ISOTOPES AND RADIATION HELP RESEARCH TO GROW MORE RICE

Agricultural land being limited, the only effective way of meeting the demand for more rice by the rapidly-growing population of Asia and the Far East is to increase productivity per acre. This can be done by more efficient use of fertilizers, by developing better varieties of rice, and by control of pests and diseases. Internationally coordinated programmes of research carried out by the Joint FAO/IAEA Division of Atomic Energy in Agriculture have these as major objectives.

Three years' work on the problem of efficiency of fertilizer utilisation have produced significant results. The Agency first attacked the problem in 1962, mainly through a coordinated programme of research contracts, but partly through a Regional Adviser on Rice Fertilizer Problems under the UN Expanded Programme of Technical Assistance. Eight countries in the region have been involved in various aspects of these programmes; over the three-year period the Agency has spent some $245 000 from its own resources, and EPTA has provided about $60 000. Initially, the countries taking part in the programme were Burma, Hungary, Pakistan, the Philippines, Thailand, and the United Arab Republic. Later China (Taiwan), Ceylon, Korea, Italy, India and Madagascar took part.*

Fertilizers containing nitrogen, phosphate, and sometimes potassium are known to raise rice yields considerably. Isotope tracer methods are particularly useful in determining the most efficient methods of applying such fertilizers. These techniques enable determination of the efficiency of the uptake of fertilizer by the plant in relation either to placement, time of application, fertilizer sources or other factors; in addition, they are completely independent of vegetative development or grain yield, so that each experiment gives useful results. In all three years, each experiment has produced conclusive results which could be immediately applied in practice. They showed that the simplest methods of applying phosphate fertilizer were the best: viz. broadcasting on the surface, or broadcasting and hoeing-in. They also revealed a considerable latitude in timing. This is significant in the developing countries because of difficulties of supply. The farmer may not receive his fertilizer until after planting, but the tests showed that broadcasting over the growing rice was almost as effective as earlier application. In 1964 nitrogen-15 was used as a tracer, and showed that the later application of nitrogen as a single dose resulted in a very significant increase in the utilisation by the plant of the nitrogen in the fertilizer. These results have all provided specific and conclusive answers about the value of practices which had previously been in doubt. It has been possible to achieve them so quickly thanks to the co-ordinated programme, under

* *This part of the programme was described in the IAEA Bulletin, July 1963.*

Hungarian scientists carrying out rice tests. They are taking samples of rice plants from an experimental plot, ten days after radioactive fertilizer has been applied.

which the same experiment has been performed simultaneously in a number of countries with widely different soils and climates and has given the same result in all cases. In this way, it has been possible to do in one year what might have required five to ten years if the experiments had been carried out in one place only. These results are of particular practical significance where the farmer is only able to apply small amounts of fertilizer, as they indicate the method of application that will give him the best return.

An associated programme, initiated by the Agency in 1964, involves co-ordinated research on the use of induced mutations for breeding new varieties of rice. The established varieties do not give the best results under heavy application of fertilizer (particularly nitrogen), they are not sufficiently resistant to disease, and they take a long time to mature. It is possible, by breeding, to improve on each of these factors. Conventional breeding by hybridization and subsequent selection depends primarily on the natural variability present in the crop species. As such breeding efforts are intensified, it becomes increasingly difficult to find the desired characteristics in the natural populations. Ionising radiation can be used to induce genetic mutations and thus to provide a wider base for the selection of desirable agronomic traits. This technique has already resulted in superior varieties of a number of crop plants.

The rice-breeding programme is being co-ordinated by the Joint FAO/IAEA Division of Atomic Energy in Agriculture, and is at present being carried out in Japan, Thailand, the Philippines, Taiwan and Pakistan.

In East Pakistan, green-house experiments are carried out on the placement of fertilizer.

All those concerned are firmly of the view that this technique, if applied on a sufficient scale and in a concerted manner, can make a major contribution to increase rice production in the area.

Insects play a major role in Asia and the Far East by the destruction of rice in all stages of development. The rice stem borer is the most important insect over the entire rice growing area of this region and is also the most important in terms of losses in the field. This insect can be controlled by insecticides, but control is expensive and requires frequent treatments with hazardous chemicals. If this insect could be eradicated by utilizing the sterile male technique, there would be a great direct saving by increased production, and indirect savings by lessening the cost of production.

Before this insect can be eradicated by the sterile male technique it will be necessary to conduct research on mass rearing, dispersal of sterile insects in the field, population dynamics studies and radiation studies to determine the best dosages of radiation for sterilization. At present arrangements are being made to hold a planning meeting early in 1966 to initiate a third similar, coordinated programme to work on these problems.