# SUMMARY ANNUAL REPORT

# 2006

# PROJECT IP - 1

## Bean Improvement for the Tropics



CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

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## 1. PROJECT DESCRIPTION

### *IP-1: BEAN IMPROVEMENT FOR THE TROPICS*

**Goal:** To obtain a lasting increase in food availability and income for the poor through improved bean productivity.

**Objective:** To increase bean productivity through enhanced access and utilization of improved cultivars and management practices in partnership with NARS and regional networks, and through them, with farmers.

**Important assumptions:** Regional bodies and national governments continue to give priority to bean production. Partners and providers of research and extension services are willing to incorporate and commit resources to innovative approaches to reach end users. Core research capacity and budgets maintained. Continued success in attracting special project funding. Continued donor support to regional networks. Resources in challenge programs accessed.

**Target Ecoregions:** East-Central and southern Africa. Neotropical regions of Mexico, Central America, the Caribbean, Brazil and the Andean zone.

**Beneficiaries and users:** Small farmers in tropical America and Africa (mainly women) will obtain higher and more stable yields. Poor consumers, especially women and children, will benefit from low-cost protein and micronutrients. The environment and community at large will benefit from reduced pesticide and fertilizer use. Food legume researchers will access an enhanced knowledge base and germplasm.

**Collaborators:** *Regional networks in Africa and Central America*: AfNet, ASARECA, CORAF/WECARD, ECABREN, SABRN, SACCAR, SADC/FANR, and SICTA. *NARS:* Central America (6), the Caribbean (3), the Andean zone (5), Brazil, East Africa (9) and southern Africa (10). *CGIAR centers:* ICRAF, CIMMYT, IITA, CIP, IRRI, ICRISAT. *Systemwide programs*: IPM program and African Highland Initiative (AHI). *Other international institutions:* EAP-Zamorano, ICIPE, Bean/Cowpea CRSP. *Diffusing technology*: More than 30 NGOs, churches, relief and governmental agencies, and entrepreneurs. *ARI's*: more than 20 universities and 10 other ARI's in Australia, Europe and North America. *HarvestPlus CP*: NARS in Brazil and East Africa; ARI's in 3 countries. *Generation CP*: NARS in 5 countries; ARI's in 2 countries.

**Explanation of project changes:** In light of the distinction drawn by the Science Council between output targets and outcomes, and in an effort to focus, two of our outputs from the 2005 Log Frame (outputs 4 and 5) that dealt with services provided to NARS have been combined into one (output 4). This presentation is more succinct and to the point.

**Project funding:** Data from Finances

## LOGFRAME MATRIX: BEAN IMPROVEMENT FOR THE TROPICS (2006-2008)

| IP-1 | Outputs | Intended user | Outcome | Impact |
|---|---|---|---|---|
| **Output 1** | Improved, small-seeded, bean germplasm resistant to major biotic and abiotic stresses with greater nutritional and market value. | NARS and farmers in Central America, the Caribbean, Brazil, East Africa | Adoption of improved varieties by farmers | More stable production, food availability, better nutritional status and income |
| **Output Targets 2006** | • Ten lines tolerant to low nitrogen and phosphorus and acid soil complex available to NARS, farmers and other partners in Africa (DRC, Kenya, Tanzania, Rwanda, Madagascar, Malawi, and Sudan), and 20 drought tolerant, disease resistant lines validated in 5 countries in Central America / Caribbean.<br>• ~40 small seeded $F_6$-derived $F_7$ families combining 40% higher mineral content and moderate drought tolerance developed (HarvestPlus) | • NARS, NGO's, and CBO's | • Lines tolerant to low fertility are used widely by partners | • Improved productivity in marginal environments |
| **Output Targets 2007** | • 5-10 interspecific progeny between common bean and *P. coccineus* that broaden the genetic base for tolerance to aluminum; resistance to ALS, root rots, anthracnose; and/or high mineral content. | • CIAT breeders | • Breeders incorporate broader diversity into populations | • Improved productivity in marginal environments |
| **Output Targets 2008** | • At least 40 lines combining drought tolerance with resistance to BCMNV, root rots, and/or ALS available for testing in Africa<br>• ~30 small seeded $F_3$-derived $F_5$ families developed with tropical adaptation, 80% more minerals, abiotic tolerance, and 2 resistances (HarvestPlus) | • NARS, NGO's and CBO's | • Drought tolerant lines with critical resistance genes are used in drought prone areas | • Yield stability |

| IP-1 | Outputs | Intended user | Outcome | Impact |
|---|---|---|---|---|
| **Output 2** | Improved, large-seeded, bean germplasm resistant to major biotic and abiotic stresses with greater nutritional and market value. | NARS and farmers in the Andean zone, the Caribbean, East and southern Africa | Adoption of improved varieties by farmers | More stable production, food availability and income |
| **Output Targets 2006** | • 15 climbing bean lines with heat tolerance and BCMNV resistance distributed to NARS and network partners in Andean region, East Africa and Southern Africa<br>• Small-to-medium seeded climbers with tropical adaptation and 40% more minerals developed (HarvestPlus) | • NARS, NGO's and CBO's | • Partners use climbing beans adapted to elevations down to 1200 masl in 4 Andean countries and 6 African countries. | • Farmer's yield doubled over bush beans in areas of adoption |
| **Output Targets 2007** | • 15 new large-seeded bush lines with high mineral trait and resistance to 2 diseases, mainly in the red mottled and red seed classes (HarvestPlus). | • NARS and NGO's | • High iron lines adopted | • Reduced levels of iron and zinc deficiency |
| **Output Targets 2008** | • 15 new large seeded climbing beans with high mineral trait (HarvestPlus) | • NARS, NGO's and farmers' groups | • High mineral lines incorporated into production system | • Reduced levels of iron and zinc deficiency |

| | Outputs | Intended user | Outcome | Impact |
|---|---|---|---|---|
| **Output 3** | Strategies developed for managing diseases and pests in bean-based cropping systems. | Breeders, entomologists and pathologists in CIAT and NARS | Best bet IDPM practices and genetic combinations for stable resistance deployed. | More stable bean yields |
| **Output Targets 2006** | • Resistance genes tagged in 3 sources of *Pythium* resistance, 2 sources of ALS resistance, and 1 source of Apion resistance. | • Pathologists, entomologists and breeders in NARS (NARO-Uganda and KARI-Kenya) | • Efficiency of selection for resistance is improved | • Reduced time to varietal development |
| **Output Targets 2007** | • Method available to quantify 2 major soil borne pathogens (*Pythium ultimum* and *Fusarium solani*), as a tool to assess disease management strategies, and to refine management of resistance breeding nurseries. | • Pathologists in CIAT and NARS | • Improved efficiency in genetic improvement and in control of disease | • Reduced yield losses from root rots |
| **Output Targets 2008** | • Multiple gene combinations to manage ALS developed through MAS | • CIAT and NARS breeders | • Per cent of resistant lines in breeding program increased | • More stable resistance in advanced lines |

| | Outputs | Intended user | Outcome | Impact |
|---|---|---|---|---|
| **Output 4** | Approaches and methods developed and available for strengthening institutional, organizational and collaborative capacity of NARS and sub-regional networks in Africa and Latin America | NARS in Africa and Latin America | Improved institutional performance by NARS, NGOs and other partners, reflected in more effective technology development and dissemination | More stable production, improved food availability, income and nutrition, especially for the poor and women farmers |
| **Output Targets 2006** | • Strategies and networking mechanisms refined and promoted for sustainable seed production and dissemination of technologies in fourteen countries in east and southern Africa.<br>• Methods and tools developed and made available for participatory plant breeding in 10 PABRA countries | • NARS, Bean networks, NGOs, seed companies, CBOs<br>• NARS, NGOs, CBOs, farmers | • National strategic alliances established, internally monitored and reaching one million people in Africa with improved varieties and/or crop management technologies.<br>• More cost-effective NARS in development and dissemination of technology. | • Increased adoption and productivity<br>• More benefits to poorer farmers and those in marginal situations |
| **Output Targets 2007** | • Innovative approaches and tools developed and made widely available to partners in Kenya, Malawi, Uganda, and Tanzania for IPDM and marker-assisted selection of varieties .<br>• Breeding programs for biofortification established in Honduras, Brazil, Bolivia, Venezuela, Kenya and Malawi. | • NARS, NGOs, CBOs and farmers.<br>• NARS, NGOs, and farmers | • Increased use of IPDM strategies that enable R&D institutions to reach more farmers, and of marker-assisted methods that improve cost-effectiveness in breeding new varieties.<br>• NARS breeders select lines with higher mineral content | • Reduced effect of diseases and pests leading to increased and more stable bean production by farmers<br>• Increased production and incomes |
| **Output Targets 2008** | • An IPM system for whiteflies on snap beans refined and promoted in major bean producing areas of the Andean zone | • NARS, NGO's, CBO's | • Pesticide use is reduced, production assured, and profitability increased | • Less pesticide intoxication in rural communities and urban consumers |

## 2. RESULTS ASSOCIATED WITH 2006 PROJECT OUTPUT TARGETS

| | Output targets | Output category | Achieved? | Means of verification |
|---|---|---|---|---|
| **Output 1:** Improved, small-seeded, bean germplasm resistant to major biotic and abiotic stresses with greater nutritional and market value. | • Ten lines tolerant to low nitrogen and phosphorus and acid soil complex available to NARS, farmers and other partners in Africa (DRC, Kenya, Tanzania, Rwanda, Madagascar, Malawi, and Sudan), and 20 drought tolerant, disease resistant lines validated in 5 countries in Central America / Caribbean.<br>• ~40 small seeded $F_6$-derived $F_7$ families combining 40% higher mineral content and moderate drought tolerance developed (HarvestPlus) | Materials | • Yes<br>• Yes | • Annual report 2006 section 1.1.2.3 and 1.1.3.4<br>• Annual report, AgroSalud project, p. 13-14; 19-21<br>•<br>• Annual report 2006, section 1.4.1 |
| **Output 2:** Improved, large-seeded, bean germplasm resistant to major biotic and abiotic stresses with greater nutritional and market value. | • 15 climbing bean lines with heat tolerance and BCMNV resistance distributed to NARS and network partners in Andean region, East Africa and Southern Africa<br>• Small-to-medium seeded climbers with tropical adaptation and 40% more minerals developed (HarvestPlus) | Materials | • Yes<br>• Yes | • Annual report 2006, summary of seed shipments, section 4<br>• Annual report 2005, p. 127-134. Annual report 2006, summary of seed shipments, section 4.3 |
| **Output 3:** Strategies developed for managing diseases and pests in bean-based cropping systems. | • Resistance genes tagged in 3 sources of *Pythium* resistance, 2 sources of ALS resistance, and 1 source of Apion resistance. | Practices | • Yes | • Annual report 2006, activity 3.2.1; Annual report 2005, section 2.2.1; Annual report 2006, section 3.2.3 |
| **Output 4:** Approaches and methods developed and available for strengthening institutional, organizational and collaborative capacity of NARS and sub-regional networks in Africa and Latin America | • Strategies and networking mechanisms refined and promoted for sustainable seed production and dissemination of technologies in fourteen countries in east and southern Africa.<br>• Methods and tools developed and made available for participatory plant breeding in 10 PABRA countries | Practices | • Yes<br>• Yes | • Annual report section 4.3.1<br>• Annual report 2005, p 317-325. Annual report 2006, section 4.1.5 |

## 3. RESEARCH HIGHLIGHTS IN 2006

We will highlight three areas of our current research portfolio:

### 3.1 DROUGHT AND YIELD POTENTIAL

Drought has long been a priority for the CIAT bean breeding program, and in recent years we have reported that levels of drought resistance have increased significantly in improved lines. Nonetheless, drought seldom is a yearly event and the question remains, do drought resistant varieties yield well in well-watered years? Yield trials of drought-selected lines were established in three different environments under well-watered and fertile conditions, to investigate the yield potential of drought-resistant materials. Lines were compared with standard commercial checks in small red, small black, and cream-striped (carioca) classes. Virtually no lines yielded significantly less than the respective checks, most yielded marginally more, and several yielded significantly more. Some lines also outyielded low P check cv. Carioca (G4017) under phosphorus stress. Moreover, lines were also earlier to mature and often presented significantly greater yield per day than checks. We suggest that selection for drought resistance has favored genes for plant efficiency, perhaps manifested as improved photosynthate mobilization, and that these genes and trait(s) have a beneficial effect on yield across multiple environments.

### 3.2 EFFECTS OF MACRONUTRIENT FERTILIZATION ON GRAIN CONCENTRATION OF IRON AND ZINC

While genetic enhancement of iron and zinc concentrations is the focus of the bean component of the HarvestPlus program and the AgroSalud project, knowledge of environmental factors that influence mineral concentration is useful to understand the causes of instability in these traits over sites and seasons, and potentially to manipulate these factors for higher mineral content. A series of studies in Kenya elucidated the effects of macronutrients on iron and zinc in grain. Ten bean lines were grown at Thika and Kabete during the short rain season, and at Kakamega and Kabete in the long rain season. N was applied at rates of 0-150 kg $ha^{-1}$, P at rates of 0-75 kg $ha^{-1}$, and K at rates of 0-150 kg $ha^{-1}$. Fertilization increased iron concentration in grain by as much as 63, 58 and 23% for N, P and K. Zinc increased by as much as 22, 27 and 14% in response to N, P and K. This suggests that if fertilization becomes feasible for African farmers, this could have positive effects on the nutritional quality of beans, as well as increasing yields. Among the ten bean lines, AND 620 and Maharagi Soja (previously identified as high iron) presented the highest levels of iron.

### 3.3 BROADER USE OF MARKER ASSISTED SELECTED IN AFRICA

Marker assisted selection (MAS) has been employed in CIAT headquarters for several years, first for resistance to BGYMV, and then for BCMV resistance. This activity has been transferred to Africa, and has been expanded significantly to include selection for resistance genes effective against other diseases. More than 1000 plants were assayed in Uganda for resistance genes (both recessive and dominant) against BCMV and BCMNV. Markers developed at CIAT headquarters to detect the Pythium resistance gene found in RWR 719 (a Rwandan bred line), were tested in Uganda on 111 backcross progeny and 54 families derived from double crosses. Meanwhile, at headquarters 282 $F_2$-derived families were tested for the presence of anthracnose resistance genes derived from G2333. This sort of targeted, selective use of markers at specific points in the breeding program will make breeding more efficient and more directed toward the deployment of recognized, highly useful resistance genes. The decentralized strategy of CIAT in Africa aims to carry out this work in laboratory facilities of NARS, thus exposing partners to routine application of these techniques.

## 4. PROJECT OUTCOME: LINKING FARMERS TO BEAN MARKETS

**Outcome statement:** Smallholder Ethiopian farmers benefit from re-invigorated international and regional markets for beans. More efficient seed systems have facilitated response of farmers to this opportunity.

**Relevant outputs:** Outputs 1 and 5, project SN-1 (2002-2004); Output 4, IP-2 (2002-2004)

**Who adopted**: The Ethiopian Institute of Agricultural Research adopted and multiplied genetic materials for distribution to small bean producers. Limited capacity of EIAR to supply seed was addressed with NGO's to develop farmer-led seed systems. A survey (N=323) revealed that 73% of farmers so reached had never before accessed a new variety.

**How adopted**: European companies have invested in new processing plants as Ethiopia has become a low-cost source for white canning beans. This market has been fostered by private companies, EIAR and leading NGO's. CIAT's role includes (i) providing genetic materials; (ii) fostering farmer-led local seed systems; (iii) helping NGO's to link farmers to markets. In the 2005-2006 season total bean exports valued $30-40 million. In 2006-07 farmers received two-to-three times higher farm-gate prices under high market demand. NGO's such as Catholic Relief Service and the national program have received training in market analysis and development of innovation platforms in support of market chains.

**Evidence**:

**Shaun Ferris and Elly Kaganzi**. Evaluating Marketing Opportunities for Common Beans in Ethiopia. Market evaluation commissioned by Improving Productivity and Market Success of Ethiopian Farmers Project. CIDA. Pp 58.

**Rupert Best, Tom Remington, Shaun Ferris and Mark Lundy, 2005**: Harnessing the Power of Partnerships in the Marketplace: Using a Learning Alliance for Agro-enterprise Integration into Agricultural Recovery: To be presented at the International Farming Systems Association Global Learning Opportunity (October 31-November 4, 2005, Rome Italy).

**Louise Sperling, R. Buruchara, R. Muthoni, R. Kirkby, J.C. Rubyogo.** Annual report 2005, project IP-1. Bean improvement for the tropics. p 283-288.

## 5. LIST OF 2006 PUBLICATIONS

(includes accepted, in press, in review and submitted ) - see complete list

### 5.1 Book chapters and books (five in English, one in French)

- Book chapters published: 1
- Book chapters in review 1
- Book chapters in press: 4

### 5.2 Refereed and non-refereed journal articles

- Papers published in English: 34
- Papers accepted in English: 2
- Papers submitted in English: 3
- Papers in press in English: 2
- Papers published in Spanish: 2
- Papers in review in English: 1

### 5.3 Workshop and conference papers

- Papers in English: 54
- Papers in Spanish: 11

### 5.4 Proceedings, posters, abstracts, others

| | | | |
|---|---|---|---|
| - | Proceedings: | in English | 5 |
| | | in French | 2 |
| - | Posters: | in English | 8 |
| | | in Spanish | 1 |
| - | Abstracts: | in English | 2 |
| - | Others: | in English | 7 |
| | | in Spanish | 4 |
| | | in others | 2 (African languages) |

### 5.5 Editorial Contributions

- Reviewed papers for:
  - Agronomy Journal
  - Crop Science
  - European Journal of Plant Pathology
  - Journal of Experimental Botany
  - Journal of Phytopathology
  - Molecular Breeding
  - Phytopathology
  - Plant Breeding
  - Plant Science
  - Theoretical and Applied Genetics

## 5.1 Book Chapters and Books

Blair, M.W., Fregene, M.A., Beebe, S.E., Ceballos, H. 2006. Marker Assisted Selection in Common Beans and Cassava. In: E. Guimaraes (ed.) Marker-Assisted Selection (MAS) in Crops, Livestock, Forestry and Fish: Current Status and the Way Forward. FAO. Chp 7 (in press).

Dwivedi, S.L., Stalker, H.T., Blair, M.W., Bertioli, D., Upadhyaya, H.D., Nielen, S., Ortiz, R. 2006. Enhancing crop gene pools of cereals and legumes with beneficial traits using wild relatives. Plant Breeding Reviews (in press).

Fortmann, L., H. Ballard and L. Sperling. 2007. Change around the edges: Gender Analysis, Feminist Methods and Sciences of Terrestrial Environments. In: Schiebinger et al.: Gendered Innovations. California: Stanford University Press (in press).

Nandwa, S. M., A. Bationo, S. N. Obanyi, I. M. Rao, N. Sanginga and B. Vanlauwe. 2007. Inter and intra-specific variation of legumes and mechanisms to access and adapt to less available soil phosphorus and rock phosphate. In: A. Bationo (Ed) Fighting Poverty in Sub-Saharan Africa: The Multiple Roles of Legumes in Integrated Soil Fertility Management, Springer-Verlag, New York (in press).

Rao, I. M. 2007. Minerals: Function. In: A. S. Raghavendra (ed). Crop Physiology. The Haworth Press, Inc., Binghamton, USA (in review).

Rubyogo, J.C. (2006) Renforcer les capacités de systèmes semenciers pour accélérer l'adoption des variétés améliorées de haricot: cas de l'Afrique de l'Est et de l'Afrique centrale et australe- In Lançon J., Weltzien E., Floquet A. (éditeurs scientifiques). Gestion du partenariat dans les projets de sélection participative. Actes de l'atelier recherche des 14-18 mars 2005, Cotonou, Bénin. CIRAD, INRAB, Coopération Française, Montpellier, France. p. 175-178.

## 5.2 Refereed and Non-Refereed Journal Articles

### Refereed Journals

Beebe, S.E., Rojas, M., Yan, X., Blair, M.W., Pedraza, F., Muñoz, F., Tohme, J., Lynch J.P. 2006. Quantitative trait loci for root architecture traits correlated with phosphorus acquisition in Common Bean. Crop Sci. 46: 413-423.

Blair, M.W., Rodriguez, L.M., Pedraza, F., Morales, F.J., and Beebe, S. 2007. Genetic mapping of the bean golden yellow mosaic geminivirus resistance gene *bgm*-1 and linkage with potyvirus resistance in common bean (*Phaseolus vulgaris* L.). Theor Appl Genet 114: 261-271.

Blair, M.W., Giraldo, M.C., Buendia, H.F., Tovar, E., Duque, M.C., Beebe, S.E. 2006. Microsatellite marker diversity in common bean (*Phaseolus vulgaris* L.) Theor Appl Genet 113: 100-109.

Blair, M.W., Iriarte, G., Beebe, S. 2006. QTL analysis of yield traits in an advanced backcross population derived from a cultivated Andean x wild common bean (*Phaseolus vulgaris* L.) cross. Theor Appl Genet 112: 1149–1163.

Blair, M.W., Muñoz, C., Garza, R., Cardona, C. 2006. Molecular mapping of genes for resistance to the bean pod weevil (*Apion godmani* Wagner) in common bean. Theor Appl Genet 112(5): 913–923.

Blair, M.W.; Beaver, J.S.; Nin, J.C.; Prophète, E.; Singh, S.P. 2006. Registration of PR9745-232 and RMC-3 red-mottled dry bean germplasm lines with resistance to bean golden yellow mosaic virus. Crop Science 46(2):1000-1001.

Checa, O., Ceballos, H., Blair, M.W.. 2006. Generation means analysis of climbing ability in common bean (*Phaseolus vulgaris* L.). J of Heredity 97(5): 456-465.

Chirwa, R. M., V.D Aggarwal, M. A. R. Phiri, and A. R. E. Mwenda. 2006. Experiences in implementing the bean seed strategy in Malawi . Journal of Sustainable Agriculture (29) 2.

Díaz, L.M., Blair, M.W. 2006. Race structure within the Mesoamerican gene pool of common bean (*Phaseolus vulgaris* L.) as determined by microsatellite markers. Theor Appl Genet 114: 143-54.

Díaz, L.M., Díaz, J.M., Blair, M.W. 2005. Diversidad genética de fríjol común (*Phaseolus vulgaris* L.) en Colombia. Fitotecnia Colombiana 5: 28-36

Gichuru, V.G.; Buruchara, R.A.; Okori, P.; Opio, F.; Ugen, M.A. 2006. Identification and characterization of *Pythium* spp. of major crops in Southwestern Uganda. Phytopathology 96(6):S40.

Gichuru, V.G.; Buruchara, R.A.; Okori, P.; Opio, F.; Ugen, M.A. 2006. Pathogenicity of bean pathogenic *Pythium* spp. on major crops in a bean based cropping system. Phytopathology 96(6):S40.

Graham, R.D., R.M. Welch, D.A. Saunders, I. Ortiz-Monasterio, H.E. Bouis, M. Bonierbale, S. de Haan, G. Burgos, G. Thiele, R. Liria, C.A. Meisner, S.E. Beebe, M.J. Potts, M. Kadian, P.R. Hobbs, R.K. Gupta, S. Twomlow. 2007. Nutritious subsistence food systems. Advances in Agronomy 92:1-74.

Hillocks, R.J., C.S. Madata, R. Chirwa, E. Minja, and S. Msolla. 2006. Phaseolus bean improvement in Tanzania 1959-2005. Euphytica 150:215-231

Iriarte, G., Blair, M.W., Hoyos, A., Beebe, S. 2006. Evaluación agronómica de una retrocruza avanzada entre una accesión silvestre colombiana y la variedad cultivada de frijol común, ICA Cerinza. Fitotecnia Colombiana 6(1): 24-32.

Kiprop, E.K., E.W. Mwang'ombe, J.P. Baudoin, P.M. Kimani and G. Mergeai. 2005. Genetic variability among *Fusarium udum* isolates from pigeonpea. Afr. Crop Science J. 13: 163-172.

Kimani, J.M., P.M. Kimani, S.M. Mwangi and J.W. Kimenju. 2006. Mode of inheritance of common bean (*Phaseolus vulgaris*. L) traits for tolerance to low soil phosphorus (P). Euphytca (accepted).

Kimani, J.M., P.M. Kimani, S.M. Mwangi and J.W. Kimenju. 2006. Genetic control of low soil nitrogen tolerance in common bean (*Phaseolus vulgaris* L.). African Crop Science Journal. (submitted).

Mahuku, G.S., Henriquez, M.A., and Ramirez, H. 2006. Analysis of genes expressed during interaction of *Phaseolus vulgaris* with the angular leaf spot pathogen, *Phaeoisariopsis griseola.* Phytopathology 96: S72

Mahuku, G.S., Jara, C., Henriquez, M.A., Castellanos, G., and Cuasquer, J. 2006. Genotypic characterization of the common bean bacterial blight pathogens, *Xanthomonas axonopodis* pv. *phaseoli* and *X. axonopodis* pv. *phaseoli* var. *fuscans* by rep-PCR and PCR-RFLP of the ribosomal genes. Journal of Phytopathology 154: 35-44.

Miklas, P.N., Kelly, J.D., Beebe, S.E., Blair, M.W. 2006. Common bean breeding for resistance against biotic and abiotic stresses: from classical to MAS breeding. Euphytica: 147:105-131.

Montoya, C.A., Lalles, J.P., Beebe, S., Montagne, L., Souffrant, W.B., and Leterme, P. 2006. Influence of the *Phaseolus vulgaris* phaseolin level of incorporation, type and thermal treatment on gut characteristics in rats. Brit. J. of Nutrition. 95:116-123.

Morales, F.J. 2006. History and current distribution of begomoviruses in Latin America. Advances in Virus Research 67: 127-162.

Morales, F.J. 2007. Tropical Whitefly IPM Project. Advances in Virus Research 69:249-311.

Muñoz, C., Duque, M.C., Debouck, D., Blair, M.W. 2006. Taxonomy of tepary bean (*Phaseolus acutifolius*) and wild relatives as determined by amplified fragment length polymorphism (AFLP) markers. Crop Science 46(4):1744–1754.

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Ochoa, I.E., Blair, M.W., Lynch, J.P. 2006. QTL analysis of adventitious root formation in common bean (*Phaseolus vulgaris* L.) under contrasting phosphorus availability. Crop Science 46(4):1609-1621

Pedrosa-Harand, A., de Souza Almeida, C.C., Mosiolek, M., Blair, M.W., Schweizer, D., Guerra, M. 2006. Extensive ribosomal DNA amplification during Andean common bean (*Phaseolus vulgaris* L.) evolution. Theor Appl Genet 112: 924–933.

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Sperling, L., H.D. Cooper and T. Remington. 2007. Moving toward more effective seed aid. Journal of Development Studies (in press).

Teshale, A., Rubyogo, J.C., Sperling, L., Amsalu, B., Abate, T., Deressa, A., Reda, F., Kirkby, R. and Buruchara, R. 2006. Creating partnerships for enhanced impact; bean variety delivery in Ethiopia. Journal of Crop Science Society of Ethiopia 12: 27-30.

Velten, G., Rott, A., Conde Petit, B., Cardona, C., Dorn, S. 2006. Influence of dry beans seed traits on tritrophic interactions. Biological Control (submitted).

Velten, G., Rott, A., Cardona, C., Dorn, S. 2006. Effects of the plant resistance factor arcelin on parasitism of the common bean bruchid *Acanthoscelides obtectus* (Coleoptera: Bruchidae) by its natural enemy *Dinarmus basalis* (Hymenoptera: Pteromalidae). Biological Control (submitted).

Velten, G., Rott, A., Cardona, C., Dorn, S. 2006. The inhibitory effect of arcelin on the development of *Acanthoscelides obtectus*. Journal of Stored Products Research (accepted).

NON-REFEREED JOURNALS

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Blair, M.W., Cardona, C., Quintero, C., Garza, R., Weeden, N., Singh, S.P. 2006. Development of a SCAR marker for common bean resistance to the bean pod weevil (*Apion godmani* Wagner). Bean Improvement Cooperative. Annual Report 49:181-182.

Blair, M.W., Astudillo, C., Beebe, S. 2005. Analysis of nutritional quality traits in an Andean recombinant inbred line population. Bean Improvement Cooperative. Annual Report 48:52-53.

Blair, M.W., Pantoja, W., Beaver, J.S., Nin, J.C., Prophete, E. 2005. Genetic diversity assessment of Caribbean common bean germplasm. Bean Improvement Cooperative. Annual Report 48:12-13.

Cichy, K.A., Blair, M.W., Snapp, S.S. 2006. Low phosphorus tolerance in an Andean bean population. Bean Improvement Cooperative. Annual Report 49:23-24.

Islam, F.M.A., Basford, K.E., Redden, R.J., Beebe, S. 2006. Preliminary evaluation of the common bean core collection at CIAT. Plant Genetic Resources Newsletter (145):29-37.

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Rosas, J.C., J.S. Beaver, S. Beebe, A. Llano, C.A. Pérez, D. Scoto, E. Prophete, J.C. Hernández, J.C. Villatoro. 2006. Resultados del SISTEVER-2005 de frijol de grano rojo. In: CD con las memorias de la LII Reunión Anual del Programa Cooperativo Centroamericano para el Mejoramiento de Cultivos y Animales, PCCMCA, p. 115. Montelimar, Nicaragua. 24-28 April.

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## 5.4 PROCEEDINGS, POSTERS, ABSTRACTS AND OTHERS

### PROCEEDINGS


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Kimani, P.M., R. Buruchara, K. Ampofo, M.Pyndji, R.Chirwa and R.Kirkby. 2005. Breeding beans for smallholder farmers in Eastern, Central and Southern Africa: Constraints, achievements and potential. In: Pan-African Bean Research Network (PABRA) Millennium Workshop, pp11-28. Arusha, Tanzania, 28 May-1 June.

Kimani, P.M., R.Chirwa and R.Kirkby. 2005. Breeding bean for Africa: Strategy and Plan. In: Pan-African Bean Research Network (PABRA) Millennium Workshop, pp 29-33. Arusha, Tanzania, 28 May-1 June.

Musoni, A., R.Buruchara and P.M. Kimani. 2005. Climbing beans in Rwanda: Development, impact and challenges. In: Pan-African Bean Research Network (PABRA) Millennium Workshop, pp 44-52. Arusha, Tanzania, 28 May-1 June.

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Rubyogo, J.C., 2006. Renforcer les capacités de systèmes semenciers pour accélérer l'adoption des variétés améliorées de haricot: cas de l'Afrique de l'Est et de l'Afrique centrale et australe- In Lançon J., Weltzien E., Floquet A. (éditeurs scientifiques). Gestion du partenariat dans les projets de sélection participative. Actes de l'atelier recherche des 14-18 mars 2005, Cotonou, Bénin. CIRAD, INRAB, Coopération Française, Montpellier, France, pp 175-178.

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### POSTERS


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Blair, M.W., C. Galeano, C. Muñoz, C. Pankhurst, P. Lariquet, W.M. Broughton. 2006. TILLING Mutagenesis for Common Beans (*Phaseolus vulgaris* L.): A Tropical Legume Mutant Resource. Annual General Meeting Generation Challenge Program, Sao Paulo, Brazil, 12-16 Sept.

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Rangel, A.F., I.M. Rao, W.J. Horst. 2006. Short and long term root-growth responses to aluminium in common bean (*Phaseolus vulgaris* L.). Poster presented at Plant Nutrition meets Plant Breeding, first joint conference of the German Society of Plant Nutrition – DGP and the Research Centre for Biotechnology and Plant Breeding Uni. Hohenheim – FSP, Hohenheim University, Stuttgart, Germany.

Rodríguez, I., Bueno, J. M., Cardona, C. 2006. Validación de una alternativa para el manejo racional de *Trialeurodes vaporariorum* en habichuela. XXXIII Congreso de la Sociedad Colombiana de Entomología SOCOLEN, Manizales, Colombia, 26-28 Julio.

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Kimani, P.M., S.Beebe and M. Blair. 2006. Breeding micronutrient dense bean varieties. HarvestPlus Regional Workshop. Mombasa, Kenya, 2-6 May.

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Pyndji, M., 2006. FOFIFA, CTHA and SAHA. 2006. Famokarana Ambioka Tsaramaso. Boky Ho ann'ny mpamokatra ambioka tsaramaso sehatra madinika. CIA Seed manual I- Malagasy version (Brochure).

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Sperling, L.; Remington, T.; Haugen, J.M. 2006. Seed aid por seed security: Advice for practitioners, Practice briefs 1-10. Rome, Italy; International Center for Tropical Agriculture; Catholic Relief Services.

## 5.5 Editorial Contribution

Mahuku, G. Reviewer for:
- Agronomy Journal
- European Journal of *Plant Pathology*
- Journal of Phytopathology
- Phytopathology
- Plant Breeding

Blair, M.W. Reviewed articles for:
- Crop Science
- Journal of Experimental Botany
- Molecular Breeding
- Plant Science
- Theoretical and Applied Genetics

## 6. LIST OF SPECIAL PROJECTS

### 6.1 AT HEADQUARTERS

#### 6.1.1 New proposals approved in 2006

| Title | Donor | Funding period | Total Amount US | Amount to partners US$ | Available in 2006 US$ |
|---|---|---|---|---|---|
| Improved beans for Africa and Latin America | DFID, UK | 2006 | 258,943 | - | 258,943 |
| Commissioned Research-GCP Consortium Members - TILLING mutagenesis and drought gene analysis | Generation Challenge Program | 2006 | 103,879 | - | 103,879 |
| Reducing pesticide use and pesticide resistance in rice and beans in the Andean zone | FONTAGRO | 2006-2009 | 125,000 | | 125,000 |
| Fighting Drought and Aluminium Toxicity: Integrating Genomics, Phenotypic Screening and Participatory Research with Women and Small-Scale Famers to Development Stress-Resistant Common Bean and Brachiaria for the Tropics | BMZ | 2006-2009 | € 1,100,000 | € 354,550 | € 256,701 |

#### 6.1.2 List of ongoing special projects in 2006

| Title | Donor | Funding period | Total Amount US | Amount to Partners (US$) | Available in 2006 US$ |
|---|---|---|---|---|---|
| Bean genomics for improved drought tolerance in Latin America | BMZ-Germany | 2003-2007 | € 740,000 | 13,046 | 94,240 |
| Increasing bean and maize agrobiodiversity as an approach for improving production systems, food security and nutrition in Nariño, Colombia | ECOFONDO/ FIDAR, Colombia | 2003-2006 | 8,823 | - | - |
| Biofortified Crops for Improved Human Nutrition – Harvest Plus Challenge Program | Gates Foundation World Bank DANIDA, Denmark | 2003-2008 | 351,570 | 63,000 | 288,570 |
| Obtención de nuevas variedades de fríjol común con atributos de rendimiento y potencial para nuevos mercados, utilizando selección convencional y asistida por marcadores moleculares | COLCIENCIAS/ Universidad Nacional de Colombia | 2004-2007 | 8,235 | - | 3,598 |
| Mejoramiento de la nutrición humana en comunidades pobres de America Latina utilizando maiz (QPM) y frijol común biofortificados con micronutrientes | IICA/BID FONTAGRO | 2004-2007 | 350,000 | 80,198 | 37,614 |
| Combating hidden hunger in Latin America: Biofortified crops with improved vitamin A, essential minerals and quality protein (AgroSalud) | CIDA | 2004-2010 | 20,000,000 Can$ | | 229,331 |
| Desarrollo de mapas genéticos para el mejoramiento del contenido de Fe y Zn en frijoles andinos como alternativa para reducir las deficiencias nutricionales de la población colombiana | FIDAR | 2005-2006 | 24,000 | - | 12,773 |
| Integrated management of whiteflies in the tropics | DFID | 2005 - 2008 | 80,610 | 31,084 | 49,526 |

## 6.2 IN AFRICA

### 6.2.1 *New proposals approved in 2006*

| Title | Donor | Comments | Funding period | Total amount US |
|---|---|---|---|---|
| Putting Seed Security at the Heart of Agricultural Relief and Recovery Response | USAID/OFDA | Focus on SSSAand Tool Development | 2006-2007 | 335,000 |
| Effects of root rots on beans on Biodiversity | Gines Mera Fellowship | Scholarship for Two years | 2006-008 | 10,000 |
| Enhancing competitiveness of snap bean for domestic and export markets | ASARECA/ EU | Started March 2006 | 2006-2009 | 400,000 |
| Getting back to basics: creating impact-oriented bean seed delivery systems for the poor in Malawi, Mozambique and Tanzania | McKnight | CIAT/SABRN in partnership with NARS in Malawi-Tanzania and Mozambique | 2006-2010 | 418,940 |
| Improved Smallholder food Security, Nutrition and Income through Increased Production and Marketing of Climbing Beans. | McKnight | Initiated by ICRAF in partnership with NARS in Malawi and Mozambique and CIAT-TSBF/SABRN | 2006-2010 | 418,940 |
| Nutribean | VLIR/ Belgium | Started July 1, 2006 | 2006-2011 | 384,000 |
| Improving Resilience of production systems in Great Lakes Region | DGDC/ Belgium | Started January 2006 | 2006-2011 | € 1,938,392 |
| Intensification of climbing bean based agro-ecosystems | EU/ ASARECA | Great Lakes region - backstopped by ECABREN | 2007-2010 | € 419,568 |
| Export marketing of beans in ECABREN countries | USAID/ REDSO/EA | In collaboration with ECAPAPA to start end March | Ending by 9/07 | 25,000 |
| Increasing the productivity, stability, sustainability and profitability of smallholder agriculture in *vulnerable* production systems through more efficient use of water and nutrients | Sub-Saharan Africa Challenge Program | Proposal approved | 4 years | 1,000,000 |

### 6.2.2 List of ongoing special projects in 2006

| Title | Donor | Funding period | Total amount | Amount to Partners (US $) | Available in 2006 (US$) |
|---|---|---|---|---|---|
| Enhanced utilization of nutrient rich beans for nutrition and income | ASARECA/ USAID | 2005-2006 | US 280,000 | 280,000 | - |
| Bean root rot disease management in Uganda | DFID-CPP | 2005-2006 | UK £ 76,927 | UK £ 47,600 | UK £ 29,327 |
| Promotion of Integrated Pest Management (IPM) Strategies of Major Insect Pests and Diseases of Phaseolus Beans in Hillsides Systems in Eastern, Central and Southern Africa | DFID-CP Natural Resources International *Ltd. (NRI)* | 2005-2006 | 107,661 | - | 40,000 |
| Evaluation of biorationals for bean bruchid pest management by small holder farmers in Lake Victoria Basin | SAREC-SIDA, Sweden | 2005-2007 | US $ 30,000 | 10,000 | 20,000 |

| Title | Donor | Funding period | Total amount | Amount to Partners (US $) | Available in 2006 (US$) |
|---|---|---|---|---|---|
| Assessing The Effect of Long-Term Seed Aid in Ethiopia | IDRC | 2005-2007 | US 232,705 | 66,932 | 49,420 |
| Increasing Food Security and Rural Incomes in Eastern, Central and Southern Africa through Genetic Improvement of Bush and Climbing Beans | RF | 2005-2008 | US 254,000 | 34,000 | 83,738 |
| East and Central Africa Bean Research Network | ASARECA/ USAID | 2003-2006 | US 319,000 | - | 239,500 |
| East and Central Africa Bean Research Network – ECABREN Phase III | USAID/ REDSO | 2007 One year No- cost extension | US 301,000 | - | |
| Supporting improved nutrition, food security and community empowerment for poverty alleviation – PABRA Phase III | CIDA | 2003-2008 | US5,298.787 | 155,000 | 1,269.992 |
| Supporting improved nutrition, food security and community empowerment for poverty alleviation – PABRA | SDC | 2004-2007 | US2,165.139 | 90,000 | 600,590 |
| Climbing bean & agroforestry interventions | FARM-AFRICA MATF | 2004-2006 | UK £59,997 | UK£59,997 | - |
| Application of marker assisted selection (MAS) for the improvement of bean common mosaic necrotic virus resistance in common bean (*Phaseolus vulgaris)* | USAID/ through ASARECA Competitive Grant System | 2004-2007 | US 150,000 | 147,818 | - |

### 6.2.3 Regional research subprojects under SABRN

| Activity | Value | Country |
|---|---|---|
| 1.1. Develop acceptable bean varieties rich in protein and micro-nutrients [establish methods for selection with regional breeders and at least two countries] | | |
| 1.1.6. Assemble and characterize germplasm of African landraces | 1000 | D R Congo |
| | 500 | Lesotho |
| | 500 | Mozambique |
| | 200 | Zambia |
| | 500 | Swaziland |
| | 1000 | Tanzania |
| | 500 | South Africa |
| | 500 | Zimbabwe |
| 1.1.7 Participatory evaluation of promising materials (fast track) in target countries | 1000 | D R Congo |
| | 500 | Malawi |
| | 850 | Zambia |
| | 1000 | Tanzania |
| 1.4.7. Increase seed of micronutrient rich bean lines for dissemination | 500 | D R Congo |
| | 500 | Lesotho |
| | 500 | Malawi |
| 1.2. Exploit genetic diversity of bean to address marginal environments | | |
| 1.2.1. Continue to characterize; generate and evaluate segregating populations for resistance to major constraints | 500 | Malawi |
| | 1000 | Tanzania |
| | 3000 | South Africa |

| Activity | Value | Country |
|---|---|---|
| 1.2.3. Complete characterization of pathogen diversity of P. griseola and *X campestris P* | 3000 | South Africa |
| 1.2.6. Bean materials for low soil fertility and moisture stress in BILFA and BIWADA. | 800 | D R Congo |
| | 1600 | Malawi |
| | 800 | Mozambique |
| | 800 | Zambia |
| | 400 | Swaziland |
| | 1500 | Tanzania |
| | 800 | Zimbabwe |
| 1.3. Improve understanding of opportunities in local, regional and international bean markets | | |
| 1.3.2. Conduct studies to identify and characterize potential local, regional and export markets | 2000 | D R Congo |
| | 1000 | Mozambique |
| | 2800 | Zambia |
| 1.4. Develop new bean varieties that address food security and market demands | | |
| 1.4.1. Continue to generate and evaluate segregating populations and advanced bush and climbing bean lines for priority trait combinations in food, canning and export beans. | 3000 | Malawi |
| | 3000 | Mozambique |
| | 2000 | Zambia |
| | 3500 | Tanzania |
| | 4000 | South Africa |
| 1.4.2. Apply marker assisted selection tools to speed up accurate selection for certain resistances (ALS, and CBB) | | |
| 1.4.3. Conduct more rapid eco-regional evaluations of best advanced lines and nurseries | 2000 | D R Congo |
| | 1000 | Lesotho |
| | 2000 | Zambia |
| | 400 | Swaziland |
| 1.4.4. Apply participatory varietal evaluation (PVS) of promising materials with end-users especially women, traders, processors and exporters and thereby identify new varieties for formal national releases. | 2000 | D R Congo |
| | 2000 | Lesotho |
| | 2000 | Malawi |
| | 2000 | Mozambique |
| | 2000 | Zambia |
| | 1100 | Swaziland |
| | 1000 | Tanzania |
| | 2000 | South Africa |
| | 2000 | Zimbabwe |
| 1.4.5. Production of breeders and foundation seed to feed adequate amounts into seed supply chains, with provision of variety descriptors (9 ECABREN countries and 7 SABRN) | 2000 | D R Congo |
| | 500 | Lesotho |
| | 1000 | Malawi |
| | 2000 | Mozambique |
| | 2000 | Zambia |
| | 1500 | Swaziland |
| | 1000 | Tanzania |
| | 5000 | South Africa |
| 2.1. Make available more options for managing soil productivity and bean pests [e.g. evaluate and document new ISFM options such as green manures, and IPDM options for managing intractable pests and diseases especially bean stem maggot and root rots] | | |
| 2.1.1. Continue testing to identify IPDM / ISFM options with farmers in 7 in SABRN countries. | 3000 | D R Congo |
| | 2000 | Malawi |
| | 2000 | Mozambique |
| | 2000 | Zambia |
| | 2200 | Swaziland |
| | 2000 | Tanzania |
| 2.1.2 Participatory development and evaluation with farmers of potential, environmentally friendly, and consumer safe IPDM | 2000 | Lesotho |
| | 500 | Malawi |
| | 1500 | Zambia |
| | 1500 | Zimbabwe |

| Activity | Value | Country |
|---|---|---|
| 2.1.3 Facilitate the use of farmer-to-farmer (also research groups) learning approaches e.g. training, research groups | 2000<br>2000<br>2000 | Malawi<br>Zambia<br>Tanzania |
| 2.1.4. Analyse health and economic effects of botanical pesticides | 2000 | Malawi |
| 2.2. Equip farmers for selecting among options for knowledge-intensive technologies | | |
| 2.2.2. Adapt the decision guides and facilitate their use in decision making in the choice of options, in partnership with service providers 5 countries in ECABREN and in SABRN | 1500<br>2000 | Zambia<br>Tanzania |
| 2.2.3. Prepare manuals for use by farmers | 2000 | Tanzania |
| 3.1. Scale up proven technologies through strategic alliances with specialist NGOs in at least 10 countries [with innovative approaches; learning by farmer research groups/field schools; provision of promotional leaflets; guidelines for adaptation and scaling up; etc] | | |
| 3.1.1. Continue wide national and regional dissemination of bean-based technologies through a series of nationally-facilitated strategic alliances with NGOs including PM&E | 3000<br>1000<br>2000<br>2000<br>2000<br>3000<br>2000<br>2000 | D R Congo<br>Lesotho<br>Malawi<br>Mozambique<br>Zambia<br>Swaziland<br>Tanzania<br>Zimbabwe |
| 3.1.2. Continue farmer-to-farmer and group-to-group dissemination of IPM methods and technologies through local extension partners | 1000<br>1000 | Malawi<br>Zambia |
| 3.1.7. Analyze uptake pathways (socio-economic characterization, dissemination and adoption) of bean IPM technologies by farmers in selected IPM promotion sites | 2000 | Malawi |
| 3.1.6. Produce promotional publications in both networks | 2000<br>2000<br>500<br>2000 | D R Congo<br>Zambia<br>Swaziland<br>Tanzania |
| 3.2. Reinforce sustainable approaches to decentralized seed systems [including women as seed entrepreneurs, and development/use of a decision support tool for designing decentralized seed interventions across crops] | | |
| 3.2.1. Support and develop decentralized seed systems, including through training in business skills for seed production for farmers in ERI pilot sites and of NGO staff more widely through the Networks | 1500<br>1000<br>200<br>1500 | Malawi<br>Zambia<br>Swaziland<br>Zimbabwe |
| 3.2.5. Publish manual on pest and disease management and more local-language versions of existing seed manuals | 800 | Swaziland |
| 3.3. Implement strategies that enable women to benefit from increased household incomes [including market studies that examine role of women traders] | | |
| 3.3.1. Identify and document new and existing post-harvest and processing bean technologies that could increase women's income in at least four countries | 200 | Swaziland |
| 5.2. Enable men and women farmers to evaluate a diverse range of crop and soil fertility management technologies to address issues linked to market production [with feedback of farmers' criteria to research | | |
| 5.2.1. Increase levels of support in soils and NRM options from NARS and partners to Farmer Experimentation Groups or Committees | 1500<br>1500 | Malawi<br>Zimbabwe |

| Activity | Value | Country |
|---|---|---|
| 5.3. Evaluate agricultural technologies for utility and acceptability in HIV/AIDS affected situations and make available relevant information to pilot communities | | |
| 5.3.1. Identify actors who are already developing or assessing agricultural technologies suited for application to HIV/AIDS situations | 1000<br>1000 | Malawi<br>Zambia |
| 6.1. Train regional and national breeders in new techniques of marker-assisted selection, selection for micro-nutrients, and participatory breeding | | |
| 6.1.7 Support an MSc student in social science in DR Congo | 2000 | D R Congo |
| 6.2. Improve NARS capacities to convert research results into extension materials and articles aimed at policy makers | | |
| 6.2.1. Support NARS to produce articles for policy makers in both networks | 1000 | Mozambique |
| 6.3. Build partnerships and capacity in research and extension organizations that support community interventions in pilot areas in at least three countries | | |
| 6.3.1. Enhance partnerships between NARIS and other stakeholders that support community interventions to institute farmer participatory research; and exchange visits | 2000<br>2500<br>1500 | Mozambique<br>Tanzania<br>Zimbabwe |
| 6.4. Make available to development stakeholders information on: research results; the BAPPA [ERI] approach to community empowerment; gender; and other "lessons | | |
| 6.4.1. Continue to support NARS partners to conduct seminars and develop publications targeting development partners in 4 countries in each network (including participation in field days. | 1500<br>2500<br>2000 | Mozambique<br>Swaziland<br>Zimbabwe |
| 8.0 Project management & performance measurement | | |
| 8.1 Support performance monitoring against RBM by national coordinators | 1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000<br>1000 | D R Congo<br>Lesotho<br>Malawi<br>Mozambique<br>Zambia<br>Swaziland<br>Tanzania<br>South Africa<br>Zimbabwe |

## 6.3 LIST OF PROJECTS SUBMITTED, PROPOSALS, AND CONCEPT NOTES PREPARED

### 6.3.1 AT HEADQUARTERS

| Title | Donor | Comments | Funding period | Total amount US |
|---|---|---|---|---|
| Obtención y evaluación de *Phaseolus vulgaris* y *Zea mays* tolerantes a la sequía | CYTED, Spain | Approved | 4 years | 1,000,000 |
| Variedades de frijol tolerantes al estres abiótico de la baja fertilidad y la sequía, y a la sostenibilidad productiva y alimentaria de Centroamérica | Red SICTA-SDC | Approved but not initiated | 2007-2008 | 245,000 |
| Improvement of Chitti bean in Iran. SPII, Iran | Iranian government | Under negotiation | 4 years | 240,000 |
| Improving tropical legume productivity for marginal environments | Bill and Melinda Gates Foundation (BMGF) | Submitted | Over 3 years | 10,800,000 |
| Enhancing Crop Productivity: Exploiting the molecular basis of host-pathogen interaction to develop durable disease resistance in African crops, using Angular Leaf Spot disease of bean as a model | Rockefeller Foundation | Concept Note | 3 years (2006 – 2008) | 322,230 |

| Title | Donor | Comments | Funding period | Total amount US |
|---|---|---|---|---|
| Improving drought tolerance in common beans using gene-based markers and pyramiding drought tolerance mechanisms | Generation Challenge Program | not selected for full proposal development | 2 years | 600,000 |
| Improving fruit and vegetable product quality from smallholder systems: Optimizing soil-crop-pest management for economically viable, socially acceptable and ecologically sustainable production | Federal Ministry of Finance (BMF), Austria | Proposal Rejected | 3 years | € 709,000 |
| Supporting livelihoods through agriculture in Nicaragua | CIDA Canada | Rejected | 4 years | 12,000,000 Can.$ |
| Habichuelas (vainitas) *verdaderamente* verdes: Una alternativa limpia para generar empleo e ingreso para pequeños agricultores | FONTAGRO | Concept Note (rejected) | 3 years | 490,000 |
| Bioplaguicidas como alternativas verdes de control de plagas y enfermedades para aumentar la competitividad de pequeños agricultores Andinos | FONTAGRO | CN-Rejected | 3 years | 490,250 |

### 6.3.2 IN AFRICA

| Title | Donor | Comments | Funding period | Total amount |
|---|---|---|---|---|
| Improving rural livelihoods in Rwanda: Promoting integrated crop, disease, and pest management (ICDPM) strategies for intensification and diversification of agricultural systems | Bilateral project for Belgium | Proposal approved pending to confirm | 3 years (2005-2007) | € 3,000,000 |
| Enhancing grain legumes' productivity, production and the incomes of poor farmers in drought-prone areas of sub-Saharan Africa and South Asia | Bill and Melinda Gates Foundation (BMGF) | Approval pending | 2007-2010 | 20,000,000 |
| Improving potato-bean-sweet potato (PBS) based rural livelihood systems through integrated soil ecosystem management (ISEM), market development and nutritional innovation in the highlands of Lake Kivu area | Sub-Saharan Africa Challenge Program | Proposal Rejected | 4 years | 2,000,000 |

## 7. PROBLEMS ENCOUNTERED AND THEIR SOLUTION

- Adjustments to financial limitations continued to distract from the basic research agenda at all levels of staff. Ex-post rechanneling of funds raised concerns with donors, partners and staff, including the use of funds raised by staff for own salary. A prompt solution is being sought to define future staffing and to facilitate regrouping and rebuilding.

- CIAT infrastructure is in need of renovation, and its state is beginning to affect the effectiveness of research. A project was submitted to the Bill and Melinda Gates Foundation that includes funds to renovate planting and irrigation equipment.

## 8. STAFF LIST (INCLUDING % TIME ASSIGNMENT)

### 8.1 STAFF AT HEADQUARTERS

Stephen Beebe, PhD, Breeder, Geneticist, Project Manager (**70% IP-1**, 30% SB-2)
Matthew Blair, PhD, Germplasm Characterization Specialist, Bean Breeder (70% SB-2, **30% IP-1**)
*César Cardona, PhD, Entomologist
George Mahuku, PhD, Plant Pathologist (**80% IP-1,** 20% PE-1)
Francisco Morales, PhD, Virologist (**70% IP-1**, 30% PE-1)
Idupulapati Rao, PhD, Plant Nutritionist, Physiologist (**30% IP-1**, 30% IP-5, 40% PE-2)

### 8.2 STAFF IN AFRICA

Robin Buruchara, PhD, Plant Pathologist/PABRA Coordinator (stationed in Kampala, Uganda - **65% IP-1**, 35% PE-1)
Rowland Chirwa, PhD, Plant Breeder/SABRN Coordinator (stationed in Lilongwe, Malawi- **100% IP-1**)
Paul Kimani, PhD, Plant Breeder for ECABREN (University of Nairobi/CIAT, stationed in Nairobi, Kenya - **75% IP-1**)
*Eliaineny Minja, PhD, IPM Specialist
Rachel Muthoni, BSc, MPA, Monitoring and Evaluation Specialist, (stationed in Kampala, Uganda - **50% IP-1,** 50% SN3)
Jemimah Njuki, PhD, ERI Specialist, (stationed in Malawi) – **50% IP-1**, 50% PRGA
Martha Nyang'aya, , MSc, Nutrition (stationed in Kampala, Uganda) – **30% IP-1,** 70% ATDT
Mukishi Pyndji, PhD, Plant Pathologist, ECABREN Coordinator (stationed in Arusha, Tanzania - **100% IP-1**)
Jean Claude Rubyogo, BSc., Seed System Specialist (stationed in Malawi – **100% IP-1**)
Louise Sperling, PhD, Social Scientist, *(stationed in Rome,* Italy- **80% IP-1,** 20% SB-2)

## 9. SUMMARY 2006 BUDGET PREPARED BY FINANCES: ACTUAL EXPENDITURES 2006

| | **Headquarter & Latin America** | | **Project Africa** | |
|---|---|---|---|---|
| **SOURCE** | **AMOUNT US$** | **PROPORTION (%)** | **AMOUNT US$** | **PROPORTION (%)** |
| Unrestricted Core | 468,049 | 61% | 151,336 | 5% |
| Restricted Core | | 0% | | 0% |
| **Sub-total** | **468,049** | **61%** | **151,336** | **5%** |
| Special Projects | 305,177 | 39% | 3,122,579 | 95% |
| **Sub-total** | 305,177 | 39% | 3,122,579 | 95% |
| **Total Project** | **773,226** | **100%** | **3,273,915** | **100%** |

* Left in 2006