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SOY

By Dr. Edwin E. Slosson

The recent rise in restaurant prices has sent economical Americans flocking to the chop sueys where a savory and satisfying meal can still be obtained for a small sum. The Chinese in their efforts to keep three hundred million people above the starvation point for three thousand years have been forced to figure closely on food values, and, although they could not tell a calorie from a vitamin at sight, they have worked out some very ingenious dietetic schemes.

Especially have they been successful in getting along with little or no meat and milk. With us Americans meat has been the main part of the meal with vegetables on the side. With the Chinese this is reversed, and meat has in many cases been reduced to a condiment. Scraps of beef or pork chopped up in the chop suey or a few shreds of chicken laid on top gives the eaters the illusion of a meat dish. And by using sprouted grain they get the vitamins that are absent in our cereals.

The chief difficulty of a vegetarian diet is to get a sufficient amount and variety of proteins. Beans and peas are the richest in proteins, but they are not of the sort and proportion found in meats and needed for our muscle-making.

But there is one exception and that is the soybean. This contains no starch, but carries instead from 30 to 45 per cent of protein, and from 18 to 24 per cent of oil. From this it will be seen that the soybean resembles animal foods in being rich in fat and protein and devoid of starch. What is more remarkable, the soybean contains a dozen kinds of protein compounds that are the same as those found in milk. In fact a "vegetable milk" can be made from soybeans and from this vegetable curds and cheese. These form a large part of the diet of Chinese and Japanese who abstain from animal food either because they are Buddhists or because they are poor. By milking the soybean they can get ten times as much lacteal fluid per acre as if they pastured cows on the land. Italian physicians who used soy milk as infant food during the war report that it was better tolerated than cow's milk by some of the babies.

The soy milk products have not yet come into use with us, but the American patron of the chop suey has acquired a taste for another product of the bean, the little glass cruet of brown sauce that seasons the rice. It looks and tastes like meat extract, such as we use in making beef tea, and is really much like it in composition and nutritive value. This shoyu or soy sauce is made by long

fermentation and ripening of a mixture of beans and wheat in brine. The longer the process the better the product. Six months or a year may suffice for the masses, but to suit the taste of the Oriental connoisseur it must be sunned for five years or even thirty, the jars being patiently uncovered every day and covered every night or whenever it rains. Over two million barrels of soy sauce are made in Japan every year.

The soybean was first introduced into America in 1804, but it is only within the last ten years that it has come to be commonly raised for oil and cattle food. Now it is becoming one of the major crops in various states. In Ohio at the present rate of increase soy will surpass oats in acreage ten years hence.

But American housewives are slow to admit soy foods to their table in spite of the assurances of C. V. Piper and W. J. Morse of the Department of Agriculture that some eighty palatable and nutritious dishes from soup to dessert can be prepared from the bean. It seems that soy will be as long in fighting its way into popular favor as were potatoes and tomatoes in their day.

READING REFERENCE - Piper, Charles V. and Morse, William J. The Soybean. New York, McGraw-Hill Book Co., 1923.

Yearbook of Agriculture, 1917, Washington, Government Printing Office, 1918.

PLANT EXPERT PUNCTURES EASTER ISLAND MYTHS

Dr. William E. Safford, economic botanist of the U.S. Department of Agriculture, in a report to the Bishop Museum of Honolulu, has presented plant and linguistic evidence in refutation of many fanciful theories woven about the lonely Easter Island in the South Pacific erroneously reported to have disappeared following the Chilean earthquake. He traces the kinship of the mysterious inhabitants of this tiny volcanic land with the people of the Malay Archipelago and finds indications that they are of much more recent origin than the various tribes of American Indians.

Easter Island, it has been claimed, was formerly inhabited by a strange race distinct from the natives of Hawaii and the other Polynesian islands. According to Dr. Safford, however, among the plants introduced into Easter Island in prehistoric times there are a number whose vernacular names are identical with the same species in Hawaii and many of them can be traced to the Malay Archipelago, the cradle of the Polynesian race.

Attacking the theory that certain South American Indians are descended from the same race which inhabits Easter Island and that the island was a stepping stone used in the peopling of America, Dr. Safford stated that from the very close similarity of the dialects of widely separated tribes like the Hawaiians, the New Zealanders, and the Easter Islanders, and the identity of many of their myths, their gods, and their calendar systems, it is certain that their separation from one another must have taken place at a very recent time when compared to the very ancient dispersal of the American stocks upon our own continent.

UN-DAMABLE RIVER LED TO CAVERN FIND

A river that appeared not to be worth a dam was the cause of the geological explorations that resulted in the exploration of the Carlsbad cavern in New Mexico and in the discovery of its surpassing beauty and extent. The river is the Pecos. Dams built along it for the impounding of water for irrigation purposes had proved to be of little use because the water disappears underground, and so the U.S. Geological Survey, before advising the construction of any more dams, sent Dr. Willis T. Lee to the scene at the request of the Commissioner of Reclamation to find the cause of the river's strange behavior.

The result was the real discovery of the Carlsbad cavern, for although it is nearly 20 miles from the river and without effect upon its course, it became known through Dr. Lee's study of the geology of the whole region and his tracing of strata found in the near vicinity of the troublesome river.

The caverns are in limestone strata 1,300 feet thick, but above and below this layer are other layers of rock salt and gypsum. These were found to be the real trouble makers. The strata are tipped at an angle to the surface, near the river and under it. The gypsum and salt are soluble in water and when the dams were built and the water-level rose beyond a certain point, it dissolved its way through these strata underground and out onto the surface again some miles below the dam.

Tracing the strata back to the foot-hills of the Guadeloupe Mountains about 22 miles southwest of Carlsbad, Dr. Lee rediscovered for the world the great cavern now made by Presidential proclamation of October 25 a National Monument.

The caverns were first discovered in 1901. Vast numbers of bats were observed issuing from a hole in the side of a hill and exploration revealed a cavern of unknown extent. It remained practically unexplored and unnoticed until this year when Robert A. Holley of the General Land Office surveyed about $3\frac{1}{2}$ miles of it. Dr. Lee later examined it from the geologic and scenic points of view.

It is, according to Dr. Lee, one of the greatest if not the greatest cavern in the world. Its total length is quite unknown. It extends at least 1,000 feet downwards from the entrance. The formations of stalactites and stalagmites are of extraordinary beauty. One of the "rooms" in the cavern is half a mile long, several hundred feet wide and with a ceiling so high that torches failed to disclose it, their bright beams being lost in the impenetrable gloom.

More remarkable discoveries are likely to be the result of further explorations, Dr. Lee says, since the geologic formations are most unusual. Underneath the limestone layer in which the cave was discovered are beds of gypsum and rock salt of great thickness. These materials are soluble in water which seeps through and honeycombs them. Dr. Lee believes that in these beds may be sculptured other great caves whose extent and beauty can only be guessed at for the present.

Incidentally, such caverns in salt beds might be developed into mines of incalculable extent and richness. The discovery is considered the biggest in the geological field in recent years, and it all goes back to sending a scientist to find out whether or not the Pecos river is worth a dam.

HELIUM ENOUGH FOR 200 SHENANDOAHS

There is enough helium gas now available in the United States to keep filled and ready for service 200 airships of the size of the navy dirigible Shenandoah, Dr. Richard B. Moore, former chief chemist of the U.S. Bureau of Mines told members of the American Institute of Chemical Engineers at their recent Washington meeting. These ships could be kept in the air for five years, he added.

Dr. Moore predicted the building within a few years of airships of twice the size of the Shenandoah, "big enough to carry fuel sufficient for a trip to Europe and return, and with enough reserve buoyancy for a good load of bombs if necessary".

Laws for the conservation of the helium resources of the country will be introduced at this session of Congress, Dr. S. C. Lind, successor to Dr. Moore as chief chemist of the Bureau of Mines, told the delegates. The gas occurs principally as a constituent in the natural gas wells of Texas, and the problem is to separate it from the inflammable part of the natural gas which may then be used for industrial purposes. There is a great demand for the unseparated natural gas, from which the helium is absolutely lost unless special measures for recovery are taken.

Helium inflated airships are useless for very long flights unless some method for condensing the water vapor, which is one of the products of combustion of gasoline, is employed. Such a method has been devised. It prevents the ship from getting lighter and lighter, and so having to release helium if it is desired to come to the surface. Rather than lose the valuable gas, the Shenandoah on her recent trip to St. Louis, dove down near the ground and was then pulled to earth by a force of some 300 men, a method which is not always applicable. Dr. Lind said that if 90 per cent of the water vapor could be recovered there would be no loss of weight of the ship.

The purification of helium is also one of the great problems in the industry, Dr. Lind said. The best method is that used in repurification of the gas at the Lakehurst station where it is passed over activated charcoal at the temperature of liquid air, resulting in the absorption by the charcoal of all gases except helium and hydrogen. This results in nearly 100 per cent helium. Airships are now using a mixture of 90 per cent. helium and 10 per cent nitrogen, he said.

Other important sources of helium gas besides the gas wells of the Dallas-Ft. Worth district are known to the government, Dr. Lind stated, but their location and extent are being kept military secrets. When the industry is more developed and the needs of the army and navy are fully met, the surplus supply of the gas will be released for commercial purposes. At present the military uses absorb the entire output.

Dr. Moore, during further discussion emphasized the unique military value of helium, saying that this country contains all the known world supply and that as an asset in time of war such a resource is invaluable and should be carefully conserved.

COMMERCIALIZED ELECTRONS BASIS OF CHEMICAL ARTS

The atoms of which all matter is composed were described as sort of half-tamed solar systems, by Dr. Paul D. Foote, head of the department of atomic physics at the U.S. Bureau of Standards in an address before the American Institute of Chemical Engineers at Washington recently. These "solar systems" are capable of a certain amount of control by man, and upon this control depends all progress in chemistry, and not only that, but all progress in all applications of science to the use of man.

The electrons which compose the "planets" of these atomic systems, have literally been commercialized, and whole industries are absolutely dependent on the understanding of the caprices of these minute particles which are really electricity, Dr. Foote stated. An electron thrown out of a glowing vacuum tube filament makes telephonic communication across the sea possible, another electron may produce the light of the arc lamp; under other conditions they are responsible for all the reactions which are the basis of the chemical industry.

These atomic "solar systems" consisting of a definite number of infinitesimal electrons whirling about a central nucleus, while in some ways resembling our well-known family of planets, are in other ways very different from it. For example, said Dr. Foote, if a comet or stray body big enough to have any effect, were to collide with a real planet, the whole energy of our solar system would be permanently altered. But if a "comet" in the shape of some form of radiant energy collides with the electron of an atom revolving about its nucleus something quite different occurs. The energy of the system is increased but only by a certain perfectly definite amount, and if there is any energy left over the "comet" takes it along with it on its journey. Real solar systems differ in energy; no two are alike; but all the atoms of the same kind of element are systems of identical energy and structure, and each behaves exactly like all its fellows.

The "solar system" theory of the atom now being expounded in this country by Professor Nils Bohr is not so satisfactory to the chemist as a static theory which provides fixed points for hooking up atoms to make molecules. But Dr. Foote thinks that the dynamic and static theories are not really in conflict.

The outer orbits of electrons might be regarded, for instance, as the corners of a cube, and this simple static picture of an atom is sufficient to explain many known facts.

Atoms after all, he concluded, are more complicated than either a cube or a sphere, and newer facts require newer theories. These Bohr has attempted to provide by the use of data provided by the spectroscopist. The Bohr theory while a distinct advance will, in Dr. Foote's opinion, either be eventually superseded by a better one, or will be so modified that it will lose its identity. Its present success is due to the vast number of observed facts which it has been able to correlate by means of a very few and simply stated ideas.

CHEAP FERTILIZER FROM WATER AND AIR NITROGEN

Synthetic nitrogen fertilizers using ammonia as a principal ingredient, may be made at prices to compete with those using nitrogen from such natural sources as Chile saltpeter, Charles O. Brown, consulting chemist of Providence, R.I., declared at a recent meeting of the American Institute of Chemical Engineers. The nitrogen may be derived from the air by one of several processes; the hydrogen, which is the other component of ammonia, may be had from water.

Economy in production of hydrogen from water, which is a well known method, may be effected, Mr. Brown said, through use of a special type of electrolytic cell and through utilization of electricity from hydro-electric power plants at other times than that of the peak load. It is cheaper, he said, to sell such power at a low rate than to waste it, and the manufacture of hydrogen offers a profitable use for it.

Another good source of hydrogen in the speaker's opinion was from the gases of coke ovens. These are two chief sources for what he termed "by-product hydrogen". Such secondary methods of manufacture were the most suitable for the making of synthetic ammonia, Mr. Brown declared.

Mr. Brown predicted that hydrogen might be produced from coke ovens at the cost of 20 cents per 1000 feet, and from water at from 29 to 88 cents, depending on the cost of the electricity used. The production cost of anhydrous ammonia, using "by-product hydrogen", he figured as from 3.84 to 6.32 cents a pound, which would enable the production of commercial fertilizer at a lower cost than that now made from natural sources of ammonia and nitrogen.

READING REFERENCE - Slosson, E.E. Creative Chemistry, New York. The Century Company, 1920.

TO RAISE TOBACCO FOR CROP OF NICOTINE ONLY

The growing of tobacco not for smoking purposes but as a source of nicotine for use as an insecticide is one of the problems upon which the U.S. Bureau of Plant Industry is now busy, Dr. William A. Taylor, chief of the Bureau told the American Institute of Chemical Engineers in convention at Washington recently.

Tobacco stems and leaf scrap, low in nicotine, are now the chief sources of the poison, and the methods of extraction are expensive, while tobacco as such has a relatively high yield per acre. The problem then is, according to Dr. Taylor, to produce a sufficiently large yield per acre of tobacco of average nicotine content or to increase the present content of the drug to the extent that cultivation of the crop for this purpose alone would be profitable.

Pure nicotine, mixed with some inert substance, is now replacing tobacco dust as an insecticide because of the greater uniformity and reliability of the product.

CROP ROTATION AS GOOD AS FERTILIZER

Crop yields may be increased about as much by the practice of crop rotation without fertilizers as by the use of fertilizers without crop rotation, Dr.

Milton Whitney, chief of the Bureau of Soils of the U.S. Department of Agriculture, told the American Institute of Chemical Engineers in session at Washington. If both crop rotation and the use of fertilizers is practiced, the yields are nearly equal to the sum of the increases obtained by rotation and by fertilizing.

Before the war, Germany was the greatest user of commercial fertilizer, with a consumption of 188 pounds to the acre of land in crops, Dr. Whitney stated. The consumption in this country was 40 pounds to the acre on the average, ranging from practically nothing in the western grain districts to 150 pounds to the acre in Maryland and 345 pounds in Florida. At present the cotton crop west of Alabama is practically unfertilized and the commercial crops of grain and hay are produced without artificial fertilization.

Dr. Whitney said the abandonment of the medieval system of agriculture in England, the development of individual farm holdings, the introduction of crop rotation, fertilization, and better methods of tillage, had increased the average yield of wheat in that country from 6 to 32 bushels to the acre in about 700 years.

ELECTRICAL TREATMENT OF FIELDS DOUBLES YIELD OF GRAIN

Yields of grain have been doubled in some cases through the application of electricity to fields during experiments made by Prof. Vernon H. Blackman for the Electro-culture Committee of the British Ministry of Agriculture and Fisheries.

The electrical discharge was from overhead wires but was not applied during the whole growing season.

Experiments so far completed demonstrate the extreme complexity of the whole problem, however, and further work is planned.

Earlier experiments in the field seemed to hold out little hope that electro-culture would ever become a commercial proposition. In these the discharge varied in the different trials from two to twelve ten-thousandths of an ampere per acre, and the voltage varied from 25,000 to 56,000. The discharge was applied for from 6 to 8 hours daily from April to August. The cost of course was quite prohibitive, and the increase in crop yield was small and inconstant.

As it seemed nearly impossible to sift out the various possibilities working on a large scale in the field, later experiments were carried out, chiefly in the laboratory, or in pots, or in small scale plots. These experiments showed first that the very high voltages used in the earlier work, far from being necessary, were much less effective than much smaller ones. For instance, currents passing through plants of the order of one hundred millionth of an ampere were injurious in the case of the early vegetative stages of maize, whereas currents as low as three ten-billionths of an ampere had an accelerating action on growth.

It was also found that it was unnecessary to continue the discharge throughout the whole period of growth of the crop; but that one month's treatment was at least as effective as a continuous one. The second month of growth appeared the best time to apply the treatment. In one such case an increase in grain yield of 118 per cent was obtained. It is interesting that in most cases of greatly increased grain yield the increases of total plant growth were very slight, indicating that the electrical discharge had stimulated the reproductive processes of the plant without affecting vegetative growth. This discriminating effect was hitherto unsuspected. Finally, it was shown that the daily discharge can be reduced from six hours to one without reducing its effectiveness.

The discovery of these facts, making possible increases in yield, notably of grain, from discharges of lower voltage, of shorter total duration, and given only for a small part of the day, has made the investigators quite hopeful that electroculture may some day become an economic possibility.

NEW DEVICE RECORDS KICK OF IRON HORSE

Railroad officials, representing a majority of the leading railroads of the country who went to Erie, Pennsylvania, to witness a demonstration of new types of electric locomotives and were thrilled to see one of the powerful Mikado type steam locomotives pulled backwards in a spectacular tug-of-war by an electric giant, and to see another type of electric locomotive glide over the rails at 105 miles an hour, found great interest in another device known as the otheograph, which accurately measures the stress or action on the rails of each separate wheel of a locomotive or motor car.

This new instrument, as explained by A. F. Batchelder, designing railway engineer of the General Electric Company, shows by a graphic chart the extent and characteristic of both the vertical and sideways thrust of all the wheels on each rail. The vertical weight is carried by heavy springs underneath the rail and the sideways thrust is carried through similar springs set vertically and bearing against the head of the rail. The deflection of these springs on the passage of the locomotive is recorded through a lever having an 8 to 1 ratio, with a pointer at the end which traces a record on paper wrapped around a rotating cylinder.

The otheograph ties may be installed in place of the regular ties, either singly or several grouped together, and on curves or straight tracks. The present installation at Erie comprises 25 of these ties grouped together covering a distance of fifty feet of straight track. The revolving mechanism provides for moving all of the recording cylinders on each side of the track simultaneously so that as many records may be taken of each side of the locomotive as the number of ties that are grouped together. The movement of the operating mechanism for the recording cylinders is independent of the speed of the locomotive.

The record from a slowly moving locomotive shows the equalized distribution of the weight, and such a record serves as the basis for comparison with a record taken at high speed. The effect of side thrust in changing the vertical component, and any variations due to dynamic unbalance, are quite noticeable.

The effect of a wheel with a flat spot shows very clearly. The record is not necessarily limited to that of a locomotive only, as by moving the paper slowly the record of all wheels of an entire train of a hundred or more cars may be taken.

VAGRANT X-RAYS CONFINED BY USE OF BARIUM PAINT

Vagrant and injurious X-rays may be confined to the room in which they originate by the use of barium in plaster or paint, Maximilian Toch, a chemist of New York City, told members of the American Institute of Chemical Engineers meeting at Washington. Long exposure to X-rays which have escaped from doctors' offices through walls, floors, or ceiling, have been reported to have caused serious injury to persons in adjoining rooms, Mr. Toch said. To prevent this, lead which is impervious to the rays has been used in metallic form as a sheathing of X-ray rooms; but the metal is heavy and buildings with rooms so equipped require strengthening.

This is not necessary if some compound of barium be used instead of lead, Mr. Toch said, since barium compounds are opaque to X-rays. His method has been either to mix the barium with the wall plaster or to use barium compounds in the wall paint. Either method keeps the rays where they belong, he stated.

\$1,000 PRIZE AWARD FOR AMERICAN SCIENTISTS

A thousand dollar award will be made to the scientist who presents the most notable contribution to the advancement of science at the seventy-fifth anniversary meeting of the American Association for the Advancement of Science to be held at Cincinnati Dec. 27 to Jan 2.

This prize has been offered by an anonymous member of the Association, who is understood to be a layman living in New York, and the recipient will be selected by a special committee to be appointed.

All of the 1200 to 1400 speakers at the meetings of the 42 sections and societies to meet with the American Association will be eligible for the prize.

During the three-quarters of a century of its existence, many of the most important developments in American science have been announced at the annual meetings of the American Association that are held during the Christmas holiday.

Laymen as well as scientists are included in the membership of the Association and associated societies whose activities extend into all branches of science, including mathematics, physics, chemistry, astronomy, geology, geography, zoology, botany, anthropology, psychology, sociology, history and language, engineering, medicine, agriculture and education.

The population of the world is increasing about twenty million a year.

TABLOID BOOK REVIEW

VITAL FACTORS OF FOODS. By Carleton Ellis, S.B., F.C.S., and Annie Louise Macleod, Ph.D. New York, D. Van Nostrand Company.

A comprehensive study of the nutrition problem, showing particularly the vital importance of vitamins. It contains practical suggestions helpful in the selection of proper diets. "Physicians who have been charging many of our ills to the presence of toxins may have to retract the charges in some cases. It is becoming known that a number of maladies are caused, not by the presence of toxins, but by the absence of vitamins. Such knowledge of 'deficiency diseases' may lead to substantial changes in medical practice."

LOW STOMACH IS BEST SAY DOCTORS

A low stomach insures good digestion. So says Drs. R.O. Moody, R. S., Van Nuys, and W.E. Chamberlain, who have made a study by X-ray and other modern methods, of the location of the stomach and other abdominal organs in 600 healthy students of the University of California. They have found that when the stomach extends downwards to from one to three inches below a line drawn around the body over the tops of the hip bones, the fortunate possessor of such an organ seldom has to have recourse to indigestion tablets. Eighty per cent of healthy persons examined had such stomachs.

This location has formerly been considered low by doctors and surgeons who have had to do chiefly with unhealthy stomachs. The present study is said to be the first which has been made on any considerable number of healthy persons, and it also indicates that the position of the abdominal organs cannot be altered by any system of diet, rest, or exercise.

DYNAMITING MOSQUITOES

Man has begun to use high explosives in his war against insects. Dynamite, which we usually think of in connection with the destruction of big things, is now being employed against little mosquitoes. It is used to blast these dangerous disease carrying pests out of existence by digging ditches which drain the mosquito breeding grounds.

SALMON PLANTING

The Pacific salmon's love of home may be used to naturalize this valuable food fish in distant foreign waters. Dr. Meyer Gurewitz of the Bureau of Science of Palestine has hopes of transplanting salmon from our Pacific Coast to the Mediterranean Sea. Salmon come back to spawn in the same stream in which they were hatched. By transplanting the eggs, however, this homing instinct may be used to establish the fish far from home.
