

Australia and ICARDA

Ties that Bind



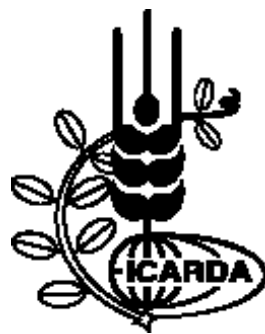
International Center for Agricultural Research
in the Dry Areas

Australia and ICARDA

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No. 3

(second revised and updated version)



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in the Dry Areas (ICARDA)

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Cover: Lentil variety ‘Nugget’ produces up to 3.5 t/ha in farmers’ fields in
Australia and is suitable for mechanical harvesting.

Headquarters

International Center for Agricultural Research in the Dry Areas (ICARDA)

P.O. Box 5466, Aleppo, Syria

Tel.: (+963) (21) 2213433, 2213477, 2225112, 2225012

Fax: (+963) (21) 2213490, 2225105, 5744622

E-mail: ICARDA@cgiar.org

Website: <http://www.icarda.org>

Australia and ICARDA

Australia has traditionally been a strong supporter of agricultural research, both at home and abroad. Total Australian funding for ICARDA research amounted to US\$ 575,000 during the 2001 financial year, a 53% increase from 1996. Perhaps even more important than this significant contribution to the Center's budget is the sharing of skills and experience between ICARDA and Australian scientists involved in collaborative projects. Australian scientists on the Board of Trustees and those employed at ICARDA have provided leadership and vision as the Center has grown, and Australian institutions and scientists have supplied considerable expertise, experience, and resources to bear on the pressing problems of Central and West Asia and North Africa (CWANA).



Philip Eberbach, a soil-water scientist from Charles Sturt University, Australia, who spent a sabbatical at ICARDA, measuring infiltration rate of soil, to assess the effect of cropping sequences on soil properties.

Australian Delegations Visit ICARDA

Members of the Australian Parliament visited ICARDA in November 2003 to explore the possibility of further strengthening Australia's relationship with the Center. The delegation consisted of Mr Sandy Macdonald (Leader), Senator for New South Wales, National Party; Mr Kim Karr (Deputy Leader), Senator for Victoria, Australian Labor Party; Mr



Luncheon meeting at ICARDA. Left to right: Senator Sandy Macdonald, Delegation Leader; Dr Mohan C. Saxena, ADG (At large); Mr Philip Barresi, Delegation Member; and Dr William Erskine, ADG (Research).

Phillip Barresi, Member for Deakin (Victoria), Liberal Party of Australia; Ms Joanna Gash, Member for Gilmore (NSW), Liberal Party of Australia; and Ms Nicola Roxon, Member for Gellibrand (Victoria), Australian Labor Party. Ms Joanne Towner accompanied the group as Delegation Secretary and H.E. Mr Robert Newton, Australian Ambassador to Egypt, Sudan, Syria and Tunisia; and Ms Suzanne Stein, First Secretary, Australian Embassy escorted the group to ICARDA.

The delegation was briefed on the mandate and mission of ICARDA and presented with examples of achievements made with Australian financial support. ICARDA appreciated the contributions of Australian senior staff and Board members and emphasized the importance of Australian support in the germplasm collection mission in Tajikistan. The delegation also had the opportunity to visit the Center's laboratories and talk to scientists.

In January 2004, the Western Australian Minister of Agriculture, H.E. Honorable Kim Chance, visited ICARDA to learn about the research and training activities of the Center. Mrs Sue Chance, wife of the Minister; H.E. Mr Robert Newton, Australian Ambassador to Egypt and Syria; Mr Henry Steingieser, Executive Director, Trade and Development, Department of Agriculture, Western Australia; Ms Sylvie

Khoury, Senior Business Development Manager for Lebanon and Syria, Australian Trade Commission, based in Beirut; Mr Nigel Brown, Representative of the Meat and Livestock in Australia, based in Bahrain; and Mr Mike Marren, Media Advisor to the Minister, were part of the Australian delegation that accompanied him.

The delegates were briefed on the mandate and mission of the Center and they discussed the emerging trends in international agricultural research and the collaboration with Australian agricultural research organizations, especially the Center for Legumes in Mediterranean Agriculture (CLIMA). The Minister praised ICARDA's work and appreciated the benefits derived by the agricultural industry in Western Australia from the genetic material enhanced by ICARDA and Australian scientists. He also hoped that the opportunities for collaboration between ICARDA and Western Australia would increase with the proposed re-organization of agricultural research in that state.

Central and West Asia and North Africa — The Australian dimension

To many Australians, the problems in CWANA, where ICARDA's research is focused, might appear distant and irrelevant. In reality, the region is very important to Australia, both as a trading partner and because of what is shared in common. Crop varieties and farming systems in many parts of CWANA are appropriate to Australia, which makes the sharing of plant germplasm and technologies potentially rewarding.

Much of southern Australia has the same kind of variable Mediterranean climate found in CWANA. Farmers in both areas have for long had to contend with periods of prolonged and unpredictable drought interspersed with equally capricious seasons of plentiful rain, and both areas have adopted a wide range of similar crops and farming practices best suited to their difficult climates. Agriculture in Australia and CWANA is largely cereal-based, principally wheat and barley, with a considerable livestock component.

For Australian plant breeders working to develop improved crop varieties, CWANA is a source of priceless genetic material. The evolution and domestication of such diverse crops as wheat, barley, lupins,

chickpea, lentil, faba bean, annual grain legumes, medics, subterranean clover, vetches, Phalaris, and fescue took place in CWANA. Domestication of sheep and goats is also believed to have first occurred in the region.

As none of these plant types or animals is native to Australia, Australian scientists are heavily dependent upon genetic material originating from CWANA. In close partnership with national agricultural research systems, ICARDA is actively engaged in the collection, analysis, and conservation of plant genetic resources in the region. The Center's genetic resources unit houses a comprehensive collection of genetic material that could increase crop productivity throughout the world's dry areas, including Australia. Australian scientists frequently request germplasm samples from ICARDA. These are provided free of charge to all bonafide users.

Australia and ICARDA— Collaborative research on common key crops

With regard to the key crops—barley, wheat, lentil, chickpea, and faba bean—ICARDA has access to resources and material critical to Australian agriculture. A study conducted by scientists from NSW (New South Wales) Agriculture, Charles Sturt University, and ICARDA estimated Australia will enjoy a net gain of A\$ 13.7 million (in 2001 dollars) annually in the period to 2022, A\$ 12.6 million going to producers through increased productivity gains and cost reduction through use of ICARDA-improved or sourced germplasm, and A\$ 1.1 million going to consumers in the form of lower prices. The study, supported by the Australian Centre for International Agricultural Research (ACIAR), recognized many other benefits, including training, information exchange, and collaborative screening for pests and disease resistance.

Barley

In terms of area and production, barley is the second most important crop in both Australia and CWANA. In trust on behalf of the FAO, ICARDA holds a base collection of barley germplasm, which includes

thousands of landraces and wild relatives with genes for tolerance to many of the biological and physical stresses afflicting barley in Australia. The mutual benefit of the Australian and CWANA barley programs is illustrated by the release of an ICARDA-improved variety, 'Yagan', in Western Australia, and the release of 'Corvette', a South Australian variety in Syria. A better understanding of the performance of barley in fluctuating Mediterranean climates in CWANA will also have a significant impact on barley production in Australia.

In recent years, collaboration between Australian scientists and ICARDA has strengthened considerably. ICARDA is working with the Department of Biochemistry and Genetics at La Trobe University on barley straw quality and is collaborating with Waite Agricultural Institute, University of Adelaide. In the first phase, 300 selections from the ICARDA breeding program were evaluated in South Australia, and a significant number of ICARDA lines performed at least as well as the best Australian feed varieties in each season. This is very encouraging, given that imported barley lines usually cannot be compared to locally bred varieties, particularly in lower rainfall regions. Even more impressive, a number of ICARDA lines have produced yields equal to the best Australian varieties tested over the contrasting seasons of 1999 and 2000. The ICARDA lines also exhibited useful levels of foliar disease resistance, and an unusually high frequency of resistance to cereal cyst nematode. The lines show a very different genetic background to current Australian varieties, and represent significant research and breeding opportunities.

Elite ICARDA lines have been promoted to stage-two trials in the South Australia Barley Improvement Program. This will entail evaluation across a broader range of environments. The material has also been crossed with current Australian feed varieties and elite breeding lines, and although the genetic and physiological basis of adaptation is not fully understood as yet, agronomic advances can be expected from pragmatic selection alone.

According to the assessment, improvements in barley production due to collaboration with ICARDA will result in an average annual gain of A\$ 2.4 million for the next 20 years.

Wheat

Benefiting from its location, ICARDA has gathered a large collection of wheat landraces and wild relatives. Together with its Mexico-based sister center, the International Maize and Wheat Improvement Center (CIMMYT), and national research programs in the region, ICARDA is using this genetic diversity to develop cultivars with greater tolerance to stressful environments. The work attracted the attention of the Australian National Durum Wheat Improvement Program, which has since joined the breeding program's integrated international durum network. Researchers in CWANA are looking at sites with similar agro-climatic conditions as those in Australia, which will allow them to predict performance in Australia; and the Australians are taking the same approach in their research. In a similar project, ICARDA scientists are developing a set of breeding lines likely to perform well under Australian conditions, and assessing suitable material from Australian wheat-breeding programs for introduction into CWANA countries.

Since 1995, ICARDA has also been collaborating with NSW Agriculture, Tamworth Centre for Crop Improvement, with funding from GRDC, in durum wheat improvement involving adaptation, grain quality, drought tolerance, dryland root rot, molecular study (for both QTL detections and use of diversity), and also in preemptive breeding for resistance to some diseases and pests, and tolerance to abiotic stresses. The collaboration covers the genetic base broadening and yield improvement as well.

Within the framework of the Challenge Program on Biofortification, ICARDA has been collaborating with the University of Adelaide in a study of the assessment of the micronutrient composition of the ICARDA durum varieties as well as those in its core collection.

Lentil

Among developed countries, Australia is the main beneficiary of ICARDA's lentil improvement program. Prior to 1993, the area sown to lentils in Australia amounted to less than 500 hectares. In the past few years, the crop has been adopted rapidly by farmers and now covers an estimated 158,000 hectares, producing 266,000 tonnes of grain.



Lentil variety 'Nugget' produces up to 3.5 t/ha in farmers' fields in Australia and is suitable for mechanical harvesting. Michael Materne (right) Australian lentil breeder spent two months at ICARDA and has completed his PhD at the University of Western Australia with joint supervision from ICARDA and Australian researchers.

This has been achieved through successful development and commercialization of better-adapted, improved varieties, which all emanated from ICARDA-supplied germplasm. All nine released varieties—'Aldinga', 'Ansak', 'Cassab', 'Cobber', 'Cumra', 'Digger', 'Northfield', 'Nugget', and 'Matilda'—were developed through direct selection from ICARDA nurseries and then tested by farmers in various regions in the country. The largest increase in area has occurred in the Wimmera and southern Mallee regions of Victoria, and the Yorke Peninsula, Upper, Mid and Lower North in South Australia since the release of 'Cobber', 'Digger', 'Matilda' and 'Aldinga' in 1993, and Northfield in 1994. Release of 'Cassab' in 1998 and 'Nugget' in 1999 further increased production of lentils in these areas.

Australian policy makers and farmers are keen to expand lentil production as it generated the highest income (A\$ 598) per hectare of any field crop grown in the country. The lentil industry in 2002 was worth about A\$ 65 million, and its commercial significance is expected to grow further.

Large-seeded kabuli chickpea lines, resistant to ascochyta blight and suitable for growing in Australia and CWANA countries, are being developed by ICARDA. Here, Dr E.J. Knights (left), from NSW Agriculture, Tamworth, Australia; Dr Nevin Acikgoz (second from left), from Ageean Agricultural Research Institute, Turkey; Dr R.S. Malhotra (second from right), from ICARDA; and Dr K. Siddique, from CLIMA, Australia, examine the performance of some promising lines in Izmir, Turkey.



Farmers, extension workers, researchers and representatives from the food industry evaluate new chickpea lines in Tavaz, Turkey.

ICARDA and Australian institutions have developed strong ties and are working together to reduce lentil crop losses. Lentils in South Asia, West Asia, North Africa, and Australia are subject to similar fungal diseases, especially ascochyta blight, grey mold, and fusarium wilt. A joint effort is being made to combat these diseases. ICARDA's collaborative projects with CLIMA, University of Western Australia, and the Victorian Institute of Dryland Agriculture involve using the latest available germplasm from ICARDA, local landraces, and selections to develop lentil lines with improved disease resistance and abiotic stress tolerance. ICARDA scientists are collaborating with their Australian colleagues in preemptive breeding for resistance to exotic soil-borne pathogens that might find their way into the country.

Chickpea

Given the favorable climatic conditions in southern Australia and the current chickpea production deficits in CWANA, there is considerable potential for export sales. It is likely that Kabuli chickpea material bred at ICARDA will have important applications in Australia—particularly considering the disease-resistance traits of some of the CWANA germplasm. For example, preemptive breeding was not carried out to combat ascochyta blight, so when the disease finally arrived in Australia in 1997, the crop was seriously affected across the nation. It eventually caused a 90% reduction in area sown to chickpea in southern Australia. Fears of a similar calamity have spurred an ICARDA–Australia preemptive breeding effort against fusarium wilt. Australia is expected to enjoy a net benefit amounting to A\$ 1.2 million annually for the next 20 years, thanks to ICARDA.

Faba bean

Australia is working with ICARDA on a number of projects to improve faba bean, especially to develop disease-resistant varieties. One project is saving the country at least A\$ 90,000 annually in quarantine costs.

There are more than 12,000 genotypes in ICARDA's faba bean program collection, and more are coming from Bangladesh, China, Ethiopia, Nepal, and Pakistan as part of projects supported by ACIAR.

ICARDA scientists are screening these for resistance to chocolate spot, ascochyta blight and rust, as well as for yield potential, at a coastal site in Syria with a climate very similar to the faba bean areas of southern Australia. The most useful material is being introduced into Australia. Improved faba bean from ICARDA is expected to generate an average net benefit amounting to A\$ 6.1 million annually for the next 20 years.

Forage and pasture legumes

All of Australia's pasture legumes originated from the Mediterranean Basin, among them seven annual medic species. There are 19 other annual medic species, several with useful characteristics, such as delayed germination and hard seed which makes ley farming possible. ICARDA scientists and their CWANA colleagues are developing new approaches to the selection of pasture and forage legumes based on an understanding of their distribution and evolution.

'Chalus' Lathyrus cicera L.

Chalus *Lathyrus cicera* L. (Reg.No. CV-175, PI 612242) was developed by CLIMA and Agriculture Western Australia. It is a high yielding and high grain-quality cultivar suitable for low and medium rainfall areas of Australia. It was jointly released by CLIMA and Agriculture Western Australia.



Turkmenistan 2001 collection mission: Australian team members Kevin Foster, Ken Street, Petter Skinner, take seed and soil samples.

Collaborative projects

ICARDA has a number of collaborative projects with Australian institutes, supported by Australian donor agencies such as ACIAR and the Grains Research Development Corporation (GRDC). In a project designed to conserve and utilize biodiversity in Central Asia and the Caucasus, ICARDA scientists have been working with scientists at CLIMA and the Australian Winter Cereals Collection (AWCC) to collect and study cereal and legume species of importance to agriculture. This ACIAR-funded project will transfer material, including promising germplasm, back to regional collections in the developing countries. In another ACIAR-supported project, ICARDA scientists are working with their colleagues in four research institutions to identify new sources of resistance to major diseases affecting faba bean, chickpea and lentil, and to work out effective disease management options.

CLIMA has licensed its lentil transformation technology to ICARDA. An ACIAR-funded research project between CLIMA and ICARDA enabled the technology transfer. The technology transfer includes training of ICARDA scientists in Australia. In the absence of biosafety regulations in Syria, ICARDA opted to implement the technology at the Agricultural Genetic Research Engineering Institute (AGERI), Egypt, where national biosafety regulations are in place. This enabled the safe handling of transformed lentils for ICARDA's research program, consistent with international rules and regulations. Now that Syria has enacted biosafety regulations, the work has been started at ICARDA headquarters as well.

In two projects funded by the GRDC, ICARDA's genetic resource unit is collaborating with the well-known Vavilov Institute (VIR), based in Saint Petersburg, CLIMA, and AWCC to study the genetic diversity held in the Vavilov collection. These projects are important because they promote scientific cooperation with the institution that first began collecting and conserving agriculturally important species. A large proportion of the VIR collection has been duplicated at ICARDA, where they are made available to the scientific community.

Trade—Australia and the CWANA market

Australian farmers are well aware of the importance of the CWANA market. The region receives roughly half of Australia's wheat exports, and the market is expected to increase.

Rising demand for wheat in CWANA has also been accompanied by increased meat consumption, and Australia is the main supplier of meat and livestock to the region. The projected increase in the demand for barley to feed livestock might provide Australia with an equally important export opportunity.

The human dimension

Australians have played an active role at ICARDA almost since the Center's founding in 1977, including serving on its Board of Trustees. Given the agricultural and climatic factors common to Australia and CWANA, the links between agricultural research in Australia and at ICARDA are understandable. At any given time, Australian scientists are on staff at ICARDA, or working with the Center on long- or short-term consultancies and sabbaticals, or making a professional visit.

ICARDA scientists have long appreciated Australia's leading position in research on Mediterranean agriculture and the country is a popular choice for ICARDA scientists seeking sabbaticals. ICARDA research managers have served on the Board of CLIMA (Dr Aart van Schoonhoven, Dr Mohan C. Saxena). Australian higher degrees are well regarded in the region because the training received is directly applicable to conditions in CWANA.

Through its support of international agricultural research, Australia is increasing regional goodwill and making mutually beneficial contacts. Australian efforts in China on faba bean improvement, in Bangladesh and Nepal on lentil improvement and in Turkey on chickpea improvement have been strongly backstopped by ICARDA researchers. The current and potential linkages outlined in this booklet illustrate the need for continued Australian interest and participation in the region's development. Australia's support for ICARDA is an important beginning, and is an excellent example of how Australia can have a profound impact using skills and experience that have been tried and tested at home.

Cereal and legume varieties released in Australia based on ICARDA germplasm

Lentil

Variety name	Pedigree	Year of release
Digger	ILL5722	1993
Cobber	ILL5728	1993
Matilda	ILL5823	1993
Aldinga	ILL5750	1989
Northfield	ILL5588	1995
Cassab	ILL7200	1998
Cumra	ILL590	1998
Ansak	ILL6243	1998
Nugget	ILL7180	1999

Chickpea

Variety name	Pedigree	Year of release
<i>desi</i>		
	FLIP94-508C	2003
<i>kabuli</i>		
	S95342	2003
	FLIP94-90C	2003
	FLIP94-92C	2003
	S95362	2003
Kimberley large	GCN133-2	2004
CLIMA kabuli 1	FLIP97-530-CLIMAS	2004
CLIMA kabuli 2	FLIP97-503-CLIMAS	2004
CLIMA kabuli 3	FLIP97-537D-CLIMAS	2004

Faba bean and Lathyrus sp.

Variety name	Pedigree	Year of release
<i>Faba bean</i>		
Icarus	BPL710	1993
Fiesta VF	BPL1179	1998
Rossa	BPL3025	1996
Manafest	BPL3026	1999
Cairo	ILB2282 open pollinated population (ILB2282 female parent)	2003
Farah	BPL1179 selection	2003
<i>Lathyrus</i>		
Chalus (<i>L.cicera</i>)	IFLA 1279	1998

Barley

Variety name	Year of release
Yagan	1989
Namoi	1993
Kaputar	1993

Net benefits (gains¹) for Australia from ICARDA germplasm²

Group	Barley	Durum	Chickpea	Faba bean	Lentil	Total
Producers	1.8	1.2	1.1	6.0	4.9	12.6
Consumers	0.6	0.3	0.1	0.1	0.0	1.1
Total	2.4	0.9	1.2	6.1	4.9	13.7

1 Discounted to 2001 Australian dollars at 5% per annum

2 Average annual benefits for 2001 to 2002 (A\$ m)

Source: Brenman *et al.* 2002. Impact of ICARDA research on Australian agriculture.

Australian Members of ICARDA's Board of Trustees

Distinguished Australians who have served on ICARDA's Board of Trustees:

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Appendix

Collaboration in Advanced Research

ACIAR (Australian Centre for International Agricultural Research)

- Near isogenic lines for the assessment of pathogenic variation in the wheat stripe (yellow) rust pathogen.
- Lentil and Lathyrus in the cropping systems of Nepal: improving crop establishment and yield of relay and post-rice-sown pulses in the terai and mid hills.
- Conservation, evaluation and utilization of plant genetic resources from Central Asia and the Caucasus.
- Host resistance, epidemiology and integrated management of faba bean, chickpea and lentil diseases.
- Impact of ICARDA Research on Australian Agriculture.

Australian Winter Cereals Collection, Tamworth.

- Development and conservation of plant genetic resources in the Central Asian Republics.
- Bread wheat landrace eco-geographic diversity studies.

Australian Temperate Field Crops Collection, Horsham.

- Development and conservation of plant genetic resources in the Central Asian Republics.

University of Adelaide, CRC for Molecular Plant Breeding, Waite Campus

- Development and conservation of plant genetic resources in the Central Asian Republics.

Centre for Management of Arid Environments, Kalgoorlie, WA

- International collaboration in grazing management.

Centre for Plant Conservation Genetics, Southern Cross University

- Development of ESTs using wild barley from ICARDA.

Centre for Legumes in Mediterranean Agriculture/Department of Agriculture, Western Australia

- Development and conservation of plant genetic resources in the Central Asian Republics.
- Preservation of the pulse and cereal genetic resources of the Vavilov Institute.
- Improving crop establishment and yield of relay and post-rice-sown pulses (lentil and Lathyrus) in the cropping systems of the terai and mid-hills in Nepal.
- Development of interspecific hybrids between chickpea and its wild relatives.
- Host resistance, epidemiology and integrated management of faba bean, chickpea and lentil diseases.

Department of Agriculture, Western Australia

- Host resistance, epidemiology and integrated management of faba bean, chickpea and lentil diseases.

La Trobe University

- Development and use of molecular genetic markers for enhancing the feeding value of cereal crop residues for ruminants

NSW Agriculture, Tamworth Centre for Crop Improvement

- Durum wheat improvement.
- Chickpea improvement.
- Identification of legume viruses and selection of legume germplasm for virus disease resistance.
- Host resistance, epidemiology and integrated management of faba bean, chickpea and lentil diseases.

Plant Breeding Institute, University of Sydney

- Near isogenic lines for the assessment of pathogenic variation in the wheat stripe (yellow) rust pathogen.

Victorian Institute for Dryland Agriculture

- Improvement of lentil and grass pea in Bangladesh.
- Improvement of narbon vetch for low rainfall cropping zones in Australia.
- Improving crop establishment and yield of relay and post-rice-sown pulses (lentil and Lathyrus) in the cropping systems of the terai and mid-hills in Nepal.
- Coordinated improvement project on Australian lentils.
- Host resistance, epidemiology and integrated management of faba bean, chickpea and lentil diseases.

About ICARDA and the CGIAR



Established in 1977, the International Center for Agricultural Research in the Dry Areas (ICARDA) is governed by an independent Board of Trustees. Based at Aleppo, Syria, it is one of 15 centers supported by the Consultative Group on International Agricultural Research (CGIAR).

ICARDA serves the entire developing world for the improvement of lentil, barley and faba bean; all dry-area developing countries for the improvement of on-farm water-use efficiency, rangeland, and small-ruminant production; and the Central and West Asia and North Africa region for the improvement of bread and durum wheats, chickpea, and farming systems. ICARDA's research provides global benefits of poverty alleviation through productivity improvements integrated with sustainable natural-resource management practices. ICARDA meets this challenge through research, training, and dissemination of information in partnership with the national agricultural research and development systems.

The results of research are transferred through ICARDA's cooperation with national and regional research institutions, with universities and ministries of agriculture, and through the technical assistance and training that the Center provides. A range of training programs is offered, from residential courses for groups to advanced research opportunities for individuals. These efforts are supported by seminars, publications, and specialized information services.



The CGIAR is an international group of representatives of donor agencies, eminent agricultural scientists, and institutional administrators from developed and developing countries who guide and support its work. The CGIAR receives support from many country and institutional members worldwide. Since its foundation in 1971, it has brought together many of the world's leading scientists and agricultural researchers in a unique South–North partnership to reduce poverty and hunger.

The mission of the CGIAR is to promote sustainable agriculture to alleviate poverty and hunger and achieve food security in developing countries. The CGIAR conducts strategic and applied research, with its products being international public goods, and focuses its research agenda on problem-solving through interdisciplinary programs implemented by one or more of its international centers, in collaboration with a full range of partners. Such programs concentrate on increasing productivity, protecting the environment, saving biodiversity, improving policies, and contributing to the strengthening of agricultural research in developing countries.

The World Bank, the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), and the International Fund for Agricultural Development (IFAD) are cosponsors of the CGIAR. The World Bank provides the CGIAR System with a Secretariat in Washington, DC. A Science Council, with its Secretariat at FAO in Rome, assists the System in the development of its research program.

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