

Revenue. Press.

G. B. no 584 n 10. 4. 1872.

Proceedings of the Madras Government, Revenue Department,
10th April 1872.

No. 93. Read the following letter from the Government Quinologist, Ootacamund, to the Officiating Chief Secretary to Government, Fort St. George, dated 7th March 1872 :—

I HAVE the honour, in the following pages, to communicate the results at present obtained by the action of certain manures on the trees of *Cinchona Succirubra* and *officinalis*, growing on the Government plantations.

2. The Government, in consequence of my suggestion,* ordered that experiments should be tried with certain nitrogenous artificial manures, in order to determine whether their action would increase the amount of alkaloid

in the bark of the Cinchona trees to which they were applied.

3. In consequence, ten casks of manures were ordered from England, consisting of 12 cwt. of Ammonic sulphate, as prepared from English "gas-liquor," and 9 cwt. of "Peruvian Guano," both being of good commercial quality. These

Proceedings.

manures were applied to several plots of trees at the Dodabet and Neddivuttum plantations in October 1869, the trees being of various ages, and the quantities applied varying from 4 ozs. to 1 lb.

4. Some fine young plants of *C. Succirubra* at Neddivuttum, three years of age, were treated in November 1869 in plots of 50 each, with 1 lb. of Ammonic sulphate and the same amount of Guano. There were but few showers after October, and no surprise was felt at the circumstance that the trees did not in the least differ in appearance from the ordinary unmanured trees. But after the succeeding south-west monsoon, it appeared somewhat strange that no greater luxuriance of growth was apparent. The trees, even during the rains of 1871, preserved still their ordinary appearance, and I thought it remarkable that these ordinarily stimulating manures should so entirely fail in their effect on the Cinchona trees. It was not until the autumn of 1871 that any change was perceptible; but at that time it appeared to me that an increase in the depth of tint of the leaves and a somewhat greater luxuriance was apparent among the trees, manured with Ammonic sulphate. The difference, however, was slight, and I was informed by Mr. McIvor that no difference was perceptible to him. I certainly perceived no change in the growth whatever in those trees which had received less than 1 lb. of the manure.

5. In January last, the time appeared to have arrived at which it was desirable to examine analytically the quality of the barks. The following statement gives the amounts of alkaloid obtained, calculated in percentages of dry bark; compared with a sample of bark taken from trees of same age, growing near, under conditions which only differed by the absence of manure.

Results with Ammonic sulphate.

Proceedings of the Madras Government, Revenue Department,
10th April 1872.

	Manured.	Unmanured.
Total alkaloids...	7.25	4.89
Quinine...	2.45	1.78
Cinchonidine and Cinchonine	4.80	3.11

I thus found somewhat to my surprise that the manure had caused an increase in the alkaloids to the amount 2.36 per cent., of which 0.67 consisted of quinine.

6. A similar examination was conducted with the trunk-bark of the trees which had received 1 lb. of Guano. The comparative results are expressed in the same manner as the above:—

	Manured.	Unmanured.
Total alkaloids...	5.29	4.76
Quinine...	0.91	1.04
Cinchonidine	4.38	3.72

7. From these analyses it is evident that the Guano had produced an increase of but 0.53 per cent. of total alkaloids, and that the manured bark contained 0.13 per cent. less quinine than the unmanured. The less of Guano, when compared with that of Ammonic sulphate, is contrary to what would be expected *a priori*. The conclusion I derive from these experiments with *C. Succirubra* is, that as the gain in the most successful case consists mainly of alkaloids other than quinine, it will not be profitable henceforward to manure this species, even with Ammonic sulphate, as the cost of such manure may be as great as the increase in the commercial value of the bark. The fact of the gain in alkaloids is, however, a result of much interest.

8. I have had occasion in the report noted in the margin and in many subsequent reports to mention the great sensitiveness with which the crown-bark trees are effected by situation, sun-light, and character of soil; and have taken the opportunity of expressing my conviction that *C. officinalis* was the best adapted for high cultivation. Hence I naturally anticipated that the influence of manures on this species would be marked, and would result in a considerable increase in the amount of alkaloids contained in the bark. The considerable variations which occur in the bark of this species from apparently slight causes necessitated much care in experiments in which the influence of manures was to be investigated. Hence in an apparently homogeneous plot of *C. officinalis*

Proceedings of the Madras Government, Revenue Department,
10th April 1872.

long double rows were selected in which to try the effect of the manures, while the trees between these double rows were left unmanured.

9. In October 1869 the manure was applied in amounts of 1 lb. and $\frac{3}{4}$ lb. of each to a tree. Smaller amounts were also used, but were applied to younger trees. The trees to which the larger quantities of manures were applied were of the same age as the trees of *C. Succirubra* at Nedddivuttum, or were, in 1869, of three years old. Several heavy showers fell after the manuring took place, and it was with much surprise that I could perceive no change had taken place in the growth of the tree. Since the above date no improvement whatever has been perceptible in the manured trees over the immediately adjoining trees which have been unmanured. As the trees of *C. officinalis*, which yield the finer barks, are nearly always of more vigorous and luxuriant growth, I for a long time concluded that the views I formerly held were wrong, and that the experiments with manures would yield negative results only. In February 1872 no difference was to be distinguished between the manured and unmanured trees, and they were only to be recognized by the posted labels which marked them. The trees which had received 1 lb of Guano gave the following percentages of alkaloid in the dry

- Results with Guano. bark. The analysis of the unmanured bark is also attached for comparison, a mean specimen of each being carefully collected for that purpose:—

	Manured.	Unmanured.
Total alkaloids...	6.51	3.98
Pure Quinine...	4.41	2.40
Cinchonidine and Cinchonine...	2.10	1.58

Hence it appears that the 1 lb. of Guano had increased the total alkaloids in the bark by 2.53 per cent., of which increase 2.01 was quinine.

10. It was with great vexation that I found that the stake, which carried the label which marked the trees that had received the 1 lb. of Ammonic sulphate, had been taken away during the last three months of 1871, and that no mark remained by which the trees could be distinguished. Hence to ascertain the effect of this Ammonic salt, I had to take trees which had received but $\frac{3}{4}$ lb. of the manure. The content of the dry trunk-bark in alkaloids is expressed as follows:—

	Manured.	Unmanured.
Total alkaloids...	5.76	4.54
Pure Quinine...	3.11	2.54
Cinchonidine and Cinchonine	2.65	2.00

The addition as manure of $\frac{3}{4}$ lb. of Ammonic sulphate had thus produced an increase of 1.22 of total alkaloids, and 0.57 of quinine.

11. In 1867 during the absence of the Superintendent of the plantations in England, I requested the Acting Superintendent Mr. Batcock to apply stable

Application of farm yard manure. manure to six average trees of *C. officinalis*. On the return of the Superintendent, Mr. McIvor continued the application of a barrow-load of pig-litter or bullock-manure every six months as commenced by Mr. Batcock. More lately, owing doubtless to the frequent changes made in the subordinate superintendence of the plantations, this manuring has been carried with great irregularity. On the whole, each tree has probably had three applications, and at the most but four. As no improvement was perceptible in the appearance of the trees, none has been applied during the last eighteen months. In February 1872 specimens of bark have been taken from four trees, and at the same time the bark was taken from several unmanured trees growing under the same conditions and immediately adjoining. The analyses are as follow :—

	Manured.	Unmanured.
Total alkaloids...	7.49	4.68
Pure Quinine ...	7.15	2.40
Cinchonidine and Cinchonine	0.34	2.28

Hence there has been a singular improvement in the quality of the bark. The total increase in alkaloids has been 2.81 per cent., but the manure has also had the singular effect in causing the alkaloids to be *quinine*, instead of cinchonidine and cinchonine. Hence the total increase in pure quinine is no less than 4.75 per cent.

Results and gain.

Hence the bark has been at least doubled in value in the English market, and the gain or difference in value in English money may be estimated at the present time to be 2s. 6d. per pound of trunk-bark. This estimate does not take into account the fact that this manured bark yields quinine sulphate sufficiently pure without the cost of the separation from the cinchonidine sulphate; and hence is of less expense in quinine manufacture.

12. In nearly every case in which the action of farm-yard manure has been compared with the more artificial manures, it has been found to have somewhat the superiority. Although in the above experiments it has had the advantage of a longer time of action, this superiority still is evident.

13. The only perceptible change which appears in the crown-bark trees by these nitrogenous manures consists in the increased yield of alkaloids. There is no greater luxuriance of growth apparent, and it is only by analysis that a change is detectable in the bark. This result appears to me strongly to corroborate the hypothesis that it is by supplying the elements of the alkaloids in an appro-

priate form that the increased yield is produced. I have long been of opinion that the alkaloids in the bark of the trees are not specially active constituents in the processes connected with the life and growth of the plant, and this supposition is supported by the circumstance that the increased amount of alkaloid produced by the manure causes no change in the appearance and rate of growth of the tree*. It is thus to be remarked that the action of manures on *Cinchona* is peculiar and specially supports the above hypothesis. It would be quite intelligible from the well-known action of manures upon growing plants that an increased growth of bark would be obtained. But this is not the result with *Cinchona*; a larger yield is not obtained; but certain constituents of the bark are increased in quantity. That there is a certain similarity in composition between some constituents of the manure and the alkaloids appears thus a fair conclusion.

14. The addition as manure of 1 lb. of Guano to a tree of *C. officinalis*, as reported above, has caused an increase in the value of a pound of bark that

Discussion of gain. may be moderately estimated at the present time to increase its market-value by 1s. 6d. per lb. The cost of the Guano bought in England, with that of freight, insurance, agent's commission, and carriage to the hills, cost 2½d. per lb. It thus is evident that even employing Guano, obtained at by no means the lowest cost, as manure to *C. officinalis*, the profit is certain and considerable. It is furthermore probable that the maximum effect of the manure has not been arrived at in the foregoing experiments, since it is unlikely that the period of greatest yield would be hit upon by chance in the first trial.

15. It thus appears to me that the action of manures promises a new direction in which the cultivation of the *Cinchona* alkaloids can be still further improved.

16. I should mention that the quinine obtained from the manured trees readily yields its normal, or nearly theoretical amount of crystallized sulphate. As the analyses were not made for a commercial purpose, the amount of crystalline sulphates has not in every case been determined.

17. There are some plots of younger trees whose treatment with manure has hitherto purposely been in smaller amount than those whose examination

Projected proceedings. forms the subject of the foregoing. I am of opinion that a further small quantity of manure should be obtained from England for the further treatment of these young trees and for certain experiments suggested by the foregoing. The manure can be procured out of savings in my next year's budget. Whether the application of manures should be carried out to a greater extent than these experimental plots Government will decide. I would recommend that *C. officinalis* be the species to which it should be applied; and that if stable-manure, as is probable, cannot be obtained in sufficient quantity, Guano should be the manure used.

* Mr. McIvor informs me that he has greatly stimulated the growth of young plants on poor soil by manuring them with cow-dung. No stimulus was, however, as has been stated, apparent in the cases to which this report refers.

*Proceedings of the Madras Government, Revenue Department,
10th April 1872.*

No. 94.

ORDER THEREON, 10th April 1872, No. 584.

Miscellaneous.

In this letter the Government
Quinologist reports the results obtained
by the action of certain manures on
Cinchonas.

2. Mr. Broughton's experiments in the matter are very instructive and important; and it seems desirable that they should, as proposed by him (paragraph 17), be continued on an extended scale. The Government will be prepared to apply to the Secretary of State for a supply of the English manures on being furnished with an Indent of the quantity required. They think it will be well that the Indent should provide for double the quantity stated in paragraph three of the report to have been obtained in 1869, so as to admit of the experiments being made under greater diversity of circumstances. Ordinary farm-yard manure should also have a competitive trial; cattle and pigs being purchased to form this manure if it is not otherwise procurable. The Commissioner of the Nilgiris will instruct Mr. McIvor to arrange for having this done.

(True Extract.)

(Signed)

W. HUDLESTON,

Officiating Chief Secretary.

To the Government Quinologist.
„ the Commissioner of the Nilgiris.
„ the Board of Revenue.
„ the Conservator of Forests.

Ed. F. R. Bantleman.

Colacamund 7th March 1872

From, Mr. J. Broughton
Government Quinologist
Colacamund

To, The Honble W. Huddleston
Officiating Chief Secretary to Government
Fort Saint George

Sir, I have the honor in the following pages to communicate the results at present obtained, by the action of certain manures on the trees of *Cinchona Succubra* and *officinalis*, growing on the Government plantations.

2. The Government in consequence of my suggestion* ordered that experiments should be tried with certain nitrogenous artificial manures, in order to determine whether their action would increase the amount of alkaloid in the bark of the *Cinchona* trees to which they were applied.

Origin and ob. of my suggestion*
* G.O. Rev. Departt. No. 335. 22nd Sep. 1868.

3. In consequence, ten casks of manures were ordered from England consisting of 12 Cwt. of Ammoniac Sulphate as prepared from English "gas-liquor" and 9 Cwt. of "Peruvian guano" both being of good commercial quality. These manures were applied to several plots of trees at the Dodavet and Ned Wicallam plantations in October 1869. The trees are now in full leaf.

Proceedings

Recd. Ch. 1872/72

Notice of Manure on Cinchona - Letter from the Government Quinologist reporting the results obtained by certain experiments, with orders thereon.

APRIL.
Nos. 93-94.

Post. of 1872 3rd JUNE.
REVENUE.
THE GOVERNMENT QUINOLOGIST.
Dated April 10th.
G. O. 10th April 1872, No. 684.

November 1869, in plots of 50 each with 1 lb. of ammoniac sulphate and the same amount of guano. There were but few showers after October, and no surprise was felt at the circumstance that the trees did not in the least differ in appearance from the ordinary unmanured trees. But after the succeeding South West monsoon, it appeared somewhat strange that no greater luxuriance of growth was apparent. The trees even during the rains of 1871 preserved still their ordinary appearance, and I thought it remarkable that these ordinarily stimulating manures should so entirely fail in their effect on the Cinchona trees. It was not until the autumn of 1871 that any change was perceptible; but at that time it appeared to me that an increase in the depth of tint of the leaves, and a somewhat greater luxuriance was apparent, among the trees manured with ammoniac sulphate. The difference however was slight, and I was informed by Mr. W. Ivor that no difference was perceptible to him. I certainly perceived no change in the growth whatever, in those trees which had received less than 1 lb. of the

Results with ammoniac sulphate.

of alkaloid obtained, calculated in per centages of dry bark; compared with a sample of bark taken from trees of same age growing near, under conditions which only differed by the absence of manure.

	Manured	Unmanured
Total alkaloids	7.25	4.89
Quinine	2.45	1.78
Cinchonidine & Cinchonine	4.80	3.11

I thus found somewhat to my surprise, that the manure had caused an increase in the alkaloids to the amount 2.36 per cent, of which 0.67 consisted of quinine.

Results with Guano.

A similar examination was conducted with the trunk bark of the trees which had received 1 lb. of guano. The comparative results are expressed in the same manner as the above.

	Manured	Unmanured
Total alkaloids	5.29	4.76
Quinine	0.91	1.04
Cinchonidine	4.38	3.72

From these analyses it is evident that the guano had produced an increase of 0.53 per cent of total alkali.

monic sulphate is contrary to what would be expected a priori. The conclusion I derive from these experiments with C. Suc. cirubra is, that as the gain in the most successful case consists mainly of alkalo-ids other than guanine, it will not be profitable henceforward to manure this species, even with ammoniac sulphate, as the cost of such manure may be as great as the increase in the commercial value of the bark. The fact of the gain in alkaloids is however a result of much interest.

8. I have had occasion in the re-
port noted in margin*, and in many sub-
sequent reports, to mention +
the great sensitiveness with
which the brown bark trees are effected by
situation, sunlight, and character of soil;
and have taken the opportunity of express-
ing my conviction that C. Officinalis was
the best adapted for high cultivation. Hence
I naturally anticipated that the influence
of manures on this species would be mark-
ed, and would result in a considerable
increase in the amount of alkaloids con-
tained in the bark. The considerable va-
riation which occurs in the bark of

Pro. Madras Govt.
Feb. 22 1870. N. 235
paras 5 & 6.

Sensitiveness
of C. Officinalis

be investigated. Hence in an apparently homo-
geneous plot of C. Officinalis long double rows
were selected, in which to try the effect of the
manures, while the trees between these double
rows were left unmanured.

9. In October 1869, the manure was appli-
ed in amounts of 1 lb and $\frac{3}{4}$ lb of each to a
tree. Smaller amounts were also used, but
were applied to younger trees. The trees to
which the larger quantities of manures were
applied were of the same age as the trees of
C. Succirubra at Neddionkum, or were in 1869
of three years old. Several heavy showers fell
after the manuring took place, and it was with
much surprise that I could perceive no change
had taken place in the growth of the tree. Since
the above date no improvement whatever has been
perceptible in the manured trees, over the im-
mediately adjoining trees which have been un-
manured. As the trees of C. Officinalis which
yield the finer barks are nearly always of more
vigorous and luxuriant growth, I for a long
time concluded that the views I formerly held
were wrong, and that the experiments with
manures would yield negative results only. In
February 1872 no difference was to be distinguish-
ed between the manured and unmanured trees,
and they were only to be recognized by the posted
labels which marked them. The trees which had
received 1 lb of guano gave the following per-
centage of alkaloid in the dry bark. The
unmanured trees

Results with
guano

for that purpose.

	Manured	Unmanured
Total alkaloids	6.51	3.98
Pure Quinine	4.41	2.40
Cinchonidine & Cinchonine	2.10	1.58

Hence it appears that the 1 lb of guano had increased the total alkaloids in the bark by 2.53 per cent, of which increase 2.01 was quinine.

10. It was with great vexation that I found that the stake which carried the label which marked the trees that had received the 1 lb of ammoniac sulphate, had been taken away during the last three months of 1871, and that no mark remained by which the trees could be distinguished. Hence to ascertain the effect of this ammoniac salt I had to take trees which had received but $\frac{3}{4}$ lb of the manure. Their content of the dry trunk bark in alkaloids is expressed as follows.

	Manured	Unmanured
Total alkaloids	5.76	4.54
Pure Quinine	3.11	2.54
Cinchonidine & Cinchonine	2.65	2.00

Results with
ammoniac sul-
phate.

Application
of farm yard
manure.

11. In 1867 during the absence of the Superintendent of the plantations in England I requested the Acting Superintendent Mr. Bateock to apply stable manure to 6 average trees of *C. Officinalis*. On the return of the Supt. Mr. W. Ivor continued the application of a barrow load of pig litter or bullock manure every six months as commenced by Mr. Bateock. More lately owing doubtless to the frequent changes made in the subordinate Superintendence of the plantations this manuring has been carried with great irregularity. On the whole each tree has probably had three applications and at the most but four. As no improvement was perceptible in the appearance of the trees, none has been applied during the last 18 months. In February 1872, specimens of bark have been taken from four trees and at the same time the bark was taken from several unmanured trees growing under the same conditions and immediately adjoining. The analyses are as follows.

	Manured	Unmanured
Total alkaloids	7.49	4.68
Pure Quinine	4.15	2.40
Cinchonidine & Cinchonine	3.34	2.28

Hence there has been a singular improvement in the quality of the bark. The total increase has been 2.81 per cent.

total increase in pure quinine is no less than 4.75 per cent. Hence the bark has been at least doubled in value in the English market, and the gain or difference in value in English money may be estimated at the present time to be 2.6 per pound of trunk bark. This estimate does not take into account the fact that this manured bark yields quinine sulphate sufficiently pure without the cost of the separation from the Cinchonidine sulphate; and hence is of less expense in quinine manufacture.

Results and gain

12. In nearly every case in which the action of farm yard manure has been compared with the more artificial manures, it has been found to have somewhat the superiority. Although in the above experiments it has had the advantage of a longer time of action this superiority still is evident.

General superiority of farm yard manure

13. The only perceptible change which appears in the Crown bark trees by these nitrogenous manures consists in the increased yield of alkaloids. There is no greater luxuriance of growth apparent, and it is only by analysis that a change is detectable in the bark. This result appears to me strongly to corroborate the hypothesis that it is by supplying the elements of the alkaloids in an intimate form that the increased yield

Corroboration of hypothesis by mentioning

of the plant, and this supposition is supported by the circumstance that the increased amount of alkaloid produced by the manure causes no change in the appearance and rate of growth of the tree. It is thus to be remarked that the action of manures on Cinchona is peculiar and specially supports the above hypothesis. It would be quite intelligible from the well known action of manures upon growing plants that an increased growth of bark would be obtained. But this is not the result with Cinchona — a larger yield is not obtained, but certain constituents of the bark are increased in quantity. That there is a certain similarity in composition between some constituents of the manure, and the alkaloids, appears thus a fair conclusion.

Discussion of gain

14. The addition as manure of 1 lb of guano to a tree of *C. officinalis*, as reported above, has caused an increase in the value of a pound of bark that may be moderately estimated at the present time to increase its market value by 1.6 per lb. The cost of the guano brought in England, with that of freight, insurance, Agents Commission, and carriage to the hills cost 2½ per lb. It thus is evident that even employing

* Mr. W. Iver informs me that he has greatly stimulated the growth of young plants on poor soil by manuring them with cowdung. No stimulus has been stated above.

ing guano, obtained at by no means the lowest cost, as manure to C. officinalis, the profit is certain and considerable. It is furthermore probable that the maximum effect of the manure has not been arrived at in the foregoing experiments; since it is unlikely that the period of greatest yield would be hit upon by chance in the first trial.

15. It thus appears to me that the action of manures, promises a new direction in which the cultivation of the Cinchona alkaloids can be still further improved.

16. I should mention that the quinine obtained from the manured trees, readily yields its normal, or nearly theoretical amount of crystallized sulphate. ^{Quinine readily crystallizes as sulphate.}

As the analyses were not made for a commercial purpose, the amount of crystalline sulphates, has not in every case been determined.

17. There are some plots of younger trees whose treatment with manure has hitherto purposely been in smaller amount than those whose examination forms the subject of the foregoing. I am of opinion that a further small quantity of manure

Projected
cedings

the foregoing. The manure can be procured out of savings in my next year's budget. Whether the application of manures should be carried out to a greater extent than these experimental plots, Government will decide. I would recommend that C. officinalis be the species to which it should be applied; and that if stable manure, as is probable, cannot be obtained in sufficient quantity, guano should be the manure used.

I have the honor to be
Sir,

Your most obed^t servant

John Broughton
Government Quinologist

Specimens to Superintendent of Gold Mining
I enclose the Cinchona & sulphate pure
results of experiment. I think the
better I desire the plant to be more
Government to be more from the
quino

REVENUE DEPARTMENT.

21x

No. 845.

From the Government Quinologist, Ootacamund.
Dated 7th March 1872.

FOR ORDERS.

Mr. Vray's experiments
are very instructive &
important. I would oblige
to the same for another
supply of the number of the
same quantity will be
sent / and also desire
that the above order
be forwarded to the same.

1872-73

1872-73

No. 845.

From
The Govt Quinologist
Ootacamund

To, The Assistant
Quinologist & Govt
Inspector
Jodhpur

Dated 7th March 1872
No. 114

See order

On the return of
numbers on the same

See order

the latter trial - the king let
purchase cattle & pigs to
form the manure - if it
is not otherwise per curia -
The lord we had better let
a Don the bubble of the English
manure - so as to admit
of experiments under great
diversity of circumstances

SOS

A. V. M. 14

FOR ORDERS.

On the Action of
Mammals on Linchman

W. defms
Draft G.O.
After according
G.O. submitted
Letter not drafted - please
see expln in draft
G.O.

C. March 1872. R21¹⁰

7
25+
#584.

10 Oct 1872

In this letter the
Govt. Zoologist re-
ports the results ob-
tained by the action
of certain mammals on
Cinchona.

2. Mr. Broughton's
experiments in the
matter are very in-
structive and im-
portant; and it
seems desirable that
they

they should, as pro-
posed by him, (para
17) be continued on
an extended scale.
The Govt will be pre-
pared to apply to
the Secy of State
for a supply of
the English manures
on being furnished
with an Indent of
the quantity required.
They think it will
be well that the
Indent should provide
for double the quantity
stated in para 3 of
the Report to have
been obtained in
1869, so as to admit
of the experiments
being made under
greater

I have somewhat
doubted from the
instructions, in calling
for an Indent - but
this seems to be the
usual course adopted
in similar cases.
On receipt of the Indent
the Dept. to the S State
will be drafted.

This seems to have
been obtained by Mr
Broughton direct.

greater diversity
of circumstances.
Ordinary Farm yard
manure should also
have a competition
trial; cattle and
pigs being purcha-
sed to form this manure
if it is not otherwise
procurable. The
Commissioner of the
Nilgiris will instruct
Mr. McEwen to ar-
range for having
this done.

Sub
under review

1. Govt. Zoologist - Desp. 11 April 72
3. Commr. of Nilgiris
11. Board of Rev.
13. Commr. of Forests.

G.O.
on Mr. Brington's report
respecting manures.