FACT

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Editor & Publisher: P. Sreedharan Pillai B A.

Our New Caustic Soda Plant under construction.

NIAGARA FALLS.

The use of the Falls' water and electric power generated by the cascades is an impressive example of the harmonious operation of natural resources by neighbouring nations. Water falling from the 167-foot-high (50.1 meters) cascades produces 4,750,000 kilowatts of power for lighting homes and operating industries.

FACT

Vol. 5 No. 5
November 1950

The Editorial Board do not hold themselves responsible for the views expressed by contributors.

Books and Pamphlets on scientific, industrial and allied themes are accepted for review in this Journal.

Editor.

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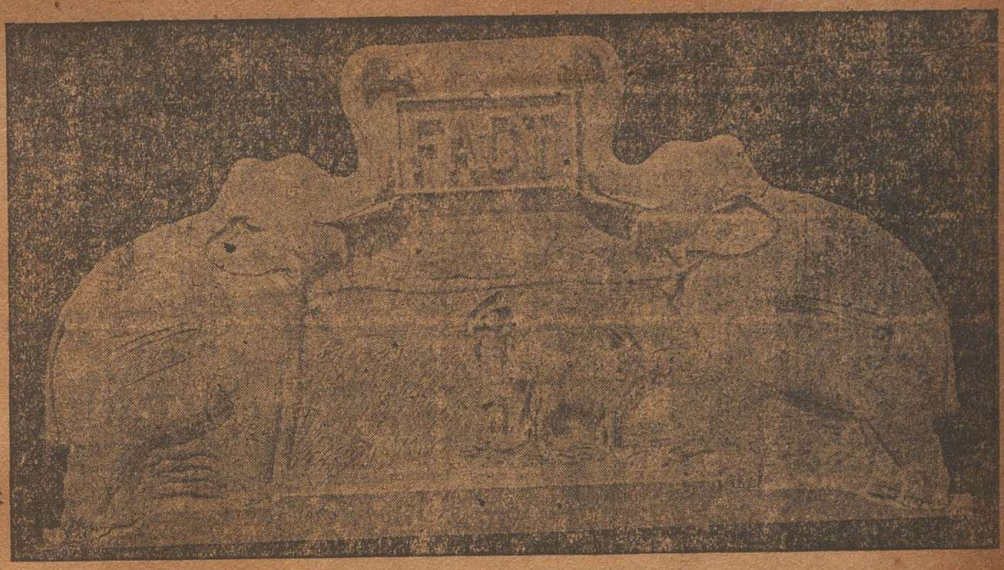

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EDITORIAL.

INDUSTRIAL PEACE AND "WELFARE STATE."

A very important pronouncement was made by Sri. Gulzarilal Nanda, Deputy Chairman of the Planning Commission when he inaugurated the annual session of the Indian National Trade Union Congress recently. He emphatically pointed out that Trade Unions, if they are to serve any purpose, ought to be allowed to function and develop untrammelled by political control or direction. All right thinking people would admit that the way politics and trade unionism are mingled together in India now, is causing deep injury to the productive programme of the country. It also causes serious inroads into the available wages of the average worker by voluntary or union-imposed stoppages from work on fanciful and sometimes even untenable pretexts, with no other object in view than to serve certain narrow party ends. It is plainly apparent that the efficiency and dependability of labour are largely suffering on this account and Sri. Nanda has made a strong appeal to political parties in the country to "give up this game of exploiting the workers' ignorance" and to seek to win their support by active help and selfless service.

Converting our country into a Welfare State as envisaged by our National leaders is closely linked to our economic self-sufficiency as well as to peaceful external relations. While the Government and their representatives

abroad are carefully and zealously ironing out our external bonds to smoothness and mutual goodwill, it ought to be the outlook of every individual citizen to work for the establishment of our economic stability and even balance. This must in ultimate analysis depend on the development of our natural resources and plentiful production of exchangeable commodities. So, production, still more production, and nonstop production at that, ought to be the principal slogan for all, who cherish the idea of a Welfare State and hope for its realisation in the near future.

For this the working classes, more than any one else, should be livened up with enthusiasm and a verve for action quite unmindful of their small troubles. Sri Nanda here points out, very realistically that they would fare much better if they thought less of immediate gain and more of the larger good of the country. It would certainly pay them in greater measure if they steadily helped in advancing the total income yield of the country instead of frittering away their energies in a struggle for a little more share from the meagre outturn of wealth now being produced. At the present critical stage of our national existence no single individual could afford to waste even a few hours in idleness or cessation from work.

The Government was being called upon, Sri Nanda added, to plan the economy of the country so as to make the best use of its resources for securing a rise in the popular standard of living. But, it would be irrational to ask India to undertake obligations of a Welfare State, while a large number refused to make their utmost contribution to the creation of wealth and were even out to destroy wealth by 'go-slow tactics and frequent strikes', solely dictated by temperamental and emotional aptitudes rather than by justifiable causes.

Finally, he stressed on the significant factor that unofficial machinery for conciliation and arbitration should occupy a very important place in Industrial relations. He decried the tendency on the part of both employers and workers to run to Industrial courts and official conciliators every time they came up against a difference. This he has not hesitated to characterise as a sign of "cowardice and bankruptcy of ideas."

Of course, we have to agree fully with Sri Nanda that this State of affairs is thoroughly unhealthy and harmful for the development of Industry in the country. It would equally affect the growth and enlargement of the movement of trade unionism in India, which, as yet, is a tender sapling needing careful nurture. We therefore appeal to both industrial employers and workers alike, to bring into their relations, which are essentially interdependent, a sane and realistic attitude as to mutual adjustments, discarding shibboleths set up by prestige, custom, profit-motive, selfseeking and the like, with a view to establishing an enduring industrial peace, which alone would lead us to the creation of this country into a "Welfare State".

NURSE MORALE AND ELIMINATE FRICTION.

THE measurement and evaluation of industrial morale is probably the major stumbling block in the process of bettering employee relations. Executives and labourers alike, are not consciously psychology minded and hence this difficulty. Sometimes it is necessary to lay aside the "money yardstick" and think in terms of long-range effect. Psychology in plant activities differs little from the same at home. Give your livingroom a new rug, or your wife a new coat, when things seem dull, and you brighten the perspective of the entire family.

In the shop, the answer is the same. And it is not necessary that the encouragement should go direct to the workers' pocket. Some of it can benefit the employer as well. A new coat of paint for the shop, colour dynamics for the machines, improved ventilation, better lighting, a modern wash-room, or a couple of new machines, are a few of the many things that can brighten the entire outlook. Also, if a definite irritant—person or condition—is causing the poor morale, remove it or the improvement will be short-lived and the effort wasted.

Remedial efforts by the management to certain aspects of industrial living will require the outlay of a few rupees, but the return, might well be very surprising.

Despite what a labour front would persuade us to believe, many plants scattered across the country have not only never approached strike talk with their unions, but had to request employees to create those unions in the first place. These are in addition to those plants where labour-management harmony is present, though without unions or employee associations.

Labour's "nickelmindedness" is about as prevalent a contention as it is untrue. Not that the worker would refuse a nickel more, nor that he does not wish it, but he can be and often is perfectly contented without it. Why all this bickering and squibbling-annual negotiation, walk-outs, slow-ups, and lost money on both sides? *Things, as they are,* make the worker unhappy. Those minor irritations which seem too trivial, "impossible" rules, discriminations, uncalled for abuse, a multitude of minor resentments, resolve themselves into one solid demand—a few annas more to work off the irritation. When such conditions persist, the self-seeking agitator has a wonderful time for planting his seeds.

Dissatisfaction is often expressed by "quits" who are perfectly content with the money but leave for jobs that pay the same, or less money in other plants. Their attitude is simply that "life is too short" to put up with avoidable irritations. These people know that a few pice won't solve their problem. Lack of financial independence has kept their number few—but it is growing. Management would gain if more employees could honestly feel free to bring the true reason for their annoyance into the open.

Many managements insist that they have no interest in their employee's personal life. Little do they realise that, in many cases, it is the restrictions of this personal life that keep the plant staffed at all, with any proportion of first-class labour, unless wages are well above the area average. Unions display an interest in their members' personal lives. Why not management, as head of the plant family, take an even more sincere interest—without prying?

Successful labour-management relations, honestly approached, result from the realization by both sides that the conference table changes nothing but the point of view. Human frailities, demands, and ideals are as prevalent on one side as on the other.

But, why are some of these petty irritations that cause so much trouble, so costly? Perhaps a few questions will provide their own answers.

Is the new worker treated with courtesy and despatch from the moment of his arrival on the first day? Is he fully orientated on his job, the men around him, wash-room, locker, toilet and cafeteria locations? Have all of the company rules been explained and the services which must work with him introduced? Or, is he told to report at 8 A. M. only to find that he must wait until 11 to be brusquely processed? Is he led to his machine and left, embarrassed and strange, to his own devices?

Are restrooms clean, neat, and sanitary; designed with consideration for personal feelings, properly maintained and well marked? In all fairness, it should be said that labour is largely responsible for the insanitary condition of some washroom facilities. Deliberate destruction by thoughtless employees should not be tolerated. A committee selected by and from the workers can very often, with management's help, eliminate this condition and thus benefit everyone.

Then there is the company House Organ. If properly used, this publication can do a tremendous job for bringing the plant family together. The purpose of this periodical is the dissemination of news and views of the company's working family, a part on the back here; an orchid there for a suggestion, award, good safety record, for high and low bowler. Pictures and accounts of outings, marriages, births and deaths provide the real personal touch. Even the most insignificant, unassuming, and possibly, ignorant worker is given a feeling of *individual* prestige and recognition. And *never* display a piece of equipment or machinery without mentioning the operator by name.

A program of morale-building, in capable hands, may reap unexpected benefits as well as develop a feeling of well-being among employees instead of "make it worth my while" demands. This happier state of mind and sense of pride in a job well done is available to all, in Good Morale.

AGRICULTURE CAN PAY.

By Cultivator.

LOUIS Bromfield begins the preface to his book *Pleasant Valley* (Cassell & Co. Ltd.) with these words: "This book is a personal testament written out of a life-time by a man who believes that agriculture is the keystone of our economic structure and that the wealth, welfare, prosperity and even the future freedom of this nation are based upon the soil."

If this belief is right about the U. S. how much more right is this when applied to India.

The present writer has held for a life-time the belief that a happy, secure, and useful life may be spent, without much toil and drudgery, even on a few barren acres, and that a financial return may be obtained comparable with that in any other business if the creative work of the farmer is directed on the right lines and that great capital, special knowledge or skill are not essential but only energy, patience, and a thorough grasp of the underlying-principles.

Mere faith takes one nowhere unless it is translated into action. A plan was conceived which differed in one vital respect from all the innumerable plans which have been pouring on the heads of a long suffering nation ever since World War II began and are still pouring out from the mouths and pens of planners. While all other plans are meant for some one else, to carry out, this one was meant for none but the planner. The planner started work according to the plan in June 1943 in the hope that his two articles of faith could be proved to be justified and the educated, unemployed youth could be convinced that farming pays.

The Desert.

A few "barren acres" were purchased in 1943-45, about a hundred acres of barren sandy waste. Two centuries ago similar barren sandy waste in Norfolk (England) had been converted into fertile farms by Lord Townshend and a neighbouring landowner Coke, afterwards Earl of Leicester. What two lay-men accomplished two centuries ago could surely be done by another today. "All you will see" said old Lady Townshend to young Mrs. Coke as she was going for the first time to their new home,'will be one blade of grass and two rabbits fighting for that.' That would be an apt description of the sandy waste purchased but for the fact that there was not even one blade of grass and no rabbits to fight for what did not exist.

The Problem.

The job to be done was to convert this barren sandy waste, as quickly and as cheaply as possible, into soil sufficiently fertile to yield reasonable profits on invested capital. How this has been achieved is briefly—very briefly—stated below. None of the methods used

are clever or original and anyone who is interested can easily pick them up from books, but not from standard text-books on agricultures. These teach you nothing of practical use to the working farmer. A small booklet of popular lecture, to English farmers delivered by Sir. John Russell contains more of practical value than his weighty and learned book "Soil conditions and plant growth." Laborious study of this standard text-book revealed only one sentence full of meaning to the practical farmer—all the rest is highly scientific information useful to a student for acquiring a Degree in Agriculture. "If 15 or 20 per cent of organic matter is present in a soil, the operation of other factors ceases to count for much, and the distinctions between sand, loams and clays are obliterated."

There you have in a nut-shell both the problem and its solution. How to add organic matter to the soil? We are told that 5 tons compost per acre adds 5 per cent organic matter to spade depth. A thorough grasp of the underlying principle makes this task easy of accomplishment.

"Perhaps the most permanent piece of advice I can give to cultivators of poor soils," said Sir John Russell speaking to British farmers, "is—first find out what will grow best in your soil, and then find out what prevents it from growing better." This principle you will not find in any of the standard text-books prescribed in Agricultural Colleges.

The globe-trotting experts sees in American agriculture nothing but the obvious—large farms, large tractors, chemical fertilisers and high yields. What he does not see is the real foundation on which the prosperity of American and European agriculture is built—the deep-rooted legumes, lucerne and clover, which are the magic formula, the open sesame, to national health and wealth through food-grown on fertile soil.

Few agronomists and fewer farmers realise what vast quantities of organic matter are added to the soil by roots of grasses and weeds, and that without any expense whatsoever. Grass is the great restorer. But plough the grass in the name of clean-cultivation at the end of the rainy season and all the organic matter disappears like so much dry ice in the heat of the tropical summer with no chance for the orchard trees to utilise it.

There is a threshold of fertility. In soils where fertility is subliminal nothing will grow except indigenous grasses and weeds. Particularly in such soils there are invaluable gifts from heaven for raising fertility to the threshold level. Once that is reached fertility increases in geometrical progression through rotational cropping.

For restoring and maintaining fertility with heavy cropping, the type of farming should be "mixed diversified farming."

To make farming pay as well as any other industry or business the new agriculture should operate on the principles of successful business and industry—that you invest a rupee plus knowledge and intelligence in

order to make five, ten or fifteen rupees—not a mere two per cent like a fixed deposit in a bank. There is no business or industry which is so permanent and profitable as buying waste land at Rs. 50 per acre and making it yield Rs. 500 net per annum.

The Plan That Worked.

Firstly an orchard, mango grafts largely and lemons to start with an experimental garden for trying out other fruits. Miles of live fence or hedges of bush fruits for the masses—what is borne on the inner side of these hedges for canning as well as for sale as fresh fruit and what is on the outer side for any passerby to pick and eat with nobody to say "don't."

Secondly—paddy followed by vegetables and roots.

Thirdly—dry land cereals and legumes for vegetable, grain and fodder.

Fourthly—pasturage for livestock.

Fifthly—livestock.

Sixthly--lastly the most important object of all, the training of apprentices.

To quote Louis Bromfield in "Pleasant Valley"—"Today any farm-boy can have an excellent agricultural education without ever seeing a college campus. He can learn an incredible amount through the 4-H clubs, the Future Farmers of America, the S. C. S. the country agent and other agencies and organisations." We have too few colleges and none of the other agencies—except of course the Government Officials who correspond to the "country agents" but who, in this province, have been transformed into mere pedlars of manures and mamooties.

An excellent orchard has been established consisting of well over 600 mango graft, a couple of dozen esapota, as many guavas, a few hundred coconut trees, a lemon garden.

Over 40 per cent of the mango plants have begun to bear. Every year more are coming into bearing. All the sapota and guava plants are in bearing. The lemon garden specially is most successful as the fruits average some four to the pound. Lemon weighing over half a pound each are not uncommon.

The live fence of bush fruits has not come into being yet. But the experiment garden has shown certain plants to be very promising as they are drought resistant. The task that remains to be done is multiplying these plants and planting them out. This farm is remarkable for the fact that it has no fence of any kind. Most people including agricultural officers warned one of the folly of trying anything without an impenetrable fence. Yet for the last six years this farm has been developed without a fence of any kind. Probably we are lucky in our neighbours for there is practically no thieving and no trespass of any kind. The residents of this locality appear to be so honest and so considerate that even though hundreds pass through this farm to the ration shop located in it barely a couple of

dozen mangoes are stolen during the mango season.

Ever since the start enough paddy has been grown to feed a house-hold of six and frequent visitors. With the increase of fertility this has more than paid for costs even at the lowest controlled prices. Owing to the conditions peculiar to this locality a tractor is necessary for growing paddy over the whole part of the farm which is suitable for this crop. The next step forward is the purchase of a garden tractor.

The West Coast imports vast quantities of pulses from other areas. For raising the fertility level there is nothing to beat legumes. What legumes will grow best had to be discovered by trial and this took time but now we are getting good monsoon crops of legumes—chiefly certain cow-pea varieties—and making appreciable profits. As the fertility is raising dry-land cereals are being extended.

The increase of pasturage and fodder for livestock has been remarkable. On this farm there is more livestock than any ten neighbours put together own. This year this livestock cost nothing in feed for six out of the twelve months. During the next year the quantity of pasturage will be doubled. As with much less livestock two years ago the feed bill used to be some Rs. 2,000 a year it will be appreciated that grass and other fodder plants are easily the most valuable crops in a system of mixed farming determined by soil conditions like those here.

Our livestock is mixed like the system of farming. There are a score and more of cows and heifers bred on the farm and a couple of stud-bulls. Of the two stud-bulls one was bred on the farm and the other is a Government supplied cross-bred one. As the two are unrelated we avoid the father breding with his daughters.

Cattle manure by itself is undoubtedly the best single manure. A mixture of cattle, goat and poultry manures makes an ideal complete mixture far superior to cattle manure alone. Moreover goats and poultry multiply quickly and yield quick returns and are the best means of rapidly increasing supplementary food rich in protein which is lacking in the South Indian diet. No single measure will contribute so much towards increasing the standards of living and health as an increased supply of cheap high-protein foods. For these reasons this year we have started goat-breding and large-scale poultry farming.

But the one achievement of which we are justifiably proud is that the new agriculture and the life of a gentleman farmer are attracting apprentices. One, a graduate in commerce, is just completing his year's practical and theoretical training and leaving shortly to start work on his own land. The second was also an educated youth, the son of a retired Government servant farming waste land nearby. He spent a month here to learn poultry farming. He left us on New Year's Day and is now busy building poultry houses and other equipment.

Concentration of Resources

PLANNING COMMISSION'S SUGGESTION

NEED FOR COMMON APPROACH BY STATES AND CENTRAL GOVERNMENTS

DRAFT five-year plans for the Central and the States Governments are expected to be ready by the end of November, and it is hoped to complete the various steps which are required in time to enable Governments concerned to present their plans to Parliament and the States Legislatures during the next Budget Session.

The Commission's request to, States Governments to formulate their plans follows three months of study of development schemes of the Central and the States Governments and an examination of the principal problems facing the economy. While States Governments have to draw up plans suited to their own conditions, it is felt that the national economy will derive the greatest advantage from investment on development if the States and the Central Government have a more or less common approach to the problem of planning.

OUTLOOK FOR RESOURCES.

The Commission examined the problem of resources when, in consultation with the Central Ministries, it prepared the six-year development plan for consideration at the recent Commonwealth Conference in London. At its suggestion, States Governments are already engaged in reviewing their resources and preparing their forecasts for the next five years. Similar studies are being undertaken in the Central Government. It is recognised that the budget at the Centre and in the States has to be balanced if inflationary forces are to be held in check, and that at the present time the outlook for resources for development is not encouraging.

In the view of the Commission, these very factors emphasise the need for careful husbanding of resources, for augmenting them as far as may be possible, and for careful selection of projects to be undertaken by Government. Equally, it is essential to bring down the price level through gradual and co-ordinated reductions in different sectors. This action has to be backed by a disinflationary fiscal and monetary policy and by positive steps to increase production and reduce unit costs.

PRODUCTIVE CAPACITY.

In the first five year plan, therefore, apart from existing commitments of an essential or inescapable character, the Commission commends schemes which will develop material and technical resources and increase the production of food and raw materials over a relatively short period. Such schemes should have priority over others which, though valuable in themselves, require a much longer period to bear fruit. Since only limited finance is available, each scheme has to be judged

by its value in terms of production or productive capacity in relation to other competing schemes. Even in respect of social services, an important test is whether the existing level in any particular field or area is so low that it entails an appreciable loss of productive efficiency which may be avoided through provision of better facilities on the part of Government.

In addition to careful selection of schemes, the review continues, it is necessary to concentrate the available financial, administrative and technical resources on a limited number of essential schemes and to attempt only so much as it is reasonably possible to achieve. In this manner the gain to the economy is likely to be greater than if a wide range of problems are attacked simultaneously without deploying sufficient resources at each point. Indeed, without a marked increase in resources, in a number of directions, it may not be practicable to do more than maintain the existing activity; in some even this may not be found possible.

In the prevailing conditions in India, the Commission considers, there is a large field in which much greater value can be obtained from the existing resources. Through improvements in administrative organisation and methods, and greater co-operation from the public, and by invoking financial and other contributions from non-official sources, it should be possible to get substantial results. It is the aim of the plan to achieve these results equally with others which depend on greater investment of capital.

PLANNING IN PRIVATE SECTOR.

The bulk of organised industry falls in the private sector. Planning in this field, though scarcely less important than in the public sector, present obvious difficulties. It has to be more flexible and is to be undertaken largely through indirect means such as capital issues control, licensing, foreign exchange allocations and import and export control, and controls on prices, production and distribution, including physical allocations. The two sectors have to be guided by a common purpose and their plans have to be in harmony with one another. The Commission has in hand a series of studies bearing especially upon short-term problems of individual industries. In co-operation with the Ministry of Industry and Supply, proposals in respect of each industry will be discussed in the coming months with the interests concerned, and working plans evolved.

INCREASING AGRICULTURAL PRODUCTION.

Although agriculture falls in the private sector, Government has a special responsibility in this sphere. The study of several basic issues such as means of increasing production, co-operative cultivation, fixation of ceilings on individual holdings, restrictions on subletting, economic holdings, provision of finance to the cultivator and the establishment of a suitable extension organisation including village multi-purpose co-operative societies has been in progress, and it is hoped shortly to formulate the Commission's views

on these subjects. The Commission's work on the preparation of a five-year plan for increasing agricultural production and on the problems of agricultural prices has stressed the need for long-term planning in agriculture.

In no field is the significance of long-term planning greater than in the development of irrigation and power resources of the country. Less than six percent of the water which flows annually through the rivers of India is at present being utilised for irrigation. Less than two percent of the hydro-eletcric potential of the country has so far been developed. Many of the major irrigation works of the past utilised the normal perennial flow of rivers. New projects have to be based largely on storage rather than on diversion and are, therefore, more costly. At present 135 projects estimated to cost Rs. 590 crores are in hand in different parts of the country. These are expected to bring thirteen million acres of land under irrigation and to provide two million K. W. of power. The Commission has suggested to States Governments to consider developments necessary and likely over a period of fifteen years. This would facilitate investigations, preparation of estimates, construction as well as full development. It has also been suggested that each State might consider creating a non-lapsable Irrigation Development Ways and Means Fund to which contributions might be made from year to year on a planned basis. These contributions would draw upon general revenues, betterment levy etc.

SMALL-SCALE INDUSTRIES.

Closely linked with the problems of agriculture are those of cottage and small-scale industries. Without these there can be no solution for rural under-employment and un-employment. The development of cottage industries presents many difficult questions of policy and organisation. Much preliminary ground has been covered and the various issues are to be discussed shortly with the Commission's Panel on Cottage Industries.

A considerable amount of urgency has been attached in the work of the Commission, the review concludes, to the problem of industrial housing. In recent years the housing situation in industrial areas has deteriorated and at present working-class housing conditions are an important reason for low productivity and industrial unrest. The problem is beyond the scope of private effort and requires both long-term planning and co-operative contribution from employers and workers as well as from Government. The Commission has, therefore, recently evolved proposals for the consideration of Government in consultation with the Ministry of Labour and its own Panel on Housing. The problem of industrial housing is however, only one important aspect of the general shortage of housing, especially in urban areas, which is engaging the attention of the Commission.

MORE FOOD ENERGY FROM PLANTS

By Dr. Dean Burke.

UNTIL recently it was widely believed that photosynthesis, the process whereby green leaves take sunlight energy and change it into food energy, is not very efficient. That is, that only 10 to 20 per cent of the light energy could be changed into chemical energy.

A team of American scientists has now developed a process whereby some 80 per cent of the sunlight may be used to form food such as sugar, which may then be readily converted into scarcer and more desirable food, such as fat and protein.

This was done with little green plants called algae, which one often sees growing as the green scum in ponds. Algae combine carbon dioxide taken from the air, and water from the soil to make sugar and starch. At the same time, oxygen gas is broken out of the water and set free to purify the air. Thus, these algae, like other plants, create the food without which man and all animal life would starve, and liberate oxygen, without which they would suffocate.

By providing algae with the best possible conditions, American scientists enabled them to carry out this photosynthesis with virtually perfect efficiency.

The team of scientists which carried out the investigations at various American institutions, used new experimental techniques. Those in the group included Dr. Otto Warburg, the winner in 1931 of the Nobel Prize for medicine, who has now returned to Germany; the American biologists Dr. Dean Burk and Dr. Sterling Hendricks of the Bureau of Plant Industry of the U. S. Department of Agriculture at Beltsville, Maryland; and Dr. Victor Schocken, now at Harvard University in Cambridge, Massachusetts.

These biologists discovered how many "bullets" of light–quant, they are called—are needed to break the water molecule. They found that four quanta of light, and, in some cases, three, will do it—releasing oxygen and at the same time changing the gaseous carbon-di-oxide of the air to sugar. Most biochemists believed that at least 8 to 12 quanta were necessary. Since less light is required, the efficiency will go up accordingly.

Agricultural crops are vastly less efficient and at best convert only about one per cent of the sunlight into food energy. Part of this comes about because the leaves of the crop do not cover all of the acreage exposed to sunlight, and because the growing periods of the crops are limited to a few months of the year. Most of the energy absorbed is used to draw water from the soil into the plant, where it is then passed out of the leaves into the atmosphere. None of these and other causes of inefficiency are present when one is dealing with one-celled plants such as the algae. Most agricultural crops

produce one to three tons per acre per year. This figure includes the stalks as well as the grain. With alfalfa, about the highest yield—five tons per acre—may be produced under the best agricultural conditions.

At the Stanford University Research Institute in Palo Alto, California, scientists and engineers working together have been able to grow algae at the enormous rate of nearly 50 tons per acre. It is now believed that even this harvest could be increased, probably four times, making a total yield per acre some 100 times as great as with ordinary agricultural crops. Thus, a one-acre algae farm could be equivalent to a 100-acre field of wheat or corn.

The present experiments at the Stanford University Research Institute convert about five per cent of the sunlight into energy represented as algal growth. In view of these results, this could probably be improved about four times, up to at least 20 per cent. The remaining difference between 20 to 100 percent represents the still fairly large amount of sugar that the algae must use to make themselves out of the sugar they have manufactured, and out of the necessary minerals that must be supplied.

The total cost of the raw materials needed to make the algae from air, water, sunlight and mineral salts is less than one cent a pound of algae. Such algae would normally contain 60 per cent protein. If one wanted to produce the same kind of food materials from yeast instead of from algae, it would be necessary to supply several pounds of raw materials such as sugar or molasses to make one pound of yeast, but with the algae no such extra cost is added, since the energy is provided by the sunlight.

Photosynthesis represents a vast potential supply of energy when properly harnessed and utilised. The amount of sunlight falling on the surface of the United States each day is equal to several thousand times the amount of energy used by everybody in one day.

The average person uses some 3,000 calories of food per day, and also 50 times as much more for all fuel needs, including heating, transportation, manufacturing and lighting. This is a total of about 1,50,000 calories per person per day, whereas the solar energy falling on the United States is about 30,00,00,000 calories per day for each person. This amount of sunlight also represents a far greater potential source of energy than is at present considered to be available from nuclear materials in atomic-energy form.

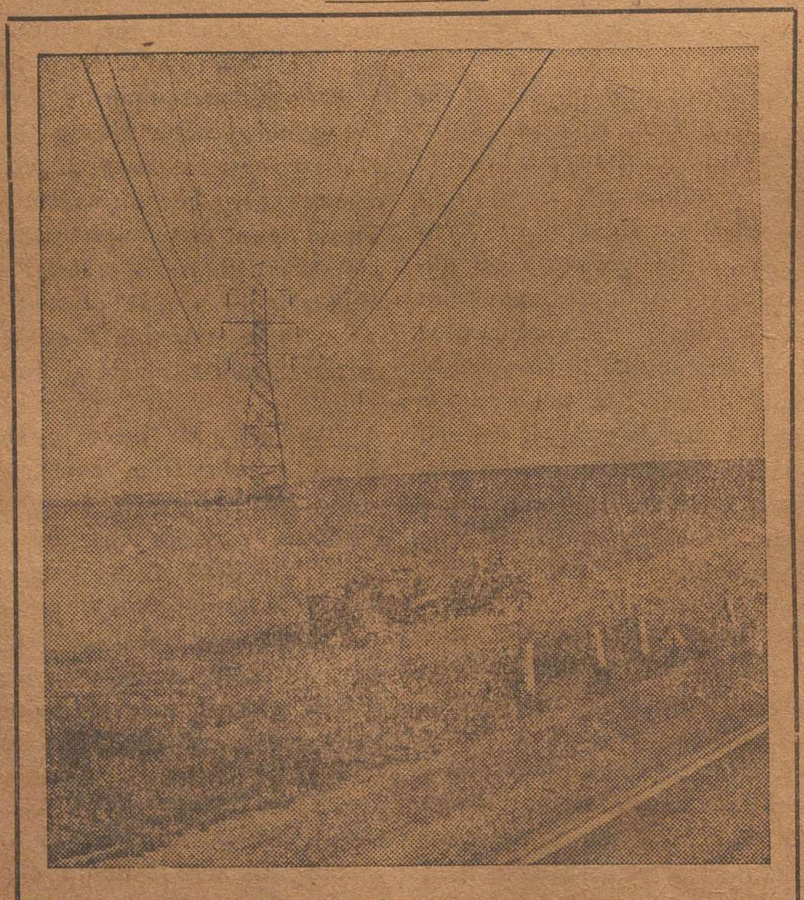
Virtually all the energy that we do use, coming from coal and oil, was derived originally from photosynthesis carried out in earlier times. The days of easy geographical search for more fuel and power are past, and new methods of using photosynthetic energy, as well as atomic energy, must rely on modern science and engineering.

The future efforts at using photosynthetic energy will include a study of the intimate chemical mechanism of photosynthesis. Much

time and research will now be spent trying to find out how the algae and other plants change carbon-di-oxide and water into sugar. When this is done, it should be possible to break the plant or algae cells apart and try to accomplish photosynthesis in the absence of life. It has already been possible to carry out half of the total process in the absence of the living cell. That is with the broken up parts of the cell, which are so small that one cannot see them even under the most powerful light microscope, it is now possible to use light to decompose the water into oxygen gas and hydrogen.

It now remains to find a way to combine this hydrogen with carbon-di-oxide to yield sugar. When this has been done, and the process thoroughly studied, it may be possible to replace the cellular enzymes of the broken up cells with chemical catalysts that can equally well change carbon-di-oxide and water into sugar.

The problem of how to make protein and fat food from sugar is, of course, a separate one, and will for a long time probably best be solved by the algae in plants. The chief object of the strictly chemical process referred to will be to convert sunlight energy into chemical energy.



A high-voltage power line crossing a farm in the midwestern State of Ohio. Below it, a farmer with modern mechanized equipment is harvesting his crop.

Introduction of New Plants

EFFECTS ON DEVELOPMENT OF COUNTRIES

THE study of the movements of plants and trees from one part of the world to another is comparatively new, yet it is no less fascinating than that of the study of the movement of human populations. In certain directions, the effects of such a movement are even more profound than those associated with the migration of peoples.

Before the discovery of America by Columbus, common plants like the potato, tomato, tobacco, groundnut and sweet potato were unknown to the people of the old world. With the development of faster transport by sea, air and land, there has been a large scale movement of plants, by way of seeds and cuttings etc. and many useful plants have been introduced into one country from another. The benefits of such introductions are many. They give greater varieties of crop, and often plants of great economic importance bring wealth to the country of their adoption.

The sugarcane industry of the West Indies and southern United States, developed from the introduction of the Indian sugarcane. Another remarkable case is that of wheat, one of our staple food plants. It has been established that the original home of the bread wheat was the mountainous area of Persia, Afghanistan and North-western India, whence it spread to the various parts of Europe and Asia. Later it was introduced in the United States of America. To-day the U. S. A. and Canada are the largest exporters of wheat in the world! Similarly, the soyabean or "wonder bean", which now grows successfully in the U. S. A. came from China and Manchuria. Two instances of plants which have come from the America to India, Ceylon, Malaya and the East Indies, bringing considerable benefit to these countries are the rubber tree and the quinine, yielding *cinchona*.

The *Jacaranda* tree with its mauve flowers and the rather unusual sausage trees with their hanging sausage-like fruits, are natives of Tropical America and South Africa respectively, and have been introduced in India and naturalised in recent years. Likewise the mesquite is a denizen of Mexico. But the story is not always one-sided. A number of harmful weeds have also found their way from other lands because of the lack of an organisation to check their entry. Harmful weeds like *Lantana*, *Argemone* and the water hyacinth have become naturalised in India, in this way.

COLLECTION OF PLANTS.

Advanced countries like the U. S. A. and U. S. S. R. maintain Bureaux of Plant Introduction for the entry of plants on scientific lines. Such bureaux collect a wide range of varieties of crop plants and wild relatives. This is essential for any scheme of improvement of plants either by breeding or by selection.

As a result of such introduction of plants, the U. S. A. now grows mangoes, introduced originally from India; dates from Egypt and oranges from Palestine. The sugarcane variety Co 281 evolved at Coimbatore and considered to be unprofitable here, has an introduction in South Africa proved to be the best cane grown in that country, over sixty per cent of the canes used in South Africa for sugar manufacture being of this variety.

In the past, plants have been introduced in India in a more or less sporadic manner; the ornamental and non-agricultural varieties, predominating over food or fodder plants. In the context of our drive for food self-sufficiency, greater attention has now to be paid to the latter types.

EFFORTS IN INDIA.

The Board of Agriculture of the Indian Council of Agricultural Research had recommended as early as 1935 the establishment of a Bureau of Plant Introduction in India. A nucleus scheme was sanctioned in 1941, but the establishment of the Bureau will have to await better times. Even so, the work done on this subject at the Indian Agricultural Research Institute, New Delhi, during the last four years is of great interest.

Over 400 samples of fodder, forage grasses, legumes, medicinal plants etc. have been collected; 528 of sweet potato, tapioca, groundnut, maize, onion, etc., 125 samples of other crops like cowpea, *guar*, *moth*, tomato, brinjal etc. and 80 of the wild relatives of wheat, barley, oat, bajra, linseed, sesame, *okra*, etc.

After studying the performance of these plants in Delhi, and multiplying the seed where necessary, they are sent to the different States for trial and the selection of varieties suitable for the various regions of India. In these trials the co-operation of the Agricultural departments of the various States is necessary and has been secured. At present, a trial of 41 varieties of sweet potatoes consisting of introductions from the U. S. A., China etc. is in progress in most of the States in India. The results of experiments of previous years in Delhi have indicated that a Chinese variety called *Tie-Shin-Tun* is very successful and its yield is over three times of the local varieties. Another promising plant recently introduced from the Philippines is a type of cowpea which grows very quickly, and yields edible pods within seven weeks of sowing. These are but two instances of the potentialities of organised plant introduction in our country. The benefits in the shape of increased food production, and also because of the larger variety of substitute food and fodder plants, that might result from a large-scale introduction and acclimatisation of improved plants from other countries, in the course of a few years, is of course incalculable.

INDUSTRIAL RESEARCH-STUDY OF RADIATIONS

THE study of radiations emitted by radioactive materials consists in estimating the intensity and frequency of various types of radiations or particles (Alpha, Beta, Gamma particles). The intensity of radiations is expressed in terms of the number of particles emitted per minute. This is done with the help of what are called 'counters' which transmit impulses received by it (proportional to the number of particles emitted) to an electronically operated machanical recorder. Normally these recorders are able to count pulses up to 1,500 per minute. Above this rate they fail to record the pulses accurately. In order to enable these recorders to count pulses of higher frequency, devices termed 'scalers' are employed.

Uses for Castor Oil Gel.

When castor oil is subjected to prolonged heating the resulting product is a jelly-like substance. About 40 per cent of this gel is soluble in common organic solvents such as benzol, naphtha, petrol, ether etc. At present there are very few industrial applications for this product. Another research paper published in this issue of the Journal relates to the detailed chemical examination of the constituents of this product carried out at the National Chemical Laboratory, Poona. This investigation has been undertaken with a view to find some possible applications for this product. A series of graded fractions have been isolated from the gel employing different physical and chemical methods. The gel fraction soluble in benzene-alcohol mixture or petrol ether, after suitable treatment, has been found useful in the preparation of plastic compositions, as a coating composition in combination with drying oils, and as a satisfactory substitute for ester-gum-oil, varnishes and solvent lacquers.

Three other research papers of interest in this issue of the journal are: (1) Preparation of Antimalarials-a series of organic arsenical derivatives have been prepared and their chemical and physical properties have been examined in order to determine the efficacy of these compounds as antimalarials; (2) Factors affecting the properties of Zircon Porcelain–This paper relates to the investigation of the relative merits of calcium fluxes (lime, whiting and wollastonite) on zircon porcelain ware. These studies have shown that lime is useful in any form for the production of earthenware and semivitreous bodies. The forming pressure of the body rather than the pressing technique is an important factor in their manufacture; (3) Applications of Dilatometry to Powder Metallurgy–A modified horizontal dilatometer has been described. Studies on the volume changes of pressed copper powder specimens during heating have been conducted employing this instrument.

A popular article of topical interest describes the outbreak of a fresh cycle of desert locust in India during recent moths.

FACTS THAT INTEREST

Primary Aliphatic Amines.

Availability of tertiary-octylamine and Alkylamine 81, two new primary aliphatic amines, has been announced by Rohm & Haas Co. Both amines have the tertiary-alkylamine structure, in which the primary amino nitrogen is directly attached to a tertiary carbon atom.

Tertiary-octylamine, 2, 4, 4-trimethyl-2-aminopentane, is a pure eight-carbon amine, boiling at 140 deg. C., while Alkylamine 81 is a mixture of highly branched primary amines, with the number of carbon atoms varying from 12 to 15, and has a boiling range of 220-260 deg. C. Both products are supplied as clear, straw-yellow, distilled liquids, with remarkably good color retention. They are comparable in basic strength to straight-chain aliphatic amines of the same molecular weight range.

In general, these amines undergo the typical reactions of primary aliphatic amines, but the presence of the tertiary-alkyl group imparts certain distinctive properties. For example, stable monomeric aldimines are formed by reaction with aliphatic aldehydes, the reaction with formaldehyde giving a stable azomethine, $RN{=}CH_2$. Such reactions as alkylation with alkyl halides, cyanoethylation and hydroxyethylation can be readily controlled to give monosubstituted products, with little interference by tertiary amine formation. Such unique properties render these amines of considerable interest in the field of synthetic organic chemistry.

Tertiary-octylamine and Alkylamine 81 may be expected to be applicable to the normal uses for primary aliphatic amines of their molecular weight range, although their branched-chain structure and modified rear activity should be taken into consideration. Among such applications are: as intermediates in the synthesis of insecticides, bactericides, fungicides, wetting agents, textile-finishing agents, detergents, emulsifiers, pharmaceuticals, corrosion inhibitors for metals, and for the introduction of oilsoluble groups into anti-oxidants and other oil additives.

Samples and technical literature containing experimental directions for many of the reactions of these are available from the producer.

Quinone Derivative.

Pilot-plant quantities of 2, 5-dihydroxy—1, 4—benzoquinone are now being produced by Edwal Laboratories, inc. This is the first time that the chemical, called DHQ, has been obtainable in such quantities. DHQ is a yellow to deep orange crystalline powder, titrating better than 97 per cent purity.

It forms stable complexes with metal ions, some of which are highly colored. The complexes with the lighter metals are soluble, while those with heavy metals are, in general, insoluble. Some of the DHQ metal complexes are available in research quantities, and it is planned to market these organo-metallic compounds also, if commercial demand arises.

Some of the uses suggested for DHQ and its metallic derivatives, based on their chemical properties, and on analogy to compounds with similar functional groups, are: anti-oxidant and stabilizer in plastics and oils, particularly where deterioration is catalized by traces of metals; organic

carrier for heavy metals for pharmaceutical and preservative uses; and synthetic intermediate. Data and samples can be secured from the producer.

Resin for Paper Making.

A new and effective resin for wet strength papers is the latest addition to Hercules Powder Co.'s array of chemicals for the paper industry.

The new resin, called Hercules Resin 138, is specially designed so that papers will retain a high proportion of the resin, which assures good wet-strength efficiency. The new resin is easy to use and can be added in the stock system or in tub sizing operations.

Besides imparting outstanding wet-strength properties to paper, Resin 138 has other advantages such as improving dry-strength properties and acting as an effective stze additive.

Resin 138 is in solution, ready to use, and may be added as received or diluted with water to any canvenient concentration. No acid additions or aging periods are required before using, and no special acted-resistent tanks are required for handling the resin.

Molding Compounds.

Three new Durez phenolic molding compounds have recently been placed on the market by Durez Plastics & Chemicals, Inc. All three fall into the impact type classification and provide either properties or production performance heretofore unabailable. They are Durez 13537 Natural and Durez 14482 Black, both high-impact, fabric-filled materials, and Durez 14658 Black, a nitrile-rubber-bearing, wood-flour-filled material.

The two new fabric-filled materials utilize two-step resins, and therefore have greatly improved flow properties and finish and are less critical when electronically preheated.

Durez 13537 Natural has an impact strength of 1. 4 ft.-lb. per in. on the izod scale. Its unusually good flow properties allow it to be either compression or plunger molded. It possesses a good balance of other mechanical properties and electrical properties for this type material.

Durez 11482 Black is similar to Durez 13537 but has almost double the impact strength (2. 2 ft. lb. per in.) Molding properties are not appreciably affected.

Durez 14658 Black has the moldability of general purpose materials, but because of its nitrile rubber content, it possesses improved impact strength and shock resistance. Its low modulus of elasticity (O. 6 x 10^6 psi. in tension) allows it to be used in thin sections around metal inserts. Molded parts are capable of standing repeated abuse without failure. The material can be plunger or compression molded and has good surface appearance.

Copolymer Latex.

New low—cost addition to Dow Chemical Co.'s line of latices is Dow Latex 744. The resin in the new latex is a copolymer of vinyl chloride and vinylidene chloride.

This copolymer latex is characterized by outstanding heat and light stability, wide compatibillity with modifying materials, and good stability to shipment, storage and processing.

Major uses for Dow Latex 744 are in the fields of paper coatings, un-

woven fabric bonding, textile coatings and industrial paints. Technical data can be secured from the manufacturer.

White Lead Pigments.

Two new rust inhibitive white lead pigments, non-reactive toward vehicles containing free carboxyl groups, have been introduced to the paint and varnish industry.

Monsanto Chemical Co. is own producing commercial quantities of tri-lead orthophosphate and dilead pyrophosphate. These are said to be among the few rust inhibitive materials that are non-reactive with solution coatings composed of a polyvinyl chloride-acetate copolymer modified with a dicarboxylic acid.

Because of free carboxyl groups, this resin reacts readily with most conventional primer pigments, particularly with corrosion inhibiting types such as the zinc and lead chromates and the red lead, resulting in the entire composition setting up in an unbreakable gel.

When lead phosphates are used the gelatin does not occur, according to Mosanto. In addition, the lead phosphates appear to inhibit corrosion. They do not function, however, as heat and light stabilizers.

The products are currently available in 100-lb. fibre drums.

Propylamines.

To its list of new experimental chemicals the American Cynamid Co. has added the following substituted propylamines; 3-dimethyl-amino-propylamine; 3-methoxypropylamines; and 3-isoproxypropylamine. These four volatile amines are soluble in most organic solvents and miscible with water to give solutions with a pH around 12.

Chemical and physical properties of these amines indicate their possible use in the synthesis of emulsifying agents, germicides and pharmaceuticals. Additional technical data can be secured from the manufacturer.

Anti-skinning Agents.

Two new anti-skinning agents for paints and varnishes have been developed by the Naval Stores Division of the Glidden Co. They are Glidcol-Regular and Glidcol-WW.

New Glidcol-WW is recommended for protective coatings where the agent used must have a very light color and mild pleasant oder. Its low boiling range insures evaporation from the film with minimum drying retardation. It will not discolor white paints.

Glidcol-Regular has a stronger odor and darker color than Glidcol-WW, but its effectiveness inxex is 85 points, 5 points higher than Glidcol-WW. Research has shown that when odors become milder, antiskinning qualities become weaker.

These anti-skinning agents are complex organic compounds including wood phenols. It is necessary to decide by actual tests the right proportion of an agent for a particular formulation.

Glidden checks the anti-skinning effectiveness of these products by a newly developed quantitative method.

Tetrazolium Salts.

The Montclair Research Corp., which has recently entered the field of fine chemical production for biological and medical research, announced the production of a number of tetrazolium salts. The salts available at present are 2, 3, 5-triphenyl tetra-

zolium chloride, neotetrazolium chloride, or p. p'—diphenylene-bis-2-(3,5-diphenyl tetrazolium chloride), and neotetrazolium phosphate.

These water-soluble compounds are reduced by living cells to stable colored derivatives. The neotetrazolium salts, which are colored purple to black in the reduced form, have been used extensively in histological research since the produced color contrasts distinctly with blood-containing tissue. The triphenyl tetrazolium chloride yields a deep red color on reduction and has been used successfully as a means of determining the germinating ability of seeds.

Daytime Sedative.

Sedamyl, a drug for relieving emotional tension and nervous strain during the daytime, is being marked by Schenley Laboratories, Inc. Chemically, Sedanyl is acetyl-bromdiethyl acetylcarbamid. Administered orally, it produces a calming effect without hypnosis. Patients retain full control over their mental and physical activities, hence the drug's usefulness for daytime sedation. Unlike the barbiturates, the drug does not cause residual drowsiness or impaired perception.

Fungicide.

A new effective non-irritating fungicide, Undesilin Ointment—Cutter has just been released for national distribution. It combines zinc undecylenate, copper undecylenate and undecylenic acid in a water-washable carbwax base. Useful in treating such fungus infections as athlete's foot and ringworm of the scalp and hands, the ointment is packed in 1—oz. jars.

Hydraulic Fluid.

Product is flame—resistant, has high lubricity.

A flame—resistant industrial hydraulic fluid, also said to have high lubricity, has been developed by Monsanto Chemical Co., St. Louis 4, Mo. The fluid, designated as OS—16, has been thoroughly fieldtested in hydraulically—operated miningequipment.

In the tests, a coal—cutting machine was operated on a 24—hour, three-day week in underground mining service. Hydraulic pressure was 1500 psi, A complete examination at the conclusion of the test showed no signs of wear in the hydraulic system, pumps or other moving parts in contact with OS—16.

Because the fluid is an ester-base compound containing no halogenated hydrocarbons, salts or water, it will not corrode bearings or other metal parts, and is a non-conductor of electricity. Tests also show that OS-16 does not irritate the skin, and requires no special precautions in handling or use.

Mothproofer.
Mothproofing Chemical used during manufacture of Woollen Yarn or Foods.

Lanoc is the name of a new mothproofing chemical being sold by Canadian Industries Ltd., Montreal, Canada, for use during the manufacture of wool yarn or goods. It is sodium dihydroxy-pentachloro-triphenylmethane. Applied in a dye bath during processing, Lanoc makes woolfibre unpalatable to the larvae of moths and carpet beetles.

News & Notes

New Drug Saves Chicks from Disease.

The Food & Drug Administration has approved the use of a new Dow chemical, Parabis-10, in poultry feeds to prevent coccidiosis, a disease that annually causes poultry losses upward of $10 million. Going even further, the Food & Drug Administration has now permitted feeding of mash medicated with the new anticoccidial drug to chickens right up until slaughter.

Tests demonstrated that the drug will not carry ever into edible portions of the chicken even if medicated feed is given just before slaughter, Dow bio-chemists state.

The Food & Drug action is important to the poultryman, the Dow bio-chemical researchers further point out, because it permits the use of a single feed instead of requiring the use of a non-medicated feed prior to slaughter.

In wide tests the new drug has proved effective and safe, according to Julius E. Johnson of Dow's biochemical research department. He supervised feeding trials with the new product.

Parabis-90 underwent extensive and successful trial with 2,00,000 chicks in Michigan during the past two years, according to Johnson, who adds that national trial was held up pending federal approval for the drug's sale through interstate commerce.

Johnson explains that chicks are fed a medicated feed from the time they are a day old until they are 10 or 14 weeks old, or through the raising period when coccidiosis is expected. Two parasites cause the disease. One, *Emeria tenella*, causes caecal coccidiosis; the other, *Emeria necatrix*, causes the intestinal form of the disease.

Chemical comprising Parabis-90 are 90 per cent 2,2'-methylene-bis-(4-chlorophenol) and 10 per cent inert carrier.

Flavor of the meat from treated chickens is not affected by the drug. This is the finding of Johnson and the Michigan State College poultry department workers who conducted taste trials.

The drug, reports F. A. Furman, who is in charge of the product's sale, is currently being sold to feed mixers. It will cost approximately $2 for enough of the drug to treat a ton of chicken feed.

Improved Natural Rubber.

A superior type of natural rubber that has up to 40 per cent better resistance to cracking than ordinary rubber was described at a recent meeting of the chemical Institute of Canada.

Cleaner, softer and more uniform in character than regular smoked sheet rubber, the extra-quality type is being produced by United States Rubber Co. through a specially patented process that removes all impurities, leaving it dirt-free and easier to handle in manufacturing operations.

"Known as USF, it is up to 40 percent better in cracking resistance than regular rubber", Dr. John Mc. Gavack, U. S. Rubber scientist, said: "In addition, it also shows exceptional

fatigue properties and improved adrasion resistance."

Although costing more than ordinary rubber, its light color and exceptional cleanliness make it highly advantageous for use in certain special products, he explained. These include white sidewalls for tires, transparent tubing, special bottle stoppers and other items.

FLAME-RESISTANT:
Hydraulic Fluid.

Monsanto Chemical Co. has developed a new industrial hydraulic fluid. It is flame-resistant and has high lubricity.

The fluid, disignated as OS-16, is chemically an ester base compound. It contains no halogenated hydrocarbons, salts or water.

OS–16 has been thoroughly field–tested in hydraulically operated min-equipment. In the tests, a coal-cutting machine was operated on a 24-hr., three-day week in underground mining service. Hydraulic pressure was 1,500 psi. A complete examination at the conclusion of the test showed no signs of wear in the hydraulic system, pumps or other moving parts in contact with OS–16. It has proved under actual operating conditions its value as a medium for power transmission.

Since OS–16 is a new type of hydraulic fluid, it generally requires the use of specially chosen hose, packing and gasket materials. These are available, however, from several manufacturers. OS–16 also has a tendency to soften and remove most finishes other than those that are baked. However, paints resistant to the action of OS–16 are available from paint manufacturers.

Because the fluid is an ester base compound, containing no halogenated hydrocarbons, salts or water, it will not corrode bearings or other metal parts. Tests also show that OS-16 does not irritate the skin, and requires no special precautions in handling or use.

Consideration of OS–16 is suggested for any of the widespread applications of hydraulic fluids. It is particularly recommend by Monsanto where the combination of non-toxicity, flame-resistance and high lubricity is of importance.

New Carbon Black.

A new carbon black just developed by Phillips Petroleum Co. and now produced on a semi-commercial scale promises to give increased wear resistance to rubber and add more miles to tire life than obtainable from any available carbon black.

Carbon black is an essential ingredient of rubber tires, imparting strength, toughness and abrasion resistance. Actually, a tire rolls on millions of carbon black particles embedded in the rubber.

New synthetic rubbers, such as cold rubber, have proved better than natural rubber for tire treads. The longest wearing tires made prior to the discovery of the new carbon black have been the result of combining cold rubber with special furnace carbon blacks.

The new carbon black when used with cold rubber is expected to produce tire treads having 25 to 50 per-cent better wear resistance than similar treads compounded with the best commercially available carbon black. The unusual properties of this new black also could be utilized to conserve both rubber and carbon black by building tires with thinner treads that would wear as long as present day tires. Such construction would further

improve tire life by reducing running temperatures, a point of special importance to users of heavy-duty, high-speed truck and bus tires.

The new carbon black, called SAF black, is produced from oil by a continuous process in equipment of unique design suitable for large scale commercial plant operation. Samples are being distributed to the rubber industry for evaluation in laboratories and on the highways. Although cost per pound of the new black probably will be somewhat higher than that of the abrasion resistant blacks now on the market, cost per mile of tire life promises to be lower.

Soybean Oil Alkyd.

Need of paint makers for a medium soybean oil alkyd solution at a higher viscosity range has resulted in the commercial development of such a resin by the Plaskon Division of Libbey-Wwens-Ford Glass Co.

The new resin has been designated Plaskon 3187. It is chemically identical with Plaskon 3185 but is bodies to a higher viscosity.

Solids include 35 percent phthalic anhydride and 50 percent soybean oil. They contain no phenolic resin. Their specific gravity is 1.10.

Plaskon 3187 is supplied as a solution of 50 percent solids in mineral spirits. The solution has a color (IP+ V. R.) of 3—7. Its acid number is 2—5. Viscosity is Z_3—Z_6. The percent solids at a viscosity of C-E is 32.5 percent. The solution weighs 7.63 lb. per gal.

This new resin is intended primarily for use in architectural finishes, porch and deck paint, and industrial primers and finishes.

Galvanizing Process Revealed.

Secret for 14 years, the Sendzimir process for continuous galvanizing of iron and steel has now been revealed by Armco Steel Corp.

In the Sendzimir process, surface preparation of the base metal is accomplished in two steps—oxidation of the surface and subsequent reduction of the oxidized surface. Preferred method of oxidation is by heating in an oxidizing medium. Not only is the surface oxidized to the same degree each time, but also rolling lubricants and other combustible material burn off.

Reduction of the oxidized surface is usually combined with heat treatment of the base metal. The full-hard, cold-reduced material is annealed at the same time the reduction takes place. The reduction is controlled by composition of furnace atmosphere and furnace temperature.

In the actual galvanizing operation, the major problem is to suppress the formation of brittle iron-zinc compounds in the coating. These alloys reduce the ductility of the coating. Formation rate is controlled by adding aluminium to the zinc bath and regulating properly the temperature of the material being coated.

Iron or steel strip to be galvanized is fed into the coating line at a constant speed under specified tension. This tension must be sufficient to guide the strip through the various line units but not so great as to stretch or break the strip.

The strip must be preheated uniformly in a furnace preferably equipped with an adjustable firing pattern so all widths can be uniformly oxidized. High-temperature, direct-firing gas burners work well in the preheat furnace.

The annealing furnace, next in line, completes heating of the strip

under a reducing atmosphere. Burners should not be of the open-flame type.

The cooling furnace is connected directly to the annealing furnace and extends to the zinc bath. Its end is sealed by molten zinc. It controls cooling rate in a non-oxidising atmosphere and has automatic heating and cooling means to compensate for variable quantities of heat in strip of different widths. The strip must reach the zinc bath at the proper temperature for instantaneous wetting and bonding with the zinc.

Zinc-bath temperature is maintained at 850° - 860°F. Temperature fluctuations must be avoided to prevent dross formation. Drossing is usually necessary only every 10-12 weeks.

One limitation of the process is that it cannot be used to coat cut length sheets and formed articles. Neither is it satisfactory for coating highly alloyed materials or severly scaled surfaces without additional pretreatment.

Newsprint from Paper Mulberry.

Paper mulberry, botanically called *Broussonetia Papyrifera*, which thrives well in tropical climate, has proved to be a promising source of raw material for the manufacture of newsprint in India, according to investigations conducted at the Indian Forest Research Institute, Dehra Dun. Paper mulberry is a fast growing species and attains pulp wood size (13" to 16" girth) in 7 to 10 years time as against 60 to 70 years of spruce and fir, the other two types of wood from which paper pulp for newsprint is manufactured in foreign countries.

Newsprint from paper mulberry mechanical pulp, produced at the New Forest, Dehra Dun, was made on a commercial scale at the Shri Gopal Paper Mills, Jagadhari, at the instance of the Forest Research Institute and under the direct supervision of one of its officers. The paper produced was given a full-scale printing trial on the high speed rotary at the STATESMAN press, New Delhi. A limited issue of a special edition of the STATESMAN was run on this experimental newsprint and, according to report received from the STATESMAN authorities, paper mulberry has proved a promising raw material for the production of mechanical pulp for the manufacture of newsprint.

The experimental newsprint compares favourably with the imported newsprint and was found superior in colour and printing properties. Further experiments are being continued at the Institute to improve the quality.

Coniforous woods such as spruce and fir are generally the most suitable raw-material for mechanical pulp required for newsprint. The Indian species, *Picea Smithiana* (spruce) and *Abies Pindrow* (fir) have been tested and appeared to be suitable for the purpose. But due to heavy fellings of these two species from the more accessible areas during the last war and the difficulties and cost of extraction from the more remote areas, utilisation of these conifers has to be ruled out for the time being. The best way of producing internally in the country raw materials for newsprint lies in the formation of plantation of paper mulberry which is suitable, fast growing, broad-leaved species capable of giving pulp within a minimum period of 7 years' time. In order to popularise the paper mulberry, the Forest Research Institute has also published an official note giving all the information available regarding the cultivation of this tree. This is intended to help in the large scale development of plantations of the trees.

QUERIES ANSWERED

(In this section answers are given by our Agricultural Chemist to questions received from the public on Soil, Agriculture and use of Fertilisers.)

Question No. 66.

What is the meaning of the term 'ley farming' ?

From Sri. K. N., Trivandrum.

Answer:—

In western countries like the U. S. A. there is a popular practice of growing grasses in association with deeprooted legumes with a view to build up soil fertility. This particular practice is called ley farming. The advantages of this practice are obvious. The grasses add to the humus content of the soil by the gradual decomposition of their extensive fibrous roots, while the deep-rooted legumes not only fix up atmosphere nitrogen in their root nodules but also help to bring up the reserve plant nutrients stored up in the subsoil. In this connection it must be pointed out that in the western countries agricultural holdings are much larger and as such the farmer has the freedom to plan out his own scheme of rotation. Every year he puts a portion of his extensive farm under ley farming, which he later breaks up with tractor ploughs and raises either food or cash crops there to his great advantage. Thus the ley farming is a sort of pivot crop around which other crops are rotated systematically. Another point of interest is that even for ley farming, large quantities of fertilisers are used to stimulate growth and the farmers' cattle are grazed on this luxuriant ley. Thus, ley-farming becomes doubly advantageous. But in our country where most of the holdings are nothing but minute bits of lands, ley farming has not much chance of being taken upon a large scale. Unless the fractionised holdings are consolidated into economic units there is no point in attempting to popularise the practice of ley farming in our country.

Question No. 67.

I find that some of the sugar-cane setts (cut pieces used for planting) blackened in colour and look quite unhealthy. Will you please inform me as to the cause and remedy for this strange phenomenon ?

From P. R. N., Coimbatore.

Answer:—

The blackened colour of the sugar-cane setts is caused by a fungus that goes by the name of ceratostomella paradoa and this disease is called the "*Sett-rot.*" This kind of fungal attack lowers the germinating power of the setts. The best way to control this disease is to steep the setts in 1% Bourdeaux Mixture which will immediately destroy all the fungal mycelia found within the plant tissue.

Question No. 68.

What are the remedial measures that may be adopted against the 'Stem-rot' disease of paddy ?

From S. S., Tirunelveli.

Answer:—

The *Stem-rot* disease of paddy is caused by a fungal parasite called *Sclerotium oryzae.* This disease is prevalent in almost all the paddy growing areas but generally, only a few plants are effected and as such the ravages of this fungus pass unnoticed. Sometimes, however, the fungus assumes very serious proportions, as it did last year in Tanjore District. Under favourable conditions of weather this parasite is quite capable of causing untold havoc to the paddy crop.

The symptoms of this disease are quite characteristic. At first, small dark coloured spots appear on the outer sheaths of the plant at about the water-line. The submerged portions of the plant begin to decompose and rot. The culm shrinks in size and it ultimately collapses, which causes the plants to fall over or lodge in a permature condition. Side tillers die off as soon as they emerge. If the attack is mild there won't be any fatality of the crop; but grains will remain partially filled which directly results in an appreciable reduction in the yield. Not only the quantity but the quality of the grain also suffers. The leaves of the affected crop possess a sort of sickly yellow colour. If we split open the diseased culm we can see the fungal growth inside. Small dark bodies of *sclerotia* (fruiting bodies of the fungus) can also *be seen* and their presence is characteristic of this disease.

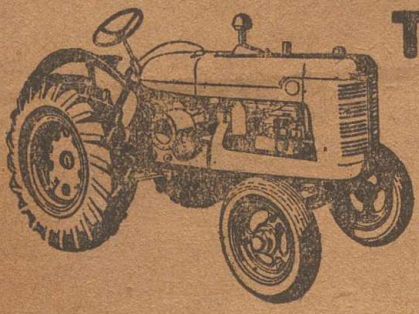
Normally, vigorous plants are not affected by this disease. The fungus enters the plant only through the base of the culm in under water reg on and then it gradually invades the plant tissues and causes rotting. If the host plant is vigorous then the fungus remains only in the outer sheath and consequently there is not much loss. But if the plant has been weakened either by drought, inadequate manuring, or an attack of some other disease, then the parasite penetrates into inner tissues and produces the stem-rot.

The sclerotia of this fungus are capable of remaining in a dormant stage for a very long time and then under favourable condition they will germinate and infect the next crop.

Control Measures:—

This disease, once it breaks out as a serious epidemic, is very difficult to check. As the fungus enters the plant only through the basal leaf sheaths that remain submerged in water, it will be advisable to drain off all the excess water from the fields and leave behind only just enough to keep the soil muddy. This measure has been faund very effective in Arkansas, U. S. A. But unfortunately such a scheme of controlled irrigation is not feasible in these regions where water supply is not certain and mainly dependant on the rains, which is the case in most of our paddy growing areas. Hence this cultural method of drainage can be recommended only in those areas where local conditions permit the same. Another method of overcoming this disease is to apply a good dose (1 cwt. per acre and more) of Ammonium Sulphate on the affected crop. A ready supply of nitrogen immediately stimulates plant growth and profuse tillering. The consequent increased rate of growth directly helps the crop to overcome the ravages of the fungal parasite. This method of fertilizing has been found effective in the delta region of the Tanjore District. Another precautionary measure is to destroy the stubbles left in the fields afterharvest. The sclerotia of the fungus remain lodged in the stubbles, which have therefore to be removed and *burnt* on the spot. Preparation of the land for sowing or transplanting should never be hurried. The land must be puddled well and all the remmants of the previous crop should be permitted to rot and disintegrate completely.

T. S. Ramakrishnan.



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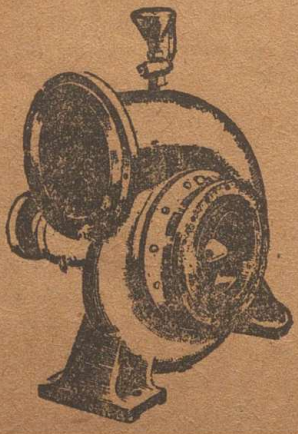
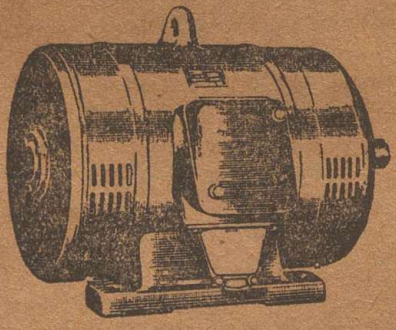
and implements for all agricultural operations, even for small farms. Tractors with belt pulley are a source of stationary power for pumping, chaff-cutting, threshing.



PUMPS

for irrigation and other purposes.



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The photographs show the Aerocar ready to be used for a highway trip (at bottom) and in flight after being converted into an airplane (at top).

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Another View of the Caustic Soda Plant under construction.

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