https://doi.org/10.29321/MAJ.10.A04596

for health. It was estimated that, if agricultural out-put were to be adjusted to health requirements, production of a number of foods would need to be increased by from 10 per cent in the case of some to as much as 100 per cent in respect of others. This increase was needed not for exports, but to provide sufficient food to enable malnutrition to be eliminated from the United States. Similar results have been obtained from investigations carried out in this country. These are the two wealthiest countries in the world. If freedom from want is to be brought to all men in all lands, we must recognise that there was, before the war, an appalling world food shortage which will be even greater after the devastation of war.

In the meantime, with a generosity unprecedented in the world's history, America is sending to this country the very health foods which she needs for her own population. If all the United Nations show the same spirit, we will have, after the war, a world food policy based on human needs. The point in time when production would be in excess of human needs is so far distant that it is beyond the range of present day practical politics.

But those engaged in food production cannot be expected to work for a wage which gives them a lower standard of living than men of equal skill in other industries. Prices to the farmer and wages to the farm worker are now being raised to that level. If we have, after the war, a food policy based on human needs which will provide a market for all we can produce for many years ahead and if, at the same time, the present policy of paying adequately those who produce the food be maintained, then agriculture, both in America and in every other country, can look forward to a new era of prosperity.—*(Scot. J. Agri. 24, 9—14, 1942).*

The Storage of Eggs

By P. RUMBALL, POULTRY EXPERT

Eggs are preserved, on the commercial scale, almost universally by means of cold air storage. For the small producer or consumer, such a procedure is generally impracticable and resort has been made to simpler methods. Packing the eggs in sand, bran, ashes, lime, or salt was once used, but these methods have now been abandoned in favour of storage in solution in which the eggs are immersed and held until required for use.

The choice of a suitable solution is determined by certain considerations. The shell of the eggs and its adhering membranes are permeable to water and certain dissolved substances; so care has to be taken lest the preserving solution contains an ingredient likely to pass into the eggs, thereby affecting its flavour or contaminating it in some way. Various substances have been tried and rejected for different reasons, so that, at present, the two solutions most commonly used are a solution of sodium silicate, better known as water glass, and lime water. An excellent alternative method is known as buttered eggs.

Fundamentally, egg preservation still requires a certain degree of cold, and, although for satisfactory results constancy of temperature is unnecessary, it is essential that the eggs should be stored in a cool place where, if possible, the temperature should always be in the range of 33° to 50° F.

Water Glass Method A strong solution containing approximately equal parts by weight of sodium silicate and water is sold commercially. It is very viscous and has a specific gravity of 1·7. A five per cent solution of this is a convenient concentration to use.

Lime Water Method Four parts of finely-slaked lime are mixed with twenty parts of cold water and the whole well stirred at intervals for several days to ensure saturation. One part of salt is then added and the clear solution decanted and poured over the eggs, which should be placed in suitable wooden, cement or galvanised containers.

Buttered Eggs This is one of the easiest methods of storing eggs. It should be done soon after they are laid. Only good, fresh butter should be used, as inferior butter is likely to impart an objectionable flavour to the eggs. The process is quite simple. A small portion of butter is rubbed in the palm of each hand and the egg is then rolled between the hands, care being taken to ensure that every part of the egg is smeared. When the eggs are completely smeared they should be placed in the holes of a perforated tray, broad ends upwards, and stored in a cold place which is not subject to much variation of temperature.

Preservation Principles and Practice If the egg storage containers are open to the atmosphere, the carbon dioxide in the air reacts with the solutions, giving a white precipitate. In the case of lime water, it is simply a precipitate of calcium carbonate, while with the water glass. silica itself is precipitated because of the neutralisation of the alkali. It is advisable, therefore, in order to maintain the solutions at the required strength, to cover the containers and so limit the ingress of carbon dioxide.

In each case, the eggs to be preserved should be clean and new laid and should not at any time have been subjected to a temperature much higher than 60°. It is advisable, therefore to candle the eggs and reject cracked ones, or any below the standard of freshness. Slightly soiled eggs may be cleansed with a damp cloth but not washed, and in no circumstances should badly soiled or cracked eggs be included. The receptacle in which the eggs are preserved should be perfectly clean and scalded with boiling water. Most investigators claim that water glass is the more satisfactory solution.

Using the solutions described, and in addition storing the eggs at a temperature of 32° to 35° F., eggs have been preserved in the course of experiments for twelve months in both solutions with good results. The taste of the eggs stored in water glass was excellent, the air chamber was the same size as before storage, and the white had all the consistency of a new laid egg. The eggs fried and poached well, but nearly always cracked on boiling unless the shell had been first pierced at the broad end. The only other point was that the shells had a slight crusty deposit, which was not removed on washing with water

The eggs stored in lime water were not so good, although the flavour was excellent. In all cases the air chamber had completely disappeared and the white was more fluid and tended to spread when the contents of the egg were emptied into a dish. The shell in every case was markedly thinner and appeared rough. In general, the shell cracked on boiling, even though pierced. Presumably, the action of the lime water had made it very brittle.

The efficacy of water glass and lime water as a means of preserving eggs is without question. Used in connection with a rough system of cold storage (i. e., paying no particular regard to constency of temperature but merely temperature limits), either method gives excellent results, with the preference, so far as present experiments show, in favour of water glass. The cost of the water glass is small and apart from the extra labour involved—*e. g.*, the washing of the eggs on removal from the solution—the only disadvantages are that the surface of the shell is marred and there is every possibility of the shell cracking on boiling. It would seem, however, that further research might reveal ways of removing these objections. Moreover, there appears to be no reason why, if clean eggs alone are used, the same preserving liquid should not be used for severel storage seasons. Lime water, possibly, has the advantage in this respect, as it is definitely antiseptic and is less likely to develop mould and bacterial contamination than water glass under the same conditions. *(Queensland Agri. J. 57,242–43, 1943).*

Extracts

Bacterial quality of market milk and the conditions under which it is handled The number and type of bacteria found in milk are the best index of the conditions in which it is produced, handled or stored. From public health point of view, the above aspect is of considerable importance. A sample of milk may be chemically pure and unadulterated but on account of faulty handling or exposure to contamination it may be grossly objectionable and even dangerous to use from the bacteriological stand point. In other countries ever-increasing stress is laid on clean production and handling of milk under hygienic conditions. In some of them bacteriological standards are also fixed for market milk and for milk sold under different grades.

In India although the defective, filthy and often dangerous methods employed in the production, handling and distribution of milk are generally well known to all including the public health authorities, little or no biological work has been done so far to bring to light the real state of affairs or their effects on public health.

As far as is known the credit of making the first bacteriological examination of market milk in India goes to Dr. L. L. Joshi, M. D., Municipal Analyst, Bombay some 25 years ago. All his findings are published in the *Milk problem of Indian cities* (1916); but these have unfortunately remained as items of academic interest only. The table below is compiled from the above memoir.

Number of bacteria per c. c. of raw milk in Bombay.

Set	*Particulars of milk samples*	*Average no. of bacteria per c. c*
I	Two samples obtained from healthy animals milked after thoroughly scrubbing and washing them. The udder and flanks were washed with antiseptic solution and finally with sterile water. The hands of milkmen were rendered surgically clean. The milk was drawn in sterile glass bottles and subjected to an immediate examination	292
II	68 samples collected from city milk stables with ordinary precautions 3 to 4 hours after milking	17,103,000
III	240 samples of market milk at random from dairies, milk shops, cattle sheds, milk hawkers, 6 to 9 hours after milking	36,000,000

Another interesting set of figures indicating the bacterial counts in milk at Bombay and in sewage of London and Boston are reproduced below.

Sample	*City*	*Bacteria per c. c.*	*Name of investigating authority*
Milk	Bombay	36,385,000	Joshi
Sewage	London	2 to 11 million	Rosenau
Sewage	Boston	2,800,000	Rosenau

Too much stress cannot be made on the above comparison as different methods would have been adopted. At any rate Bombay enjoys the dubious honour of standing first in the above list.

With a view to examining factors affecting the bacterial count in the production and handling of milk as well as exercising day to day control on its bacterial quality, the Imperial Dairy Institute, Bangalore, made certain bacterialogical studies on farm produced milk. Samples of milk were examined in different stages.

Hours	*Stage after milking*	*Count per c. c.*
—	In milking pail	6,800
¼	In weighing pail	27,300
1	In container (churn)	91,300
2	In bulked milk before pasteurisation	2,25,000
2½	After pasteurisation	9,400
3	After bottling	15,000
18	In returned milk	1,21,000

Even without having a series of comparative figures from other farms, the above study is of enormous value to show that under farm conditions it is possible to produce quite clean milk. It also shows the efficiency of pasteurising in making the milk safe, extending its saleable life.

The comparison of the number of bacteria found in the raw milk 3 hours after milking (2,25,000) with that found by Joshi in the milk obtained after 3 hours (17,103,000) shows how grossly contaminated the Bombay milk supply is.

Bacterial standards for market milk in other countries— England

Grade Certified	Herd to be tuberculin tested every 6 months. Maximum microbes to be 30,000/c.c. and no B. Coli in 1/10 c.c. No treatment by heat permitted.
Grade A (TT)	Herd to be tuberculin tested every 6 months Maximum microbes to be 2,00,000/c.c. and no B coli in 1/100 c.c. No treatment by heat permitted.
Grade A.	Herd to be subjected to clinical examination every 3 months. (same as A (TT). No heat to be applied; if pasteurised becomes Gr. A pasteurised.
Pasteurised	Maximum microbes to be 1,00,000/c.c. No treatment more than once by heat allowed.

Increasing attention to bacterial quality is paid to market milk in most countries. Quality control really commences with the cow itself, particularly in the case of tuberculosis. The first attempt for bacterial standards was made in 1900 in New York by the Board of Health. Originally it prescribed a minimum of 1,000,000 bacteria per c.c., but later this was considerably modified. The legal standard for Boston is now 5,00,000 microbes per cc. Under the Milk Special Designations Order, 1923, in England the above standards are prevalent. (Vide table above)

The requirements under the grade standards for market milk in England and in Bombay shows how unhygienic is the latter's supply. Bacterial standards by themselves will not solve the problem unless there is practical and effective control on the production, handling and sales of market milk. Before suggesting suitable standards a good deal of study of the conditions and the practicability of application and effecting improvements is needed and the Health Department should give increasing attention to the subject of bacterial quality of milk.

For testing bacteria in India it would be advisable to adopt the 'methylene blue reduction test' for bacterial counts.

This test has been used in Europe for many years but is now intensively used by all the dairying countries for determining the bacterial quality of raw milk. The results are considered reliable and as reliable as those obtained by the method of plate counts.

The test is based on the fact that bacteria have the power of reducing various dyes, including methylene blue. If therefore methylene blue solution is added to milk, the bacteria present react and the blue colour eventually disappears. The greater the number of bacteria in a sample of milk, the more rapid would be the loss of colour. The process for the test is simple and inexpensive and elaborate apparatus and qualified workers are not required. 1 c.c. of the methylene blue solution of a specific strength is added to 10 c c. of milk. The sample tubes are placed for incubation in a water bath at a temp of 98° to 100°F. The following classification is used—

Standard classification for bacterial quality of milk based on the methylene blue reduction test

Grade		*Time taken and the approximate number of bacteria per c c. of milk*
1	Good	Not decolourised in 5½ hours, containing as a rule ½ million baceria per c.c.
2	Fair average qulity	Decolourised in less than 5½ hours but not less than 2 hours containing as a rule ½ to 4 million per c c.
3	Bad	Decolorised in less than 2 hours but not less than 20 minutes, containing as a rule 4 to 20 million bacteria per c.c.
4	Very bad	Decolorised in 20 minutes or less, containing as a rule over 20 million bacteria per c.c.

(*From Report on the marketing survey of milk in India, 1943.*)

Fundamental Economics of Export Crops The Industrial Revolution is familiar to all of us, but how many of us have ever stopped to think out the implications of the astonishing Agricultural Revolution which has accompanied it? Let us look back for a moment.

Trade in agricultural products, like trade in manufactured goods, is no creation of the last century and a half. Both have existed through history. It is their scale and the conditions under which they are carried on which have been revolutionized beyond all recognition. But while the social and economic consequences of the Industrial Revolution are inescapably obvious all round us, the true nature of the Agricultural Rovolution seems to have remained hidden behind the different problems it has raised, which have appeared as separated though often inter-connected difficulties instead of being recognized as different manifestations of one basic problem.

As a result we tinker—can we really call it more?—with our problems of soil erosion, dust bowls, floods, droughts, diminishing fertility, wasteful and shifting cultivation, without thinking out the fundamental principles of the process in which we are engaged. Baldly, what we have built up is an elaborate system for exporting fertility from the tropics and dumping it into the sea *via* the sewers of great cities.

The great industrial populations of the earth clamour for foodstuffs to use and finally dispose of in their cities. The farmers of the civilized world, constantly feeding the precious fertility of their land to the cities in the form of dairy products, meat and vegetable foods, clamour for feeding materials and plant nutrients from distant lands. The manufacturers of the industrialized world clamour for the raw materials and the crops of tropical and other farming countries, to transform them into products of which only a minute proportion eventually returns to the countries and so to the soils that produced them. At the producing end, the governments of agricultural communities dream of annually soaring export figures accompanied by corresponding imports of manufactured goods (most of which unfortunately do not greatly help the hungry land), abundant revenue and a prosperous and contented community. Scientific methods of farming and that noble animal the cow will, it is held, look after the land.

But there is an unfortunate, and it may well prove tragic, oversight in all this. We cannot escape the law of conservation of matter. With all our science and with all our cows we can only transform, transport, redistribute, conserve plant nutrients, we cannot create them. If we export them faster than nature can replace them, we must either import them from somewhere else or reap a harvest of failure. Our proudly quoted export figures, besides being a measure of our income, also represents a loss to the soil which must be made good from somewhere before we can justifiably start talking about our profits.

We read, for instance, of a thousand tons of paddy rice being sold in some market at fifteen cents a kilo, and we probably think of this transaction solely in terms of the £ 7,500 which the fortunate growers receive. We usually forget that there has been exported from the cultivators' land some twelve tons of nitrogen, six hundred and sixty pounds of calcium oxide, the same quantity of potash, thirteen hundred pounds of sodium oxide, two tons of phosphorus, seven hundred and fifty pounds of chlorine, thirty tons of iron, quantities of sulphur, magnesium, iodine and traces of certain other substances.

Fortunately a number of plant nutrients—carbon, oxygen and hydrogen—are available in the atmosphere, so that given rain and air our supplies of these elements are inexhaustible. The same is true of nitrogen, provided conditions are such as to allow of its fixation by means of leguminous plants, but when we come to the other essential soil constituents, the minerals, we find a very different state of affairs These substances are derived from the weathering of the rocks and the available supply is limited by four factors, the composition of the rocks their rate of weathering, the proportion of decomposition products that reaches the surface layers of the soil and the rate at which this occurs. If by over-cropping we remove them from the surface layers faster than they arrive, sterility must ensue.

Let us consider how this works out in East Africa. The African with his primitive methods has long ago discovered that a given piece of land will not yield a crop indefinitely, and has therefore adopted the system of shifting cultivation at which so much abuse is so constantly hurled. It is, however, only fair to point out that the native does not move for fun. He dislikes it immensely. It involves him in a great deal of heavy labour. He moves because he has to and would starve if he did not.

Having worked out one piece of land he selects another plot, his choice depending in many cases on the type of vegetation upon it, which he has come to associate with certain soil properties. He then cuts down the trees and grass and fires the lot, which causes the European heart-burning, but provides him with a much needed supply of ash as fertilizer. When the plot is worked out he leaves it. Bushes and trees grow up, their deep roots tapping the sources of minerals in the sub-soil and conveying salts to the leaves, which eventually fall and restore fertility to the impoverished soil so that barring destruction by erosion before vegetation has had time to cover it again, it becomes once more fit for cultivation.

Nowadays, the African is being taught that this system is wasteful and various schemes have been set on foot to make a respectable farmer of him. Side by side with a drive towards more and yet more crops, he has been urged to farm the same plot year after year by adopting rotations, which are invaluable as a means of supplying organic material and nitrogen to the soil, but can in no wise increase its mineral content because the essential salts come only from the weathering of the rocks. He has been urged to adopt scientific methods of mixed farming and composting, with which none could pick a quarrel were their limitations duly taken into account. But a misapprehension appears to have arisen that if only one has a cow all things are possible agriculturally. The wretched beast has had supernatural powers ascribed to her. She has become a sort of fertility symbol, and it has been forgotten that though a cow may be very useful in transforming matter or transporting it in her belly, she is quite incapable of creating it. She cannot defy the law of the conservation of matter, and consequently nothing can come out of her which does not first go into her.

Let us take an example. A peasant farmer is given twenty acres and a cow. He grows a cash crop, say cotton, food for himself and fodder for his beast. He is an industrious man and produces perhaps half a ton of seed cotton and a surplus of food which he sells. He buys a bicycle and puffs out his chest with pride and is held up as a shining example to his less enlightened brethren. Year by year he toils, the ideal pains-taking farmer—rotations, paddocks, legumes, catchcrops, milk sales, fodder crops, contour ridges—sheer joy to his teachers. But his yields fall, his cow sickens and dies, and one day, alas! he says he must move. What has happened? Every year he has been exporting minerals from his land, exporting at a greater rate than weathering has been able to replace them. In spite of his conservative methods, he has been, not an intelligent progressive farmer, but a poor fool living on capital. He has spent not a penny on importing fertility, but has squandered his plant nutrients on bicycles, trunks and clothes—trash so far as the land is concerned.

Rotations, mixed farming, anti-soil erosive measures and so on are essential if the best use is to be made of the land, because they help to conserve plant nutrients and prevent their wastage. But the conservation of nutrients is one thing, their creation quite another, and what we must realise is that no system of farming, however advanced, can possibly put certain essential minerals into the land which are not there, unless they are imported from elsewhere. Not even the poor cow can overcome this, for all she can do without imported feed is to assist in the transference of soil nutrients from the paddock to the arable land, with the consequent impoverishment of her own food supply. In Europe the process of deterioration is arrested by the use of "artificials" and by feeding the herds on cotton seed and groundnut cake taken from our peasant cultivator's land, a process which is in fact transferring the essentials of the black man's existence to the white man's pastures, thence, as we have already pointed out, to the millions in the towns and eventually *via* the sewer into the sea.

Without the importation of fertility in some form or other this process can go on indefinitely only so long as the fertility exported does not exceed the annual increment of fertility produced by the weathering of the rocks of the country, and one of the most necessary pieces of research is an investigation into the value of that increment. Naturally it varies from place to place. Much of our river valley land possesses considerable powers of recuperation; other areas like the central plateau country in Tanganyika are very slow in regaining lost fertility; and it is perhaps unfortunate that the richest land we possess is often unhealthy and sparsely populated.

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The same process can be observed in other parts of East Africa; does not one even hear of agricultural settlements barely a few years old already in difficulties over soil fertility? It is madness to blind ourselves to the grim truth that we are not only allowing, but earnestly encouraging, natives to export what is in fact more than the annual increment of soil fertility. They are living on capital and heading inexorably for agricultural bankruptcy in many areas.

The various schemes for introducing better farming methods prevent waste and encourage the more economic utilization of our resources, but they are mere palliatives so long as our export trade continues unbalanced by any adequate return of lost plant nutrients to the land.

There are only two economic ways open to us. Either the crop exports from any area must be reduced to balance the annual increment of fertility from weathering—and it seems likely that this would mean a very considerable reduction in many cases—or imported fertilizers must be appiled to the land to make good the deficit. The former is unlikely to commend itself, while to the latter it will indubitably be replied that "artificials" are expensive and we cannot afford them. Are we any better able to afford to live on our capital?

"With adequate knowledge", says Professor Soddy, "of the physical realities that dominate the economic affairs of the peoples, the road is clear for unlimited progress and the attainment of universal peace and prosperity." He strips the science of economics right down to its basic priniciples, the fundamental physical realities, of which the ordinary economist too often stops short in his thinking, and sums up in a few words: "The production of wealth.............obeys the physical laws of conservation and the exact reasoning of the physical sciences that can be applied. Wealth cannot be produced without expenditure, and a continous supply of wealth cannot be supplied as the result of any expenditure once for all. Its production demands a continuous supply of fresh energy."

Our modern economic system has fundamentally altered the conditions of agricultural production in such a way as to draw recklessly on the stored resources of the land, too often without adequate provision for maintaining a balance between what is drained from it and what is put into it, either by natural processes or by human agency; and where individual pieces of land are well tended, it is all too often achieved simply by robbing some other pieces, perhaps the pastures next door, perhaps the fields of a distant continent, of their plant nutrients. We have become a generation of unparellelled wasters of capital, the loss of which is likely to eventually hit the peoples of the world in a tender spot.—A. T. Culwick, M. B. E., M. A. *(E. Afri. Agri. J. Oct. 43.)*

Gleanings

New method of seed extraction* In Australia and the United States of America, the usual method of tomato and cucumber seed extraction involves the fermentation of pulped well ripened fruit for 24—48 hours in order to free the seed from the plup. This process is time-consuming, and is not always entirely satisfactory.

An officer of the Division of Plant Industry, C. S. I. R., has discovered a simple and inexpensive new method which overcomes many of the disadvantages inherent in the old method of seed separation by fermentation. The principle of the new method is to add commercial hydrochloric acid (muriatic acid) to the pulped fruit after whch the seed is washed out in the usual way. Tomatoes should be pulped in a wooden barrel or galvanised iron container, painted inside with quick-drying bituminous paint, as the acid attacks galvanised iron. Cucumbers are mechanically crushed before placing in the container or are cut lengthwise and the seed-containing flesh scraped into the container, the skins being discarded. The pulp should be well stirred while the acid is acting. If any difficulty is experienced in incorporating the acid into the mixture, the acid can be diluted with about twice its volume of water before mixing with the pulp. After one hour the seed can be washed out in the usual way.

With tomatoes the acid is added at the rate of 1¼ gallons per ton of fruit, which is equivalent to 62 c. c. or one-tenth pint per box of 25 lb. of fruit.

With cucumbers, where the whole fruit is crushed for seed extraction, the same quantity of acid used with tomatoes is satisfactory. Where the seed-containing pulp only is used, 2½ gallons acid per ton of plup which is equivalent to

*Information supplied by the Commonwealth Council for Scientific and Industrial Research