NOTES ON INDIAN AGRICULTURE

Written jointly by J. G. Harrar, Paul C. Mangelsdorf, and Warren Weaver

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I. PREFACE

Three of us have just spent four weeks in India studying Indian agriculture. This is much too short a time for a comprehensive study. The agricultural problems of India are so numerous, so complex, and so interwoven with traditions, religions, and philosophies which are strange to Western minds that it is obviously impossible to do justice to them in a month's stay. Nevertheless, some of the problems are so obvious that it would be impossible not to recognize them. Furthermore, we have had the benefit of many competent observers, including several on the staff of The Rockefeller Foundation who have spent long periods of time in India and whose experience has contributed toward providing invaluable perspective. Finally, there are fairly reliable statistics on India which themselves tell a large part of the story. Our trip has made the statistics become alive and meaningful to us.

II. THE PHYSICAL AND BIOLOGICAL BACKGROUND

1) Population

India's population is the second highest in the world and accounts for about 15 per cent of all the people now on earth. India with 361,820,000 people (The World Almanac, 1952, - 1951 Census) has more than twice as many people as the United States. Her population density, 296 persons per square mile, is almost six times that of the United States. West Bengal, with a population density of 839 persons per square mile, is one of the most densely populated areas in the world.

India's population is increasing at a fairly rapid rate. There will be an additional 26 millions to feed by 1956. Improved public health measures could conceivably bring the rate of increase to 8 million per year.

The population is largely rural. The 75 largest cities have a population of 24 millions, or about 7 per cent of the total. The remainder live in small towns and villages. About 70 per cent of the population is supported directly by agriculture.

There are many racial and ethnic groups in India and many religions. India is predominantly Hindu, but Muslems, Sikhs, Christians and others account for about 80 millions. The Christian population, now at 8.4 millions, has tripled since 1900.

Over 200 languages are spoken, of which 14 are of major importance. A movement to make Hindi the only official language might, if successful, create almost disastrous confusion.

2) Land Area and Water Resources

India has one of the world's largest populations, but is by no means one of the world's largest countries. The approximate area of the Union of India is 1,221,064 square miles. This is substantially less than half of the area of the United States - 3,022,387 square miles.

India, however, has a somewhat larger proportion of arable land than has the United States. There are in India 251 million acres under cultivation, which is 58 per cent as much as in the United States. Furthermore, a substantial part of India's cultivated land, 19 per cent, is under irrigation. Indeed, India with 60,000 miles of canals utilizing 6 per cent of the river flow, and 48 million acres under irrigation, has more irrigated land than any other country. Plans for increasing the future use of water provide for 8.7 million additional acres to be brought under irrigation schemes by 1956; another 3 million acres by tube wells; still another 3 million acres by pumps lifting water from rivers, streams, ponds and tanks; and several million acres by Persian wheels and more primitive water-lifting devices.

3) Agricultural Systems and Methods

The agricultural system in India is predominantly a village system. Some 80 to 85 per cent of the population live in small villages, practicing a subsistence type of agriculture on tiny fields. It is estimated that there are more than a half million villages with an average population per village of about 600 people.

The villages are so overwhelmingly important in the agricultural economy of India, as well as in its social structure, that they merit a brief description. The villages may vary somewhat from region to region but within a region they are as uniform as so many ant hills. Indeed, from the air, where a number of villages may be seen simultaneously, they have the appearance of structures built by creatures motivated largely by inherited animal instincts, and devoid of any inclination to depart from a fixed hereditary pattern. The inheritance in this instance, of course, is social.

The houses are usually built of mud, adobe, or, in the warmer parts, of canes or fibers. The village money lender may have a brick house. The roofs are of tile or thatching. The villages, in many parts of India, surround or adjoin a pond or water hole which accumulates surface drainage and provides water for the cattle and for bathing and laundry, as well as mud for the repair and construction of houses. Drinking and cooking water comes from wells. Sanitary measures are simple and direct. Toilet facilities are provided by the open fields or at best by drilled holes, sometimes covered at ground level. Garbage disposal is handled by dogs and pigs, both of which are maintained as scavengers. The pigs also supply some revenue (at least they did before the invention of nylon) in bristles, which are periodically plucked.

The role of cattle in the village economy deserves particular mention. It is impossible until one has seen an Indian village to appreciate the importance

of the cow in Indian rural economy. The village system is a well-established ecological complex, centuries old, in which three elements - plants, cattle, and man - exist in a strange symbiotic relationship. The only substantial source of energy for all is the sun, whose radiant energy, captured by plants, fuels both man and his cattle and through them furnishes the power for all agricultural operations.

The cattle consume whatever coarse vegetation is available naturally, and their ration is supplemented by chopped straw and by weeds and grass gathered in the fields. Weeds, even in private fields, are public property; a cultivator planning to utilize them for his own cattle may wake up to find his field already weeded by a neighbor. Grass along the roadsides is laboriously dug up tuft by tuft as feed for cows.

The cow, in return for man's ministrations, provides three necessities of Indian life: milk, manure, and draft power. The milk, which is produced in pitifully small amounts, is an important article of diet and is also the principal source* of ghee, which is pure butterfat without water or non-fat milk solids, and is extensively used for cooking.

The manure is as important as, or perhaps even more important than, the milk. Women and children gather the droppings from the fields and roads, carrying these to their homes in baskets gracefully balanced on their heads. The dung is kneaded with the hands into a homogeneous dough-like mass, water being added if necessary to attain the proper consistency. The moist dung is then formed into loaves whose style varies from region to region but which is remarkably uniform in any one region. The loaves, dried by the sun, are stacked in neat piles to be

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* Water buffaloes also produce a good bit of the ghee.

used either for fuel or fertilizer. It is estimated that about 40 per cent of the manure is used for fuel, about 40 per cent for fertilizer, and about 20 per cent is lost. We saw no evidence that any is lost.

The plants, the second element in the village complex, are largely cultivated species dependent upon both man and cattle for their existence. Without the care of man most of the species could not survive at all; without constant replenishment of fertility through the application of manure, and without the draft power furnished by the cattle, their cultivation would be virtually impossible.

Man, the third element in the village complex, is dependent upon both his plants and his animals. Indeed the three elements are so completely mutually interdependent that it would be difficult for any one to exist without the other two. Any improvement of agriculture in India therefore must necessarily not only involve improvement at the village level but must also take into account the three biological elements which make up the village economy. A change in any one will inevitably affect the entire system. Improved implements, for example, will reduce the need for draft animals and tend also to produce a surplus of manpower. Improved health of the people will create a greatly increased demand for food which must be supplied largely by plants. The problem of village agriculture in India is not one to be attacked piecemeal.

4) Food Production

The principal foods of India are cereals and legumes which are known as "food grains." The total food production of India is now approximately 50 million tons. Even with the present dietary intake of 1800 calories per capita per day (a rate generally considered to be below the subsistence level) there is a shortage of 5 million tons of foodstuffs - a shortage equivalent to about

10 per cent of present production, and roughly equivalent to the food consumption of the cities. In other words, the villages maintain themselves on a subsistence level with respect to food, but do not produce a surplus for the cities. India has reached a point where the practice of agriculture no longer serves the traditional and important purpose of providing leisure for the development of the creative aspects of culture, the arts, sciences, and religions.

Present shortages are being met by imports at a cost to India equivalent to about 700 million dollars per year. She cannot afford such expenditures indefinitely, and there is some doubt whether foodstuffs imported from other countries will continue to be available. This is especially true of rice. A large proportion of India's population is dependent upon rice for the major part (in some areas up to 90 per cent) of its food. All of the Asiatic countries except China, Indo-China, and Siam are already on a deficit basis with respect to rice, and even these three have only small exportable surpluses.

There is a definite effort to move foodstuffs from surplus areas to deficit areas within India, and to accomplish this equitably, approximately one-third of the population is now on food rationing in some degree. The rationing system suffers from the fact that the food-surplus areas do not willingly part with their surpluses. Even the state governments in such areas are known consistently to underestimate their production. It is also suspected that the deficit areas overestimate their needs.

The problem of food is so acute that practically all government officials are preoccupied with it. During our stay in India there was scarcely a day in which the newspapers did not have a front-page story on some aspect of the food problem or upon measures initiated to solve it. Mr. Munshi, the Minister of Food and Agriculture, told us that unless the food problem is solved within the next five years, at least South India will go Communist. Other ob-

servers are not certain that this is true. There can, however, be little doubt that India will remain a world danger spot so long as she has an acute food problem. The people of India, although accustomed to famine in the past, have come to look to their government to guarantee them freedom from hunger. If the government fails it will undoubtedly change.

5) Soils

There are many different soil types, some of them probably originally quite fertile, but now depleted through continous cropping which often involves two or even three crops per year. Also insufficient attention is given to maintenance of soil fertility. Practically all Indian soils respond to application of nitrogen and phosphorous. It is believed that they will also respond to potassium, once nitrogen and phosphorous, the present limiting elements, become adequate. There is wide variation in acidity and alkalinity of the soils. Large areas have become too alkaline through continuous irrigation.

6) Crop Plants

India grows a great variety of crop plants, of which rice is by all odds the most important. The crops are divided into two principal groups according to the season in which they are generally produced. Winter-growing crops are known as Rabi and summer-growing as Kharif. The principal crop plants in order of their decreasing importance are: rice; the millets, which comprise bajra, ragi, and a number of small millets; jowar (sorghum); and wheat. Gram includes primarily the chick pea but is a general term for all of the pulses (grain-bearing legumes) which are grown in India as sources of protein in the human diet. The statistics of production of the principal food-crop plants follow:

	Million Acres			Million Long Tons			Pounds Per Acre
Rice		75.4			20.4		605
Millet, Bajra	22.4			2.3			235
" Ragi	5.2			1.4			589
" Small	12.6			1.8			322
Total Millets		40.2			5.5		
Jowar (Sorghum)		38.2			5.2		305
Corn		7.6			1.7		498
Total Kharif (Summer)			161.4			32.8	
Wheat		24.0			6.6		616
Barley		7.6			2.3		681
Total Rabi (Winter)			31.6			8.9	
Total Cereals				193.0			41.7 484
Gram (legumes)			19.4			3.8	435
GRAND TOTAL			212.4			45.5	

Indian agricultural scientists think of their country as comprising three great regions: (1) the wheat (and barley) region of the north, (2) the jowar and millet region of the southwest, and (3) the rice region of the east. The crops in question are not confined to these regions, but do predominate in their respective regions. Legumes are grown in all of the regions.

Other crops used primarily to furnish oil for industry, but which yield foodstuffs as a by-product are: sesame, 421,000 tons; peanuts, 3,331,000 tons; rape seed and mustard, 826,000 tons. The coconut is also of considerable importance, occupying an estimated 1.5 million acres.

It is not difficult to see that rice is all-important in India. India is second only to China in the acreage devoted to this crop and in total production. The problem of rice production in India is inseparable from the

problem of malaria. The geographical distribution of rice acreage corresponds closely with the distribution of high incidence of malaria. Indeed, large parts of the rice region are classified as hyperendemic with respect to malaria. There would seem to be little opportunity to improve rice production in India without simultaneously attacking the problem of malaria control, especially since some of the agronomic measures recommended for improving rice production are likely to increase the malaria hazard.

India has for many years supported a large program of crop improvement through plant breeding. With some crops, notably wheat and sugar cane, the program seems to have been reasonably successful. In other crops there is less evidence that improved varieties have been developed, or at least that they are reaching the cultivators and are affecting production. As far as we yet know, this seems to be true of rice, the most important crop. Some improvement has been effected by selection, but selection alone (at least in the case of the other self-fertilized cereals) although important with respect to other characteristics, is only of moderate value in increasing yield. The procedure which has dramatically improved the yields of other cereal crops is, of course, hybridization.

Although we have been unable to discover any evidence of successful improvement of rice in India through hybridization, there is no doubt that the Japanese have been highly successful in this field. The Japanese varieties of rice are generally considered to be the world's best. Indeed, the large FAO program of rice improvement is based on the idea of crossing the best Japanese varieties with the best varieties in other Asiatic countries, but there are both technical and practical difficulties here which have not as yet been overcome.

Not only have the Japanese substantially improved their own rice, but they seem to have been equally successful in improving the rice of Formosa. It would appear therefore that any rice improvement program for India or for other Asiatic countries should begin with a study of past Japanese programs, and an evaluation of the factors which have contributed to their success. Perhaps it is possible that Japanese rice geneticists, especially those involved in Formosa (and now said to be displaced) could be employed to great advantage in attacking the rice problem of India.

7) Livestock

India, with 136 million cattle and some 40 million water buffaloes, has about one-fourth of the world's bovine population. The cattle serve three main purposes: the production of milk, providing draft power for agricultural operations and transportation, and furnishing manure which is used for fuel and fertilizer. There are at least eight fairly distinct breeds, of which two, Sahiwal and Sindhi, are especially good milk producers, and others are valued as draft animals. There are four or five distinct breeds of buffalo. At least 60 per cent of the Indian cattle are mongrel and inferior both for milk production and draft. The average milk production is less than 2 pounds per day, about one-tenth that of average production in the United States. Selected cows at the Agricultural Research Institute have produced an average of 21 pounds per day.

Other livestock include sheep, goats, pigs, poultry, elephants, and camels. Camels represent the chief means of transport to villages without roads.

III. THE PRINCIPAL AGRICULTURAL PROBLEMS

1) Too Many People, Too Little Land

Reduced to its simplest terms, the agricultural problem of India is that there are too many people on too little land. Circumstances in India are too complex to be faithfully described by any simple catch-phrase, but nevertheless the population density is so important that it necessarily must furnish the basic fact in any discussion.

To see this tragic situation on a grand scale, as one sees it in India, is a sobering experience, and one which becomes doubly so when it is realized that other large areas of the world are moving in the same direction, and have either already reached or will soon reach the same situation. In this one respect India is ahead rather than behind the remainder of the world. Her population has already outrun her food supply, and she is making desperate efforts to solve the numerous problems which this situation imposes. The world would do well to follow her progress, benefiting from her success if she should succeed, taking warning from her failure if she should fail.

Examined in greater detail, the problems of Indian agriculture become exceedingly complex. Not only are there too many people, but the great majority are illiterate and not easily reached by educational programs. Millions are infected with a variety of diseases, among which malaria predominates, and are not easily aroused from their lethargy. More millions are enslaved by centuries of tradition and are not truly free to try new methods or to exploit their own inherent ingenuity.

Not only is there too little land, but the land has too little water, too little fertility, and is divided into far too many small holdings. The Indian cultivator does not farm - he gardens - and he does so under innumerable handicaps.

All of these factors combine to create a situation in which the food supply is already below the subsistence level and in which any circumstances which reduce production below normal over a large area, such as floods, hail, early frost, or drought, invite widespread famine.

To us it thus appears that the agricultural problem of India is a complex of problems, some of which at first glance may seem only remotely related to agriculture.

2) The Cultural Milieu

The most serious problem faced by agriculture in India is not a technical one, but a cultural one. The greatest handicaps which agricultural development must overcome are those imposed by the caste system, by ignorance, by religious prejudices, by multiplicity of languages, by the many stifling customs, and by habits of thought which prize tradition over improvement.

In view of the exposition of these phases of Indian life by our colleagues in other divisions, this statement needs no elaboration here. However the situation is one which confronts with a serious dilemma any organization or agency which seeks to improve conditions in India. It would be difficult indeed to effect great material improvement under the present culture pattern, or to avoid drastically changing the pattern if improvements were successfully introduced. Furthermore, the various aspects of India's culture are so interwoven that to make a change at any point will almost inevitably produce secondary changes at many other points.

3) The Basic Technical Problems

We would list the basic technical problems as follows, roughly in a decreasing order of importance:

a) Water

The situation regarding water is one of maldistribution both in terms of geography and time. Although India drains the Himalayas and contains several of the world's great rivers, it is in the position of having too much water at certain seasons of the year without control systems for its impoundment and utilization when most needed, and therefore too little water during most of the year. Consequently, India finds itself in a situation in which both floods and droughts are common. Certain areas have water resources which, year after year, are inadequate for normal agricultural production; while other areas which are low-lying require drainage systems for proper utilization. The fact that native forests in accessible areas have been essentially destroyed without any program of reforestation has further contributed to the critical flood situation, has lowered the water table in many parts of the country, and has set the stage for the erosion of thousands of square miles of otherwise arable land. Therefore, although India has appropriated large sums of money in an effort to establish irrigation systems for the drilling and digging of wells, this plan does not recognize the total problem. The impounding of river waters, the establishment of irrigation systems and the drilling of wells should be associated with broad programs of reforestation and soil conservation. Only in this way can the present trend be reversed.

b) Health

The low state of health of agricultural workers greatly affects their energy and efficiency. Large parts of the rice region are hyperendemic with respect to malaria, and it can be stated without qualification or elaboration that agricultural and health problems should not be treated as separate.

c) Training

The unrealistic training of agricultural workers is a great present handicap. Training of technical workers is at a reasonably high level but there are far too few vocationally trained workers. This is a problem of large dimensions and of urgency.

d) Improved Plant Materials

In spite of India's long agricultural history, its numerous schools of agriculture, and a sizable body of trained agricultural scientists, the country has still not produced any considerable number of improved food crop varieties designed to meet the ecological conditions under which they are grown. Certain new varieties of cereals have been developed either by selection or hybridization; and although Indian scientists are cognizant of the importance of disease and pest resistence, drought tolerance, and resistance to lodging, these factors do not appear to have been taken into effective consideration in the production of varieties of wheat which have been released for distribution.

Rice, which is even more important than wheat as a human food, has not received the attention in India which it merits. It is estimated that varietal improvement and disease and pest control could result in significant improvement in yields and contribute markedly to relieving Asia's perpetual problem of insufficient rice production. A project of this sort would doubtless require cooperation with public health agencies in view of the association of malaria with rice producing areas.

Improvements in other crop varieties such as sorghum, millet, corn, and legumes could further increase India's annual food production by a significant figure, stabilize production, and reduce the hazard of famine.

e) Control of Plant Pests and Diseases

Although it is sometimes possible to produce plant varieties resistant to certain important pests and diseases, it is not feasible to solve most pest and disease problems by this technique. On the contrary, it is necessary in modern agriculture to consider the application of insecticides and fungicides as a standard procedure in the production of certain crops, this procedure being of equal importance to tillage, irrigation, and other operations which together make up farm practice. In India such procedures have been given too little attention, in part due to the fact that they require considerable field work for the demonstration of their effectiveness, in part due to the very low economic and educational level of the village farmers, and possibly because it is believed that such practices would not be generally acceptable to rural populations.

f) Transportation and Communication

A deficiency of means of transportation and communication, both internal and external, adversely affects agricultural activities. Many of the villages have no access to the world except by itinerant vendors and craftsmen traveling by camel back. Foodstuffs and other goods are moved long distances by bullock carts. Indian scientists suffer a high degree of isolation from science in other parts of the world.

g) Animal Surplus

One of the most dramatic and shocking aspects of Indian agriculture is the surplus of cattle and other animals which plunder the already meager crops. Stray cattle roam over the fields, consuming the crops unless they are guarded. Birds, monkeys, and insects make serious inroads upon the food supply. The Hindus will not kill these animals but in parts of India are quite willing to have them destroyed by others.

h) Manpower Surplus

In spite of the primitive methods used, there is a surplus of manpower in the villages. Perhaps one reason that Indian methods are so inefficient is because a surplus of labor does not encourage labor-saving methods. If more efficient methods and implements are developed, there will be a still greater surplus for which some outlet must be found. This need for developing small-scale village industries to utilize the surplus manpower is, without doubt, one of the pressing and important social and economic problems of India.

i) Land Tenure

An antiquated system of land tenure and land inheritance leads to smaller holdings in each generation. The fields are already pitifully small. The average family tills 2 - 4 acres divided into 5 - 15 small pieces. The cultivator who owns land must, when he dies, leave it more or less equally to all of his sons. Renters may sublet a piece of land to a number of smaller renters. There is little possibility of the widespread use of modern agricultural machinery under present conditions.

There are undoubtedly other important problems impinging upon agriculture which we have overlooked. But this list at least gives some hint of the complexity of the problem.

IV. WHAT IS BEING DONE AND BY WHOM?

1) Agricultural Activities of Indian Central and Provincial Governments

a) The Five-Year Plan

First of all one should mention the Five-Year Plan which was recently announced by the Indian Planning Commission, an agency of the Central Government. This plan will involve the expenditure of approximately

1.48 crore rupees (equivalent to approximately 3.4 billion U.S. dollars). Much the largest emphasis in this plan is being placed on the problem of providing more water for agricultural purposes. This involves irrigation projects, tube well projects, and the furnishing of the necessary steel for tube wells, Persian wheels, etc. A certain amount of power development is also involved in the irrigation projects. This first category of activity will require something like 1.5 billion dollars of the total 3.4 billion. The second largest emphasis in this plan is on increasing arable acreage, the third is on fertilizer production, and the fourth is on improving the capabilities of the workers. This last category involves a certain amount of social service and similar items, but is very small in total as compared with the previous items.

As is obvious at once, the whole drive of this plan involves a major attack on immediate needs. The plan has little or nothing to do with such long-range problems, for example, as agricultural education.

Of the total money necessary for this Five-Year Plan, it is hoped that approximately 2.3 billion dollars would be furnished from Indian sources (including sterling aid from London), and the remainder is hoped-for support from foreign sources.

b) Research Institutes

With respect to the government-supported research organizations which are concerned with agricultural problems, it can be said at once that in general these are surprisingly good in physical facilities and staff, but that they do not seem to be very effectively focused on the problems of Indian agriculture. In addition to a large central research institute for agriculture at New Delhi, there are numerous institutes for (regional) problems such as rice, sugar cane, cotton, jute, hemp, potatoes, coconut, tobacco, etc.

c) Agricultural Colleges and Schools

In connection with agricultural education, there are three topics that should be mentioned. With respect to agricultural colleges, there is one central College of Agriculture supported by the Central Government, and three outstanding provincial colleges (Kanpur, Poona, and Coimbatore). There are upwards of twenty other smaller provincial colleges. The four first named are surprisingly good in physical plant and facilities. Their primary weaknesses are that they have a tradition which is almost wholly devoted to training for civil service rather than for the actual practice of agriculture: they are foolishly concentrated on a system of (external) all-important final examination; they are essentially undemocratic in atmosphere; and both the research and the teaching are on the whole poorly related to local problems.

Secondly, one should mention vocational schools of agriculture. Of these, Bombay province has eighteen, and the one of these which we saw is absolutely excellent. But there are only about ten more such schools in the whole of India, not more than two being in any one province (Orissa). The development of such practical schools in India appears to offer a large and a most promising opportunity. The scale of expenditure involved is clearly beyond RF possibility except for certain possible "pump-priming" activities.

Thirdly, one should at least mention here the educational aspects of the village improvement schemes, but the Village Improvement Projects include many activities other than education and will be described below.

d) Village Improvement Projects

These so-called Village Improvement Projects (sometimes called Intensive Development Centers) originated in the Etawah project in the United Provinces. The basic vision and philosophy for this Etawah project seems to

be due almost entirely to Albert Mayer*, who received very important help from Art Mosher**. In spite of the fact that the vision and certain over-all leadership has been furnished by a Westerner (Mayer), it should be emphasized that Etawah is very definitely an indigenous project. It has been, from the very beginning, under the complete control of the Development Commission of the Ministry of Agriculture of Uttar Pradesh. Not one cent of external money has, so far as we know, come into this project to date, and at the present time every single man employed in this project is an Indian. It remains true that Albert Mayer is retained by the government of Uttar Pradesh in a consultant and planning capacity, and that he spends several months a year there.

The plan for reduplicating "Etawahs" all over India will be described below. As to Etawah itself, this project involves 97 villages of about 830 persons each, and a total area of about 61,000 acres. The project costs, in total, a number of rupees equivalent to about $48,000 a year. There is a DPO (District Planning Officer), four DDO's (District Development Officers; devoted to the agronomy, village participation, engineering, and training respectively), and 24 Village Level Workers.

The completely interrelated program of activities involves better seeds, better agronomic practices (green manures), upgrading of cattle, veterinary aid, literacy, cooperatives, village schools, primitive sanitary measures, etc., etc. The project has gained large local acceptance, has succeeded in establishing the use of improved seeds for practically all of the irrigated area, has improved food production in the area from 15 to 30 per cent, has started numerous decent village schools, has made real headway on literacy, etc.

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* A city planning architect who became acquainted with Indian problems during the war, is a friend of Nehru, and continues as the chief advisor of the U. P. Government on the Etawah project.

** The head of the Allahabad Agricultural Institute.

It is really an inspiring show. But one nevertheless has certain serious reservations. How do you get enough good personnel to reduplicate this project in many other localities? Having solved, by the mere application of existing knowledge, a few of the most important and most basic problems, how do you now obtain in such a project the technical competence to go on and deal successfully with the second array, the third array, etc., of problems which inevitably arise when the initial set of problems has been solved? How much can this kind of a project do for an area which has no irrigation available? How does such a project proceed in less favorable parts of India, such as areas (sorghum and rice) for which there do not exist good improved varieties of seeds?

2) Agricultural Activities Under TCA (Point Four)

Let us turn now to activities which are under support, or at least under contemplated support, by the United States through the Technical Cooperation Administration (Point Four). The present plan here involves two main areas of activity: first, to aid in setting up a large number of intensive development centers, and second to give large aid in connection with a program of tube well projects, steel needed for tube wells, Persian wheels, pumps, etc., all of this second activity being aimed at increasing the irrigated area. This second aspect of furnishing more water for India's agricultural land is planned, for the present fiscal year, at the level of approximately 18 million dollars. But nearly twice this amount is earmarked out of present TCA funds for the first stage of the expanding program of reduplicating Etawah by the setting up of large numbers of Intensive Development Centers.

It is planned that each one of these new Intensive Development Centers will include about 300 villages of from 500 to 700 persons each, so that each project will affect about 200,000 persons. Each project will have from 30 to

60 Village Level Workers, and from 10 to 15 supervisory personnel. It is estimated that each one of these projects will cost a total of approximately $435,000 a year, of which about 40 per cent must be in dollars and about 60 per cent in rupees.

The TCA officials (informally and confidentially) plan to set up these projects as follows: 40 by July 1, 1952; 80 more in 1953; 160 in 1954; and 320 in 1955.

The 600 projects thus contemplated will require from 6,000 to 9,000 (college and specially trained) supervisory personnel, of which they think that at least 1,500 must be Americans; and from 18,000 to perhaps 40,000 Village Level Workers, who will all be Indians, but all of whom have to have special training for this work. These 600 projects would include a total of some 120 million persons, or just about one-third the population of India. TCA officials have estimated that these projects will result in enough gain in food production (based on what we are confident is a substantially over-optimistic estimate of 46 per cent for Etawah) to "solve India's food problem in four years, taking into account increases in population."

There are those who believe that the urgency of the situation in India requires and justifies heroic measures, even though it may be clear in advance that there will be large wastage involved. The men involved in this TCA plan all seemed to be intensely earnest and deeply sincere in their wish to do something to help India. Some of them are essentially small persons who have been lifted up into positions of tremendous responsibility for which they are unequipped, intellectually or in any other way. As a result the situation is characterized by a frightening mixture of almost fanatic devotion, optimism based on the supposed accuracy of technical information which has in many

instances passed through incompetent hands, and an administrative confusion which would be found congenial only by the Mad Hatter.

3) Agricultural Activities Aided by The Ford Foundation

First of all, The Ford Foundation is providing part of the funds to assist in the setting up of the first 15 of the Intensive Development Centers just described. We understand that TCA - India agreements have already been signed for the next 50 of these projects.

Secondly, Ford has taken a major responsibility in helping to set up the Training Centers which are needed to produce the tremendous number of (Indian) Village Level Workers, and also to give the necessary orientation to (Indian) agricultural graduates who will work at higher supervisory levels in the Village Improvement Projects.

The Ford Foundation has, so far, committed itself to helping get started five such Training Centers - at or near Lucknow, Nampur, Bombay, Calcutta, and Bangalore. They have negotiated an agreement under which they will furnish half of the money for the first year and the Central Government half; for the second year one-third each is paid by the Ford, Central Government, and the State Government in question; for the third and subsequent years half is to be paid by the Central Government and half by the State Government.

TCA is also involved in these Training Centers, and in a way which we were not able financially to unscramble. They are furnishing the salaries of the United States personnel who are actually setting up these five centers. For the Intensive Development Centers and the Training Centers, The Ford Foundation, in accordance with an announcement made by Mr. Hoffman on April 11, 1952, appropriated 1.2 million during the year 1951.

TCA has asked Ford to add 25 more of these training centers on July 1, 1952, and Horace Holmes stated that TCA has already obtained all 30 of

the U. S. men needed to head these. Substantially more than half of all of these men were obtained from Texas A. & M. Ford has apparently earmarked several million more dollars to cover the expansion of this program.

In addition to Ford's contributions to the Training Centers and to the initial group of Intensive Development Projects, they have given $500,000 to Allahabad Agricultural Institute for buildings, and they have given a second sum of $440,000 to Allahabad Agricultural Institute to enable that group to set up an intensive program of extension work.

The Ford Foundation has also given a half million dollars to the All-Pakistan Women's Association to establish a college of home economics with associated rural training centers; 1.1 million to the Government of Pakistan to help establish a polytechnic training institute, a training center in general engineering trades, and two short-term industrial training centers. They also granted $85,000 for a community center in Delhi to honor Gandhi.

4) Agricultural Activities of Other Agencies

The Indian Government agencies, the Point Four people, and The Ford Foundation support the bulk of the major activities now being addressed to agricultural problems in India. But there is of course a large number of other organizations, some missionary in background, some purely Indian in origin, and some international in character (such as FAO) who are carrying on a considerable number of projects on which we can at present not report in detail. Some of these are undoubtedly significant, but the sum total of all of them appears to be relatively unimportant as compared with the activities described above.

V. SUGGESTED PRINCIPLES FOR ROCKEFELLER FOUNDATION AGRICULTURAL ACTIVITY IN INDIA

Any attempt to aid agriculture in India must take into account the highly complex social and cultural patterns of that country including the confusing diversities of religions, castes, and languages; must recognize the dominant fact of the existing population density and its rate of growth; must cope with the handicaps of poor internal communication and transport; and must seek eventually to improve the system of land tenure.

Any plan for The Rockefeller Foundation to aid agriculture in India must also take into account the fact that the most serious and limiting difficulties fall into two main categories: cultural complexities which will yield only to an exceedingly broad, skillful, and patient approach; and physical handicaps, such as the maldistribution of water and the improverishment of the soil, which can be effectively attacked only on a very large scale and with enormous funds.

One must recognize that tremendous forces are already being brought to bear on these large-scale problems, these forces being principally financed by the Indian and United States governments, with substantial aid from The Ford Foundation.

These considerations, together with the facts previously stated in this memorandum, lead, in our minds, to the following general conclusions as to the necessary and desirable characteristics of any Rockefeller Foundation agricultural activity in India:

1) To a degree not, in our experience at least, duplicated elsewhere, any project in India proposed by any one Division should have the active interest of, and should profit by the competence of all other Divisions. On

the other hand, we see no present desirability of an "all-Foundation" program; and think that projects should be initially studied and formally sponsored by the separate Divisions.

We think that RF activities in India must be exceedingly selective, with a primary emphasis on excellence and basic character. There are going to be, in India, far too many second and third rate projects sponsored and supported by external funds. It should be our aim to establish high standards in anything we do.

As one important aspect of the principle of high selectivity, we need not, and we should not, get directly involved in any of the very large-scale movements which already have tremendous funds, and which in some instances are based upon doubtful assumptions, particularly as to the availability of sufficient and sufficiently good personnel.

We have no desire to adopt the precarious role of being prophets of India's future, but we nevertheless are skeptical concerning the confidence that is leading some persons to believe that the major problems of Indian food production can be solved in some brisk Western tempo*. We think that any RF activities should be planned with respect to a long future of slow improvement, retarded by inevitable but unforeseeable setbacks.

Although it would be folly to ignore or underestimate the difficulties - particularly those connected with the cultural patterns - of working in India, still we do not think it necessary to be paralyzed by these difficulties.

We would suggest that there are two types of activity which make sense: first, activities which explicitly face up to the complex and inter-

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* Somewhere Kipling quotes an epitaph - "Here lies a fool who tried to hurry the Orient."

related problems of ignorance and tradition, and seek to attack these problems; and second, isolable technical problems which are so important that their solution would find acceptance and application even under present circumstances.

The two projects already proposed for aid fall under the first category. Although the main emphasis at Etawah and at the Agricultural Institute of Allahabad is upon agriculture, in these two proposals which are superficially so different the underlying philosophy is really the same - that improvement has to occur on a broad social front and at a simple level, and that there has to be a departure from old customs and ways of thinking.

As examples of the second category, we would for the present merely mention two technical problems which we now propose to study intensively, to discover whether or not there is a real opportunity for RF aid.

India does not have wheat varieties which are resistant to the various local species of rust; and it is roughly estimated that losses due to rust run up to 40 per cent. It seems well worth while to determine more accurately the extent and seriousness of this problem in India, and the practicability of aiding in its solution. This problem is all the more significant because of the fact that wheat is also an important crop in Pakistan and throughout the Arab world.

Of much larger potential importance for India and for the whole of the Orient, is the problem of breeding improved hybrid varieties of rice. This problem is one of very special technical difficulty. It is one which cannot usefully be separated from the problem of the control of malaria. And the importance of the problem is roughly indicated by the fact that rice is grown, in India and the Orient, on more than 200 million acres.

A good deal of excellent work has been done on rice breeding in Japan. An FAO project on rice breeding is now under way in India. But it is

our present impression that important opportunities continue to exist in this field; and concerning this problem we propose to obtain considerably more furnished information, perhaps starting by sending an expert plant breeder, acquainted with rice problems, to Japan, to India and probably to other parts of the Orient to make, over a period of perhaps six months, an intensive study of what is being done.

Finally, we wish to make some comments on the subject of agricultural education. For any improvements in agriculture in India should be approached through the framework of Indian agricultural education. Indian nationals would be involved in any program and would ultimately have to accept full responsibility for the continuance of improvement programs.

At the top level, Indian scientists are intelligent or even brilliant, serious and scholarly, although often if not indeed usually impractical. They enjoy research and its mathematical interpretation. They make elaborate plans and keep elaborate records. However, they often seem to be more interested in science for its own sake than for its application to basic national problems. In general, they shun direct field work, possibly from the point of view that there is something demeaning about physical work. Even those Indian scientists who as a result of their experience in U.S. land grant colleges have now come to respect field work and to practice it to a degree, seem to lack the vision necessary to enable them to transpose results thus obtained into terms of practical application for improved national yields.

It would seem that there are at least three useful approaches to an improved agricultural education at the college level and that these might have impact far beyond the strict limitations of education. These are:

First, collaboration with agricultural institutions of higher learning in an effort to better utilize the available talent in the solution of fundamental

agricultural problems. Since most Indians do not seem to be familiar with their own country and its agriculture, one approach might be through enabling key individuals to travel within India in order to obtain a clearer picture of Indian agriculture and fundamental production problems.

A second approach might be through enabling administrative personnel who are to have responsibility for the future development of agricultural institutions to visit land grant colleges in the United States and become familiar with their organization and with teaching, research, and with extension methods and their interrelationships, as well as administrative procedures. If such individuals might subsequently become imbued with a sense of the responsibility which agricultural institutions have, not so much to science but rather to farmers through science, a tremendous improvement in the services rendered by Indian agricultural colleges to national agricultural progress might eventually result.

A third approach might be through the establishment of one or more small research projects in collaboration with Indian colleges of agriculture. Such projects directed at basic problems of agricultural production and involving collaboration between American scientists, Indian scientists and students might conceivably initiate a new school of thought in India as to the functions of the agricultural college and the agricultural research worker.

Because of the nature of Indian rural life, it is particularly important to emphasize intermediate and even elementary levels of agricultural education. There are at present only relatively few vocational schools of agriculture in India. Actually, this type of institution should be the most numerous since, while there is inevitably a limitation in the number of top-flight scientists that can be absorbed into the present or future agricultural

institutes in the country, there is essentially no limit to the number of vocationally trained Indian youths that can be reabsorbed into village life.

One of the most direct and effective ways in which village improvement might take place is through the vocational training of outstanding village boys and their return to the village with a knowledge of materials and practices which are completely reproducible in the village and which will help in general improvement of village agriculture and life. Such schools should be very carefully designed and located and they should be protected in such a way that the students receive essentially only simple practical instruction which will enable them to return to their villages as community assets, but will not make them dissatisfied with village life and create an urge for urban existence or further education which will make them unable or unwilling to return to their native villages. Any effort which might be made to stimulate India to multiply by any reasonable factor the number of vocational schools of this type would have tremendously far-reaching effects on agricultural improvement over the years. Moreover, it has been observed that when properly designed, located, and staffed, such schools may become entirely self-supporting from the sale of agricultural products. Thus, the number of schools would be limited largely by the need, and by the initial cost for their establishment.