Engineering for Higher Yields

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I. INTRODUCTION

It was difficult for me to understand the meaning of "engineering" as used in the title of my speech. I asked Dr. Haskins who told me that the term engineering is used here because one traditional role of the engineer has been the application of scientific principles in the solution of practical problems, and that in this case we want to consider the application of biological principles in both past and future increases in crop yield. Accordingly, I intend to express my thoughts on this problem, and to ask your suggestions for obtaining higher and better yields in the future. As I belong to an Asian nation, where rice is the main food, I will use the rice plant (Oryza sativa L.) as an example to illustrate my ideas. However, I am convinced that the principles which can be applied to the rice plant, will also apply to other crops such as wheat [Triticum (aestivum L.) sp.] or corn (Zea mays L.).

II. CHANGES IN RICE YIELD FROM 1000 A.D.

The yield of brown rice in 900 A.D. was approximately 1 ton/ha (Table 2-1) and in 1885, the year of the Meiji Revolution, which was the dawn of modern Japan, the yield was about 2 tons/ha. Thus, it took about 1,000 years (from 900 A.D. to 1885) to double the yield, while it took less than 100 years, from 1885 up to the present time to redouble the yield. The main reason for the relatively rapid improvement in rice yield since the turn of the century (Fig. 2-1) is the intelligent integration of the following factors:

1) New varieties developed by scientific and systematic breeding.
2) Progress of cultivation techniques.
3) Use of chemical fertilizers, especially nitrogen.
4) Use of fungicides, insecticides and herbicides.
5) Improvement of soils.

Use of these production techniques may seem only common sense to