# Statement
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**Before the**
**House Hunger Caucus**
**June 5, 2008**

## Agricultural Development and Long-Term Solutions to the Food Crisis

**June 2008**

## Statement of Amit H. Roy Before the House Hunger Caucus

Co-Chairs, Representatives Earl Pomeroy, Jerry Moran, Jim McGovern, and Jo Ann Emerson, and distinguished members of the Committee, thank you for giving me the opportunity to meet with you today to discuss long-term solutions to the food crisis—a crisis that is particularly cruel for the developing world.

First, let me say a few words about IFDC. IFDC is a public, nonprofit, international research and development organization with headquarters in Muscle Shoals, Alabama. It was established in 1974 as a response to the food crisis that was at that time affecting the developing countries and at a time when oil prices had skyrocketed. Our mandate is to help developing countries and transitional economies increase agricultural productivity through the proper management and use of fertilizers. We have offices in more than 20 countries and activities in another 30 countries. Our greatest focus is on sub-Saharan Africa, where nutrient-depleted soils are the main constraint to agricultural productivity. We are funded by bilateral and multilateral donors including the United States Agency for International Development (USAID).

The recent increase in food prices has caught the world by surprise, particularly since low commodity prices were viewed as the bigger challenge and food prices were predicted to continue to decline steadily only a few years ago. Instead, the international food price index rose by 43% from March 2007 to March 2008, compared with just 9% in 2006. While some farmers welcome such price increases, they are causing incredible hardships for those subsisting on $1 per day or less. Thus, we have an immediate problem that must be addressed with urgency, sufficient expertise, and resources. At the same time, short-term solutions to the current crisis should not compromise our ability to develop and implement effective long-term solutions. The world population will continue to grow, mainly in developing countries. Incomes are also increasing rapidly in some countries, especially China and India, whose combined populations comprise almost 40% of our global population. This means greater demand for more and better food—especially meat—leading to an increased demand for cereals such as corn or maize, and the plant nutrients to grow them.

You have asked me to share my perspectives on:

- The role of agricultural inputs such as fertilizer and seeds in the current food crisis.
- How to use such inputs in long-term solutions to the food crisis.

### Role of Agricultural Inputs Such as Fertilizer and Seeds in the Current Food Crisis

The fundamental driving force for soaring food prices is the increased demand, particularly for meat and dairy products, from a growing middle class in many developing countries, especially China and India. Exacerbating the situation is a new and rapidly growing biofuels industry and a substantial crop failure in wheat. The rising cost of fertilizers and energy for food production and distribution also contributes. Other factors include financial speculations and limitations or bans on grain exports by some governments. We cannot expect food prices to level off until good harvests are achieved, productivity is increased, and world grain stocks are replenished.

The three main nutrients required for plant growth are nitrogen, phosphorus, and potassium. The most common and widely traded source of nitrogen is urea; of phosphorus is diammonium phosphate (DAP); and of potassium is muriate of potash. From April 2007 to April 2008, urea prices increased by 43%, DAP prices by 200%, and potash prices by 176% (Figure 1). These unprecedented price increases are because fertilizer supply has not kept pace with fertilizer consumption, and prices of raw materials including energy has increased rapidly.

The three nutrient sources for fertilizers are derived through different processes. Nitrogen is produced from atmospheric nitrogen through an energy-intensive process commonly fueled by natural gas. Phosphates are mined from phosphate deposits, with variable quantities and qualities of available phosphate. Currently, 65% of the world's phosphate resources are in Africa. Potash is also mined. Investment costs for fertilizer production are enormous and construction of new plants and mines typically takes at least 3 years.

Fertilizer prices cannot be expected to fall until a new investment cycle reaches fruition and supply again matches demand. Even then, if energy prices continue to hover at current levels, nitrogen prices will remain high. Similarly, phosphate fertilizers, particularly DAP, will remain high because of the higher costs of quality phosphate rock and sulfur. Investment costs in fertilizer manufacturing plants have also escalated considerably in the past 2 years.

Soil fertility is central to crop growth. Both inorganic and organic fertilizers are an important way to maintain or increase soil fertility on agricultural lands. But resolving soil fertility issues in isolation will not achieve the productivity gains required to feed the poor in developing countries, or even in Africa where nutrient depleted soils are the main constraint to increased productivity. Removing one constraint simply reveals the next. The situation requires holistic solutions that address a range of barriers: lack of access to improved seed varieties and inputs such as fertilizers because they are either unavailable or too costly; low crop management skills; poor market linkages for agricultural outputs; and limited access to credit at all stages in the value chain. Within this panoply of need, the surest way to increase productivity in most environments is to improve soil fertility through proper fertilizer use, and to "deploy" plant genetics by providing quality, nutrient-responsive seeds to farmers. No amount of fertilizer can achieve results beyond the genetic potential of the crop variety. Similarly, no variety can achieve its potential without proper nourishment. Raising yields significantly requires fertilizers.

This was the basis for the Green Revolution. In the 1950s and 1960s, food shortages in south-east Asia, resulted in mass starvation and famines. Developed countries, led by the United States, responded with massive food assistance. There were also dire warnings of food shortages—that the 1970s would be a "time of famines." This situation led to the establishment of international research centers that focused on new crop varieties that would double or even triple yields from the same area of land. The introduction of these seeds, along with proper fertilization, launched the Green Revolution. In 1970, Dr. Norman Borlaug was awarded the Nobel Peace Prize for developing high-yielding semi-dwarf wheat varieties that spearheaded the Green Revolution. In his acceptance speech, Dr. Borlaug stated, "If high-yielding dwarf wheat and rice varieties are the catalysts that have ignited the Green Revolution, then chemical fertilizer is the fuel that has powered its forward surge." The use of high-yielding varieties (HYV) of seed and fertilizer expanded rapidly in both Asia and Latin America. As a result, cereal production has more than doubled; 80% of that increase is from higher yields and only 20% because of cultivated land area.

Thus, well-functioning seed systems are essential to all productive agricultural systems. These systems provide farmers with seeds adapted to their environments and market channels to promote continual improvement in productivity. Research organizations have found that even after developing promising crop varieties, they often lack the resources to make them available to farmers. Unfortunately, expectations in the development of the seed industry of the 1970s and 1980s have not been met, particularly in Africa. This is mainly because rigorous seed quality control must precede the industrialized agriculture it is intended to support. But formal seed systems are inadequately funded by both the public and private sectors in many developing countries. Consequently, the proportion of seed actually supplied through those formal channels remains low. A further consequence is that more than 75% of seed that African farmers use today is obtained through informal channels of exchange, community seed production, and seed that the farmer saves from harvest.

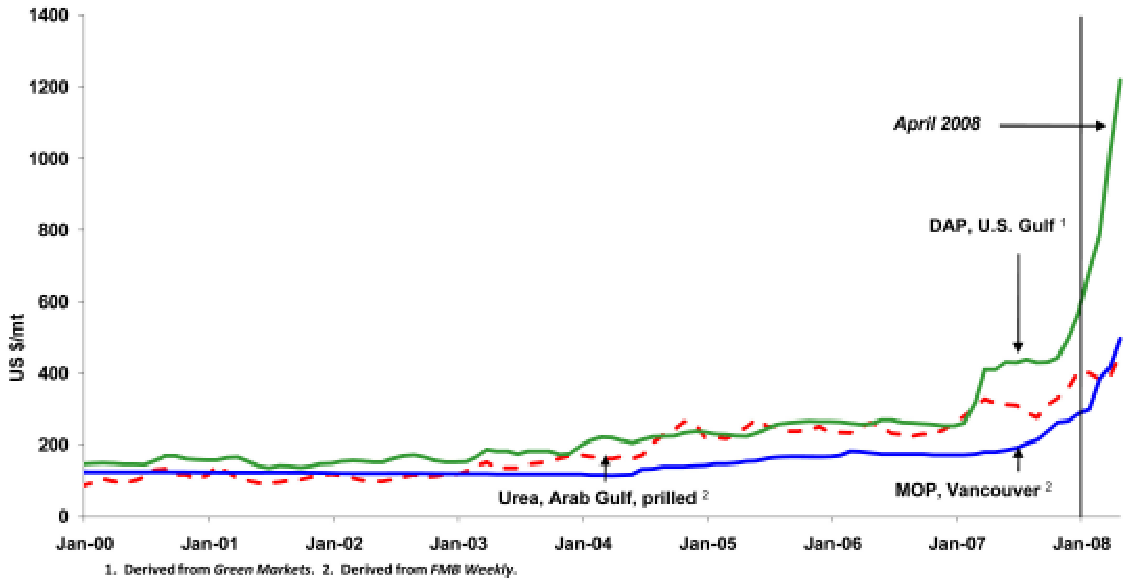


**Figure 1. Fertilizer Prices**

The annual average fertilizer use in Sub-Saharan Africa (SSA) is the world's lowest—only 7 kg of nutrients per hectare. Compare that with the world average of more than 100 kg of nutrients and almost 200 kg in the Green Revolution countries of Asia (Figure 2). This is particularly ironic because more than 65% of the world's known phosphate reserves are in Africa (Figure 3). Inadequate plant nutrients is why the meager production increases in SSA have been mainly through expansion of land area cultivated, often into marginal and fragile areas, destroying wildlife habitats and contributing to global warming (Figure 4). Such nonsustainable production systems continue to "mine" African soils of their vital nutrients (Figure 5).

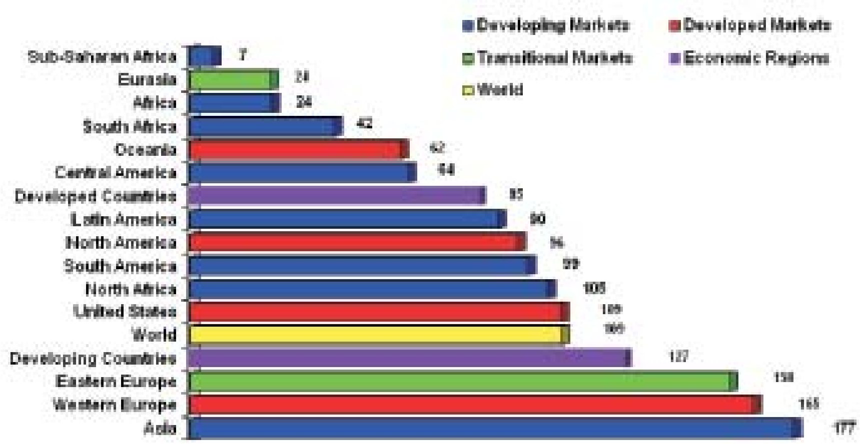


**Figure 2. Per Hectare Fertilizer Use by Markets and Economic Regions, 2005/06**


**Figure 3. Significant Phosphate Rock Deposits of Africa**

But not all is doom and gloom in Africa, as we shall see.

Poor non- and semi-commercial farmers and the urban poor in developing countries are bearing the brunt of the global food crisis. Their situation will be worsened by the certain faltering of the development processes in SSA and the least-developed Asian and South American countries. The Green Revolution successes lulled the world into believing that the food production problem was solved and that production would keep up with population growth. Governments and most international organizations cut back on agricultural research and development expenditures in developing countries. In 1990, about 12% of global Official Development Assistance or foreign aid went to agriculture. Today it has dropped to 4%. In the early 1980s, 30% of World Bank lending was for agriculture, but only 10% by the early 2000s. USAID reduced its commitment to agriculture comparably.

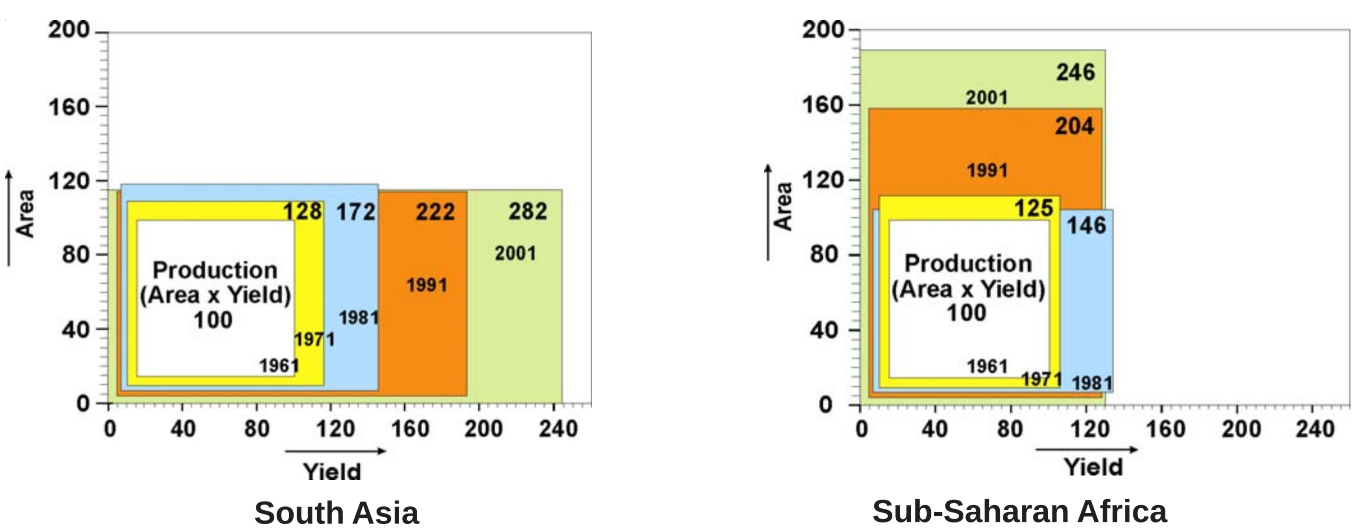


**Figure 4. Cereal Production, 1961-2001 (% Change)**

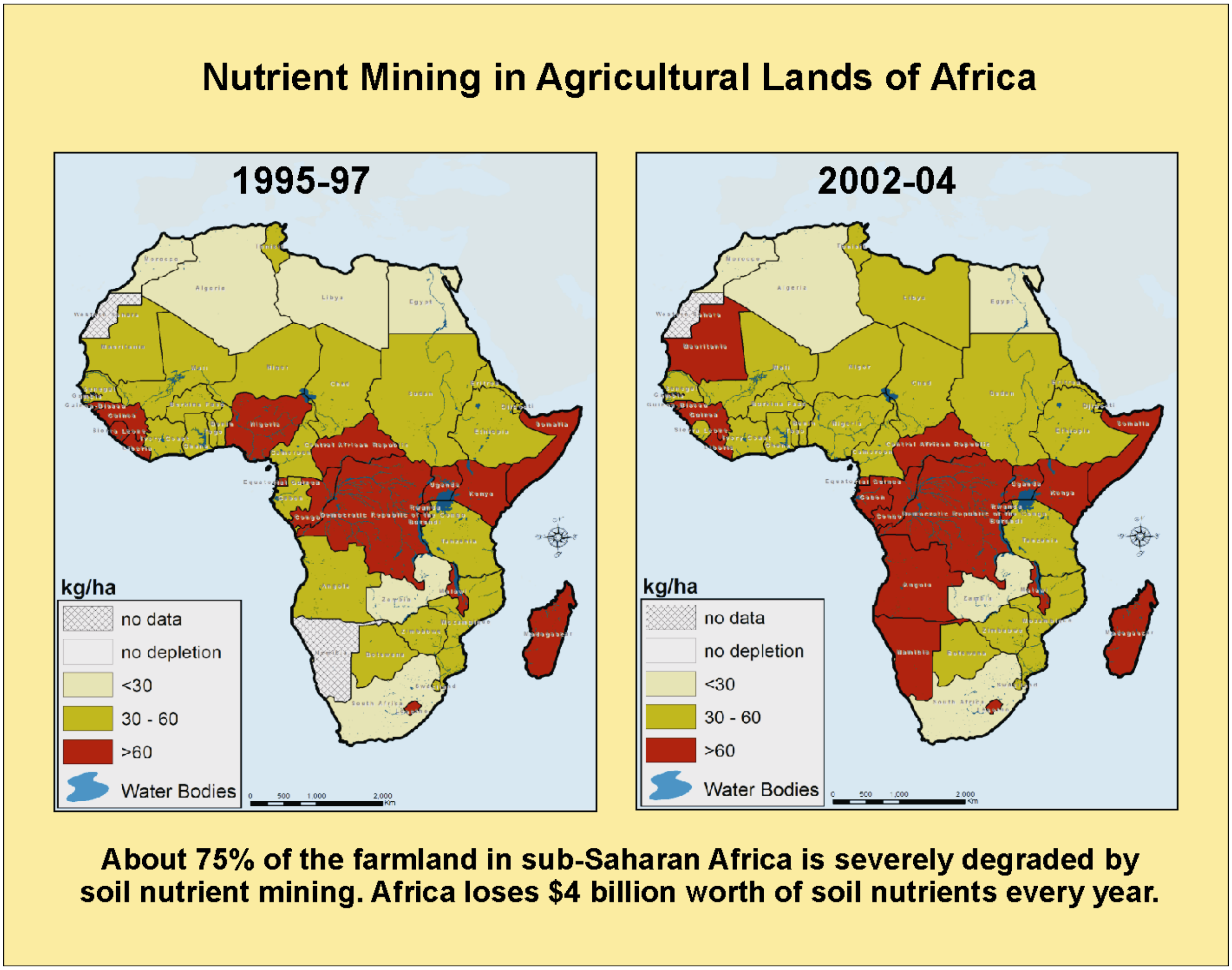


**Figure 5. Nutrient Mining in Agricultural Lands of Africa**

During this period, the international centers continued research to develop new and better varieties, but at a substantially reduced scale. The private sector, sensing an opportunity, invested heavily in biotechnology research and developed several high-yield, disease-resistant crops.

Despite all the problems, the past 10 years have seen Africa's longest sustained positive per capita economic growth since the 1960s. Also, African governments have committed to a comprehensive and coordinated approach to agricultural development through the Comprehensive Africa Agricultural Development Program (CAADP), under the New Partnership for Africa's Development (NEPAD), an initiative of the African Union. African Heads of State have committed to spend at least 10% of national budgets on agricultural development. But the current food crisis endangers this momentum, along with the Millennium Development Goals and the Africa Fertilizer Summit Resolutions. The African Fertilizer Summit was a African Union led Head of State meeting specifically to address low fertilizer use in Africa and ways to improve agricultural productivity through increased use of fertilizers and modern varieties of seeds.

The objective of any intervention in SSA or other developing countries should now be to help poor farmers while encouraging—or at least not disrupting—progress already made toward competitive market systems.

## How to Use Such Inputs in the Long-Term Solutions to the Food Crisis

First, I want to emphasize that promoting agricultural productivity in Africa, where both the need and opportunity are greatest, requires that we focus on major food staples: cereals, such as maize, sorghum, millet, and rice, and root crops like cassava, yams, plantains, and bananas.

Fertilizer must be part of our long-term approach. Furthermore we must focus on increasing efficiency of fertilizers in future use. Although fertilizers were a key component of the Green Revolution, fertilizer has received little attention over the past two decades. Most of the present suite of fertilizer products were developed by the fertilizer program of the Tennessee Valley Authority (TVA) through U.S. Government funding. The TVA fertilizer program, which had more than 1,500 members at its peak, was discontinued in the early 1990s. The TVA products were designed in an era of apparent energy abundance, but we now recognize the increasing scarcity, and thus higher price, of energy. The burden of increasing emissions on global climate falls most heavily on developing countries.

The current fertilizer products and application methods are wasteful. Growing plants sometimes use only 30% of the nutrients that farmers apply as urea. This is particularly alarming because urea is not only a "modern" high-analysis fertilizer, it is also the dominant nitrogen fertilizer product, in terms of market share, used by farmers worldwide. Based upon the current manufacturing processes the energy equivalent of about 4 barrels of oil is used to convert "free" atmospheric nitrogen to 1 ton of urea. But after leaching and atmospheric losses, the energy equivalent of about 2.5 of these 4 barrels of oil are wasted for every ton of urea applied. Furthermore, the "lost" nitrogen becomes atmospheric or water pollution.

Also important, consider the energy wasted in transporting more fertilizer product than plants actually need. We must direct far more research and development resources to the improvement of efficiency of nitrogen fertilizer use.

Phosphorus, another necessary nutrient for plant growth, is mined as phosphate rock—a nonrenewable resource. Conversion of phosphate rock to soluble fertilizers such as DAP is inefficient. With current technology and rate of use, the world has only 200 years of known reserves of phosphate rock. The cost of exploiting phosphate resources will rise as we exhaust the more readily accessible deposits. Phosphates will be a far greater concern than nitrogen or potash in the next decade. Thus, research is urgently needed to improve efficiency of existing processes for processing phosphate, and/or utilizing phosphate rock directly from the mines, without processing.

We must develop "smart" fertilizer products through investments in the next generation of fertilizer products using advanced techniques in conjunction with plant genetics. "Smart" fertilizers will release nutrients only at the time and in the amount needed, and will diminish environmental externalities. We must also develop systems to make these products cheaper and more accessible to developing country farmers. Fertilizers, to be fully effective in achieving higher productivity, must be applied as part of a comprehensive package of high-yielding varieties, crop protection products, and appropriate farm management techniques. Fertilizers, seeds, and other farm inputs cost money, so they are practical only when applied in the context of a viable value chain that compensates the producer for production costs and returns a reasonable profit.

I want to share results of some interesting work in rice production in Bangladesh. Traditionally, farmers across the tropics have broadcast urea


**Figure 6. Loss of Urea in Rice Production**

directly into the paddy floodwater—a practice that is only about 30% effective in terms of nutrient uptake. Thus, two of every three bags of urea that a farmer applies are lost (Figure 6). To reduce losses and improve productivity, Bangladeshi rice farmers are adopting urea deep placement technology—inserting large briquettes of urea into the rice root zone. Farmers are increasing yields by 25% while using 40% less urea by using urea deep placement. Farmers worldwide need this type of gains in efficiency and productivity.

In addition to greater investments in research, we must address important policy issues that can improve agricultural productivity and efficiency at all levels. One such policy issue is farmer access to fertilizers and seeds. Many advocate direct product subsidies on the grounds that poor farmers in developing countries cannot afford fertilizers and HYV seeds. More than 15 countries provide direct or indirect subsidies to reduce the cost of fertilizers to farmers. These subsidies increase as prices and consumption of fertilizers increase. This year, India will spend about $22 billion on fertilizer subsidies. However, because there is no incentive for farmers to maximize return from use of fertilizers, this method of fertilizer subsidy results in inefficient use leading to low agricultural productivity and air and water pollution. These expenditures are at the expense of other important government investments in rural areas such as roads, schools, and health clinics.

Some argue for free distribution of fertilizer and seeds. Others claim that free distribution will destroy or prevent growth of the private sector. Voucher programs are an option to support and strengthen commercial distribution by transferring purchasing power to subsistence farmers who can't afford to pay high prices for inputs such as fertilizer. Vouchers can be given at a discounted price or earned by targeted farmer groups, then redeemed through private sector dealers for fertilizers and seeds. Voucher programs can also make reduction of subsidies over time easier as farmers become more commercial, build their capital bases, and become more credit-worthy. Voucher programs also allow use of subsidies as incentives for extension and farmer adoption of productivity-enhancing technologies.

## Conclusion

The food price crisis has caught many by surprise, but the demand for food and feed has been increasing steadily for some time. The biofuel phenomenon and vagaries of weather have exacerbated the situation.

Fertilizer and HYV seeds were key to the Green Revolution that saved more lives than any event/technology in history. But during the past year, fertilizer prices have risen faster than any other farmer input. The high prices make it almost impossible for farmers, particularly in developing countries, to access fertilizers. This will reduce crop yields, worsen the current food situation, and lead to further deterioration of soil fertility.

Immediate relief is obviously needed. But short-term relief should not undermine long-term solutions. The successes of the Green Revolution mislead policymakers into believing that food production would keep pace with demand. Governments and most international organizations cut back on agricultural development expenditures in developing countries. Meeting the current food production crisis will require a major recommitment to agriculture research by developing countries and donors. Our focus should be to increase efficiency and productivity in all farming systems, particularly in dryland and rainfed environments, and along the entire value chain to produce better food at lower cost, and save energy while protecting natural resources, biodiversity, and the environment.