necessary to get the GCP off the ground in a timely manner. This has been rectified, and more Steering Committee members including WARDA are still being recruited. It is particularly appropriate that ILRI is included as the host of BECA.

### **Logframe Analysis**

The balance between sub-programmes in terms of outputs, goals and resources over the 4-year projection is reasonable. Germplasm characterisation falls away while gene discovery and breeding build up. Capacity building is appropriately flat over the period. Much depends on increased funding over the period.

Many of the milestones for 2005 are well written, i.e. precise, quantified and time-bound. However many appear extremely ambitious, particularly where completion depends on success by several partners, even with the significant funds to be applied over the next 12 months. Examples are the analysis and publication of diversity studies involving large numbers of markers over very large varietal panels in multiple crops, and the development of complete comparative maps and consensus QTL models.

In the capacity building sub-programme the milestones are silent about the identity of the NARS being targeted. At this stage where regions, rather than individual countries, are being considered this is not unreasonable. However SC would expect more specificity in this area for 2006 and beyond

The indicators for time-bound and clearly defined outputs appear extensive and appropriate at the moment. However the scientific objectives must change over the duration of the CP to accommodate new lines of research introduced by successful bids into the competitive programme and to accommodate advances in technology and our understanding of the underlying biology.

Future milestones will clearly be achieved more readily with entirely commissioned work, which will then lose much of the advantage of a competitive programme, which

will incorporate new ideas and new partners. A mixed system of soliciting work seems appropriate so some flexibility in CP indicators must be allowed. This need not affect the next reporting year and so should not affect the reviewing process.

### **General Comments**

This CP has already shown good evidence of new synergies across the System, particularly with portable skills, such as bioinformatics, which can be deployed anywhere virtually.

Opportunities arising from CGIAR scientists joining pre-existing independent international initiatives, as has happened with the CGIAR bioinformatics group, will leverage large amounts of relevant in-kind work those programmes into GCP and then the System as a whole.

The standardisation of procedures, e.g. for marker and phenotyping protocols, and data handling, will also produce savings (in addition to putting the CGIAR in the international spotlight for setting the standards). These could probably only emerge from a CP-like structure involving internationally leading laboratories. Similar opportunities could be sought in new CPs.

Another area where GCP is putting substantial effort is in linking with, and obtaining funding from industry. As yet private sector science has impinged little on the CGIAR, in terms of added knowledge.

It probably is clear that the CPs do offer opportunities for bringing new funding to bear on CGIAR problems. It is also clear that at least some of these funds, e.g. those from industry and charitable foundations, are new money. It is equally clear that other funds will result from reallocation.

The in-kind contributions from ARIs (and possibly NARS) to this CP are very significant and the point that capital costs, e.g. for specialised equipment, are often excluded (at the moment) is well made. A further advantage, not stated in the MTP, is that some researchers from ARIs and NARS will be diverted in their interests to work on CGIAR problems (and with CGIAR partners) in the longer term and with funding independent of the CP. It would be valuable to monitor such developments, which could provide strong arguments for the CP approach.

It is not yet apparent how broadly the genetic platform concept will affect change in how the CGIAR develops priorities and organizational strategies in one of its core, “heartland” research areas. This CP will, in several ways, provide a “proof-of-concept” test for one alternative.