

Lord Curzon Lecture :

Increasing Agricultural Production *

by

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Part I. A WORLD PICTURE

At the present day, agriculture as a science and as an industry, has made such rapid strides, that it is difficult if not impossible to confine oneself to one particular aspect of it without referring to other branches that dovetail into it. And today again, not only the technician and the scientist, but also the general public have been caught by an awareness of the immensity and complexity of the problem that modern agriculture is. This awareness is reflected in the changed attitude of people in many countries to agriculture. The people of the world are now well seized of the fact which several years ago was voiced only by the knowledgeable few, that the rate of increase of agricultural production has not kept pace with the rate of increase of the population. Unless drastic and emergent measures are taken, humanity will have to face a crisis of unpredictable magnitude. No wonder, people have come to recognise, agriculture as a technical subject, even as engineering and medicine are, and today, we see the emergence of a technical approach to the problem.

The subject will be approached along three broad lines—a World Picture with relevant data, culled from F. A. O. reports, something about the work done in some countries with F. A. O. Technical Assistance, the technical work that is being done in a few countries which are paying tremendous attention and application to the subject and in the last and third portion the situation in India and about some ideas for improving the situation.

Various definitions of agriculture have been made from time to time. The simplest way to define it, is, as the result of work or labour on land. The application of labour should be such as to make the land produce more than it would by itself, without the application of that labour. The labour may be physical or mental, manual or mechanical, rational or empirical, each of these characteristics affecting production in different degrees. Of the three factors concerned in agricultural production, it is obvious that depending on the agricultural situation, Land is of a fixed character. The other two, Capital and

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* The Lectures were delivered by Professor M. R. Balakrishnan on 1st, 2nd and 3rd February 1966 under the auspices of the University of Madras for the Lord Curzon Endowment Lecture. On the first two days of Lecture, Professor M. R. Balakrishnan dealt with the world agricultural situation, and about F. A. O. technical assistance to many countries including his own work in that capacity in Thailand and in Burma. On the third day, he talked about the situation in India, which alone, we are publishing.

Labour are variable, but of the three, Labour is the most important and must find an expression in the will of the people to work and to make sacrifices to attain the objective. Labour properly applied, will even change the other two, Land and Capital favourably.

Early man's first needs were few and of short magnitude, and hence, work could be at a low efficiency level, even in the matter of producing what was needed from the land. Agriculture, the oldest human occupation, needed but little effort, but, even today it continues to occupy a predominant place in the economy of any country, because, its primary function is to provide enough food for the people. In such a function, Land the fixed character, imposes a restriction on production, whether it be food, or of raw materials for industries. We have, therefore, to answer the basic question: How much Land is available in the world and what is the population that has to be maintained by it?

World Population: Some half a dozen years ago, the population of the world was stated to be 2800 millions or 2.8 billions. The estimates and forecasts furnished by the United Nations indicate that the world population is increasing at an alarming rate of 1.3 to 1.5 per cent every year. Based on this estimate, the population will be reaching today 300 million or the three billion mark. For some years more, the population of the world will be in the neighbourhood of this figure.

It is a general rule, that a country enjoys a high standard of living, derived from agriculture, when more than three acres of land per inhabitant are cultivated. There is some difference of opinion among Economic experts on this; some say that three acres are absolutely necessary, others state that even 2.5 acres would be enough, but all of them are agreed that anything less than two acres would lead to economic distress. Some countries in the past have secured for their population a high standard of living even with less than one acre. This is because, they had an early start when the population was low, and they could embark on the second stage of human welfare, namely, industrialisation which augmented their capital resources. At the same time, they had the aid of dependencies and colonies whose land and labour resources they could draw upon, with the result that they had indirectly more land than was present in their own country. Their cases are only exceptions to the general rule that there must be at least two acres for every individual. On this basis, three billion people of the world would require six billion acres of agricultural land. Are these available?

World Agricultural Area: An examination of the total land area of the world and its distribution in the several regions shows that the total is 34.1 billion acres. Of these, forested land occupies 9.39 billions, while built-in area, and waste land, and deserts absolutely unfit for cultivation, take up as much as 14.81 billions. These two together, totalling 24.2 billion acres, or 71 per cent of the total, constitute the *non-agricultural* area. The balance of 10 and odd billion acres form the *agricultural* area. Of these, pastures and meadowlands occupy six billions and the cultivated area at the present moment, is only 3.42 billions of

acres. To these can be added another 1.33 billions which at present are not used, but are potential, in that they can be brought under cultivation gradually. Thus, 3.42 billions of acres, constitute all the agricultural area for the people of the world. We should not consider the area under pastures as area available for the people. Livestock maintenance which is important for human welfare, depends on this area and it will not be a wise or desirable policy to encroach into this area, although small adjustments can be made now and then. Thus, we come to the final result, that there are 4.7 billions of acres for 3 billion people, roughly 1.6 acres for each individual - a figure which falls short of the two acre limit set by the optimistic among the Economic Experts.

What about the several regions of the world? Are any of them more favourably situated? North America, Africa, and the U. S. S. R. are well above the three acre limit. Europe with its limited area, and Asia with its teeming population, have less than an acre. Oceania, on account of its low population, 17 millions, is better placed than Europe and Asia. But, all of its agricultural area of 0.02 billion acres is under cultivation and there is hardly any cultivable area, although, under pastures, it has 90 million acres which can now and then be brought under cultivation. When the population increase, Oceania will have the same handicap as Europe and Asia have today.

Twelve countries of the world have the fortune of having more than 3.0 acres per capita (Table I).

TABLE I.

Countries with more than three acres per capita

Country	Per capita area
Congo	9.5
Liberia	9.0
Iraq	6.6
Canada	6.3
Australia	6.1
Libya	5.5
Chile	4.7
Iran	4.5
Sierra Leone	4.4
Uruguay	3.8
Argentina	3.7
Cambodia	3.7

Of these, Canada and Australia with over six acres each, and U. S. S. R. (not shown in table) are already in the forefront of agricultural development with a proper planning and a technical approach. They will continue to be in the

vanguard for quite a long time to come. How far the countries which have the initial advantage of high per capita area, will make maximum use of that advantage, depends not only on scientific planning but also on their future political set-up and stability to carry out long term plans.

Seven countries of the world have between three and two acres per capita. All these have great potential, particularly the U. S. A. In this country, which has nearly 3.0 acres, the application of science and of mechanisation to production, has produced outstanding results, taking it beyond the level of countries which have more than three acres. And it is in a position to have surplus production today and make it available for countries with less production.

Thirty countries have between two and one acres and another 28 less than one acre. Thus, of the 79 countries, for which data have been collected, only 21 countries have more than 2.0 acres. To these 21, may be added another eight which have the world average of 1.6 acres. Fifty countries of the world have an agricultural area available for production of less than 1.6 acres, figure obtained for the world, a figure low enough. Thus, the picture emerges clearly. *The malady the world is suffering from, is first and foremost, poverty of land.* It is well to remember that in making these calculations, not only the cultivated area at present has been taken into account but also the cultivable area, which in many countries, is only slowly coming under cultivation or is being neglected altogether. If, only the cultivated area is considered, the position will be more depressing still.

Looking at these figures as they stand, one is mystified to see how some countries with high areas are economically not so high up, while others with smaller areas are in the economic forefront. As illustrations, Congo which heads the list with over nine acres, and New Zealand with but 0.07 acre per individual may be taken. Congo has not yet properly and fully utilised its agricultural potential. The low efficiency of labour has nullified the advantages of land and affected the production of capital. Its population also at present is low, but development both agriculturally and industrially is bound to take place in the future, with increasing pressure. In such development, other more advanced countries have a great part to play by giving a sane and healthy lead to a solution of its political problems and to the establishment of political stability. This lead must arise from a feeling of *oneness of the world* and recognition of the basic fact that the strength of a chain depends on its weakest link. Congo and many other similarly situated countries have a significant part to play in contributing to the future welfare of humanity on the agricultural front.

New Zealand with that small area of 0.07 acre per individual, has assured for its people, a very enviable standard of living. It enjoys the highest nutritional level among all the nations of the world, with an intake of more than 4,000 calories for each citizen. Livestock maintenance and the promotion of the dairy industry have secured for them this position, an instance of the importance of pastures and the undesirability of encroaching into that area. Wherever land was

unsuitable for raising crops, the New Zealanders have reserved for their livestock and their maintenance. In addition, the people are very active and industrious and never spare themselves when hard work is needed. They have attained a high level of nutrition. Milk and mutton are as important to them as cereals, pulses and other produce from the land. The intrepid New Zealanders have recognized this to the extent of not only feeding themselves adequately but exporting surplus to other countries! The application of labour at a high level of efficiency has enabled them to make maximum use of land and add to the Capital.

Belgium, Netherlands, Germany, Ireland, U. K., Italy and Denmark among the European countries, Japan in Asia and Egypt in Africa are all countries which have per capita area less than the world average, yet they have a high reputation for hard work and progress not only in industry but also in agricultural production. With larger areas they are capable of adding substantially to the world output. Their examples should inspire countries with larger areas to rise to their full height and help to drive away the spectre of hunger and poverty.

With this chronic shortage of land, what is the hope for the future world? One possible way is to increase productivity. Area and productivity are involved as components in an arithmetical product, which is production. A high level of productivity will help to counter-balance the limitations of reduced area. Is the world at present producing enough to meet the need of three billion people? Let us, again have a world picture, first with cereals, the basic human diet.

World Production-Cereals: Table 2 shows the world production of all cereals and the percentage contribution from each region of each cereal. Rice, maize and wheat in the order named, form the chief cereals of the world, contributing 71 per cent of the world total. The other grains barley, millets, oats and rye constitute the remaining 29 per cent.

TABLE 2.

World Cereal Production in Million Tons

Regional-wise			Cereal-wise		
Region	Production	Percentage	Cereal	Production	Percentage
Europe	125	17	Rice	215	29
N. & C. America	107	25	Wheat	159	21
S. America	32	4	Maize	164	22
Asia	367	49	Barley	75	10
Africa	38	5	Millets	71	9
Oceania	6	0.8	Oats	52	7
			Rye	20	2
Total	756			756	

Among the regions, Asia contributes nearly half the world total, chiefly because it is the main region growing rice, which occupies the top position among the cereals. North America comes second with 25 per cent and Europe third with 17 per cent. The contribution of South America and Africa is very little being only four and five per cent. It is worth noting the performance of Europe. Its agricultural area is 297 million acres excluding the U. S. S. R. which has not been included in the above tables for cereal production. Against this area of Europe, South America with 316 millions and Africa, with 897 millions make a total of over 1,200 millions of acres. Thus, Europe's total is only one-third of that of South America and Africa combined, but its production is 125 million tons while South America and Africa together produce only 70 millions, a little more than half of Europe's total. To produce atleast up to Europe's level, these two regions must produce 160 million tons, that is, more than double their present output. And, if they succeed in going beyond Europe's present productivity, to that extent, they will swell the world total, to one million tons instead of the present 756 million tons. Is it such a difficult target to reach? This clearly indicates what great potential these regions have for saving the world from hunger. All eyes will be turned to them and all advanced countries have a duty to discharge in seeing that they get the technical assistance and aid for translating their potential into benefit for the world.

How great is the difference between the potential of some countries and the performance of others, can be seen from the Table 3. In fact, the world cereal total of 756 million tons is produced in a major measure by only a few countries. Table 3 shows the countries with over 10 million tons of cereals every year. Their actual contribution is also seen.

TABLE 3.

Country which produce over 10 million tons of cereals every year

Country	Production
U. S. A.	148
China	108
India	72
Canada	31
France	19
Pakistan	18
Germany	17
Japan	17
Italy	14
Argentina	13
Indonesia	13
Brazil	12
Poland	11
Turkey	11
Total	506
Percentage of world total	66

These are 1958 figure. Recently, all countries have increased their production, for example, U. S. A. is reported have produced 184 million tons. But as, correspondingly the world total has also increased, the position and importance of these 14 countries have not altered much and they still continue to be the bulk suppliers of the world.

The total of these countries' production is 506 million tons which is 66 per cent of the world total of 756 million tons.

Not all the countries mentioned in the table have, however, recorded high acre yields, but the total production is made up by the areas they have. For example, the contribution of China and India to the world total is due to their large areas. This can be seen by a reference to Tables 4, 5, and 6 which show countries with high acre yields of the cereals; neither China nor India find a place in those tables.

TABLE 4.

Countries with high average yield per acre of rice. Over 2,500 pounds

Country	Yield in pounds
Spain	5,220
Egypt	4,840
Australia	4,770
Japan	4,320
Yugoslavia	3,350
U. S. A.	3,280
Peru	3,240
Argentina	2,880
Venezuela	2,700
Taiwan	2,520
World average	1,636
India average	1,443

TABLE 5.

Countries with high average yield per acre of wheat. Over 2,000 pounds

Country	Yields in pounds
Denmark	3,600
Netherlands	3,240
Belgium	2,880
Ireland	2,800
U. K.	2,790
Newzealand	2,610
Japan	2,070
Egypt	2,160
World average	1,044
India average	657

TABLE 6.

Countries with high average yield per acre of Maize. Over 2,000 pounds

Country	Yield in pounds
Belgium	3,870
Canada	3,060
Japan	2,790
U. S. A.	2,610
Austria	2,520
France	2,430
Italy	2,430
Netherlands	2,270
Egypt	2,000
World average	1,476
India average	666

Productivity: Table 4 shows 11 countries yielding over 2,500 pounds of rice per acre. Spain leads with over 5,000 pounds. Egypt, Australia, and Japan with over 4,000, Yugoslavia and Peru with over 3,000, Argentina, Venezuela and Taiwan with over 2,000 are the other countries with high yields per acre. By comparison, India's yield is only 1,400 which is even less than the world average of 1,636.

As regards wheat, (Table 5) Denmark and Netherlands lead with over 3,000 pounds, Belgium, U. K., Ireland, New Zealand and Egypt follow with over 2,000. India's average is only 657 pounds while the world average is 1,044. The Maize Table, 6, gives a similar picture with nine countries, Belgium, Canada, Japan, U. S. A., Austria, France, Italy and Egypt all producing over 2,000 pounds per acre.

One point will be clear from a study of these tables. Among the large countries, U. S. A., Canada, and Australia figure as countries of high yield. But it is the small countries of Europe, like Belgium, Ireland, U. K., and Netherlands, and even New Zealand from Oceania which obtain pride of place by their performance. Japan and Egypt, also countries with small areas per capita find a place in all the three tables, Rice, Wheat and Maize and deserve special notice. In addition, the European countries, and Japan in Asia, also produce high yields of barley and oats, cereals which have not been included in the tables.

What are the reasons for the high acre-yields of these countries? One obvious reason is that all these countries have irrigation facilities. But more important is the fact that intensive cultivation methods, based on scientific knowledge obtained by research, are being followed in these countries. Mechanisation of operations also helps to promote the efficiency of production programmes. Further, with small areas and the need to survive, there is a stimulus for hard work and

application. The people of these countries are well known for their industry and their keen desire to make Mother Earth give the maximum yield under the given conditions. It is an instance of the maximum utilisation of *Labour* over number of years, that has considerably enhanced the capital, although the other factor land, has more or less remained constant. The increased capital enables still greater utilisation of a *disciplined, enthusiastic and willing labour*.

The data presented in the above tables are average yields. There have been instances of high record yields by individual farmers. For example, a few years ago, an Australian farmer produced a yield of $5\frac{1}{2}$ tons of rice, that is, 12,000 pounds per acre. In Japan, yields of 10,000 pounds are recorded. Even in India farmers taking part in crop-competitions have produced yields of 6,000 and 8,000 pounds. If in spite of this, the average yields are low, it only means that for every high yield, there are perhaps tens and hundreds of low-yield-performances, which bring down the average. The world average is about 1,100 pounds per acre, for all cereals combined. This is about one-fourth of the average of high yielding countries. These again, are half or one-third of the individual records produced. The world average is thus, only one-tenth of the potential. This is the gap that has to be covered and that has to be planned for.

There is another point, namely the calculations for *per capita area* were made on the total area *available*. But the production data for the cereals were obtained only from the actual area under cultivation. When all the cultivable area is also brought under cultivation, the world production will also correspondingly increase.

Possible Measures: Thus, bringing the cultivable area under production and increasing the yield per acre are the obvious solutions for meeting any world shortage. With the data presented, let us see the possibilities of accomplishing this. No doubt, the increasing population has made us take a grim and desperate view. Is there need for such a view? is it not possible with a measure of our present performance and future possibilities, to plan an all-world campaign, to banish the threat that is hovering over humanity like a Democles' sword. A few features that can guide the plan to take shape are discussed below.

The total cultivated area of the world is 3.4 billion acres; and the area under cereals alone, for which the world total is 756 million tons, is 1.39 billions. Thus, cereals occupy 40 per cent of the total cultivated area. Agriculture's primary function is to provide food and therefore, food-crops like cereals deserve and need more than a 40 per cent representation. It must be at least 50 per cent to have a balance between cereals and other crops. If this is done as the first step, the yield of 756 million tons will go up to 830 million tons.

There are 1.3 billion acres of cultivable area. The next step is to bring half of this or 0.65 billion acres, immediately under cultivation for cereals only. The new area added, at the present rate of production, would produce 420 million tons bringing the world total to 1250 million tons, or 1.3 billion tons. Thus, by

taking more area from the present or cultivated area and bringing half the cultivated area alone under cereal cultivation, there is the possibility of raising the present world total from 756 million tons to 1250 million tons, a 66 per cent increase.

What are the potentialities of increasing productivity? The average yield per acre of all cereals combined, is only one-tenth of the potential. To attain this, atleast in the near future, is certainly not possible. But even a pessimist will admit that a two-fold or three-fold increase is within reach. That would mean 2.5 to 3.5 million tons of cereals, which is four times the present production of the world. Possibility is one thing. But performance is another. What is wanted first is a perfect understanding between countries of the world. Today with international tension in many parts of the world, understanding between nations seems a difficult thing to achieve. Steps taken by a world organisation like the United Nations, the nations can be united for a common and noble purpose, namely the banishment of hunger from the world. At least that seems to be the only hope for the world with its increasing population. In spite of all the tension, there is a greater understanding everywhere and a desire for Universal Peace. One has travelled far from the days of Cain and Abel. No longer would human beings so low stoop as to capitalise on the hunger of their brethern. With such an understanding, and a plan put into effect immediately, it is possible to reach this target indicated in the course of five to ten years. Utopian, it may seem but it is not necessary that the people of the world come together for this object, pool all their resources and prove that Man is really the highest and noblest of God's creations?

Other Agricultural Commodities: Not only as regards cereals, but even in other crops, India produces less than what her contribution to the world's total should be. The cultivated area in India is 25 per cent of the world's cultivated area. So, she must produce at least 25 per cent of the world total in other crops.

But it is seen that only of pulses, groundnut, sesamum, jute and tea, she produces more than 25 per cent of the world total. This is likely to make it seem that atleast in some crops, she is producing her due share. This is not so. The true picture is given not by taking the percentage of total cultivated area, but the percentage of cultivated area under each crop. An examination reveals that the cultivated area under cereals is 15 per cent of the world area under cereals, but her production is only 9.9 per cent of the world total. Only in Tea, her production is more, on the basis of area cultivated and produce obtained.

How low her production is brought out by another comparison. On the assumption that produce is assembled at a central place and divided between all the individuals of the population, the world citizen gets more than the Indian citizen, who has the consolation that he has more pulses to consume. The difference between the world citizen and the Indian citizen is shown in Table 7.

TABLE 7.

Available per head of population per year in pounds

Product	World	India
Cereal grains	56.8	40.8
Sugar Centrifugal	28	13
Sugar non-centrifugal	4	15
Sweet potato, Yams	54	7
Cassava	47	10
Pulses	19	42

All this pinpoints India's low productivity, and the need for greater effort on scientific lines. Then alone can she take her place among the countries of the world as a developed and an advanced nation. Because her acre yields are even less than the world average, her efforts should be much more intense. If the world average has to be doubled, India's yields should be increased four and five times. Then alone she can contribute substantially in improving the world average from its present low level.