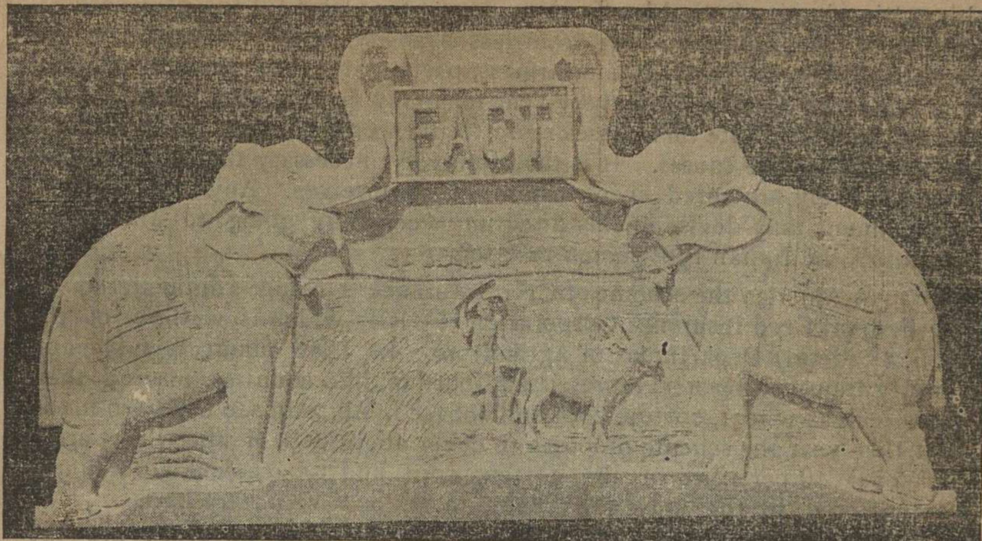

VOL. 4 | NOVEMBER 1949 | NO. 5

EDITORIAL.

THE CASE FOR CROP INSURANCE.

THIS is a time when the Ministry of Agriculture of the Government of India are seriously contemplating the introduction of schemes for Crop Insurance in this country. An officer for investigating the problem was specially appointed by the Government in August 1948 and he had sent in his interim report embodying definite suggestions and plans by the middle of April last.

Crop Insurance as a protection against various types of crop hazards and as a source of immediate relief to the average cultivator was first organised in the U. S. A. about nine years ago. In that country the scheme passed through various vicissitudes. During the first seven years the payments exceeded the receipts, but by steady propaganda and the bringing within the fold of the scheme larger areas, and more varieties of crops than originally contemplated, the receipts were increased. In the years 1947 and 1948, the latter exceeded the payments by about 15 million dollars.

The scheme protects the farmer from loss of crops owing to floods or droughts caused by the vagaries of the seasons. In his own interest the average farmer tries to control or minimise the damages to his standing crops caused by these natural phenomena by vigilant watching and timely methods of drainage or irrigation or other preventive measures. But every often, working singly or at best in small disorganised groups he is not able to control or stay these ravages to any effective extent. It is the case more often than not, that a farmer is completely crippled financially when his cultivation is affected by floods or drought, at least till the next harvest, when also, his partial recovery from loss is solely dependant again, on the hazards of the weather. Indian farmers, particularly, are liable to undergo the same sort of difficulties every year for many years continuously, as they are liable to attribute their losses more to the workings of an evil fate than to any remediable causes. It is therefore very necessary that they should be adequately protected even inspite of themselves. Any measure the Government may devise in this direction is certainly going to ameliorate the lot of the Indian ryot sooner or later.

In America the scheme of Crop Insurance is being administered by the Federal Crop Insurance Corporation (FCIC) which is a limb of the U.S. (Federal) Department of Agriculture. In 1948 about a lakh and seventy thousand farmers representing four hundred counties insured their crops such as wheat, cotton, corn and tobacco. An estimate has been made that this year the scheme proposes to cover about 30% of the wheat areas and over 10 per cent of the cotton, corn and tobacco areas. Though administered by the state the scheme works on a voluntary basis.

The chief features of the scheme as adopted in the U. S. are the following: There should be a minimum of 200 farmers at least for the operation of the scheme in a particular area. Statistics in respect of average investments and losses are computed on a five-year basis, and the premium rates based on these figures. Recently a form of multiple insurance, that is, the insurance based on the gross investment of a farmer in a number of different crops, was also programmed. The latter scheme has been found successful in seven counties and is expected to be extended to fifty more counties for the 1950 crop year.

It would not be too much to emphasise the extreme importance of such a scheme as this to the average Indian farmer and particularly, a farmer of the West Coast, whose sole criterion for a successful harvest is the favourable nature of the monsoon rains. It is hoped that the Government of India would accept Mr. G.S. Priolkar's (the Special officer mentioned above) report and launch their scheme of Crop Insurance in certain select areas at least, within the next few months. Our administrators—we are referring to the Travancore-Cochin Union-need not have to wait the lead of the Government of India to take the matter on hand in this part of the country. It would be well if they go ahead with a scheme of Crop Insurance adaptable to local needs modelled on the American Scheme, as an immediate programme of help to our long-suffering cultivators.

There is difference of opinion, in expert circles, whether a voluntary or a compulsory scheme of crop insurance would be best suited to the interests of the average farmer. Both systems have their respective advantages and disadvantages, and in some quarters a mixture of the two is advocated as capable of giving the maximum benefit to the cultivator. While considering about a scheme for crop insurance in C. P. and Berar, the report above referred to, says "a compulsory scheme may be tried in areas in the *rice region* even if a voluntary scheme operates elsewhere". In view of this finding, the staple crop of our United State being rice, it will not be a bad idea if a compulsory scheme of Crop Insurance is adopted for this country also, without further delay.

Editorial Board.

SOME NEW FERTILIZER MATERIALS

By

Dr. S. V. Govinda Rajan, B. Sc., (Hons.,) Ph. D. (Lond) D. I. C; A. R I. C.

DURING the period of World War II, in common with the developments and improvements that have taken place in the various industries, the fertilizer industry has also made considerable progress. In the decade prior to World War I, the notable innovation made in the fertilizer industry was the development by German Chemists of fixing atmospheric nitrogen by economical methods and this, in the succeeding years produced spectacular results in the vastly increased outturn of nitrogenous fertilizers. In the period between the two wars, the most significant development in the fertilizer industry was the ammoniation of superphosphate, a development which allowed the use by the farmer, of cheap forms of fixed atmospheric nitrogen. Though the developments in the recent War period have not been as spectacular as the earlier ones, the economic aspects of the improved methods have considerable importance in extending the use of various fertilizers. The improvements in the technological side during this period have mainly been directed towards producing more effective and concentrated forms of known fertilisers at much reduced cost.

Advances in Phosphate Technology.

The important developments that have taken place are in the production of phosphate fertilizers, the methods developed being radical departures from the traditional methods. During the century following the discovery in 1842 by Sir John Lawes, the founder of the Rothamsted Agricultural Experimental Station, of the process of making superphosphate the phosphate industry, in common with the fertilizer industry in general, has grown tremendously. But the process of manufacture of phosphate fertilizers has shown but little progress. The traditional method has been to treat phosphate rock and other phosphate rich materials with strong sulphuric acid, and getting a material containing from 14 to 26% of available phosphoric acid, the process usually involving a period of "Curing" and "Setting" of anything from two weeks to several months. Phosphate rock, the important raw material for this process occurs in extensive deposits in the United States of America, Russia, North Africa and a few other countries. Though these reserves are plentiful and may last many years at the present rate of consumption, phosphates are an exhaustible source and in many places are getting rapidly depleted. Since an efficient use of even the poor grade minerals becomes a necessary and useful step in effecting conservation of the present phosphate reserves, research and development have been proceeding to improve washing methods used in the recovery of even low grade phosphates which will thus facilitate more complete utilization of the raw materials.

In the recent production developments, emphasis has been placed on development of new plant nutrient processes which promise to reduce the cost to the farmer and provide more effective and concentrated fertilizers. One method of attack has been the development of highly concentrated products, since they make for economy by reducing the cost of bagging, handling, transport and storage. Simultaneously, processes for the production of low cost fertilizers of moderate concentration have also been developed so that these economical production methods now permit of transportation of the materials even over great distances. The following are some of the materials showing promise of greater advantage andutility.

Triple Super-phosphate.

This is a fertilizer containing 45 to 50% phosphoric acid and had been made till recent years by industry in relatively small quantities by the so-called "Wet Process" using rock phosphate and sulphuric or phosphoric acids. Largely due to the programme of development and improvement of these processes by the Tennessee Valley Authority, an electric process of producing triple superphosphate containing 47% available P_2O_5 has been evolved and the product placed on the market. The process is claimed to produce the material at a very cheap cost.

Calcium Metaphosphate.

This is a new product, the most concentrated phosphatic fertilizer yet produced and tested on large scale on the fields. It contains 63% P_2O_2, that is, more than 3 times the amount found in ordinary commorecial superphosphate. This is a purely war time development by the Tennessee Valley Authority involving a new and radically different process. In this method phosphate rock in the form of pulverized sand is blown directly into phosphorus bearing furnance gases at about 1500°C to get the metaphosphate. Further, this method permits the use of relatively cheap phosphate sand instead of the more costly and scarce, lump material. Calcium metaphosphate because of its high concentration is of special interest in the problem of cheapening delivery costs. Since 1938 the American production has exceeded 65,000 tons and in 1947, the T. V. A. authorities alone produced nearly 5000 tons. The product however has not yet appeared on the Indian market.

Fused Tricalcium Phosphate.

This fertilizer is produced by a cheap and relatively simple process, also developed by the T. V. A. and this product appears to have attracted considerable interest from commercial fertilizer producers. Phosphate rock contains considerable amounts of fluorine, which locks up to phosphate, making it unavailable as plant nutrient and useless to plants and animals. The T. V. A. process removes most of the fluorine by fusion of the rock in an oil-fired furnace. This gives a phosphate material of about 26--30% phosphoric acid, being nearly 50% greater than ordinary superphosphate.

Manufacture of this material requires neither sulphuric acid, nor high grade phosphate rock and the consumption of electric power is said to be not large. In addition no "curing" is necessary. Estimates of production costs appear to indicate that fused calcium phosphate could be produced more cheaply than ordinary superphosphate particularly if coal gas is used instead of oil. The fluorine content is also reduced to such a low extent that the material is considered fit for use as an animal feed supplement in place of the more commonly used bonemeal and bone flour.

During the year 1947, the T. V. A. production of fused tricalcium phosphate was more than 24,000 tons and most of it was used for fertilizers.

Diammonium Phosphate.

This product contains nearly 75% plant food, being composed of about 54% phosphoric acid and 21% nitrogen.

The usual method for preparing this material has been to produce phosphoric acid by a wet process from rock phosphate in the first instance and then to treat it with the requisite amounts of ammonia. The recent T. V. A. developed process combines relatively pure electric furnace produced phosphoric acid and synthetic ammonia, and this product is even superior to the commonly produced mono-ammonium phosphate, which is prepared by a "Wet" process using phosphoric acid and containing only 11% nitrogen and 48% P_2O_5.

Dicalcium Phosphate.

A particularly promising phosphate fertilizer process has been to use nitric acid for the acidulation of phosphate rock to produce dicalcium phosphate. A concentrated product containing 40 to 50% P_2O_5 results from this process and ammonium nitrate produced as a separate product is combined with this. An important consideration in development of this method is the fact that sulphur reserves are limited and sulphuric acid commonly used for treating phosphate rock depends on sulphur supplies and hence is fairly costly. On the other hand supplies of nitric acid have increased considerably during the war by the construction of plants that fix the unlimited supplies of atmospheric nitrogen.

Potassium Nutrients.

While the need for phosphate is universal, the requirements of potash fertilizers are restricted to certain crops and to soils which are deficient in this nutrient. Potassium is particularly needed by root and tuber crops like potatoes and also by tobacco. The normal supplies of potash salts have been from the considerable variety of the naturally occuring potash salts excavated from deposits occuring in Europe and America and recent work has been directed to preparing some concentrated forms of this nutrient for commercial supplies. One of these is potassium metaphosphate having a concentration of over 90% plant nutrients, being composed of 55% phosphate and 35% potash. This fertilizer is prepared by a wet process using potassium chloride obtained from the natural minerals and phosphoric acid. A new method developed by T. V. A. uses a comparatively poor mineral Polyhallite ($Ca SO_4$, $Mg SO_4$, $K_2 SO_4$, $2H_2O$). which forms the largest reserve of potash minerals in America, by treatment with phosphoric acid or phosphoric anhydride.

Nitrogenous Fertilizers.

Ammonium Nitrate. During the war the nitrogen fixation industry had been developed to an enormous extent to produce nitric acid through ammonia and then from these two chemicals ammonium nitrate, an ingredient in the production of high explosives. As a result of such expansion, the production capacity of the United States for synthetic ammonia was estimated in 1944 to be in the vicinity of 1,200,000 tons of *nitrogen* per year with individual plants like that of the T. V. A. having a capacity of 60,000 tons of ammonium nitrate and over, per year. Canada has three ammonium nitrate plants with a capacity of 1,20,000 tons of nitrogen a year. With the falling off of the military demands, ammonium nitrate has been diverted to fill the serious shortage of nitrogenous materials for agricultural purposes. One draw back about this fertilizer is its combustible and explosive nature and its hydroscopic property under humid conditions. This latter property causes the material to cake badly and make uniform distribution over land a difficult problem. Much progress has been made since 1943 to ensure against absorption of water, so that the products made available today largely do not suffer from these disadvantages. This is achieved by suitable treatment to grannulate the crystals of ammonium nitrate and mix with 3–5% of tricalcium phosphate, kieselghur, plaster of Paris or kaolin. Further when ammonium nitrate is mixed with ammonium sulphate, superphosphate and similar materials used for making mixed fertilizers the dangerous quality of detonation is largely lost.

Anhydrous Ammonia.

As a means of lowering the cost of nitrogenous fertilizer, anhydrous ammonia (liquid NH_3) and aqueous ammonia have been investigated for use on the soil. During the war period the potential supply of ammonia for use as nitrogenous manure was greatly increased, and it was found that the cost of the ammonia was just half that of nitrogen in solid nitrogenous materials like ammonium sulphate, nitrate etc. Many American Experimental Stations have conducted research on applications of anhydrous ammonia and aqueous ammonia with safety and without loss, and to study crop response to such applications. With the effectiveness of ammonia established in terms of crop response, developments for a feasible and economic means of introducing same into the soil have been made. It is estimated that anhydrous ammonia has been used to fertilize and furnish nitrogen to over I lakh acres in America during 1947, through special machines fitted up to apply this fertilizer material.

Ammonia as a fertilizer material is bound to be of great interest to our country because of the cheapness and the elimination of the acid materials like sulphuric, hydrochloric and nitric acids which are necessary to prepare solid material in the form of its salts. Sulphuric acid is prepared by burning sulphur and for this raw material our country is almost entirely dependent on imports from America, Sicily and Japan and even in the method for preparation of ammonium salts through gypsum, we are dealing with an exhaustible commodity. Apart from reducing the production costs and reducing our dependence on imported raw materials, the use of ammonia is also likely to benefit the soil. Continued use of ammonium salts e. g. ammonium sulphate, is recognized to cause acidity in the soil due to leaching and removal of the calcium of the soil in the form of calcium sulphate. The use of ammonia as such is likely to diminish such harmful tendencies resulting from the use of ammonium salts.

There are thus a variety of new fertilizer materials which have been developed in recent years and many of which have come into common use in the Western Countries. The tremendous advances in technology made during the recent war have facilitated their production in large scale and supply to agriculturists at cheap price. It is to be hoped that our country too would take early advantage of these developments to the ultimate benefit of Indian Agriculture and of our ryots.

"ചില പുതിയ വളദ്രവ്യങ്ങൾ" എന്ന ഈ ലേഖനത്തിൽ മൈസൂറിലെ കാൎഷികരസതന്ത്രജ്ഞനായ ഡാക്ടർ എസ്. വി. ഗോവിന്ദരാജൻ, സൂപ്പർഫോസ്ഫേറ്റ്, ട്രിപ്പിൾ സൂപ്പർഫോസ്ഫേറ്റ്, കാൽസ്യം മെററാഫോസ്ഫേറ്റ്, ഡൈകാൽസ്യം ഫോസ്ഫേറ്റ്, ഡൈ അമോണിയം ഫോസ്ഫേറ്റ് മുതലായ ഫോസ്ഫേററ വളങ്ങളുടേയും, അമോണിയാ, അമോണിയം നൈട്രേറ്റ്, പൊട്ടാസ്യം നൈട്രേററ മുതലായവയുടേയും പ്രത്യേകഗുണങ്ങളെക്കുറിച്ചും അവയിൽ ചിലവയുടെ വെച്ചു സൂക്ഷിപ്പാനും കൊണ്ടുപോവാനുമുള്ള കൂടുതൽ സൗകര്യങ്ങളെക്കുറിച്ചും സവിസ്തരം പ്രതിപാദിച്ചിരിക്കുന്നു.

NEW SYNTHETIC FIBRES

COUNTRIES with an almost limitless market for textile yarns and fabrics, on one hand, and a lack of natural raw material sources, such as cotton, wool, flax and hemp, on the other, will watch with special interest the advent of new synthetic fibres. Such a new family of synthetic fibres, in many respects comparable to the nylons, are the Orlons, recently developed in the United States.

Orlon is made of a chemical of the acrylic plastics family. When construction of plants to mass-produce the new fibre is completed, a great number of textile products woven of Orlon fibre will probably invade the market which, as far as artificial fibres are concerned, is steadily expanding. Since the first rayon was introduced more than half a century ago, the new industry has been growing steadily. In the United States, rayon has out-paced wool and silk and is now second only to cotton.

Research aimed at the development of yarns that were chemically inert under all conditions of normal wear and tear, was carried out over a number of years by the laboratories of E. I. du Pont de Nemours and Company, where nylon was developed. It resulted in the creation of Orlon, a polymer of an acrylonitrile which, like nylon, can be dry-spun by melt-extrusion when dissolved in suitable organic solvents. Polymers are chemical compounds, the molecules of which are multiples of the molecules of another compound. The compounds known as acrylonitriles are derived from acetylene, natural gas or petroleum.

Distinctive Characteristics.

There are various types of Orlon acrylic fibres and yarns, all of which have many properties in common and, in addition, possess distinctive characteristics of their own. Orlon fibres have many of the qualities which have been responsible for the success of nylon. Unlike nylon, which is cold when dry and slippery when wet, Orlon has the warm, dry touch of silk, the dimensional stability of silk in high humidities, and the bulking power, high thermal insulation and wrinkle recovery of wool. Moreover, it has extraordinary resistance to outdoor exposure, chemicals, micro-organisms and insects as well as high strength and flexibility and heat resistance.

Altogether, the new fibre possesses a combination of properties which make it suitable for many purposes in which nylon and the rayons will not equal its performance. Its resistance to outdoor exposure, for example, is so high that it is perhaps the best of all known textile fibres, natural synthetic, for outdoor uses.

In an outdoor exposure test of yarns, Orlon retained 77 per cent of its strength at the end of one and a half years, after silk, nylon, linen, cotton and viscose rayon fibres had completely failed. Other tests have shown the new fibre's excellent resistance to sunlight and industrial smoke, soot and acidic fumes. Tests with awning fabrics exposed over a year have corroborated the superiority of the new fibre over cotton with respect to resistance to ultraviolet light, mildew, molds and degradation by industrial contamination of the air.

The acrylic fibre has very good resistance to acids, fair resistance to alkalies, and is not harmed by common solvents, oils, greases and most salts. Its resistance to bacteria and such insects as clothes, moths, beetles and cockroaches is excellent. In soil burial tests, it has proved superior to sisal, cotton, jute, hemp and even nylon.

Dimensional Stability.

Unlike wool, cotton or rayon, all synthetic fibres like Orlon generally absorb little or no moisture and, therefore, are nearly as strong when wet as when dry. The tenacity of the new fibre is little impaired by low and elevated temperatures occurring under ordinary conditions. Like all thermoplastic yarns, orlon shows different degrees of shrinkage in different mediums and fabrics. Excellent dimensional stability has been attained with domestic and wearing apparel fabrics. Yarn shrinkage in boiling water is only one and one-half percent, and is considerably less in hot air and steam of the same temperature.

Though Orlon will burn, it will not slashburn. Because it is not affected by fungus growth and has low moisture absorption, the new material is of interest in electrical laminates. Orlon is dyeable with several classes of dyestuffs, especially in deep, bright colors. It has very good wash fastness and acceptable light fastness. Commercial dyeing processes are now being worked out. The fibre bonds well with all classes of resins and can be blended with viscose and acetate rayons, nylon and wool.

All these attributes assure satisfactory performance in many diverse industrial applications, such as electrical insulation, automobile tops, filter fabrics, mine belting, chemical and marine cordage, fish nets, sails, agricultural approns and belting, fertilizer bags, tents, tarpaulins, awnings, outdoor furniture, sewing threads for out-door uses, and many more.

Because of its high strength silk-like touch, recovery from wrinkling, easy launderability, quick drying, dimensional stability in wearing, and washing, and resistance to moths, mildew and atmospheric contaminations, the new fibre can be used in domestic and apparel fabrics. It is particularly suitable for curtains, window shades, venetian blind tapes, umbrella fabric, raincoats, sport jackets, slacks and shirts, dress shirts and woven lingerie. Other applications now planned are suits and dresses, blankets, light-weight underwear and neckties. The material's non-absorbent quality failed, facilitates cleaning, since dirt does not become embedded in the fibres.

പഞ്ഞി, ചണം, പട്ട മുതലായി പ്രകൃതിദത്തങ്ങളായ നാരുകൾക്കു പുറമേ, അടുത്തകാലത്തു്, രാസസംശ്ലേഷംകൊണ്ടു് റേയൺ, നൈലൺ തുടങ്ങിയ നാരുകൾ നിർമ്മിക്കപ്പെട്ടു. ഗുണവിശേഷങ്ങളിൽ ഇവയെ ജയിക്കുന്ന 'ഓർലൻ' എന്നൊരു പുതിയതരം നാരുകൂടി ഇപ്പോൾ കണ്ടുപിടിക്കപ്പെട്ടിരിക്കുന്നു. ഈർപ്പത്തിൽ ചുരുങ്ങാത്തതും ചൂടിൽ ചുളുങ്ങാത്തതുമാണു് ഇതു്. ഈ പുതിയ നാരിനെപ്പററി വിവരിക്കുന്നതത്രേ മുകളിൽ ചേർത്തിരിക്കുന്ന ഇംഗ്ലീഷുലേഖനം.

Co-operative Farming in India

By
MANILAL B. NANAVATI.

CO-OPERATIVE farming holds out a great promise, particularly for the over-populated agricultural regions, as a means to minimizing farm-costs and maximizing agricultural production. But, in practice, the application of the principles of co-operation to farming is a tough task which calls for not only tact and administrative skill but also for a clear understanding of the various issues involved in organizing a co-operative farming society. It is also necessary for the organizers to know about the various factors which aid its progress and others which hinder its development.

The two notes given below have been prepared for the benefit of those who are interested in co-operative enterprise for joint cultivation. Note I is based on two recent publications viz. (1) *Exploring* Tomorrow's Agriculture by Joseph W. Eaton, and (2) *Co-operative Communities at Work* by Henrik F. Infield. It gives the types of such societies and the conditions under which they succeed or fail. Note No. II which is based partly on the experiments narrated in the above-mentioned publications and partly on our own experiences of the Co-operative Movement, shows the conditions under which co-operative farming can succeed in India and the steps to be taken therefor. On a careful study of the existing conditions in India, it will be realized that instead of making a few experiments on a comprehensive basis or along with them, we have to re-orientate the co-operative movement as a whole so as to create ultimately conditions for a wide-spread adoption of the system of co-operative farming. It is hoped that these two notes would help to make a realistic approach to this important problem which is engaging the attention of the country.

Planning for the co-operative farm Land.

Those are the sources from which the land may be secured for the society: (i) Government, (ii) landlords and (iii) members. Where the land belongs to the Government, it may be leased either to the members individually or to the society collectively. Lands from the *landlords should be leased by the society on a fairly long term. Where members have their own lands, some more may be taken on lease, if necessary, and all the lands may be jointly cultivated by the society.

Selection of the area.

It is hazardous to launch an experiment on lands which are subject to violent climatic changes like droughts or floods. Where the rainfall is precarious, the society

*1. Co-operative Communities at Work by Henrik F. Infield. pp. 8-24.

must be capable of organizing crop insurance. But it is highly advisable to avoid such areas during experimental periods. In fact, the Society must have lands which are capable of development at reasonable cost and also possess adequate facilities such as roads and means of transport to market its produce.

Membership.

The experiments made show that the members either belong to a fraternity as in Hutterities, or belong to the same religious order as, for example, the Jews in Palestine, or are *bona-fide* cultivators and/ or landless labourers as in the case of the Madras Land Colonization Societies or colonists or settlers like war veterans with no previous experience of agriculture. It may be noted that the success of the enterprise depends largely on the selection of members, their ability to go through trying times during periods of formation of the Society, their capacity to work for higher co-operative ideals and better living.

Types of co-operation.

Co-operation may be either (i) confined to cultivation only, with or without reservation of homesteads or (ii) cover entire agriculture as under collective farming or (iii) may be further extended to purchase and sales and to even social services such as education, hospitalization, etc. along with co-operation in cultivation.

Management.

The internal administration of the co-operative farming may be entrusted either to (a) leaders selected by the members or (b) a specially selected staff for the management and for keeping the accounts and allocating the tasks. The supervising agency, however, may be either (i) autonomous from among the members—leaders of the organisation—, (ii) promoters of the movement as in the Delta—Provinces Societies[2] or (iii) supplied by the Government sponsoring the movement.

The success of the enterprise will depend upon the ability of leaders to bring about impartial and harmonious working as also upon the tact and qualifications of the supervising agent.

Types of assistance from outside.

The members of the Society may obtain help in the form of (i) costly implements on hire from tractor farms as in the U. S. S R., (ii) equipment, technical advice and assistance as in Farm Society Administration, including housing facilities; (iii) loans and grants from (a) banks as in case of Mexico KVUTZA[3] (b) from the Government as in the Farm Security Administration, (c) societies' own funds as in Hutterites, or (d) from the members' own contributions.

Conditions which lead to success.

(i) There must be an assured increase in production and income

2. Exploring Tommorrow's Agriculture, pp. 202-204; Co-operative Communities at Work, Infield, p. 174.

3. Co-operative Communities at Work, pp. 51-78 and 117-142.

and, if possible, longest seasonal employment, e. g. the Mexican Experiment (KVUTZA) which was successful because most of the members were tenants of landlords and co-operation offered them a distinctly improved income and higher status.

(ii) To ensure harmonious relations among the members, there must be homogeneity of membership or identity of interests, e. g. Hutterites which is a semi-religious body.

(iii) Much depends upon the leadership and the spirit of co-operation of the members. They must be intelligent and more or less of equal status, as, for instance, the Jews in the land settlements in Palestine.

(iv) The work as well as the produce must be distributed equitably as in the Bulgarian Experiment. This experiment which was initiated for the purpose of co-operative distribution of farm labour, has been superseded by cooperative farm proper. The benefits of this transformation are, economy of labour as well as of expense to the organization.

(v) The members must have the capacity for hard labour and to undergo privations in the early stages.

(vi) The Society must not ignore the need of maintaining individual interests through homestead land and production,

(vii) The members must be helped from outside so as to keep them loyal to the Society.

(viii) Often, the force of circumstances alone suffices to make the members run the Society successfully, e. g. the land settlement in Palestine.

Causes of failure.

(a) The greatest danger to the Society comes from the friction between the members and the management, bureaucratic tendencies in the leaders or supervisors, and bad manners of some of the members. The Llano Co-operative Colony founded in 1914, failed because of its faulty plan, discrepancy between principles and practice, inability of the members to put up with the difficulties in the initial stages and low admission standards. 'Dissatisfaction, splits, loafing by some, overwork by others, farm left to scanty operations are among the other causes mentioned.[4]

(b) Some ventures have failed, due to frequent crop failures or fall in prices as, for instance, the Sunrise Community.[5]

(c) The Farm Security Administrations Experiment in The U.S.A. failed because the costs were disproportionately high as compared to the results.

(d) Many Societies come to grief due to friction among the members caused by (i) partiality, (ii) incongruity of interests as for instance, where big landlords as well as small ones or landless people are members of the same Society, (iii) unequal social status of the mem-

4. Co-operative Communities at Work, pp. 25-40.
5. Ibid.

bers, (iv) Differences among womenfolk and (v) religious or caste differences.

(e) A Society's progress is sometimes hindered where it tries to adhere to rigid and stereo-typed rules and bye-laws which ignore local customs and conditions.

Conditions under which co-operative farming may succeed in India.

1. New land settlements as in the United Provinces under the refugee administration have considerable chances of success, provided the members are *bona fide* agriculturists and are of the same status. Otherwise, they will leave the farm later on when peaceful conditions are established.

2. In special circumstances, co-operative capitalistic farms with membership composed of big landlords may succeed where large funds are required, provided the workers are given a standard wage and share wage and share in profits.

3. Where men are of unequal status, men in lower grades may be guaranteed a minimum wage and a minimum income by the Government. This special subsidy is necessary to lower grade workers to ensure their enlistment in the membership of the Society.

4. When the members are of the same status, the successful working of the Society will depend upon an assured increase in production and net income. This, therefore, requires a thorough survey of the area and an assessment of the possibilities of increased income before the Society is formed.

5. From the organization of the Society to the realizing of noticeable benefits from co-operative farming is a long way. It is, therefore, necessary for the members to carry the project through with great patience and under strict discipline.

6. The Society should be provided with adequate funds in the form of short and long term loans and initial grants for housing and other equipment.

7. Servicing should be near at hand and prompt.

8. New lands should be exempted from assessment until they are brought under full cultivation and become a paying proposition.

9. The Society must be given free service of the Co-operative Department by way of audit and supervision.

10. Guidance should be in the hands of specialists trained in accountancy, works management, agricultural engineering, agricultural technology, etc. These experts must be social but also firm and tactful.

11. Other State assistance such as free service from technical departments such as agricultural, veterinary, public health, etc. in planning for the development of the farm. Red tape and delays in administration should be avoided. The assistance should be whole-hearted and the Government must trust the men on the spot.

12. Members must have completely sunk their caste and community differences and be free from village squabbles and local politics,

13. Members must be taught to appreciate the significance and value of the co-operative method. They should be made to realize that co-operative farming does not stand merely for pooling their holdings and giving them wages in proportion to their labour but for certain definite economic and other benefits.

14. The members must have undergone training and discipline in a multipurpose society and have appreciated the benefits arising out of co-operative method.

How Beginnings may be made under Indian Conditions.

There would be two distinct types of co-operative farming societies: (1) for lands newly acquired or reclaimed and (2) for lands already under cultivation.

Societies under group (1) may be for (a) first class cultivators from congested areas. These may be either co-operative agricultural societies or both, (b) small holders, landless labourers and tenants, (c) men newly taking to cultivation, e. g. retired soldiers belonging to various castes and communities. Societies under group (2) should be for (i) first class cultivators in the village and (ii) small holders and tenants pooling their resources together.

Each of the above type would require different treatment and assistance. Societies of landlords and big cultivators, for instance, would need loans for housing. Small holders and tenants would need guidance and help almost at every step until the society gets into satisfactory working. Non-agriculturists being settled on land are apt to take up the work half-heartedly and provision, therefore, will have to be made to give them adequate training to make them efficient cultivators.

There is no denying that some of the factors hindering the development of co-operative farming obtain in India and would present serious obstacles to progress in this direction unless we have a systematic plan for the formation and working of such societies.

Societies under (a) will succeed only under extra-ordinary conditions with a very reliable leadership and with members who have absolute faith in their own ability to develop agriculture as also in the advantages of the co-operative method.

Looking to conditions in India, two distinct methods may be adopted to popularize co-operative farming (a) to form co-operative societies where conditions look favourable and results almost assured and (b) to prepare the ground for co-operative farming so that in course of time people themselves come forward to form such societies, having had their apprenticeship in the working of co-operative methods in various directions and appreciated the benefits of joint working.

As for (b), it is highly desirable that attention should be paid to formation of multipurpose societies all over so that the scope of their working can be widened to include farming subsequently when the members have fully realized the benefits of co-operation and would be prepared to stick to the movement under all circumstances. Our approach to co-operative farming, therefore, must be from two sides; where possible, the agriculturists may directly combine and form a co-operative farming society; in other cases, the members may be asked to form co-operative associations with less ambitious aims and objectives and then gradually develop the societies until they are capable of taking up co-operative farming. The various stages in this development may be as follows:

(1) Co-operation in a business, i. e. for purchase of farm requirements; and in agriculture, sale of farm produce and finance and co-operative ownership of costly implements and other farm equipment, and in improvements in the technique of agriculture and provision of some social services.

(2) Co-operation for consolidation of holdings.

(3) Joint programme of cultivation—each member cultivating his own farm but according to a plan agreed upon by all members.

(4) Joint cultivation of all farms. We may call it collective farming.

Each of these stages, would in practice vary considerably in its details. To help the societies to develop in this order, the Government must maintain a specialized staff. If co-operative farming is to spread on any appreciable scale, the whole of the co-operative movement would have to be reorientated with this end in view.

While the shift of emphasis from credit to multi-purpose type of societies would create the necessary atmosphere for the formation of co-operative farming societies, further measures would be necessary to help such societies to come into existence and to assure their smooth progress. The most important of these measures are as follows.

1. A special study of the agricultural conditions of the locality and to find out what definite and marked benefit would accrue from the enterprise. A distinct gain must be established, such as larger and better realization of values through collective sales. Otherwise, most of the members would hesitate to pool their resources and consider the venture as a leap in the dark.

2. The law of inheritance would have to be modified to prevent actual sub-division and fragmentation of holdings; otherwise, the co-operative farm would be lacking in stability.

3. To find out men from the village and outside who will be able to keep proper cost accounts and task assignments to members.

4. To collect such implements as would increase production and take them on lease as from a Government Farm.

5. To prepare land surveys for realignments of fields. Before this is done it is advisable to cansolidate the holding and re-arrange them. It would be easier to realign consolidated holdings than scattered ones. This will reduce capital investments to the minimum.

6. To obtain Government assistance for (2), (3) and (4) and arrange for loan, subsidies and finance, if the society has not got funds of its own or is unable to borrow from its own bank. Government's help and guidance must be prompt, business-like and near at hand.

7. Government should appoint superior staff for guidance and advice to ensure that the societies work according to plan and that mistakes are discovered in time. The local staff engaged to work relating to accounts, agricultural technique, farm management, etc. should be well-paid as the success of these societies largely depends upon their efficiency and zeal.

8. Arrange for agricultural programme including crop rotation, new crops, manuring and irrigation.

9. Assignment of work among members, selecting leaders or appointing committees for management.

10. Organization of subsidiary industries to help members of the Co-operative Farming Society to supplement their farm income.

11. Development of social services along with joint cultivation so that the men get the full benefit from co-operative work. Every aspect of social work should be attended to: health, sanitation, education and entertainment. Reduce the drudgery of the women in the villages and thus enlist their co-operation. Develop their dairy industry and instruct them in their domestic sciences. If a woman worker could be engaged to help them, it would serve as a stimulus in getting the co-operation of the women-folk in the new venture.

12. The most essential factor in co-operative farming is that every step should be taken to ensure a definite increase in production because, otherwise, in the case of a fall in the yield, the members would cease to be loyal to the society. Necessary measures, therefore, should be taken to prevent crop failures. These measures may take the form of irrigation or/and larger areas being made available to the society to provide an insurance fund.

13. The most difficult problem would be to get the co-operation of the landless workers or the small holders. It should be made worth their while to join this society. Landless workers should get their fair wages and a small holder a decent return. Possibly in the initial stages an adequate income should be guaranteed by the Government to both these classes. It is they who need the utmost help and they should be induced to join the society.

14. Fall in agricultural prices has been responsible for the winding up of many co-operative farming

associations. Experience during the last depression has demonstrated the disastrous consequences of fall in prices on Indian agriculture. Stabilization of agricultural prices, therefore, is a fundamental requisite to the development of co-operative farming.

The success of any venture depends largely on the human factor the integrity and ability of the men behind it. This fact cannot be overlooked while forming associations for co-operative farming. Normally, every individual likes to work along in his own domain and would not like to surrender even a part of his individualism or economic freedom to any association, unless he is assured of a material gain. Hence the importance of a preliminary survey of the possibilities of increasing the farm income before forming the society. This also brings out the necessity of selecting the members, since those who have no faith in co-operative ideals or who have not been trained to work according to co-operative principles would only shirk their duty and lead the society to disaster. Where the co-operative society has developed stage by stage, the multipurpose co-operative society would have provided the necessary apprenticeship to the members and qualified them for running the co-operative farm. But in other cases, all possible care would have to be taken to ensure that the indifferent or difficult people are kept out of the society. Co-operative farming would succeed only where each of the members is not only experienced and trained in the co-operative method but also imbued with hope, courage and determination to contribute his maximum to the working of the society.

We are all agreed that co-operative farming is a very complicated undertaking and a costly experiment. It should, therefore, get guidance and support from a very efficient administrative machinery from the very start. A co-operative farming society will need assistance from at least three departments of Government, Co-operative, Agriculture, and a Department concerned with land consolidations. Therefore, there must be a perfect harmony among these agencies, specially between the first two which will have to work together all along the career of the society. Usually no two departments of Government co-operate with each other and therefore, most of our efforts fail or do not get the results expected of them. At least that is the experience in the working of the co-operative movement. Therefore, whichever Department is entrusted with the administration of the co-operative farming (though in the natural course the Co-operative Department should have the preference), that Department should have a specially qualified staff to make the preliminary surveys, to prepare schemes for farming and to see that the programme works to the plan. For these purposes it shall not have to depend upon the Department of Agriculture for advice and guidance. If we want to avoid mistakes of the past, this is one of the conditions precedent to the large scale formation of co-operative farming enterprises.

Co-operative farming is one of the items in the programme of land reforms to be carried out in India. The central idea in the land reform movement is to create economic peasant farms. To that ideal our energies are to be directed. The programme for this can be summarized as under.

1. Declaration of all land as State property; elimination of intermediary interests in land; land to be given to actual cultivators with occupancy rights, with restrictions on their right to transfer and subdivide the holding.

2. Each occupancy holding to be an economic unit and as far as possible, in one consolidated block.

3. Making the farmer live on the farm or as near to it as possible.

4. Prohibiting the use of land as security for non-productive purposes.

5. Cultivation of the land by the man who owns it, or has the occupancy right.

6. Abolition of share cropping and its substitution by low cash rental based on a certain multiple of Government rent and correlating rent with price levels.

7. Assessment on land to be graduated, uneconomic holdings paying less or nothing; agricultural income-tax to tap more revenue from the larger groups.

8. Regulation of land values on the basis of yields, abolition of speculation in land and provision o cheap finance for cultivators who want to own lands and cultivate them.

This programme would require a good deal of legislation and take time to bear fruit. In the meanwhile, co-operative farming may assist in some selected areas, to help the cultivators, though it would be very difficult to assist small tenants and uneconomic farmers to improve their lot unless they are bodily removed to some more remunerative employments. Co-operative farming for these classes alone would be almost impossible of achievement as they would be too many for small areas owned or cultivated by them; unless larger areas owned by absentee landlords are leased out to such societies, so that the area of the co-operative farm is sufficiently enlarged.

(*Indian Farming*)

"ഇൻഡ്യയിൽ സഹകരണ അടിസ്ഥാനത്തിൽ കൃഷി" എന്ന ഈ ലേഖനത്തിൽ ചെറുതും തുണ്ടുകളുമായ അല്പഭൂമികളിൽ, സാമ്പത്തികമായി പ്രയോജനശൂന്യമായ കൃഷി നടത്തിക്കൊണ്ടിരിക്കുന്ന നമ്മുടെ ഭൂരിപക്ഷം കർഷകരും അവധാനപൂർവ്വം ആലോചിക്കേണ്ട പല സംഗതികളും നിർദ്ദേശിക്കപ്പെട്ടിരിക്കുന്നു. ലേഖകനായ ശ്രീ. മണിലാൽ ബി. നാനാവതി ഇൻഡ്യയിലെ ഒരു സഹകരണവിദഗ്ദ്ധനാണ്. ബഹുമുഖോദ്ദേശങ്ങളോടുകൂടിയ സഹകരണസംഘങ്ങൾ നാടൊട്ടുക്കു സ്ഥാപിച്ച് കൃഷിയെ വികസിപ്പിക്കുകയും കാര്യക്ഷമമാക്കുകയും ചെയ്യുന്നതിന് അദ്ദേഹം ചില പ്രായോഗികമാർഗ്ഗങ്ങൾ ചൂണ്ടിക്കാണിക്കുന്നു. ഭൂവുടമ രാഷ്ട്രത്തിന്റേതു മാത്രമാകുന്നതു് സഹകരണാധിഷ്ഠാനത്തിൽ കൃഷി നടത്തുന്നതിന് ആവശ്യമെന്നദ്ദേഹം പറയുന്നു. നല്ലതില്ലനുസരിച്ചായിരിക്കണം ഭൂമിക്കു കരം ചുമത്തുന്നതും വില നിശ്ചയിക്കുന്നതും. വ്യാപകമായ തോതിൽ നിയമനിർമ്മാണവും, സംഘടനയും ഊർജ്ജിതപ്രവർത്തനവും, പ്രചരണവും എല്ലാം വേണ്ടിവരുന്ന ഒരു വമ്പിച്ച പദ്ധതിയാണിതു്.

Cation Exchange Resins

By

Dr. T. R. CHANDRASEKHAR.

I

REMOVAL of anions and cations for purification of natural water in manner comparable with distillation is one of the remarkable effects produced by using organic resinous exchangers.

In considering the reaction pertaining to these exchangers we have two groups of resins, anion exchange adsorbants and cation exchangers to be used in tandem. Anion adsorbant resins are condensation products of aliphatic or aromatic amines with formaldehyde, active groups for ion exchange being the amino groups. Cation exchange resins are mono-or polyhydric phenol aldehydic resins. The active group for cation exchange may be a phenolic hydroxyl group, carboxyl group (COOH) or Sulphonic group (SO_3H); resins having the sulphonic group being the most active for cation exchange. A highly cross linked structure to ensure chemical stability and insolubility in water and other organic solvents is an essential requirement for synthetic ion exchange resins.

To illustrate mechanism of removal of ionic salts by ion exchange process we will allow R the synthetic organic exchanger except for its replaceable ion. The following is typical of what will take place when natural water containing sodium, calcium and magnesium chloride passes through a bed of hydrogen form of synthetic cation exchanger.

$$CaCl_2 + 2HR = Ca\,R_2 + 2HCl.$$
$$MgCl_2 + 2HR = Mg\,R_2 + 2HCl.$$
$$NaCl + HR = Na\,R + HCl.$$

(Where HR is hydrogen form of base exchange resin and $Ca\,R_2$ is calcium form of the same resin)

Natural water, thus deprived of its metal content and charged with hydrochloric acid during the cation exchange process, flows through another bed composed of anion adsorbant, when the resin absorbs the acid present in water as exemplified by following reaction.

$$R\ OH + HCl = R\,Cl + H_2O$$

(Where R. OH is the basic form of anion adsorber and R. Cl is the used form after adsorption)

The effluent will be free of ionic impurities and comparable to the quality of distilled water.

Regeneration of depleted cation exchanger can be effected by excess of dilute acid when reaction on following lines takes place.

$$Ca\,R_2 + 2Hcl = 2HR + Ca\,Cl_2$$

Similarly anion adsorbant saturated with acid can be regenerated by treatment with dilute alkali or sodium carbonate according to reactions:

$$R.\,Cl + NaOH = R.\,OH + NaCl.$$
$$R.\,Cl + Na_2\,CO_3 + H_2O = R.\ OH + Na\,HCO_3 + Nacl.$$

In the treatment of water for industrial and domestic use where only the hardness of water is objectionable exchange of sodium ions for the heavy metal and alkaline earth ions in water is effected by use of sodium form of cation exchange resin instead of the hydrogen form. The reaction then follows such as the following.

$$2\ NaR + CaSO_4 = Na_2SO_4 + CaR_2$$

(Where NaR is Sodium form of a cation exchange resin)

Regeneration of the resin, after depletion, can be made with sodium chloride.

$$CaR_2 + 2NaCl = CaCl_2 + 2\ NaR.$$

Some of the applications of ion exchange operation in industry:

1. Hardness and alkalinity elimination in tanning industry for decreasing.

2. Hardness and iron removal: Operated either as hydrogen or Sodium exchanger.

3. Soluble chloride removal.

4. Soluble salt removal.

5. Recovery or removal of small amounts of metallic ions, such as copper, nickel, aluminium etc. from industrial effluent or mine waste.

6. Isolation of rare earth metals. A short cut procedure is offered by ion exchange–Chromatography for isolation of rare earth metals, which by ordinary procedure involves as many as 1500 fractional crystallisations. (Plutonium project reports. J. Am. Chem. Soc. November 1947, pages 2769 to 2881)

7. Purification of sugar-cane juice. Removal of ash producing and nitrogenous substances enabling increased recovery of sugar. In the manufacture of Dextrose by hydrolysis of starch the ash, acid, copper, iron, nitrogen and 5–hydroxy methyl furfural are removed from liquors by passing through columns of ion exchange resins.

8. In dairy industry: To produce soft curd quality milk out of cow's milk by partial removal of calcium and phosphorous and thus bringing it to the quality of mothers milk suitable for infant feeding (Otting. Ind. Eng. Chem. March 1949, page 457).

9. In Pharmaceutical field: Isolation of amino acids, vitamins, alkaloids antibiotics and many other physiologically active products (Winters & Kunin, Ind. Eng. Chem., March 1948 page 460).

10. Recovery of tartaric acid from winery still sloop (grape wastes) by exchange adsorption on an anion exchange resin in chloride form (Legault, etc. Al. Ind. Eng. Chem. March 1949, -page 466).

11. "No silica pick up" lime softener to remove bicarbonate hardness for boiler feed water

Trans. Am. Insti. Chem. Engineers. 1941 (37) page 549.

II

Adams and Holmes made the basic discovery in 1935 that condensation products of polyhydric phenols with formal-dehyde exhibited cation exchange properties. They also observed that aromatic amines (aniline or phenylene diamine) on condensation with formaldehyde gave water-insoluble resins with anion-exchange properties. Their discoveries were covered in British Patents 450,308-9; 447,361 and United States Patents 2,104,501 and 2,151,883. Subsequently Holmes in 1936 discovered sulphited tannin type of resin capable of adsorbing cation out of neutral solutions (U. S. Patent 2,191,853). These patents were bought in U. S. by Rohm and Haas Company and I. G. Farben-industrie in Germany. According to Holmes patent resins of tannin formal-dehyde or phenol formal-dehyde were subjected to the action of sulphur dioxide, sulphurous acid or sulphites.

In 1940 Wassenegger and Jaeger secured a patent for I. G. Farben-industrie (U. S. Patent 2,204,539) on nuclear sulphonated type of phenol formal-dehyde resin for effecting cation exchange. In the U. S. this patent was developed by Dow Chemical Company whose "Dowex 30" is an improved type of Wassenegger and Jaeger's resin. "Dowex 50" is a development by Dow Chemicals of a resin patented for General Electric Company by D' Alelio (U. S. Patent 2,366,007). This resin is out of aromatic hydrocarbon with olefinic side chain and nuclear sulphonic acid group. Vinyl benene (Styrene) or its homelogue is polymerised and sulphonated when powerful cation exchange resins possessing exceptionally high resistance against organic solvents and heat are obtained.

III

A systematic account of the efforts made to synthesise a cation exchanger resin that comes up to the quality of British or American manufactured resins had been the body of my monthly reports for the past one year. In February 1949 a composite resinous polymerizate out of formal-dehyde, resorcinol and sodium phenol sulphonate was worked out and this polymerizate had been designated as "Resin 18"-in all my previous reports. A typical sample of our Resin 18 has actual specific gravity of 1.43. Due to highly cross linked structure the resin is unaffected by organic solvents, alkalie below 10 per cent strength, dilute or concentrated Hcl and sulphuric acid below 20 per cent strength. Nitric acid above 15 per cent oxidises the resin while in the cold.

Density of the resin grannules after drying on a Buchner funnel for 4 hours was 1.31 gram per c. c. and contained 38.24 per cent water. A cubic foot of the resin bed weighed 48.3 lbs. The dry resin contained 6.726 per cent sulphur, amounting to 1.993 lbs. per cubic foot of resin bed. A resin bed of 250 c. c. on titration against normal sodium hydroxide required 350 c. c. for complete neutralisation showing a total exchange capacity equivalent to 26,000 grains per cubic foot. A single pass of strong sodium chloride solution through an eight foot layer of the resin resulted in effluent containing 12 per cent hydrochloric acid.

A few commercially available forms of cation exchange resins, we had in stock, were examined and measurements were made regarding their qualities. In Table I is presented data regarding some physical characteristics and exchange capacities of Zeokarb (Permutit Company), three different grades of Amberlite (Rohm and Haas Company) and our Resin 18. In density moisture content and exchange capacity our resin approaches to the best grade of cation exchanger of Rohn and Haas.

TABLE I.

Resin type	Density lbs./c.ft.	Moisture content per cent	Screen Grading	Total exchange capacity. grains equivalent $CaCO_3$/c.ft
Zeokarb	41.73	45	14 to 40 mesh.	16,000
Amberlite IR-100	37.38	45	20 to 50 mesh.	7,000
Amberlite IR-105	47.0	45	16 to 50 mesh.	14,000
Amberlite IR-120	48.0	40	16 to 50 mesh.	28,000
Resin-18	48.3	38.2	14 to 60 mesh.	26,000

Duncan & Lister in Quarterly Review of London Chemical Society (1948-pages 307 to 348) have enumerated some of the different cation exchanger resins manufactured in U. S. A. and Germany. The list does not include some of the well-known brands as "Iomac" of American Cynamid Company, nor are the data in any way complete. A vague indication of the active groups with maximum weight capacity, expressed as milliequivalents of hydrogen per gram of dry resin are tabulated. The table is being reproduced (table II) for comparison with our Resin 18.

TABLE II.

Exchange	Made by	Type	Active group	Maximum capacity milliequivalents gr. dry enchanger.
Dowex 50	Dow. Chemical Co.	"Aromatic hydrocarbon polymer".	HSO_3 only	4.92
Dowex 30	Dow ,,	Synthetic resin	HSO_3 and OH.	
Amberlite	Rohm & Haas (Resinuous	,,	Probably- HSO_3	2.3 — 2 5
IR-1	Products division)	,, ,,	CO_2H and-OH	Between 1 and 2
IR-100	,,	,,		
Zeokarb 215	Permutit Co.	,,	Largely due to SO_3 group	2.3
216	,,	,,	NO-SO_3H group Only CO_2H group	2.3
Wofatit R. Resin	I. G. Farben-industries	,,	OH only	2.1
,, C ,,	,,	,,	COOH (some-OH)	1.1
,, P or A resin	,,	,,	$CH_2.SO_3H$.	
,, K ,,	,,	,,	Aromatic-SO_3H and OH	2.0
,, KS ,,	,,	,,	,,	1.9
Resin 18	F.A.C.T.	Synthetic resin	Aromatic-SO_3 H and OH	Between 2. 4 and 3

IV

Out of several experiments carried out at this laboratory to judge serviceability of our Resin 18 for fixing traces of heavy metals one is described here briefly. Results prove our resin as good as any American resin for recovery of removal of metallic ions.

An exchange column consisting of 260 c. c. of resin 18 in sodium form (14 to 60 screen grading) was set up in a 20 m. m. wide pyrex glass tube. From an overhead bottle cupric chloride solution (5 gms. of copper/litre) in distilled water was led to the bottom of the exchange column and made to flow upward through the resin bed. 3,500 c. c. of effluent collected did not contain copper, but only sodium chloride. This showed 17.75 gms. of cupric copper has been fixed by the resin equivalent to 48,000 grains of $CaCO_3$ / c. ft. of resin bed.

The cupric form of our resin so obtained was rinsed well by sending distilled water through the column. A solution of sodium chloride (9.6 gms. / liter) was then passed through the resin column and effluent collected. 1920 c.c. of the effluent contained 9.8 gms. of copper as cupric chloride with only small traces of sodium chloride. This amounted to 55 per cent recovery with 18.4 gms. of sodium chloride; a ratio of 1.025 times the theoretical quantity of sodium chloride. Since ion exchange is governed by laws of Mass Action, to effect complete recovery of copper out of the resin 4.613 times the theoretical amount of sodium chloride was needed.

In table III is shown figures to convey a rough idea of the per cent of chemical equivalence of regenerant required for the particular cycle. The figures are not strictly accurate, being slightly higher than actual values. According to first figure 618 per cent of theoretical quantity of hydrochloric acid will be needed to convert sodium form of Resin 18 completely to hydrogen form.

TABLE III.

Sodium Hydrogen to form	618.0 per cent HCl.
Hydrogen to sodium form	539.0 per cent $NaCl$.
Hydrogen to calcium form	165.0 per cent $CaCl_2$.
Calcium to sodium form	397.0 per cent $NaCl$.

"ഋണവിദ്യുത്തിന്റെ അണു വെച്ചുമാറുന്ന രാളങ്ങൾ" എന്ന് തർജ്ജിമ ചെയ്യപ്പെടാവുന്ന ഈ ശാസ്ത്രീയലേഖനത്തിൽ ഡാക്ടർ ടി. ആർ. ചന്ദ്രശേഖരൻ പ്രസ്തുത വെച്ചുമാററം വ്യവസായികമായി എങ്ങനെയെല്ലാം ഉപയോഗപ്പെടുത്താമെന്നു വിവരിച്ചിരിക്കുന്നു. തുകൽ ഊറയ്ക്കിടുമ്പോൾ അതിന്റെ കടുപ്പവും, ക്ഷാരപരതയും കുറയ്ക്കുന്നതുമുതൽ, ബോയിലറുകളിൽ പ്രവേശിപ്പിക്കുന്ന വെള്ളത്തിൽ ബൈക്കാർബണേററു മൂലമുണ്ടാകുന്ന ഖരത കുറയ്ക്കുന്നതുൾപ്പെടെ പതിനൊന്നുപയോഗങ്ങൾ അദ്ദേഹം നിർദ്ദേശിച്ചിരിക്കുന്നു. വിശേഷിച്ചും, ഈ കമ്പനിയിലെ പരീക്ഷണശാലയിൽ അദ്ദേഹം സ്വയം കണ്ടുപിടിച്ച, രണ്ടാംപട്ടികയിലെ അന്ത-രാളമായ റെസിൻ 18, സ്വർണ്ണം മുതലായ ലോഹങ്ങളുടെ അല്പാംശംപോലും വെള്ളത്തിൽ കലർന്നിരുന്നാൽ കണ്ടറിവാൻ പര്യാപ്തമാണത്രെ.

FACTS THAT INTEREST

The Anti Arthritic Drug.

The recent news from the U. S. A. that a new and much richer source of supply of "Compound E" or cortisone, which has produced such spectacular results in the treatment of arthritis, has been found, has aroused wide interest in medical and chemical circles. Hitherto the drug (a naturally occurring hormone of the adrenal gland) has been available only from the very small amount of acid secreted in the bile of oxen, but has now been discovered that one ton of the seeds of the tropical vine *strophantus sarmentosus*, which grows in West Africa, will produce as much cortisone as 12,500 head of cattle. Even such an amount would not go very far however since it would only be enough to keep one arthritic sufferer relieved for about a year. Cortisone is not a cure for this serious rheumatic disease, but it may fulfil a function similar to that of insulin in diabetes. The greater potential supplies should enable more comprehensive clinical study and give an impetus to the work on the possible commercial synthesis of the drug and to the investigation which may prove even more fruitful in the long run, of the mechanism of its action in the human body.

New Soap Material.

The development of a new seriee of "multi-cleaner" soap substitutes which are claimed to have powerful bactericidal action besides removing dirt, was announced in a recent report to the American Chemical Society. The new detergents can be used for surgical instruments and household utensils alike, it is stated. They are known chemically as morpholinium alkyl sulphates. These non-metallic and non-caustic products, are described in the report as showing "remarkable chemical stability and compatability with other substances encountered in house-hold use and in certain industrial process."

French Soap Process.

Low-Temperature Emulsification.

Modernisation of soap production was the subject of a recent lecture by M. Felex Lanchampt, Director of the Laboratorie de la Societe des Savons Francaise.

He stated that if fats melted at as low a temperature as possible were treated by a suitable proportion of cold caustic soda (at 20%c) but sufficiently concentrated (33 per cent NaH), by means of a momogeniser an emulsion of lye could be obtained in which suspended particles are of 1 micron, giving a perfect contract of the two fluids over a considerable total surface. In these conditions there is a complete and almost instantaneous saponification when the emulsion comes into a heated zone—of 8^0c—100^0C—in a reaction tube.

The composition of the soap solution is as follows: Combined fatty acids 65 per cent, combined soda 9.5 per cent, glycerine 6·5 per cent, free soda 0.3 per cent, impurities 1 per cent, water 17.7 per cent. Liquidation at 85^0 removes salt from the soap which is then composed as follows: Combined fatty acids 62 per cent, combined soda 9 per cent, glycerine 0.5 per cent, sea salt 0.5 per cent, water 28 per cent without impurity or causticity.

Saponification by the process is stated to be much more rapid than in vats, the apparatus not being cumbersome or complicated There is no great loss of heat and a saving of 250 kg. steam per ton of soap is possible. Finally, there is no loss of soap in the glycerine lye, which is easy to purify. The glycerine, of which only 0.5 per cent is lost, is at a higher concentration than that produced by other process.

Alcohol from citrus waste.

Two newly established factories built by the Assis Palestine Fruit Products Company for the production of alchohol and cattle fodder from orange residue come within the scope of the Government of Israel's plan to make full use of locally produced commodities.

Industrial alcohol has hitherto been imported into Israel. Now from six to eight tons of spirit will be produced daily during the 100 day citrus season. That yield will cover about half the present local market demand. On an average, 300 tons of oranges are brought daily during the citrus season to the Assis factory in Ramat Gan—near Tel Aviv—where juice and concentrates are manufactured. From one ten—about 4000 oranges—some 300 liters of juice are pressed. Another 300 liters of liquors are extracted from the peel. These contain water and essential oils. The remaining peel and pulp are cut, crushed and dried and sold as cattle fodder. From each ton one and a half kg. of essential oils are extracted, for use by manufacturers of sweets, liquors, soft drinks and medicines.

The machinery for the cattle fodder and alcohol production has in most cases been imported from U. S. A. with the aid of the Palestine Economic Corporation.

Wheys as animal Feed.

Whey from cheese and casein plants, once discarded, can now be used as an animal feed supplement and as the starting point in the manufacture of U. S. P. lactose. By concentrating and then either tunnel, drum, or spray drying, cheese and casein whey can be converted into useful powder.

Whey contains milk-sugar protein in the form of milk minerals and vitamins. It can be processed to recover the milk-sugar content in the form of U. S. P. lactose.

Fermentation of whey offers another means of processing; lactic, butyric and ethyl fermentations are practiced on a commercial scale. In the lactic fermentation, calcium albuminate is produced as a by-product, for subsequent use in producing animal feed.

Oil from coal.

Boldest advance towards a commercial synthetic-liquid-fuels industry in the United States was the recent dedication of two coal-to-oil demonstration plants at Lousiana, Mo.- a $10 million hydrogenation plant to produce 200-300 bbl. of liquid fuel each day and $5-million gas-synthesis plant to turn out 80-100 bbl. per day of motor gasoline and diesel fuel.

From the stand-point of reserves and accessibility coal is in a more favourable position than any other natural resource to provide raw materials for a large synthetic-fuel industry.

Big difference between coal and crude petroleum is that petroleum contains about twice as much hydrogen. By adding hydrogen and rearranging the structure of hydrogen and carbon molecules, coal can be converted to oil under proper conditions of pressure and temperature and with the help of certain catalysts. Two basic processes bring about this change: (1) indirect conversation by gas synthesis and (4) direct hodrogenation.

For both processes, the coal first has to be dried. Comprehensive trials of two drying methods have produced the following results: (1) removal of over 90% of bed moisture; (2) a boost in heating value of sub-bituminous by 25% and off lignite by 45%; and (3) weight reduction equal to 90% of weight of moisture removed.

The real problem is coal gasification. Some 60-70% of the cost of gas synthesis is changeable to maging synthesis gas and 30-50% of hydrogenation costs are changeable to compressed hydrogen required.

Three methods for direct gasification of high-rank bituminous, eliminating the coke-making stage are being investigated. They are (1) a vortex generator; (2) underground gasification; and (3) a continuous high-temperature pebble-stone gasifier. The Bureau of Mines is also experimenting on ways to make gas from sub-bituminous coals and lignites.

No matter which process is used for gasification, the gas must be cleaned and purified afterwards. Bureau Engineers at the gas synthesis and coal hydrogenation plants assume thatgasification and purification will soon be perfected and are working on actual basic conversion processes.

The basis of gas synthesis is a converter. A catalytic reaction converts the coal gas into oil vapours. It is then condensed and distilled to form the end produces.

A good deal of investigation still must be done on various catalysts which determine the proportion of carbon monoxide and hydrogen needed in the synthesis gas.

In hydrogenation, solid coal, heavy oil, and catalyst form a paste which enters first a series of liquid-phase separators which use hydrogen from coal gasification, and then a fractionating tower. The Bureau, in an effort to reduce costs, is studying the possibility of converting only half the coal to liquid fuels, the remainder going to coke breeze or gas.

NEWS & NOTES

Processing of Monazite.

The Government of India have entered into a 15 year agreement with two French firms for the setting up of a plant for the processing of monazite sands in India.

Monazite sands, found in abundance on the Travancore coast, can be processed to yield thorium, cerium and other rare earths which India has been importing for use in various industries such as the gas mantle industry and metallurgical operations for manufacture of special flints, aluminium base alloys, etc. Traces of uranium used in the production of atomic energy may also be present in Monazite sands.

Announcing the agreement with the two French companies—Banque Maro-came de-Credit and Societe de Produits Chimiques des Terres Rares—a Press Note issued by the Department of Scientific Research says that the work of processing monazite has a great bearing on national development and it has, therefore, decided to keep the management of this venture in the hands of the State. It has been agreed, after consultation with the Government of Travancore, that all the work will be managed by an Indian co-operation financed jointly by the Government of Travancore and the Govt. of India. It is hoped, that well within a year the plant for the processing of monazite sands will have been set up in India and that India would be producing thorium, cerium, etc., for internal consumption as well as for such export as may be considered desirable in the nation's interest.

Indians to Man Plants.

The agreement provides that the plant to be set up by the French firms will be manned by Indian scientists. Indian scientists will also be trained in the laboratories of the firms in France. Two young scientists will be shortly leaving for France to work at the factories and laboratories of the two firms.

In return of these services the French firms will receive payment at a fixed rate when the full working drawing of the plants to be erected in India are delivered to the Government of India. They will also receive a further sum of money when the factory goes into operation and treats the monazite sands at the rate of 1,500 tons per annum.

Industrial Fuels.

India's industrial development or under-development could best be judged by a glance at coal statistics and consumption in the country, thus observed Dr. Whitaker, speaking at weekly meeting of the Calcutta Rotary Club in last week of August.

The total annual production of coal in India was about 30 m. tons of which railways consumed 10m tons, steel industry 4½m tons and other engineering works, mills and factories another 0½m tons. The amount of coal used for iron and steel production, according to Dr. Whitaker, was out of proportion to that used by the railways, despite the fairly well developed nature of the latter when compared with countries in Europe and America. The figures indicate that the Indian industry was at a low ebb and its expansion and development was an urgent necessity.

Dr. Whitaker deplored the fact that a large amount of coal suitable for coking was being used for non-coking purposes. In particular between 30 and 50% of the coal used on railways was of the coking variety and he added "there is no virtue in using coking coal for steam raising purposes." For this the Railway Authorities were not to blame; they had agreed to use 100% non-coking coal for their work but the difficulty at present was one of transport.

Though a Government report in 1946 put the total reserve of workable coal in India at 16, 500m tons—500 years' supply at the present rate of consumption—supply of coking coal in India was dangerously low. The Central Government were alive to this danger and a committee had been appointed to estimate the reserves of this type of coal.

The desired end, said Dr. Whitaker, was that coking coal should be used solely in metallurgical operations, particularly in the production of iron and steel and, as India's industries developed, larger supplies of this coal would be needed.

In the course of this talk, Dr. Whitaker also pointed out that only 7% of India's annual consumption of 2¼m tons of oil was being produced in the country. The cost of oil imported into the country was equivalent to the cost of producing 13 tons of coal. By processes which had been found suitable for India, only five tons of coal were needed to produce a ton of oil. Thus, apart from the economic advantage of producting oil from coal, India could at the same time save valuable dollars.

Fertiliser Granulation.

The results of ten years' work on the development of the rotating conditioner process for the manufacture of granulated superphosphate fertilisers were described by Mr. J. T. Procter, a director of Henry Richardson and Co., Ltd., York, in a paper to the Fertiliser Society on Wednesday this week. In this type of process. granules are formed by mixing a slurry of super or triple super in a rotating conditioner with a controlled volume of the product itself in a finely divided form. If compounds are to be made, other fertiliser materials are fed into the slurry at the same time. The method allows of the practically instant formation of granules of controlable size, whilst the proportion of fines produced is much less than when working by what is known as the "seeding" process. The method has the further advantage that there lies in it the possibility of combining the chemical reactions of superphosphate manufacture with granulation as an integral works operation.

Features of New Process.

Experimental work was commenced in 1938 and by 1948 a plant capable of producing an average of 5 tons an hour of all grades of compound was in operation at York. During the intervening period the problems which had to be solved were many and complex and several promising methods of approach had, in the light of practical experience, to be abandoned. The earlier trials were carried out with the rapidly reacting ground Morocco phosphate, but with the non-availability of this material during the war years the many new problems due to the enforced change over to the more recalcitrant Florida phosphate had to be faced. As finally worked out and confirmed on the plant scale, according to Mr. Procter's paper, the process was established as technically efficient both in regard to the solubilisation of the phosphate rock and the production of a finished material in suitable granular form. So far as the end stages are concerned the process incorporates a distinct departure from conventional methods in the fertiliser industry in that the rotary dryer is used mainly as a cooker, the throughout being subsequently hardened before screening in a rotary cooler. Another departure from recent practice has been the provision of equipment to establish the circulating load against the dwindling effect experienced when granulation is overstepped and a correspondingly higher "fines" load required.

Inflammable-Liquids Storage.

The work carried out by the Fire Research Board, and described in the recently issued report of that body for 1948, seems to have finally disposed of the hope that the fire risk inherent in the bulk storage of petrol and other highly volatile and inflammable liquids can be greatly reduced by the addition of other volatile products the vapours of which do not support combustion. The theory underlying the proposed method was sound enough. It might be found possible to select a volatile inhibitor with a much greater vapour pressure than that of the liquid it is desired to protect so that the vapour in equilibrium with the liquid under the conditions of storage is non-inflammable, whilst the bulk liquid itself remains inflammable. That this could be done was established by the tests, but it was found that the amounts of inhibiting compounds required was much larger than anticipated. In the case of methyl bromide, for instance, a content of 24 p. c. in the aviation spirit was needed for the equilibrium vapour to be nonvolatile. With methyl iodide the comparable percentage was 62. With certain chloro-fluoromethane derivatives and with sulphur hexsfluoride, no protection could be obtained within the limit condition dictated by the requirement that the total vapour pressure should not exceed one atmosphere. Apart from the high costs which the use of methyl bromide or iodide under the above conditions would represent and the marked change in the properties of the aviation spirit due to the admixture, the method would be of temporary value only owing to the unavoidable loss, with the passage of time, of the vapour of the inhibitor.

Question Box

Question No. 62:-

Please tell me which is the most effective insecticide for eradicating the attack of insects on stored grain sacks?

From M, K. P., Trivandrum.

Answer:—

There are many species of insects that attack stored grain and cause great damage. There are also several insecticides in the market that can be used against these pests. Of these gammexane (D.034) is largely employed for this purpose. This contains 4% deodorised benzine hexachloride with 0.5% active gammexane. The proper dosage is 8 to 10 oz. per sq. ft. of surface area. The material should be dusted with the help of foot pumps, as used for dusting cyanogas. It will be better to take a little more (at least 10% more) than what is exactly needed for covering the total area. Dusting by hand will not be effective as uniform coverage will not be achieved and only pumps (either foot pump or rotary pattern duster) will be found suitable for the purpose. One important precaution is that the men engaged in dusting operations should protect themselves by covering their mouths and nostrils with handkerchiefs. If the period of storage is prolonged more than one dusting will have to be given.

Question No. 63:—

I find my paddy crop being damaged by swarms of tiny black insects. I also find the leaf tips turning white. Please tell me what control measure I can adopt?

From T. R. V., Tirunelveli.

Answer.—

The symptoms mentioned by you point to the attack of a well-known paddy pest, known as **The Rice Hispa** *(Hispa aenescens.)* This is a small, blackish beetle having spines all over its body. It can cause great havoc, particularly if the crop is young. The beetle lays its eggs on the leaf tips and the young ones (called grubs) hatch out of these egg-masses, bore into the leaves and eat their way. Gradually all the vital green tissues within the leaf will be eaten away and consequently the leaf tips turn white and complete withering will ensue. When they are fully grown, these grubs turn into pupae within the leaves and after a short period of 10 days or so, adult beetles will emerge, which again will lay their eggs and thus their life cycle goes on and on, causing untold havoc to the young paddy crop. One of the easiest methods that can be adopted against these insects is to capture the adult beetles with the help of hand nets and destroy them immediately. The whitened leaf tips may also be cut off and burnt on the spot, so as to prevent any further multiplication of the insect. Insecticides such as DDT and gammexane also can be sprayed or dusted over the affected crop. These insecticides have been found very effective against this pest.

Question No 64.

Is it advisable to incorporate saw dust into the soil direct as manure?

From K, K. N., Alwaye.

Answer:—

Direct incorporation of saw-dust as manure is not very advisable. Saw-dust is useful to crops, only after it has been broken down by bacteria and converted into humus. For this work the bacteria will need nitrogen which they cannot get from saw-dust itself. Hence they will be forced to draw upon the nitrogen reserve within the soil and consequently the crop will temporarily suffer from nitrogen starvation. Thus the incorporation of saw-dust into the soil temporarily starves out the succeeding crop. Even if the soil has large amounts of free, active nitrogen, most of the latter will be used up by the soil organisms for breaking down the saw-dust. Another danger in applying saw-dust is the fact that it will invite termites, which will cause great damage to the crop. Hence it will be more advisable to convert the saw-dust into good compost outside the soil and then apply the composted material to the soil. Though saw-dust is nothing but particles of wood, it will be readily decomposed provided some active nitrogenous fertiliser, like ammonium sulphate is added to it. Because of the fineness of its particles, saw-dust undergoes decomposition quickly. So composted saw-dust and not the raw variety as such is to be incorporated into the soil.

Question No. 65.—

Is there any truth in the belief that the yield of paddy will be more when the crop is transplanted from nurseries than when it is sown direct ?

From N. G. N., Alwaye.

Answer:—

Yes. Other conditions being equal, a transplanted paddy crop will give a better yield for the following reasons:-

(1) The early sprouting stage is a very important phase of the paddy crop and in the case of the crop to be transplanted, this stage is spent in a nursery. Generally a paddy nursery is well manured a larger number of ploughings are given and consequently the crop during its early phase comes up luxuriantly. Because of the limited space of the nursery it is efficiently looked after also. On the other hand if the crop is sown direct on a very large area it cannot hope to get as much close attention and care.

(2) The young paddy crop is attacked by various insect pests and in small nurseries we can hope to eradicate the pests more thoroughly and at greater speed.

(3) During the course of actual transplantation we can rouge out the diseased, ill-developed seedlings and select only healthy ones for planting.

(4) This process of pulling out the seedlings and planting them at a different place stimulates the young crop for better growth.

Inspite of these advantages transplantation is not carried out in all our paddy areas mainly because of the lack of irrigation facilities.

T. S. Ramakrishnan,
Agricultural Chemist.

ഭക്ഷ്യോല്പാദനം വർദ്ധിപ്പിക്കുന്നതിനുള്ള മാർഗ്ഗങ്ങൾ

1939-നു ശേഷം ലോകത്തിൽ വലിയൊരു മാററം നേരിട്ടിട്ടുണ്ട്. താരതമ്യേന ചുരുങ്ങിയ വിസ്താരമുള്ള രാജ്യങ്ങളിൽനിന്ന് ഇറക്കുമതി ചെയ്യുന്ന ഭക്ഷണ പദാർത്ഥങ്ങളെയാണ് അനേകം രാജ്യങ്ങൾ അധികമധികം ആശ്രയിച്ചുവരുന്നതെന്നാണറിയുന്നതു്. ധാന്യങ്ങളുടെ ഉല്പാദനം വർദ്ധിപ്പിക്കാൻ മിക്ക കമ്മി രാജ്യങ്ങളും ഇപ്പോൾ പരിശ്രമിക്കുന്നുണ്ട്. ഉല്പാദനം വർദ്ധിപ്പിച്ചാൽ മാത്രമേ ഭക്ഷണക്ഷാമത്തിന് സ്ഥിരമായ പരിഹാരം കാണുവാൻ കഴികയുള്ളുവെന്ന് അവർക്കു മനസ്സിലായിരിക്കുന്നു.

ഇക്കഴിഞ്ഞ നാലഞ്ചു കൊല്ലങ്ങളിലായി ഭക്ഷ്യോല്പാദനം വർദ്ധിപ്പിക്കാൻ ഇന്ത്യ പരിശ്രമിച്ചുപോന്നിട്ടുണ്ടെങ്കിലും അതിൽ ചില പ്രത്യേക വിഷമതകൾ നേരിടേണ്ടിവന്നു. മററു രാജ്യങ്ങളിൽ നിന്നു വളങ്ങൾ കിട്ടാൻ സൌകര്യപ്പെടാതിരിക്കുക-കൽക്കരി, സിമൻറ്, ഉരുക്ക് മുതലായവയും കാർഷികോപകരണങ്ങളും ചുരുങ്ങിയിരിക്കുക ഇവയായിരുന്നു പ്രധാന വൈഷമ്യങ്ങൾ. അതിനാൽ രാജ്യത്തിലെ ഉല്പാദനം ഉദ്ദേശിച്ചവിധം വർദ്ധിച്ചില്ല. അതാതു ദേശങ്ങളിലുള്ള കാർഷിക സൌകര്യങ്ങൾ വിപുലപ്പെടുത്തിയാൽതന്നെ നമ്മുടെ രാജ്യത്തിലെ ഭക്ഷ്യവിഭവങ്ങൾ എഴുപതുലക്ഷം ടൺ കൊല്ലംതോറും വർദ്ധിപ്പിക്കാവുന്നതാണ്. ഈ വർദ്ധനവിന് ഇന്നത്തെ കൃഷിഭൂമികൾ വർദ്ധിപ്പിക്കണമെന്നില്ല. കൃഷിക്കാർക്കു ശരിയായ നിലയ്ക്കുള്ള വിത്തും വളവും കിട്ടുവാനിടയായാൽ മതി. ജലസേചനത്തിനു കൂടുതൽ സൌകര്യങ്ങളുണ്ടെങ്കിൽ നെല്ലും ഗോതമ്പും കൃഷിചെയ്യുന്ന പ്രദേശങ്ങൾ വർദ്ധിപ്പിക്കാവുന്നതാണ്. മാത്രമല്ല, ഓരോ ഏക്കറിലും അധികരിച്ച വിളവും ഉല്പാദനത്തിൽ ഒട്ടാകെ ഗണ്യമായ മാററവും ഉണ്ടായിരിക്കയും ചെയ്യും.

മൊത്തത്തിൽ ഉല്പാദനം വർദ്ധിപ്പിക്കുന്നതിന് മൂന്നു സൌകര്യങ്ങളാണ് ഉണ്ടാകേണ്ടതു്. 1. നല്ല വിത്തിനങ്ങൾ. 2. ധാരാളം വെള്ളം. 3. വേണ്ടത്ര വളം.

അടുത്ത കൊല്ലങ്ങൾവരെ പുതിയ നെൽവിത്തിനങ്ങളിൽ വേണ്ടത്ര ശ്രദ്ധ പതിയ്ക്കപ്പെട്ടിരുന്നില്ല. ധാരാളം വിളയിക്കുന്നതിനും കേട്ട്, രോഗങ്ങൾ ഉണ്ടാകാതിരിക്കുന്നതിനും ഈയ്യിടെയായി ഐ. സി. ഏ. ആർ. സംസ്ഥാനങ്ങൾക്ക് ധനസഹായം നല്കിവരുന്നുണ്ട്. നല്ല വിത്തുകൾ ഉപയോഗിച്ചാൽ ചില ധാന്യങ്ങളുടെ വിളവ് 10 മുതൽ 15 ശതമാനംവരെ അധികമാക്കാമെന്ന് തെളിഞ്ഞിരിക്കുന്നു. ചില ഇന്ത്യൻ സംസ്ഥാനങ്ങളിൽ ധാന്യവിളവിൽ ഉണ്ടായിട്ടുള്ള വർദ്ധനവും ഇതിനു സാക്ഷ്യം വഹിക്കുന്നുണ്ട്.

പരിഷ്കരിച്ച വിത്തിനങ്ങൾ ഉപയോഗിച്ചു് കൃഷി നടത്തുന്ന സ്ഥലങ്ങൾ ഇപ്പോൾ പറയത്തക്ക നിലയ്ക്കായിട്ടില്ല. അവിഭക്തഭാരതത്തിലെ നെൽ വിളയുന്ന പ്രദേശങ്ങളിൽ ആറു ശതമാനം മാത്രമേ ഈ നിലയ്ക്കു് കൃഷിചെയ്തു വരുന്നുള്ളു. മദിരാശിയിലും ഐക്യസംസ്ഥാനങ്ങളിലും ആകെയുള്ള നെൽകൃഷിനിലങ്ങളിൽ മൂന്നിലൊരു ഭാഗം നല്ല വിത്തിനങ്ങൾ ഉപയോഗിച്ചു് കൃഷിചെയ്യുന്നതാണ്. പക്ഷെ മററു സംസ്ഥാനങ്ങൾ കൃഷിയിൽ കാണിക്കുന്ന ശ്രദ്ധ തീരെ ചുരുക്കമാകുന്നു. ഉദാഹരണമായി ഒറീസ്സായിൽ ഒരു ശതമാനം കൃഷിസ്ഥലമാണ് പരിഷ്കരിച്ച വിത്തിനങ്ങൾ ഉപയോഗിച്ചു് കൃഷി ചെയ്യപ്പെടുന്നതു്. 1945—46-ൽ ഇന്ത്യാ

ഡൊമിനിയനിൽ ഒന്നാകെ നല്ല വിത്തിനങ്ങൾ ഉപയോഗിച്ചുവന്ന കൃഷിസ്ഥലം ആകെയുള്ള നെൽവിളഭൂമിയുടെ 14 ശതമാനമാണ്. ഈ സ്ഥലത്തുനിന്ന് അധികം കിട്ടിയ വിളവ് 13 ലക്ഷം ടണ്ണായിരുന്നു. നല്ല വിത്തുപയോഗിച്ചതുകൊണ്ട് വിളവിലുണ്ടായ വർദ്ധനവ് അഞ്ചു ശതമാനം മാത്രമാണെന്ന കരുതുക. ബാക്കിയുള്ള 86 ശതമാനം വിളഭൂമിയിലും പരിഷ്കരിച്ച വിത്തിനങ്ങൾ ഉപയോഗിക്കുന്നാപക്ഷം 1945—46-ൽ ഒട്ടാകെയുള്ള ഉല്പാദനത്തിലുള്ള വർദ്ധനവ് 7.9 ലക്ഷം അഥവാ ഏകദേശം എട്ടുലക്ഷം ടണ്ണായിരിക്കും.

കൃഷിക്കു വെള്ളം കിട്ടാറാകുന്നതിനെപ്പററി പറയുകയാണെങ്കിൽ നമ്മുടെ കൃഷിസ്ഥലങ്ങളിൽ കിട്ടുന്ന മഴവെള്ളം പോരാ എന്ന ആവലാതിയല്ല ഉള്ളത്. മഴ പെയ്യുന്നത് ശരിക്കു നിശ്ചിതകാലങ്ങളിലല്ല; മഴവെള്ളത്തിൻെറ വിതരണം സമനിലയ്ക്കുമല്ലെന്നാണ്. ആവശ്യത്തിലും കവിഞ്ഞ മഴവെള്ളം സംഭരിച്ചു വെയ്ക്കുവാൻ താണ വിതാനത്തിൽ കുറെയധികം ചിറകൾ നിർമ്മിക്കേണ്ടതാണ്. ഈ ചിറകൾ ഓരോന്നും ഒരു നിശ്ചിതപരിധിയിൽ കൃഷിക്കുവേണ്ട വെള്ളത്തിനുള്ള ആവശ്യങ്ങൾ നിർവ്വഹിക്കാൻ കഴിവുള്ളതായിരിക്കണം. ബോംബെ സംസ്ഥാനത്തിൽ ഈ നിലയ്ക്കുള്ള പരിശ്രമങ്ങൾക്ക് കുറെ പുരോഗതിയുണ്ടായിട്ടുണ്ട്.

വെള്ളം കിട്ടാവുന്ന പ്രദേശങ്ങളിൽ പററിയ വളങ്ങൾ കൂട്ടിച്ചേർക്കാൻ കഴിയുമെങ്കിൽ വിളവു വളരെ വർദ്ധിപ്പിക്കാം. പ്രകാശകവും (Phosphorous) നൈതൃജനമാണ് (Nitrogen) നെൽവിളവിന് ആവശ്യമായിട്ടുള്ളത്. അതിൽ കൂടുതലായി വേണ്ടത് നൈതൃജനമാണ്. ഏതെങ്കിലും തരത്തിലുള്ള ഒരു ടൺ എണ്ണപ്പിണ്ണാക്കുണ്ടായാൽ അഞ്ചേക്കറോളം വരുന്ന കൃഷിനിലത്തിനു വേണ്ട വളമായി. ഇന്ത്യാ ഡൊമിനിയനിലെ 580 ലക്ഷം ഏക്കറുകൾക്ക് ഈ കണക്കുപ്രകാരം 116 ലക്ഷം ടൺ പിണ്ണാക്കുവളം ആവശ്യമായി വരും. ഇന്ത്യയാകട്ടെ ഇതിലെ ഒരു ഭാഗം മാത്രമേ ഇപ്പോൾ ഉല്പാദിപ്പിച്ചുവരുന്നുള്ളു. മണ്ണിൽ വേണ്ടത്ര നൈതൃജൻ മുഴുവൻ പിണ്ണാക്കുവളത്തിൽനിന്നുതന്നെ ഉണ്ടാക്കണമെന്നുള്ള നിർബ്ബന്ധം ആവശ്യമില്ല. ഒരു ഭാഗം എണ്ണപ്പിണ്ണാക്ക്, ഒരു ഭാഗം ചാണകവളം അല്ലെങ്കിൽ കമ്പോസ്ററുവളം, ഒരുഭാഗം പച്ചിലവളം ഈ നിലയിലെല്ലാം സൗകര്യംപോലെ ആകാവുന്നതാണ്. നൈതൃജോല്പാദനത്തിന് ആവശ്യമായ വളങ്ങൾ നാം മൂന്നിനങ്ങളിൽ ഭാഗിക്കുകയാണെങ്കിൽ 386 ലക്ഷം ടൺ പിണ്ണാക്കുവളം മാത്രമേ നമുക്കു സംഭരിക്കേണ്ടതായുള്ളു. കമ്പോസ്റ്റിലും പച്ചിലവളത്തിലും നൈതൃജാംശങ്ങൾ കണ്ടുവരുന്ന തോതനുസരിച്ച് 580 ലക്ഷം ഏക്കറിനു വേണ്ടിവരുന്ന വളത്തെ നമുക്ക് മൂന്നിനങ്ങളായി ഇങ്ങനെ ഭാഗിക്കാം. പിണ്ണാക്കുവളം 38·6 ലക്ഷം ടൺ, ചാണകവളം (കമ്പോസ്റ്റ്‌വളം) 38·8 ലക്ഷം ടൺ, പച്ചിലവളം 27.6 ലക്ഷം ടൺ. ഈ വളങ്ങൾ മേല്പറഞ്ഞ തോതിൽ കിട്ടിയെന്നു വിചാരിക്കുക. ഇവയുടെ ഉപയോഗംകൊണ്ട് ഏക്കർ വിളവിൽ 20 ശതമാനം അധികരിക്കുമെന്ന് നാം കണക്കാക്കുന്നാപക്ഷം നമ്മുടെ അരിയിൽ 37 ലക്ഷം ടൺ ഏററമുണ്ടാകും. അങ്ങിനെ 1945-ം 46-ം കൊല്ലങ്ങളിൽ അരിയുടെ ഉല്പാദനത്തിനായി 185 ലക്ഷം ടണ്ണോടൊപ്പം നല്ല വിത്തിനങ്ങൾ ഉപയോഗിച്ചതിനാലുണ്ടായ 8 ലക്ഷം ടൺ, ഏററവും വളംചേർത്തുണ്ടായ 37 ലക്ഷം ടൺ അങ്ങിനെ 45 ലക്ഷം ടൺ ഒട്ടാകെ കൊല്ലംതോറും അധികമാകുന്നതായി കണക്കാക്കാവുന്നതാണ്.

വിളവ് ഈ വിധത്തിൽ അധികമാക്കുന്നതിന് എന്തെല്ലാമാണ് ചെയ്യേണ്ടത്? ഒന്നാമതായി നല്ലജാതി വിത്തിന

ങ്ങൾ വേണ്ടത്ര ഗുണത്തോടുകൂടി ആവശ്യത്തിനനുസരിച്ച് ഉണ്ടാക്കുകയും അത് കൃഷിക്കാരുടെ ഇടയിൽ വിതരണം ചെയ്യുകയും വേണം. 2) വളം വേണ്ടത്ര കിട്ടുവാനുള്ള സൗകര്യമുണ്ടാക്കണം.

ഇന്ത്യയിൽ 580 ലക്ഷം ഏക്കർ നെൽവിളഭൂമിയും 250 ലക്ഷം ഏക്കർ ഗോതമ്പു വിളഭൂമിയുമാണുള്ളത്. ഈ കൃഷിസ്ഥലങ്ങൾക്ക് ആകെ 18 ലക്ഷം ടൺ നെൽവിത്തും 9 ലക്ഷം ടൺ ഗോതമ്പുവിത്തും ആവശ്യമാണ്. വിത്തുകൾ പരിശോധിക്കുവാൻ നെല്ലും ഗോതമ്പും വളരുന്ന പ്രദേശങ്ങളിൽ നടപടികൾ എടുത്തുകഴിഞ്ഞിട്ടുണ്ട്. വിത്തു പെരുക്കലിനും ഏർപ്പാടു ചെയ്തിരിക്കുന്നു. വിത്തു കൃഷിക്കാരുടെ ഇടയിൽ വിതരണം ചെയ്യുന്നതിനുള്ള സംഭരണകേന്ദ്രങ്ങളും ഏർപ്പാടു ചെയ്തിട്ടുണ്ട്. 1943-44-ൽ വിത്തു പെരുക്കുവാനും വിതരണം ചെയ്യുവാനുംവേണ്ടി ഐക്യസംസ്ഥാനങ്ങളിൽ 640 വിത്തു സംഭരണശാലകളുണ്ടായിരുന്നു. 1947-48-ൽ അവ 780 കേന്ദ്രങ്ങളായി വർദ്ധിച്ചു. 1946-47-ൽ ഏതാണ്ട് പത്തു ലക്ഷം മന്ന് റാബി വിത്തുകളും 24 ലക്ഷം മന്ന് ഖരഫ് വിത്തുകളും സംസ്ഥാനത്തിൽ വിതരണം ചെയ്യപ്പെട്ടു. നല്ല വിത്തിനങ്ങൾ പെരുക്കുന്നതിനും വിതരണം ചെയ്യുന്നതിനും പററിയ അനേകം പദ്ധതികൾക്ക് ബോംബെ ഗവമ്മെണ്ട് അനുവാദം നൽകിയിട്ടുണ്ട്. 1946 ജൂണിനു ശേഷം 6 പദ്ധതികൾ അവതരിപ്പിച്ചിരിക്കുന്നു. 208 ഏക്കർ വിസ്താരമുള്ള ആറു വിത്തുപെരുക്കൽ പാടങ്ങൾ സ്ഥാപിക്കാൻ പടിഞ്ഞാറൻ ബങ്കാളിലെ ഗവമ്മെൻറ് തീരുമാനിച്ചിരിക്കുന്നു. പരിഷ്കരിച്ച വിത്തിനങ്ങൾ വിതരണം ചെയ്യാൻവേണ്ടി ബീഹാർ ഗവമ്മെൻറ് കൃഷിക്കാരുടെ പേർ രജിസ്റ്റർ ചെയ്തുതുടങ്ങിയിരിക്കുന്നു. 1000 മന്ന് നല്ല ഗോതമ്പു വിത്തു കൂടാതെ കരിമ്പ്, ചോളം അർഹാർ എന്നിവയുടെ വിത്തുകളും കൃഷിക്കാർക്കു വിതരണം ചെയ്യാൻ ഈ പദ്ധതിയനുസരിച്ച് ഉദ്ദേശിക്കപ്പെടുന്നുണ്ട്. ഇത്തരം പരിശ്രമങ്ങൾ സംസ്ഥാനങ്ങളിൽ കൂടുതൽകൂടുതലായി വ്യാപിപ്പിക്കുകയാണ് ഇന്നത്തെ ആവശ്യം.

തൊഴുത്തുവളങ്ങൾ, പിണ്ണാക്കുവളം, കമ്പോസ്റ്റ്‌വളം എന്നിവ ഏററവുമധികം സംഭരിക്കുവാൻ ശ്രമിക്കേണ്ടതാണ്. എന്നിട്ടും പോരാതെവരുന്ന വളത്തിൻെറ ആവശ്യം നിർവ്വഹിക്കുവാൻ കഴിവുള്ളത്ര രാസവളങ്ങൾ ഇവിടത്തന്നെ ഉണ്ടാക്കുകയും വേണം. ബാക്കി പോരാതെവരുന്നതു മാത്രമേ അന്യരാജ്യങ്ങളിൽനിന്ന് ഇറക്കുമതി ചെയ്യാൻ ഒരുങ്ങാവു. ചാണകവളം, ആട്ടിൻവളം മുതലായവയിൽനിന്ന് ഇന്ത്യാ ഡൊമിനിയനിൽ ഏതാണ്ട് 7,10,000 ടൺ നൈത്രജൻ കിട്ടിവരുന്നുണ്ട്. ഇതാകെത്തന്നെ ഉപയോഗിച്ചാലും ധാന്യവളർച്ചയ്ക്കാവശ്യമായ ഏററവും ചുരുങ്ങിയ നൈത്രജൻപോലും ആകയില്ല. യഥാർത്ഥത്തിൽ തൊഴുത്തുവളത്തിൽനിന്ന് 284,000 ടൺ നൈത്രജം മാത്രമാണ് മണ്ണിൽ എത്തിച്ചേരാനിടയാകുന്നത്.

കാഷ്ഠവളത്തിൽനിന്ന് കമ്പോസ്റ്റുണ്ടാക്കുവാനായി ഇക്കഴിഞ്ഞ മൂന്നു കൊല്ലങ്ങളോളം പരിശ്രമം തുടൻവന്നിട്ടുണ്ട്. ഇപ്പോൾ ഇന്ത്യയിലുള്ള നാലായിരം മുനിസിപ്പാലിററികളിൽ അറുനൂറെണ്ണം മാത്രമേ അത്തരം പദ്ധതികൾ നടപ്പാക്കാനുദ്യമിച്ചിട്ടുള്ളു. കൊല്ലംതോറും 6,00,000 ടൺ കമ്പോസ്റ്റാണ് ഉണ്ടാക്കിവരുന്നത്. ഇതിൽ അധികഭാഗവും ഉപയോഗിക്കുന്നത് ധാന്യവിളവുകൾക്കും എണ്ണവിളവുകൾക്കുമല്ല, ചന്തയിൽ വില്ക്കുവാൻ കൊണ്ടുവരുന്ന പച്ചക്കറികൾക്കാണ്.

ഇതിൽനിന്നെല്ലാം തെളിയുന്നത് നമ്മുടെ വിഭവങ്ങൾ കൂടുതൽ ഫലപ്രദമായി ഉപയോഗിക്കുവാൻ അടിയന്തിരനടപടികൾ എടുക്കണമെന്നത്രെ. മററുള്ളവരുടെ നേക്കു സഹായത്തിനു എപ്പോഴും കൈനീട്ടുന്ന സമ്പ്രദായം നാം ഉപേക്ഷിക്കണം. അന്യരാജ്യങ്ങളുടെ സൌജന്യംകൊണ്ട് കിട്ടാവുന്ന സാധനങ്ങളുടെ ഉല്പാദനം കഴിവുള്ളത്ര ഇവിടെത്തന്നെ നിർവ്വഹിക്കാൻ സാധിക്കത്തക്ക നിലയിൽ രാജ്യത്തുള്ള വിഭവങ്ങളെ ഉപയോഗപ്പെടുത്തണം. അന്യരാജ്യങ്ങളുടെ നിയന്ത്രണങ്ങളിൽനിന്ന് സ്വയം മോചനം നേടുവാനുള്ള ഒരു വഴി, അപ്രകാരമാണെങ്കിൽ, നമ്മുടെ മുമ്പാകെ തെളിയാതിരിക്കയില്ല.