(d) To call meetings of veterinary workers, carry on training programmes for veterinary technicians and facilitate the exchange of information on all phases of rinderpest work.

(e) To establish committee headquarters at a suitable location.

Organisation of scientific and techinical personnel: 1. That an International Committee to set up, to be known as the Far-East Rice Investigation Committee, its personnel to consist of Government-appointed scientists and technicians from each country concerned.

2. That the proposed Committee provide for three sub-committees as follows:— (a) Utilisation and control of water. (b) Machinery and Equipment. (c) Soil, Agronomy and Plant Improvement.

3. That the F. A. O. Regional Office for South East Asia when established take the initiative in organising the proposed Far East Rice Investigation Committee and give the leadership required for its effective functioning.

4. That the proposed committee, together with its sub-committee, meet at least once a year to review the progress and results of investigations, exchange information and experience, decide on the most urgent problems, and plan further investigations for the ensuing year.

https://doi.org/10.29321/MAJ.10.A04500

Features of Rice Work in Japan and how they differ from those in India

By

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Rice is the most important single crop in Japan, occupying 7·8 million acres which is 53 per cent of the total annual cultivated area of 15 million acres. The total production of rice is 10·4 million tons giving an average yield of 2,350 lb. (shelled rice) per acre. Due to the importance of rice in the national economy, great attention was given to rice improvement by the Government with the result that during the last 60 years, the area under rice has increased by about 25 per cent while the acre yields during the corresponding period increased by about 70 per cent. Thus the total production increased from 4·9 million tons during 1880 to 10·4 million tons during 1942, i.e. an increase of 113 per cent. It is due to the higher acre yields of rice and other crops that Japan is able to

produce about 80 to 85 per cent of its food requirements for its population of 78 millions from the annual cultivated area of 15 million acres. The cultivated land of Japan consists mostly of coastal plains and narrow river valleys extending up into mountains. The diluvium is usually sandy and sterile, uplands are leached and soils developed on volcanic parent material consisting of acidic lavas and ash are infertile. Thus the soils are generally poor in natural fertility, and soil fertility is apparently thus not a factor for higher acre yields. The high levels of production have been attained and are maintained mostly by the application of results of research in practical farming.

It may be useful to consider the organization of crop research and extension service, which combined with the disciplined and progressive ideology of the cultivating classes and the high percentage of literacy in the country are responsible for such phenomenal results.

The whole country is divided into 46 agricultural districts known as prefectures, each of about 500 square miles. There is a central experimental station at each prefecture and there are 250 technicians for each prefecture or roughly one for each village. This works out to a technical man available to advise for every two to three square miles. These technicians who are either agricultural graduates or sufficiently trained hands maintain the liaison between the farmers and the experimental stations, passing the results of research to the farmers, and bringing to the notice of the research stations the problems of the farmers for investigation. Besides, the agricultural departments of the six Imperial Universities, the Imperial primary, secondary and tertiary branch stations carry out research on specific crops for different ecological regions and pass on the results and the improved varieties to prefectural stations, who after further testing, multiply the seeds on primary seed propagation farms and the co-operative branch stations under the management of the people in the villages. Due to extensive research and extension service organization with a number of small research stations spread all over the country, manned by a large number of technicians, direct contact with the cultivators is possible and the dissemination of results of research to farmers is made easy.

Rice-growing conditions in Japan: Despite the recent urbanization and industrialization, Japan is still a nation of farmers with 43 per cent of households engaged in farming. About 5·4 million farm households are engaged in tilling an area of 15 million acres which works out to about 2·6 acre holding per family. Thus the average holding is very small and the cultivator and his family pay personal attention to cropping, treating it more as a garden than a field. Because of the north latitude, mean temperatures are low, and rice cultivation is confined to the period April to October.

Japan could be divided into four agricultural divisions from the standpoint of rice crop. The extreme southern districts take two successive harvests of rice per year. Central Japan can be divided in two regions, the southern region growing one rice and one dry crop and the northern region raising one crop of rice only, The extreme north, due to its low summer temperatures, is not suitable for rice. Sixty per cent of the rice fields are left fallow during winter. When two successive crops of rice are taken, the farmer uses an early variety for the first crop and a late variety for the second crop. The first crop is sown in nursery beds in late March, transplanted a month later and harvested by early August. The second crop is sown in nursery beds in July and transplanted after the first crop is harvested. The yield of the second crop is about 60 to 70 per cent of the first crop.

In general the rice varieties grown in Japan belong to *O. sativa forma japonica* which usually possess short and stiff straw and have short and coarse grains. The rice crop is classified as paddy rice (lowland rice) and upland rice. The former occupies about 95 per cent of the rice area and is transplanted and irrigated, while the latter is sown broadcast without irrigation. Attempts are being made to see if direct sowing in lines could replace transplanting.

Breeding of improved varieties of rice: Rice breeding in Japan is carried on according to traditional methods of selection, introduction and hybridization. The basic sciences, especially genetics, cytology and plant pathology, have played an important role in developing the improved varieties. Of late much attention is being paid to genetico—ecological approach to plant breeding. By this is meant the determination of the reaction of varieties to specific climatic, edaphic and biotic environmental factors.

Rice breeding work in Japan was started as early as 1893 when the Ministry of Agriculture and Forestry established the Imperial Agricultural Experiment Station in Tokyo and its six branch stations in different districts. They collected 4,000 native rice varieties from all over the country which were carefully examined for various characteristics and yielding capacity. Several superior varieties were thus isolated which became popular and their cultivation extended to wide areas. The pure line selection method was first used in 1910 and because of its simple technique and effective results, the method was adopted on the prefectural and branch stations. This method was very successful and by the year 1922, 490 new strains for various parts of the country were isolated.

Hybridization or cross breeding for rice improvement was first used in 1904 for combining in a single strain the desirable characters of high yield, disease resistance and cold resistance. Certain varieties which

were resistant to the most important rice disease of Japan, caused by *Piricularia oryzae*, were used in the hybridization programme. Up to 1925, 50 new varieties had been developed by this method.

As already mentioned, the hybridization work since 1926 has been remodelled and the new method is mostly based on the genetico-ecological conceptions. For this purpose, the whole country has been divided into ten main ecological districts based chiefly on climatic, soil and biotic factors, each having a local rice research station, called a secondary breeding station. Under this scheme the whole set-up of rice breeding consists of seven primary breeding stations under the control of the Imperial Government, where the programme of breeding, choosing of parents, making the crosses and growing and study of F_1 and F_2 progenies are carried out. The selected F_3 progenies from these stations are distributed to secondary stations, where the behaviour of the F_3 progenies and later generations are studied and the selections made in accordance with the local requirements. These selections are subjected to preliminary trials for yield and resistance to diseases. When the superiority of these is established, they are sent to prefectural stations for final tests and if the results are confirmed, the variety is given a *Norin* number and is taken to seed farms for multiplication and distribution. By this method 16 new *Norin* varieties have been evolved which are widely cultivated.

The success of the rice breeding programme can be gauged by the fact that 69 per cent of the area under rice is grown under improved varieties, 46 per cent under the varieties developed by hybridization and 23 per cent under the varieties developed by pure line selection. According to the estimates of rice experts, the increase in yield of the line selections based on the average of 261 strains was about 9 per cent, whereas the increase in yield of 20 varieties developed by hybridization was about 16 per cent.

Improved cultural practices: *Use of good disease-free seed.* The cultivators are conscious of the advantages of the improved vārieties and renew their seeds very frequently and often every year, which is made possible due to the existence of a large number of agricultural cooperatives, one in each village. The cultivator usually gives his own produce to the co-operatives in exchange for the improved seed he gets.

In order to get assured and uniform germination, the seed is sifted through a sieve and then put in salt water solution to float out the light grains. The seed is treated against fungoid diseases mostly with mercuric compounds before sowing.

Nursery and field practices: Ninety per cent of the rice crop is transplanted and great importance is attached to healthy and vigorous seedlings for transplanting. The nursery area is well-prepared and laid

out in rectangular beds with raised side bunds and having a width of 3½ ft. to 4 ft. and length according to requirements. The seed beds are invariably manured with organic and inorganic manures before sowing. Mostly sprouted seeds are sown either by hand or by special drilling machines which deposit five seeds in each hole. Frequent weeding is done to keep the seed beds free of weeds and the spraying of the seed beds with fungicides and hand-picking of egg masses of insects is a very common practice. In the northern districts where the temperature at planting time is low, hot beds are used to get quicker and satisfactory germination.

The holdings in Japan being small, the land is mostly prepared with hand tools and sometimes with implements driven by animal power. The Japanese cultivator is well disciplined and hard-working and promptly carries out the recommendations of the technicians. The main operations consist of dry ploughing and puddling, irrigation, making bunds and levelling, Liberal doses of both organic and inorganic manures are applied at the time of preparation of land and after transplanting. The transplanting is done mostly in June and July at a distance of 9 in.×9 in. with 4—5 seedlings per hole. The crop is usually irrigated and 4—5 weedings are given either with hand or with implements, the latter being possible only in fields where the distance between rows is wider. Weeding is considered a very necessary practice, the first weeding being given a fortnight after transplanting, and subsequent ones at an interval of 10 to 15 days.

Harvesting and preparation of the produce: The rice crop is cut close to the ground with sickles as in India. Threshing is either performed by human labour or motor power. Japan has made much progress in designing small power-operated machines for threshing, winnowing and hulling operations. Power threshers are operated by 3-5 h.p. gasoline engines or by electric motors. All operations being performed at the same time. Motor threshers are community-owned and are commonly used by the farmers in the village community.

Application of fertilizers: As stated already the soils of Japan are rather low in fertility and can supply only about two-thirds of the important plant food ingredients necessary to produce a good rice crop. Thus various methods are practised, which are standardised as a result of extensive manurial trials conducted in the country.

Manuring of nursery beds: Complete fertilizers are applied to the nursery before sowing and thoroughly mixed with the soil, On an average, about 5 to 6 lb. of N and 3 to 4 lb. of each of P_2O_5 and K_2O are applied to a seed bed area of 1/25th of an acre which is sufficient to transplant about an acre of paddy field. Wood ashes are applied when the seedlings are about 1 in. in height.

Manuring of paddy fields: From experiments it has been found that application of complete fertilizers gives the best results. Based upon the properties of the soil, the average amount of the main plant food ingredients applied is 80-100 lb. of nitrogen and 70-80 lb. of each of phosphoric acid and potash per acre. They always use a combination of organic and mineral fertilizers.

As regards organic manures there obtains the practice of growing a green manure crop, mainly of soyabean, which is cut and ploughed under about three weeks before transplanting. The amount of green matter thus added varies from three to five tons per acre. The field is then irrigated and often about $\frac{1}{3}$ ton of lime per acre is applied to promote decomposition of the green manure ploughed in. Besides green manure other organic manures like soyabean cake, night soil and composts made from farm wastes are also extensively used. The organic manures are applied to the land before ploughing.

The most effective method and time of application of concentrated manures have been determined from the standpoint of rice physiology. As a result of these investigations two-thirds of the quantity of the ammonium sulphate and phosphate and potash is applied in the dry condition just before puddling and the remaining one-third is applied in two later applications, one about three to four weeks after transplanting, and the other two to three weeks before ears emerge. This is supposed to prevent ammonia escaping as gas from the soil and improve the effectiveness of nitrogen. Ammonium sulphate is the common nitrogenous manure applied, of which about one million tons were produced in Japan before the war. During the war due to the non-availability of sufficient quantities of this fertilizer, the yields are said to have gone down.

According to the Japanese investigations the use of commercial fertilizers and better varieties are dependent upon each other. That is to say, the improved varieties produced in recent years are better only when heavily fertilized and also improved varieties must be grown if the full benefits of fertilizers are to be expected.

The question of water facilities in Japan as compared to what obtains in India may also be considered. Irrigation facilities in Japan are only afforded to the paddy crop and 90 per cent of the crop is irrigated. It is stated that at the time of sowing and transplanting there is always plenty of water available. The sowing and transplanting are carried out expeditiously within a short period during which the assured water is available. There may be difficulty of obtaining water in the later period but this is not considered as serious as scarcity in the earlier stages, as it is known that early and timely planting contributes more to satisfactory yields. In India the failure of early monsoons delays the planting and

ultimately affects the yield adversely and even in canal-irrigated tracts, there is always insufficiency of water in the beginning to get through the planting expeditiously. In fact the canal supplies as in parts of Orissa become plentiful only when the monsoon has set in strongly and there is not very much need for the canal water at that stage.

Rice being the master crop and the characteristic food of the entire population of Japan, the yields have been raised by skilful cultivation, fertilization and scientific seed development. To sum up the main features responsible for higher acre yields can be said to be :

(i) use of improved seeds, (ii) intensive fertilization, (iii) assured supply of irrigation water for the crop, (iv) control of diseases, (v) the large number of technicians available for giving advice (vi) the high percentage of literacy among the people, (vii) the large number of agricultural co-operatives, and (viii) the pesonal attention each cultivator pays to rice cultivation, treating it more as a garden than a field crop.

We can now compare the position of India with that of Japan.

Improved seed: The work of breeding improved varieties is well-advanced in India and in several of the provinces there are improved varieties available suited to the different tracts. The testing of these improved varieties is however not thorough in some of the provinces. This might have to be undertaken immediately so that the areas suited to the different improved varieties could be delimited before an intensive seed distribution organization could be set up. There is also great scope for intensifying breeding in some areas to obtain varieties not only with higher yields but also with improved ancillary characters.

The dearth of sufficient technical personnel will however be an obstacle to overcome, particularly in Bengal, Bihar and Orissa. We shall also require many more experimental stations than what we have. Though there has been considerable improvement in seed multiplication and distribution organization in recent years, we will still be behind Japan for a long time to come before the ideal conditions of each village having a seed area to meet the requirements of the village every year could be reached. It is mainly through the agricultural co-operatives which exist in each village that Japan has reached this ideal condition.

Intensive manuring: This is a more fruitful source of improving production than even improved seed, and in fact in Japanese agriculture the two always go together to get the maximum benefit. Experience in Madras has always shown that this is the ideal thing to do. The comparative low price of foodgrains was however a great obstacle against cultivators taking up intensive manuring practices with the result that

the best out of the improved varieties could not be realized. Things have however changed and people have become fertilizer conscious, but unfortunately sufficient quantities of fertilizers are not available. The present position is not likely to improve in the very near future. Since the war Japan is also suffering for want of sufficient quantities of fertilizers. The only course left open to us is to exploit other sources. Oilcakes, bone-meal, composts and green manuring can be thought of. Of these, quantities available of the first are not unlimited and it would be more economical to use them in limited quantities in conjunction with the last two. In fact green manuring has proved the best and cheapest form of fertilizing rice everywhere, and there is no doubt that all our efforts at present should be concentrated on popularizing green manuring wherever it can be done. Applying small quantities of fertilizers along with composts or green manure should be the best form of manuring rice.

Although experimental data on manuring practices are not available in India on the scale existing in Japan, we have sufficient information to go on with for the next few years until more critical data as applicable to small individual areas could be obtained. It has to be remembered that the quantities of manurial ingredients, namely nitrogen and phosphoric acid, applied in Japan are roughly three to four times those which we are recommending in India in the 'grow more food' campaign. Experimental evidence available does show that these quantities can be safely increased to twice or even three times the present level in certain tracts of India. The use of night soil, both raw and composted, is very common in Japan whereas it is almost completely wasted in India.

Cultural practices: While transplanting is the universal practice in Japan, in parts of India direct broadcasting still obtains even where facilities for transplanting do exist. How this can be changed needs immediate consideration. Transplanting will be the only way of keeping down weeds which are mainly responsible for lower yields in broadcast fields. Holdings in Japan being small as in India there are not any improved practices of preparing the land which obtain in Japan and which can be usefully copied here. Small improved implements are however used in Japan for threshing, shelling of grain, polishing, etc., and there appears to be definite scope for such improved implements in India too. In fact in Japan all the preparation of the land is done by hand and cattle are used only where the size of the holding is more than three acres. It has to be admitted that the small Indian rice farmer does not put in so much of hard labour in the field as his Japanese opposite does.

Extension service: It is here we find the greatest difference between Japan and India. While we are not far behind Japan in the availability of technical information, it is in the application of such information in

actual cultivation practice that India has to learn from Japan. The organization and the strength of personnel is every different in the two countries. That Japan has a technician for every two or three square miles is something which India cannot hope for even after several years. Even in Indian provinces where there is an agricultural demonstrator for each *taluqa*, there is not much personal contact between him and the farmers. Things have become even worse in recent years as most of the demonstrators' time is taken up in the business aspects of selling seeds, manures, iron, etc.

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(Indian Farming, Vol. XI, No. 2, February, 1950)

Useful Span of Life of the Fowl in India

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In commercial poultry farms where economic production is the prime concern layers are seldom kept for table eggs during the second and subsequent years. The common practice is to retain a third of the pullets after the first year of laying for a year more and sell the remaining birds for table. Unfortunately this procedure will not enable the poultry-keeper to test his birds for their breeding worth.