

Home (1917) Department.
(Education)

Ordinary SERIES.

G.O. No. 27

DATED 6-1-1917

INDEXED

[Despatch Abstract.]

Wood Distillation.

Communicating to the Commissioner of Land Revenue and Forests and to the Officer in charge of the Department of Industries a question asked by the Honourable Rao Sahasr Annamalai Chettiyar at the meeting of the Legislative Council held on the 31st November 1913 and the answer given thereto regarding the -----in the Madras Presidency and directing an investigation of the subject.

L.M. (iv) 8-1,005-9-3-16.

LEGISLATIVE DEPARTMENT.

QUESTION.—No. 71

for the meeting of the Legislative
Council to be held on the 21st November 1916.

SUBMITTED that two copies of this Question may be forwarded to the
Home (Educ.) Department with reference to Nos. (1) and (4) of the
rules regulating Secretariat procedure in dealing with these Questions in the
Legislative Council. Orders regarding admission will be communicated in due
course.

V. T. K.

21. 10. 16.

Legislative U.O. No. 2508 dated 21-x-16

To

The Home (Education) Department. with Q-71

Local and Municipal (Legislative) Department.

In the article on wood distillation referred to in the question on the previous page Mr. Chatterton has given a brief account of the scheme submitted by him to this Govt Home (Education) Department.

Q.71. (a) Has the attention of the Government been drawn to a very practical and instructive paper on wood distillation published in the Special Supplement of the "Madras Mail" of October 7, 1916, from the pen of Mr. Alfred Chatterton?

(A) The committee on wood distillation was appointed to consider whether such a venture should be left to private enterprise or should be undertaken by the Govt. from the pen of Mr. Alfred Chatterton.

(A) Its resolutions will be found on pages 62-63 of the report of the committee.

(P) (b) Will the Government be pleased to direct the Department of Industries to submit proposals to Government with a view to stimulate indigenous enterprise to attract in this direction?

as the market for acetate of lime (from which acetone used in cordite manufacture is obtained) was uncertain, that the establishment of a Govt. factory for the manufacture of charcoal would be an unjustifiable interference with private enterprise, but that there would be no ground for complaint if the Govt. considered it necessary for military purposes to manufacture acetate of lime, provided the utilisation of the bye-products, such as charcoal, tar, methylated alcohol, etc., was left to private enterprise. The Govt. of India, Army Dept. were not in favour of the proposal and the matter was dropped.

3. Mr. Chatterton urges in the article in the "Madras Mail" that the Govt. might now undertake the pioneering of the industry. He considers that in the present state of the war the bye-product, acetate

of

Home Department.
(Education).

In the article on 'wood distillation' referred to in the question on the previous page, Mr. Chatterton has given a brief account of the scheme submitted by him to this Govt. in 1908. The capital cost of establishing a factory for wood distillation on the Nilgiris was then estimated at Rs 4.4 lakhs and the working expenses were estimated at Rs 1.38 lakhs. A committee mostly composed of non-officials was appointed to consider whether such a venture should be left to private enterprise or should be undertaken by the Govt. in the first instance. The proceedings of the committee and its resolutions will be found on pages 62-63 of G.O. No. 3314, Revenue, dated the 2nd December 1909. The committee was of opinion that the establishment of a factory for wood distillation on the Nilgiris was not a business which would be likely to attract private enterprise as the market for acetate of lime (from which acetone used in cordite manufacture is obtained) was uncertain, that the establishment of a Govt. factory for the manufacture of charcoal would be an unjustifiable interference with private enterprise, but that there would be no ground for complaint if the Govt. considered it necessary for military purposes to manufacture acetate of lime, provided the utilisation of the bye-products, such as charcoal, tar, methylated alcohol, etc, was left to private enterprise. The Govt. of India, Army Dept, were not in favour of the proposal and the scheme was dropped.

2. Mr. Chatterton urges in the article in the "Madras Mail" that the Govt. might now undertake the pioneering of the industry. He considers that in the present state of ~~the~~ war the bye-product, acetate

(A)

page 46 of p. 3314
2.12.09 (P)

(P)

page 65 of Lp. 3314 (P)

(A)

Local and Municipal (Legislative) Department.

The Hon'ble Mr. Secretary S.R. Annamalai Chettiar, Madras.

Home (Education) Department.

G.O. No. 3314 (a) Has the attention of the Government been drawn to a very practical and instructive paper on wood distillation published in the Special Supplement of the "Madras Mail" of October 7, 1909, from the pen of Mr. Alfred Chatterton?

G.O. No. 3314 (a) Will the Government be pleased to direct the Department of Industries to submit proposals to Government with a view to stimulate indigenous enterprises in this direction?

clause (b), p. 2 Supra.

of lime, is likely to fetch a much higher price than what was possible in 1908 and that the profits are likely to be correspondingly greater. The Additional Member suggests that the Dept. of Industries should be directed to submit proposals to Govt. with a view to stimulate indigenous enterprise in undertaking the business.

3. Attention is solicited to the Hon'ble Sir M. Hammick's notes on pages 3, 4, 9 and 10 of notes to G.O. No. 3314, Revenue, dated the 2nd December 1909, which set out the difficulties in the way of starting a scheme such as that proposed by Mr. Chatterton. Mr. Chatterton's conclusions as to the ultimate success of the industry are not based on experience, and his figures as to the prices of wood, charcoal, etc. may turn out to be incorrect in actual trial, thereby entailing considerable loss to the Govt. Besides, the Govt. cannot well spend such a large sum as ~~four~~ lakhs in mere experiments. From Mr. Chatterton's article published in the "Mail" it appears that experiments are already being conducted in the Indian Institute of Science at Bangalore in wood distillation and in the utilisation of bye-products. The results of the experiments will, it is presumed, be eventually made known to the public. The Govt. may however assist the industry by granting reasonable concessions to private individuals ~~and~~ firms that may desire to undertake the business. For this purpose, it does not appear necessary to call ^{on} the Director of Industries to submit formal proposals. The following draft answer is submitted for approval:-

"(a) The Govt. have ~~been~~ perused the article in question.

(b) From the article ~~published~~ in the "Mail" it appears that experiments in wood

Larger meaning.

Ch. 4
1.11.66

" distillation are already being conducted in the
" Indian Institute of Science at Bangalore. The
" results of the experiments, when published, should
" prove of ~~great~~ value to the public. If, after
" a consideration of the data obtained, any pri-
" vate individual or firm wishes to establish a
" factory in this Presidency and applies to Govt.
" for assistance, the Govt. will be prepared to
" consider any reasonable proposals that may be
" made."

11/11/66

S. At the Chatterton points out in his
article, the activity of Govt. in the
industrial sphere was no longer be
restricted according to pre-war standards.
The case seems to be a suitable one for
re-consideration & scrutiny in all its
aspects by the office of the Director of
Industries, to whom, I submit, the article
may be referred. There seems to be no
reason why this Govt. should remain inactive,
because of the alleged experiments of the
Bangalore Institute, of the scope of which
we are only vaguely informed. It may pay to
await the results of these experiments; on the
other hand it may pay to cooperate with the
Institute, in instituting independent experiments

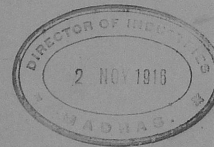
with all alacrity. Submits that in line of part 6 of the draft answer we may reply that the Deputy Assistant is being consulted.

clerk
1.11.16

Mr. Jones. Ld. for security
removes.

W
1.11.16

Home (Econ) 37711-1911-16.



The question raised in Mr. Chatterton's article is a very difficult one. Taking pre-war figures of prices and assuming Mr. Chatterton's calculations to be correct, the dry distillation of 10 tons of casuarina wood would yield charcoal worth Rs.75 and other products worth Rs.182-4-0. Commercially, therefore, the other products are the principal ones, and of these the most important are Acetate of Lime and Methyl Alcohol. Acetone, which is required for the preparation of cordite, is obtained from Acetate of Lime, and the original idea was to obtain, by wood distillation, partly a cheap supply of good charcoal for the development of Suction Gas Plants in Madras and partly supplies of Acetate of Lime for conversion into Acetone at the Cordite Factory at Wellington. Now, however, if Government take up wood distillation seriously and on a commercial scale, we cannot count on the Cordite Factory taking any part of the Acetate of Lime. For I understand (from a letter written by

Mr. Richmond, District Forest Officer, Nilgiris, who has consulted Col. Babington of the Cordite Factory, to the Board of Revenue) that it has finally been decided by the Government of India to manufacture Acetone by the biological process - (probably from Mohwa flowers)- and to establish a factory for that purpose at Nasik in the Bombay Presidency. Probably, therefore, we should have to export all our Acetate of Lime to England. Now, supposing we deal with 15,000 tons of wood per annum as proposed by Mr. Chatterton in his report on pages 42 - 49 of G.O.No.3314 Confl. Rev. dated 2-12-1909, 15,000 tons of Casuarina Wood, if Mr. Chatterton's figures are correct, would yield 900 or 1,000 tons of Acetate of Lime. The present price of Acetate of Lime in England is very high.

It varies from £20 per ton for brown to £40 per ton for grey, and no doubt England would now take all that we could supply. But there is no definite information on record as to whether we could sell 900 or 1000 tons of Acetate of Lime in England in normal times at a remunerative figure.

2. It might even be a question whether it would not be more profitable to produce Acetic Acid instead of Acetate of Lime. Acetic Acid, I am informed, is used for coagulating rubber, and probably the demand for it in India, in Ceylon and in the Straits will go on increasing for many years. Obviously we should be in a very good position to supply it if Government went in for wood distillation, though it appears from Messrs. Turnbull & Co's report in page 15 of G.O.3314 (Confl) Rev. dated 2-12-1909 that Casuarina wood at any rate is not particularly rich in Acetic Acid.

3. 15,000 tons of wood would also, on Mr. Chatterton's figures, yield some 60,000 gallons

of Methyl Alcohol. There is very little information on record as to what prospect there would be of disposing of this large amount in India or in England at a remunerative price.

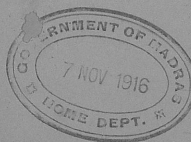
4. In the matter of the disposal of the charcoal too, further investigation is necessary. It is true that the price of Liquid Fuel is increasing, but it is probable that in most parts of the Presidency Gas Suction Engines burning not charcoal but waste fuel such as paddy husk and groundnut shells will be found the most generally suitable type, and we hope, in due course, to demonstrate the utility of such an engine in Tanjore. In any case, charcoal is a light and bulky article, and the freight on it would be heavy. Its cost even now, I am told, is only Rs.32 per ton in Madras, and, if we are to dispose of our charcoal profitably, probably we must establish the factory as close as possible to the place where there is the greatest demand for it. It is doubtful whether a factory near Madras is feasible. For one thing, I find in a report by Col. Babington that, in a factory on the plains, distillation would be difficult and losses would occur both of Methyl Alcohol and Acetic Acid. Secondly, the continuous supply of 15,000 tons of Casuarina wood ^{per annum} anywhere near Madras would probably be an impossibility, at any rate without extensive and expensive plantation by the Forest Department. Most of the old Forest Department casuarina plantations have, I think, been sold to private parties in recent years.

5. It might be possible to get sufficient supplies of wood in a factory established nearer the sources of supply, or nearer Salem where, I understand that there is some proposal to work iron ore and where charcoal might be required. But unless the factory were near a place where a large charcoal demand exists, it would

probably be necessary to work up the charcoal and the tar bye product into some form of compressed fuel or briquettes.

Yet another point for enquiry is whether we could use for wood distillation only a single species, such as Eucalyptus or Casuarina, or whether we could use a mixture of the ordinary jungle trees one gets in a mixed forest. If the latter is the case, one part of the problem would be greatly simplified. In Messrs. Turnbull & Co's works in Glasgow, apparently any sort of wood is used, and laboratory experiments conducted by Mr. Lodge with various common Indian timber trees did not show a marked superiority in the Eucalyptus in Acetic Acid. The experiments now going on in the Indian Institute of Science may throw valuable light on this point. It seems to me to be one of primary importance for if we are confined either to Eucalyptus or Casuarina, ~~it would~~ ^{be necessary} ~~we should~~ first begin to form plantations.

6. It is clear therefore that the whole matter must be considered afresh and from different standpoints from which it was approached in 1907-09. I think myself that there is a case for enquiry. If Government agree, the Commissioner of Forests and myself might be asked to make a joint investigation into the subject.



Calcutta
6/11/16

9
Home (Est.) Depth

Please see Mr Innes' note on
pages 6 to 9 supra. For orders
as to the answer to be given to
the question.

8x
7.11.16.

[Handwritten signature]

draft answers submitted for consideration -
a/ The Government has read the article.
b/ The ~~former~~ ^{former} in charge of the Deputy Secretary
will be asked to investigate the ~~possibilities~~ ^{possibilities} of the
~~possibility in connection with the Commission~~
of ~~the~~ ^{the} ~~fact~~ ^{fact}

8.11.66

AE

Mr. Linn's note
on pgs 6 to 9 is interesting
and worthy perusal.
Dough and in pro
appl.

8/14

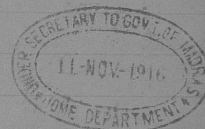
I suggest - Reply in this form: 10

(a) Yes.

(b) Without closer examination than has at present been possible, the Government are unable to express any opinion upon the paper referred to, but they hope to be able later to consider whether further examination of the subject may profitably be undertaken.

P
10.11.16.

JSC
11.11.16



120 Q.—(a) Has the attention of the Government been drawn to a very practical and instructive paper on wood distillation published in the special supplement of the *Madras Mail* of October 7, 1916, from the pen of Mr. Alfred Chatterton, O.I.E.?

Wood distillation in the Madras Presidency.

(b) Will the Government be pleased to direct the Department of Industries to submit proposals to Government with a view to stimulate indigenous enterprise in this direction?

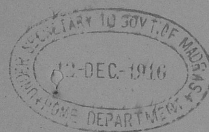
120 A.—(a) Yes.

(b) Without closer examination than has at present been possible, the Government are unable to express any opinion upon the paper referred to, but they hope to be able later to consider whether further examination of the subject may profitably be undertaken.

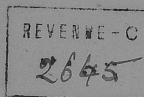
It is presumed that no further action should be taken at present as suggested in para 6 of Mr. Lines' note on page 9. The draft order is being sent to the Secretary to Govt. of Madras for his consideration.

7.12.16
7.12.16
7.12.16

The joint investigation may be approved
7.12.16



Ref. no 3771-3
12. 12. 16



Regd. 13.12. 1916

need to stop it
as right to do so
som
up



15/12

Rev. no. 2645 C116-1
15. 12. 16.

Will Rev agree to a
joint investigation as
proposed by Mr. Jones in
para 6 of his note at
page 9 supra?

W. ~~10/12~~

Rev. steps

To And: Re:

It is noted that the proposal of the
Home (Educ.) Dept may be accepted in
this Dept. That Dept will no doubt
circulate the case to the Hon. (Dorset) in
due course.

S. G. 12.16.
14

Home (E.) (10)

Mr. Jones' note suggests the need of information as to prices and demands in the English and European markets is very fragmentary and unreliable. This seems inevitable in the absence of more systematic methods of community facts of a commercial nature to the Indian Government by agencies in England and the Continent.

W. G. 12.16.

Box 77
Ans 3/1/17
Red

Home (Ed.) Department

A draft order is submitted for approval. It may be circulated to H.E. and H.M. (Forests)

SA
18.12.16.

HA
21.1.17

S.

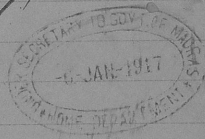
E.H.
22.12.16

D
3.1.17

P
4.1.17.

W.S.
5.1.17

[Handwritten signature]



Wood Distillation.

Communicating to the Commissioner of Land Revenue and Forests and to the ^(Officer in charge of the) Department of Industries a question asked by the Honourable Rao Bahadur Annamalai Chettiyar at the meeting of the Legislative Council held on the 21st November 1916 and the answer given thereto regarding ----- in the Madras Presidency and directing an investigation of the subject.

C. No. 3771.

O R D E R:-
MIS.

27 9 6-1-17.

Question 120 asked by the Honourable Rao Bahadur S. R. M. Annamalai Chettiyar at the meeting of the Legislative Council held on the 21st November 1916 and the answer given thereto regarding the institution of experiments in wood distillation in the Madras Presidency ^{in the} ~~to~~ communicated to the Commissioner of ^{Revenue} ~~Land~~ and Forests and ~~the~~ the Officer in charge of the Department of Industries with the request that they will make joint investigation of the subject and submit their recommendations to the Government.

To the Board of Revenue,
Land Revenue & Forests,
" Officer in charge of
the Department of Industries.

N.K.
21-12-16

with copy of
question & answer.

F.A.H.
22-12-16

Received
with
M.V.S.
21.1.17

3.1.17

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GREEN MANURES.**THEIR VALUE.**

The Indian Tea Association reports:—

All planters are firmly convinced of the value of green manuring, and the practice of treating annually, a large part of the total area of a garden with a green crop is now very generally recognised as a valuable piece of garden routine, but it is possibly not always the case that this form of manuring is done in the best way. In the cultivation of many crops other than tea it is customary to fertilise the field by means of a green manure, which is buried previous to the sowing of the crop, and this practice generally yields large increases; but there have been many cases where such a practice has led to substantial decreases in crop compared to the crop from unmanured check plots.

The Indian Tea Association published some years ago results of several experiments during which weekly pluckings from green manured and untreated check plots of tea were recorded.

The manures used were *Mati-kalsi* and *Dhaincha* (*Phaseolus* sp. and *Sesbania aculeata*).

The production of leaf in each of the many experiments showed, by the end of the season, a considerable increase in favour of the green manured plots. On reference to these figures, however, it will be noticed that the green manured plots were behind the check plots during the earlier portions of the experiments (1) while the green manure was growing, and (2) for a period of about one month after burial. We will consider separately the reasons for the falling off in yield during each of these periods and briefly discuss methods by which these losses may be minimised.

In these experiments a fairly quick growing crop was sown thickly and hoed in as soon as sufficient growth was obtained.

While green manures are growing at least one round of light hoeing is missed. The value of surface cultivation is well established by agricultural experience, and the loss of a round of hoeing no doubt causes appreciable loss of crop in tea cultivation.

In addition it is well known that the effect of one plant growing in the neighbourhood of another is always harmful. The obvious explanation of this is the competition for water and food; and there appears to be a further reason for this effect. It was shown at the Woburn Experimental Fruit Farm, and again at Pusa that if grass is allowed to grow round apple trees the bad effect is considerable. In the course of researches on this point it was shown that the mere washings from grass and other plants growing in trays were distinctly poisonous to plant life.

Of the factors mentioned water is the most important. In many of the reported failures of green manuring the causes has been shown to be that the green manure had lowered the moisture content of the soil sufficiently to affect the following crop. In the tea experiments the green manure generally has ample water during the rains for both tea and green manure plants, but the point should still be borne in mind and care taken not to leave a big crop standing during the cold weather, nor should a green crop be sown before the soil is thoroughly moist.

One is grappled with is the limitation of progress. It is to be regretted that little progress can be reported in this country. If anything can convince planters of the necessity of this country of the necessity of it ought to be the present state of affairs in Ceylon. I wrote in July about complaints that were being made by planters there of the enormous advances made by the Kanganies. One correspondent of the *Planting Gazette* declared the total indebtedness of coolies in island amounted to more than Rs. 20 lakhs, and that the greater part of it was hopelessly irrecoverable. He was of opinion that the only remedy was liquidation which would clear the entire population of debt and prevent them getting into debt again. There has been an immense amount of correspondence then in the Colombo papers on the subject. The controversy has been chiefly between those who advocate a further attempt at limiting advances by agreement with planters under the rules of the Ceylon Labour Federation and those who say that no agreement could be made without legislation to enforce it. An actual instance of the kind of thing is going on is furnished by a case reported in the *Times of Ceylon*, which was fought by a planter to recover Rs. 6,276. The merits of the dispute do not concern us. What matters is that a "tundu" was given to a Kanganian, allowing him and his

CONDITIONS OF SUCCESS.

Our problem then is to get a large weight of green matter in a short time, and this may be done by paying attention to five points:—

1. *Choice of plant.*—On this first point much work has been and is still being done by this Department, by the Agricultural Research Institute at Pusa, and by the Scientific Staff attached to Provincial Governments. Perhaps the best plants at present known for this purpose in the case of tea are Cowpeas (*Vigna catianga*) Sann hemp (*Orotolaria juncea*) and Dhaincha. (*Sesbania aculeata*) and, for the Darjeeling district Bhotmas or Soy Bean (*Glycine hispida*).

2. *Choice of season for sowing.*—A sufficient supply of water and a suitable temperature are of course necessary for rapid growth. The conditions in these respects are generally satisfactory in the tea districts at the beginning of the rains.

Late sowing will usually be found to interfere seriously with plucking because either the green crop or the plucking will have to be neglected and so it is advisable to sow as early as moisture conditions will allow.

3. *Preparation of the seed bed.*—should need little comment. The land, of course, should be clean to give the green crop a good start and so reduce the competition with jungle; and the surface should be as well pulverised as the coolies can be induced to make it. The seed should be lightly covered and with earth after sowing.

4. *Manuring.*—It is not suggested that it would always pay to manure simply to obtain increased growth of green crops; but since all the manurial substances used by the green crop are returned to the soil for the use of the tea when the green crop decomposes, care may be taken where possible to choose, as the sections on which green crops are to be sown, those on which it has been decided to apply artificial manures, and we are inclined to think that this combination of the use of artificial manures and green crops is the soundest method of manuring of tea.

It often happens, however, that just those soils which urgently require organic matter will not grow a green crop unassisted. In such cases the soil must be specially manured for the sake of the green crop. The particular manures necessary will, of course, depend upon the soil, but attention may be drawn to one or two points of general application.

Treatment of the soil with lime and phosphatic manures will practically always assist the growth of leguminous plants, and potash very frequently does so. Light dressings of nitrogenous manures may be necessary to start growth, but part of the work expected of a green crop is to gather nitrogen from the air, and it will do this to a smaller extent if the soil is already well supplied with available nitrogen. Cattle manure even in light dressings often has a remarkable effect in promoting the growth of green crops when other manures fail, probably because it provides a favourable environment for the beneficial bacteria which are frequently lacking in the infertile soils under consideration.

Since a green crop will require to use them at once all manures for the purpose of assisting a green crop should be in readily available forms. The cattle manure should be well rotted previously. Fresh organic manure hinders germination.

5. *Choice of time for hoeing in the crop.*—The time for hoeing in will in general be when

neighbouring tea is as little as possible, and it will not greatly interfere with cultivation. If these hedges or clumps are cut at intervals immediately before a light hoe, a large weight of green material is added to the soil during a season. This is an excellent method of green manuring and often adapts itself to labour conditions more easily than the use of a quick growing crop which must be hoed in as soon as ready. It has additional advantages compared with those obtained by the use of sun trees. Its light shade, and the action of its roots in breaking up the soil may be beneficial, although the roots may not be very deep. On inefficiently drained land it may even help the tea by assisting to dry out the soil. Apart from prunings useful manure is supplied by falling leaves and seeds.

"RIGGING" THE TEA MARKET.**A DENIAL.**

At the quarterly meeting of the Co-operative Wholesale Society in London, the Chairman (Mr. G. Thorp Dewsbury) declared on behalf of the directors that there was no truth in the allegations that the tea market had been "rigged" by that Society. On behalf of the Society he expressed surprise that a Government department should have "been persuaded to associate itself with a campaign of calumny that had proved to be an entire failure." With regard to the alleged over-buying which led to an "unfair and futile" raid upon their great tea warehouse, the official reply states that the Co-operative Wholesale Society is the biggest tea dealer in the kingdom, and adds that in the autumn of 1915, by taking away the business from the selling brokers, the price of tea was reduced from 11/6 in August to 8/6 in November. The Tea department bought during the period mentioned in the accusations only 45,000 lbs. more than was purchased in the same period of 1913, whilst sales had, in the meantime, increased to the extent of 2,400,000 lbs.

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The foot of the Coorg Ghat to Cannanore. A railway that would run through its southern taluqs to Shoranur would be almost certain of the Board's support. Mr. Richards' suggestions, which may be assumed to be those of the Railway Board, are to build several short lines on the Mysore-Wynaad plateau linked up with the Mysore Railway and giving an outlet on the East Coast via Bangalore. The Wynaad line would connect Coorg with Manantoddy and end there. Mr. Richards intends to visit Manantoddy, when he will understand how little support this scheme is likely to obtain from planters. Anything beyond the above, such as a connection with Meppadi, or a railway to the coast down the Western Ghats, were spoken of as, perhaps, to be built "eventually." The delegates at the meeting made it perfectly clear that they would not be led away from their own proposals. Their cause is a good one, and ought to prosper. The Madura-Bodinaikanur Railway is in a different position. The money for it is ready, and construction is likely to be begun if the District Board agrees with the resolution that was passed.

THE LATE MR. LAMPARD.

Mr. Lampard was well known among planters in Southern India, where his firm has large interests, and his death will be generally regretted. He had been in poor health for a long time, but his sad end was quite unexpected.

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WOOD DISTILLATION.**ITS ADVANTAGES.**

BY ALFRED CHATTERTON, F.C.G.I., C.I.E.

IT SEEMS DESIRABLE TO ONCE AGAIN DRAW attention to the advantages to be derived from the establishment of the dry distillation of wood as a primary industry in India, the products of which will be of great value to existing industries or will serve as raw materials for new industries. Nearly ten years ago, I first submitted proposals on the subject to the Board of Revenue in Madras, the only practical result of which was that ten tons of casuarina wood were sent to England to be tested by expert distillers to determine the yield of charcoal and the value of the pyroligneous acid. About the same time, but independently, Major (now Colonel) Babington, R. A., the Superintendent of the Cordite Factory, proposed to subject the Blue gum, which grows so freely on the Nilgiris, to dry distillation to obtain acetate of lime for conversion into acetone, an essential reagent in the manufacture of cordite. He also sent to England ten tons of wood for similar tests, and it may be convenient to present the results of both sets of experiments in the following tabular statement:—

		Blue gum, Nilgiris.	Casuarina, Nellore Dist.
Charcoal	per cent...	35.0	30.0
Acetate of Lime	" "	5.42	5.2
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My object in proposing that the Government of Madras should start a wood distillation plant on the banks of the Buckingham Canal to the north of Madras was primarily to obtain for suction gas plants a cheap supply of good charcoal, the cost of which would be reduced by the sale of the bye-products. Major Babington only wanted acetate of lime, and regarded the charcoal as a bye-product. Obviously, the two schemes could be and were combined; but our joint efforts failed to impress the commercial men of Madras to whom they were referred, and we only succeeded in eliciting a very strong protest against Government taking any action in the matter. The information collected on the subject of wood distillation was made public, and private enterprise was invited to take up the industry; but, naturally, to the invitation there was no response. In those days few thought it was necessary to prepare for the possibility of a war with Germany, even to the extent of rendering India independent in such an important matter as acetone for the Cordite Factory, which was at that time mainly obtaining its supplies from Germany. Further, the European commercial community was then bitterly opposed to Government entering the industrial field as a pioneer of new industries, and the doctrine of *laissez faire, laissez passer* was still regarded with reverence, and the growth of sea-borne trade was accepted as an infallible indication of the moral and material progress of the country.

Forest Department. The data of *Englishman* describes this as "an such contracts could be equitably first of rhetoric without facts." We not exist, and only practical experience it at that. Then the *Evening* wood distillation under Indian control up the subject, and attacked will provide them. The establishment of tea broker and the Co-operative industry new to the country involve wholesale Society who were alleged gain amount of risk due to the possibility of being buying recklessly at any price some factors may have been overlooked object of cornering supplies. It wrongly estimated. This risk is willing to do thing that nobody appears to when success on a small scale will damage the British Treasury which the promoters of the enterprise to solid shilling per pound on all tea it with the elements of risk eliminated, for the rise in price.

NEUTRAL IMPORTERS

the case of wood distillation, the NEUTRAL IMPORTERS will have to face the risks with the or these controversies there came the that they will not enjoy this reward on all shipments to Holland, viously, they can only start on a small and Sweden. This is said to and without any prospect of obtaining for the recent drop in prices. It even for a limited period, any sort of though the embargo was necessary. poly, and the greater their success into these countries from the more rapidly will competition develop Kingdom for the first seven months

The successful introduction of wood amounted to nearly 17 million lbs., stillation in India will greatly increase 10 millions in the same period value of the forests, will provide 15, and only 6 millions in 1914. materials of prime importance from India is a tea-drinking country, and tary stand-point, and will greatly have been hampered by the difficulty use of small power plants in those of getting tea from her own colonies of the country where coal is expensive which would account for some of the present time a very large amount increase. But there appears to be industry is dependent upon power supply that a great deal was passed on by oil engines worked with kerosene many. If the prohibition is effective liquid fuel, and the bulk of these enemies will have to mortify their duties is imported from abroad. developed taste for tea, and, as their have already risen and may rise still of coffee are said to be exhausted, and there is no assurance that they ed to finish the war on beer. The later the supplies may not altogether investigations of the British Army or that prices may reach such a level. Some trenches show that there is seriously handicap power users. It of that left. When victory crowns be wise, therefore, to encourage the ms your prohibitionist correspond- gas engine and suction gas plants, still, no doubt, point the obvious moral, can easily be done by providing plenty the cruelty of the measure must cheap supplies of charcoal. To obtain to them to equal many German advantages, it is worth while for them.

to experiment on the manufacture of them drink beer, the British statesman coal by the modern method of wood. they drank the poison and their spirit died. stillation. The forests of the country by drank the poison and their spirit died. to the State, and if full advantage while the British planter is left to taken of the fuel supplies which the de with a falling market, the re-awaken- wood distillation must be resolutely ticism of his brokers on the badness It is, of course, possible for Govern tea and the extortions of the ship- to grant such concessions to private re is no business in the world that duals as would make the pioneering ally carried on at a smaller margin distillation an attractive proposition than the planting industry. There is would be somewhat of the nature of periods of prosperity which generally bargain between Esau and Jacob where speculation in the home markets former sold his birthright for a mess of pottage. collapse. Certainly with regard to and tea the present margin is a very one. There is a probability of prices for tea later in the year. The and Java exports to the United m seem certain to be lower than ar. Those from India and Ceylon obably be less. With regard to as long as the war lasts the great s of Central Europe are closed to duer.

ESTIMATED RESULTS.

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LABOUR PROBLEMS.

There has been little written about labour in India during the past few years, though there are many local complaints of shortage of coolies. Mr. Martin, Director of the U. P. A. S. I. Labour Commission, gave a very interesting address at Bangalore meeting, and was able to report a satisfactory increase of the bing acreage. He has had many difficulties to contend with in the last year, and lost two of his best Superintendents. The outstanding question that

gang of 40 coolies to take work elsewhere on payment of the above sum. It came out in evidence that some of the gang were children of ten years of age. Nevertheless, the planter who got the "tundu" agreed to pay the money for them, and actually gave a cheque. This works out at more than Rs. 150 a head. There was a dispute as to whether some of the coolies were really members of the Kanganis gang. But the plaintiff declared that the trouble was that the coolies refused to leave the estate they were on till their "kaddie debts" (i.e., the money they owed to local bazarmen) were paid, and that their purchaser declined to find the money for this. This question of bazaar debts, or "sillary kadan" as they are usually called in Ceylon, is the rock on which any attempt to free the coolies is likely to be wrecked. The amount was not stated in this particular case, but it was probably large. One correspondent mentioned an instance where, having paid Rs. 4,000 on a "tundu" to clear what a Kanganis owed to the estate, he had to pay another Rs. 3,000 for "sillary kadan" before he got the coolies.

It has not taken so very many years for this reckless system of advancing to grow up in Ceylon. Affairs are speeding up, and if nothing is done, we may soon be in the same position in South India. On the 8th September a special meeting of the Ceylon Planters Association was held in Kandy to decide whether planters were to ask for legislation or not. The Chairman announced that a Committee of the Association and the Proprietors Labour Federation had discussed the subject. As a result, a sub-committee had been appointed to "draw up concrete proposals as to the form of legislation that it is recommended should be submitted to Government." Proprietors now wished for the opinion of their managers. The subsequent proceedings were animated; the opponents of legislation were given a hearing, but the result was evidently a foregone conclusion. Some speakers complained that they were asked to vote for legislation without knowing what form the legislation was to take. That objection was brushed aside, and the meeting decided to ask Government to pass the draft ordinance. The fact is that the nature of the draft is supposed to be confidential. A speaker at the meeting of the Pussellawa Planters Association (*Ceylon Observer*, 4th September), which was held a few days before the Kandy meeting, said that the proposed law would make advances absolutely irrecoverable either direct, or through a second or third party, and would make illegal the use of any document known as a "tundu."

There were a few "minor but still important items," such as the compulsory registration of all immigrant Tamil labourers in the Island and Tulikans (Mahomedans) as well. The Chairman subsequently remarked that they would be able to bind the coolies down for three years. The first speaker considered that if Government accepted the draft, "the labour problem would at last be solved." He, however, doubted if Government would ever legislate solely on these lines. One stumbling block was the case of the solvent Kanganis whose coolies owe him more than he owes the estate. He is apparently to be given three or four years to settle his affairs, during which

Government would allow their own subjects. It is not necessary to enlarge upon that. The perusal of the Madras Planters Labour Law provides sufficient commentary.

THE U. P. A. S. I. MEETING.

The plan introduced by the Chairman, Mr. Browne, of first talking over the various items of the agenda paper in Committee had a good effect in preventing the occasionally discursive debates of former years and the confusion caused by having to constantly go into Committee in the middle of a discussion. It, however, led to the curtailing of the report published in the press. Those who were not present will have to wait for the publication of the book of proceedings, which will, I hope, not be long delayed, for a full account of what occurred. The Director of Agriculture, Mr. G. A. D. Stuart, was present, and the statement he made about the intentions of Government with regard to the Association's Scientific Department were very satisfactory. Though the additional staff cannot be appointed during the war, the experimental stations are to be begun, and everything ought to be ready for work when peace returns.

The position with regard to the railways that planters have asked for is not so cheerful. The recent news that the Dindigul-Palghat railway is not to be proceeded with is disappointing, though of course, the delay is only temporary and owing to the difficulty of raising capital during war time. There are two railways about which, as the Hon'ble Mr. Barber said, planters are tenacious, the Hassan-Mangalore and the Manantoddy-Shoranur lines. Both have the support of the Madras Government. The Mysore Government, who will have to pay for the more difficult section of the first line, have expressed their willingness to proceed with the work, the South Canara District Board is taxing itself to provide for the portion in British territory. The Manantoddy-Shoranur Railway would, undoubtedly, pay a good return on the cost of its construction, given a harbour at Cochin, which seems a certainty in the near future. You have strongly advocated both these lines, and, as I have said the Madras Government want them constructed. I do not think I could add anything to the arguments that have been advanced in their favour. Mr. Richards, the Engineer-in-Chief, Mysore and the West Coast Railway Survey, read a note at the meeting, which, to put it plainly, threw cold water on both the schemes. He is the representative of the Railway Board, and what he said should be carefully studied by planters. He was fully reported at the time in your columns. The Railway Board is not the Government of India, but it is its expert adviser, and its recommendations take some getting past. But, shortly, Mr. Richards is in favour of first linking up the Coorg Province with the existing railway. A line from Siddapur to Mysore is likely to be begun soon. Wynaad is recommended to follow the example of the Coorg District Board and find money for a Coorg-Manantoddy Railway. As for that, Coorg is a province, Wynaad is a taluq of Malabar. The Malabar District Board will not tax itself to provide a short length of railway on a plateau 3,000 ft. above the coast. It refused to find money for the part of the railway that it was proposed to run from

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Forest Department. The data on which such contracts could be equitably framed do not exist, and only practical experience of wood distillation under Indian conditions will provide them. The establishment of an industry new to the country involves a certain amount of risk due to the possibility that some factors may have been overlooked or wrongly estimated. This risk is willingly faced when success on a small scale will enable the promoters of the enterprise to develop it with the elements of risk eliminated. In the case of wood distillation, the pioneers will have to face the risks with the certainty that they will not enjoy this reward. Obviously, they can only start on a small scale and without any prospect of obtaining, even for a limited period, any sort of monopoly, and the greater their success, the more rapidly will competition develop.

The successful introduction of wood distillation in India will greatly increase the value of the forests, will provide certain materials of prime importance from a military stand-point, and will greatly facilitate the use of small power plants in those parts of the country where coal is expensive. At the present time a very large amount of industry is dependent upon power supplied by oil engines worked with kerosene oil or liquid fuel, and the bulk of these commodities is imported from abroad. Prices have already risen and may rise still higher, and there is no assurance that sooner or later the supplies may not altogether cease or that prices may reach such a level as to seriously handicap power users. It would be wise, therefore, to encourage the use of gas engine and suction gas plants, and this can easily be done by providing plentiful and cheap supplies of charcoal. To obtain these advantages, it is worth while for the State to experiment on the manufacture of charcoal by the modern method of wood distillation. The forests of the country belong to the State, and if full advantage is to be taken of the fuel supplies which they contain, wood distillation must be resorted to. It is, of course, possible for Government to grant such concessions to private individuals as would make the pioneering of wood distillation an attractive proposition; but it would be somewhat of the nature of the bargain between Esau and Jacob when the former sold his birthright for a mess of red pottage.

ESTIMATED RESULTS.

Wood distillation may, therefore, be taken as a typical industry which it is justifiable for Government to pioneer, and we may proceed to briefly enumerate the results likely to accrue from the introduction of this method of dealing with part of the fuel supplies which are grown in this country. Ordinarily, charcoal is made in heaps on the ground by a method as simple as it is wasteful. The yield from the wood is generally less than 20 per cent., and everything else is lost. By subjecting the wood to dry distillation in closed retorts or kilns, the volatile products, gas and pyroligneous acid, are saved and passed through a water-cooled condenser, while there remains in the kiln charcoal equal in weight to from 25 to 40 per cent. of the original wood. The condenser separates the pyroligneous acid and tar from the incondensable gases, which are of some heating value and can be burnt

the wood may be employed, and, if so, it will amount to about 50 per cent. of the wood carbonised. From 15 tons of wood, by the primitive process of charcoal burning, 3 tons of charcoal worth Rs. 75 may be obtained, while by wood distillation, the total value of the products calculated at pre-war rates is Rs. 257. In 1908, it was estimated that a factory dealing with 11,200 tons of wood a year would cost Rs. 4 lakhs, and that the working expenses would be Rs. 12.8 per ton of wood carbonised, to which would have to be added the cost of transport and the cost of marketing the goods. On the assumption, the worst possible, that all the acetate of lime and all the methyl alcohol was sent to England for disposal, the annual profit was estimated at 13 per cent. on the capital outlay. At present prices and allowing for the enhanced rates for freight, the annual profit would be at least 50 per cent. A recently prepared estimate for the production of 20,000 tons of charcoal a year, to be used in the manufacture of charcoal iron, amounts to Rs. 18 lakhs, and with wood at Rs. 3 per ton at the site of the factory, and, taking credit at the rate of Rs. 20 a ton for the charcoal, the net profits at normal prices for the bye-products are estimated at Rs. 3,40,000, or nearly 19 per cent. on the capital outlay. Doubling the price of the wood reduces the profit to Rs. 1,40,000, or, roughly, 8 per cent. on the capital outlay. The crux, therefore, of wood distillation is the cost of the wood. On the Nilgiris, Blue gum plantations will yield wood at a cost of Rs. 3.8 a ton, and casuarina can be grown on the Coromandel Coast for about Rs. 3 per ton, while in natural forests, the cost of the wood is the cost of felling, extraction and transport. On a sufficiently large scale and by employing light railways for transport, these charges can be kept within Rs. 2.8 a ton. Many forest reserves would be greatly improved by systematic felling, but it is impracticable to so treat them as there is no market for the timber. Vast areas of waste lands and forest reserves might be covered with fuel plantations; but for firewood, except for domestic purposes, there is little demand. Yet in large towns it is usually inordinately expensive, and no steps are taken to establish public fuel reserves. Madras is greatly handicapped by the insufficient areas under casuarina within a reasonable distance of the city, and its industries suffer greatly from the high cost of fuel. With casuarina wood at Rs. 4 a ton, wood distillation would provide charcoal on the spot at about Rs. 15 a ton, and such charcoal, used in suction gas plants, would generate electric energy at a very low cost. With cheap salt obtained from the pans at Ennore and with abundant supplies of pure lime in the Pulicat lake, it will then be possible to start the manufacture of alkalis by electrolytic methods.

BY-PRODUCTS.

Allusion has already been made to the proposal to manufacture charcoal iron, and it will not be difficult to extend industrial development in the future when once a serious attempt is made to remove the disabilities under which we labour in the south of India due to the distance from the sources of mineral fuel.

The Madras Mail.

Agricultural and Industrial Supplement.

SATURDAY, OCTOBER 7, 1916.

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AGRICULTURE AND SCIENCE.

PLANT BREEDING.

ONE OF THE FEATURES OF WHAT MAY BE called modern agriculture has been the rapid advances which have been made with the improvement of crops and animals, and the success which the plant and stock breeders have obtained. On all sides now-a-days one hears of improved strains of plants, disease resistant, and producers of heavy yields or special qualities, and improved strains of animals for farm, dairy and market. The famous new wheat raised by Biffin in England, Burbank's many fruit novelties in America, the Pusa wheat, the Tinnevely Company No. 1 cotton, and the sugarcane work at Coimbatore in India are familiar examples of what has been done along these lines, or of what is being done. Each year more and more attention is being paid to this side of scientific agriculture, and men are beginning to look forward to a time when by selection and plant breeding and by intensive cultivation crops will be raised on an acre which it now requires ten acres to produce.

MENDEL'S LAW.

The rapid advance in this work was rendered possible by the discovery and re-discovery of what is commonly known as Mendel's Law, a law so much quoted in modern scientific literature and yet so little understood that it may be of interest to readers of this Supplement if it is explained here in some detail. Mendel was a monk at Brunn, who first carried out scientific experiments in plant breeding, and he discovered as a result of his work a definite law of relationship between the characters produced in the offspring of plants and animals produced by mating known characters in the parents. His work was published in an obscure publication and lost

character. Thus in our example coloured flowers are dominant and white flowers recessive. The next step was to produce a second generation of plants from these hybrid offspring by allowing them to become self-fertilised. On sowing the seeds thus produced we find that in the second generation the two contrasted characters of the parent plants re-appear again, and though all the hybrid parents bore coloured flowers, their offspring have both coloured and white flowers, but at the same time a remarkable fact becomes plain, that the coloured and white flowered peas of this second generation bear a numerical relation to one another. There are always three coloured to one white flowered pea. That is to say, in the second generation there are three plants with the dominant character to every one with the recessive character. The third step was to raise another generation of plants from each of the members of this second generation by self-fertilising them and raising plants from the seeds produced. When this is done another remarkable fact comes to light. All the plants raised from the white flowered peas in the third generation have white flowers, and they continue to do so ever afterwards when selfed or bred among themselves. Thus by starting with two parents originally with contrasted flowers we have arrived in the third generation at a pure strain of white flowered peas.

These laws hold true for any pairs of contrasted characters, however many there be. Thus, suppose we cross, to begin with, a tall pea bearing coloured flowers with a dwarf pea bearing white flowers, we have two pairs of contrasted characters, tallness and dwarfness, and coloured and white flowers. In the first generation we shall find that all the hybrid peas are tall with coloured flowers. Coloured flowers we have already discovered are dominant to white flowers, and tallness, we now find, is dominant to dwarfness. Now in the second generation we are prepared for what will happen. We shall get coloured peas and white peas in the proportion of three to one, and tall peas and dwarf peas in the proportion of three to one. The smallest number of plants in the second generation which will show all these characters is twelve, and they will be divided in the following proportions, nine coloured tall peas, three coloured dwarf peas, three white tall peas, and one white dwarf pea. This ratio of 9:3:3:1 is true of any two pairs of contrasted characters. The more characters which are contrasted, the more complicated does the problem become, but the law of proportions always holds true. When we come to deal with a plant like a coffee-tree, for instance, it will be realised what a complicated business it is with all the pairs of con-

trasted characters. Thus in our example coloured flowers are dominant and white flowers recessive. The next step was to produce a second generation of plants from these hybrid offspring by allowing them to become self-fertilised. On sowing the seeds thus produced we find that in the second generation the two contrasted characters of the parent plants re-appear again, and though all the hybrid parents bore coloured flowers, their offspring have both coloured and white flowers, but at the same time a remarkable fact becomes plain, that the coloured and white flowered peas of this second generation bear a numerical relation to one another. There are always three coloured to one white flowered pea. That is to say, in the second generation there are three plants with the dominant character to every one with the recessive character. The third step was to raise another generation of plants from each of the members of this second generation by self-fertilising them and raising plants from the seeds produced. When this is done another remarkable fact comes to light. All the plants raised from the white flowered peas in the third generation have white flowers, and they continue to do so ever afterwards when selfed or bred among themselves. Thus by starting with two parents originally with contrasted flowers we have arrived in the third generation at a pure strain of white flowered peas.

WHEAT EXPERIMENTS.

One of the coloured peas in the second generation, be it noted, also contains only pure germ cells carrying colour, and this will also breed true producing only offspring with coloured flowers, but it is impossible to know which it is or distinguish it by external appearance from the plants bearing coloured flowers, but having the two kinds of germ cells and the power of producing white flowered peas in the next generation. As an example of the value of the knowledge of Mendel's Law to the plant breeder we may take the case of wheat. For a great number of years agriculturists have been endeavouring to improve British wheat, and they have affected a great number of crosses without making any very marked progress, because they had no guiding principle to go upon. When the problem was attacked in the light of Mendel's Law, however, it was quickly solved. British wheat is particularly liable to be attacked by a fungus known as rust, but there are certain kinds of American wheat which are not liable to attack by this fungus, which are resistant to it in fact. These two kinds of wheat were crossed by Biffin. The resulting hybrids were all attacked by the rust, so badly in fact that he had great difficulty in raising enough seed from the hybrids to carry on the experiment to the next generation. The susceptibility to the disease was, in fact, a dominant character and immunity a recessive character. The next step was easy once a second generation could be raised, since, according to Mendel's Law, a quarter of the plants in the second generation would bear the recessive character, immunity, and these would breed true among themselves and produce immune plants. At the same time the large-eared grain of the British wheat was found to be

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All the above are grown on young gardens under European supervision, in a District, that is noted for producing teas of fine quality.

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VENTILATION.

ITS EXTREME IMPORTANCE.

ONE OF THE SUBJECTS TO WHICH GREAT attention is being paid at the present time is ventilation. The extreme importance of ventilation, both as regards the well-being and the output of work of human beings, has, of course, long been recognised, and has been given expression in the laws relating to factories and work-rooms. It is only recently, however, that the real reason of its significance has been discovered. During the last two or three years, English physiologists have shown that the principal factors which make for comfort are temperature, humidity and air movement, and that alterations in the chemical composition of the air or the presence of volatile organic poisons, formerly considered to be all important, have no effect. The latter are generally not enough in amount to produce the ill-effects known to proceed from ill-ventilated rooms. Air-movement, in addition to its cooling effect on the body, exerts a stimulating effect on the nerves of the skin, and a large part of the beneficial effects of punkhas and electric fans must be attributed to this cause. The subject has now been taken up by the New York Commission on Ventilation. The Commission, in the main, with the findings of the scientists, but is inclined to attribute some of the effect to the chemical composition of the air. The subject is still being investigated, and it is hoped that the publication of the results will be of direct benefit to all workers in factories, offices and similar places of employment.

SOIL AERATION.

Simultaneously with the investigation of the effect of ventilation on human workers, the question of an adequate supply of air for the roots and plants—soil ventilation or soil aeration—has attracted much attention. As is so often the case in scientific work, this aspect of the growth of plants, after being ignored for many years, has recently attracted the interest of several investigators working quite independently of one another. The simultaneous independent discovery by two or more observers of facts which have long been overlooked, is a curious phenomenon in the history of science, the most notable example being the enunciation of the theory of the origin of species by both Darwin and Wallace.

It has, of course, long been known that the roots of plants respire. Oxygen is absorbed by the active cells, and carbon dioxide is given out. What, however, has not been realised is the supreme importance of an adequate supply of air, for the development of the roots themselves, and consequently for the growth of the whole plant. Experiments recently carried out in England by plants growing in water showed that with continuous aeration the root-development was at least three times as great as when a single daily aeration was given. The growth of the green part of the plant was in proportion. Thus it is obvious that roots require not the presence of air, but continuous gaseous interchange between the soil and the atmosphere. The need of air for the respiration

of the above experiments, it is easy to see that the maximum outturn will not be obtained from the soil unless the requirements of the roots as regards air are considered in addition to the supply of water.

Many interesting examples could be quoted to show the connection between aeration and well-being of crops. The instant response of tobacco, flowers and vegetables when the surface crust is broken must be well known to most garden lovers in India. Very significant also is the distribution of the gram crop. This leguminous crop is only cultivated to any extent where good aeration of the soil is possible. Perhaps, the most interesting are the cases in which the diseased condition of plants has been shown to be simply due to want of air. Thus in Quetta, in the case of the peach and other fruit trees, the foliage is apt to turn very yellow after which the tree slowly dies, a branch at a time, with every sign of disease. The whole trouble has, however, been shown by experiment to lie in want of air for the roots. Once this condition is removed the plant recovers. Another interesting example is the case of indigo wilt in Behar. Indigo is a leguminous plant, absorbing nitrogen from the air by the nodules on its roots. The monsoon conditions of North Behar, by cutting off the air supply, kills these nodules, and the plant is starved. Another most interesting case of the connection between want of aeration and disease is given in two papers published by the Forest Department. The *sal* forests of North India are a valuable asset to the country, and much attention has been paid to their maintenance and reproduction. The growth of the seedlings is, however, most unsatisfactory, many dying each year, and the rest forming but feeble growth. By a large number of most painstaking and conclusive experiments, the main factor influencing this has been shown to be soil-aeration.

RICE.

So far we have been considering only crops which are not aquatic. The question of the rice plant, one of the most important crops in India, has, however, also received attention. Several important papers dealing with this question have been issued by the Agricultural Department, and it has been shown that in swamp rice the plant obtains its oxygen from the algae which live on the surface of the ground. The algae which form the green film on the surface of a rice plot decompose the carbon dioxide of the air, and give out oxygen, which, dissolved in water, is slowly carried through the mud in which the rice is growing. In ordinary rice, the highly oxygenated rain water is one of the aerating agencies. A little drainage is required in all cases to move this aerated water over the rice roots.

The necessity, if a maximum crop is to be obtained, of an ample supply of air for the roots having been demonstrated, there remains the question of the means to be employed. Drainage, improved methods of cultivation and the addition of aerating agents to the soil are the most important. Among aerating agents, farm-yard manure and green manure are most commonly used. Part of the beneficial effect of the addition of such substances lies in the improvement of the tilth they produce, that is, in the porosity of the soil. It has been suggested

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Letters to the Editor.

East India Chocolate and Cocoa.

Sir,—In the interests of the East India Chocolate and Cocoa Factory, Mr. N. S. Sardesai and myself are endeavouring to make our Chocolate and Cocoa Factory sufficiently remunerative to maintain and conduct the only establishment of its kind in India. But an import duty of 7½ per cent. on Cocoa Beans which we have to import from Ceylon is a severe handicap. Considering that, with our own exception, there is little or no demand for Cocoa Beans in India, as also that the planting and selling of Cocoa Beans is not an Indian industry, and, moreover, that the beans imported are not from a foreign country, but from a country whose interests are very much in sympathy with those of India, I cannot conceive the object nor the wisdom of imposing a tax, which seriously hampers a small but promising and very desirable Indian industry to no material end, so far as the swelling of the Indian revenue is concerned.

I have petitioned the Industries Committee of India, presided over by Sir Thomas Holland, but, so far, without result. I, therefore, should feel greatly obliged to you if you would kindly give the matter the benefit of publicity in your columns. Surely it would be better for the Government to encourage such an industry than to seek to make a paltry revenue on the produce of Ceylon—the more so, as owing to difficulties of Home supplies Chocolate and Cocoa are much in demand for the use of our troops here in India.

Cocooner.

J. E. DONNISON,

The East India Chocolate & Cocoa Co.

AGRICULTURAL EXPERIMENTS

ELIMINATION OF ERRORS.

Mr. A. C. Dobbs, Deputy Director of Agriculture, Bihar and Orissa, writes in the *Agricultural Journal of India*:—

Having had occasion recently to collate the results of a large number of field experiments conducted throughout India, and having had some difficulty in drawing anything but vague general conclusions from them, it occurred to the writer that a plea for more scientific planning and execution of such experiments might not be out of place.

The Rothamsted experiments seem to have been taken perhaps too much as a model on which experiments in India should be planned rather than as supplying a basis of information to be utilised in devising experiments more particularly suited to Indian conditions.

The information provided by the Rothamsted experiments is of two kinds, relating, firstly, to the reaction of the Rothamsted soil, and of the crops grown there to different manurial applications, and, secondly, to the wider subject of field experiment generally.

Little need be said about the first of these aspects except as regards certain limitations to the direct application of the results to conditions other than those under which the experiments were tried.

These results have proved that the application of manures containing nitrogen and the elements found in plant ashes, in quantities of the order of magnitude in which these elements are removed in crops, has a marked influence direct or indirect on the production of crops.

They have shown also that by a continued application of a manure complex in all but one of the important ash elements, the productive capacity even of land that contains enormous reserves of that one element may, by the removal of the crops grown, be reduced, in a comparatively small number of years, to very much below normal. And they have shown how rapidly nitrogen may be accumulated by the growth of leguminous crops, provided that a moderate supply of these ash elements in a soluble condition is maintained.

But while a foundation for local investigation of, and it was only years afterwards that it was re-discovered and its immense value and importance realised. Mendel's method was to select two individual plants which differed in some well-marked character such as height, colour of the flower, shape or size of the seed, and cross these two, sow the seeds produced, and study the plants raised from these seeds. The problem which presented itself for solution was when the parent plants show a marked difference what will the offspring be like? Will it be like one of the parents, and if so which? Or will it be intermediate between the two? Obviously it cannot be both. This, then, is the problem which Mendel set himself to solve, the Law of Inheritance in hybrid offspring, the laws governing the resemblance between parents and offspring. Let us take an example, and as Mendel experimented very largely with peas let us consider the case of two pea plants, one of which has coloured flowers and one of which has white flowers. Here are two contrasted characters, if these two peas are used as parents what will the flowers of their offspring be like? When such an experiment is tried, it will be found that all the offspring resulting from the seeds produced by the cross have coloured flowers and none of them ever have white flowers. Mendel called the character which asserted itself in the first hybrid generation the dominant character and the character which apparently disappeared the recessive

characters, but by keeping steadily to the characters wanted and breeding these and selecting from each generation accordance with the laws of Mendel those which contain the elements at we are aiming much can be done. case the time factor is the controlling since there must be a period of four years between each new generation. Now what is the explanation of all We know that when fertilisation place it is the union of two germ cells according to Mendel, a germ cell is purely dominant or purely recessive; never be partly one and partly the other. As the character of the plant resulting the union of two germ cells depends character of these germ cells, it follows the first generation, the hybrid plant resemble the dominant parent, and a pure pea crossed with a white pea produce a pea with coloured flowers as offspring. But this hybrid offspring with coloured flowers now possesses kinds of germ cells, and so its offspring be of two kinds. All the possible white these two kinds of germ cells unite four only; a germ cell carrying colour unite with a similar germ cell, a germ carrying white may unite with a one, a germ cell carrying colour may with a germ cell carrying white, a germ cell carrying white may unite one carrying colour, the two last combinations producing the same result. Hence

Looking through a large number of experiments it appears that while much labour has been spent on testing the commoner commercial manures, comparatively little has been done on attempting to get the most out of the by particular study of its constitution and reaction to special treatment.

Moreover the special value of leguminous crops as subjects for experiment under the conditions just described, hardly seems to have been taken into account in designing experiments in India.

Another limitation, and possibly a very important one, to the utility of the particular results obtained at Rothamsted in designing experiments in India, is the fact that chlorine and sulphur are supplied in exacting the demands of crops at Rothamsted rain; owing perhaps to the comparative proximity of the sea, and to the large consumption of coal in England, and to the distribution of the rainfall. The writer is not aware of any published figures relating to this point in India, but recent experience at Ranchi of the very remarkable effect of small quantities (10 to 40 lb. per acre) of sulphur, and of gypsum, on groundnuts, indicates that sulphur at any rate may sometimes be a limiting factor on highly well-drained soils in Peninsular India which are subject to leaching by heavy rainfall. Under such circumstances the use of sulphur or of gypsum on control plots in experiments with sulphate of ammonia, superphosphate, is essential if reliable information is to be obtained.

But the intention of this paper is not so much to point out particular differences between English and Indian manurial problems as to indicate the necessity for independent scientific surveys of local requirements before planning experiments, and to suggest that the use of classical experiments at Rothamsted to investigate elsewhere, lies rather in the lessons that have been drawn from them as regards agricultural experimental methods in general than in the direct application of the methods employed there.

From this point of view the value of Rothamsted experiments lies in the number and reliability of the statistics obtained.

Examined in the light of statistical selection these figures have demonstrated the considerable magnitude of the "experimental error" in field experiments conducted under the most favourable conditions; and that it is now some years since this was pointed out, there is little evidence that the lesson has been taken to heart in laying out experiments in India.

Hall in an article in the *Journal of the Royal Society of Agriculture* in August, 1909, quoted instance of the yield of two unmanured plots one of which gave, on the average of years results, 10 per cent. more than the other frequently gave over 30 per cent., and on one occasion 96 per cent. more; and on occasions over 20 per cent. less.

In a subsequent paper in the *Journal of Agricultural Science*, October, 1911, Hall Mercer showed that the most careful method of growing, harvesting and weighing plot mangos and wheat, under apparently uniform conditions, gave results that were subject to "probable errors" sufficiently great to make comparisons of the results from a single plot worthless for most purposes. He recommended that for practical purposes any field experiment each unit of comparison should be given five plots of one-fortieth of an acre each, systematically distributed within the experimental area.

The authors attached considerable value to the scattering of plots throughout the field and showed that the shape of the field (as indeed would be expected) in itself appreciable effect in reducing the error. In an appendix to their paper, one who himself "Student" showed how considerably error could be reduced by having the plots comparison relatively long, narrow, and a side, the other. By dividing squares into plots for comparison less than two-thirds the area was required to obtain the same accuracy as by random comparison in the case of roots and in the case of wheat, less than in

PROGRESS OF SUMATRA

characters, but by keeping steadily to the characters wanted and breeding these and selecting from each generation accordance with the laws of Mendel those which contain the elements at we are aiming much can be done. case the time factor is the controlling since there must be a period of four years between each new generation. Now what is the explanation of all We know that when fertilisation place it is the union of two germ cells according to Mendel, a germ cell is purely dominant or purely recessive; never be partly one and partly the other. As the character of the plant resulting the union of two germ cells depends character of these germ cells, it follows the first generation, the hybrid plant resemble the dominant parent, and a pure pea crossed with a white pea produce a pea with coloured flowers as offspring. But this hybrid offspring with coloured flowers now possesses kinds of germ cells, and so its offspring be of two kinds. All the possible white these two kinds of germ cells unite four only; a germ cell carrying colour unite with a similar germ cell, a germ carrying white may unite with a one, a germ cell carrying colour may with a germ cell carrying white, a germ cell carrying white may unite one carrying colour, the two last combinations producing the same result. Hence

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COTTON LINT.

ITS MINERAL CONSTITUENTS.

An interesting note by Mr. Barnes, Agricultural Chemist, Punjab, deals with the mineral constituents of cotton lint. It arose from the supposed adulteration of raw Chiniot cotton by the addition of earth salts to increase the hygroscopic properties and the investigation of such a possibility led to the discovery that the inorganic constituents of this cotton fibre were far more variable than had hitherto been supposed and the large percentage of magnesium chloride it contains seems likely to seriously affect the reaction of the fibre to dyes.

We quote Mr. Barnes' summary in *extenso* as it points to another factor which will have to be considered by the grower, breeder, and buyer.

"There appears to be no evidence of the reported practice of salting the cotton to increase its water-holding capacity. Mr. Arno Schmidt reports that he has seen watering of raw cotton actually taking place, but this is a crude form of sophistication, and will certainly lead to deterioration of the fibre and cannot but come to the notice of the buying agents of exporting firms in India. It will thus rebound immediately on the persons practising this fraud and can be dismissed from the scope of this enquiry.

"The complaint of Messrs. Volkart that the Chiniot cotton contains an unusually high percentage of magnesium chloride seems to be true, but we do not think that this substance has been artificially added, for the analysis of sample No 53 shows that it compares with other genuine samples in the amount of water and mineral matter which it contains. The assumption that cottons grown on saline soils will produce a fibre more heavily impregnated with mineral matter does not seem to be justified by the results, for alkaline soils are much more prevalent in the Punjab than in Bombay.

"The total amount of ash material in cotton fibre seems to have been underestimated by previous workers who seem to have assumed that this was largely due to foreign mineral matter in the form of dirt in the baled cotton.

"The presence of highly varying quantities of silica especially seems to have escaped attention. I am inclined to lay considerable stress on the established fact that genuine cotton fibre may contain upwards of one per cent. of ash, and that the composition of this ash is variable and variable to a far greater extent than has hitherto been supposed.

"There is little doubt but that this will seriously affect the reaction of the fibre to dyes—how far it will affect the tensile strength and keeping qualities of the fibre remains to be shown. It is evidently a factor which both grower and breeder must take into consideration, namely, the nature and quality of the mineral salts taken up by different varieties of cotton grown in the same soil, and under the same conditions, and how far climatic variation will effect this, as well as the effect of these mineral constituents on the commercial value of the fibre."

INDIAN TEA ASSOCIATION.

IMPORTATION OF TEA SEED.

A meeting of the General Committee of the Indian Tea Association was held at Calcutta on the 13th September. The following is an extract from the proceedings:—

The subject of the importation of tea seed was last referred to in the proceedings of the 16th August, when reference was made to the correspondence which the Committee were having with Messrs. James Finlay and Co., Ltd., Colombo, on the subject of the procedure now in force regarding the importation of tea seed into Ceylon. Since that meeting the Committee had received a further letter from Messrs. James Finlay and Co., Ltd., from which it was noted that the Ceylon Government had withdrawn the requirement to the effect that tea seed imported from India could not be cleared locally from the Customs until the importer produced to the Principal Collector of Customs a certificate from the

Chemists certifying that, the tea seed was not packed in soil or a mixture containing soil. It was understood that, although this requirement was withdrawn, the Government notification of the 4th October, 1910, still held good, clause 3 of that notification being to the effect that tea seed imported from India would not be admitted into Ceylon if packed in soil. It seemed to the Committee that much would depend on the interpretation of this condition, as it was practically impossible to obtain charcoal manufactured in India that was absolutely free from soil. It was decided to address Messrs. James Finlay and Co., Ltd., Colombo, asking them for further particulars.

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Wood Distillation

Home (Edn) Dept.

- ① Please see G.O. No. 27, dated the 6th Jan. 1917, in which the Officer in charge of the Dept. of Industries and the Commissioners of Land Revenue & Forests were ~~both~~ requested to make a joint investigation of the question whether experiments in wood distillation could be undertaken in this Presidency and to submit their recommendations to Govt. ~~Recommendation~~ No reply has yet been received from them on the subject. In his notes on page 10 to 12 and 17-18 of notes to G.O. No. 1222 Home (Edn), dated the 24th September 1917, Mr. regarding the feasibility of manufacturing disinfectants in this Presidency. He refers to the scheme for destructive distillation of wood under consideration in places outside this Presidency. He, however, did not state anything as to the result of his own inquiries in the matter. It is for order whether he may be reminded

NOTES.

Page 2

reminded on the subject. G. So,
 the draft ^(reminder) below is for signature.

8A

7.12.17

For
 10/17

Approved
 by
 [Signature]

(P.T.)



3186
C.No. 777
1-M. C.F. 88
Recd 17-12-17

Home Department.
Education Branch.

REMINDER.

REPLY.

To
The Officer in Charge
of the Department of Fisheries
The

~~has the honour to invite~~
The undersigned is directed to invite

attention to the communication noted in the
No. 27, dated 6.1.17 margin and to
request that
this reminder may be returned at once with
information as to—

- (1) the stage at which the matter now is,
 - and (2) the date by which a reply may be expected, and
 - (3) the circumstances which have caused the delay.
2. It is requested that the reply to this reminder may be sent not later than

Signature

Office Home Dept.
Station Jnt. St. George
Dated 7.12.17

Signature
Designation
Under Secretary

SUBJECT.

Institution of experiments to take up
in wood distillation.

Handwritten notes:
The file is on my table. It is not urgent & I fear I cannot fix any date for submission of a reply. In any case my report was told me about 4 weeks back. I don't know to what it is "expensive". It is a waste of a wood distillate. Please to write.
Calhoun
12/17



en given for copying _____
 en copied _____
 en examined _____
 en signed _____

191 .

LAD AGAIN G.O. No. _____
 191 .

DATED

CURRENT No.

ENCLOSURE TO C. No.

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