

The Chairman then thanked Mr. Edwards and Dr. Park Ross for their useful and interesting papers.

Mr. Mortifee drew attention to one fact which affected the health of both natives and Europeans in the northern districts, where the issue of quinine was necessary. He referred to the stamps which have now to be attached to bottles of medicine, whereby a large increase in the cost of such medicines was made. He considered some relief ought to be brought about, as anything which discouraged the purchase and issue of drugs, such as quinine and aspirin, would not tend to the health of people in the fever districts.

Dr. Park Ross, in replying, stated that the point raised put him rather in a difficulty as a Government official, and he would have to answer it very tentatively. It seemed to him that the one aim of

these duties was to tax luxuries. Speaking as a private individual, and not as a Government official, he had no hesitation in giving his opinion that quinine is an absolute necessity. "If this tax is placed on a necessity it is a question which I think is quite open for your Association to take up. I know that my own Department considers that quinine is an absolute necessity, otherwise we should be accused of distributing luxuries through the Magistrates' offices, and we are not given to distributing luxuries." The Doctor further stated that he understood the tax was limited to the tabloids. His Department distributed quinine largely in tabloid form. He was sure the point had not been properly represented before, and that the Association would get a sympathetic hearing.

## Sugar Experiment Stations in Sugar-Producing Countries.

(Paper by B. PEARCE, of Illovo.)

There has been some discussion of late in regard to a sugar experimental station in this country. Having had the good fortune to be able to visit some of the chief sugar-producing countries of the world, I thought it might prove interesting to some of you to hear a little of the methods which they adopt.

The Louisiana sugar experimental station is one of the sub-stations of the Louisiana State experimental stations, and the sugar station is perhaps the oldest of its kind in the world. In conjunction with the sugar school at Louisiana State University, at Baton Rouge, some of the best-known sugar men have obtained their training.

In Louisiana the conditions for cane-growing are exceptionally difficult, owing to the freeze in winter, and the crop has to be taken off in two or three months. Then there are the various insects, pests and diseases to which the cane are easily subject, and these have to be combated.

The Louisiana crop produces about 200,000 tons of sugar per year. This is a small quantity as compared with the 4,000,000 tons of 96 deg. test which are produced in Cuba, only two days' journey away, and part of which is refined in the large American sugar refinery at Chalmette melting 1,500 tons per day; Californian beet crops of 1,000,000 tons per season; Hawaiian crop refined in San Francisco of 500,000 tons per year. Thus the Louisiana people have great odds against them, and without a sugar experiment station to lead them I doubt if the sugar industry there would be able to stand the strain.

This station has made great investigations to produce a cane that will stand the climatic conditions, and have been improving every year in this line by seed selection and producing other canes from seedlings, etc. Then there is the borer, which has been introduced into their canes from Cuba. The parasite, in Cuba, is able to keep this insect in check, but it is unable to live in Louisiana. The entomologists on the station are now trying to acclimatise this parasite. Then, again, there are the fungi and diseases of the cane which they are investigating.

More has been done during the last few years to improve the sugars produced than anything else. Good sugar has to be made, or it will never sell.

Dr. Zerban, who was chief chemist, has made some extensive researches into the colouring matters of cane and cane juices, etc., and many of you may have read his articles.

At the small factory which they run at the station for purposes of experimenting, and also to give the sugar students from Baton Rouge practical training, they conducted some experiments in various processes of manufacture, and a full detailed account of the procedures and results were published to the sugar people of Louisiana. Every year something new is tried, and the result published in pamphlet form.

Some of the publications issued the 1920-21 year were:—

"Effect of Fungi on Germination of Sugar Cane."

"Factors determining the keeping qualities of Cane Sugar."

**Sugar Experiment Stations, etc.**

"Amount of Salt in Irrigation Water, injurious to Cane."

"The Clarification of Cane Juice without Chemical Treatment."

"Chemical Composition of some Louisiana Soils."

"The Importance of Colouring Matter in Cane Juice and Syrups."

Thus all experimenting work is done at the station, and if a failure is the result, there is no great loss, as would be the case if the large factories were to undertake this work; also the work is more thorough.

This small factory consists of a set of rolls driven by a belt from a small steam engine; a few types of filter presses; a sulphuring apparatus; a small pan; a double effets; and two small centrifugals. Part of this machinery has been donated, and the sugar obtained is sold to help cover expenses.

Every year a "field-day" takes place at the sugar experimental station. On these days lectures are held and agricultural implements and machinery are exhibited. Committees are formed for the coming year to investigate the different sections of the industry, such as planting and growing of canes, transportation of cane, and others for the various processes of manufacture.

The staff of the sugar experimental station, in conjunction with the Louisiana State experimental station, consisted of a director, assistant director, agronomist, plant pathologist, assistant pathologist, bacteriologist, veterinarian, parasitologist, entomologist, assistant entomologist, horticulturist, chief chemist, five assistant chemists, research chemist, farm manager, and specialist in show exhibits.

The area covered by the new sugar experimental station is about 30 acres.

Financial figures that may prove interesting:—  
Dollars.

Received from Treasurer of the U.S.A., as appropriated by the Hatch and Adams Fund . . . . .	30,000
Received from the Louisiana State Fund Sale of Goods . . . . .	37,250
Received from Commissioner of Agriculture (for Fertilizers Fund) . . . . .	7,886
Received from the Dairy Section for Sales of Milk, Livestock, etc. . . . .	27,325
	6,348
Total running expenses therefore amount to . . . . .	108,809
or £22,000.	
Of this, salaries to trained men, not including common labour . . . . .	45,702
or £9,150.	

In Cuba, the effect of a sugar experimental station is not so greatly felt, as the sugar cane grows there like a weed, and not much science is needed in the agricultural section, although in parts they are coming to this. There are harmful insects, but they have their parasites, which keep them in check. More care and science is applied in the mechanical and manufacturing sections on most of the estates.

Whilst in Cuba I was with Professor W. W. Kerr, who was employed as experimental engineer by the Cuba Cane Sugar Corporation, which company owns sixteen large factories in Cuba. At the beginning of each season, arrangements are made to visit certain factories to conduct experiments, and four or five graduate engineers accompany the professor.

The tests carried out on the mills were such as: horse-power needed for certain quantities of cane per hour with certain percentages of fibre in the cane, and friction on trash plate, etc. Juice heaters were tested for heat transmission, evaporators for entrainment, heat balances obtained evaporation per sq. ft. per hour, and pans for same. Boilers were tested for combustion of gases, evaporation of water, radiation losses, etc.

In one factory a complete heat balance was obtained. The bagasse weight and analysis was obtained, and so the number of calories coming into the factory were estimated. Steam recording flow meters were installed in all departments, and the test was conducted for three days. It was thus possible to find out what percentage of heat was used in the different stations, and what could be done to lessen radiation losses and increase the efficiency.

In California I was not able to obtain much information on experimental work. Most of the beets for the factories are supplied by planters, and they are paid by sucrose content. A chemist and two assistants have a small laboratory near the dump, and every truck delivered is weighed, a sample taken and tested, and the percentage of sucrose sent to the office. This is again checked as an average by the chemists employed at the factory in their daily tests, which take place every hour.

An expert agriculturist is employed by the sugar manufacturers to give advice to planters. These men specify the time to plant and dig the beets, the quantity and quality of fertilisers that should be used, and generally inspect and see that the planters are going to deliver good beets to the factories by having them properly cared for.

During the four months I was in a beet factory in Southern California, there was no complaint as to the quality of the beets, although at times they were hard to slice owing to their being hard through shortage of rain or irrigation water.

Hawaii is the leader of scientific sugar production in the world to-day.

**Sugar Experiment Stations, etc.**

They have a very fine organisation, and everyone works for the bettering of it. Every year, two three-day meetings are held. The first is usually the chemists' and engineers' meeting, which is open to all. The other, which is more private, is held for the managers and directors, and all financial and private matters are discussed. During this meeting the agricultural side of the industry is dealt with, and all improvements in the methods of cultivation, fertilisation, irrigation and haulage, etc., are lectured on by members, and committees submit their reports.

The chemists and engineers originally had a meeting for each body, but it was difficult to attend both meetings, so the two amalgamated. As so many forms of engineering and chemistry are needed on a sugar estate, it was decided last year to include all forms of engineering and chemistry, and to have one big meeting each year. At these meetings everything relating to factory practice is discussed. Committees which were formed the previous year read their reports, and any new methods are criticised, and if they stand the strain are considered workable. There are 42 factories represented at these meetings, and it is through these and the experimental station that Hawaii has reached the top to-day. Good feeling exists everywhere, and everyone is out to help his neighbour. Competition for efficiency is great.

Not much notice was taken with regard to an experimental station until the years 1903-4-5, when the sugar industry was almost ruined by the insect, the leafhopper (*perkinsulla saccharicida*), and the experimental station has been a great help to the Hawaiian sugar people.

It may be as well to first explain a little about the Hawaiian Islands. These islands came out of the Pacific Ocean after the rest of the world was made. They were not connected in any way with the mainland, consequently there was no living thing on them. Everything that is there has had to be introduced at some time or other. The Hawaiians came up from the Southern Pacific Islands in outrigger canoes. A few insects were brought with them, rats were introduced by boats and became later almost a plague. There are no snakes, but a few lizards and plenty of scorpions and centipedes. Now, when an insect or any such thing which has no parasite is introduced into the islands unawares, it goes ahead with nothing to stop it, and may do considerable damage.

The rats came, so it was decided to introduce a mongoose from Australia to keep them down; they themselves are a nuisance to-day, and seem to have formed a union of their own with the rats. That was a mistake, which perhaps was a good one, as it taught a lesson. If any insect or animal is intro-

duced to-day to keep in check any that are already there, it is kept under close supervision for some time before it is set free in the country.

The leafhopper was brought into the country on some Australian canes that were introduced. There was no natural parasite, so it thrived, and almost wiped the whole industry out. The entomologist at the station got to work, and one of his assistants was sent to Australia, Fiji and Japan to look for a parasite. After thirteen months' work, a parasite was found in Australia, and after several attempts it was finally landed into Hawaii. Breeding stations had to be arranged at various points on the way. This parasite—*Cyrtorhinus Mundulus*—has done wonders in keeping the leafhoppers in check, but has itself a parasite—the kissing bug. Another has also been found lately, and is slowly gaining ground. Entomologists have been sent all over the world to investigate this insect and its parasites.

There has already been mention about the possibilities of the Uba cane dying out. It is true, and when it does commence to go off it will make no mistake, and do so quickly too. An instance of this happened in Hawaii, and may be interesting. The Lohawa cane in Hawaii, originally a cane from Mauritius, called Bourbon, introduced by a Scotch sailor about 1800, and so called because it was landed at a place called Lohawa, suddenly commenced to go off; the roots died and withered, and so far no real cure has been found. Other canes had to be planted.

The experimental station has done wonders in helping the planters and millers to produce large quantities of sugar cane per acre. I have seen ratoon cane there, on one of the large experimental plots, that produced 125 tons of cane per acre from the plant cane, and the first ratoon that I saw, I am sure would produce almost 150 tons per acre. Ewa Shammel plantation, a few miles from here, has produced 12 to 15 tons of sugar per acre. Puenenne factory produced 40,000 tons of sugar, with a season's average of 6.9 tons of cane per ton sugar; a 99.07 extraction, and 99.04 recovery.

There are many more matters I could mention, but I think what I have said will signify the great efficiency that Hawaii has attained through scientific methods and control.

A comparative statement of maintenance of this station will show its growth and the value put on its services:—

1895	..	7,000	dollars.
1900	..	14,000	"
1905	..	114,000	" (the leafhopper scourge.)
1910	..	82,500	"
1916	..	142,000	"
1921	..	226,190	" or £45,000 approximately.

**Sugar Experiment Stations.**

A sub-station of about 125 acres, on which I saw the huge tonnage of cane, was able in 1921 to make a profit of 57,000 dollars. The average yield on 71 acres of this plot produced 700 tons sugar.

This station is almost wholly supported by the sugar industry, the pineapple companies contributing a small proportion. Each plantation pays proportionally to the sugar produced.

A committee is appointed to supervise the station arrangements in conjunction with the director.

The staff consists of a director, consulting entomologist, botanist in charge of forestry, four pathologists, superintendent forest nurseries, sugar technologist, assistant sugar technologist and two assistant chemists, research chemist and three assistants, fertiliser sampler, agriculturist and seven assistant agriculturists, illustrator, and assistant to the director.

What struck me most was that less labour was employed in the factories generally. All the labour was more efficient.

**DISCUSSION.**

Mr. Murray stated that he had seen the experimental stations mentioned by Mr. Pearce, and he hoped that we would have our experimental station here in the near future.

Mr. Mortifee asked what was the age of the cane which produced such an exceptional tonnage at date of cutting, and Mr. Pearce replied that it was from 18 to 20 months.

Mr. Pearce was also asked as to how the country compared with ours, and replied that the rainfall was supplemented by irrigation. The fertilising there is done on a proper scale. Nitrate of soda had been found to be the best, and as much as 300 lbs. per acre had been put on. It was either done through the irrigation water or put on by hand; he could not say what the cost was. The wages paid to the European employees varied; in Cuba it was 250 dollars a month; Louisiana 175; California 175; and Hawaii from 150 to 200 dollars a month. He had been away three years.

The Chairman thanked Mr. Pearce for his paper, and then addressed the members in the following terms:—

“Mr. Murray has suggested that a committee should be formed for the purpose of choosing the papers for next year. That of course will have to be dealt with by the new committee of the Association. No doubt a method will be employed to try and learn the lessons that we have had from this year's Congress; to find out exactly what are the points upon which further investigation could be interestingly followed, and then to find men who will undertake to read papers on those subjects and make a special study of them during the next twelve months.

“I would like to mention that it has been a very great pleasure to see attending this Conference some of the students from the Technical College. I have taken particular notice of them, and have been delighted to see the close attention given to all the papers. I am sure they will benefit very much for having been here.”

Mr. O. J. Johnson, in remarking that this practically brought the Sugar Week to a close, stated that it would be a great mistake to bring the meeting to an end without thanking the Chairman and Secretary for the work they had done to bring about this Congress. He asked the members to accord them the heartiest vote of thanks for what they had done. This was enthusiastically responded to by the meeting.

The Chairman, in a few well-chosen words, thanked the members for what had been said concerning himself, and said he would leave the Secretary to speak for himself.

Mr. Eadie, in expressing his thanks, said:—

“I think the best reward the organisers could possibly have is the attendance, and the interest that has been shown in the Congress. As far as I personally am concerned, I did everything I could with the idea of making the meeting successful, but I can frankly say that a few days before I was doubtful as to whether the work done would have the effect it was intended to have. That feeling has disappeared entirely, and as to the gentlemen who have read the papers, I take a personal pride in the fact that they have come up to scratch so wonderfully. The papers have been from beginning to end just of the right length, and all of a very high standard, and if we can do next year even what we have done this year we will do well, but with the experience we have gained I hope we shall do at least 50 per cent. better.”

This concluded the Conference.