

CHALLENGES FOR AGRICULTURAL SCIENTISTS

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Historical Perspectives

Since the dawn of civilisation, advances in agriculture have played a pivotal role in allowing on-going progress in human well-being and human pursuits. Without a filled belly, no civilisation can flourish and achieve continued progress. Contributions by agricultural scientists have served to fuel dramatic advances in the supply of food, fibre and other basic necessities by applying Mendel's law of heredity, the combined use of water, fertilisers and pest control, and labour-saving machinery in large fields. The underlying knowledge for such scientific innovations has come from the natural sciences, especially biology, together with engineering, and the experience and initiatives of farmers themselves.

Until recent decades, scientific innovations experienced widespread use in the developed nations but much less so in the developing countries. Meanwhile, total human population has risen from one billion at the beginning of the twentieth century to over six billion in late 1999. Of these about three billion have been added since the end of World War II. Food production remains inadequate in the developing world where a high proportion of the population remains under-nourished. The history of continued progress in agriculture has been the product of a true integration of technology, science and human endeavour. These processes have amply demonstrated the importance of the inter-dependence between scientific disciplines and demographic factors.

Achievements in the Developing World over the Last Three Decades

Since the early 1970s, giant strides in food production have been made in the developing world, in particular in rice and wheat, in what is widely

known as the 'Green Revolution'. Not only was the spectre of the predicted widespread food shortage of the 1970s averted, but calorie intake *per capita* has been appreciably raised.

Recent estimates calculate that about 78 percent of rice land has been planted with modern varieties; the corresponding figure for wheat is about 60%. In the year 1992-93, rice yield was nearly double that of 1961; for wheat, a gain of about 60% was achieved.

Yield increases in rice and wheat scored an annual growth rate of about two percent during the period of 1970-90, but the growth has slackened since 1990 and the yield potential has remained the same since the late 1960s. Further advances in wheat and rice yields have also slowed down in recent years. During the same period, other cereals and root crops have also scored production increases but they have been less dramatic than is the case with rice and wheat. The massive US food aid programmes have disappeared.

The Human Factor

While the role of scientists has been emphasised up till now, we should not overlook the essential human attributes in these processes: dedication, pride, perseverance, and incentives. Agricultural research has been discouraged by the low respect and poor incentives accorded to its research, educational, and extension groups. Even more important is the less than equitable returns on the toil of farmer. Unless we attack the roots of the malaise, food insecurity will be the primary destabilising event on a grand scale during the twenty-first century. Its damaging consequences and ramifications will also affect the developed nations.

When scientists of all professions come to grips with the realities of the uncertain future with an eye on the plight of the under-privileged rural population, they will be in a better position to further the benefits of science and attract more young men to pursue scientific endeavour. Indeed, man and science are intertwined and are inseparable parts of scientific advance. Continuity is the essence of progress.

Rising Constraints in the Twenty-First Century

A number of wide-ranging and widespread constraints lie ahead. Productive land is on the decline due to competition from industrial and housing development, highway-building projects, and soil erosion. New

irrigation projects have been installed with high costs and low local investment. Old projects are increasingly silted and in poor repair. Good quality water is becoming scarcer and more costly. Region-wide climatic aberrations have upset the stability of rainwater supply. Above all, the escalating rise in food production costs, poor returns from declining crop commodity prices, and the shortage of labour on farms, have all discouraged farmers from investing in increases in production. The dwindling supply of both natural and human resources has lowered the scale of vital improvements and on-farm experimentation. Most governments and urban communities are neglecting the primary food-producing sector. Meanwhile, the world's population continues to grow at burgeoning levels, although at a slightly lower rate than that envisaged by previous predictions.

Centres of modern and intensive production are beginning to face the aftermath of overly intensive cultivation: pest epidemics, soil degradation through erosion, salinisation and alkalisation, and the pollution of neighbouring areas.

What and how much Can Agricultural Scientists do?

While agricultural scientists will again bear the primary responsibility for dealing with a long list of daunting challenges, all sectors of society and the international community must mount an all-out and co-ordinated campaign to cope with the problem of food security on a global scale before serious food shortages suffered by an impoverished and populous planet grow into civil strife and international conflict. The basic element in enabling food supply to meet increased demands and expectations is of such paramount importance that it cannot be lightly treated as mere routine business. Research, educational and extension groups need to work together to sharpen their focus; and they should work together for a common cause. Agricultural scientists themselves need to re-assess their strength and weaknesses in order to redirect their strategy and logistics, and thereby recapture the momentum of the past decades. The necessary moves proposed are as follows: (1) a return to, and improvement of, the 'bread and butter' type of productive research which has suffered greatly from the heat waves of biotech; (2) an exploitation of the merits of biotech, but with due consideration of related issues such as ethics, intelligence property rights, bio-safety, and social justice; (3) more mission- and field-oriented-young researchers/workers, who need to be trained and supported. Above all, inter-disciplinary and institutional collaboration must be fur-

ther strengthened and implemented. Agricultural scientists must respect and use the expertise, initiatives and experience of farmers and enrol the latter as partners in field research. Farmers are no longer an ignorant and passive sector. Enhanced education in rural areas will elevate their standing and representation in society.

Thus, the synergism of science and man can be reaped to mutual advantage. Such an interaction will enable us to deal with this urgent problem in time.

REFERENCE

Papers by T. T. Chang, P. Pinstруп-Andersen, and D. Byerlee *et al.*, in the 1999 P.A.S. Study-Week entitled "Food Needs of the Developing World in the Early 21st Century", 27-30 January 1999, the Vatican.