



## Final Discussion and Conclusions

G. MONTALENTI

Ladies and gentleman, I would like to call the meeting to order and this should be the final discussion. I would like to convey the greetings of the Italian Society of Ecology and to express my feeling of great appreciation for this meeting which will be closed today, for the very important new trends of policies of environmental and agricultural resources which have been discussed. This meeting will certainly not be a final but a starting point for a new policy and for new techniques. I will call on the members who will take part in the final discussion: *Dr. Barbosa, Dr. Marini-Bettòlo, Dr. Naponpetch, Dr. Odhiambo, Dr. Pimentel and Dr. Scarascia Mugnozza.*

I propose that a short summary of what has been discussed during the meetings be started by Prof. Barbosa, going on in the order indicated with exception of Dr. Odhiambo and Dr. Marini-Bettòlo, who will close the discussion and submit a final document to the participants in the meeting. May I ask Dr. Barbosa to begin.

BARBOSA

During this meeting, we have discussed several agricultural aspects and how to develop a new Green Revolution and how to avoid problems brought about by the first Green Revolution. Being myself an entomologist and concerned with plant protection, I would like to stress that the future of plant protection should be based more on integrated pest management. Everybody concerned should help the developing world in this so that integrated pest management can go to the field, at farm and village level, and be of help to the farmers. My recommendation, based on what Dr. Hartmans mentioned, refers to the great potential that exists in the crops in relation to the germplasm which has not yet been explored and exploited to its maximum potential. A few years ago there was a movement to protect germplasm from erosion and if the germplasm has not yet been used to the extent it should, at least it should be maintained for future utilisation. Illiterate farmers in the Third World will not be able to read the recommendations for integrated pest management, but if these farmers are given seeds of resistant varieties which do not require the use of pesticides, this would save all costs involved in integrated pest management. Of course, the use of resistant

varieties will not solve all the problems, but I am convinced that it should be the cornerstone of future integrated pest management.

My recommendation is therefore that resistant varieties be considered as the basis for any integrated pest management programme. Thank you.

#### NAPOMPETH

I am sure that developing countries in Asia, Latin America or Africa share common interests, either we are looking forward to new strategies, new techniques or any viable technology that we could possibly yet find to suit our local conditions. In the past, biological control has been very much neglected. Now it has been identified as one of the most obvious and needed areas of future investments in terms of research and implementation. But it is being developed as a separate discipline with a view that it can be incorporated into the future integrated pest control programmes. My past experience of both biological control and integrated pest management tells me that a lack of communication blocks this development. What is going on in one country is not known in neighbouring countries. Likewise, within the same country, projects and activities are not known in the vicinity. More effort should therefore be given to what I would call intra- or inter-communication on the projects' implementation and achievements.

In the past, we made a mistake: the agro-chemical people used their own language and the biological control people turned their back on the agro-chemical people. This should be changed, by turning ourselves around, talking the same language and by trying to utilise, to our best advantage, the benefits we have; put our results together and then try and work out a common strategy in a harmonious manner. Thank you.

#### MONTALENTI

You have made a very important point, that the intra- and inter-communications are lacking.

#### PIMENTEL

The themes I would like to deal with here are the ecological problems, the environment problem and the energy problem. The major breakthrough for agriculture in the future is that we will finally get a managing agriculture as a holistic system. And if we do consider that a holistic or system approach will be a step forward in the next Revolution, then I see it focusing on what I term an ecological resource management strategy for a productive sustainable agriculture. Then, we really can put the pieces together.

The most serious environmental problem is soil erosion. With soil erosion you get rapid water run-off, loss in nutrients, loss in organic matters, and all these factors influence productivity, particularly the loss of water. Water is the most limiting factor in crop production in the world today. Next come nutrients.

It takes 500 years, approximately, under agricultural conditions, to get 2½ cm or 1 inch of topsoil to be replaced. We have no resources or methods to reduce that time, so I consider it a fundamental resource to our whole agricultural system. We dispose today of techniques and technologies to conserve water, soil, nutrients, and, at the same time, to reduce pest problems. I will give some examples: crop rotation, alley cropping, strip cropping.

These are the major points that we should work together. And I am not only talking about the agricultural scientists but also our colleagues the economists and the sociologists can aid in adopting these technologies. Thank you.

#### SGARASCIA MUGNOZZA

I am convinced that future progress in world crop production, especially in the less developed countries, must be reached by a systematic, integrated agricultural system, i.e., by paying attention to ecological, sociological and economic aspects and by involving the farmers, by heading an appropriate governmental policy, etc.

Being myself a research fellow in the field of applied biology, in other words, an agro-biotechnologist, I will say something more from a genetic and breeding point of view. I believe we must consider a series of facts, not only disease, pests and herbicide resistance, as has been said during this meeting, but also look at an ideotype appropriate to environmental conditions. In other words, we should work, in the genome of cultivated varieties, for the introduction of hereditary changes, which are better adapted to the environmental architecture of the plants, we should work for changing the life cycle of the plants to escape insects and diseases, for a better use of fertilizers and water, and, above all, for obtaining resistance to all physical and chemical stresses: drought, frost, salinity, aluminium and other constraints present in the soil.

But it should not, according to my opinion, be limited to consider only genetic engineering as the most relevant and advantageous application of biotechnologies in agriculture. Certain production qualities need also to be improved, pollution to be controlled, nutritional diets to be diversified, to give a few examples. Many of these strategies need drastic governmental regulations, as such strategies often increase costs and reduce competition. But agricultural policies need to be studied and adopted in an integrated context, where different production sectors are interlinked. As a matter of fact, sectorial policies can be very inappropriate and dangerous in the short term, especially whenever agriculture is part of the commercial exchange sector.

Scientific and technological research is essential in order to maintain and sustain high production levels as it also may help to eliminate the surpluses; although, for economic-political reasons beyond its control, it has contributed to creating and accumulating them. It can play a vital role in the establishment of sustainable food and nutrition security, provided it is coupled with economic and social policies rooted in human values and developed with respect for the environment.

MAREVI-BETTÖLO

On behalf of the Academy I wish to express my thanks to all the participants in this very interesting, and I may say, important meeting. Important because it has for the first time considered the possibility and thus the strategies to extend to Africa the new techniques in agriculture which made possible the *Green revolution* in Asia with great benefit for millions of inhabitants.

It has been shown that the results cannot be transposed to Africa without some important modifications because of the differences not only in climate, soils, plagues and cultivars but also in tradition, habits and social organization. Even more, the experience of more than twenty years in Asia has demonstrated some negative aspects of these techniques, e.g., the impact on the environment from the increasing quantities of pesticides — which need to be reconsidered.

Many new avenues have been suggested and discussed in this meeting. I should like also to recall that if we have not sufficiently discussed the problem from an economic point of view. This aspect was discussed last April in Rome in a meeting organized by Professor Scarascia Mugnozza, with the participation of some of the scientists here today with us. I think that the final document issued on this occasion will be of help for future discussion on agriculture in Developing Countries and I will be glad if it can constitute one of the documents for future action. (Appendix page 495).

Now may I ask Professor Swaminathan, to read the recommendations of our meeting, which are not only the conclusions of the present work but also guidelines established by the great experience of all the participants of the meeting and especially by the experience and wisdom of Professor Swaminathan.