improved strains. In this particular aspect of cotton improvement work, India can be said to be ahead of other cotton growing countries and our Technological Laboratory is in many ways a unique institution. The result of all this work on cotton improvement is that quite 4 million acres are now under these improved varieties and that but for this development India will be importing foreign cotton to the value of some 7 crores of rupees.

In respect of better plant nutrition the second line of improvement work has somewhat lagged behind. Numerous experiments have brought out however the great deficiency of nitrogen in Indian soils, the need for organic manures, of aeration and of drainage. All of these have been emphasised and composts and green manures studied and recommended. Work on soil colloids, on the laterite soils of Eastern Bengal, on rice and sugarcane soils in the Bombay Deccan and the C. P. is in progress as well as a comprehensive scheme for the study of dry-farming methods. Problems of excess water, of waterlogging, alkali troubles and kindred matters relating to irrigation are also receiving attention. In regard to artificial manures they have been found to be economic under certain circumstances and India now uses not only the whole of her local production of 13,000 tons of ammonium sulphate, but also had a net import of 38,000 tons in the year 1931–35. Field experiments covering manurial and other problems have become more precise in lay-out and interpretation, thanks to the aid of mathematical technique furnished by the Research Council.

The third division in crop improvement relates to the avoidance or reduction of losses caused by plant pests and diseases. These levy a heavy toll on agricultural wealth and there is need for all the help science can give. Taking sugarcane for instance, these pests comprise moth borers, the Hispa beetle, the cane hopper, mealy bugs, white fly and termites. By suitable varieties, cultivation methods and dusting with insecticides some of these can be controlled and biological methods also hold out promise. The pink boll-worm of cotton and the spotted boll-worm cause large losses annually, but simple methods of control have been devised and demonstrated, *viz.*, the heating of the seed in the first case and the removal of the cotton stumps after harvest in the second case. The heating of the seed has been found to impair neither the vitality nor the oil content of the seed.

Plant diseases are caused by fungi, bacteria or viruses and the best weapon to fight them with in India is the use of immune or resistant varieties, coupled with proper cultivation and rotation methods. Direct methods are also economic, and good instances of such work are furnished by Mysore where spraying arecanuts to prevent the nuts dropping and the coffee bush to prevent leaf disease is extensively practised.

Among improved implements, mention may be made of the large number of improved ploughs being sold annually and of that most recent introduction, the pneumatic tyre for bullock carts. The latter has been found to result in 50% increase in the hauling capacity, in less strain and jerking and fewer sore necks.

The scientific worker in India will find a wealth of material for research in agricultural problems intricate enough for the most ambitious. In all applied sciences, the most important problems often lie on the border line of two or more pure sciences and their successful solution leads to an advance in general knowledge or to the opening up of new fields of scientific investigation. [The address was profusely illustrated by a splendid set of lantern slides.]

Preparation of Fine Chemicals in India.

A SYMPOSIUM on the scope of preparation of fine chemicals in India was held at a meeting of the Chemistry Section of the Indian Science Congress 1936, under the Chairmanship of Dr. P. C. Guha, the President of the Section.

In opening the discussion, Dr. P. C. Guha stressed the desirability of considering seriously the question of preparing fine chemicals in India. A start has been made by the Organic Chemistry Department, Indian Institute of Science, Bangalore, where, since the inception of the Preparation Section in 1930, more than 200 research chemicals have been prepared (some of them in considerable quantities) in an economic way. When an experimental scheme of this nature has to be viewed on a commercial basis, several points demand careful consideration. Now that the preliminary efforts have proved successful, the time has arrived when Indian capitalists should make an attempt at commercialisation. The history of the Eastman Kodak Company of Rochester may be recalled in this connection, and this should serve as a stimulus. India possesses several advantages; for instance plenty of cheap expert and ordinary labour is available. A beginning can be made with the object of meeting the demands of the laboratories. Such an establishment with its *indispensable research section*, could undertake the preparation of other chemicals of general and every-day use in industries and also exploit the possibility of utilising the chemical resources of India. Caution is necessary in such an enterprise and external source of information and experience cannot be depended upon and the necessary technical skill being acquired by Indians themselves. India, like other advanced countries, must pass through a preliminary evolutionary period, but this instead of damping her spirit should make her all the more resolute and active. Prof. Guha appealed to capitalists to utilise the experience already available in the country and explore the possibility of starting industries in this line.

Dr. Wheeler (Bombay) endorsed the President's views and added that some firms in India should take the lead. He felt that the Council of the Indian Chemical Society might organise the production of a limited number of important research chemicals in the various university chemical laboratories. Dr. J. C. Ghosh (Dacca) supporting, instanced the case of a pupil of his, successfully starting the manufacture of gas mantles at Dacca. Dr. N. R. Dhar (Allahabad) felt certain that there is plenty of scope for the

manufacture of fine chemicals in India. He observed that there is no dearth of well-trained chemists in the country, but what is lacking is business experience which is of great importance in running a manufacturing concern. He cited an instance of a properly trained chemist earning Rs. 150 per month by purifying (by recrystallisation) ordinary bazaar chemicals and selling them to the schools and colleges in the United Provinces. Dr. R. B. Forster (Bombay) observed that before the preparation of chemicals could be undertaken, it was essential to have the necessary supply of starting materials and solvents. There is no reason why the distillation of tar should not be undertaken and the importation of raw materials rendered unnecessary. Dr. N. N. Godbole (Benares) opined that fine chemicals can and should be manufactured in India. While pointing out the difficulties in packing and selling, the latter requiring business experience, he suggested the desirability of the Science Congress constituting a body that will analyse and certify the standard preparations. Dr. J. N. Ray (Lahore) was in full sympathy with the views expressed by the President and Dr. Wheeler. He realised that such ventures may not be financially very profitable in the beginning but if the Indian Chemical Society takes the lead, there is no reason why the desired goal should not be achieved. While expressing his disagreement with the view expressed by Dr. Forster, *viz.*, that it is essential to manufacture starting materials and solvents, pointed out the possibilities of exploring new solvents, *e.g.*, furfurol, furyl alcohol, etc., there is no reason why alkaloids, *e.g.*, ephedrine, emetine, etc., as also other useful chemicals from indigenous plants could not be economically manufactured in this country. Dr. J. N. Mukherjee (Calcutta) expressed the view that as a first step, it is desirable to restrict the scope to the preparation of such chemicals as would meet the requirements of research workers in India. By mutual agreement a list might be prepared and the work may be distributed over the different laboratories. Regarding the broader issue of preparations on a commercial scale, he suggested that the first step should consist in collecting information on the possibilities and to have them critically examined by a committee with a view to arriving at definite proposals.

The following resolution proposed by Dr. N. R. Dhar and seconded by Dr. J. N. Ray was unanimously passed at the meeting :—

"That the Council of the Indian Chemical Society be requested to carefully consider this important question and explore means as to how and on what lines the preparation of fine chemicals can be undertaken in this country."*

---

* The following resolution was passed at the annual general meeting of the Indian Chemical Society held on Monday, 6th January, at Indore :

" Resolved that a committee consisting of the following members with powers to co-opt be appointed to consider possibilities of preparing fine chemicals for laboratory use and to collect informations regarding the possibility of new chemical industries in India :

Dr. H. K. Sen (Calcutta) ; Dr. J. N. Mukherjee (Calcutta) : Dr. S. K. Ray (Dhanbad) ; Dr. P. K. Ghosh (Calcutta) ; Dr. N. N. Godbole (Benares) ; Dr. J. K. Chowdhary (Dacca) ; Dr. N. R. Dhar (Allahabad) ; Dr. P. C. Guha (Bangalore) ; Dr. P. C. Mitter (Convener); Dr. T. S. Wheeler (Bombay) ; Dr. S. G. Sastry (Mysore); Dr. B. Sanjiva Rao (Bangalore); Dr. K. L. Moudgill (Trivandrum); Dr. S. S. Bhatnagar (Lahore); Dr. M. S. Patel (Bombay) ; Dr. K. H. Hassan (Hyderabad, Deccan); Dr. B. S. Srikantan (Waltair) ; Dr. N. G. Chatterjee (Cawnpore)."

Progress of Fuel Research.*

THE Department of Scientific and Industrial Research issued the Report of the Fuel Research Board together with the Report by the Director of Fuel Research for the year ended 31st March 1935. The Report is made the occasion for a review of the progress achieved in the Fuel Industry during the twenty-five years of His Majesty's reign. Consideration is given to the relation between the Board's researches and the remarkable changes which are taking place in the utilization of coal.

Despite increasing industrial prosperity and rising population the consumption of coal in Great Britain has fallen from 180 million tons a year in 1910 to 165 million tons in 1934. It is sometimes suggested that this fall is due to the replacement of coal by oil but the report shows that this is largely erroneous and the decrease is due mainly to the increased efficiency of practically every process for which coal is used.

In 1910 about 4½ million tons of coal were required to produce 2,500 million units of electricity, while for the 16,100 million units generated by authorised undertakings in 1934 only 11.4 million tons were necessary. If the efficiency of production of electrical power had remained the same, 29 million tons of coal would have been used in 1934.

An overall thermal efficiency exceeding 27 per cent. has now been obtained in large installations and further major advances in this direction cannot be expected. Incidentally it may be stated that the capacity of individual boilers has been raised from 20,000 or 30,000 to 300,000 pounds of steam per hour, and an efficiency exceeding 90 per cent. has been attained in this section of the plant.

The gas industry has also made great advances, and in the period under review the gas supplied by all authorised gas undertakings in Great Britain increased from 178,000 million cubic feet in 1910

---

* Department of Scientific and Industrial Research; Report of the Fuel Research Board for the year ended 31st March 1935, with report of the Director of Fuel Research. His Majesty's Stationery Office, London, xi + 188 pp. Price 3 *sh.* 6*d.* net.