FACT

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Sri. V. Seshasayee
Whose Shashtiabdapurthi was celebrated on 12—8—1950

"The Last Ones Came from Korea": The woman representing "World," has received numerous bouquets of beautiful flowers, all labeled "Peace". The one on the mantle is marked "Yours for Peace, Joe Stalin." But she is puzzled when she picks a thorny spray from a box labeled "Far East Aggression."

"NEW SERVANT OF MANKIND": This cartoon, shows Man as he envisions the peacetime uses of atomic power (the huge wheel at the right).

FACT

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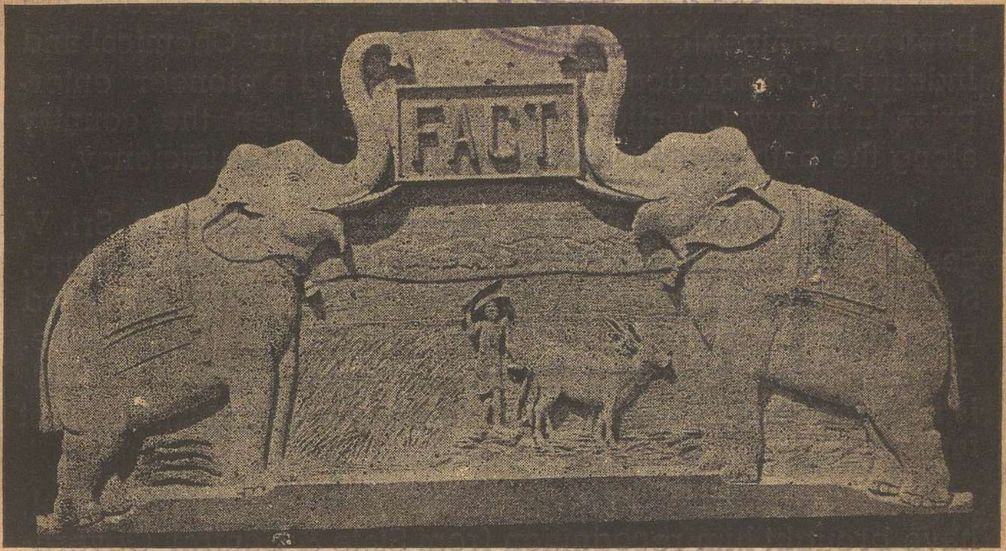
The Editorial Board do not hold themselves responsible for the views expressed by contributors.

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

Editor.

In this Issue ....



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EDITORIAL.

Sri. V. SESHASAYEE.

THE sixty-first birth day of Sri. V. Seshasayee was celebrated on the 12th August 1950. With very great pleasure FACT associates with this auspicious occasion and offers him warm felicitations.

The biography of Sri. V Seshasayee when it comes to be written will stand out as a record of signal service and significant achievements. But for his pioneering endeavours India would have been the poorer for several of her present prominent Industries. Institutions like the South Madras Electric Supply Corporation, The Mettur Chemical and Industrial Corporation, The Fertilisers and Chemicals, Travancore Limited, The Aluminium Industries Ltd., Kundara owe their existence solely to his unflagging efforts and prescience. These units attempt to bridge some of the wide gaps in the country's economy and are enduring assets for the regeneration and uplift of our people.

The South Madras Electric Supply Corporation brought electricity within the reach of the poor man in Tamil-Nad.

The rural and industrial progress it has brought about has been pre-eminently remarkable. The Mettur Chemical and Industrial Corporation in addition to being a pioneer enterprise in heavy Chemical Industry, has taken the country along the path of industrial progress and self-sufficiency.

In the hard and uncertain years of the last war Sri. V. Seshasayee took up the programme of fertiliser manufacture. Setting aside dissuasive and derisive criticisms that emanated from several quarters he forged ahead with the scheme. Again success crowned his efforts and the F. A. C. T. Ltd. is now the country's most effective weapon in our war against famine.

His eminence in matters technical and commercial, have brought him recognition from State & Central Governments, as well as corporate institutions. As adviser to the Central Planning Commission and to the Government of Madhya Pradesh, his remarkable talents have been aptly availed of by the leaders of the country.

Sri. Seshasayee is ever anxious to preserve cordial relations with labour. His affability of manners, sympathetic outlook and ready adroitness to grasp the other man's point of view have endeared him to all those who come in contact with him. His friends and admirers have formed the "Seshasayee Shashtiabdapurthi Committee" at Tiruchi with a view to establishing a fitting monument for commemorating this event. They propose to start a Technological Institute at Tiruchi, which no doubt will symbolise not only the tastes and sympathies but also the untiring zeal and pioneering enthusiasm of the Sexegenarian himself.

Sri. Seshasayee, successful industrialist that he is, prefers to lead a modest and unostentatious life. This simplicity of habits and his easy accessibility to one and all, are two very endearing aspects of his remarkable and colourful personality.

May he live long and pursue his path of service for our welfare. More than ever, India now is in need of the services of entrepreneurs like him.

Editorial Board.

SOIL CONSERVATION.

By
A. T. SEN

IN India, soil conservation has not received the attention it deserves; in fact in many quarters the subject is not even fully understood. Thus to some, soil conservation is merely a control of erosion. It is not that only, it is something more. It means control of erosion, prevention of the impoverishment of the soil, making the best use of the available water, drainage where necessary; in fact 'whatever else needs to be done to keep the soil permanently productive or make it more productive.'

Soil conservation, to define it briefly, is a matter of putting the land to its appropriate use and then to subject it to maximum exploitation consistent with its safety with supporting practices. It, therefore, calls for the determination of the appropriate use to which a particular land is best suited and of the practices which will enable the maximum and safe exploitation of the land in that use. It is possible with our present scientific knowledge to say with a fair degree of accuracy the appropriate use to which the particular land should be put to, but the practices, enabling the maximum safe exploitation of the land in that use, are still a matter of experimentation and research particularly in India. However, an appraisal of our present knowledge on the subject both in India and elsewhere, is desirable.

It must also be mentioned that although it is possible to find out the appropriate use of the land from scientific consideration, the adoption of that use by our farmers is beset with difficulties. The present land uses in India are the results of cumulative influences of economic and social factors. It will not be wise to ignore the fact. In a conservation programme, therefore, due recognition should be given to fact, and the object must be achieved through education rather than through enforcement. The progress will necessarily be slow; but it is better to face facts in their correct perspective, from the very beginning, in order that we may be able to fill up the gap, in an appropriate manner, between our existing efforts in securing information and what is needed for applying soil conservation measures on the field.

Finally, there is a need for drawing up a national programme of soil conservation in which the activities of governmental agencies and of farmers are to be integrated and co-ordinated.

It is the purpose of this paper to deal with each of the above-mentioned points very briefly with the objective in view, viz. increased agricultural production and the conservation of the most important of our natural resources, the soil.

Appropriate land use.

To evolve a system of determining appropriate land use, a new concept of classifying land according to its use capability has been introduced. In this system all the important factors which limit maximum production of land are taken into consideration. The factors considered are:

1. The basic nature of the region on which the land in question is situated, represented by more or less uniform conditions of soil, topography, climate and vegetation.

2. The depth, texture and permeability of the soil.

3. Inhibitory factors such as wet conditions, salinity, stoniness, etc. which may be present in the land.

4. The slope of the land.

5. The extent of erosion to which the land has already suffered.

The information on the above factors for any given land is collected by conservation surveys and the land is classified on the basis of this information. It is obvious that a land, in any region, which is level enough to be erosion free, which has a good depth of soil with texture and permeability conductive to plant growth and which possesses no inhibitory factors, is surely a very good land for the purpose of agricultural production. This is a Class I land and the conservation problem here is the maintenance of soil fertility under maximum exploitation with the help of normal agricultural operations. If on the other hand, all other conditions remain the same but one of the inhibitory factors or causes of soil erosion is present, the land requires more care for its stability than the Class I land. The conservation problem becomes more difficult requiring the introduction of such practices as will overcome the state of instability of the soil together with what is required to maintain its fertility under maximum agricultural production. This is a Class II land. It is clear, therefore, that the intensity or the degree of hazards form the basis of this system of classification. It also follows that as the degree of hazards increases, a stage will be reached when agricultural 'use' of the land may not be a feasible proposition. Such lands should be retired to pastures or forests, if not permanently, at least for some years to come until the intensity of the hazards has been partially or fully mitigated or, as may happen, further scientific knowledge, gained during those years, makes agricultural exploitation of the land possible even under such inherent hazardous conditions.

In the U.S.A., and certain other South American countries, eight broad classes of land have been recognized. Of these four are placed under agricultural use and the other four under pasture, forest or other uses.

In all the above cases, particularly for the agricultural use group a considerable volume of research and experimentation was and is still being carried on to evolve suitable supporting practices to enable maximum safe exploitation of each class of land in each region. It needs no mention that a set of practices found suitable for a particular class of land in one region will not necessarily hold good for the same class of land in another region. The intensity of research and experimentation is thus evident but let this not be a disquieting feature in the determination to go ahead at a rapid pace with soil conservation in India. Broad principles on which the supporting practices are to be based are already known in India and elsewhere, and these could be profitably applied at once to effect stabilization of the soil and increase production. In the Bombay–Deccan area contour bunding has been used with considerable success over five lakh acres in light and medium textured soils with an appreciable increase in yield. Improved dry farming methods in Bombay have given as much as 70 per cent increase in yield. Unfortunately data on the increase in yield due to introduction of soil conservation practices are not available in India since it is only recently that such practices have been introduced in very limited areas in this country. However, since the supporting practices in a soil conservation programme have the objective of maximum production in view, recourse will be automatically taken, based on existing knowledge, to all available means of manuring and fertilization, increasing irrigation facilities, suitable crop rotation, etc, the effects of which on crop yield are somewhat better known in India. Thus manures and fertilizers have given an increase in yield from 22 to 128 per cent, irrigation from 30 to 145 per cent and crop rotation from 48 to 114 per cent. Not in all cases requiring irrigation it will be possible to introduce irrigation and the supply of fertilisers may remain inadequate for some time to come, but crop rotation can be introduced in a large number of cases with immediate beneficial effects. In regard to fertilisers if the basic dose of 20 lb. of nitrogen per acre is distributed equally between dung, oil cakes, bone meal, ammonium sulphate and green manure, there may be better chances of meeting the major part of the requirements with the resources that are available or can be developed further in a short time in the country.

It has already been mentioned that the introduction of conservation practices in India is of a very recent origin. They cover only very small areas and are therefore too meagre to meet the need of the country. Furthermore, the meagre work is all piecemeal and not properly co-ordinated. At each place of such trial, emphasis has been laid on one or two aspects of the problem and sufficient integration has not yet been introduced to bring about an all round improvement for maximum production. Such trials, however, are not without value since they furnish information on which to base later the integrated approach to the problem. Briefly these efforts have been mainly in the direction of:

1. Pasture improvement through the control of grazing and, in some cases, with reseeding.

2. Reclamation of waste lands also be closure to grazing and, in some cases, with systematic planting.

3. Contour bunding and field embankment to conserve rain water. It is only in very recent years that researches have been introduced at a

few places on contour cultivation, strip cropping, terracing, contour trenching, gully plugging, etc.

4. Planting of soil-conserving grasses and legumes.

5. Erection of shelter belts against wind erosion.

6. Control of flood and river bank erosion.

In the United provinces an all phase rural development project has just been launehed.

In almost all the cases mentioned above promising results are being obtained, as expected; but the point stressed here is that the sum total of such efforts is extremely small as compared with what it should be and that the work throughout the country should be planned, co-ordinated and placed under one programme.

On the other hand, there is a considerable volume of information on the benefits that have resulted from proper land use supported by conservation practices in the U.S.A. and other countries. It is not possible to discuss them with in the limits of this paper. It will suffice to generalize that an over-all increase of 30% in production in the conserved areas, over and above previous heavy fertilisation, appears to have been achieved. In Russia with the introduction of conservation measures, including crop-grass rotation system, in the steppe and forest-steppe areas, the productivity of the land has been pushed up to 47 to 84%. If conservation measures have given increased yields in other countries, it will not fail to do so in India also. Therefore, taking a very conservative estimate, an immediate average increase of 30% in production can fairly be expected from the areas in which conservation practices are introduced with the added advantage of stable and permanent agriculture. Where irrigation is needed and can be extended, the increase in production will be much higher.

Integrated soil conservation measures.

So far as India is concerned this will be a theoretical discussion since a beginning has not yet been made in this direction. But it may be desirable to probe into how other countries, especially the U.S.A., have proceeded in the matter keeping in view any suitable modifications necessary to suit Indian conditions.

In the beginning a large number of demonstration areas were opened and run in many states in the U.S A., but it was soon realized that the problem of conservation could not be solved adequately by work in isolated areas, and that it was necessary for the farmers to organize themselves for co-operative action to apply on their lands conservation practices with technical help from the Soil Conservation Service. The help was assured through legislation and soil conservation districts came into being. As soon as twenty-five per cent of the farmers of any area signify their willingness to co-operate with the service in applying soil conservation measures on their farms, the area is included in a district and free technical help as well as help with equipments on hire are made available to the farmers.

The technicians survey each farm, demarcate the different use capability classes of the entire farm land and prepare a plan for the farm indicating the measures to be introduced in each demarcated area, including those of engineering, forestry, crops and crop rotations, pasture improvement, etc. The plan also goes into the economics of the farm and indicates the number of cattle that should be maintained, also poultry, hogs or any other livestock in which the farmer is interested and which can be developed under the conditions of the farm. In fact a complete plan is presented with emphasis on the proper use of each class of land occurring in the farm holding and on the stepping up of production and therefore of the income of the farmer. Furthermore, technical supervision (e.g. in the laying of contours, terrace, contour strips, etc.) and advice in executing the plan is also made available to the farmer free of charge.

Let the subject be now considered for India. In the first place, the small size and the scattered nature of our individual farm holdings make them unsuitable for preparing a farm plan for each holding. The area of a village has been suggested for this purpose. But the rational approach will be the entire area of a sub-watershed with the areas of villages, or portions thereof, that come within the catchment. For the sake of speed, and at the same time without loss of accuracy, a unit of the order of ,10,000 acres is considered expedient, so that, if necessary, more than one sub-catchment should be lumped together for the purpose of preparing the plan. The efficiency of the planning staff will not be affected since in any case they will have to meet the farmers in groups. On the contrary, a sub-watershed affords a better scope for drawing up an efficient plan on the basis of utilization and disposal of water.

In the second place our farmers have not the equipment to undertake the execution of the engineering part of the plan, which may call for the use of heavy machinery. However, we have now some information on the type of organization needed to deal effectively with such work on the basis of the working of the Central Tractor Organization. The difficulty in this respect therefore does not seem unsurmountable.

In the third place we have not the requisite number of trained personnel to take up the work on any wide scale. This may be so, but that was also the case with the U.S.A., and for that matter any country when they made a beginning in that direction. In fact, dearth of trained personnel is not likely to prove any serious handicap, if we adopt the principle of getting the men efficiently trained as they work. A short refresher course of about 14 weeks given to a couple of dozen of agricultural, forestry and engineering graduates on the fundamental principles of soil coservation with practical illustration in the field, can bring lakhs of acres under the conservation programme.

In the fourth place we have not enough research data on which to base effective conservation measures, nor have we enough facilities for research to keep feeding the field staff with new and better information. It has been stressed before that broad principles on which conservation practices have to be based are already known to a large extent. In the early stage in India, as was done and is still being done in the U. S. A. and elsewhere, we shall have to depend on the ingenuity of the farmers and the best judgment of the technicians in evolving effective conservation measures to suit local conditions. At the same time, steps could be taken to organize research to solve specific problems as they are presented by the field staff from time to time. The research staff should try to solve the problem on the spot, if they are not already in possession of the requisite information available from experiments carried out elsewhere on similar set of conditions. Cultivators' fields are to be utilized for the purpose and the cultivators guaranteed against losses. Supporting laboratory data for such researches are to be obtained with the co-operation of the existing Central and Provincial Research Stations, and Institutions and the Commodity Research Stations, supplementing the staff of these Stations and Institutes, where necessary, by the soil conservation organization. This will of course be a temporary measure. As this work progresses, the volume of problems presented by the field staff will be so great that properly equipped Soil Conservation Research Stations will have to be set up both under the Central and Provincial Governments. In this matter of researches in soil conservation, 'the objective should not be to make them of the cloistered or collegiate type by more of the type carried out in business organization in developing particular products. Furthermore, instead of going in for a complete solution, research on a particular item is to be finished off when something that will work with a reasonable degree of soundness has been obtained, so that research on the next item waiting in the list of priority can be taken up.

But what we do not really have in India is the appreciation of the fact that through the application of soil conservation measures on the field, we can make our agriculture rational, stable and the most productive. And because of this lack of appreciation there is yet no definite policy and no national programme for soil conservation. The position was exactly the same in the U.S.A. until 1934, when, it is said, that while a prominent scientist (now the father of the U.S. Soil Conservation Service) was addressing the House of Representatives to convince the members of the immediate need of a definite policy and a national programme, dust from the dust bowl in the central U.S.A., after travelling hundreds of miles, entered the House and settled on the papers and desks in front of the members. It was not so much the speech of the scientist as the settling of the dust that stirred the members and a fillip was given to soil conservation proposals. Scientists, prominent public men and even newspapers have all stressed the need of introducing soil conservation measures in India. Dust from the Rajputana Desert is blowing into everybody's house in

Delhi and even in Simla, but we have not yet sufficiently awakened to one of the most pressing needs of the country.

A national programme of soil conservation.

It has already been mentioned that the U.S.A. is carrying on a nationwide programme of soil conservation and is profiting by it. A number of South American countries have followed suit. Australia and New Zealand also have done the same. Recently Russia has launched a soil conservation programme of almost incredible magnitude in the South and Central Black-Earth Belt of the European U. S. S. R. The truth is that soil conservation is the basis of permanent and productive agriculture. That being so, India is bound to accept the need for soil conservation on a nation-wide scale, be it today or tomorrow. The sooner she does so, the better will it be for her.

It seems justifiable, therefore, to discuss ahead some of the broad lines on which a national programme of soil conservation in India may be based. Some of the difficulties in developing an efficient national programme for India have already been discussed. It has also been pointed out that the acceptance of the programme by the farmers should also be achieved through education and not by enforcement and that this has been found feasible elsewhere by personal contacts of the technicians with the farmers making the latter learn as they work and by granting effective powers to the farmers to organize themselves for co-operative action. Over the greater part of India, in the provinces and States, certain measures are being launched to re-organize the *panchayats* to whom such effective powers may be delegated. In other words *panchayats* are to be made responsible for carrying out soil conservation work within their respective jurisdictions, the service of the technicians being made avilable to them free of charge.

Let us now try to build up a programme by considering the requirements at successive states beginning from the bottom. It has been proposed that our farm plan is to be a conservation plan for a sub-watershed with an area of about 10,000 acres. Two points arise here for consideration, one on technical aspect of survey and planning, and the other on the actual survey, preparation of the plan and the execution of the work. In the national programme the former is to be made the responsibility of the Centre so as to ensure a uniform procedure of survey and planning throughout India, while the latter will be the responsibility of the provinces and States.

To start with, the Centre will make rough delineations of the different Basic Soil Regions (B. S. Rs.) occuring in the country, carry out reconnaissance survey of each B. S. R. to fix provisionally the normal soil profiles and the approximate ranges of slope, erosion and inhibitory factors for determining the various land use classes, make tentative recommendations for the practices necessary for each class of land, based on judgment and local information, and prepare *ad hoc* technical guides for survey and planning. As information becomes available through application of conservation measures on the field, the *ad hoc* guides will be replaced by better ones for use in future planning.

The actual survey and the preparation of the plan for the sub-watershed will be carried out by the provincial or State staff following the procedure laid down in the technical guides referred to above. If the pro-State Governments introduce rural development boards and committees to secure co-operation of the villagers on the same line as mentioned above, soil conservation should be made a part of the function of those boards and committees. The formation of such boards and committees will indeed be welcome as it will provide for an effective co-ordination of the activities of the various governmental agencies for rural development. It needs no stressing that maximum agricultural production is achieveable when the farmers do not suffer from lack of health, credit facilities, essential supplies, etc.

As soon as legislative enactments have been made to enable farmers to organize themselves for co-operative action through the *panchayats* and committees mentioned above, soil conservation work on the field on sub-watershed basis should be taken in hand. In the beginning each province or State may select three sub-watersheds in three districts with three work unit offices. This is suggested because of the absence of field experience of the trained staff who have just undergone a refresher course of 14 weeks about which reference has been made before. All the trained staff should be distributed between the three work units. Every six months three new sub-watersheds in other districts should be taken up for soil conservation work until the work has begun in all the districts in the province. A target of three years should be fixed for completing the work of each sub-watershed and adequate staff should be provided for the purpose. On completion, contiguous sub-watersheds should be taken up until the entire district is covered. It will be possible after the first two years to start work simultaneously in several *parganas* and different tehsils in a district. The point stressed is that in the first two to three years we should proceed with our programme rather slowly and cautiously in order to organize, consolidate and gain experience both in the field work and in handling farmers to secure their maximum co-operation.

Research in soil conservation and the sifting of information from this and other sources all over India and elsewhere should be mainly the responsibility of the Centre. It must keep the field staff at the various levels in the provinces and States fed with new useful information and new ideas continuously so as to improve the efficiency of the field staff. The provinces and States should also share in the responsibility of carrying out research and should maintain research stations and nurseries. The main research activity of the States will be the quick solution of specific problems presented by the field staff. A very close co-operation should be maintained between Central and provincial research staff so that co-ordination of work could be effected throughout India and duplication is avoided.

The training of personnel required for the field work, through a 14 weeks refresher course, should receive top priority in the national programme and should be the sole responsibility of the Centre in the beginning. Later on the provinces and States will train their own staff, but the preparation of the course of instruction will remain the joint responsibility of the Centre and the States. It may be desirable to invite Central staff to take part in the teaching from time to time.

It will be thus seen that at the Centre there must be a fact finding, planning and co-ordinating organization. The establishment of such an organization should receive the topmost priority in the national programme. The next priority will be the preparation of *adhoc* technical guides for soil conservation planning of sub-watersheds and the training of the field staff. Meanwhile legislation should be enacted to enable farmers to organize themselves for co-operative action through *panchayats* and other committees at pargana, tehsil, district and provincial/State levels. As soon as this is done, soil conservation work should be started in three sub-watersheds in three districts, adding three more sub-watersheds in other districts every six months until the work has begun in all the districts in the provinces or States. On completion of the work in a sub-watershed for which a target of three years may be fixed, contiguous sub-watersheds should be taken up until the whole district is covered. In the meantime research and continued dissemination of useful information to the field staff on a country-wide scale should be pursued vigorously by the Central organization.

The above is a broad outline of a proposed national programme. It is by no means complete, but it may serve as a basis for further discussion and improvement.

In conclusion, it may be repeated that the introduction of the integrated soil conservation work is long overdue in India and that the sooner she takes it up on nationwide scale the better will it be for her. 'Every day of delay in applying conservation to the land means just that much more loss of food for the people, now and in future, and it means also, a more difficult and expensive job'.

(Indian Farming)

COFFEE INDUSTRY

THE economic position of the Indian coffee industry has improved considerably during the last few years due to the renumerative price which the industry has been getting for its produce. The introduction of the coffee control and the activities of the Coffee Market Expansion Board—now called the Indian Coffee Board—in establishing the prices of coffee at a higher level have imparted prosperity to the industry. During the last few years, there has been an appreciable increase in the acreage under coffee due to the stimulus given by high prices. The area under coffee in 1941-42 amounted to 1,80,412 acres. By 1945-46 it increased to 2,10,865 acres, and further to 2,18,841 acres in 1947-48. Out of the above, the area under Arabica aggregated to 166,581 acres and Robusta 52,260 acres. The relatively better yield of the latter has resulted in the extension of the area under this crop. In 1940-41, the area under Robusta remained at 28,824 acres, improving to 46,138 acres by 1945-46. As compared with the area in 1940-41, the 1947-48 acreage shows an expansion of 23,436 acres—a rise of 82 per cent. Whereas during this period, the increase under Arabica plantations came to 15 per cent. It may be mentioned that a few decades before the area under coffee in India stood at about 3,00,000 acres. The low prices coupled with devastating pests were responsible for slowly reducing the area.

Production of coffee during 1948-49 (July-June) was encouraging, the total being placed at 22,300 tons inclusive of the quantities retained by growers for domestic consumption. Upto November 15, 1949, the total quantity tendered into the Coffee Pool amounted to 21,604 tons, consisting of 11,615 tons Plantation, 6708 tons Arabica Cherry and Estate provided and 3,281 tons Robusta Cherry and Estate Pounded. Production during this season might have been greater but for the sharp decline in the output of Robusta which, for instance, accounted for 8,830 tons, out of the total crop of 15,800 tons during 1947-48. Prospects for the 1949-50 coffee crop are reported to be satisfactory while those for 1950-51 are reported to be very promising due to increased allocation of fertilisers. Experienced planters are reported to be of the opinion that the outturn in 1950-51 would amount to the high figure of 30,000 tons. If the above figure were reached, it will be a new record in the history of the coffee industry. it will also enable the industry to recapture its traditional European market which used to absorb nearly 8,000 tons in the prewar years, besides meeting the increased domestic demand.

The following table gives the outturn of coffee in recent years:—

	In tons.
1945—46	25,500
1946—47	14,953
1947—48	15,800
1948—49	22,300
1949—50	19,890
1950—51	30,000 *

* Estimated.

The relatively better outturn in 1948-49 enabled the Indian Coffee Board to allocate 3,000 tons for purpose of export. Exports were allowed to the U. K., Switzerland, Persian Gulf countries, Holland, Italy, the U. S. A., Finland, Czechoslovakia, Yugoslavia and Egypt. Sales for export to all destinations except to the U. K. were made through exporters in India while those to the U. K. were concluded directly with the Food Ministry through the Government of India. Prices varied between Rs. 118 and Rs. 152 per cwt. ex-bags, ex-curing works exclusive of sales tax.

Although Indian coffee is claimed to be the finest in quality, India produces only 1 per cent of world's coffee production out of the total world production of 2½ million tons. Brazil produces nearly 60%, Columbia 11% and Dutch East Indies 5%. The biggest consumer of coffee is the U. S. A. at 7,50,000 tons, and is supplied by Central and South America. Canada consumes 18,000 tons. South Africa 16,000 tons, Australia and New Zealand 2000 tons each.

Before the war domestic consumption of coffee was 50% of the production, but since then the grave demand has increased by leaps and bounds. Our main markets in the pre-war period were France, England, Norway, and some of the Middle East countries.

In view of the urgency of earning dollars it has been strongly urged that Indian coffee should be exported in increased quantities. It is felt that the export of 3000 tons is inadequate and in view of the fact that it has now a ready market both as regards price and quality, six to seven thousand tons shouldbe exported and a good part of this quota should go to Canada and America. There is but legitimate ground for this view in view of the fact that a record crop is expected for the coming year. The Central Government would do well to consider this matter inas much as coffee is one of the chief dollar earners.

As in the case of other Industries Research has not been employed on a large scale to increase the output of coffee. Both as regards quality and quantity this lacuna should be overcome with the undertaking of more useful research work in order to expand and stabilise the expcrt trade of the country.

HYBRID CORN FOR INDIA

By

BOSHI SEN.

NOWADAYS it is possible to make plants to order, and hybrid corn is one of these new products. In 1947–48, a little over 7¾ million acres were under cultivation of corn (maize) in India. Our estimated total yield was a little over two million tons, 20 per cent short of the demand, and over four lakh tons had to be imported from abroad. Our average yield in 1947 was 8 maunds per acre, which is 1½ *maunds lower* than the average yield per acre obtained during 1936—40. In the United States of America, during the corresponding period, the average yield per acre was *raised* from 16 maunds (1930–34) to 25.3 maunds in 1946. This increase was achieved by the use of hybrid corn seeds. In 1933, hybrid corn seeds were sown in only one acre out of a thousand, but by 1945, 675 acres out of a thousand were planted with hybrid corn. In that year, the increase of yield of corn in the United States of America was over 17 million tons. Translated into increased income to the farmers, this meant 700 million dollars.

Hybrid corn—a modern miracle.

How was this miracle achieved? By a long and strenuous programme of research work, carried out at a cost of nearly five million dollars to the U. S. Department of Agriculture. The old method of crop improvement was to select plants which showed desirable characteristics, and reselect from their progenies, and so on, until improved varieties were stabilized. Revolutionary changes in plant breeding work, however, have been brought about during recent decades as a result of the application of certain fundamental discoveries made about the middle of the 19th century by the Austrian monk, Gregor Mendel. Briefly stated, the principal concepts advanced in the Mendelian theory are that (a) the characteristics transmitted by the parents to the offspring, in both plants and animals, are determined by the unit factors, called genes, (b) the gene complements in the first generation of offspring from the same parents are similar, but (c) from the second generation onwards the genes segregate out in different combinations and patterns. The correctness of this theory has been amply verified by innumerable genetical experiments, and hybrid corn is one of the outstanding practical results.

Through work based on modern genetics, it has been possible to evolve new types of corn by combining several desirable characteristics and eliminating undesirable ones. For example, plants have been produced which have good roots and strong stalks, which are early or late as demanded by particular climates, which are resistant to diseases, and which have uniform vigour and high yield. But since in the progency of hybrid corn plants, segregation takes place, hybrid corn for seed purposes must regularly be produced afresh. This is not only practicable, but an economically sound proposition, as proved by the results of the work in U. S. A.

Almora trials.

Different varieties of corn, like all other plants, have their own specific requirements of temperature, water and duration of the sun-light. Whether varieties of corn which have been evolved to suit the climatic conditions of different regions of the U. S. A. will do equally well in India, has yet to be determined by experimental trials in this country. Work along this line has been stated at the Indian Agricultural Research Institute, New Delhi, and at the Vivekananda Laboratory, Almora. Small samples of the U. S. A. hybrid seeds, obtained through the courtesy of Dr. Merle T. Jenkins, Corn Specialist, U. S. Department of Agriculture, were sown in June, 1948, in Almora, in replicated field plots, along with the local varieiy and one of the best U. P. varieties, T. 41, seeds of which were obtained from Mr. M. A. A. Ansari, Economic Botanist, Kanpur. Seeds of the U. S. hybrid corn were also sent to several Experimental Farms in the United Provinces and to New Delhi for trials. Reports of these trials, indicate that as result of the late monsoon in 1948 and excessive rain later on, there was either poor germination or the germinated plants became spoilt. The data obtained at Almora, on the other hand, were most encouraging. The observed yield per plant from the different varieties is given in Table I and the photographs of the cobs graphically illustrate the data given in the Table.

TABLE 1.

Yield per plant of different varieties of corn observed at Almora.

Almora Local	T. 41	Min. 404	Towa 306	U. S. 13.
0.77 oz	3.91 cz	3.01 cz.	6.73 oz	9.09 cz.

It will be seen that compared to the Almora local, the yields of all the U. S. hybrids are unusually high, and compared to T. 41, the yield of Min. 404 is lower, while that of Towa 306 is 72 per cent and of U. S. 13, 132 per cent higher.

Experimental trials with the U. S. A. and other hybrid corn should immediately be undertaken all over India, in view of our acute food shortage, and the necessity to conserve dollars for our industrial development. On the basis of Almora results, it would appear that by the use of hybrid corn seed, we can more than make up our 20 per cent deficit in corn, without increasing the acreage under corn cultivation.

The next question is, do we have to import our hybrid seeds, or is it possible for us to produce them in India? The main work is to discover and produce desirable parent seeds of pure breed (inbred parents) which can be used for producing the desirable hybrids suited to particular growing regions. Once the seeds of suitable parents are obtained, the mating of different parents is a simple process, well within the competence of an intelligent cultivator. For corn, unlike wheat, for example, produces separate male and female flowers on the same plant. The tassel, or pollen bearing male flower, appears at the terminal end of the plant and the female flower, the cob with its silken strands, branches out from the stalk further down. Fertilization of the cob with pollen gathered from a selected tassel presents no very great difficulty.

Double Cross Hybrids.

To obtain hybrid seeds on a commercial scale, double cross hybrids are used, since inbred parents produce weak plants and the quantity of seeds obtained from crossing inbred parents is generally small. For double crosses, four desirable parents, say A, B, C and D, of pure breed, are selected. When the cob of A is fertilized by the pollen of B, a single cross, AB, is produced. Likewise when C and D are crossed, the single cross CD is produced. Both AB and CD seeds will produce uniform vigorous plants. Cobs of AB plants fertilized by the pollen of CD plants then give the double cross, AB × CD. Since in this case both parents have hybrid vigour, an increased quantity of seeds is obtained, thus making the production of hybrid seeds a good commercial proposition.

Technique of production.

The technique of producing hybrid corn is very simple. The basic idea is to fertilize the cob of the pure breed female parent by the pollen from the tassel of a different pure breed male parent. This is normally done by dusting the silk of the cob with the pollen. When several varieties of corn are grown in a single experimental plot, the silk strands before they emerge from the cob, must be protected by paper or cloth bags for a few days only, to exclude any contamination by unknown pollen (which may be floating in the surrounding air or carried by visiting insects). Bagging is unnecessary, however, if plots at least 300 yards apart are available. Then only two varieties to be crossed are planted in adjacent rows in a single plot. As soon as the tassels emerge in the plants selected for the female parent, they are simply pulled out by hand, and the cobs are then automatically fertilized by the pollen from the tassels left intact on the male parent. The cobs of the female plants will produce hybrid seeds—single crosses, if inbred parents have been used, double crosses, when single crosses are used as parents. In single cross plots, the cobs of the male parent plants will give inbred seeds. In double cross plots, the seeds produced in the cobs of the male parent should not be used again for sowing, but should be utilized for consumption.

Increase yield of corn obtained by the use of hybrid seeds in the U. S. A. has more than repaid the extra cost of the seed production. A new industry valued at 70 million dollars a year, for producing hybrid corn seed, has grown up. In India, to begin with, production of hybrid corn seeds should be undertaken by our Government Farms. Later on, a few intelligent cultivators in every suitable corn-growing area can be taught how to produce hybrid corn on a small scale, to meet the local needs. This work might well be taken up by the *Gaon Panchayats.*

In the field work efficient help was rendered by Shri Bansilal Shah and Shri Udinath. The data were kindly analysed by Shri A. R. Roy, Statistician (A. H.) I. C. A. R., New Delhi. The expenses of this work were met from a grant from the Department of Agriculture, United Provinces, for my Scheme of Plant Introduction.

Towards Maximum Efficiency in Industry

By

JOHN KINGSLEY

IN almost all parts of the world today there is a desire to achieve one or both of two ambitions—to become independent of outside economic aid as soon as possible and to raise the standard of living. There is consequently widespread interest in the means to these ends. A major means is the raising of output per worker by increasing industrial efficiency, and it is worthwhile looking at some of the ways in which this task has been approached in Britain. Industrial production in the U. K. increased by six-and-a-half per cent in 1949. This is a very high rate of progress which, if it was maintained on the same scale, would give an increase of 50 per cent in less than 10 years. It was a solid advance because it was only partially due to the increase in the number of workers employed. It was mainly due to an increase of nearly four per cent in the total output per worker per year. This was more than the two-and-a-half per cent increase which had been expected, but the British Government are cautiously working on the assumption that the output per worker will increase in 1950 by no more than two-and-a-half per cent though it might be more since British industry is growing increasingly aware of the importance of increasing output.

This whole question is summed up in one word "Productivity"—a word which is not easy to define, but one which is now well-known to men and women in British factories. For the Government have for some two years been running a publicity and educational campaign to make workers and management conscious of the possibilities of higher productivity. At the same time the Anglo-American Council of Productivity, which is financed by Marshall Aid funds, has organised 12 visits by teams from British industries to study the latest methods employed in the U. S. A. The result has been an ever growing volume of information available for the help of British industry. Much of this has come from industry itself, for the best British industry is well abreast of the latest industrial techniques in spite of the interruption of the war, which postponed the installation of the most up-to-date manchinery. The problem is to bring the less efficient sections up to the level of the best. One way this is done is by the pooling of industrial experience. Many British firms have made public reports showing how they have been able to increase output and lower costs. A large number of these success stories have now been published. An analysis of them shows that they have many common features likely to encourage widespread imitation.

The most common route to more efficient production happens to be attractive to workers. About three-quarters of the case histories pooled through the Economic Information Unit of the Treasury had some form of incentive wages scheme. Details varied widely, from a simple bonus on production to complex payment by results, but the effect was to give the worker the chance of earning more by greater effort or by greater efficiency. Widening the range of some form of payment by results has enabled a large section of British workers to increase their earnings substantially during the last two years of the wage stabilisation policy. This has been welcomed by the Government because higher earnings linked with greater output are healthy signs of expanding economy. Equal in importance to wage incentive schemes is the practice of "Joint consultation"—the establishment of committees and other means of enabling workers and management to discuss problems of production together. Again, about three-quarters of the reports from successful firms make a point of finding ways of making every man and woman understand the importance of the job to be done. Many firms take their workers fully into their confidence by giving them the facts of production and finance.

Factories working for the export trade try to give their workers some idea of how they are individually helping to pay for Britain's imports. The Treasury Economic Information Unit helps by distributing posters and information which aim to give the worker this feeling that he is doing something directly important. For example, the Government's latest monthly bulletin on productivity gives a list of imports which can be bought for a hundred pounds' worth of exports; wheat for more than 5,000 loaves enough timber for a house, 180 gallons of rum, 900 dozen eggs and so on. Individual firms can use this information to show what their own particular exports will buy. The use of this kind of psychological approach to establishing good industrial relation is not unlike the practice of Army Commanders such as Lord Montgomery, who liked to take his troops into his confidence. Other methods most often mentioned as ways to industrial efficiency are improved factory layout, reduction in the number of processes and standardisation of products, and systematic training. All these are ways which have been proved to raise industrial efficiency without the introduction of expensive new machinery. The demand for new equipment is so heavy that it must be spread over a period of years even though the U. K. is spending one-fifth of the national income on capital investment.

One of the most difficult problems has been to find ways of extending payment by results and wage incentive schemes to the ancillary trades which provide services rather than make things. This problem has been successfully tackled by British European Airways in their aircraft maintenance branch. By fixing a standard time for job, and paying a bonus for time saved, British European Airways have made substantial economies, yet the earnings of their maintenance staff have increased, and the quality of the work has, if anything, improved. British European Airways are believed to be the first airliner company in the world to adopt an incentive bonus scheme for maintenance. Working on 40 Viking airliners at Northolt, flying time has been increased by a quarter with 25 per cent fewer maintenance staff. This example of productivity technique being applied outside the field of industrial producion is an indication that the drive for maximum efficiency extends to the whole of British economy.

TRISODIUM PHOSPHATE.

By
S. SUNDARAM M. Sc.

REACTION of Caustic Soda with the fatty materials under controlled conditions is the basis of soap manufacture. It is well known that ash could also be used as a detergent for domestic purposes because it contains a small percentage of potash. Soda ash also finds favour with many house-wives for home cleaning on a large scale because it also possesses detergent qualities. Besides these, there are many other dish washing compounds sold by various soap manufacturers in the form of white powders wherein a tribasic salt of phosphoric acid, tri-sodium phosphate $Na_3 PO_4$ is used as the basic material. This chemical compound which is manufactured from phosphoric acid, besides being used for cleaning, finds various other uses also as a corrosion inhibitor and water-softener. The raw water that is fed into boilers for steam raising contains salts of calcium and magnesium which form scales on boiler tubes at elevated temperatures. tri-sodium phosphate is used in careful and regulated quantities, depending upon the concentrations of Mg and Ca salts, to purify raw waters and strip them of these undesirable elements.

The manufacture of tri-sodium phosphate comprises of two main steps—namely neutralisation of phosphoric acid and crystallisation of an aqueous solution of tri-sodium phosphate. The chemistry of the industry is explained by the following equations:—

$$Na_2CO_3 + H_3PO_4 \quad Na_2HPO_4 + H_2O + CO_2 \ldots (1)$$

$$Na_2HPO_4 + NaoH \quad Na_3PO_4 + H_2O \text{-} (2)$$

If it is planned to produce one short ton of tri-sodium phosphate it will be necessary to use about 1300 pounds of soda ash, about 1200 pounds ot phosphoric acid and about 620 pounds of NaOH. It is a common practice to specify soda ash for industrial use on the basis of its Na_2O content and 58% soda ash can be used in this case. The phosphoric acid can be of quality containing about 45% P_2O_5 It is desirable to use a caustic soda containing a slight percentage of NaCl, since NaCl at the later stages of crystallisation forms a double salt with the tri-sodium phosphate which incidentally helps to prevent caking of the crystals during storage. It is necessary to heat the neutralisation batch to drive out all the CO_2 that will be liberated during the reaction between soda ash an-l phosphoricacid. This is accomplished by passing steam in closed coils inside the batch tank. At suitable intervals the solution is sampled and tested to ensure the complete elimination of CO_2. To be on the safe side, it is always considered advisable to add a slight excess of phosphoric acid over what is actually required theoritically. As is observed in the reaction (1) the pH and alkalinity of soda ash is just sufficient to displace two hydrogen atoms in the first stage of the chemical reactions Caustic soda is used according to equation (2) to eliminate the third hydrogen atom since it possesses pH and alkalinity higher than soda ash.

After the formation of disodium phosphate has been accomplished in the solution, it is filtered keeping the temperature between 185° to 212° F. The filtrate contains 14.5 P_2O_5 and 13% Na_2O. About 1500 gallons of di-sodium phosphate of this composition is pumped into a wooden tank of about 4000 to 5000 gallons capacity and to this is slowly added caustic liquor which contains 1100 to 1200 grams of NaOH per litre. The rate of flow of caustic liquor is kept usually between 10 to 15 gallons per minute so as to enable the reaction to be completed in the course of one hour. The temperature of the caustic liquor is kept at 194°F to prevent undesirable effects due to its high concentration and also to avoid crystallisation of trisodium phosphate at quite an early stage in the causticising batch tank. The reaction between NaOH and Na_2HPO_4 being exothermic, heat is liberated and the solution starts boiling at 234° F. The mixture of solution is kept agitated with the help of motor driven stirrers. The tank is kept open all the time through a vent to carry off the caustic spray.

The solution of trisodium phosphate is kept at a specific gravity of 1.34 to 1.40 at 194° F and it is controlled in such a way to keep the ratio between P_2O_5 and Na_2O between 0.7 to 0.8. As a further control on the solution a sample is titrated to phenolphthalein and methyl orange end points. At this stage an excess of sodium hydroxide over that for exact neutralisation is desirable. The ratio of the phenolphthalein end point reading to the total reading has been suggested to be between 0.51 to 0.54.

The trisodium phosphate is then filtered, if necessary and pumped to a common feed tank into which the mother liquor from the previous centrifuge batches are continually received. The hot solution is drawn by centrifugal pumps from this tank into crystallisers through heated pipes which are kept preferably above 160° F to prevent formation of crystals in the pipe lines. The crystals are formed by reducing the temperature below 120° F. The solution from the crystalisers which can contain a magma varying between 300 to 400 cc/litre is pumped to contrifuging machines of the continuous type to free them from the mother liquor and moisture. This could be later dried further in hot air driers or steam jacketted rotary driers.

It may appear at a casual glance that the production and manufacture of trisodium phosphate involves almost the same details as one would encounter in the Mersburg Reaction for the manufacture of Ammonium sulphate. The main producers of trisodium phosphate in the world today are U. S. A. and England. America manufactures about 70,000 to 80,000 tons of this chemical per annum. India does not manufacture this important commodity which has got abundant and various uses both in the house and in industry by virtue of the many important physical and chemical properties it possesses.

As observed in many crystalline products, one serious draw-back with tri-sodium phosphate is its tendency to cake if the crystals are rather fine. According to United States Government specification at least 50% of the product must pass through a 10 mesh and be retained on a 100 mesh sieve. The formation of double salts with tri-sodium phosphate minimises its tendency for caking. For this purpose it is common practice to use sodium fluoride, sodium chloride, sodium borate or even sodium hypochlorite. Sharp and even-surfaced crystals are always preferred to crystals with rough and uneven surfaces.

The important uses of trisodium phosphate are as a detergent and a water softner. A good detergent should have a high hydrogen concentration even in dilute solutions, or in other words should be highly alkaline. Oils and greases which are the bases for accumulation of dirt are compounds of saturated or unsaturated fatty acids and the detergents chemically precipitate these acids in the form of salts which could be easily washed with ordinary water. A detergent should also have the capacity to emulsify oily matter or dirt either as a result of physical contact or a chemical reaction. The pH of 0.1 normal solution trisodium phosphate is 12, while the pH of solution of Na_2CO_3 and NaOH are 11.6 and 13 respectively. In practice as a detergent one ounce of trisodium phosphate is added per gallon of water. Borax which has a pH of 9.2 has been completely displaced in recent years by trisodium phosphate as a base for household detergents. In advanced countries it is eliminating sodium carbonate also from the domestic field. It can be used for cleaning glass-ware, porcelain, metal-wares, greasy and burnt pots and pans. In proper proportions it can be also safely used for cleaning painted wood-work and walls, furniture, marble, tile, cement, linoleum, rubber, wood floors and shelving. It is useful for the removal of oil and grease from machinery and clothes. For cleaning of milk tanks, pasteurizers and pipe lines where bacteria are likely to accumulate, this compound finds use not only as a detergent, but also as an antiseptic.

The property of producing lather with soap can be popularly defined to indicate the quality of hardness of natural waters. This hardness is mostly due to the presence of carbonates and sulphates of calcium and magnesium. When hard waters are fed to steam generating boilers they tend to form a scale on the tubes which are in contact with them. The efficiency of a boiler depends roughly on the heat supplied by the fuel and the heat that is being actually used up in the raising of steam. Since the heat supplied has to pass through the surface of the metal tubes before it could heat up the water, the capacity of the metallic surface to transfer the heat to the water will govern the economic operation of a boiler. If there is a thick scale formed on the water side of the tubes, all the heat supplied may not be completely useful for heating up the water. Besides, on one side, the temperature will be much higher than that on the other sides. Such a lack of uniformity in the temperature on either sides of the boiler leads to failure and quick deterioration of their tubes. So, before feeding hard raw waters into boilers, it is necessary to sotten them, or in other words it is essential to bring down to the minimum, the amounts of carbonates and sulphates of calcium and magnesium which form scales at high temperatures.

Ion exchange resins are used in modern boiler operation for softening of raw waters. Trisodium phosphate is also very commonly used for boiler water treatment. The Ca and Mg. salts form insoluble precipitates of calcium and magnesiun phosphates which form sludge tending to settle down. This is carried away during blow-down. As a boiler water softner, trisodium phosphate takes up on itself many useful and important roles. It provides the necessary alkalinity to control pH of the boiler water, acting as an emulsifying agent. It also reduces the metal ion concentration by precipitation. At times since the scale found in boilers consist mainly of calcium sulphate, phosphate treatment helps to maintain sufficient phosphate ions and the necessary alkalinity, to attain the solubility product of the insoluble Ca phosphate before the solubility product of $CaSO_4$ is reached after which only scales are formed. It is necessary to keep always a slight excess of phosphate over calcium in order to obtain good results due to the frequency of boiler blow downs employed in modern boilers. Careful control requires the presence of 30 to 50 parts per million of excess phosphate ions. The amount of trisodium phosphate required to soften 1000 gallons of water is estimated by multiplying the parts per million of calcium carbonate hardness by 0.021 except that a minimum of 4 pounds is usually specified.

There are many other uses for Na_3PO_4 including soaking of hides, stripping of color from leather, clarification of sugar and photographic applications. In short the uses of this phosphate compound, are so many at home and in industry that it will be in the interests of the Industrial economy of India to explore ways and means for its manufacture.

FACTS THAT INTEREST

Manufacture of Activated Carbon.

A new method of producing activated carbon employing hydrochloric acid gas and the hydrochloride of an alkaline earth as an activator has recently been patented.

The carbonaceous material is intimately mixed with magnesia which is obtained by calcining the carbonate, hydroxide, nitrate or an organic salt of magnesium at a temperature below 800°C. Sufficient magnesium chloride solution of 27° to 32° Be. is then added to the mixture so as to form a firm dough.

The dough is next flattened to a slab of convenient thickness, which is dried in the air from 1 to 3 hr., subdivided and allowed to set. On a large scale, bricks may be formed in a clay pig mill of the extrusion type, while in the laboratory the small blocks are heated to between 650°C. in a crucible having one escape vent for vapours in the lid.

After heating, the blocks or bricks are crushed to powder, extracted with hydrochloric acid solution, filtered and washed free from salt solutions and hydrochloric acid with water. The material is finally treated with dilute ammonia to neutralize residual acidity. Traces of ammonia are removed by drying below 100°C., leaving a carbon with high powers of decolourization and gas absorption.

Analysis of Coal Ash.

A new scheme of analysis embodying several improvements in the quantitative methods of analysis of the constituents of coal and coke ashes has been worked out at the Fuel Research Station.

The principal changes in the methods previously reported relate to: preparation of ash for analysis, solution of the ash, separation of silica, determination of barium, treatment of the iron group, determination of iron, determination of titanium, removal of platinum and manganese, determination of magnesium, phosphorous and alkalies. The scheme is considerably simpler than schemes for the analysis of silicate mineral in general.

Maturity of Cotton Fibres.

A single chemical test to determine how cotton fibres are likely to react during spinning and other phases of processing is being used by cotton mills in the United States. The test, which involves the use of a special mixture of red and green dyes, quickly reveals whether fibres are mature or immature.

The new test is based on the fact that differences in dyeing properties of cotton are related to the maturity of the fibres. When subjected to the operation, thick-walled or mature cotton fibres turn red in colour and thin-walled or immature fibres turn green. The test obviates the time, expense and complications involved in the microscopic test.

Air Gun Aids Arc Cuts.

Faster cutting out of faulty welds in stainless steel at Portsmouth Naval Shipyard was made possible by combining an air pistol with an electrode holder. Arc cutting is speeded up by a blast of compressed air.

Valve mechanism of pistol is clamped on the electrode holder. A short flexible hose leads from valve to the hollow tube forming the nozzle. The operator can hold both pistol and holder in one hand and direct the air jet into the arc.

Besides cutting faster, the device leaves no carbon deposits, makes arc easier to control, causes no pitting, removes least amount of weld metal of any method tried, and lessens probability of quench cracks.

Novel Plastic Developed.

Plastic Laboratories at Princeton University has announced a new series of polyurethane plastics that will find many industrial applications. Chief use so far is as potting compounds for transformers.

The plastics vary from soft rubbery to extremely hard materials. They exhibit good elastomeric, electrical, and physical properties. They are good shock dampeners.

The polyurethane plastics are made by reacting castor oil with tolylene diisocyanates. The castor oil, basically a trihydroxyl alcohol, forms cross linkages with diisocyanate, making the material thermosetting. Di-teritary butoxy di-amino silane is added as a catalyst.

Urea-formaldehyde Fertilizer.

The development of a new urea-formaldehyde compound as a source of nitrogen for tobacco fertilization is reported.

Urea-formaldehyde ("ureaform") in combination with cotton-seed meal results in 16 to 23 per cent increase in grading and yield over cotton-seed meal alone. The combination material has an advantage over urea which produces too dark a colour in the tobacco leaf because of the rapid rate at which it releases ammonia. In comparison with cotton-seed meal, 4 per cent less dark leaf colour was produced with the urea-form-cotton-seed meal treatment. A treatment consisting of a mixture of 25 per cent cotton-seed meal gave best crop value.

Waxes from Lignite.

Results of a survey conducted by the American Bureau of Mines concerning yields and properties of solvent-extractable waxes from lignites are reported.

The lignite coals gave yields similar to those obtained in commercial extraction of montan wax from German brown coal. Although higher yields were obtained with a solvent mixture of benzene and alcohol than with benzene alone, the properties of the benzene extracts more closely resembled commercial grades of montan wax than did the benzene-alcohol extracts. The most significant difference between the extracts obtained from American lignites in this investigation and the Reibeck brand of wax from Germany was the greater resin content of the extracts from the American lignites. The benzene-alcohol extracts had a higher content of asphaltic material than the benzene extracts.

Interlocking Shipping Boxes.

Latest advancement in shipping containers is a new interlocking carton that cannot slip when tiered on pallets. Steel banding is unnecessary. One manufacturer reports lack of breakage during shipment and warehousing more than offsets the 15% extra cost.

Locking is achieved in construction of carton. Side walls are arranged so that each container has a recessed bottom and top extends above shoulder of the side walls. Thus top of one container fits into the recessed bottom of the container above.

Fluorescent Street Lights Still under Development.

Experimental fluorscent street lighting installations in Detroit, Cleveland, and Schenectady have been studied for the past 8 years. The studies showed that:

1. Advantages include long life, low brightness, high efficiency of light generation, and good visibility on wet streets.

2. Disadvantages include low output per foot of source, large size of luminaries, and the need for jacketing in cold weather to assist in maintaining light output.

3. Fluorescent lamps are likely to find their earlier use in tunnels, underpasses, and other locations where structural features allow their ready mounting.

Economically, fluorescent lighting cannot be justified; it costs more for fixtures, lamps, poles, brackets and maintenance than does incandescent lighting of the same lumen output.

But when more is known of visibility and how to evaluate it, economy of fluorscents may be compared with that of incandescents with more favourable results for fluorescent.

European Screen-Printer.

Semi-automatic screen-printing machine, developed by Teximpex, Sweden, allows one man to do hand-printing work. All movements are automatic. Printing is done wet-on-wet without slipping because of exact registry of stencils. Once register is set, it will remain through the entire run.

Blotches, stripes, and fine lines of any length are possible without bleeding, splits, or smears. Printing is by endless rubber blanket which is washed as it passes under machine. Screens are positioned hydraulically. Sqeegeing is by hand.

Designs up to 59×59 in. are possible. After printing, cloth is dried in dry box at rear. Machine is suited for printing vat colours. Capacity is 16 screens.

Recording with Ultrasonics.

Permanent record on paper can be made without touching the paper's surface by using a special sono chromo tropic paper. The paper is chemically treated so portions of its surface when subjected to high-intensity ultrasonic energy undergo a visible change.

Thus a modulated source of ultrasonic energy can inscribe information on such paper for a permanent record. Energy concentration is needed. So a generator that is capable of pin-pointing 2 watts of ultrasonic energy was developed at State College of Washington under Office of Naval Research sponsorship.

The recorder point is the end of the vibrating element of a magnetostriction oscillator. The element, a thin-wall nickel-alloy tube 3/8 in. in dia., is driven by an 805 triode at 20 kc. The electrical also contains a plate coil and grid coil.

Boiler-Slag Prevention.

Experience of Narragansett Electric Co. indicates that lime coating on power boiler surfaces prevents slag formation. Surfaces are first cleaned of slag by hot water spraying for at least 8 hr., mechanical cleaning, and then washing with alkaline water solution to neutralize all acid in metal pores.

The lime slurry is made of water and hydrated lime. Its consistency is adjusted so it can be sprayed over the metal surfaces.

Results have been good. No appreciable slag deposits build up within a year. Contrary to Narragansett's results, lime coatings for Detroit Edison Co. showed few beneficial results.

Ceramic Boosts Ultrasonics.

Barium-titanate, a new ceramic material, overcomes disadvantages imposed by quartz crystals in industrial applications of Ultrasonics. The cheap ceramic used as the transducing element will make pilot-plant and commercial-scale use of ultrasonics economical. Its use as a transducer was a development of Brush Development Co.

The new material is cheaper than quartz crystals and can be made in large sizes, or several pieces can be used together. It requires less voltage to produce equal vibrations. A pilot-plant can operate on 115-230 volts and consume 3,000 watts.

Barium-titanate transducers can be formed into any shape, depending on the desired focus of the vibrations required.

Adapt 44-Passenger Bus to Use liquefied Petroleum Gas.

To lower operating costs through lower fuel bills, Twin Coach Co. and the Chicago Transit Authority have adapted a 44-passenger bus to operate on butane-propane-liquefied petroleum gas. Bus will operate on a regular schedule of daily service during test period. Preliminary figures indicate L. P. G. consumption averages 4 mpg. compared to 3.9 mpg. for gasoline. But figures are not conclusive as yet.

Bus engine operates at a compression ratio of 10 to 1. Spark setting from 5 to 10° before top dead centre is permissible and should result in longer spark plug and distributor life.

Additional advantages of L. P. G. are: clean burning without offensive, low CO content, quiet smooth operation, little or no crankcase dilution, no spark knock, reduced cylinder wall were, 2½ per gal. fuel cost at refinery.

Problems presented by L. P. G. use are: high compression and more efficient engines are necessary; fuel tanks must be rugged enough to withstand street collissions; tanks must be equipped with shutoff valves in case fuel line breaks; special carburector and fittings cost about $3 0.

Lime Aids Desulphurization.

Lime added to blast-furnace hearth slag aids desulphurization. One method of getting the lime into the slag uniformly and economically is through the tuyeres. In a mechanized system developed for this purpose, lime crushed to pass through a No. 20 mesh goes by screw conveyor from a storage hopper to a 2-in. pipe to each tuyere. Each pipe has its own blower. Air needed to inject the lime is about 5% of the total furnace air.

News & Notes

Popularising use of Phosphates.

The need for popularising the application of phosphatic manures on land to keep the balance in soil nutrition, has been emphasised by the Government of India in a recent communication to all State Governments.

The communication urges on the States to make full use of the pospha-tic pool maintained by the Government of India and to take adequate steps for educating the cultivator in the use of phosphates.

A technical note accompanying the communication indicate how with each crop grown on the land, the latter is depleted of phosphates, which, if not replenished periodically, is likely to reduce the production considerably. There is also a recognised relationship between the phosphatic content in the soil and the health and productive capacity of animals which feed on crops grown in it. About 20% of the bone weight in animals and human beings consists of phosphates and if the foods that are consumed are poor in phosphates it will result in the undermining of the health of the nation.

With a view to utilising fully the available production of super-phosphates in the country, the Central Ministry of Agriculture has been maintaining a phosphatic pool for the last three years. The internal production is controlled by the Centre and the fertiliser is distributed out of the pool to State Governments according to their requirements. The communication urges on the State Governments to make the fullest use of the superphosphates available from the central pool so that by adding this essential ingredient to the soil, agricultural production may be increased.

New Paint-Spraying Process.

Spray-applied protective coatings on metal last up to 15 yr. with a new paint-spraying process developed by A. B. Antros, Sweden. Acetylene blowers on gun serve two purposes—to dry surface and speed drying of paint. Plant can be applied under all weather conditions at speeds up to 375 sq. ft. per hr.

Advantages of the process: coating is not weakened by addition of thinners, rust protective raw materials can be used that cannot otherwise be used with organic solvents, paint penetrates pores of the metal being coated.

World Oil Production.

Crude-oil production outside the U. S. (excluding Russia and her satellites) rose 10.2% in the 1949 over the preceding year. Daily average during last year was 34,33,000 bbl.

This record volume is due principally to increases made in the middle East. Production in Persian Gulf area was up more than 20%, while that in Venezuela declined slightly (about 1%) Available data from Russia and Eastern Europe indicate a gain there of 10% over '49 for a daily average of 8,03,100 bbl.

Money-Saving Ideas.

These ideas have saved money for automobile makers:

* Reduced leaks in compressed-air piping—$1,00,000 a year.

* Small-tool testing and research to increase tool life as much as 825%—$1,91,000 last year on only one type of tool.
* Changing from rubber gloves at $1.14 a pair and lasting 1 day to plastic gloves costing $0.88 and lasting 3 days—$71,703 a year.
* Control system on work gloves—cutting monthly glove cost from $20,000 to $14,000.

Sprays Paint with Steam.

A method to spray organic finishes with superheated steam instead of air has been developed by E. I. du Pont de Nemours & Co., Inc. Simultaneous heating and atomizing of the paint at the gun nozzle eliminates need for pre-heating the paint. Higher heat permits spraying at higher viscosities and higher solids, thus allowing reduction of volatile material content and producing much faster coverage.

Light Loses a Customer.

Utilities lose pig growers as potential customers as a result of experiments conducted by Universities of Illinois and Minnesota. Pigs do not need light to get fat. Those in electrically illuminated feeding pens daily from 10-11 p m and 3-4 a m gained weight no faster than those in darkness from sundown to sunrise.

Accidents Rise in Summer—U. S. disabling-injury figures for 1949 show injury rate rises during the hot months-May, June, July and August. Reasons: hazardous jobs increase in these months; hot weather listlessness and slacking off of safety precautions. The 1949 rate set a new low of 14.1 disabling injuries per million man-hr. worked.

How to Keep Potatoes—Potatoes in storage use oxygen and give off moisture, heat, and carbon dioxide, much the same as human beings They do it faster at high temperatures. So an Idaho potato-grower has air-conditioned his storage house to reduce spoilage and sprouting.

Traces Metal Atoms—General Electric Research Laboratory measures atom movement in metals by radioactivity. Radioactive isotope silver-110 was electroplated on a block of ordinary silver, and movement of tagged atoms into silver block checked at various levels by Geiger counter.

Gas from Coal— Not Now—Pittsburgh Consolidated Coal Co. is closing its pilot plant for producing synthetic gasoline from coal. Cost of the synthetic fuel was running 40-50% above the cost of gasoline produced from crude. Either the price of coal must drop sharply or the price of gasoline rise before the process can prove commercially successful.

Double Superphosphate Process.

The Development of the double super-phosphate and wet phosphoric acid processes is reviewed and the manufacture of double super-phosphate in modern plants is described.

This process differs from the ordinary super-phosphate process in: the mixing period is shorter, solidification sets in more rapidly, seasoning period is longer, calcium sulphate is not formed, a lesser quantity of gases is evolved and less heat is developed. The two principal factors affecting the costs are: the need for finer grinding of the phosphate used to quicken the seasoning process and the production of concentrated phosphoric acid. Regarding the former it is suggested that if the double super-phosphate produced were dried after the production, the need for fine grinding of the phosphate used would be lessened. Regarding phosphoric acid it is indicated that if the acid made from phosphate and sulphuric acid was concentrated to about 50 per cent P_2O_5, a normal product could be produced at a reasonable cost. If the phosphoric acid used is produced according to the wet process and is to be concentrated to about 50 per cent P_2O_5, it might be better to use it in its original, more diluted form and to remove the surplus of water by drying the double super-phosphate. This could be done as follows: a comparatively large quantity of double superphosphate is returned to the process in the form of small granules. The phosphoric acid with 30 to 35 per cent P_2O_5 is reacted with a corresponding quantity of phosphate and the sludge thus formed is mixed with the granules, covering them with a thin coating of sludge. The moistened granules are then dried, preferably with combustion gases in a rotating drum, the dried granules screened and a small fraction taken away as product. About 80 to 90 per cent is returned to the process, the oversize particles having been crushed. The double superphosphate plant belonging to the *Southern Acid & Sulphur Co.*, Houston, Texas, and built by the Dorr Company, is run on this process. A similar process that enables the production of an acid with a P_2O_5 content of between 45 and 48 per cent has been developed. The acid is sprinkled into a granulator working intermittently or continuously, the granulator being fed with ground phosphate and crushed over-sized particles. Granules are formed rapidly and heat is evolved so that very little heating is required in the dryer. Granular double superphosphate can be manufactured by this process in any superphosphate granulating plant of normal design without the trouble of making pulverized double superphosphate at an earlier stage.

Investigations on the wet phosphoric acid process were undertaken to determine a suitable method of making a comparatively strong phosphoric acid which, when mixed with the sulphuric acid in suitable proportions, would give a high percentage of plant available P_2O_5 in the superphosphate. The process could be performed according to 3 different methods, depending on the former of calcium sulphate left in the sludge. In order to make a relatively strong phosphoric acid without evaporation and at the same time to be able to obtain as high a yield as possible, it is essential to (i) make a good filtrable sludge after the disruption of phosphate with sulphuric acid and (ii) to employ suitable filters. To achieve this the reaction is to be conducted in such a way that the calcium sulphate will form: (a) stable crystals and (b) large crystals (or agglomerated crystals). This depends mainly on the concentration of phosphoric acid in the sludge and the reaction temperature.

Electric Fences.

The use of the electric fence as an alternative to the more orthodox type of fence is discussed and the type of controlling units available in Great Britain and other countries are compared in a report.

The electric fence consists of one or more strands of fencing wire, supported on insulations affixed to light wooden posts and connected to an energizing unit. This unit is neither an electro-mechanical nor a purely electrical device which applies a high voltage between the wire or wires and earth at regular intervals so that any animal or human being coming into contact with the fence suffers an electric shock. The electric fence differs from the more orthodox type in that the barrier provided by the fence is more psychological than physical, since it controls not by force but by fear.

An account is given of tests carried out upon three British units to check their compliance with the British Standard 1222: 1945 and to determine whether they could be altered, intentionally or otherwise, so as to increase the severity of the shock given by them. The advantages and disadvantages of these fences are discussed in detail.

The electric fence offers two principal advantages over the orthodox type, namely economy and flexibility. Large fields can be protected from unwanted animals with little trouble or difficulty at a small running cost.

New Agca Landing System Handles Six Plants at Once.

Automatic ground control approach, a new landing approach system, is capable of handling six planes simultaneously. It overcomes a major obstacle in the path of jet-transport development. Successful tests at Los Angeles' Ontario airport brought down planes to within 50 ft. of touchdown point by autopilot controlled system's signals. At 50-ft. point, pilot took over.

Basically, AGCA is a new circuit system added to conventional GCA equipment. The circuits, from radar signals received on the ground, measure distance of plane from touchdown and its position right or left of course and up and down from glide angle.

AGCA eliminates human control error factor both in the air and on the ground. The system combines the three present landing systems into one. Airborne equipment weighs only 7 lb. and operates on a single frequency.

Improves Fish Quaity.

Washed fish keep better. Organoleptic spoilage occurs quicker in unwashed fillets. Washing in an acid phosphatic and sodium nitrate solution does not improve the keeping quality.

These conclusions were drawn from experiments made at Pacific Fisheries Experimental Station, Vancouver, B. C. Bril, lincod, and chum salmon were tested.

This method was found to be the best of those tried: Fish were headed and dressed without washing, then placed in a rotary washer and washed for 1 min. at 30 rpm. Fish were next washed in running water.

Filleting was promptly done on boards that had been scrubbed with 1% sodium hypochlorite solution and thoroughly rinsed. Boards were washed with stream of water during the cutting process.

Adhesive from Cashew-nut shell oil.

The possibility of producing cold-setting adhesives from cashew-nut shell oil has been investigated at the *Forest Research Institute*, Dehra Dun.

The adhesive is a polymerized product of the oil using sulphuric acid, with addition of rectified spirit to increase miscibility of the oil and acid and of paraformaldehyde as a hardener, polymerization being effected by heating in an oil bath or water bath followed by oil bath. Tests have also been carried out on the storage life of the adhesive, influence of viscosity on adhesive strength and influence on the surface of the wood treated. Results of tests on the use of the adhesive for bonding plywood have been tabulated.

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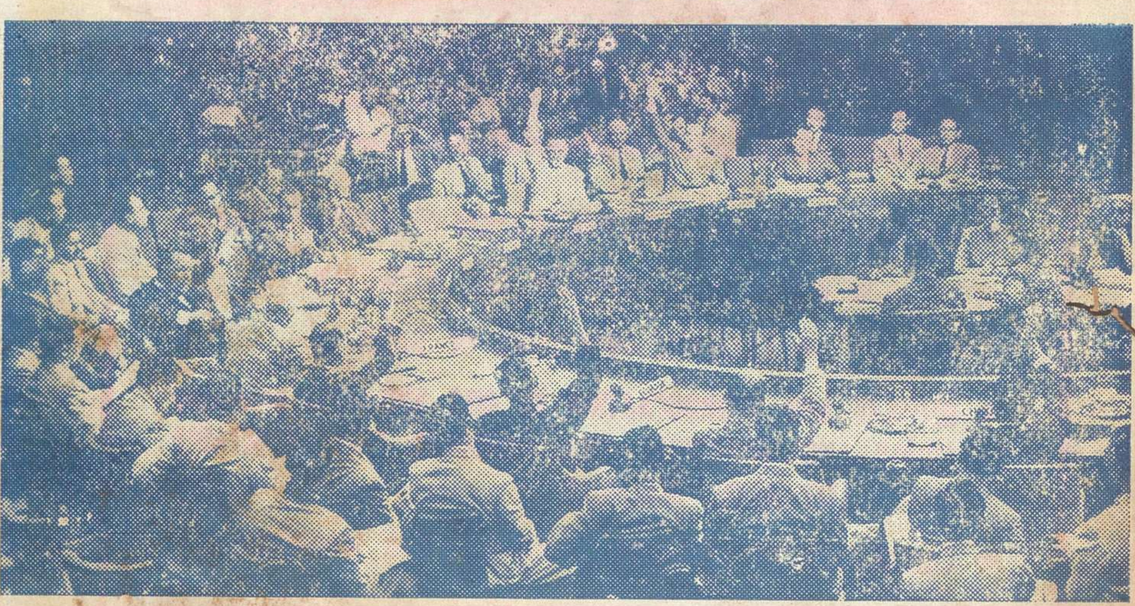

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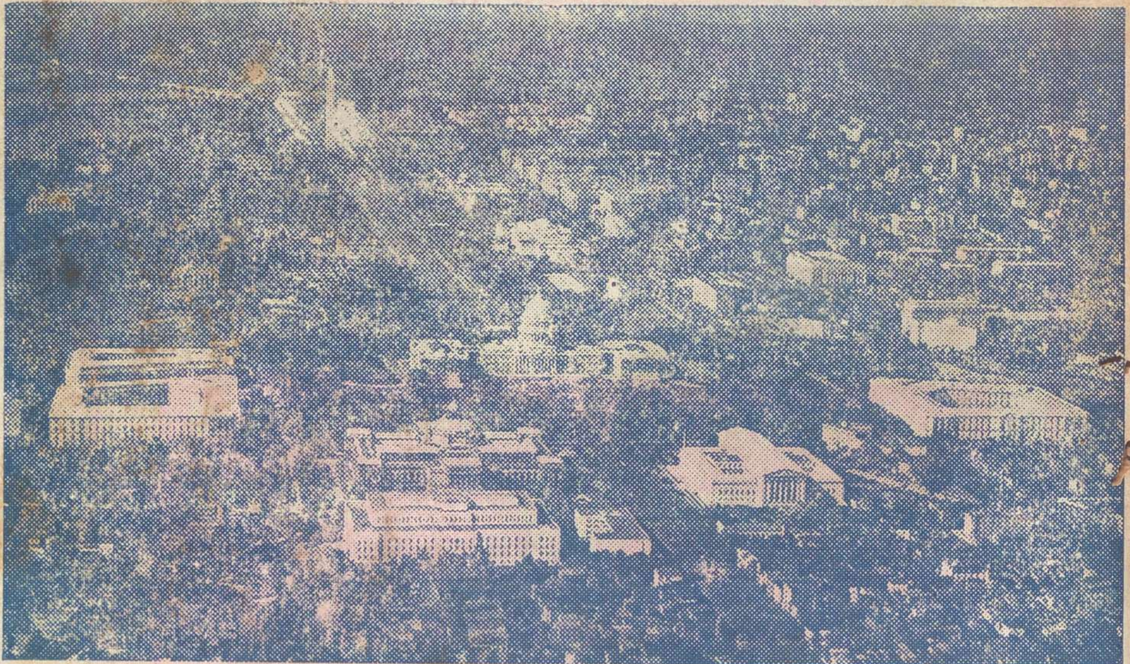

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