[Kakenhi Essay]
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Grants-in-Aid Have Fueled a Quantum Leap in Research

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Nitrogen (N) is the most important nutrient for farm crops. My field of research has to do with the nitrogen cycle in the soil. That has been a central theme of my research since I started my career in a university laboratory some 40 years ago. The technologies of modern agriculture made impressive strides during the 20th century. Heavy injections of chemical fertilizers, pesticides, and herbicides led to a startling increase in crop yields. On the other hand, that approach also caused environmental pollution, the destruction of ecosystems, and even the contamination of crops and food products, and created huge problems for the future survival of the human race.

My research has been driven by several objectives. One has been to shed light on the essential nature of crop productivity (also known as soil fertility), an inherent quality of most soils. Another has been to harness the findings of that endeavor to boost soil fertility, foster more efficient cycling of crop nutrients in the soil, reduce the utilized volume of chemical fertilizer and other farm chemicals, and develop crop cultivation methods that produce safe and of high quality crops. Research I conducted during my years with Kyushu University's Graduate School of Agriculture demonstrated that microorganisms in the soil have an instrumental influence on the properties of soil fertility and that the living and dead cells of such microorganisms are the prime sources of the nutrients that provide soil fertility. However, applications that translated these findings into actual practice in the field of agriculture remained a serious challenge.

At that time (in the 1960s and 1970s), hardly any other researchers in Japan were then engaged in research in the same field that attracted me. Since it was considered to be a relatively minor field, acquiring competitive research funding proved to be extremely difficult. That said, the hard reality was that any progress toward the attainment of research objectives would not be forthcoming unless one had enough research funding. For my own research work, I for some time had to scrape by with the small sums of funding that I secured through commissioned research projects and joint research with private firms. However, eventually, a chance to take a further step arose.

In fiscal 1974, I received 270,000 yen in the Grants-in-Aid for the Encouragement of Scientists (A). This sum was for a project on the theme, “Dojo-chu ni okeru kintai saibo oyobi saiboheki busshitsu no muki-ka to, sono muki-ka katei ni shuseki suru ibunkai-sei yukibutsu ni oyobosu muki oyobi yuki koroido no eikyo” (The mineralization of cellular organisms and cell wall materials in the soil and the effects of inorganic and organic colloids on readily degradable organic materials that accumulate during the mineralization process). Next, in fiscal 1977, I received 1.84 million yen in the grants-in-aid for general research (C): specifically, a project on the theme, “Shokubutsu itai no fukyuka katei to chiryoku ni kansuru kenkyu” (Study of soil fertility and the decaying process for dead vegetative matter). This was followed in fiscal 1985 with 1.7 million yen in the grants-in-aid for general research (C) on the theme, “Sakumotsu konken no dojo no biseibutsu baiomasu chisso no dotai” (“Metabolism of Microbial Biomass N in Rhizosphere Soil”). Further, in fiscal 1993, I was awarded 11 million yen in the grants-in-aid for pilot research (B) in a project with the theme, “Shinrin dojo no shinshoku boshi—jurin keisei shizai no kaihatsu” (“Development of Materials for Prevention of Soil Erosion and Reforestation”). With this grant assistance, my efforts in research made a quantum leap forward. Through these research projects, I began to deepen my interaction and exchange with the many other researchers then engaged in related research at other universities and national institutes of research. I still recall the powerful stimulus these factors had on my research as if it were only yesterday. Another major reward from this endeavor was that it strengthened my resolve to seek larger amounts of research funding so that I could identify new challenges based on the accomplishments of my research to date and pursue solutions to them.

The acquisition of grants-in-aid funding for the four projects I described above set the stage for additional funding. In 1999, a project focused on the theme, “Kyosei biseibutsu to o riyo shita kohai dojo no shin shufuku gijutsu no kaihatsu” (“Development of a new regenerative technology for depleted soils using symbiotic microorganisms”) was selected to receive grant assistance (of approx. 400 million yen). A venture in basic research sponsored by the Bio-oriented Technology Research Advancement Institution (BRAIN), this project investigated the role of mycorrhizal fungi—a plant symbiont—in fostering the process of revegetation. To that end, we were successful in understanding the effectiveness of strains of mycorrhizal fungi injected into the root systems of plants by utilizing genetic analysis techniques at revegetation test sites located in areas scarred by pyroclastic flows from the eruption of Mount Fugen in Shimabara, Nagasaki Prefecture. That was an accomplishment I will never forget for the rest of my life, and something made possible through access to grants-in-aid and collaborative researchers.

In time, this series of achievements earned strong acclaim, to the extent that I was eventually honored with the 63rd Chugoku Cultural Award in 2006 as well as the Japan Prize of Agricultural Science and Yomiuri Prize of Agricultural Science (for research on the function of microorganisms in the supply of soil nutrients and the development of technologies for environmental restoration) in 2007. Currently, by utilizing a new material for the prevention of soil erosion and promotion of vegetative regeneration (product name: Multifunction Filter) I co-developed with other researchers, I am doing what little I can do to restore damaged natural environments in Japan as well as abroad.

In any event, I can safely say that I would not be the person I am today had I not had access to the grants-in-aid research funding that gave me hope for future research on a major scale at a time when I was burning with enthusiasm and a yearning to engage in research.

Incidentally, upon assuming my post as President of Yamaguchi University in 2006, I became aware of a heavy burden of responsibility to improve, expand, and strengthen my university's research prowess from a school-wide perspective. As the outcome of a fact-finding study into university conditions in this area, I felt it would be important to boost our share of grants-in-aid funding, funding for commissioned research, funding for joint research, and other forms of competitive research funding.

To that end, Yamaguchi University has introduced several programs of its own to provide needed assistance. Launched in fiscal 2008, the Financial Assistance for Young Researchers program awards research assistance of 500,000 yen (total program funding of approx. 10 million yen) to A-ranked young researchers under the age of 40 who have not been selected to receive Kaken Grants-in-Aid for Scientific Research.

In fiscal 2010, we launched our Strategic Research Promotion Program, which provides assistance of up to 10 million yen per annum to "pump-priming" projects in group- or individual-led research with the goal of stimulating that research to world-class levels.

In fiscal 2012, we introduced the Scientific Research Challenge Project, which provides assistance of up to 3 million yen per annum to around 20 recipients, and the Onko-chishin Project (funding of up to 100 million yen per annum to combined research undertakings in the humanities and sciences). Under these programs, assistance of up to 100 million yen per annum is awarded at the discretion of the university president. Little by little, these programs have begun to show real results.

As a country striving to be a global power in the fields of science and technology, Japan considers it essential that it support the aspirations and enthusiasm of young researchers. It is my sincere hope that the Grants-in-Aid for Scientific Research program will be steadily expanded in the years ahead.