Interview: Dr. H. K. Jain

Indian agriculture: 'Bold policy, statesmanship and vision'

Director of the Indian Agricultural Research Institute (IARI) since 1977, Dr. Jain holds one of the most important positions in the country in the management and coordination of agricultural research and education, on the one hand, and transfer of technology to the farmers, on the other. His responsibility is to plan, organize, manage and administer the central research and post-graduate training program in India in the field of agriculture. The Institute, with a staff of more than 1,400 scientists and technicians and with 14 regional stations across India, is one of the largest institutions of its kind in the world. The Institute is the hub from which India's agricultural modernization was built and directed.

Prior to assuming directorship of the Institute Dr. Jain had headed its Division of Genetics since 1966. Under his leadership the high-yielding-varieties development program, the major instrument of India's agricultural modernization strategy, was designed and launched. Dr. Jain also planned the diversification of the improved-varieties program so that the production of grain legumes, oilseeds and other crops could be increased in the same manner as the cereal crops—a program now in full swing.

More recently, under the direction of Dr. Jain the Institute has developed strong programs in soil and water management, extension education, and technology transfer—also known as the "lab to land" program. The Institute has a modern Nuclear Research Laboratory. The Institute has also become an important national coordination center in the country for a number of All-India Coordinated Research Projects.

Dr. Jain is a member of the Board of Trustees of the International Maize and Wheat Improvement Center, a member of the International Board for Plant Genetic Resources, and a co-editor of the Zeitschrift für Pflanzenzüchtung (Journal of Plant Breeding), *Berlin.*

Dr. Jain has conducted basic research, taught advanced courses in genetics and published more than 100 papers in some of the foremost scientific journals of the world. He has received some of the highest scientific awards in India, including the Jawaharlal Nehru Fellowship. Dr. Jain was cited in the Republic Day honors list announced by the President of India in January 1981 for his contribution to Indian agriculture.

Below is an edited transcript of an interview EIR *Agriculture Editor Susan Brady conducted with Dr. H. K. Jain in New Delhi, on Aug. 16 during her tour of Indian agricultural, industrial and scientific centers this summer.*

Brady: India has come on the map, having gained self-sufficiency in foodgrains, as a developing sector country that's successfully created a viable modern agriculture. Dr. Sylvan Wittwer from Michigan State University, following a visit to Punjab several years ago, asserted that the greatest progress of all time in agriculture did not take place in the United States, as many believe, but in Punjab, where yields were doubled in a 10-year period from 1965 to 1975. How was it done? What was the key to India's success?

Dr. Jain: The potential was always there. You must have seen, even in the course of your brief visit, that India is very richly endowed with all the natural resources which go for very high agricultural production. Above all, we have tremendous resources of irrigation water. In addition, we have sunshine throughout the year, which is not so in most temperate countries—Canada, for example. There you can take only one good crop; you can't take three crops a year, which we can do here. Then, something which is not widely appreciated: India has reasonably fertile soils—some of them are very fertile, in fact some of the best in the world. Right here where we are located, in the Gangetic plains, we have alluvial

soils which are very, very fertile—and although we have badly treated them, they still retain their fertility. Over the rest of the country also—considering our rainfall pattern, and leaching of nutrients—I would say basically Indian soils are still good. Now that is very different from a country like Brazil, for example, which is a very large country but because of heavy leaching there are problems of toxicity of various kinds—for example, aluminum toxicity is a major problem in Brazil. And then you know the situation in Africa, where many soils have been eroded because of dry conditions.

So, we have a combination of many favorable factors. In fact, I keep insisting that India has the potential not only to be self-sufficient, but to be a major exporter of foodgrains simply based on the potential. So, your question really is: what was it that was keeping us back all these years? Why could we not have done it earlier?

The answer is very simple, so simple indeed that it may come as a surprise to you: namely, that basically we had been living with a *traditional agriculture* for more than 5,000 years. Traditional agriculture has many virtues: one of them is that it doesn't require too much support from industrial inputs like chemical fertilizers. (Right now in your country there's a great deal of criticism of modern agriculture because of pollution and other environmental hazards, which to my mind are greatly exaggerated.) But let me say this, that we really didn't have a choice—we didn't have an industrial base.

The other reason probably was that the kind of population pressures which we have now didn't exist earlier. You'll be surprised that at the turn of the century India was doing very well in agriculture—we were self-sufficient—not because our agriculture was characterized by a very high productivity, but because our needs were not very great. The population was small, kept so because of disease, epidemics, and lack of medical services.

So when India became independent in the late 1940s, we became conscious of two things: first, we thought we must improve the nutritional standards of our people, because, although we had some sort of self-sufficiency, it was not self-sufficiency in terms of the recommended levels of nutrition. Secondly, with massive investments in public health services, starting with the 1950s, India's death rate declined very sharply and the population pressure started to build up.

This became very clear in the 1960s when we had some serious droughts—far more serious than anything you saw during your trip, and, I must say, probably for the first time in the 5000-year history of Indian agriculture, some very, very far-reaching decisions were taken by the government of India.

Fundamentally, the decision was that even in a developing country like India, with all the problems of resources, with all the problems of farmers who are not very literate, with all the problems of creating an infrastructure—*we must modernize, and we must modernize essentially on the lines the Western countries had done earlier*. Now, this called for some very bold public policy decisions, statesmanship, and vision. Fortunately we had leaders in the 1960s who embarked on this very ambitious program—because I want to tell you that there were many people who were highly skeptical about our moving to this modern agriculture. . . .

'Agriculture requires industry'

Brady: There's a debate that still goes on about agriculture *versus* industry. . . .

Dr. Jain: Right! Now in the 1960s, it was absolutely clear that there is no room for debate, that if you want to talk about agricultural development, platitudes will not do. You have to take some very difficult decisions.

What is *modern agriculture*? Basically it is based on two things: the geneticists produced what we call genotypes, a combination of genetic factors which can interact favorably with a highly manipulated environment to give good yields. Now, how do you really manipulate this environment? You do this by giving massive doses of chemical fertilizers, because in traditional agriculture there's very little fertilizer, and plants need nutrients just as we do. Then you need to provide irrigation. You need to provide pest control. You need to provide better farm tools. These are the things we had to give to the farmers—for the first time, and it was not easy. But I'm very happy that the leaders at that time did not listen to the skeptics, and they moved fast; they moved forward, and you see the results today.

Let me first give the results in terms of the buildup of the infrastructure. We are today the fourth largest producer and consumer of nitrogen fertilizer in the world. This is rather remarkable when you consider the fact that 20 years back we used very little chemical fertilizer at all. We have the second largest area in the world under irrigation. No other country in its entire history has invested so much, and is investing so much, in irrigation. In the next 20 years we are planning to add two and a half million hectares every year to our irrigated land so that by the end of the century we will have 113 million hectares, which is our total potential for irrigation. So it is these bold policy decisions which helped.

Now, these were the decisions on the part of the government leaders, but this advance presented a very great challenge to scientists. How do you really react to a situation where you have been called upon to develop a new technology? All the time the emphasis has been on "relevance," and "relevant" means "traditional"—that is, no fertilizer, no pesticides, no other inputs. And suddenly you are told that the farmers are going to use fertilizer now, and water, and you must now come up with all the other kinds of seed varieties which will take advantage of this!

I must say that my colleagues at this institute and in other places have responded rather well to this challenge, and they received some support from the international community of scientists. For example, we were very fortunate in the 1960s

to be able to get some genes for dwarfing of wheat from Mexico. We also were able to get hold of some very good genetic stocks of rice from the International Rice Research Institute in the Philippines. We organized very major programs of crop improvement. The kinds of varieties we are recommending to our farmers today are very different from those which they had grown for hundreds of years.

Now, in your country this kind of transformation of crop varieties (a complete change in their architecture; you used to have very tall wheats, now they are very dwarf) started very slowly, because your farmers took to improved levels of management in a gradual manner. The breeders were not even conscious of this change, and they were slowly improving their crop varieties.

But in India, since time was not on our side, and we had to bring about this change rapidly, we decided to use major genes. Your people really didn't use major genes for dwarfing; they used what we call a system of poly-genes, genes making small contributions to reduced height; they added together a number of genes and gradually these added to reduce height and increase the proportion of grains. But fortunately the world was in a very happy position 20 years back in discovering *some* genes, especially in wheat and rice, with major effect. That is, a single gene will suddenly bring down the height of a wheat plant from 120 centimeters to 80 centimeters, and if you had two such genes you could bring it further down to 70 centimeters. We said, "Well, we don't have to do what the Americans did over a period of 60 years"—we incorporated this gene directly. You will be surprised how successful we have been in this.

I must tell you that we didn't have such a strong research base 20 years back. The challenge was there, but the country didn't have too many research institutes and universities. That's another area where the government moved very fast. Today almost every state of India has an agricultural univeristy, on the pattern of the [American] land-grant college. And this, to my mind, has played a very big role, because earlier agriculture used to be tied up with these traditional universities where they teach humanities and basic sciences and everything under the sun—and agriculture was just one faculty. This faculty was answerable not so much to the Department of Agriculture as to the Department of Education. We took it out of the Department of Education and we linked it right up with the Department of Agriculture, so that today the latter has very direct linkages with these agricultural universities and they work in very close collaboration.

We had to create an altogether new research infrastructure, and this institute had a tremendous role, if I may say so, in this process. We were ourselves declared a university, not of a very traditional kind, but simply a graduate school, to train a very large number of graduate students. You will be interested to know that in the last 22 years we have turned out from this Institute 2,600 Ph. D. and M. S. graduates, and it is these people who are mostly in the universities in the states. This Institute was set up, more research institutes were set up and a very large number of new universities were set up. India today has one of the largest research infrastructures, apart from the development infrastructure.

To summarize: we had a very clear objective, but before that I should say we had a great deal of potential and we knew how this potential could be exploited. The government took the right policy decisions to create modern industrial support—in terms of fertilizers, in terms of pesticides, in terms of machines, in terms of irrigation. The scientists were given the responsibility and they have responded. The research infrastructure has been vastly increased, and we have this harmonious interaction between all these sectors.

Brady: That interaction, and its success, is particularly visible in Punjab.

Dr. Jain: Yes, although you saw the *best* effect in Punjab, you must not go away with the impression that Punjab is the *only* state. Although of course Punjab has moved the fastest, there are other states—even the states which are today considered very backward, for example, Bihar and Uttar Pradesh—even they have made considerable progress.

Brady: Are there specific plans, area-wide or otherwise, to generalize the achievements of Punjab?

Dr. Jain: First, let me clarify one point. If Punjab has moved forward it is not because the inherent potential for productivity in Punjab is any greater. Some of the other states, like the largest state in terms of area, Uttar Pradesh, or a state like Bihar, in terms of natural resources of sunshine, water and fertile soils—they are as well placed as Punjab. And some parts of Uttar Pradesh, the western part for example, is progressing now almost as fast as Punjab. So has Haryana.

Do we have specific plans? Well, yes, the plans are that there are major universities for research in these states to develop the relevant technology—so the research support is just as good in these states as in Punjab. Perhaps we have to improve the extension services there. That's our greatest concern right now. Perhaps we have also to improve the motivation of farmers.

However I think our greatest gain is going to be education. The new generation, the children who are in schools and colleges now, they are more ambitious and they are more motivated; they are not going to stay with the kind of life that their ancestors lived in terms of nutrition or health care or education. So, with more and more education, with better extension services, with better seed production and fertilizer, and above all with better transfer of technology, things should improve in these states. There is no reason why not.

How to transfer technology

Brady: You have mentioned previously the importance, in particular, of providing integrated services to farmers. The Sixth Plan calls for establishing 500 "Agro-Services Units"—

is that what you have in mind?

Dr. Jain: If I may say so, I influenced the thinking of the Planning Commission on this point. I did a detailed analysis to find out the factors responsible for slow transfer of technology, and I came to a very major conclusion, which I am sorry to say is still not widely known, even in India. My contention is that in the developed Western countries all that you need is a good production technology, a technology in which farmers have faith. Then you need the various kinds of extension services, advisory services to take this technology to the farmers, just to tell them that here is something that is good for you.

But in India I think we need a third dimension in this process of transfer. I have repeatedly seen that you have a good technology, you demonstrate it on the farmer's field, and he says: "Yes, I'm convinced, but where do I go from here?" He says: "You're asking me to use so much pesticide—if it was merely a question of buying the pesticide I would not mind it; I can go and buy it like fertilizer." But application of pesticide is a little more complex: you need machines, you need dusters, you need sprayers, you need skill, and you need maintenance facilities for these machines. That's one reason why millions of farmers in this country are often not able to adopt a good production technology, even if they are convinced about its efficacy.

My suggestion is that in a country like India we need a large number of agro-services centers—someone who will do the job for you. You pay for it, and get the job done. But of course, it should be as far as possible a non-profit kind of operation, at least to begin with. I know that a rich entrepreneur can go and do the job, but then his costs will be high. I'd like to see a government institution which would not be so profit-minded, but will do the job and charge reasonably for the services.

Now of course in some countries, like Israel for example, the answer is the cooperative services. The farmers come together and organize their own services. In some parts of India, a very few parts, this is beginning to happen now—especially in Gujarat. But I have my doubts that most parts of India will follow this example. Generally the Indian farmer, you must have seen, is very individualistic. He doesn't want to combine with anyone, and he's a little distrustful of what might happen to his land if he joins in a cooperative endeavor.

Brady: Have many such centers been set up yet?

Dr. Jain: I think we have yet to move in a big way in this direction. We have some sort of centers in our block administration—you must have seen that we have these blocks where services and advice is given to farmers. But I don't think they are well equipped for the service part. They are very well equipped for the advice part, and that's where they have succeeded. But when the farmer says, "Well, yes, I accept your advice but I need your services. . . ." They do their best, but I think they need to be strengthened a great deal to render this kind of service.

Brady: At this point there's a serious problem of infrastructural bottlenecks in the Indian economy generally—power, transportation. . . . Is this a problem for agriculture?

Dr. Jain: Especially in the matter of power we have a problem. This problem is felt more in a dry year, like this one for example. We have as you know these enormous resources of irrigation—tubewells, for example, but they run on power. I argued in 1979 that the drought was in a sense a drought of power, where the water was there all the time, only a few feet below the ground or at best a few meters, if you could only lift it—and we didn't have enough electricity, or we could have overcome this very difficult situation. I would say that infrastructure in some respects is a problem, but services are a greater problem.

Brady: It is clear that India's capability is strong in the whole range of biological and agricultural sciences. What areas in particular are you concentrating on, and where do you think the coming breakthroughs will be?

Dr. Jain: This is my favorite subject. I personally believe that future agriculture of necessity will have to be very different from the present. The basic difference will be that we will depend more on renewable resources of energy, rather than non-renewable ones. But please do not misunderstand me: this does not mean going back to traditional agriculture. This means going for very high yields, even higher than those which you are having now, going for very big harvests, but substituting the industrial inputs with *more* sophisticated scientific inputs. For example, biologically fixed nitrogen.

In my view, probably the biggest breakthrough in agriculture in the next 20 years will be in the field of agricultural microbiology. We are looking for microbes which will do many of the things industrial processes do now. We should be able to identify right in nature many of these bacteria—blue-green algae, and other organisms which we've so far neglected. But if we fail to find them in nature, we can even manipulate them genetically. You know the recent techniques of genetic engineering. Now, I don't want to give you an impression that genetic engineering is already advanced so much that you can do virtually anything—no. In fact, I am sometimes surprised that you have nearly 100 major corporations set up in the last five years in the field of genetic engineering for agriculture. I am not all *that* hopeful, but things are moving. And I think that in the next 20 years, we can use this tool effectively to do many things which we can't do today.

Let me summarize this by saying that when the Western scientists developed the present technology we are following, they did it at a time when energy was not a problem. They were concerned with productivity, which we have now. But now we want to combine productivity with efficiency—and efficiency means substituting the industrial inputs with bacteriological inputs.