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RECENT DEVELOPMENTS IN THE METHODS OF RICE CULTIVATION IN INDIA

INDIA grows rice in 75 million acres out of the world total of 233 million acres and the production is 32 million tons of rough rice or paddy against a world total of 150 million tons. Among the largest rice-growing areas, Japan records the highest yield of nearly 3,200 lb. with an acreage of nearly 7·8 million acres. In China with an acreage of 47 million acres, the yield is 2,200 lb. while in India the yield is 913 lb.

Rice Improvement in India

The improvement work in rice was first started in India in the second decade of this century in Madras and Bengal and was followed in other States much later and the Indian Council of Agricultural Research from its inception in 1929 promoted this work by giving financial aid to the various rice schemes sponsored by the States. The improvement work consisted mainly in the evolution of higher yielding varieties by the methods of selection and hybridization. There are now nearly 284 improved varieties suitable to the different climatic and soil conditions in India. These varieties on an average give about 10 per cent. more yield than the local varieties Side by side with the improvement of varieties by breeding, extensive manurial experiments were also conducted in various rice-growing States. Though the investigations on the manurial requirements of rice crop have not been carried out on the same scale as in Japan, the results so far obtained lead to the general conclusion that the application of organic manures like green manure at the rate of 4,000-5,000 lb. per acre supplemented by artificials like ammonium sulphate and superphosphate 150 lb each, give responses to the extent of 15-40 per cent. or more, depending upon the soil condition. In the field of experiments regarding improvement in cultural practices the very first recommenda-

tion of the Madras Department of Agriculture as early as 1918 is the thin sowing of paddy nurseries and economic planting. It was shown by experiments that thin sowing not only increased the yield but also contributed to a considerable saving of seed. The yields from various Rice Experimental Farms in India which have adopted these methods range from 2,000-4,000 lb. which is nearly two to four times the average yield in India. On the other hand, the average yield figure in India has not increased so far due to various reasons.

During the Conference of Agricultural Scientists held in New Delhi in 1949, the problem of low yield obtained in crops in India was discussed fully and it was pointed out that the most important contributing cause is the delay in cultural operations. There is generally deficiency of available bullock power and it was recommended that in areas with assured irrigation, transplanting should be done as this alone gives 20 per cent. more yield than when sown broadcast. It was also recommended that provision must be made in every locality for sufficient number of nurseries for raising seedlings of rice and their supply at transplanting time. The advice regarding the thin sowing of nursery should be imparted to cultivators. All effective methods so far known regarding cultural operations such as early ploughing, timely sowing and planting, irrigation and weeding should be brought home to the cultivator by oral and visual propaganda and through leaflets Prizes and certificates should be given to the best farmers who produce good crops

The encouragement given by the Government recently in the shape of substantial awards has resulted in some farmers producing record yield of 8,000-12,000 lb. per acre There is, therefore, great scope for increasing the rice yields by adopting good cultivation practices, judicious manuring of fields with organic and inorganic fertilizers and the extensive use of the good seed of improved varieties. These experimental results have not been extensively utilised by the cultivators due to the want of adequate extension machinery in India.

Rice in Japan

The attention of the Ministry was directed to the important features of rice cultivation in Japan which has recorded an average yield of 3,500 lb. per acre and an article on 'Features of Rice Work in Japan and How They Differ from Those in India by Ramiah and Vachhani was contributed to the *Indian Farming* in 1950. This article aroused a lot of interest and a number of enquiries regarding this was answered by the Central Rice Research Institute. Since its publication, it is gathered that this article had been reproduced in some journals in different States of India. In November 1952, issue of the *Farmer* issued by the Director of Publicity, Government of Bombay, an article on "Paddy Growing in the New Way" dealt with the results of work done in 1951 at the Agricultural School Farm at Kosabad near Gholwad and also at the Kora Gram Udyogic Kendra at Borivili, near Bombay by following "the modified Japanese methods" to suit the local conditions. The Minister for Agriculture, Government of India, in his broadcast from the All-India Radio, Delhi, in January 1953, gave the details of the Japanese methods of rice cultivation which has given 4,000-6,000 lb. paddy per acre in the two farms mentioned above in Bombay and a lot of interest among the public and the Press has been roused about this new Japanese way of cultivation in rice. This enthusiasm, it is hoped, augurs well for the future of rice cultivation in this country.

The essential features of the Japanese method of cultivation are :

(1) *Seed-bed.*—Good nursery management for the production of strong and healthy seedlings. This is effected by bestowing proper care in the preparation of seed-bed, thin sowing and proper manuring Importance is also given to sieve out strong well-filled seeds by using brine water Preparation of the nursery beds is done generally before sowing. The land is ploughed to a depth of 3½" and 4½" after which the soil is cultivated and irrigated. The beds are approximately 3½' to 4' wide and the bed length varies with the seedling requirements. The beds are raised 2" to 3" above the field level to facilitate drainage. Mixed organic fertilisers are generally recommended for the seed-bed Ammonium sulphate and other water-soluble fertilisers are thoroughly mixed with soil before the rice seeds are sown. Wood ashes are applied when the seedlings are about 1" in hight 2 lb of nitrogen and 1 lb. each of P_2O_5 and potash are applied per cent. The seed is sown at the rate of 2 lb. per cent. and 3·5 cents of such seed-bed is used for planting one acre of paddy field. The seed is sifted through a sieve and then the light seed is removed by soaking the seed in brine solution of specific gravity of 1·13. Then the seeds are washed and soaked in pure water and drained. Sprouted seeds are sown in the seed-bed area. The weeding of the seed-bed is another special feature. It is also recommended by the Government officials that the seed be treated with Uspulum, a mercuric fungicide to control seed-borne diseases.

(2) *Preparation of Fields for Planting and Manuring.*—The preparation of fields for planting is done thoroughly. Chinese veteh or soya-beans are often grown for green manure. After the green manure crop has been cut and dried for two or three days it is ploughed under. Irrigation water is added to prevent the loss of nitrogen through aerobic bacterial activity. The amount of green manure crop harvested varies from 4,000-7,000 lb. per acre. The green manures are turned under about three weeks before the rice is transplanted to avoid the injurious effects caused by the decomposition products of fresh plant material. It is also the practice to supply 670 lb. of lime whenever green manures are used It can be thus seen that the organic manures are applied to the land before actual puddling. Based upon the properties of the soil, the standard amount of manures and commercial fertilisers required to produce satisfactory yields has been determined for the various rice-growing regions of all the prefectures. The average amount of the three principal plant food elements applied are: nitrogen 80-100 lb. per acre ; phosphate 60-80 lb. per acre ; and potash 50-80 lb. per acre Two-thirds of this manure mixture is applied as a sub-surface application in rice soils before letting in water for puddling, one-third is applied in two later applications, one about two to three weeks after planting and another two to three weeks before ear-emergence. Because of the shortage of fertilizers in recent years the farmers have attempted to increase the production of farmyard manures and a heavy dose of compost is applied to the field just before puddling.

Nearly 90 per cent. of the rice area in Japan is transplanted. The rows are usually 8"-12" apart, while the hills in the rows are between 3" and 8" apart. The spacing is determined by climate, soil fertility, amount of fertilizer applied and time of transplanting and variety. More seedlings are planted for low-tillering varieties or where tillering is low because of cool climate, infertile soil, lack of sufficient fertilizers or delayed transplanting.

(3) *After Cultivation.*—Inter-culturing is another important cultural operation done by a hand rotary weeder. This not only helps to bury the weeds but also helps in stirring the soil round about the roots and the fertilizer gets well mixed up with the soil which encourages tillering. The first interculturing is done 10-14 days after transplanting. It is repeated after intervals of about 10 days and stopped a week before the normal flowering time. The standard depth of irrigation water is usually 1"-2". The fields are drained when the rice begins to ripen, *i.e.*, when the heads start to turn down. Water is usually applied by canal but occasionally it is pumped from wells.

Distinguishing Features of Japanese Cultivation

The striking differences between the methods of cultivation described above and the general cultivation practices recommended by the various Agricultural Departments in India are: (*i*) sieving of the seed and soaking of the same in brine water to remove the light and ill-filled seeds, (*ii*) heavy application of commercial fertilizers both for seed-bed as well as for transplanted fields, (*iii*) inter-cultivation for which the cultivator plants the crop in lines. The practice of sieving the seed is commendable, but a few experiments carried out in India show that yield from the crop raised from light seeds is not significantly different from that raised from healthy seeds. As a cultivation practice, it should be followed in view of better germination and good stand. Regarding the application of manures, it has been generally found in India that the yield response obtained from the application of more than 40 lb. of nitrogen is not remunerative and economic. When compared to Japan, where with high doses from 50-80 lb. nitrogen, the responses are of the magnitude of 20-30 lb paddy for every lb. of nitrogen applied, in India on the other hand, there is a very low response of even less than 10 lb. of paddy for 1 lb. of nitrogen under such high doses Even the favourable response obtained with doses of 20-40 lb nitrogen is of the order of 15 lb of paddy per 1 lb. of nitrogen. In most of the areas, the application of higher doses of nitrogen induces profuse vegetative growth resulting in the premature lodging of the crop and reduction in yields. The supply of ammonium sulphate in the country is also limited and even with the minimum recommended dose of 150 lb. per acre, a quantity of about 5 million tons of ammonium sulphate will roughly be required for 75 million acres of rice land alone. As it is, the schedule production both at Sindhri and Travancore, will not exceed more than 0·5 million tons a year. Realising this, the propaganda of the various Agricultural Departments is more towards growing green manure crops and the application of organic matter like compost supplemented by a moderate application of ammonium sulphate. Heavy doses of these artificials are not, therefore, insisted on, but stress is laid on the

application of compost and green manures. Inter-culturing of rice is probably a new one. This, perhaps, has a value in connection with the application of higher doses of nitrogen for getting better response. Further research on this aspect is needed.

India, like Japan, has enough technical information for increasing rice production in the country. In Japan, however, experimental results have been adopted quickly with the help of an efficient extension organisation. There is also an additional advantage of protected irrigation for over nearly 90 per cent. of rice area. There is a technician for every two or three square miles in Japan, while in India, the extension machinery has still to be strengthened. As it is, we have now only one demonstrator in a taluq comprising several villages and, as such, personal contacts between the technician and the actual villager are few and far between. With the completion of the new irrigation projects which will supply more assured and timely irrigation water, and by popularising the intensive methods of rice cultivation and making the supplies of fertilizers and improved seeds available to the cultivators, rice production is bound to be substantially raised and the country made self-sufficient in her rice requirements.

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CENTRAL BUILDING RESEARCH INSTITUTE, ROORKEE

THE Central Building Research Institute, Roorke, the eleventh in the chain of National Research Institutes to be set up under the auspices of the Council of Scientific and Industrial Research, was formally declared on 12th April this year by Maulana Abul Kalam Azad, Minister for Education and Natural Resources and Scientific Research, Government of India, and Vice-President of the C.S.I.R.

The establishment of this Institute was recommended in 1944 by the Building Research Committee set up by the C.S.I.R. As a start, a Building Research Unit was organised at Roorke to work in co-operation with the Thomason College of Engineering, now the Technical University of Roorkee. As in the case of other national research institutions, research work did not wait for the erection of the Institute's buildings, but was started as early as 1947 in temporary quarters. The foundation-stone of the new building was laid in 1951 by the Hon'ble Shri Prakasa.

The Institute has been constructed on a site of 10 acres leased by the U.P. Government and the Roorkee University and an additional area of 57 acres has been acquired for further expansion. It consists of four blocks, the main block containing the Chemical and Physical Laboratories, the Technological Block housing the Soil Mechanics Laboratory and Workshops, the Library and the Museum Block and an Auditorium Block with a Lecture Hall having 250 seats Very briefly, the Institute is dedicated to research which will step up the quality of building construction in India, while reducing its cost To achieve this purpose, it will undertake surveys on building materials and construction on national scales and carry on research in building materials, methods of construction and the performance of buildings.

The problems for investigation in an Institute of this type are largely common to different countries, but there are some which are of special interest to India. The Institute will therefore pay special attention to problems like factors governing comfort and efficiency under tropical conditions, study of soil stabilization, use of indigenous materials, utilization of industrial wastes, construction of houses for persons of low income on an extensive scale, etc. The work of the Institute will deal with these problems under four main heads, *viz.*, problems relating to (*a*) building materials, (*b*) methods of construction, (*c*) performance of buildings, and (*d*) survey and information. Mention may be made particularly of four typical problems whose satisfactory solution will have a great significance for the development of our building industry. They relate to improvement in the quality of bricks, the possible use of bamboo as a reinforcing material, investigation on novel methods of construction, evolved by the Institute itself or by others, prefabrication and assembling of building components, heat and sound insulation, resistance to moisture penetration, fire and weather, consideration of new architectural and structural designs and problems relating to brick industry, lime industry.