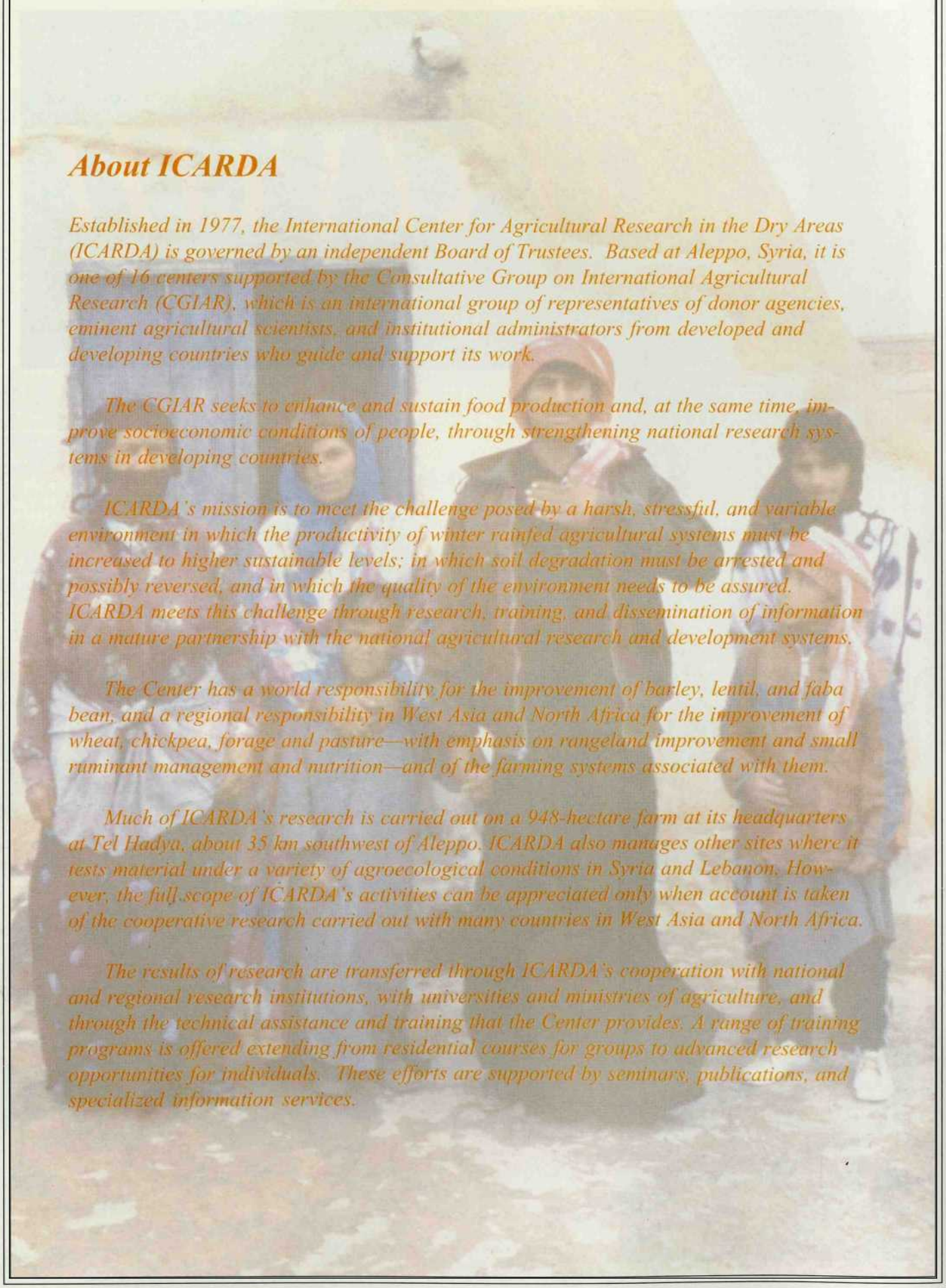
ICARDA

Caravan

Issue No. 1 Autumn 1995

Review of dryland agriculture

In this issue:



About ICARDA

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 16 centers supported by the Consultative Group on International Agricultural Research (CGIAR), which 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 seeks to enhance and sustain food production and, at the same time, improve socioeconomic conditions of people, through strengthening national research systems in developing countries.

ICARDA's mission is to meet the challenge posed by a harsh, stressful, and variable environment in which the productivity of winter rainfed agricultural systems must be increased to higher sustainable levels; in which soil degradation must be arrested and possibly reversed, and in which the quality of the environment needs to be assured. ICARDA meets this challenge through research, training, and dissemination of information in a mature partnership with the national agricultural research and development systems.

The Center has a world responsibility for the improvement of barley, lentil, and faba bean, and a regional responsibility in West Asia and North Africa for the improvement of wheat, chickpea, forage and pasture—with emphasis on rangeland improvement and small ruminant management and nutrition—and of the farming systems associated with them.

Much of ICARDA's research is carried out on a 948-hectare farm at its headquarters at Tel Hadya, about 35 km southwest of Aleppo. ICARDA also manages other sites where it tests material under a variety of agroecological conditions in Syria and Lebanon. However, the full scope of ICARDA's activities can be appreciated only when account is taken of the cooperative research carried out with many countries in West Asia and North Africa.

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 extending from residential courses for groups to advanced research opportunities for individuals. These efforts are supported by seminars, publications, and specialized information services.

From the Director General

Welcome to the first issue of ICARDA's Caravan. We hope that it will be a useful source of information on current trends in agricultural research; and a forum for debate on matters that concern us all.

The title Caravan is not an accident. Of course, it expresses our link with the ancient city of Aleppo, for so long the hub of trade to which Western and Eastern merchants came to do business with each other. But it also points to the dynamic nature of agricultural research. A caravan of old moved from one place to another, depending on the load it must carry. It might have to travel through unmapped territory. And it carried untold wealth.

Here at ICARDA, we like to think that we are a hub. Through us, the national research programs of the countries with which we work can communicate and cooperate with each other, as well as with us; for example, through research networks in which each country covers a topic in which it has experience, or for which it has an appropriate environment. ICARDA sets its research agenda after extensive consultations with its national partners.

Moreover, like a caravan we are flexible, and will take the loads that are needed to the places where they need to go. We have six regional programs; and the results of our research are also applied worldwide, for dry regions are not confined to any one region, and neither are the crops on which we work.

Do we, like a caravan, travel when we must into unmapped territory? Yes, because the dynamic nature of agricultural research sets a new challenge every day. We are constantly examining our research program to ensure that it meets the real needs of a changing world.

And the untold wealth? Yes, because ICARDA and the national programs it works with are in the business of helping people feed themselves in a sustainable way, so that the soil and water will be there for their children and grandchildren. Freedom from hunger is perhaps the greatest treasure of them all.

In search of riches, a caravan crosses deserts. This Caravan seeks to green them.

—Prof. Dr Adel El-Beltagy
Director General, ICARDA

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Distinguished scientist takes over as ICARDA Director General

A distinguished scientist and research administrator, Dr Adel El-Beltagy, took over as Director General of ICARDA on 1 February 1995. Dr El-Beltagy is from Egypt, where he has been Board Chairman of the Agricultural Research Center at the Ministry of Agriculture. He is also former Professor of Agriculture at Ain Shams University, Cairo, and has published extensively.

Dr El-Beltagy, who has also been Director General of ARC, Egypt, has held a number of senior positions in agricultural research administration. However, he has maintained a keen interest in teaching and research, and held the position of Adjunct Professor at the Faculty of Agriculture, Ain Shams University, Cairo. He has also been Visiting Professor at San Diego University in the United States. He has over 110 scholarly publications to his credit. Other previous responsibilities have included the position of First Under-Secretary of State for Land Reclamation, Agricultural Foreign Relations, Minister's Office, Ministry of Agriculture, Egypt.

Dr El-Beltagy's professional involvement at regional and international level has included Secretary General, International Desert Development Commission; Chairman of the Executive Board, Arab Center for the Studies of Arid Zones and Dry Lands; Chairman of the Scientific Technical Council of the International Sahara and Sahel Observatory; and Co-Chairman of a Government of Egypt-led mission with the World Bank, UNDP, FAO, UNEP and World Food Programme, to develop a report on *An Agricultural Strategy for the 1990s.*

Participation

Dr El-Beltagy has been quick to stress the need for full participation of all countries in research. "To further strengthen the CGIAR and its associated centers, all stakeholders, including the governments of WANA (West Asia and North Africa) countries, must become full partners," he told ICARDA's Board of Trustees in April. "It is no longer enough for NARS (National Agricultural Research Systems) to be active only in research collaboration, coordination and implementation. The time has come for each WANA country to be a full stakeholder, which requires a commitment of financial resources." He welcomed the fact that Egypt and Iran have already become full members of the CGIAR.

> ***"The time has come for each WANA country to be a full stakeholder, which requires a commitment of financial resources"***

On 8 June 1995 the Director-General (right) was host to HE Mr Asa'ad Mustafa, Minister of Agriculture, Syria (left), and Dr Fawzi H. Al-Sultan (second left), President of IFAD (International Fund for Agricultural Development). They are seen here touring ICARDA's laboratory facilities, where Masters student Sayid El-Hassan (standing), of the University of Aleppo, and technician Iman Maaz helped show them some of ICARDA's work. The Minister expressed his confidence in the team led by Prof. Dr El-Beltagy, who, he said, "has an excellent knowledge of the problems of the region and in whom we have complete trust."

Meetings

Dr El-Beltagy has also moved quickly to further strengthen the relationship between ICARDA and its partners in WANA. In April, he was received by H.E. Mr Elias Al Hraoui, the President of Lebanon, and they discussed future collaborative projects. Lebanon was ICARDA's first home and has donated three research sites to the Center. Dr El-Beltagy also held discussions with other senior Lebanese officials, including Minister of Agriculture H.E. Dr Adel Cortas.

In Syria, Dr El-Beltagy was received by H.E. Mr Abdul Halim Kaddam,

Vice-President of the Syrian Arab Republic, Minister of Foreign Affairs Mr Farouk Al Shar'e, and H.E. Mr Asa'ad Mustafa, Minister of Agriculture and Agrarian Reform; the Minister later visited ICARDA. Syria is ICARDA's host nation, and donated the 948-hectare site at Tel Hadya, near Aleppo, where ICARDA has its headquarters.

More recently, Dr El-Beltagy visited Turkey at the invitation of H.E. Rafaeddin Sehin, Minister of Agriculture and Rural Affairs, with whom he discussed matters of common interest.

He also met a number of senior officials and academics, who expressed appreciation of ICARDA's ongoing collaboration with Turkey.

Dr El-Beltagy does not underestimate the scale of the challenge facing ICARDA and its NARS partners. "Worldwide, every year, about 600 million hectares of land are lost to desertification ...The net annual loss of topsoil through erosion is estimated at 26 billion tons a year," he stated in his address at the Board of Trustees meeting in April this year.

Disasters

Moreover, he points out, the world continues to be plagued by both man-made and natural disasters. ICARDA's research program continues to work on problems such as desertification, rising demand for water, and loss of biodiversity.

Dr El-Beltagy has brought with him an intimate knowledge of the problems of rainfed agriculture in the region, rich experience as a researcher and research manager in arid land and desert development, and of project and policy formulation both at national and international levels. ■

German Minister sees for himself

On 28 August, Mr C-D Spranger, Minister of Economic Development and Cooperation of the FRG, and Dr H. J. Elshorst, Director General of GTZ, visited ICARDA to see how the Center is fighting to prevent hunger without turning the region into a dust bowl.

Mr Spranger (right) and an interpreter with the Director General, Prof. Dr El -Beltagy

Mr Spranger and Dr Elshorst visited ICARDA with a party which included Governor of Aleppo Mr. M. M. Miro and German Ambassador to Syria Mr T. Troemel. They were accompanied by German officials and a large press delegation.

During his visit to ICARDA, Mr Spranger expressed his concern about the negative effects of agricultural policy in developing countries. These are not properly understood, especially with regard to their effect on the long-term productivity of farms. He also expressed concern about recent trends of reduced foreign aid in agriculture.

At the conclusion of his visit, the Minister praised the achievements of the staff at ICARDA. The Center has a number of professional staff from Germany, and collaborates with German universities in research projects.

Issues

The Minister and delegates were welcomed by Prof. Dr Adel El-Beltagy, Director General of ICARDA. He gave the visitors an overview of the issues facing agriculture in the dry areas.

The optimal use of water is a key concern, and Prof. Dr El-Beltagy stressed especially the crucial importance of water in such regions, both for the agricultural sector and its competing demands from industry and households. Studies have shown that farmers often use up to 50% more water than needed, thus aggravating water shortages and contributing greatly to soil salinity. ICARDA is developing regional strategies for water-use efficiency, as well as for resource management through research on techniques such as water harvesting. Prof. Dr El-Beltagy also described other aspects of ICARDA's work.

After a lunch with the large community of German staff and students working in ICARDA, Prof. Dr El-Beltagy showed the delegation some of the ways in which ICARDA is meeting the challenges of agricultural development in the region.

The party toured one of the biotechnology laboratories, where ICARDA introduces new technologies from the

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industrialized world and transforms them for adoption by developing countries. German scientist Dr Michael Baum demonstrated techniques used to cross between species to transfer desirable traits to crop plants that lack them. ICARDA also uses biotechnology tools to detect and identify viruses and diseases.

Mr Spranger's party saw the genetic resources unit of ICARDA, where a total of 110, 000 accessions of different varieties of food plants are stored; these include some of the many crops that first came from ICARDA's part of the world. ICARDA tries to preserve these before they are lost forever through land encroachment and overgrazing.

Crop trials

The Minister's party made a tour of the 948-ha research station and saw field experiments in which the long-term effects on productivity of different crop rotations were shown, as well as the effect of different sheep management practices on the productivity of such crop rotations.

The visitors also saw the sheep unit, where the Center houses about 700 animals to test the effect of various farming practices involving sheep. Sheep feeding trials were shown where sheep are fed different varieties of barley to test their nutritional value. Infrared techniques are also used to identify the characteristics of barley straw that have proved suitable. Some of this work on barley is being supported with generous assistance from Germany's overseas development arm, BMZ, and there is also collaboration with the University of Hohenheim (see story, right.)

Work with farmers

The Minister's delegation heard how all ICARDA's research is done in close collaboration with the farmers, who are the end-users of the new technology. If it does not meet their real needs, researchers have to go back to the drawing board straightaway to make their plans farmer-friendly.

ICARDA also evaluates the impact and contribution of the new technology. Mr Spranger was told how, for example, the new wheat technology which the Center has developed has helped bring hundreds of millions of dollars of extra income to farmers in Egypt, and in Syria itself; the latter has returned to wheat self-sufficiency for the first time since the 1950s.

Another example cited is the self-sufficiency in lentils that Sudan has achieved through the use of new agricultural technology. It has also come close to self-sufficiency in wheat, which has been grown south of Khartoum for the first time.

This work has been done jointly by national programs and ICARDA. ■

Real plants for

ICARDA, together with German and Syrian partners, is starting a major project that will help give farmers the seed varieties they need and want—not the ones that look good on paper. The project will be on barley, which will be tested and bred in farmers' fields—not just in ideal conditions on a research station.

ICARDA has world-wide responsibility for barley research, and does much work on the crop in South America as well as in the Middle East.

The project will be called *Farmer participation and use of local knowledge in breeding barley for specific adaptation*. It is a collaborative project between ICARDA, Syria's Ministry of Agriculture and Agrarian Reform and the University of Hohenheim in Germany. It is being generously supported by the German overseas development ministry, the BMZ.

For too long, plant breeders have developed high-yielding new varieties of established crops—only to see them ignored by farmers. The project should lead to the development of varieties that farmers will actually adopt.

Farmers at eight locations in Syria, with highly variable rainfall, will grow 208 lines and populations using their own agronomic practices. The same lines will also be grown at ICARDA's Tel Hadya research station. In both cases, the farmers' own lines will be included. At the end of the first three years, it is hoped that the participants—and their neighbors—will start commercial production of the best lines.

The barley breeding project addresses some of the flaws in conventional thinking on breeding. For example, new varieties are often developed using the best agronomic practices and inputs, which may be lacking in the real world. Breeders also assume that varieties must be suitable for a wide range of geographic areas (broad adaptation). But local varieties often show very different chacteristics over small distances (specific adaptation). Farmers have always known all this, and that is why they often do not adopt new varieties.

There is another reason. Yield tends to be the main criterion in conventional breeding. This is not the only thing that farmers want; it may not even be the main one. Even if stress and disease resistance are also taken into account, something more may be needed.

Some years ago, a new barley variety, Beecher, was introduced in Syria. But, despite its qualities, farmers did not always adopt it, and some who did turned back to the traditional Syrian varieties, Arabi Abiad and Arabi

real farmers

Aswad. It was found that sheep did not like the fibrous straw that Beecher produced.

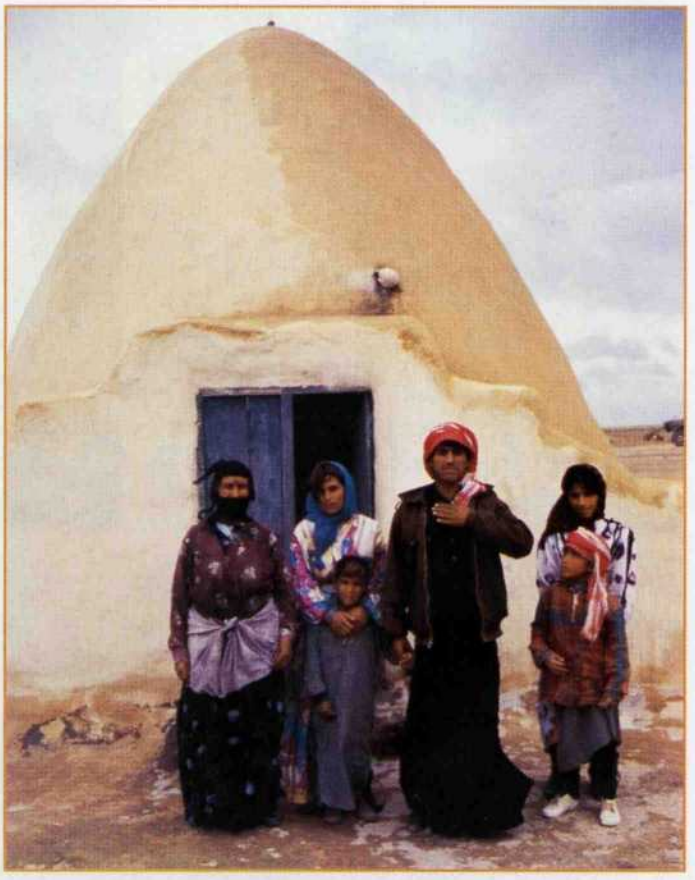
As a result, ICARDA started breeding barley for straw quality, as well as yield and stress resistance.

To establish which characteristics were suitable, it tested a number of varieties with sheep and analysed them through Near-Infrared Reflectance Spectroscopy (NIRS).

This technique, developed in collaboration with the University of Hohenheim, allows a first sample of a new line to be quickly checked for feed suitability. A large amount of baseline data has been obtained from sheep-feeding experiments to ensure that the right characteristics are looked for. NIRS will now be applied to all the lines tested to identify a broader range of characteristics that the participating farmers find attractive.

ICARDA and the University will also cooperate on gathering socioeconomic information on the characteristics which are sought by off-farm buyers in the marketplace, as well as by the farmers. This work has already begun.

A wider range of varieties actually grown in farmers' fields means a broader spectrum of disease and drought resistance—and will help scientists and farmers together to guard against the ever-present threat of crop failure...and famine. ■



Several generations of a farmer's family together. ICARDA thinks their experience will help it breed improved barley varieties.

WANA works for a livelier seed sector

Expansion of national seed industries into the private sector can improve seed supply and substantially increase national crop yields. This is the experience of the seed industries in Europe and America, and it will be shared with seed industry managers from WANA countries in a four-day workshop in Tunis in November 1995.

ICARDA, in collaboration with the German Agency for Technical Cooperation, GTZ, and the Tunisian Ministry of Agriculture, has organized this meeting to bring together seed managers from the public and private sector of WANA countries, and private seed sector officials from Europe.

Several WANA countries have already started to develop private seed companies, and many others are considering the same.

The workshop aims to allow discussion of the difficulties faced in setting up a private enterprise—experiences will be shared and each participant will learn from all the others.

Both ICARDA and Germany have have done much to help develop the seed sector in WANA. ICARDA has contributed improved crop varieties and seed since its creation in 1977. In 1985, ICARDA established a separate Seed Unit which focuses on networking and training. The Unit was instrumental in setting up the WANA Seed Network, in which each country contributes an activity in which it has expertise. The Seed Unit has achieved a high profile among WANA seed scientists.

Early work by Germans supported state production of quality seed for distribution to farmers. In Morocco, however, the Germans helped build up a mainly state-owned company which operates like a private business. Germany is now helping Egypt privatize its seed sector.

But most support to date has been to the public sector; direct support to the private sector has been very limited.

Since WANA countries are either in intermediate stages of privatization, or are still considering it, now is a good time to share experiences, and to pass on information from the seed industry in Europe and America.

Feed for the future?

Rangeland degradation is one problem; loss of nutrients through continuous cereal planting is another. And we must ensure adequate feed supplies. Part of the answer to all these may be ley farming, using medics and vetches. ICARDA is working on both.

by SCOTT CHRISTIANSEN and GUY MANNERS

Ley farming is the idea of increasing the feed potential of rangeland by alternating cereal and legume crops. Back in the 1930s, Australian researchers discovered the value of including annual legumes known as medics in the cereal crop-cycle.

The medics helped add nitrogen and organic matter to the soil because they have the capacity to convert atmospheric nitrogen into a biochemical form, and also provided substantial feed resources for sheep.

Farmers in WANA grow crops mostly to feed their livestock. They prefer a crop which gives storable grain in good years, so that they can feed their animals in the off-season. They are, therefore, much more interested in introducing a legume fodder crop such as vetch into a rotation with cereals than they ever were in sowing pastures of medic.

ICARDA has been developing ley-farming practices for the West Asia/North Africa (WANA) region since the late 1970s—following the same logic as the Australians. We have come a long way since the early attempts to introduce Australian strains of medic into the region.

There are good reasons for encouraging farmers to break the habit of growing cereal crops year after year. The first is the decline in yields. Successive cereal crops require the same nutrients from the soil, and these are not replenished during the non-growing season.

A second, and more sinister, problem is a disease known locally as "Abou Alowei". Abou Alowei infests fields where barley has been grown for several consecutive years. The problem has been identified to be caused by a nematode, that infests the plants and causes sterile heads. The only known effective control measure is to break the barley–barley crop cycle by introducing another crop in alternate years and using clean seed for the cereal crop. Are medics the answer? Or vetches?

Vetch—the answer!

Just a few years ago, the ICARDA pasture group was promoting the use of medics in barley-based systems. However, Near Eastern farmers in particular proved resistant to this idea—they want a crop they can harvest at the end of a good season.

This is where vetch comes in. Vetch is the perfect answer.

It is adapted to the target environment, an area where few other legume crops will grow, and can be used for grazing or harvested at the end of the season.

If farmers do decide to graze their sheep on the vetch, they find it ideal for fattening lambs. At the same time, grazed vetch uses less water over the season compared to a crop grown to

Mechanizing

Three machines have helped make on-farm medic-seed production easier for sedentary livestock farmers in WANA – the roller (see box on next page), a seed-sweeper and a thresher.

Medic seeds develop within tough pods, which is what makes them ideal for low-risk pasture establishment; if a year is too dry, then ungerminated pods will easily survive until the following season, whereas naked seed would dehydrate and die.

However, medic plants are too short for the pods to be mechanically harvested in any conventional way. Thus, we developed (in collaboration with a manufacturer in

Sheep grazing on legumes (left); next year, the barley will be better

maturity. Having the animals in the crop directly benefits the soil in terms of organic matter and nitrogen; it also reduces pressure on traditional grazing lands, which will only improve as a result. The downside of grazing vetch is that there is no seed for the following year or for off-season feed. Thus, ICARDA recommends that a portion of the field be left to mature for harvest of seed.

Not all farmers have animals, but they still need rotations with legumes. On these farms, the vetch can be left to mature and then be harvested. Most farmers have some animals so their straw and seed can either be sold in the market or fed to sheep and goats in the fall and winter.

The main constraint to the wide-scale adoption of forage legumes has been the cost of harvesting (labor is not cheap). However, two low-cost machines have been developed by ICARDA and local manufacturers to mechanize vetch harvesting. The roller and cutterbar with catchbox make harvesting vetch a much more attractive proposition (see box).

So this is ICARDA's strategy for feeding livestock in the higher-rainfall areas (250–350 mm/year): introduce vetch into rotation with cereals. But what of the medics, into which so much research effort has gone over the years?

Medics - not dead yet

Medics now have a subtly different role in ICARDA's strategy—rehabilitation of marginal land. Not that this is a new idea—range and marginal land rehabilitation has always been seen as a priority; and medics as one of the best vehicles for achieving it.

Range and marginal areas cover some 375 million hectares in WANA (about 22% of the total land). However, much of the land classified as semi-desert is coming under increasing pressure from livestock grazing. Together, these areas contribute nearly one-third of the diet of the 320 million or so small ruminants.

Increased population pressure (both human and livestock), combined with changes in land ownership, has led to the degradation of much of this land. In fact, overgrazing has gone so far that the land's ability to regenerate has been severely impaired. If these lands are not to become semi-desert, there must be immediate human intervention. Part of that intervention is to regulate land use, but we shall not discuss that aspect further here; it's a large subject, and a separate one. The other part is resowing fertile arable land with native pasture plants. Resowing (or over-sowing) can be viewed as anti-environmental, since natural regeneration is likely to occur with greater biodiversity. But there is little choice for the range and marginal lands of WANA. If we do not resow and encourage growth, the land will become more and more denuded of life and less and less useful to the livestock that need it.

Early work on ley farming involved attempts to introduce species and varieties of medic and other annual legumes from Australia and the USA. The environments were different from those of the plants' origin, and these attempts failed. In fact, no real success was achieved until work concentrated on local plants. These have evolved in the same regions that we want to regenerate, so are adapted to the target environment. The lack of adaptation of the exotic material was partially attributed to the soil types and climate, and also the micro-organisms (rhizobia) that do the work of fixing the atmospheric nitrogen. The imported legumes were not as attractive to the rhizobia as native plants. Native plants, however, evolved in competition with other locally-adapted species.

We are now encouraging farmers to revegetate land marginal to their crop farming – for example, sloping and stony areas and areas with shallow soil. Until recently, we were still pursuing a policy of integrating pasture spe-

Continued on page 10

medic nurseries

Aleppo) the seed-sweeper. This machine enables dropped pods to be swept off the soil surface and collected. If nursery plots are used, then the pods can be harvested using the sweeper for transfer to the target marginal area.

When establishing nursery plots on flat, quality land, near-optimum conditions can be provided and growth ensured. Since the pods are so tough, seeding pods in nurseries does not ensure either good germination or a good crop of new pods at the end of the season.

So we have also developed a thresher (again using a local manufacturer), to remove the pods from the seeds for sowing in the nursery.

Vetch-harvest mechanization

Surprising as it may seem, labor is not cheap in WANA. So farmers in the region are far more interested in crops which can be harvested by machine than in ones which need hand-harvesting. Part of the attraction of introducing vetch into rotation with cereals, primarily barley, is the fact that ICARDA offers an appropriate-technology package to address just this point.

One of the great problems with machine harvesting is the need to have a crop tall enough to yield seed and straw. Legumes are not tall, upright plants like cereals, so farmers need to ensure that the ground is flat before sowing. The ICARDA roller was designed with the dry and fragile soils of the WANA region in mind. It comprises a cylinder with ridges on it. It has two vehicle attachments so that it can be towed from field to field by any vehicle with a towbar; while the tractor attachment allows it to be pulled along behind the tractor to level the topsoil.

The harvesting itself is done with a double-knife cutterbar—two cutting blades which slide across each other cutting the crop with protruding knives. This, too, is held by a tractor. The latest development is a catchbox which enables seed and straw to be collected and deposited at 5-m intervals.

From page 9

cies (i.e. medics) into rotation with cereals in the 300-mm rainfall zone. If we can convince a farmer of the need to grow pasture species for land rehabilitation, we can create medic nurseries on flat ground for repasturing the *uncultivated* rangeland.

This involves the use of locally-manufactured appropriate technology—the roller, a seed-sweeper and a thresher (see box).

An alternative to mechanical harvesting is possible with small-seeded plants such as clovers. Here, we are thinking of promoting sowing by sheep. Experiments have shown that up to 70% of the small grains ingested by sheep pass right through the digestive tract and are then deposited in ready-fertilized packages.

Thus, sheep could be grazed on land revegetated with clovers one day, then moved on to the target area (the next piece of marginal land for revegetating) the next. The sheep can be encouraged to stay in the target area for the whole day by the judicious placing of piles of hay.

However, this is currently no more than a nice theory. It has yet to be put into practice. These techniques will be tested in the coming season on farmers' rehabilitated rangeland in the El Bab area of northwest Syria. ■

Barley,

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creatures in the threatened
informed, it's about preser
buildings. To ICARDA's Dr
about Sardinian beer. He ex

In the summer of 1990, scientists fro
samples of germplasm from the barley
in the western Mediterranean, farmer
produce the seeds in the fields for the

Why? Scientists all over the world have devoted years to breeding improved crop varieties with better yields, so why should Sardinian farmers ignore them? And why were our colleagues collecting local varieties? And why has ICARDA itself collected some 20,000 unique accessions of its own? The answers are in the past, but are crucial to the future.

Barley cultivation started in Sardinia in the fourth millennium BC. The Sards have used it in many different ways. A few years ago, anthropologist Murru Corriga researched the making of *ghimisone*, a special starter made up to the 1950s; something similar seems to have been used in beer preparation in ancient Egypt–methods still used in Ethiopia and Eritrea. *Ghimisone* was for making *orgiathuy*–barley bread.

Sards made this because it enabled them to be self-sufficient within their own communities. Other foods were unreliable. According to the English historian Day, during the 14th Century, most of the wheat raised was exported by the Sards' Pisan and Genoese masters, while fluctuations in prices have always made it dangerous to depend on the island's grain markets.

Lessons from history

When a crop is as crucial to a community as barley was to the Sards, it must not fail. So, over many centuries, local varieties were developed that would *not* fail.

We must keep them.

beer...and biodiversity

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Salvatore Ceccarelli, it's
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n Sassari University began collecting populations of Sardinia. On this island prefer to grow local varieties - and still ollowing season.

Santayana wrote that those who do not remember the past are condemned to repeat it. (A more cynical man once said that all man learns from history is that he learns nothing from history.)

Civilizations have risen and fallen through changes in their means of sustenance. Crop failure through drought is thought to have brought down the Akkadian empire around 2200 BC; the early bronze society in the southern part of the Fertile Crescent may have fallen for the same reason. Anyone who thinks this is of no relevance to our modern world should think back to the famine in the Horn of Africa in 1984-85. One day, such a tragedy may profoundly affect the geopolitical stability of the modern world and threaten, not just its victims, but civilization itself. Unlikely? Perhaps, but the last stage of any civilization is to think itself immortal.

So we must breed crops for resistance to any such threat–and preserve them. ICARDA is a leading world player in this respect. Not only do its scientists breed crops for resistance as well as yield; it also has a gene bank with a massive collection of 110,000 accessions. This is no plant museum; ICARDA ships out 25,000 samples a year, a third of them to the developing world.

But breeding cannot be done entirely on well-managed research stations, because the variations in abiotic and biotic stress are not great enough. For example, when wild populations that have been preserved are reintroduced under test conditions, they can't compete with the local vegetation.

So breeding must take place in the target environment. Those who accept this are still a minority among plant breeders; but they have on their side geneticists, physiologists, economists and anthropologists—and common sense. And if farmers are not involved, the absurd can occur. Once upon a time, officials in a remote mountain region introduced a new variety. It was higher yielding, had better resistance to biotic and abiotic stresses, and was easier to thresh. It was not adopted. A couple of years later, they tried to find out why. The answer was simple. It tasted horrible.

First, find your germplasm

A first step to such breeding is to collect germplasm from diverse environments, and that is what Sardinia has. The Sassari scientists collected from as diverse a range as possible, so the germplasm will provide sources of heat and cold tolerances, resistance to salinity, and yields under different agronomic practices.

ICARDA itself is also collecting in a crucial area. The Near East was where wheat, barley, pea, rape seed and wild races of rye and oats were first cultivated; these account for 38% of the world's agricultural production. In a joint venture with the International Plant Genetic Resources Institute (IPGRI), ICARDA researchers are now starting to use wild ancestors/relatives and farmers' varieties (landraces) for breeding. And they are laying more stress on *in-situ* conservation of germplasm.

And here is the link with Sardinia. *Ghimisone* preparation, reconstructed by Murru Corriga, showed many similarities with the first steps of beer preparation as used in ancient Egypt—and still practised by Ethiopian and Eritrean people.

Barley was not indigenous to Sardinia. It came from *this* end of the Mediterranean. With biodiversity threatened in the Fertile Crescent, beer-drinkers from the past may provide us with genetic clues to our future. ■

*Extracted from: Attene, G, S. Ceccarelli and R. Papa. 1995. The barley (*Hordeum vulgare *L.) of Sardinia; Ceccarelli, S. and S. Grando. 1995. Drought as a challenge for the plant breeder. Proceedings of InterDrought 95, Montpellier, France, September 1995.*

Barley in the Sardinian farming system

In Sardinia, barley cultivation is just as important as that of wheat, as this cereal serves as food for part of the population in the mountains as well as being the main source of nutrition for horses. It is sown at the same time as wheat and harvested towards the end of May; however, care must be taken not to feed it to horses prematurely, or, if this is done, to wet it beforehand. The right time to use barley as food for domestic animals is one year after harvesting. The barley can also be cut early in the season to provide the horses with green fodder, but sowing must then be denser.

Sardinian peasants, primarily those from Campidano, use the straw of barley for the fabrication of sieves, panniers in which to knead dough, and other household utensils.

I saw some baskets bearing a remarkable resemblance to those found in Egyptian tombs and preserved in various collections.

Is time worth money in Sivas and Kayseri?

Are big farms the future? Will commercially-oriented agriculture replace the family holding? Maybe not. Last year a joint Turkish/ICARDA team did a field study of farming systems in Anatolia - and found a persistence of subsistence, but an uncertain future.

There are two contrasting visions of our farming future. One is of the decline and eventual disappearance of small, subsistence-oriented family farms and their replacement by larger, more capital-intensive and commercial operations. This has often been the pattern, and we have seen smallholders become wage-laborers—not always with the best of results for either the natural-resource base or for the laborers themselves.

Maybe it doesn't have to be like that. Perhaps family farms can survive, even thrive, by adapting to social and technological change. Subsistence provision and commercial production are not necessarily antagonistic.

by RICHARD TUTWILER

There could be a persistence of subsistence, combined with improved incomes.

Here in the West Asia and North Africa (WANA) region, there was early development of capitalist agriculture, with large commercial farms developing from the first half of the 19th century. But there has also been a parallel evolution by small farmers, and they continue to dominate WANA. Our study of farming systems in East Central Anatolia was meant, in part, to look at where small farms stand today.

The study was a joint effort between the Central Research Institute for Field Crops (CRIFC) in Ankara, and ICARDA. It is an ongoing project, and everything in this article should be taken as interim reporting.

Why Sivas-Kayseri?

It was CRIFC which identified Sivas and Kayseri. The area is within its mandate both geographically and in terms of crops. And it has not seen either the wheat-yield increase or the fallow-replacement that other regions have experienced. (Nearly all, 99%, of farmers grow wheat, and 68% grow barley; however, the actual area planted to barley is much smaller, especially on larger farms.)

The area seems to have potential, though, and the team wondered if the cause of the poor yield increase and fallow replacement lay in socioeconomic conditions or the farming systems. We were also interested in the survival of smallholders. The general objective was simply to talk with farmers, do a descriptive analysis—and feed the information back into the research system.

Farms tend to be larger than they are elsewhere in Turkey. About 75% were less than 25 hectares, but the national average is 94.4%. This is due to the environment in the area and is prob-

The survey team based its work on discussion with farmers (left)

ably irrelevant to small-farm survival. More important clues may lie in the intriguing mix of off-farm activities.

To take the smallest farm category (less than 10 hectares), only 9% of available labor days were deployed off-farm. Yet 58% of the labor (expressed as available days) was not used. For larger farms, the unused labor was not quite so great, but there was still a surplus. However, some of this time must be in use for income generation; we have not yet fully investigated how much cash comes from the sale of carpets, for example.

Weaving—an important local industry

This is suggested by the figures for cash income. This was US $180 per capita for the smallest farms, which reported only 41% of cash income from on-farm production. This comes mainly from the sale of livestock and products (US $80 per capita); not from crops, as a *loss* of US $5 is reported from sale of surplus. Where is the remaining 58% coming from? The answer may lie in tractor hire and sale of handicrafts, neither of which are included in these figures. Go back to our figure for unused labor days—also 58%.

Unfortunately, the solution is rarely so neat as that! But it seems subsistence farming is underwritten by off-farm income, at least to some extent. Larger farms in the area also have a labor surplus, but it is smaller; enough to prevent them from "swallowing up" the smaller farmers as wage-laborers, but perhaps not enough to compete with them for off-farm income.

A balance?

Does this mean that there is a balance that will enable subsistence and commercial farming to co-exist in the area? Well, maybe—if the cash income is enough. It may not be. This is not lucrative work.

Moreover, the below-10-hectares category carried a debt burden of US $64 per capita. Some of this may be traced to tractors. There are more than one would expect, a legacy of an official scheme some years ago by which farmers were able to raise the cash to obtain the machines, but are now still paying it back.

In fact, we found evidence that subsistence farming is subsidized not *just* by off-farm income, but also by spending fixed assets. This takes the form of slow depreciation of such assets (e.g. farm buildings), which are deteriorating because there is no money for maintenance.

How long does this go on before the fixed asset being sold is the land itself? It is at that point that subsistence is no longer possible.

In some countries (such as Yemen or Sudan) the gap may be closed by remittances from family members overseas, but we found no evidence of this in Sivas and Kayseri. Given the labor surplus that already exists in the region, the only solution would be to get on a bus.

The only solution would be to get on a bus

Or increase yields?

But this assumes that there is no chance to increase the productivity of the farms so that they come closer to profitability, closing the gap that off-farm income can't deal with on its own. Why have yield increases not matched those elsewhere in Turkey? Could they? This, it will be remembered, was the other area we wanted to study.

The CRIFC researchers found a number of shortcomings in current agronomic practices:

* Inadequate tillage for moisture conservation, and ineffective seed-bed preparation.
* There is a need for selection of better-adapted varieties; and for better seed quality.
* Seeding rates and dates of planting are inappropriate.
* Rates and times of fertilizer application must be attuned to soil moisture supply and soil fertility.
* Poor agronomic practices were as great a constraint to yield improvement as input levels or cultivars.

But we also found that livestock production was more important to the smaller farms than it was to the larger ones. Here, there may be a chance for greater profitability.

For the future

We concluded that, as far as the smaller farms were concerned, it was here that the effort should be concentrated. How should this be done? It is a subject for another study, perhaps. But we thought that the key lay not in the allocation of resources, but in the type of resources used. We have established that:

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How to double chickpea yield

Chickpea is a crucial crop, accounting for 15% of the world's pulses area. Winter planting can double yield, but it has always been chancy. ICARDA and its partners have found a way to make it safe. Now the benefits are being felt.

By K.B. SINGH, M.C. SAXENA and S. VARMA

Chickpea is prized for its high-quality protein. It is the basis for many popular dishes, such as *hummus* in the Arab world. But it is also vital in the diets of vegetarians and millions of people who cannot afford meat. And it provides valuable feed for livestock.

It is also a sustainable crop, good for the soil. Chickpea, like other legumes, is referred to as "nature's fertilizer factory" because of its ability to fix atmospheric nitrogen; it thus plays an important role in farming systems. It is grown in at least 33 countries in the Indian sub-continent, West Asia/North Africa (WANA), East Africa, southern Europe, South America, and Australia.

There are two types of chickpea; desi—with small, angular colored seeds—primarily grown in South Asia; and kabuli, which has large, ram-head shaped and beige seed and is predominantly grown in WANA. Between them, they account for 15% (10.1 million hectares) of the area and 13% (6.3 million tonnes) of world pulses production.

Chickpea production in most WANA countries, however, has been outpaced by the growing population. As a result, the region has been importing an average of 800,00 tonnes, costing US$ 47 million, annually. Some years ago, scientists at ICARDA and elsewhere decided that it was time to reduce the burden.

With the establishment of the International Center for Agricultural Research in the Dry Areas (ICARDA) in Syria in 1977, a joint project was begun with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), based in India. The objective was to improve productivity and yield stability of chickpea in WANA. Before long, they found at least part of the answer.

Winter sowing

In the Mediterranean environments, with cold rainy winters and hot dry summers, chickpea is traditionally sown in spring. When the crop approaches maturity, it invariably suffers from heat and drought stresses which result in low and variable yields and discourage farmers from investing in inputs.

In a preliminary experiment on date of sowing at ICARDA's main research station at Tel Hadya, near Aleppo in Syria, chickpea sown in winter produced bigger flowers, more pods and over 100% higher yields than that sown in spring. This is because winter crops get the benefit of winter rainfall; moreover, the moisture they do receive is less subject to evaporation, because the temperatures will be lower as the crop approaches maturity.

(Left:) ICARDA has developed large-seeded lines of winter-sown chickpea for areas where this is preferred

A crop that can produce 100% higher yield, simply through earlier sowing? It sounds too good to be true, and at this stage it was a little too early to cry "Eureka". The question the scientists had to ask was: if winter sowing can double chickpea production, why are farmers not doing it already? After all, they know their environment, and have thousands of years of accumulated experience to draw upon.

In fact, investigations by the ICARDA/ICRISAT researchers revealed that farmers avoided winter sowing because of the risk of a heavy to total loss of the crop due to two factors—a fungal disease called ascochyta blight; and cold stress in years with severe winter.

Picking on the lead provided by the Tel Hadya experiment that winter sowing can boost yields, the researchers decided to work with nature.

A powerful ally

Nature is a powerful ally—especially when it gets a little help. The key would be to use existing germplasm and breeding lines to breed for the characteristics needed. In their search for suitable genes, the team of researchers turned to the gene banks of ICARDA and ICRISAT where over 20,000 accessions of chickpea germplasm, collected from all over the world, are stored. Then, in cooperation with, and active participation of, national scientists in WANA countries and elsewhere, the ICARDA/ICRISAT team developed a breeding strategy that hinged on two key factors: early sowing to allow the crop the full benefits of winter rainfall, and the development of cold-tolerant and ascochyta blight-resistant cultivars.

An easy and reliable field-screening technique was developed for the screening of germplasm and breeding lines for ascochyta blight resistance. This involved sowing susceptible lines all around the experimental plots and at frequent intervals within the plots. In February, the nursery was deliberately contaminated with ascochyta blight by inoculating with debris from diseased chickpea, supplemented by spore suspension spray prepared in the laboratory from a mixture of races identified in Syria. Relative humidity was increased to above 60% by sprinkler or mist irrigation. Included in the varieties sown was a check—that is, a line known to be susceptible. When it died, the scientists evaluated the remaining germplasm lines and breeding material to see which had proved resistant. This resistance was then tested more thoroughly, using selected lines over several years at several locations in several countries. Over 20,000 chickpea accessions were evaluated and several sources of resistance to ascochyta blight were identified.

A field-screening technique for the evaluation of germplasm accessions for cold tolerance was also developed. The breeding material was sown in early October, two months ahead of normal winter sowing, with a susceptible check sown after every nine test rows. Supplemental irrigation was used to allow the nurseries to reach their late vegetative stage before the onset of severe winter. The lines that survived the winter were selected and reevaluated for more than one season—again, in several places, to allow for variations in conditions.

This technique permitted the evaluation and development of germplasm capable of tolerating as low a temperature as -10°C for 60 days in a year at the late vegetative stage. Over 9000 accessions from ICRISAT and ICARDA were evaluated and several cold-tolerant sources were identified.

Using the identified sources of resistance to ascochyta blight and cold, and following a bulk-pedigree method of breeding which permits the selection of blight- and cold-resistant plants in winter, some 2000 breeding lines were developed that combined high yield with resistance to ascochyta blight and cold. These lines were tested in both winter and spring sowing at three agroecologically different locations.

This takes time; in fact, it took 10 years. But it proved worthwhile. On average, winter-sown chickpea consistently yielded 62% more than that sown in spring. Since the protein content of seed was not related to date of sowing, higher yields also meant more protein.

There was a bonus. The newly-bred lines were about 50% taller than traditional cultivars, making them more amenable to machine harvesting. This is important in WANA, where labor is not cheap in real terms.

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(Left:)Biotechnology plays a part in the breeding cold- and blight-tolerant lines. Here, lines are crossed in ICARDA's laboratory

(Left:) Chickpea has a long history in the WANA region and is the base for **hummus**, *pureed chickpea much eaten in Syria and elsewhere. This is the traditional* **jerjer**, *a horse- or donkey-drawn thresher from Syria. It is still in use; although larger-scale farmers now use stationary powered machines for threshing, the* **jerjer** *is still popular with farmers on smaller plots*

And there is another, perhaps greater, benefit. Studies at ICARDA have shown that 80-120 kg/ha of atmospheric nitrogen is fixed by winter-sown chickpea, compared with 15-35 kg by the spring-sown crop. Thus, winter chickpea meets over 90% of its nitrogen requirement through symbiosis, leaving the stored soil nitrogen for the subsequent crop. This could have enormous implications for efficient land use. Traditionally, in the wheat-based farming systems of West Asia and North Africa, over 20 million hectares of land is left fallow every alternate year to recharge. But recent studies have shown that the fallow-cereal rotation does not store as much moisture as was previously thought.

Winter chickpea can replace the inefficient system of leaving the land fallow, improve water-use efficiency, and contribute to both improved productivity and sustainability of the system. It is estimated that, among other alternatives to fallow, at least 5% of the fallow land could be brought under winter chickpea cultivation. That is a million hectares, or equivalent to nearly 10% of the area already planted to chickpea worldwide.

Inevitably, there are drawbacks to any new technology. What is good for chickpea is also good for weeds, and these posed yet another threat to winter sowing as they competed with the crop for moisture and nutrients.

An integrated weed control strategy, using chemical and mechanical methods, was developed. Hand-weeding was recommended for small-holder farmers, and it provided employment for family labor. Effective herbicides were identified for large farms and where labor was short. Given some of the benefits outlined above, perhaps this is something we can live with.

Adoption

We also have to be aware that a new technology must be genuinely attractive to farmers, or they will not adopt it. Socio-economic surveys in Syria and Morocco have revealed that the winter chickpea technology is attractive to small-holder farmers using family labor, but adoption is hindered partly by non-availability of seed and other inputs, and partly because adjustments in marketing systems have yet to be made.

Nonetheless, the struggle to develop a "winter chickpea technology," as it is now popularly known, saw early signs of success in 1983/84, when new cultivars with tolerance to cold and resistance to ascochyta blight were first released in Cyprus. To date, 14 WANA national programs, and others in China, Pakistan, Europe and the USA, have released over 60 cultivars of winter chickpea.

In Spain, five chickpea cultivars from ICARDA were released for winter sowing in 1985; these were successful, so Spanish scientists crossed them with ICARDA's ascochyta-blight resistant sources and have just registered three new cultivars. These have large seed—important in Spain, as it is in Morocco.

In California, winter sowing has almost completely replaced spring sowing. The new cultivars have a yield advantage of 60 to 100% over spring types. The area under winter chickpea has increased rapidly from 1300 ha in 1988 to about 150,000 ha in 1995, providing an estimated additional income of US$ 18 million annually.

Within WANA and other countries with a Mediterranean-type environment, where winter chickpea has been adopted, there is potential for bringing some 2 million ha under winter chickpea with an additional annual income of US$ 500 million per year.

Developing winter chickpea took time; benefits may last a lot longer. ■

ICARDA's airborne pest patrol

Are moles and voles destroying your crop? Is chemical control proving costly and ineffective? ICARDA may have part of the answer

Deep inside ICARDA's 948-hectare farm, there is a quarry hewn out of the hillside. In it is a workshop complex where the Center maintains its hard-working collection of farm machinery and vehicles. It is a hive of activity, with tractors, harvesters and cars lined up in the hot Syrian summer sun, and the constant sound of spanners clanging on metal as engineers work to keep everything running smoothly.

By ICARDA staff

In the cliff above, something stirs; a kestrel is bringing home its lunch. It is one of five species on the farm—there are also kites, harriers, barn owls and little owls. They are not as obvious as the workshop, but they too have a useful role to play at ICARDA. And the Center is encouraging them by providing perches and nesting boxes; there are several of the latter on the cliff above the quarry.

This is because the farm has a real problem with rodents. Birds, and snakes, can help control them, as they eat the voles and moles that are so damaging to the crops; sometimes they cut off stalks just above the ground, not only destroying food but sometimes wrecking months of careful research. The worst are voles, because their holes, unlike moles', are not obvious.

The standard way of dealing with this is through chemical control, but this is unsatisfactory in a number of ways. It is quite costly—ICARDA's bill is US$ 5000-20000 a year. And it is not environmentally desirable. ICARDA has had no problems with the chemicals it uses, but most scientists are reluctant to turn the farm into a chemical lake. The quantities needed are enormous; a few years ago, rodents ate the contents of 75 bait stations in just two days.

"You cannot poison the world just to kill a few mice," says ICARDA's farm manager, Jurgen Diekmann. A few years ago, Dr Diekmann started to encourage the bird population by building the perches and boxes, for there was nowhere for the birds to land. They cost about US$30 each to make, and there are now about 60 of them.

The perches need to be 5-6m above the ground. They are roughly 100 m apart—this has been found about right—and they are away from field activity and roads. More have been added this year, sited near high-tension lines. It was thought the birds might not like this, but it seems they don't mind.

Not one of ours! This long-eared owl dropped by at ICARDA and was cared for by staff. The owls living on the farm are little owls. Sadly, the visitor did not live long

Success?

Does all this work?

The nesting-boxes for the kestrels are fully occupied. There are now about 50 kestrels on the farm, and about 100 little owls. Examination of droppings shows that the birds are certainly eating rodents. Their presence has no negative effects, and there has been a drop in rodent infestation in several parts of the farm. However, for the experiment to be a success, any costs incurred have to be balanced against the reduction in chemicals costs, and so far the two are just about even. It is necessary for the bird population to rise, and to spread about the farm.

Getting the birds to patrol a wider area of the fields means putting more perches, and this has not been a total success, as the perches have to be completely rigid. However, it can be done.

Increasing the number of birds as a whole is another issue. There will be more perches and the bird population on the farm will rise, but Dr Diekmann thinks it will be 10-20 years before the maximum number of perches are installed and the bird population reaches saturation point. He doesn't want to move too quickly. "We want the population to increase slowly in case there are problems we don't know about. There are constraints anyway—in a bad year, many of them will die, and anyway, they can get killed outside

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the farm. As to using birds alone to control rodents, no, that's not possible. Even with chemicals, we'll never eliminate them completely." He points out that the number of birds will always be limited by their food supply, which means by definition that their population will always lag behind that of rodents. "But we can solve a big part of the problem this way, and we are trying."

Spreading the word

The technique may spread outside ICARDA. Hrisham Hreitani, who works in ICARDA's Sheep Unit, rotates barley and lentils on just over six hectares of his own 38 km from Aleppo, in the Baab area. When he bought the land six years ago, he built a small house for himself there—but never used it. A couple of owls moved in instead. And a lot of rodents moved out. His neighbors, however, do still have damage. "I think this helps. I'm quite pleased to have owls as my house guests," he reports.

Dr Diekmann says that he is not actively marketing the idea beyond ICARDA (we have, after all, nearly 1000 hectares of our own to take care of).

But he and his staff would be pleased to advise farmers on how to encourage birds, and will even supply them with a perch and a leaflet to show them how to do it.

And he is not just interested in birds. "Snakes are a useful predator where rodents are concerned," he says, "and anyway, there's no need to kill them—we've only ever identified one poisonous type on the farm." (It was a viper, with reddish-brown stripes running down the length of its body.) He says he has now got the message across to the Center's workers: snakes are your friends, don't kill them. He may find people outside difficult to convince.

Still, when it comes to rodent control, snakes may be better than poison. And birds certainly are. ■

When sheep's tails had wheels

They did once—in Aleppo at least, according to Dr Alexander Russell. His *The Natural History of Aleppo* provides a fascinating glimpse into the past of ICARDA's home region.

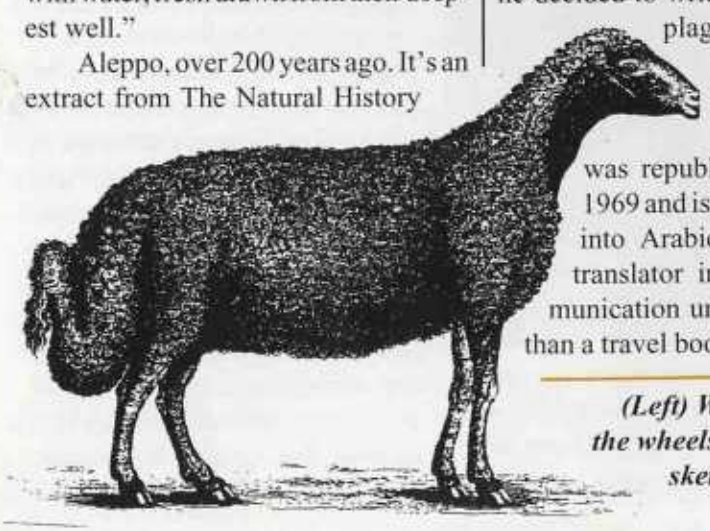
by MIKE ROBBINS

"The Peasants are simply clothed, indifferently lodged, and live chiefly on coarse bread, *Lebban*, pulse, barley and melons. They rarely taste mutton, or lamb, except at festivals; and a great part of their poultry and eggs is sent also to the town market. They, in reality, enjoy but a scanty pittance of the fruits of their labour, yet on occasion they show a spirit of hospitality which would grace better fortune.

"They freely offer a portion of their homely fare to the stranger, and the women press forward to present him with water, fresh drawn from their deepest well."

Aleppo, over 200 years ago. It's an extract from The Natural History of Aleppo, by Alexander Russell, physician to the British Factory in the city; living there for some years up to 1753, he decided to write an account of the plague in those years, and later expanded it.

The book was republished in Britain in 1969 and is now being rendered into Arabic by Khalid Jbaili, translator in ICARDA's communication unit. It is much more than a travel book. Dr Russell was a shrewd observer of all things Aleppine—including botany and agriculture.



(Left) Well, he didn't draw the wheels! An Awassi sheep sketched by Dr Russell in the 1750s.

Inputs

"The fields near the city," he reported, "are made, by force of manure, to yield annually two or three crops of different kinds. Where manure is not employed, which is the case in most places remote from towns, the fields are sown only once a year, with different sorts of grain alternately, but are seldom permitted to lie fallow."

Did progressive farmers better understand the importance of inputs - or was it just that their proximity to the market made it worthwhile? Perhaps others had no means of profiting from a surplus.

As the Farm Resources Management Program of ICARDA was not in business then, no one thought to enquire.

"They sow the following grains: wheat, barley, lentils, chiches, beans (he was referring to faba bean), chickling, small vetch, a small green

Aleppo in the 1750s: an important crossroads between East and West

kidney bean, and India millet...The horses are fed universally with barley; but Lucern is also cultivated for their use, in the spring."

A hazard...

"The grain [is stored in] large subterraneous grottoes with one round opening at the top; and this being close[d] shut, when the magazine is full, is covered over with earth, in such a manner as to remain completely concealed from an enemy. These magazines are sometimes found...even in the middle of the high-way; and as they are often, when empty, left carelessly uncovered, travelling near the deserted villages, in the night, becomes extremely dangerous."

Dr Russell went on to tell much of the agriculture of Aleppo; cotton, tobacco, olives, herbs and many different kinds of fruit are mentioned, often with approval.

But he is scathing about the local red wine, which was "deep coloured, strong, heady, without flavour, and more apt to produce drowsy stupidity, than to raise the spirits."

Clearly the good Doctor did not drink it much, for he was most observant. The local Awassi sheep did not pass unnoticed; the tail of a large sheep, he claimed, might weigh 50 pounds, and then as now the fat from it was much used by local people.

"The sheep of the extraordinary size above mentioned are very rare, and usually kept up in yards, so as to be in little danger of hurting their tail[s] as they walk about; but in the fields, in order to prevent injury from the bushes, the shepherds, in several places of Syria, fix a thin piece of board on the under part, which is not like the rest covered with wool, and to this board are sometimes added small wheels; whence, with a little exaggeration, we have the story of the Oriental sheep...having carts to carry their tails."

It is hard not to admire Dr Russell; his writing, sketches and lively interest in his surroundings suggest a shrewd and likeable man.

Sadly, he did not live long after leaving Aleppo; hard work back in England, where he continued to practice medicine, may have contributed to his death in 1768. The manuscript was edited by his brother, who had also lived in Aleppo, and was published some years later. ■

Is time worth money in Sivas and Kayseri?

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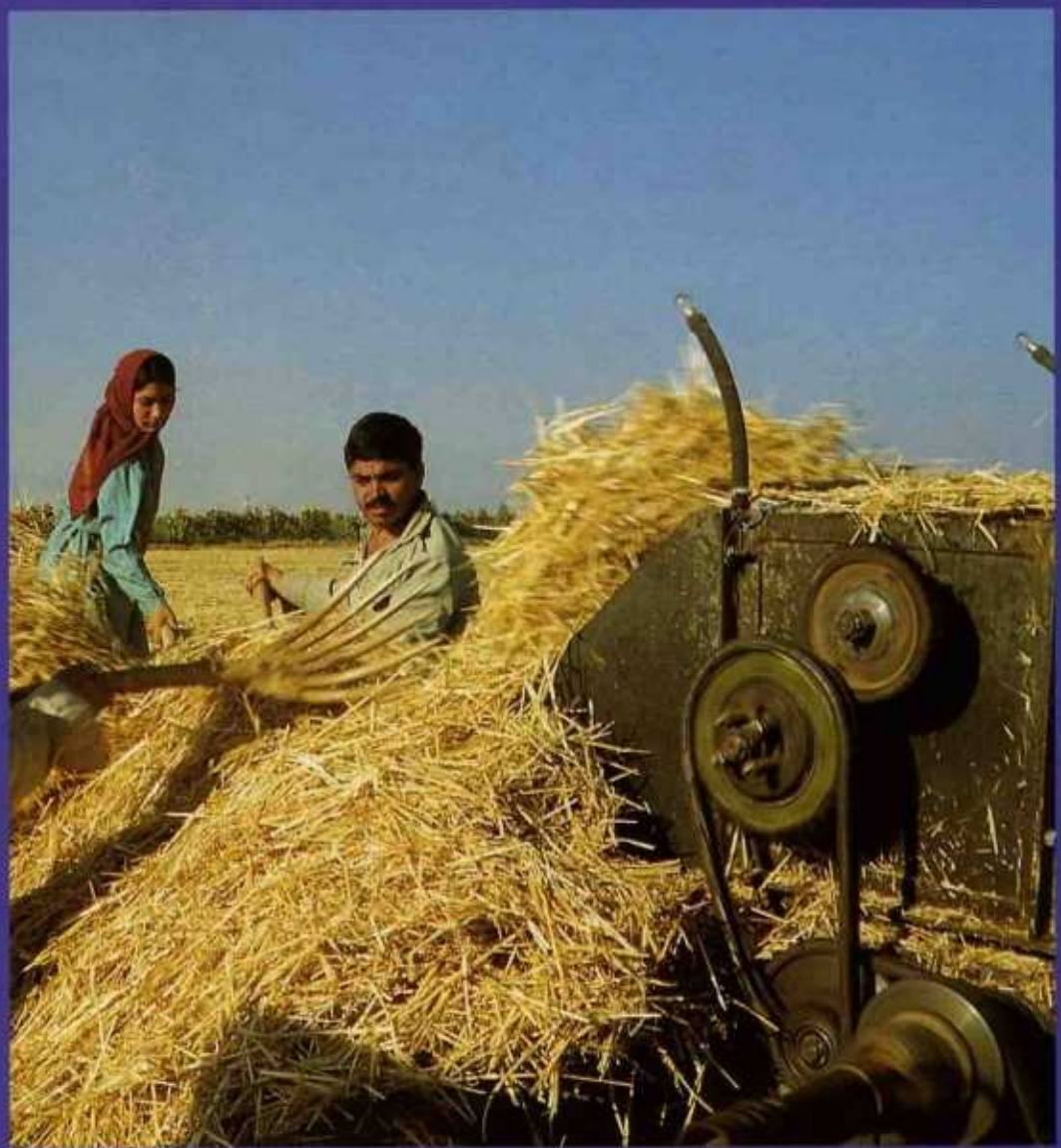
* The smallholders' biggest need is cash. Most of the problems they themselves identified were financial.
* Offering soft loans is not the answer. Debt is already high; in fact, previous loan schemes may be part of the problem.
* In all farm-size categories, there was a high percentage of labor days unused for either on- or off-farm purposes. In the case of the smallest farms, it was 58%.
* There is plenty of scope for boosting yield through improved agronomic practice. But this will be of more help on large farms, where wheat is more profitable. Farmers themselves identified poor wheat prices as a constraint.

Time is money

We hypothesize that the answer is to replace capital with labor. More intensive animal husbandry can help, coupled with income-generating product sales (milk, butter, yoghurt, meat etc.). Fallow replacement can also play a role; Sivas and Kayseri were not part of an earlier Government scheme for this, and fallow accounts for 28.7% in the below-10-hectare category.

All this must be done with labor, not capital. Time is money in Sivas and Kayseri.

Principal contributors besides Dr Tutwiler: A. Bayaner and V. Uzunlu, Central Research Institute for Field Crops (CRIFC), Ankara; J. D. H. Keatinge and S. P. S. Beniwal, ICARDA Highlands Regional Program, Ankara; and M. Martini, Farm Resources Management Program, ICARDA, Aleppo, Syria. ■



Labor is often the greatest resource of the farm family. In recent years, the West Asia and North Africa region has been experiencing major changes in the relative availability and cost of land, labor and capital. These changes have important implications for the design of new agricultural technology. ICARDA's research must ensure that improved technology is technically, economically, and socially suitable to farmer conditions.