

ANNUAL REPORT

ON THE

AGRICULTURAL EXPERI- MENTS AND DEMONSTRA- TIONS

IN

ASSAM

FOR THE

YEAR ENDING THE 30TH JUNE 1914.



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ANNUAL REPORT OF THE JORHAT AGRICULTURAL
EXPERIMENT STATION FOR THE YEAR ENDING
THE 30TH JUNE 1914.

This station is situated about 3 miles south of Jorhat, Sibsagar district, Assam Valley, and was established in the beginning of the year 1906. It was intended principally for sugarcane work. Since then, on account of peculiar soil conditions which altogether precluded the growth of *rabi* crops even in the presence of abundance of soil moisture, the work has been extended to include a study of the factors causing this sterile condition with a view to its amelioration. This work has been continued for five years, and we are now in a position to state that the sterile condition of the soil to most crops in the cold weather and also to certain crops in the rains is due to the accumulation of acid substances, which are readily neutralised and rendered harmless by dressings of lime to the soil. A full account of the experimental results leading up to this conclusion has been written by Mr. A. A. Meggitt, Agricultural Chemist, and will be published shortly as a memoir of the Department of Agriculture.

Introduction.

In connection with the improvement of the soil by liming, the application of other fertilizers has been studied, and our regular scheme of manuring now includes green manuring and the application of raw phosphates.

The original area of the station was about $35\frac{1}{2}$ acres, of which 1.7 acres is *hola* or ravine land and the remainder high land which was under grass and scrub jungle at the time of acquisition. An additional area of about 24 acres has since been acquired, of which about 4 acres is *hola* land and the remainder high land. The total area at present is thus about $59\frac{1}{2}$ acres. Most of the newly added area has been put under cultivation and is being treated uniformly in blocks with a view to future experiments.

2. The soil of the high land is a reddish sandy loam of the old alluvium, lying on a hard greyish yellow sub-soil. Where the conditions have not been improved by cultivation, the soil is extremely shallow, varying from only 3 to 6 inches in depth.

Soil.

The following report is by Mr. A. A. Meggitt, Agricultural Chemist, Assam :—

Report on analysis of Jorhat farm soil.

	Surface soil.	Sub-soil.
	Laboratory No. 5.	Laboratory No 5 (a).
1	2	3
<i>Soluble in Hydrochloric acid with 12 hours digestion at 100°c</i>	Per cent.	Per cent.
Phosphoric acid (P_2O_5)	0.025	0.020
Potash (K_2O)	0.115	0.135
Lime (CaO)	0.154	0.144
Magnesia (MgO)	0.166	0.148
<i>Soluble in 1 per cent. citric acid with 7 days digestion.</i>		
Phosphoric acid	0.008	0.008
Potash	0.007	0.011
Loss on ignition (organic matter and combined water).	3.26	1.84
Nitrogen	0.114	0.051
Calcium carbonate	0.048	0.018
Reaction	Acid	Acid

Physical constants.

—	Hygroscopic capacity.	Maximum water-saturation capacity		Minimum water-saturation capacity.		Moisture in air dry soil.
		Per cent of water in saturated soil by weight.	Per cent. of water in saturated soil by volume.	Per cent of water by weight.	Per cent of water by volume.	
1	2	3	4	5	6	7
Surface soil ...	3.10	31.9	50.5	11.2	13.9	1.3
Sub-soil ...	...	30.0	50.0	7.2	9.1	0.19

“ These analyses agree quite well generally with some others made some years ago by the Imperial Agricultural Chemist.

These samples are acid in reaction, and the total lime present in all combinations, as well as the carbonate of lime, is quite deficient in quantity.

Carbonate of lime has an enormous influence on a soil's welfare chemically, physically, and bacteriologically.

Its effect on soil biological processes are in the right direction, and very great ; it also influences the texture of soils in a remarkable way, and is active in bringing into use the reserves of dormant plant food. Its presence in fair amount also ensures the most economical effect of any manuring given. Its absence forbids the use, for most cropping, of certain kinds of manures, unless it be first resorted to.

Any upland soil containing such small amounts of total lime and lime carbonate as are here present will most certainly respond markedly in the case of most cropping to applications of lime.

The amount of organic matter is probably greater than obtains in many Indian soils, but there is no doubt that a light soil of this character will be much improved in many ways by an increase in the amount of humus.

" A good deal of the organic matter present is of a doubtful character and consists very probably of very old residues of little value ; it is the presence and active decay of comparatively recent additions of organic matter which puts life into a soil.

The percentage of nitrogen present in the surface soil is what would normally be considered a fair one, but in view of the absence in anything like adequate quantity of carbonate of lime, conditions for nitrification are probably not as favourable as they might be by a long way, and an increase in the amount of nitrogen is indicated as desirable.

Of potash there is no dearth, and there would seem to be no immediate need for potash manuring.

Regarding phosphoric acid, these samples show a deficiency both in total as well as available supplies. There is thus a "real" as opposed to a mere temporary lack in respect of this element of plant food.

This lack of phosphoric acid is further aggravated by the absence of sufficiently large amounts of lime carbonate and humus, high percentages of which may, and often do offset a smaller percentage of phosphoric acid.

An acid condition of soil, besides being harmful in itself very often brings about a more rapid depletion of the soil's stock of phosphoric acid, in consequence of which most soils of a decidedly acid character are found to be lacking in this element, and to respond to its suitable application.

Turning to the physical constants, the hygroscopic capacity is low, and about what one would expect for this class of soil. It means that only water which is in excess of about 3 per cent. is available for crops, and plants, are able to reduce the soil moisture content to somewhere about this figure before they begin to wilt. The top 6 inches of soil even during the cold weather normally contains a good deal more moisture than 3 per cent. when under a close standing crop, so that usually there is sufficient water for the crop's requirements.

As regards maximum saturation capacity, these soils agree quite well with quoted figures for similar soils in Europe, and suggest that the optimum proportion of water for the growth of the plant is about 13.16 per cent. A recent determination of soil moisture in the surface 6 inches of the soil of this farm

in August some few hours after rain gave 17 per cent. water. Soil moisture conditions are therefore probably extremely favourable for growth during the rainy season.

The figures for minimum saturation capacity are much lower than those cited (Hall, *The Soil*, page 69) for similar soils in Europe, and this probably due to the lower content of humus which obtains in our soils. This is an extremely important figure in gauging a soil's power to retain a reserve of moisture for crops during dry periods.

The sub-soil is worse in this respect than the surface layer, suggesting that the incorporation of organic matter, if it can be buried sufficiently deep, will have a great ameliorating effect indeed.

The sub-soil is capable of very great improvement indeed as the figures show, but it would probably be immediately disastrous to work it so deeply as to bring any considerable amount to the surface at once.

The growth of deep-rooting legumes as green crops will assist materially, but if the sub-soil could be stirred occasionally, while at the same time the surface cultivation is gradually deepened so that green crops may be more deeply buried, a greater depth of surface soil will result, which on this farm is very much to be desired.

I am convinced that for cane cultivation, until the surface soil has been deepened and the amount of humus increased, it is of little use attempting manurial experiments on cane with artificial manures. No amount or combination of the latter can ever make up in the case of a crop like sugarcane for loss of fertility due to shallow cultivation and lack of humus."

3. The farm is equipped with a godown, combined office and rest-house, quarters for Farm Superintendent, Fieldman clerk and apprentices, and a cattle shed with brick walls and corrugated iron roof. A three roller 12' × 18' cane mill driven by a 9 B. H. P., Hornsby oil engine was installed in 1911.

Buildings and machinery, etc

During the year a pucca culvert was built over the *hola* between the old and new areas at a cost of Rs. 510, and Ideal wire fencing was purchased at a cost of Rs. 1,895 including freight.

4. The rainfall recorded during the growth of the crops referred to is given in the following table together with the normal rainfall:—

Month.					Actual rainfall in inches.	Normal rainfall in inches.
1					2	3
1913	April	...	...	...	20.47	8.54
	„ May	...	...	...	7.34	9.26
	„ June	...	...	...	8.88	11.36
	„ July	...	...	...	13.49	14.76
	„ August	...	...	...	8.54	15.15
	„ September	...	...	...	12.32	9.13
	„ October	...	...	...	8.11	4.07
	„ November	...	...	...	0.22	0.69
	„ December	...	...	...	3.53	0.52
1914	January	...	...	...	0.84	0.93
	„ February	...	...	...	2.42	1.32
	„ March	...	...	...	0.34	3.90
				Total	86.00	79.68
	„ April	...	...	...	5.67	8.54

The rainfall was ample, and a little above the average. The cold weather set in rather early and was more foggy than usual thus shortening the growing season for the sugarcane. Otherwise the season was normal.

5. This mainly consisted of continuing, and in some cases extending the work of previous years under the following heads :—

I.—Sugarcane experiments.

II.—Soil investigations.

III.—Trials of new crops.

6. In previous years as a rule, in all experiments with this crop the whole produce of each plot has been weighed and, after crushing, samples have been taken from the juice in bulk. This year owing to the facts stated below it was impossible to do this, so only about 20 maunds (1,600 lb) of cane of each variety were crushed and the juice sampled. Subsequently the whole of each plot was harvested and weighed, and the figures per acre shown in Tables I to VII are calculated from the results of the analysis of the 1,600 lb. sample of cane, in conjunction with the actual weight of cane from the whole of each plot.

The reason for this departure from our usual practice was that large quantities of our best varieties of cane were required for planting near the site of the proposed sugarcane growing experiment in Kamrup, and a great deal of this had to be provided from the experimental plots. In all over 60 tons of cane was despatched to Kamrup during the crushing season. This involved the farm staff in a good deal of extra work, as the cane had to be made into convenient sized bundles of from 80 to 100 lb. weight, wrapped round with thatching grass, and carted over 10 miles to the railway. Some 1,315 bundles in eleven consignments were packed and forwarded in this way between February 23rd and April 10th.

7. The following varieties planted in Block

Sugarcane Varieties
Ratoon cane,

A in 1912, were ratooned :—

B. 147	} $\frac{1}{2}$ acre duplicate plots.
B. 376 ...	...
Striped Mauritius ...	...
B. 208	} $\frac{1}{20}$ acre plots.
Yel'ow Tana ...	...
Magh ...	...
Kheri ...	...

The results of the first crop were given in last year's annual report. After harvesting the crop of plant cane in March 1913 the trash was spread over the field and burnt, and all pieces of diseased cane which escaped burning were collected and destroyed. Subsequently the land was hoed. A dressing of 10 maunds of rape cake per acre was applied and the cane was partially earthed in the beginning of June. At the end of June a light hoeing was given, and in the second week of July another 10 maunds of rape cake per acre was applied and the cane was given a final earthing. Stripping was done in October.

The cane was harvested in March 1914. As usual Magh, the local variety, failed to produce a ratoon crop worth harvesting. The results of the other varieties, with the exception of Striped Mauritius which, in the hurry of sending cane to Kamrup, was not sampled, are given in Tables I and II.

TABLE I
RATON CANE, 1913-14.

Juice.

Serial No.	Variety.	Area of plot.	Cane, sugar.	Invert sugar.	Total sugar.	Glucose ratio.	Total solids.	Purity coefficient.	Remarks.	
1	2	3	4	5	6	7	8	9	10	
			Per cent	Per cent.	Per cent.		Per cent.			
1	B 147 (plot 1) ...	...	½ acre	16.11	0.60	16.71	3.75	17.55	91.8	
2	B. 147 (plot 4) ...	...	"	17.14	0.43	17.57	2.50	18.40	93.1	
3	B. 376 (plot 2) ...	...	"	14.86	0.79	15.65	5.33	16.35	90.8	Badly lodged.
4	B. 376 (plot 5) ...	...	"	15.67	0.55	16.23	3.60	16.90	92.7	Ditto.
5	B 208 ...	...	1/10 acre	17.86	0.33	18.19	1.87	19.00	94.0	
6	Yellow Tana ...	...	"	15.34	0.74	16.08	4.85	17.30	88.6	Albuminoids in juice high. Difficult of defecation.
7	Magh ...	...		No crop worth harvesting.						
8	Kheri ...	...	"	11.67	1.67	13.34	14.36	14.55	80.2	

TABLE II.

RATOON CANE, 1913-14.

Figures are per acre.

Serial No.	Variety,	Cane,	Juice.	Juice on cane.	Total sugar in juice.	Total sugar in juice.	Total cane sugar (sucrose) in juice.	Remarks.	
1	2	3	4	5	6	7	8	9	
		lbs.	lbs.	Per cent.	Per cent.	lbs.	lbs.		
1	B. 147 (plot 1) ...	33,704	24,150	62.40	16.71	4,036	3,891	} These two plots and especially plot I were badly injured last year by a violent storm which laid the plant cane and injured the stools. This accounts for the comparatively poor ratoon yield.	
2	B. 147 (plot 4) ...	45,508	28,420	62.45	17.57	4,993	4,871		
3	B. 376 (plot 2) ...	55,824	36,145	64.75	15.65	5,656	5,371		
4	B. 376 (plot 5) ...	55,676	35,600	63.95	16.23	5,778	5,578		
5	B. 208 ...	44,800	26,520	59.20	18.19	4,824	4,733		
6	Yellow Tana ...	62,800	36,240	57.70	16.08	5,827	5,560		
7	Magh ...			No crop worth harvesting					
8	Kheri ...	62,320	32,700	52.50	13.34	4,302	3,816		

The yields of ratoon cane are considerably less this year than last. In assigning a reason for this state of affairs the following facts must be taken into consideration :—

- (1) That the land of this Block (A) is amongst the worst of the farm. In 1909, when it was under plant cane the crop practically failed in spite of heavy manuring, while in 1910, the ratoon crop was little more than half that of this year.
- (2) That owing to the treatment, *viz.*, liming, green manuring, etc., which this block received from 1910-12 it carried a very heavy crop of plant cane last year which would have the effect of exhausting the soil for the succeeding ratoon crop.
- (3) That the cold weather of 1913-14 set in exceptionally early and there was more fog than usual.

It would appear that our usual dressing of 20 maunds of rape cake per acre is not sufficient on this class of land for a ratoon crop following on a heavy plant cane crop, so this year we have raised the amount of cake to 30 maunds per acre for the ratoons (about 120lb N per acre).

With regard to quality, B 376 and B 147 are about the same as last year while B 208 shows a very marked improvement.

8. The following varieties were grown on Block D :—

Sugarcane Varieties
Plant cane.

B. 147	...	...	... }
Striped Mauritius	...	...	... } $\frac{1}{4}$ acre duplicate plots.
B. 376.	..	..	... }
Magh	...	...	... }
B. 208	...	...	... } $\frac{1}{10}$ acre plots.

Kheri and Tana were planted on small non-experimental areas, and Rogapura and Gendari (Dacca), which were rejected as failures some years ago, were re-introduced on small areas with the object of testing whether under the improved condition of the soil they will be more successful. These varieties have now been planted on experimental plots and the results will be recorded next year.

Block D was under plant cane in 1909-10 followed by ratoon in 1910-11. In March 1911, after the ratoon crop was harvested, a dressing of 25 maunds of slaked lime per acre was applied. Then a crop of *ahu* paddy was sown followed by a crop of matikalai (*phaseolus radiata*) in the cold weather. In March 1912, another dressing of slaked lime was applied at the rate of 5 maunds per acre, bringing up the total lime dressing to 30 maunds per acre. In 1912, a crop of cowpeas was grown for green manure, and sugarcane was planted in the spring of 1913.

The sugarcane cuttings were planted direct in the field in rows four feet apart, as against the usual practice in previous years when the cuttings were sprouted in a nursery and planted in rows three feet apart. The manuring also in the case of plots 4 to 6 differed from our usual method of treating plant cane, in that oilcake was substituted for half the usual amount of cowdung in three plots thus:—

Plots 1 to 3—Per acre 200 maunds cowdung at planting time.

Ditto 150 ditto „ first earthing.

Ditto 150 ditto „ second „

Total ... 500 maunds.

Plots 4 to 6—Per acre 200 maunds cowdung at planting time.

Ditto 25 ditto and 5 maunds
and 35 seers cake at first earthing.

Ditto 25 maunds cowdung and 5 maunds
35 seers cake, second earthing.

Total ... 250 maunds cowdung $11\frac{3}{4}$ maunds
cake.

The cowdung was valued at $1\frac{1}{2}$ annas per maund and the cake at Rs. 2 per maund, the money value of 250 maunds of cowdung being supplied as cake in plots 4 to 6.

A few reserve sets were kept in a nursery with which to fill up blanks in the plots, but germination was good and there were very few blanks to fill.

The cane was planted in the first week of March 1913. Weeding and first earthing was done in the middle of April, and final earthing and manuring in the beginning of July. The cane was stripped in November and harvested during the latter half of March 1914. The results are given in Tables III and IV:—

TABLE III.

PLANT CANE, 1913-14.

Juice.

Plot	Variety.	Plot area.	Cane sugar.	Invert sugar.	Total sugar	Glucose ratio.	Total solids.	Purity coefficient	Remarks.
1	2	3	4	5	6	7	8	9	10
		Acro.	Per cent.	Per cent	Per cent.		Per cent.		
1	B. 147	1/2	16.55	0.50	17.05	3.03	18.1	91.4	
2	Striped Mauritius	1/2	16.68	0.44	17.12	2.65	17.9	93.2	
3	B. 376	1/2	16.76	0.28	17.04	1.65	17.8	94.1	
4	B. 147	1/2	17.24	0.40	17.64	2.35	18.6	93.0	
5	Striped Mauritius	1/2	16.94	0.42	17.36	2.49	18.1	93.9	
6	B. 376	1/2	16.83	0.29	17.12	1.73	17.7	95.0	
7	Magh	1/6	14.61	0.68	15.29	4.64	16.7	87.7	
8	B. 298	1/6	18.30	0.54	18.84	2.93	19.6	93.6	

TABLE IV.
PLANT CANE, 1913-14.

(Figures are per acre.)

Plot.	Variety.	Plot area.	Cane.	Juice.	Juice on cane	Total sugar in juice.	Total sugar in juice.	Cane sugar (sucrose) in juice.	Remarks.
1	2	3	4	5	6	7	8	9	10
			lbs.	lbs.	Per cent.	Per cent.	lbs.	lbs	
1	B. 147 ...	1/4 acre	65,296	46,569	71.32	17.05	7,940	7,707	
2	Striped Mauritius ...	1/4 "	69,060	43,580	63.11	17.12	7,462	7,270	
3	B. 376 ...	1/4 "	59,450	34,670*	58.32*	17.04	5,908*	5,811*	* These figures are much too low and cannot be accepted as accurate. See same variety on plot 6
4	B. 147 ...	1/4 "	62,608	40,470	64.64	17.64	7,139	6,977	
5	Striped Mauritius ...	1/4 "	62,760	44,230	70.48	17.36	7,679	7,493	
6	B. 376 ...	1/4 "	62,016	45,395	73.20	17.12	7,771	7,640	
7	Magh ...	1/10 "	59,540	38,440	64.56	15.29	5,878	5,616	
8	B. 208 ...	1/10 "	57,080	36,800	64.47	18.84	6,933	6,735	

With the exception of Magh, which is about the same as last year, the yields of total sugar per acre although high are about 1,000 lbs. less than those of the plant cane last year. This is partly due to the effect of the season which, as remarked before, was unusually cold and foggy, and also to the fact that the numbers of sets per acre were largely reduced owing to spacing the rows 4 feet apart instead of 3 feet. With 4 feet spacing of rows, a larger number of sets per row is required to produce a full crop.

On the other hand the results obtained this year are very superior to those obtained on the same land in 1909-10, as will be seen from the following figures :

	Sugar per acre.		
	1909-10.	1913-14.	
	Lbs.	Lbs.	
Striped Mauritius ...	5,379	7,570	average of 2 plots.
B. 147 ...	2,648	7,539	ditto.
B. 376 ...	2,102	7,771	1 plot.

This improvement can only be ascribed to the treatment of the land during 1911-12 when, in addition to thorough cultivation, it was given a dressing of 30 maunds of lime per acre and green manured. This bears out our experience in the case of Block A last year, where the cane crop more than doubled itself since the last rotation (*vide* Jorhat Farm Report for year ending June 30th, 1913).

With regard to quality, the juice is very similar to that of last year's plant cane, the three Barbadoes varieties and Striped Mauritius maintaining their position as producers of high purity juices.

Examining the yield figures from the point of view of the differential manurial treatment, and neglecting both plots of B 376 since the figure for plot 3 is probably erroneous, we find that the cowdung-only plots give an average yield of 7,539 lbs. sugar per acre against 7,409 lbs. for the cowdung *plus* oilcake plots. The difference is very small and is well within the bounds of experimental error, so apparently when cowdung is scarce oilcake may be used advantageously as a substitute. It is probably unnecessary to point out that a very great deal depends on the quality of the cowdung and oilcake used. An average sample of cowdung made in a pit may be taken to contain 0.5 per cent. nitrogen, and rapecake 5 to 6 per cent. nitrogen.

This experiment is being repeated during the current year.

9. This was laid down in Block A in 1912. There are three plots each $\frac{1}{8}$ th acre in area, the distance between the rows being 3, 4, and 5 feet respectively. The same number of sets was planted in each row. The variety planted was B 376 in all plots. Cultivation and manuring was the same as in the ratoon variety experiments. The results are given in table V.

TABLE V.

Planting Experiment—Ratoon Cane, 1913-14.—B376— $\frac{1}{8}$ acre plots.

Plot No.	Area of plot.	Number of rows.	Width apart of rows.	Sets per row.	Sets per acre.	Weight of cane per row.	Weight of cane per acre.	Remarks.
1	2	3	4	5	6	7	8	9
1	$\frac{1}{8}$ th acre ..	20	3 feet	45	7,200	330	52,800	Each row had same number of sets. Distance between rows and hence number of sets per acre were the only variants
2	$\frac{1}{8}$ th	15	4 ..	45	5,400	471	56,528	
3	$\frac{1}{8}$ th	12	5 ..	45	4,320	504	57,072	

As in last years' plant cane so in the ratoon the variation in the composition of the juice of the 3 plots was negligible. Apparently the number of sets per acre within reason below about 10,000 has very little or no effect on the quality of the juice. All our planting experiments up to date point to this.

With regard to yield per acre, wider planting has come out best in the ratoon, while last year in the case of the plant cane of which this is the ratoon, the reverse was the case; but this needs further confirmation.

10. This was set out in Block D in 1913. There are 4 plots each $\frac{1}{10}$ th acre in area. The experiment is very similar to the one laid down last year, differing from that only in so far as the three feet planting has been eliminated and two varieties have been used instead of one.

Cultivation was the same as for the variety experiments in the same block. Manuring was 500 mds. cowdung per acre, 200 mds. being applied in the rows at planting time and the remainder in two equal doses at the times of earthing.

The results are given in Tables VI and VII :—

TABLE VI.

Plant Cane.—Planting Experiment, 1913-14.

Variety	Plot area.	Number of rows	Width apart of rows.	Number of sets per acre.	Weight of cane per row.	Weight of cane per acre.	Remarks.
1	2	3	4	5	6	7	8
			Ft.	Acre.	Lbs.	Lbs.	
B 376	{ 1 st th acre ...	10	4	5,400	712	71,230	Each row had same number of sets. Distance between rows and hence number of sets per acre were the only variants.
		8	5	4,320	737	58,930	
B 147	{ 1 st th " ...	10	4	5,400	696	60,580	
		8	5	4,320	616	49,310	

TABLE VII.

Plant Cane.—Planting Experiment, 1913-14.

Variety.	Width apart of rows	Cane per acre.	Juice per acre	Juice on cane.	Cane sugar in juice.	Invert sugar in juice.	Total sugar in juice.	Glucose ratio.	Total solids in juice.	Purity co-efficient	Total sugar per acre.
1	2	3	4	5	6	7	8	9	10	11	12
	Ft.	Lbs	Lbs.	Per cent.	Per cent.	Per cent.	Per cent		Per cent		Lbs.
B 376	4	71,250	46,750	65 64	17 71	0 24	17 95	1 35	18 75	94 4	8,793
	5	68,930	38,320	65 03	16 42	0 40	16 82*	2 43	17 64	93 1	6,446
B. 147	4	60,580	38,890	63 37	17 47	0 42	17 89	2 39	18 03	92 3	6,868
	5	49,310	31,018	64 73	17 63	0 41	18 04	2 34	19 04	92 6	5,753

*This plot was lodged and attacked by parrots. This probably accounts for reduction in quality of juice.

As regards quality of juice, leaving out of account B 376 one plot of which was lodged and attacked by birds, these results confirm the previous year's plant cane results, and also those of this year's ratoon crop, *viz.*, that the number of sets per acre does not affect the quality of the cane.

On the other hand the weight of cane per acre is increased where the larger number of sets is used, thus agreeing with last year's plant cane results.

This year we have laid down a more comprehensive experiment with the object of ascertaining the optimum number of sets for 4 feet and 5 feet spacing of rows respectively, and the results will be given in next year's report.

11. This work, which has been fully described in the last two annual reports* of this farm, Soil investigations, was continued and extended during the year under report. This year it is proposed to treat the subject very briefly, and to confine remarks chiefly to the results obtained in 1913-14. When sufficient material has been collected, a bulletin will be issued describing the results of the several years' work in full.

The investigations were commenced in 1909 and now consist of the following experiments:—

Block G.—Liming experiment laid down in 1909.

Block C.—Liming and manurial experiment; also wood ashes experiment laid down in 1911.

Block K.—Experiment to ascertain the reasons for the observed remarkable affect of lime on this soil, laid down by Mr. Meggitt in 1912.

Block L. (new area).—Limestone experiment laid down in 1913.

Block E.—Experiment with flour phosphate laid down in 1913.

The results of the experiment on Block K have been written up by Mr. Meggitt and will be published shortly as a Memoir of the Department. This year's results of the remaining experiments will be dealt with in the following paragraphs.

12. *Block G.*—Slaked lime at the rate of 50 mds. (4,100 lbs.) per acre was applied to half the area in 1909. The limed area was divided into two equal parts longitudinally in 1911, and 6 mds. (492 lbs.) bone meal per acre applied to one part. In 1913 the

* Annual reports of the Jorhat Experiment station for the years ending June 30th 1912 and 1913.

whole area including the non-limed plot was given a dressing of 100 mds. (8,200 lbs.) cowdung per acre. *Aus* paddy has been sown annually on the whole area followed by representative crops in the cold weather. The cold weather crops were sown in strips across both treated and untreated plots. Usually the *aus* paddy yields a moderate crop on all the plots, being rather better on the limed plots. The cold weather crops on the other hand fail altogether on the non-limed plot, while yielding small crops on the limed plots. It is evident from the annually diminishing outturn of the cold weather crops that the effect of the lime is wearing off, and the experiment will be continued without further manurial treatment of the plots to ascertain how long the effect of the lime will last.

This year the *aus* paddy results are omitted as unreliable, since, through oversight, some of the plots were weeded and others not. The results of the cold weather crops are given below in lb. per plot.

Crop.	Lime and Bonemeal,		Lime,		Nil	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Matikalai ...	6	12	3½	9½	1	2½
Mustard	1½	...	½	...	Nil	Nil
Oats	14	...	11	...	Nil	Nil

The only thing that grew at all on the non-limed area was a very miserable crop of *matikalai*. This experiment has all along been regarded as qualitative rather than as quantitative, and figures are given only to emphasize the fact that, in the absence of liming, some crops, *e.g.*, oats and mustard produce absolutely no crop at all.

13. This experiment commenced in 1911 was continued in its third year. The plots which had ten maunds lime per acre in 1911 and 1912 were given a third dressing of ten maunds during the year under report, and the bonemeal and cowdung dressings were applied as before. The plots which received initial lime dressings of 30 maunds and 60 maunds per acre, respectively, in 1911 received no addition of lime.

Block C.

Liming and manurial experiment.

The cropping during 1913-14 was :—

		Non-green manure block.		Green manure block.
Rains	...	<i>Aus</i> paddy	...	Cowpeas for green manure.
Cold weather...		Barley	...	Barley.

Notes made during the growing period of the crops go to show that *aus* paddy is most unsatisfactory as a test crop for manurial experiments on this farm. This was specially noticeable on the portions crossdressed with bonemeal, where the phosphate had encouraged an enormous growth of grass weeds which had a most prejudicial effect on the crop. The difficulty of keeping this crop clean in the showery weather prevalent during its growth is so serious that we have decided to abandon the crop altogether, and have cut it out of the rotation from this year. Two years ago when *aus* came into the rotation we experienced the same difficulty, the results being practically worthless on this account. Cowpeas for green manure did very well, but made better growth on the lime plots, the heaviest growth of all being on the portions of the limed plots crossdressed with bonemeal.

The cold weather crop, barley, appeared to be much better on the green manured block than on the non-green manured block. In both blocks the crop on the plots annually dressed with ten maunds lime (10+10+10) looked much better than that on the 30 maunds lime plots.

The results in lb. of paddy and barley grain per acre are set out in Table V.III.

TABLE VIII.
BLOCK C.
Aus paddy and barley.
Third year of experiment.

Cross dressings.	Non-green manured block.				Green manured block.			
	No lime.	Lime 30 mds (10 + 10 + 10).	Lime 30 mds.	Lime 60 mds	No lime.	Lime 30 mds (10 + 10 + 10)	Lime 30 mds.	Lime 60 mds.
Nil ...	P-320 lbs.	P-240 lbs.	P-220 lbs.	P-180 lbs	...	...	..	...
	B-Nil	B-560	B-500	B-670	B-Nil	B-690 lbs	B-470 lbs	B-710 lbs.
Bonemeal 3 maunds per acre in first, second and third years.	P-100	P-190	P-140	P-220	.	..		..
	B-Nil	B-590	B-500	B-550	B-10 lb.	B-710	B-310*	B-780
Bonemeal 3 maunds and cow- dung 100 maunds per acre in first, second and third years.	P-170	P-210	P-210	P-200	..	...	...	...
	B-Nil	B-620	B-540	B-520	B-30	B-780	B-620	B-1,270
Cowdung 100 maunds per acre in first, second and third years.	P-370	P-220	P-220	P-440	..		...	.
	B-Nil	B-780	B-640	B-720	B-20	B-640	B-700	B-980

All figures are per acre
One maund = 82 lbs
P = Paddy grain.
B = Barley grain

* This figure appears to be erroneous.

In considering the above table the *aus* paddy crop may be neglected for reasons already given. The barley figures, however, are instructive and generally bear out the conclusions arrived at from the results of the two previous years. In the non-green manured block the average outturn per acre for all plots is 449 lb as against 545 lb for the green manured block, the advantage on the green manured side being not so great as anticipated from the appearance of the crop during its growth. The effect of the green manure is greatest on the plots receiving the heaviest dressing of lime, *e.g.*, taking the 60 maunds lime plots there is an average advantage of 320 lbs. per acre in favour of the green manured plots, indicating that, when green manuring is practised, heavier dressings of lime are required to get the full advantage of the green manure. Another point brought out this year is the superiority of the plots which receive ten maunds of lime annually over the 30 maunds plots which got the lime all in one dressing in 1911. This is especially noticeable in the green manured block.

As is usual with the cold weather crop, the plots receiving *no lime* produced *no crop*, with one or two exceptions in the green manured block where it is very probable that a certain amount of lime has been washed over from the neighbouring 60 maunds lime plot.

The largest crop is obtained on the plot which received the heaviest dressing of lime *plus* bonemeal *plus* cowdung *plus* green manure.

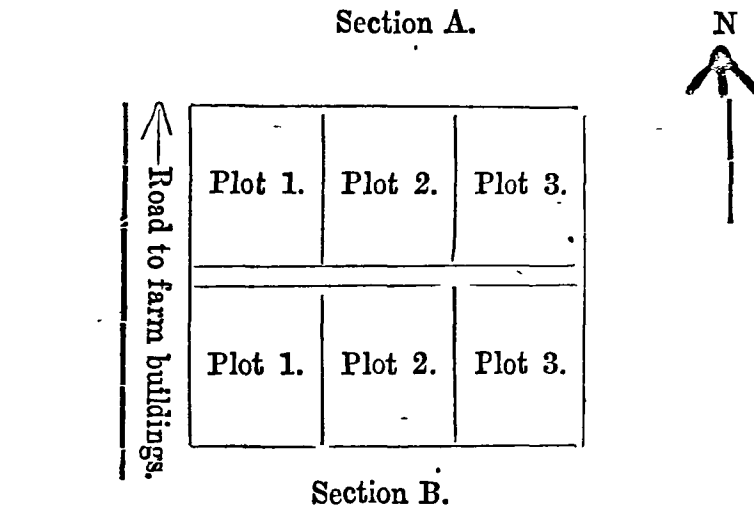
14. This experiment was commenced in 1911 with the object of ascertaining how far applications of wood ashes would replace lime in the improvement of this soil. There are five plots receiving per annum respectively 5, 10, nil, 15, and 20 maunds of wood ashes per acre. Half of each plot is cross dressed with cowdung at the rate of 100 maunds per annum. *Aus* paddy followed by oats in the cold weather was the cropping for the first three years. Each successive year the effect of the ashes is becoming more marked, and this year the 20 maunds plot *plus* cowdung yielded 826 lbs. of oats (grain) per acre, the 15 maunds plot *plus* cowdung 476 lbs. and the 10 maunds plot *plus* cowdung 233 lbs. The "no manure" plot never produces any oat crop, as also the 5 maunds plot without cowdung, while the 5 maunds plot *plus* cowdung yielded a very small crop this year.

The effect of the wood ashes appears to be qualitatively the same as lime, but very much larger quantities will have to be

used to get as good results. Still the cumulative effect of the larger dressings is beginning to tell, as witnessed by the crop of oats harvested this year.

This is important from the point of view of the cultivator who is not in a position to lay out money in lime, as in most parts of the province there is an abundance of jungle which can be converted into ashes for nothing except the labour employed in collecting it.

15. *Block L.*—This experiment was laid down in the spring of 1913 on new land in the area recently added to the farm. There are 6 plots each $\frac{1}{2}$ acre arranged thus :—



There are 3' turf divisions between plots, and 8' turf divisions between the sections. Section A will be cultivated shallow with country implements, while section B will be deep cultivated with English ploughs.

The land was under grass closely grazed. After it was broken up and a fair tilth obtained, ground limestone was applied as follows :—

Sections A and B Plot 1—15 mds. limestone per acre.

Plot 2— Nil.

Plot 3—30 mds. limestone per acre.

The cropping over the whole area was cowpeas for green manure in the rains followed by oats in the cold weather.

The cowpeas germinated and grew well on all the plots, but the growth was heavier on the limed plots, the heaviest growth being on the 30 maunds limestone plots.

The oats germinated well on all plots, but soon after germination died out entirely on the untreated plots.

All the treated plots matured a crop which was harvested, threshed and weighed, the results being given in Table IX:—

TABLE IX.
OATS.
(Figures are per acre.)

Plot.	Treatment	Section A.		Section B.	
		Grain.	Straw.	Grain.	Straw.
1	2	3	4	5	6
		lbs.	lbs.	lbs.	lbs.
1	15 maunds limestone ...	369	796	214	715
2	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>	<i>Nil.</i>
3	30 maunds limestone ...	537	1,422	615	1,104

The above figures indicate that finely ground limestone has a very striking effect on this soil immediately after application. The effect on the cowpeas was apparent within three months of application, and the effect on the oat crop in the same year is overwhelming. The untreated plots produced *no crop at all* as against poor to fair crops for the treated plots.

It is evident that the smaller dressing of limestone is insufficient on this soil, while probably the larger dressing of 30 maunds per acre is also rather on the conservative side.

It must be remembered, however, that, with the exception of green manure, no other manures were applied to any of the plots, and that this soil is inherently deficient in plant food with the possible exception of potash.

16. *Block E.*—This block was limed at the rate of 30 maunds slaked lime per acre in 1909, and was green manured with cowpeas the same year. In 1910 and 1911 it carried crops of sugarcane manured with 500 maunds of cowdung and 20 maunds Flour phosphate experiment

rape cake per acre respectively. This was followed by *aus* paddy and *matikalai* in 1912 without manure. In 1913 a plot measuring 7 acre was dressed with 7 maunds per acre Flour phosphate, and the whole area was green manured with cowpeas in preparation for sugarcane again in 1914. Following the cowpeas, mustard was taken during the cold weather of 1913-1914.

It is proposed to record the effect of the phosphate on each crop during the succeeding rotation.

The effect of the phosphate was very great on the mustard as will be seen from the following figures :—

Yield per acre on phosphate area	...	231lb grain.
Ditto non-phosphate area	...	22lb „

Practically the crop failed altogether on the non-phosphate area, while on the phosphate plot, although the crop was poor, yet there was a *crop*.

This only confirms our previous experience in Block C experiment that in the case of mustard, phosphatic manuring is absolutely essential on this soil, otherwise, whatever the manuring the crop fails altogether.

17. On the whole, this year's results, confirm the results obtained in previous years, the chief among which is that in order to grow most ordinary crops on this soil a preliminary dressing of lime, is absolutely essential. The exact amount of lime to be applied and the frequency of application is not so clear. The results of Block C experiment rather tend to show that, after the first two years, 10 maunds per acre of slaked lime applied annually for three years will give better results than 30 maunds applied once in three years, but in the case of the smaller annual dressing it would probably be advisable to increase the initial dressing to at least 20 maunds per acre. However, it is hoped that more light will be thrown on this point before the experiment is finished.

The most striking result this year is undoubtedly the rapid effect of the applications of ground limestone on Block L. How long this effect will last, and also whether it will be more pronounced in the second year remains to be seen, but the fact remains that it does have a marvellous effect on the soil almost immediately after its application ; and this is important in view of the fact that the cost of ground limestone at present is little more than half that of slaked lime delivered at the farm.

18. *Aus* paddy was grown on Block B followed by *matikalai*. The outturn of the paddy was poor. The *matikalai* was a little better, yielding 16½ maunds on about 3 acres. Block F received a dressing of wood ashes from the sugar boiling furnaces and was subsequently sown with cowpeas for seed, but these had to be burnt before coming to maturity owing to a severe attack of insects.

Block H was under ratoon cane, most of which was sent to Kamrup.

Small plots of soybeans, groundnuts, and Buri and Cambodia cotton were put down in the kitchen garden. Half the area to be sown with soybeans and groundnuts was given a dressing of 7 maunds of flour phosphate per acre. The soybeans were resown three times but practically failed on account of wet weather. Groundnuts did fairly well, the yield from the area dressed with flour phosphate being 1,316 lb. per acre against 1,062 lb. per acre from non-phosphate area.

Both varieties of cotton did very badly. The crop was sown rather late and apparently the heavy rains were unfavourable to the healthy growth of the plants.

19. There are now about a dozen Muzafferpur lichi trees on the farm. For some reason or other those near the bank of the tank are gradually dying out. Those further away from the tank, however, are making good growth and bore fruit this year.

Of three varieties of pineapples, *vis.*, Ceylon, West India and Spanish, the Ceylon does best, and there are a large number of plants of this variety now on the farm. A quantity of good quality fruit is produced, but it is difficult to protect it from the attentions of birds which swarm in the neighbouring sugarcane fields.

Three Langra mango trees ripened fruit for the first time this year, but the prospects of this fruit are not particularly hopeful at Jorhat.

Guava trees are making good vegetative growth and are fruiting annually, but the fruits are gradually degenerating.

20. The receipts amounted to Rs. 1,462 *plus* Rs. 600 (value of cane despatched to Kamrup) equal to Rs. 2,062 total. The total expenditure, including Rs. 2,220 for establishment and Rs. 2,958 for capital charges, was Rs. 10,839.

21. Two pairs of bullocks were purchased at Sonepur fair at a total cost of Rs. 325 including freight and attendance charges for delivery at the farm. One bullock died of old age during the year.

22. This consists of a Farm Superintendent on Rs. 100-10-200, a Fieldman clerk on Rs. 25-1-8-40 and a peon on Rs. 8. During the year Government sanction was obtained for two more apprentices bringing the total up to four.

These posts are now held by :—

Bhola Nath Gogoi appointed October 25th, 1912.

Bhudhar Phukan „ November 10th, 1912.

Anandi Ram Gohain „ April 5th, 1914.

Davendra Nath Hazarika appointed April 5th, 1914.

Srijut Bina Ram Das held the post of Farm Superintendent and I am pleased to be able to report great improvement in his work during the year. Srijut Devi Prasad Gohain was Fieldman-clerk up to June 15th when he left to join the Bihar Agricultural College, having been nominated as a Government scholar. This vacancy had not been filled at the end of the year.

23. The Director of Land Records and Agriculture inspected the farm three times. The Deputy Director visited Jorhat 10 times inspecting the farm several times on each occasion. Mr. A. A. Meggitt joined his new appointment as Agricultural Chemist, Assam, on January 10th, 1914, and remained at Jorhat, in connection with the sugarcane and soil investigation work until April 4th, when he went on leave.

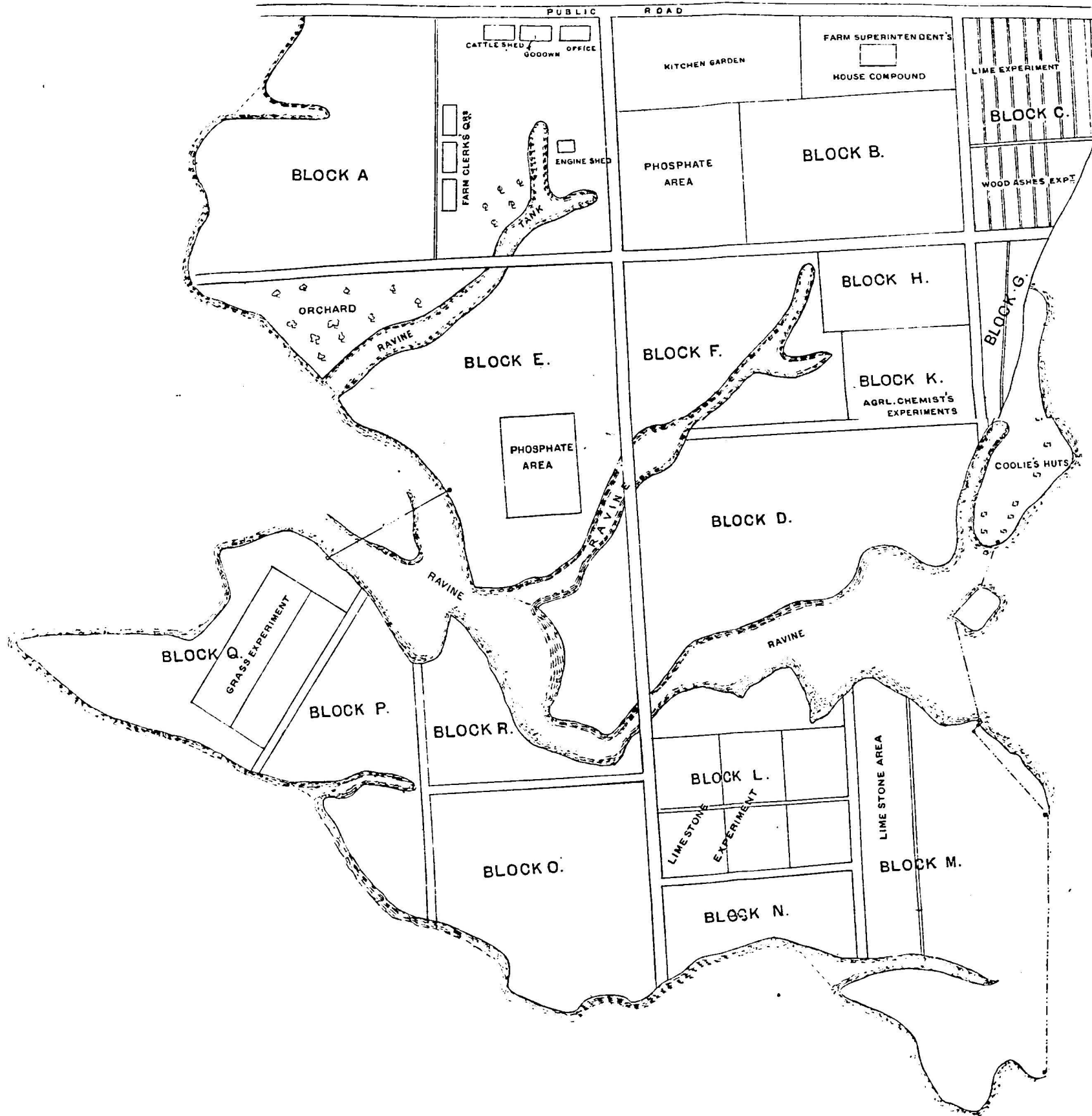
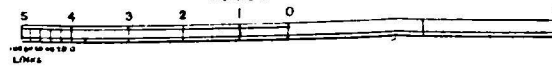
A. G. BIRT,

The 30th July 1914.

Deputy Director of Agriculture, Assam.

MAP
OF
JORHAT FARM

Scale 32 = 1 Mile



SURVEYED & DRAWN BY

MESSRS. K. C. HAZARIKA & CO

JORHAT ASSAM

2-8-1914

ANNUAL REPORT OF THE UPPER SHILLONG AGRICULTURAL EXPERIMENT STATION FOR THE YEAR
ENDING JUNE 30TH, 1914.

The Upper Shillong Agricultural Station was established in 1897-98. It is situated on the Cherrapunjee road, $5\frac{1}{2}$ miles from the town of Shillong, and occupies the site of the old "Model Farm" which ceased to exist in 1879. The elevation of the station is 5,200 feet, i.e., about 900 feet higher than Shillong town. A large area of pine forest was annexed to the station in 1905. The total area of the farm, inclusive of forest, is 336.67 acres. Most of the cultivated land lies in a long narrow valley, the bottom of which consists for the most part of marshy land covered with thick growth of wild grass. A considerable area of this marshy land has been reclaimed by deepening and straightening the stream which drains the valley and cutting lateral *nullahs* to connect with it. A part of this area has been bush-drained. The work of reclamation is being continued and extended. The results of the work already done are very apparent. Soft boggy ground on which previously it was unsafe to work has been converted into farm pasture land, and at the same time the herbage shows a marked change for the better.

The soil of the greater part of the station is a coarse reddish loam of very loose texture which can be worked with the greatest ease. The sub-soil is of a more pronounced reddish colour and of great depth. In a small portion of the station the soil is black owing, it is believed, to the existence of some mineral compound. At the bottom of the valley a different type of soil is found, namely, clay or clayey loam, extremely rich in organic matter. Having been under a thick growth of grass for many years, the upper portion of this soil is a matted mass of half decayed grass roots.

In point of quality, the soil of the farm is extremely poor, and very little can be grown on it without the help of manure. A sample of soil was analysed during the year by the Agricultural Chemist, but the analysis being of doubtful accuracy is not quoted here.

Besides the natural poverty of the soil, the greater portion of the station suffers from the disadvantages of an exposed situation. It is colder and more windy than Shillong; frosts are of very

common occurrence and are more severe than in the town. During the winter the growth of vegetation is entirely suspended.

2. The main objects for which the station was established were the introduction of superior varieties of potatoes which are the most important crop grown on the plateau of the Khasi Hills, the breeding of improved strains of cattle suitable for this tract, and the cultivation of fodder crops and making of ensilage for use in winter when green fodder is short. These objects are still kept in view, and in addition sheep-breeding experiments with the object of improving the local breed were commenced in 1909.

3. The following table gives the rainfall during the year under report :—

Weather.	Inches.
1913—	
July	12.91
August	13.38
September	6.95
October	8.21
November	0.16
December	0.90
1914—	
January	0.00
February	2.15
March	1.00
April	9.55
May	13.32
June	24.14
Total	92.97

The spring rains of 1914 were particularly favourable for the germination of the potato crop which has yielded a full outturn. The maize crop of 1913 suffered badly from heavy rain in May and June. Most of the autumn crops were untimely killed by early frosts.

4. The work done during the year included :—

Summary of work.

- (1) Reclamation.
- (2) Potato experiments.
- (3) Potato growing for seed.

- (4) Rotation experiments.
- (5) Manure experiment in peaty soil.
- (6) Rice experiments.
- (7) Trials of new fodder crops.
- (8) Trials of other new crops.
- (9) Fodder crops for silage and hay.
- (10) Cattle breeding.
- (11) Sheep breeding.
- (12) Distribution of seeds, implements, etc.

5. The work of reclaiming the peaty land in the bottom of the valley was continued. Some 11 acres of land had been reclaimed in the previous year. A further area of about 8 acres was ploughed up and a part of it was bush-drained during the year with the intention of laying it down to grass for grazing. This particular area belongs to the Forest Department, though the farm is allowed to graze its cattle thereon.

The bush-drains are made by partially filling up the drains with brush-wood and finally covering them in with earth. This kind of drain is expensive to make, but cannot be expected to last long. Shortly after the close of the year, two experimental drains were made, in one of which the lower six inches were filled up with pebbles and covered with slates, and in the other slates only were used, these being placed in such a way as to leave a clear opening six inches deep all through. The two experimental drains which were 40 and 44 feet long, respectively, cost Rs. 19-8 and Rs. 16-3 per 100 running feet, respectively. The latter kind seems preferable in a clay sub-soil, as is the case with the land in the bottom of the valley. It is proposed, if funds permit, to drain a few acres of land in the current year by means of slate drains; by arranging for a wholesale supply of slates, the cost may be reduced to about Rs. 10 per 100 running feet.

Potato experiments. 6. These included—

- (a) Variety tests and
- (b) A combined experiment to test whole *versus* cut sets and to compare different seed rates.

Experiments had been made for many years past to compare the merits of winter against those of summer seed, with the invariable result of the former shewing an enormous superiority over the latter. These experiments having attained their object were discontinued from last year.

7. The following varieties were compared in the season just closed (1914), - each variety being planted on duplicate plots, each $\frac{1}{10}$ th acre in area :—

Khasi round, obtained locally in	...	..	1900
Khasi Nainital ditto	...	..	1908
King Edward VII, from England	...	...	1906
Sutton's Magnum Bonum, ditto	..	...	1908
Windsor Castle, ditto	..	...	1909
British Queen, ditto	...	...	1909
Up-to-date, ditto	...	...	1909
King of Potatoes, ditto	...	...	1912
Magnum Bonum, ditto	...	...	1912
Windsor Castle, ditto	...	...	1912
British Queen, ditto	...	...	1912
Gladiator, ditto	...	...	1912
Flour Ball, ditto	...	...	1912
Harbinger, ditto	...	...	1912
Imperator, ditto	...	...	1912
Belle de Juliet, ditto	...	...	1912
White City, ditto	...	...	1912
Californian, from California	...	...	1912

All the varieties were planted in March and harvested in August. Sets were taken from the previous winter crop. The land was given a dressing of 300 maunds of cowdung and 10 maunds of rape cake per acre, and the crop was sprayed with 240 gallons of Bordeaux mixture per acre in two equal doses.

The outturns of each variety in 1914 and in previous years are exhibited in the following table :—

Statement showing the average yield per acre on duplicate plots for the last seven years.

Variety.	1914.	1913.	1912.	1911.	1910.	1909.	1908.	Average of last three years	Average of seven years.
1	2	3	4	5	6	7	8	9	10
	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.	Mds. srs.
1. King of Potatoes ...	217 35	186 20	234 0	201 0	131 20	95 30	319 0	212 32	197 38
2. Magnum Bonum (1908) .	214 0	165 20	232 0	160 35	132 20	87 30	277 0	203 33	181 15
3. King Edward VII ...	168 5	133 20	128 20	103 13	78 20	90 15	239 0	143 15	147 13
4. Khasi Nainital ...	186 0	174 10	166 20	157 30	119 0	111 30	203 0	176 23	172 35
5. Khasi Round ...	133 8	123 0	111 20	135 2	95 25	102 25	253 0	119 9	185 6
6 Windsor Castle (1909)	209 35	168 20	205 0	181 15	63 15	.	.	191 5	.
7 British Queen (1909)	196 5	152 30	181 20	189 35	92 30	.	.	176 32	.
8 Up-to-date ...	207 25	186 20	178 0	153 0	90 0	.	.	190 28	.
9. Magnum Bonum (1912) ...	170 10	156 0	224 0	...	...	...	...	183 23	.
10. Windsor Castle (1912) ...	218 20	129 0	196 0	...	...	...	...	187 35	...
11. British Queen (1912) .	181 20	142 10	72 20	...	...	...	...	132 3	.
12. Gladiator ...	109 0	127 10	93 26	...	...	...	...	109 37	...
13. Flour Ball ...	142 10	160 30	173 0	...	...	...	...	168 27	.
14. Harbinger ...	146 30	108 30	126 0	...	...	...	...	127 7	...
15. Emperor ...	183 15	167 30	211 0	...	...	...	...	187 12	...
16. Belle de Juliet ...	96 0	63 20	81 20	...	...	...	...	80 13	...
17. White City ...	174 20	82 0	80 20	...	...	...	...	112 13	...
18. Californian ...	144 10	92 25	...	...	...	...	...	...	...

Of the older varieties, King of Potatoes again gave the highest yield, and the next best was Magnum Bonum (1908). The varieties named above stand in the same relative order on the average of the last seven years.

Of the varieties imported since 1909, Windsor Castle (1912) came out at the top, and excelled even the best of the older varieties. The next in order were Windsor Castle (1909), Up-to-date, British Queen and Emperor.

As in former years, 50 tubers of each variety were selected at random, cut open and examined for signs of disease. The following table gives the results of the last six years :—

Variety.	Number of diseased tubers					
	1909.	1910.	1911.	1912.	1913.	1914.
1	2	3	4	5	6	7
King of Potatoes* ..	10	12	Nil	Nil	Nil	1
Magnum Bonum (1908) ...	...	6	4	2	4	2
King Edward VII (1905) ..	Nil	18	8	4	6	5
Khasi Nainital (1908) ...	10	43	16	8	4	4
Khasi Round (1900) ..	Nil.	4	8	6	10	6
Windsor Castle (1909) ..	..	..	..	4	3	3
British Queen (1909) ..	Nil.	12	Nil	6	4	2
Up-to-Date (1909) ..	...	4	32	16	4	1
Magnum Bonum (1912) ..	..	...	..	6	6	2
Windsor Castle (1912) ..	..	..	...	4	3	2
British Queen (1912) ..	..	...	..	4	4	3
Gladator (1912) ...	..	..	...	8	4	2
Flour Ball (1912) ...	...	..	..	6	3	1
Harbinger (1912) ...	..	...	...	2	8	2
Imperator (1912) ...	..	...	..	22	3	3
Belle de Juliet (1912) ..	...	...	..	6	Nil.	2
White City (1912) ...	...	..	...	10	9	15
Californian (1912) ...	...	...	..	...	3	17

* Figures for 1909-11 are for the old stock of King of Potatoes imported in 1906, while those for 1912-14 are for the new stock imported in 1912.

These figures must not be regarded as an absolute test of the amount of disease in the crop, but taken over a series of years they indicate to some extent the comparative disease-resisting power of the several varieties. It is clear, however, from the table that the amount of disease has steadily decreased since 1910 when it was at its worst, and this year, most of the varieties exhibited a very small proportion of diseased tubers. The three worst varieties in respect of disease were Californian, White City and Khasi Round.

Of the many varieties of potatoes, tried on the farm, Flour Ball is the only kind which flowers, sets and matures fruit. Some ripe fruits were gathered from the crop of this variety in 1912, and the seed obtained therefrom was sown in the spring of 1913. Some of the tubers of the resulting crop were found to be white, and others of a pink colour. These were separated and planted last season in two separate plots. The plants which came up from these tubers differed a good deal from each other in several important particulars such as colour of leaves and veins as well as of the tubers' habit of growth and flowering. Altogether seven different types were observed and a few plants of each type were marked out and separately harvested. The tubers from these have been preserved for sowing next year in order to compare the merits of the different types. One or two of these types seem promising.

8. Experiments had been made for several years past to compare the merits of whole *versus* cut sets under the conditions of climate and cultivation obtaining in the Khasi Hills. In the case of winter grown seed, the results of the experiments in 1911 and 1912 were contradictory, the 1911 experiments indicating that cut sets were more productive, while in 1912 the results were decidedly in favour of whole sets. In 1913 it was found that in case of summer seed, whole sets were preferable to cut sets, while for winter seed whole and cut sets showed little difference in point of outturn.

The results hitherto obtained having proved discrepant, the experiment was repeated this year (1914). It incidentally appeared in 1913 that in the case of cut sets of winter seed, the yield was not appreciably diminished by halving the seed rate (that is, by reducing it from 12 maunds to 6 maunds per acre). It was therefore decided to institute an experiment in 1914 with a view to determine the optimum seed rate for cut as well as for whole sets. This experiment was combined with the one intended to compare the respective merits of whole and cut sets. Winter

seed alone was used in the experiment, it being thought unnecessary to duplicate the experiment with summer seed which past experience had shown to be greatly inferior to winter seed in productive power.

For this combined experiment, 48 plots, each $\frac{1}{40}$ th of an acre, were taken and divided into two series of 24 plots each, the two series being exact counterparts of each other. Out of the 24 plots of each series, 12 were planted with King of Potatoes and 12 with Magnum Bonum. Of the 12 plots planted with each variety in each series, 6 were planted with whole sets, and 6 with cut sets, and the 6 plots planted with each description of sets of each variety and in each series, received 6, 8, 10, 12, 14 and 16 maunds of seed per acre, respectively, the distance apart between the rows being 2 feet and in the rows 9 to 10 inches in case of each seed rate.

The crop was planted in the first week of March and manured with 300 maunds of cowdung and 10 maunds of oil cake per acre. It was sprayed twice with 120 gallons of Bordeaux mixture used each time.

The scheme of the experiment and the results obtained are set forth in detail in the following table:—

*Whole versus cut sets and seed-rates.
(Each plot = $\frac{1}{40}$ th acre)*

Seed : whole or cut.	Seed rate per acre	First series.		Second series.		Average yield per acre.			
		Plot No.	Yield per acre.	Plot No.	Yield per acre				
1	2	3	4	5	6	7			
KING OF POTATOES.									
Whole	Mds		Mds.	sr	Mds.	sr	Mds.	sr.	
..	6	1	160	20	19	150	20	155	20
..	8	2	195	0	20	189	30	192	15
..	10	3	214	0	21	245	0	229	20
..	12	4	230	20	22	248	30	239	25
..	14	5	228	0	23	258	30	243	15
..	16	6	* 224	0	24	* 258	20	* 241	10
Average of all seed-rates—Whole sets.								216	27½

* The asterisks indicate the few cases in which an increase in the seed rate was not attended by an increase in the yield—a discrepant result due in all likelihood to experimental error.

Whole versus cut sets and seed-rates—concl'd.
(Each plot = $\frac{1}{10}$ th acre)

Seed · whole or cut.	Seed rate per acre	First series		Second series.		Average yield per acre—	
		Plot No.	Yield per acre	Plot No.	Yield per acre.		
1	2	3	4	5	6	7	
	Mds		Mds. srs.		Mds srs.f	Mds	srs.
Cut	6	7	218 20	13	177 0	197	30
"	8	8	* 184 30	14	196 30	* 190	30
"	10	9	211 10	15	224 10	217	30
"	12	10	235 0	16	229 10	23	5
"	14	11	258 20	17	232 20	245	20
"	16	12	233 0	18	* 230 30	256	35
Average of all seed rates—Cut sets.	...	.	..	...	..	223	18
MAGNUM BONUM.							
Whole	6	30	183 0	48	182 20	182	36
"	8	29	197 0	47	183 20	190	10
"	10	28	205 10	46	203 0	204	5
"	12	27	234 0	45	229 20	231	30
"	14	26	* 219 30	44	245 20	232	25
"	16	25	250 0	43	245 20	247	30
Average of all seed rates—Whole sets.		..	.	.	.	214	35
Cut	6	36	188 20	42	166 0	177	10
"	8	35	234 30	41	199 20	217	5
"	10	34	* 210 30	40	212 20	* 211	25
"	12	33	236 0	39	235 20	235	30
"	14	32	241 10	38	240 20	240	35
"	16	31	264 0	37	252 20	258	10
Average of all seed rates—Cut sets.	.		..	..	...	223	19

* The asterisks indicate the few cases in which an increase in the seed rate was not attended by an increase in the yield—a discrepant result due in all likelihood to experimental error.

First, with regard to the outturns obtained from the use of whole sets and cut-sets respectively. These, quoting from the foregoing table, were as follows :—

Whole or cut sets.				Seed rate per acre.	King of Potatoes (average of duplicate plots)	Magnum Bonum (average of duplicate plots).	
1				2	3	4	
				Mds	Mds.	Mds.	
Whole	}	6	{	155	183
Cut						198*	177
Whole	}	8	{	192	190
Cut						191	217*
Whole	}	10	{	229	204
Cut						218	212*
Whole	}	12	{	240	232
Cut						232	236*
Whole	}	14	{	243	233
Cut						215*	241*
Whole	}	16	{	241	248
Cut						257*	258*
<i>Average of all seed rates taken together.</i>							
Whole		217	215
Cut		223	223

If we compare the outturns for each seed rate separately, the results appear to be discrepant, cut sets yielding a larger outturn than whole sets in 8 cases (marked with asterisks), and the reverse being the case in the remaining four. Such discrepancies are unavoidable in a field experiment in which the conditions of

soil, manure and cultivation are never actually, though apparently, uniform. The differences in yield which were in all but 2 of the 12 contrasted pairs less than ten per cent. might be set down to accidental error.

But if we take all the seed-rates together, the chances of accidental error are greatly reduced and the averages thus obtained may be accepted as reliable. The averages show cut sets to be but very slightly superior to whole sets, the difference in outturn in favour of cut sets amounting only to 6 mds. or 3 per cent. in case of King of Potatoes and 8 maunds or 4 per cent. in case of Magnum Bonum. These differences are so slight that one might safely say that there was not much to choose between the two descriptions of seed, and that both are equally good.

The results of the experiment viewed in this light may be taken as decisive, and there will be no object in repeating it next year. It is to be remembered, however, that while whole and cut sets are under ordinary conditions equally good, there are circumstances in which the use of the one or the other is preferable. For instance, with small seed tubers, it would be inadvisable to cut them up into smaller sets, while with large sized seed, it would be very desirable to split them up in order to reduce the cost of the seed. Then again, if the potatoes happen to be infected with disease, it is very desirable to cut open each tuber and reject such as show any sign of infection.

Secondly, with regard to the merits of the different seed-rates, the yields were as follow, taking whole and cut sets together :—

Seed-rate per acre.	Variety.	Yield per acre.	Average of two varieties.	Increase in yield for each extra 3 mds. of seed.
1	2	3	4	5
Mds.		Mds.	Mds.	Mds.
6	{ King of Potatoes	177	178	...
	{ Magnum Bonum ...	180		
8	{ King of Potatoes ...	192	198	20
	{ Magnum Bonum ...	204		
10	{ King of Potatoes ...	224	216	19
	{ Magnum Bonum ..	208		

Seed-rate per acre.	Variety.	Yield per acre.	Average of two varieties.	Increase in yield for each extra 2 mds of seed.
1	2	3	4	5
Mds.		Mds	Mds.	N'ds.
12	{ King of Potatoes ...	236	235	19
	{ Magnum Bonum ...	234		
14	{ King of Potatoes .	244	241	6
	{ Magnum Bonum ..	237		
16	{ King of Potatoes ..	249	251	10
	{ Magnum Bonum ...	253		

The figures of yield in the third column are averages of four plots, and those in the next column are averages of eight plots. Errors due to accidental differences in soil and cultivation, which are indicated by asterisks in the table on pages 8 and 9 have been reduced by averaging.

It will be seen that each increase of two maunds in the seed rate was attended by a greater or less increase in the yield. The rate of increase was greatest with the smaller seed rates, there being an increase of 18 to 20 maunds at each step. It fell off to 6 maunds between 12 and 14 maunds of seed rate, though it was somewhat greater, apparently owing to accidental error, when the seed rate was raised from 14 maunds to 16 maunds.

From a consideration of these figures it would seem that under the conditions of soil and cultivation we have to deal with in the Khasi Hills, the optimum seed rate would be somewhere in the neighbourhood of 12 maunds per acre. This is the seed rate ordinarily used on the farm.

9. Of the many varieties of potatoes tried, the three which had proved most prolific, *viz.*, King of Potatoes, Magnum Bonum and Up-to-date, were grown this year (1914) for seed. The total area planted was $9\frac{3}{4}$ acres. The time of planting extended from 16th February to 20th March. The manures used were 150 maunds of cow-dung and 10 maunds of rape cake per acre, except that on a portion of the area, where the soil seemed particularly poor an extra dose of 50 maunds of cow-dung was applied. The crop was sprayed with Bordeaux mixture twice at the rate of 120 gallons

of mixture each time. The total quantity of sets used was 142 maunds 36 seers, which gave an average seed rate of 12 maunds 30 seers per acre. The outturn was as follows :—

Variety.		Area in acres	Yield.	
			Mds.	srs.
King of Potatoes	...	4 875	770	24
Magnum Bonum	...	4 100	679	22
Up-to-date	...	0 775	64	33
Total	...	9 75	1,514	39

The average yield for the whole area amounted to very nearly 155 maunds or 5·7 tons per acre. In 1913, the total area planted with potatoes for seed was 9·65 acres and the total yield was 1,038 maunds giving an average of 105 maunds to the acre. The better outturn of 1914 was due wholly to more favourable weather.

To these maunds 1,515 have to be added the following quantities which were obtained from the experimental area :—

				Mds.
King of Potatoes	...	...	...	142
Magnum Bonum	...	...	...	142
Up-to-date	..	...	..	10

These bring up the total quantity of potatoes available for seed purposes to 1,808 maunds. The greater portion of this quantity, that is after excluding small and defective tubers and setting apart the quantity required for the farm, will be available for sale as seed to the public.

From the crop of 1913, 804 maunds of King of Potatoes and Magnum Bonum were sold during the year to the public (see paragraph 18). The price charged was Rs. 3-4 per maund which was the average bazar rate last season. For the convenience of Khasia cultivators wanting to purchase our seed, temporary depôts were opened last year at Cherrapoonjee, Mawphlang, Lad Mawphlang, Dumpep, Laitlyngkot and Marbisu, and an extra charge of 8 annas to Re. 1 per maund was put on to cover the cost of transport to the depôts. Depôts at the same places and also one at Mawkhar have been opened this year again, but instead of charging a fixed price all through the season, it has been decided to sell the potatoes at the current bazar price which

varies from week to week. At the same time steps have been taken to reduce the cost of transport which was somewhat excessive last year.

The total of the experimental and non-experimental areas cropped with potatoes in 1914 was 11 84 acres. The total yield of potatoes from this area was 1,931 maunds which gave an average of about .163 mds. to the acre. The total cost of cultivation, exclusive of the cost of cow-dung and charges for rent and supervision, amounted to Rs. 1,926-9-3 or practically Re. 1 per maund. The sale price at the time of harvest fluctuated between Rs 2 and Rs. 2-8 per maund.

10. This experiment was initiated in the previous year (1912-13) to compare the effect of cow-dung alone and cow-dung *plus* insoluble phosphates on limed and unlimed areas, through the following rotation :—

1st year potatoes.
2nd „ maize.
3rd „ soybeans.

The plan of the experiment is as follows, each plot being $\frac{1}{40}$ th acre in area :—

Lime,	No lime.
6 plots numbered 6, 5, 4, 3, 2, 1.	6 plots numbered 6, 5, 4, 3, 2, 1.
-----	-----
No lime.	Lime.
6 plots numbered 6, 5, 4, 3, 2, 1.	6 plots numbered 6, 5, 4, 3, 2, 1.
-----	-----

Slaked lime was applied at the rate of 10 maunds per acre about a month before the first crop of the rotation, *viz*, potatoes, was planted in 1913, and the following manures were applied in the drills at the time of planting the potatoes :—

Plots '1 and '4	... 300 maunds of cowdung per acre.
„ 2 and 3	... 300 maunds of cow-dung <i>plus</i> 3 maunds of flour phosphate per acre.
„ '3 and '6	... 300 maunds of cow-dung <i>plus</i> 3 maunds of raw bone meal per acre.

The flour phosphate and bone meal were mixed with the cow-dung before application.

The first crop of the rotation, potatoes, grown in the summer of 1913, did not show any appreciable benefit from the application of lime or the phosphates. The second crop of the rotation, maize, was sown in May last. It was not to receive any manure and so none was applied. The crop is now on the ground, but shows a very poor growth. The soil is of a very loose texture and appears to be incapable of retaining manure. The experiment is not expected to yield any positive result.

11. This is a new experiment. It is designed to test the effect of lime and bonemeal on peaty soil. Two large plots of land in the bottom of the Valley have been selected for the experiment. The land had been a marsh and reclaimed by draining. Each plot was divided into four equal areas and the four sub-plots were treated as follows :—

Manure experiment
on peaty soil.

- Sub-plot 1.—Manured with 30 maunds of lime per acre.
- „ 2 —Manured with 30 maunds of lime and 3 maunds of bone meal per acre.
- „ 3. - Manured with 3 maunds bone meal per acre.
- „ 4.—No manure.

N.B.—One maund = 80 lbs. roughly.

One of the two plots which has an area of $1\frac{1}{20}$ acres was sown with soybean in May last and the other plot having an area of $\frac{7}{10}$ acre was sown at the same time with maize. The land in each case had received several ploughings during the winter and spring months, but is still in a more or less sour condition, even in those sub-plots which have received lime. The soybean and maize crops are now on the ground. The maize looks very poor and is evidently suffering from the acidity of the soil. The soy bean appears more promising. The actual result will not be known till next autumn.

12. It was reported in the last Annual Report of the Farm that two acres of newly reclaimed marsh land had been put under rice for the first time in 1913. Half the area was sown with rice broadcast in the ordinary local way, the seed rate being 100 lbs. per acre, and on the other half transplanting was tried with single plants about 6 inches apart, the seed-rate used being only 25 lbs. per acre. The object was to test the merits of transplanting against broadcast sowing. It was also intended to test the effects of bone meal and flour phosphate which were applied in some portions of the land, while the rest remained unmanured. The experiments, however,

proved abortive. The yields obtained were so poor as to count for next to nothing. The land, though reclaimed from marsh, still remained full of tough masses of grass roots and very little real soil was visible on the surface. It will take some years for the grass roots to decompose and for a sufficient depth of soil to collect at the top. The latter process may be artificially hastened by bringing down silt with water from the hill slopes and causing it to settle on the land—a method of improving rice-land which is well-known to the Khasias. It is proposed to adopt this method from next winter.

An additional area of two acres was added to the rice land during the year under report. These two acres, together with the two acres taken up in the previous year, have again been sown with rice, partly broadcast and partly transplanted. But the crop which is now on the ground looks no better than last year, and is not expected to give any results worthy of record.

13. Mention was made in the last Annual Report of several species of exotic and Indian fodder crops having been sown as an experiment in the spring of 1913. The exotic fodders tried were lupins, swedes, turnips, mangels, sugarbeet, lucerne, swordbeans, florida velvet beans and some species of Australian grasses and clover. The crops germinated well, but with the exception of lupins, swedes, and turnips, none were able to survive the monsoon rains. Lupin continued to grow and flower till the end of October when it was prematurely killed by early frosts. A few pounds of seed was saved and was sown again in May last. The crop grown from the new sowing is now on the ground and seems to be doing well. Swedes were sown on $\frac{1}{10}$ acre in May 1913 on land which had been liberally manured with cow-dung and phosphates. The crop made fair growth and stood the rains fairly well, but the outturn of roots was small— $4\frac{1}{2}$ maunds (340 lbs) from the tenth of an acre. A similar area was sown with turnips, but these suffered more from the monsoon rains than the Swedes and gave only $2\frac{1}{4}$ mds. (180 lbs.) of roots. The failure of the exotic fodder crops last year only served to confirm the experience of previous years that the peculiar climatic conditions of the Shillong plateau, with its heavy spring and monsoon rainfall followed by a dry cold winter, are not suited to those crops.

The Indian fodders which were tried during the year were Darjeeling soybeans, radish, and a native wild grass called *Tyrdip*.

The soybean was sown in May and grew well till October when it was prematurely killed by frost. Radish was sown on 2.65 acres of land in September after a crop of summer potatoes. It grew well until it was overtaken by the October frosts and killed out. A small yield of green fodder and roots was obtained and fed to sheep in the winter. *Tyrdip* is a local fodder grass. About half an acre of land was planted with it in March 1912. The land was lightly ploughed once in May 1913 and a hoeing was given to it in January 1914. The grass was found to spread laterally on the ground instead of forming thick upright clumps. It seems more suited to grazing than for cutting for green fodder or hay. The crop was mown in October last and gave only two loads of hay from about half an acre of ground.

14. *American maize*.—Seed of five varieties was saved from the previous year's crop and sown on small plots separately in different parts of the farm. All failed except one, Other crops. *viz.*, Early Huron Dent which produced a small quantity of grain. The seed was saved and has been sown this year for a fresh trial.

Rhubarb.—About $\frac{1}{10}$ th acre was planted in October 1912 with plants removed from the old Fruit Garden at Umlyngka. The land had been liberally manured with cow-dung before planting, and received a further dressing of manure last winter. The crop has grown exceedingly well. Between April and June last, it yielded 171 lbs. of stalks which were sold locally for Rs. 17-14-0. Several Khasi cultivators in the neighbourhood of Shillong have taken to the cultivation of this vegetable and they bring it for sale in the local bazar.

Strawberries.—Nine varieties, removed from the Fruit Garden at Umlyngka, were planted on about $\frac{1}{20}$ th acre. Only one variety, Louise Gautier, has done well. Last spring it yielded an outturn of 14 lbs. of fruit from an area of 30 square yards which is equal to $\frac{1}{160}$ th of an acre. It was sold locally at 12 annas per lb. This variety has done well throughout since its introduction in the Umlyngka Fruit Garden several years ago.

Asparagus.—One-third of an acre was planted with Asparagus in October 1912. The crop is doing very well. It was decided not to pick any shoots last spring, but to let the crop grow for another year and get strong so as to yield a good picking next year.

Buck wheat.—It was sown on $\frac{1}{10}$ th acre in May 1913. The sowing proved untimely; the crop suffered greatly from the heavy monsoon rain and yielded a meagre outturn of only 4 lbs. of grain. The crop will be tried again in the current year.

Fodder crops for 15. The fodder crops grown during the year and their yields are shown below :—

Name of fodder crop.	Area sown in acres.	Outturn of green fodder.	Outturn of hay.	Remarks.
1	2	3	4	5
Maize	14.7	Mds. 557 = 20.5 tons	Mds. ...	Ensiled.
Langtylli	2.5	43 = 1.5 tons	...	Ensiled. Scientific name not known.
Wild grasses	...	117 = 4.3 tons	...	Ditto ditto.
Raishan millet (Paspalum Sanguinale).	33.07	...	412 = 15.1 tons	Made into hay.

The maize crop was greatly damaged by heavy rain during early growth and gave a poor yield of fodder. The total quantity of fodder ensiled amounted to 717 mds. (= 26.3 tons). Only one pit silo was used. Five hundred and one maunds or about 70 per cent. of the fodder put in was recovered as silage. The total cost of the silage was Rs. 442-7-1 which was made up as follows :—

	Rs a. p.
Cost of cultivation and harvesting of maize 14.7 acres ...	323 3 1
Ditto ditto of Langtylli 2.5 acres	62 9 6
Cost of collecting wild grasses ...	14 0 0
Cost of chopping fodder and filling silo ...	42 10 6
Total	442 7 1

The cost per maund of silage amounted to about 14 annas per maund which was 50 to 100 per cent. more than what it ordinarily costs. The high cost was due principally to the very poor yield of the maize crop. The Langtylli grass too gave a miserable outturn of green fodder. It was at one time hoped that it might be profitable to cultivate this grass which is wild in the Khasi Hills, but I am now led to think that it will not pay to grow it as a cultivated crop.

Raishan was grown in a number of fields with an aggregate area of 33.07 acres. A small portion of this area was sown with soybean in mixture with *Raishan*, but the soybean plants remained stunted and did not amount perhaps to even one per cent. when the mixed crop was cut for hay. The sowings of *Raishan* and soybean extended from the beginning of April to

the middle of June 1913. The crop was cut for hay in October. The total yield of hay was 412 maunds (15.1 tons) which cost Rs. 582 or about Rs. 1-6-6 per maund.

Both the silage and hay proved exceedingly useful for feeding the farm stock during the winter.

This year about $7\frac{1}{2}$ acres of maize and 30 acres of *Raishan*, soybean and jobs' tears have been sown for fodder. The maize crop promises a good outturn of fodder. The greater part of the land sown with the other fodder crops received little cultivation and no manure. The crops are allowed to come up along with wild grasses, the object being to cut them all together and use them for either silage or hay.

Cattle breeding. 16. The following table shows the number of cattle in the herd on 30th June 1914:—

Description	Patna (P)	Bhutia (B)	P x B	P x B x P	P x B x P x P	P x Khasi	P x K x P	Total on 30th June 1914	Total on 30th June 1913	Remarks.
1	2	3	4	5	6	7	8	9	10	11
Breeding bulls	2	.	.	..	..	.	...	2	2	
Bulls (3 years and above)	2	.	...	3*	.	2	4	11	9	* Are being used as plough cattle.
„ (2 to 3 years)	2	.	2	1	.	..	..	5	4	
„ (1 to 2 years)	2	.	1	1	.	...	..	4	6	
„ (under 1 year)	2	.	.	.	.	..	..	2	6	
Heifers (2 to 3 years)	3	.	.	..	.	..	...	3	4	
„ (1 to 2 years)	1	...	...	4	1	...	.	6	5	
„ (under 1 year)	2	.	1	6	...	.	..	9	4	
Cows	9	1	5	2	..	..	...	17	16	
Total on 30th June 1914	25	1	9	17	1	2	4	59		
Total on 30th June 1913	27	1	7	13		2	6		56	

In addition to the above, there were 3 Hindustani and 5 Khasi bullocks. The total number of cattle was, therefore, 67 as against the same number on the 30th June 1913.

During the year, twenty-one animals were born, 12 died and 9 were sold. Of the 12 deaths as many as ten were young stock under one year, and two were old Patna cows. The mortality among the calves was excessive, most of the deaths being attributed to a disease known as white scour. Since 1911 it has been the practice to bring up the calves by handfeeding, the object being to accustom the cows to be milked without the calves. It has been found easy enough to feed the calves from a pail, but the cows, as a rule, refuse to be milked in the absence of the calves. This too has been the experience in most places in India where attempts have been made to milk cows without bringing the calves before them. There is danger besides in handfeeding the calves, on account of the risk to their health from drinking milk contaminated by accident, a risk which it is not possible to avoid altogether in view of the uncleanly habits of the men who are entrusted with the management of the cattle. I am inclined to attribute to this cause the excessive mortality which occurred last year among the young stock. The handfeeding of calves has accordingly been stopped and replaced by the ordinary practice of allowing them to suck their mothers.

Of the 9 animals sold, five (*viz.*, 3 Patna and 2 Patna × Khasi) were breeding bulls, one was a Patna × Bhutia heifer and three were Khasi plough bullocks which were weeded out as useless for further work. Three more breeding bulls were sold during the year, but they were not taken delivery of by the purchaser before the close of the year. With these three bulls the total number sold during the year would be 8 against 12 in the preceding year.

The eight bulls sold were purchased one by Mr. Fergusson of Dhamai Tea Estate in Sylhet, one by the Rangpur Dairy Farm, one by the Local Board of Nowgong, one by a European resident of Shillong, one by a Khasi cultivator, and three by the Bengal Veterinary Department.

The pure-bred bulls were sold, as in previous years, at Rs. 50 each and the cross-bred bulls at Rs. 40 each. These prices are much too low, but we have to sell at these purposely low rates in order to suit the means of the small cultivator.

It has become a question for serious consideration whether we ought to continue to spend a large amount of money annually for the sake of a few breeding bulls. The actual cost of maintaining the herd amounted last year to Rs. 5,805 and all we got in return for the money was Rs. 1,190, of which Rs. 700 represented the value of the milk and Rs. 490 the price

of the animals sold during the year. To this income might be added the value of the cowdung which might be valued at about one thousand rupees, more or less.

On the other hand, it is to be borne in mind that the Patna breed as well as the crosses between that breed and the Khasi and Bhutia cattle have proved remarkably well adapted to the Khasi Hills and they are far superior, both as regard size and milking capacity, to any cattle we possess in Assam. It would be extremely undesirable, therefore, to abolish the herd of Patna and cross-bred cattle on the farm. There is a proposal to establish a special cattle breeding farm in Assam, and when it comes into being it may be found possible, in the interests of economy, to transfer the herd thereto.

A large number of pure Patna and cross-bred breeding bulls has been sold to Khasia breeders and others during the last decade. We do not know how all these bulls have done, but recently we made an enquiry about the condition and work of the bulls sold since 1911. Some of the animals are reported to have proved useful and given satisfaction to the owners, some died within a short time after their removal from the farm, and a few proved useless for breeding purposes.

17. On 30th June 1914 the total number of sheep on the farm was 136 against 171 on the corresponding date of the preceding year. The flock was made up as follows:—

	1914	1913.
Dumba rams	2	5
" ewes	11	10
" ram lambs	2	...
Khasi ewes	37	63
" rams	2	6
Dumba x Khasi rams	12	4
Ditto ewes	26	17
Ditto ram lambs ... ..	...	26
Ditto ewe lambs ... ..	...	21
Dumba x Khasi x Dumba rams	17	3
Ditto ewes	8	1
Ditto ewe lambs	7	6
Ditto ram lambs ... ..	...	9
Dumba x Khasi x Dumba x Khasi ram lambs.	2	..
Ditto ditto ewe lambs	1	...
Dumba x Khasi x Dumba x Dumba ewes	3	...
Nepali ram	1	...
Nepali x Khasi ewe lambs	3	...
Ditto ram lambs	2	...
Total	136	171

The Nepali ram is private property and has been kindly lent to the farm by the owner for breeding purposes.

The results of sheep breeding last year were very disappointing. The flock instead of increasing decreased by no less than 35 animals. The decrease was due wholly to heavy mortality. No less than 95 sheep died from various causes, chiefly cold and bowel diseases, while only 65 lambs were born. The corresponding figures for the preceding year were 56 deaths and 95 births.

The sheep breeding experiment seemed promising in the beginning, but it is becoming clear that the climate and grass of the Khasi plateau do not suit sheep well. The grass though plentiful in summer is wanting in nutrition. The sheep do not put on flesh quickly as they ought to do if the grass were good, and it has been found necessary to supplement it with artificial food and even then they do not thrive well. The long spells of wet weather, often accompanied by cold, are particularly harmful to the sheep, and many animals have died from exposure.

Only three breeding rams, all being Dumba × Khasi, were sold during the year as against 6 in the previous year. The price charged for each ram was Rs. 8.

Ninety-nine sheep were shorn last spring and gave a total outturn of 63 lbs. of wool. The heaviest fleece was obtained from the Nepali ram, but it weighed only 1½ lbs. The Dumba and cross-bred sheep gave about a pound of wool each. Samples of wool from the last clipping were forwarded to the Director-General of Commercial Intelligence, who was kind enough to get them appraised by Messrs. Ralli and Brothers of Calcutta. The valuations are quoted below:—

“*Sample A. Wool of pure Dumba sheep.*—“ White, fair quality and staple, some kemp and grey, greasy, a little frib and earth.

“ Value 7½*d.* per lb.

“*Sample B. Wool of pure Khasi sheep.*—“ White, coarse in quality, rather short in staple, some grey, much grease and kemp, some frib and earth.

“ Value 5½*d.* per lb.

“*Sample C. Wool of Dumba × Khasi sheep.*—“ White and grey, fair quality and staple, some grease and kemp, a little frib and earth (sample shows about 20 per cent. of grey).

“ Value 7½*d.* per lb.

“*Sample D. Wool of Dumba × Khasi × Dumba sheep.*—“ White, medium quality, fair length of staple, some kemp and grease, a little grey and earth.

“ Value 8*d.* per lb.

“ *Sample E. Wool of Dumba × Khasi × Dumba × Dumba—* White and grey, fair quality and staple, some grease, a little earth (sample shows about 50 per cent. grey).

“ Value 8*d.* per lb.

“ *Sample F. Wool of Nepali sheep—* White, coarse, good length of staple, some kemp, rather much grease, some grey and earth.

“ Value 7½*d.* per lb.

“ We may remark that all the wool shown is of a saleable character in this market.”

These valuations are encouraging, but regard being had to the very small weight of the fleece, it is very doubtful if it would pay to shear the sheep.

18. The following were the seeds, plants, implements, and spraying materials supplied to agriculturists during the year—

Distribution of seeds and implements

				Mds. srs.	Number
Seed-potatoes	...	..	...	804 23	...
Maize	...	...	...	5 0	...
Fruit grafts	...	..	...	...	12
Mulberry cuttings	...	..	...	...	24
Strawberry suckers	...	...	...	...	400
Copper sulphate for spraying	...	...	...	1 7½	...
Spraying pump	...	...	...	...	1
Turn wrest ploughs	...	...	...	...	3

N.B.—1 md. = 80 lbs. roughly.

Of the 804 mds. 23 srs. of seed-potatoes sold during the year, 615¼ maunds was supplied to Khasia cultivators, 10 maunds was sent to the Political Officer on the North-East Frontier, 25½ maunds to Honorary Correspondents in the plains, 20 maunds to the Superintendent of Lushai Hills, 20 maunds to the Subdivisional Officer of Mokokchang in the Naga Hills, and the remainder was supplied to private individuals outside the Khasi Hills, some of it going as far as Bengal and the Central Provinces. The sale of three turn wrest ploughs costing Rs. 40 to Rs. 50 indicates the growing appreciation of this implement by the more well-to-do among the Khasi cultivators.

19. The establishment consists of a Farm Superintendent on Rs. 100—10—200, a Fieldman Clerk on Rs. 50, a Mali on Rs. 12 and a Peon on Rs. 9 per mensem. The staff also includes an Overseer on Rs. 40, but he is employed exclusively on demonstration work and has no

direct connection with the farm. Besides there are two apprentices under practical training on an allowance of Rs. 15 each per mensem.

There were no changes in the staff during the year. The apprentices are appointed for two years. One of the two existing apprentices will complete his term of training at the end of October 1914 and the other on 31st May 1915.

The Farm Superintendent, Mr. L. Herrick Singh, continued to work well.

20. The total receipts, excluding receipts from bonemeal and spraying of Bordeaux mixture, amounted to Rs. 4,018, of which Rs. 2,444 was by sale of potatoes, Rs. 897 by sale of milk and Rs. 300 by sale of cattle. The receipts in the previous year were Rs. 3,449.

The total expenditure, excluding the pay of the Overseer, which is now debited to demonstration, was Rs 14,952-15-1 against Rs. 20,600 in the preceding year. The decrease is mainly attributable to the fact that in 1912-13, a large amount was spent on petty construction and reclamation under which there was comparatively little expenditure in the year under report. A part of the decrease was due to economy in management.

SHILLONG ;

The 25th August 1914.

B. C. BASU,

*Special Officer, Agricultural
Department, Assam.*

ANNUAL REPORT ON THE FRUIT EXPERIMENT
STATION, SHILLONG, FOR THE YEAR ENDING
THE 30TH JUNE 1914.

1 *Introductory*.—The fruit station commenced work in October 1912. It is situated on the south side of the Jowai road distant about a mile from Shillong. The elevation of the land is about 5,100 feet. The total area of the grant is 47.90 acres of which 15 to 20 acres are suitable for fruit planting. Three-fourth of an acre has been added to the "Lower Garden" laid out in 1912-13 bringing the planted area of the block to $4\frac{1}{4}$ acres. The soil of this block varies from light sandy loam lying above stone, to heavier loam of good depth.

The trees planted in 1912-13 required little winter pruning, and what was necessary to be done was finished by the 15th January. The majority of the Bush Apple trees put on a good growth during the year. The Standard and Espalier trees transplanted later, made little start before the spring this year, but since then they have put on very satisfactory growth. The Pyramid and Bush Pear trees took a long time to start, and the new growth last year was twiggy. This year the majority of the trees have thrown out strong growth. The Cordon, and the Upright trained trees are all thriving. A small percentage of the Plum trees are still backward; the remainder started this spring and are now doing well.—The Cherry, Peach, and Fig trees are now full of vigour.

All the trees were winter sprayed with Lime Sulphur Solution and have been summer sprayed with a weaker solution this year. Spraying for Aphis was done as necessary. Methylated spirit rubbed in where woolly apple Aphis had attacked the trees has proved a successful remedy.

No parasitic fungoid diseases have yet been discovered on the trees. The cause of the few cases of constitutional troubles met with, has in nearly all cases been traced to woolly Aphis at the roots of the apple trees and to the Cockchafer grub at the young roots of the trees. Vaporite, an insecticide, rids the soil of many insects, and this year has been used before planting.

The experiments made with Superphosphate of Lime Sulphate of Potash and Sulphate of Ammonia as recorded on page 7 in the report for the year ending the 30th June 1913 were repeated this year on the same trees.

The wall fan trained trees planted this year have made a good start. The Currant and Gooseberry bushes started well but have been at a standstill since May. It remains to be proved if they can be grown successfully in this climate. Loganberry and similar fruits are sending up strong canes and as far as can yet be judged, will thrive.

The fruit of the Laxtonberry, a cross between the Loganberry and the Raspberry, has the real Raspberry flavour and no core. Pyne's Giant Himalaya Berry of California is a large Blackberry. It differs from other "Berries" of this class by bearing fruit on the old wood which continues to bear for years and has not to be cut back each season. It is an extra strong grower. The 7 varieties of American Vines planted, are said to succeed when grown in the open, in a climate where the rainfall is heavy.

Only a few apples were allowed to remain on the trees this year, sufficient to judge of the quality of the fruit. Of the culinary varieties, Red Victoria, a very highly coloured early fruit, shows promise of cropping well. Of mid-season varieties, Bismarck appears to be a heavy cropper. Of the late varieties, Bramley's Seedling, Alfriston, Lane's Prince Albert and Newton Wonder all carry good sound fruit. Of the dessert varieties, James Grieve, and Lady Sudeley are decidedly good. The Kerry Pippin promises to be a heavy cropper and the fruit though small is of good flavour. The Alexander, Peregrine, and Duke of York peach trees, bore good well coloured fruit in June, ripening well on the trees. All the hilly portion of the land has been stone terraced and there has been little loss of soil. A small plot of red clover was planted as an experimental cover crop for the land and has grown to a height of 2 feet before flowering. The tillage of the land began early in March, and the entire surface of the orchard was kept stirred once a month during the year to September. The early tillage saved the moisture in the soil. April as a rule, is a very dry windy month. This year March was dry. A good fall of rain during the first week of April was most beneficial to the growth of the young trees. A dry April would probably ensure a better crop of fruit to bearing trees. Dryness at the roots would check the root action and cause the trees to flower more profusely. Bees are kept for the purpose of fertilisation.

2. 1913-14, *Extension* — Work on this commenced in October 1913. A block of about $12\frac{1}{2}$ acres of forest on a higher level to the east of the "Lower Garden," was selected for this extension. Of this area which has been designated "The Upper Garden," $10\frac{1}{2}$ acres have been planted in 5 blocks, viz: —

Top block.—Area $1\frac{3}{4}$ acres planted with bush apple trees $15' \times 15'$ diagonally.

North block.—Area $1\frac{1}{2}$ acres planted with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$.

South block.—Area $\frac{3}{4}$ acre planted with Bush Apple tree $15' \times 15'$ diagonally.

East block.—Area $5\frac{1}{2}$ acres planted with Standard Apple trees $34' \times 34'$ diagonally, interplanted with Bush Apple trees $17' \times 17'$.

West block.—Area 1 acre planted with Standard Pear trees $25' \times 25'$ diagonally, interplanted with Bush Pear trees $12' 6'' \times 12' 6''$.

The remaining $2\frac{1}{4}$ acres cleared on the North-east, and West blocks will be planted during 1914-15.

The whole area of $12\frac{1}{2}$ acres has been fenced with Page's wire fencing. The soil is a good loam of about 12 inches depth, lying on a reddish sub-soil. A small area only has a hard pan sub-soil about $2\frac{1}{2}$ feet from the surface.

Practically the whole of the planted area will have to be terraced to prevent denudation of the soil by rainfall. Earth banks in addition to the stone terracing have been made on the East block with satisfactory result. Before planting, the land was trenched to the depth of about $2\frac{1}{2}$ feet and the top spit was left as near the surface as possible—all stumps and roots were removed. For each fruit tree 10 seers of slaked lime, and about the same quantity of wood ash were mixed with the soil in a circle 8 feet in diameter to the depth of the trenching. It has been proved that lime is effective against insect and fungus attacks on trees and for promoting soil fertility. Lime rubble as used in the Lower Garden was not procurable. The fruit trees were purchased from Messrs. Thomas Rivers and Sons, Sawbridgeworth Herts; Messrs. Stuart Low and Co, Bush Hill Park, Middlesex; Messrs. Seabrook and Sons, Chemsford, Essex; Messrs. H. Merryweather and Sons Limited, Southwell, Notts; and Messrs. Stark Bros., Louisiana, Missouri U. S. A. The Blackberry canes were purchased from George Pyne, Topsham, Devon. The majority of the trees arrived in good condition. The first consignment arrived on the 5th February and the last consignment on the 13th April. Planting was finished on the 28th May. The trees have started well, and there will be few vacancies or weak trees to replace.

The two Khasi apprentices did all the planting under my direction and work very satisfactorily.

Establishment consists of an Overseer on a monthly salary of Rs. 25 ; 5 Khasi gardeners on a monthly salary of Rs. 15 each ; and a Bengalee gardener on a monthly salary of Rs. 12. With training the Khasi makes a good gardener.

Three iron roofed houses on the Upper Garden and on the Lower Garden have been built for the staff. In each house a room has been reserved for use as a godown for stores and implements.

3. *Varieties planted.*—The following statement shows the number and varieties of fruit trees planted.

Species of fruit trees.	Variety.	Planted 1913-14					Planted 1912-13. Lower garden	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block	Lower garden			
1	2	3	4	5	6	7	8	9	10
Apple trees	James Grieve ...	61	78	148	58	6	48	309	} Bush.
	Boston Russet ...	...	...	12	...	.	.	12
	Bens Red ...	...	..	10	10	..	9	29
	Alfriston ..	..	...	30	..	..	10	40
	Egremont Russet ..	10	..	..	10	...	..	20
	Annie Elizabeth	...	...	10	..	.	.	10
	Claygate Pearmain .	10	...	...	10	...	.	20
	Lord Hindlip .	..	...	10	.	.	.	10
	Mannington Pearman	6	...	...	10	4	.	20
	Winter Queening of Kent	.	..	10	..	.	.	10
	Pineapple Russet	...	.	.	10	..	...	10
	Edward VII .	...	..	...	10	..	...	10
	Red Juneating ..	6	.	.	6	.	10	22	
	Flower of Kent ..	..	...	8	..	..	...	8
	Barnack Beauty .	..	..	.	6	6	.	12
	Coronation .	.	...	6	...	.	.	6
	Wealthy .	..	.	.	6	6	..	12
	Feltham Beauty, .	..	...	10	..	..	..	10
	Norfolk Beauty ..	10	...	.	10	..	10	30
	Christmas Pearman	...	...	10	.	..	.	10
Yorkshire Beauty .	5	..	.	5	..	.	10		
Kings Acre Pippin .	..	..	.	6	...	...	6	
Crimson Bramley ..	15	.	.	20	..	5	40		
Royal Snow	..	..	.	10	.	.	10	
Bramleys Seedling	15	..	.	15	..	14	44		

Species of fruit trees.	Variety.	Planted 1913-14.					Planted 1912-13	Total number.	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden		
1	2	3	4	5	6	7	8	9	10
	Houblon . . .	..	...	6	...	...	...	6	
	Roundway Magnum Bonum.	6	.	..	...	..	6	12	
	Wellington	...	...	6	...	.	.	6	
	Lanes Prince Albert ..	15	...	15	...	...	10	40	
	Stirling Castle .	10	.	10	...	...	..	20	
	Golden Russet .	...	...	6	...	...	...	6	
	Charles Ross	10	...	10	...	..	...	20	
	Bismarck ..	...	...	15	...	...	6	21	
	Rymer ..	6	...	..	...	..	...	6	
	Warners King	..	..	.	...	...	12	12	
	Thomas Eivers .	10	...	.	...	..	...	10	
	Grenadier	...	...	10	...	...	...	10	
	Rev W. Wilks	...	20	...	..	...	6	26	
	Hounslow Wonder	...	...	21	.	...	6	27	
	Newton Wonder .	15	...	15	.	...	10	40	
Apple trees	Red Victoria	...	...	..	..	...	10	10	Bush.
	Potts Seedling	..	5	..	5	.	10	20	
	Hector McDonald	..	...	20	.	..	10	30	
	Domino	15	...	...	.	...	...	15	
	Rival	..	..	16	..	..	...	16	
	Wadhurst Pippin	...	10	...	...	...	..	10	
	Court Pendu Plat	...	...	6	..	...	..	6	
	Eckhnylle Pippin .	5	..	5	.	...	...	10	
	Early Red Margaret ..	..	..	10	..	..	..	10	
	Gascoynes Scarlet	..	5	...	5	..	..	10	
	Spitzenberg	..	..	6	...	.	...	6	
	Braddicks Nonpareil	6	..	..	...	...	.	6	
	White Nonpareil ..	10	...	.	..	...	...	10	
	Baumann's Bernette .	6	6	..	...	...	...	12	
	Pitmaston Pineapple	10	...	...	..	...	.	10	
	Brownlees Russet	...	6	..	..	...	.	6	
	Sturmer Pippin	...	6	6	..	...	9	21	
	Court Pendu Plat	6	.	..	..	..	.	6	

Species of fruit trees-1	Variety.	Planted 1913-14.					Planted 14-12-15.	Total number	Description.
		Upper garden.							
		Top block.	South block.	East block	North block.	Lower garden.	Lower garden		
1	2	3	4	5	6	7	8	9	10
Apple trees	Williams Favourite	10	...	...	...	...	..	10	
	Scarlet Nonpareil ..	...	...	10	..	...	16	26	
	Reinette doree de Heu- gen.	10	...	..	..	...	..	10	
	Coe's Golden Drop ...	...	...	...	..	..	6	6	
	Coxs Orange Pippin .	...	...	...	...	24	..	24	
	Kerry Pippin ...	...	10	10	...	..	10	20	
	Sanspareil ...	...	...	...	..	6	...	6	
	Golden Reinette ...	...	...	...	..	..	6	6	
	Peasgood Nonesuch...	..	...	24	..	6	6	36	
	Fearns Pippin ..	...	..	12	..	...	6	18	
	Lady Sudeley ...	...	...	20	..	4	6	30	
	Devonshire Quarrenden	..	...	...	...	...	18	18	
	Duke of Devonshire	...	..	..	..	6	..	6	
	Yellow Ingestre .	...	..	..	..	..	6	6	
	Allens Everlasting ..	...	..	...	...	6	...	6	
	Ardcairn Russet ..	..	..	6	...	..	5	11	Bush.
	Allington Pippin	...	16	...	...	4	..	20	
	William Crump ..	..	..	12	...	..	6	18	
	Worcester Pearman	...	..	..	...	6	..	6	
	Herrings Pippin ...	..	...	3	...	...	1	4	
	Beauty of Bath ...	...	..	6	..	6	...	12	
	Ellison Orange ...	..	..	...	...	...	1	1	
	Ribston Pippin ...	...	...	...	...	12	..	12	
	Charles Eyre ...	...	..	3	...	..	1	4	
	Syke House Russet .	...	..	...	..	6	...	6	
	Spring Ribston Pippin	...	2	8	..	..	..	10	
	Mr. Gladstone .	..	...	7	...	5	..	12	
	Golden Spire ..	..	14	..	...	...	..	14	
	Rosemary Russet ...	..	..	6	..	6	...	12	
	Early Peach ...	..	10	..	...	...	..	10	
	Yellow Newtown Pip- pin	...	4	8	...	6	...	18	
	American Mother ..	..	9	...	...	...	..	9	

Species of fruit trees.	Variety.	Planted 1913-1914.					Planted 1912-13.	Total number.	Description
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden.		
1	2	3	4	5	6	7	8	9	10
	Encore	2	.	4	...	6	} Bush.
	Irish Peach	...	.	6	..	...	...	6
	Total	340	161	639	151	129	205	1,715	
Apple trees	Crimson Bramley	10	10	} Standards.
	Bhymer	...	.	...	..	...	8	8
	Bramleys Seedling	...	...	..	8	14	..	22
	Count of Wick	.	.	...	6	..	...	6
	Irish Peach	..	...	...	6	..	..	6
	Northern Greening	..	..	...	..	..	9	9
	Norfolk Beefing	...	.	..	6	..	..	6
	Newton Wonder	..	...	..	6	..	..	6
	Sterling Castle	..	.	...	5	1	..	11
	Duchess of Oldenburg	...	..	..	6	..	..	6
	Norfolk Bearer	..	..	..	5	1	...	6
	King of Tompkins County.	...	...	..	6	...	..	6
	Emperor Alexander	..	..	..	6	..	..	6
	James Grievs	...	.	..	12	..	..	12
	Coxs Pomona	..	...	..	2	4	...	6
	Smalls Admirable	..	...	..	6	..	..	6
	New Hawthorden	..	...	..	6	..	...	6
	Delicious (Starks)	..	..	..	12	..	...	12
	King David	..	...	..	12	..	...	12
	York Imperial	..	..	..	6	..	..	6
Paragon Winesap	..	..	..	6	...	...	6	
Jonathan	..	...	..	6	..	...	6	
Black Ben	..	...	..	6	...	...	6	
Champion	..	...	..	3	...	...	3	
Stayman Winesap	..	...	..	6	...	...	6	
Senator	..	...	..	6	..	...	6	
Grimes Golden	..	..	..	5	...	...	5	
McIntosh Red	..	..	..	3	..	...	3	
Mother	..	..	..	6	..	...	6	

Species of fruit trees.	Variety.	Planted 1913-14.					Planted 1912-13.	Total number	Description.
		Upper garden.							
		Top block.	South block.	East block.	North block.	Lower garden	Lower garden.		
1	2	3	4	5	6	7	8	9	10
Apple trees ...	Early Melon (Starks)	6	6	Standards.
	Wealthy ( )	...	...	18	..	..	...	12
	Wilson's Red June (Starks).	...	...	6	..	..	..	6
	Liveland Raspberry (Starks)	...	..	6	..	...	.	6
	Total	176	48	...	22	245	
	James Grieve	4	...	4	Horizontal trained
	Lady Sudeley	...	2	..	...	3	..	5
	Gascoyne's Scarlet	...	2	...	...	...	..	2
	Brownlee's Russet	...	2	...	..	2	...	5
	Beauty of Bath	...	...	..	...	5	..	5
	Cox's Orange Pippin	...	...	...	...	...	1	1
	Cox Pomona	...	1	...	..	3	...	4
	King of the Pippins	...	..	...	...	...	2	2
	Kerry Pippin	...	...	...	...	...	1	1
	Cl. ygate Pearmain	...	...	..	..	..	1	1
	Total	...	9	17	5	31
	Scarlet Golden Pippin	2	2	Upright trained.
	Allington Pippin	...	...	..	...	..	2	2
	Beauty of Bath	...	...	..	...	...	2	2
	James Grieve	...	...	..	..	...	2	2
	Barnack Beauty	...	...	...	...	..	2	2
	Total	10	10	

Species of fruit trees	Variety.	Planted 1913-14				Planted 1912-13	Total number.	Description.
		Upper garden.				Lower garden.		
		Top block.	West block	North block	Lower garden.			
1	2	3	4	5	6	7	8	9
Pear trees	Fertility	.	50	20	70	Bush and Pyramid.
	St. Swithuns	.	.	.	..	10	10
	Beurre Hardy	..	10	.	.	...	10
	Red October	...	...	...	.	10	10
	Beurre d' Anjou	...	6	..	...	.	6
	Pariot	..	..	...	..	10	10
	Williams Bon Chretien	.	9	...	.	...	9
	Seedling Bergamot	..	...	...	.	6	6
	Fondante Thirriot	...	12	.	.	10	22	
	Dr Hogg	.	.	..	.	9	9
	Triomphe de Vienne	.	5	.	..	.	5
	Beacon ...	..	...	.	.	9	9
	Beurre d' Amanlis	..	6	.	...	10	16
	Beurre de Naghan	...	...	...	.	6	6
	Charles Ernest	..	6	.	...	...	6
	Rosevelt	..	..	.	..	6	6
	Doyenne d' Ete	.	12	.	.	...	12
	Blickling	.	.	.	...	6	6
	Gansels Bergamot	..	6	...	.	...	6
	Santa Claus	...	...	.	.	6	6
	Josephine de Malines	...	6	...	.	10	16
	Precoce de Juillet	..	..	.	.	6	6
	Dr Jules Guyot	..	6	.	.	6	12	
	Madame Treyve	...	...	.	...	10	10
	Durondeau	..	6	...	..	6	12
	Hessle	..	5	...	1	15	19	
	Beurre d'Amanlis	...	6	.	...	..	6
	Emile Heyst	..	5	.	.	10	15	
	Maue Benoist	..	6	...	.	...	6
	Clapps Favourite	.	5	.	.	10	15	
Louise Bonne of Jersey	..	5	.	...	...	5	
President Barabe	...	6	.	..	.	6	
Total	...	..	173	...	2	169	869

Species of fruit trees.	Variety.	Planted 1913-14				Planted 1912-13	Total Number	Description.	
		Upper garden							
		Top block	West block.	North block.	Lower garden	Lower garden			
1	2	3	4	5	6	7	8	9	
Pear trees.	Beurre Hardy	.	10		..	5	15	Single Cordon.	
	Clapps Favourite	.	10		.		10		
	Durondeau	...	10	.	.		10		
	Mada e Treyve	...	10		.		10		
	Williams Bon Chretien		10	.	.	5	15		
	Marguerite Marillat	.	10	.	.	5	15		
	Doyenne du Comice		10	.	.	5	15		
	Louise Bonne of Jersey		10		.	5	15		
	Conference	.	10			5	15		
	Emile Heyst	.	10				10		
	Winter Nelis	...	6		...	..	6
	Beurre Superfin	.					5		5
	Princess	5		5
	Beurre Diel	.				.	5		5
	Beurre d' Anjou	5	5	
	Total		.	106			50	156	
	Duchess d' Angouleme	...		2		.		2	Horizontal trained.
	Clapps Favourite	..		2		..		2	
	Josephine de Malines	.		2				2	
	Emile Heyst	..		2				2	
	Louise Bonne of Jersey	...		1		1	..	2	
	Beurre Superfin			1	.	1		2	
	Conference	.		2	2	
Dr Jules Guyot	..		2	.		..	2		
Durondeau	.		2		..	..	2
Pitmaston Duchess	..		1		1	.	2		
Fondante d' Automne			1		1	.	2		
Doyenne du Comice			2		.		2		
Winter Nelis		4		...	...		4
Total		4	20	.	4		28		

Special of fruit trees	Variety.	Planted 1913-14					Planted 1912-13	Total number	Description.
		Upper garden.							
		Top block.	West block.	North block.	Lower garden	Lower garden.			
1	2	3	4	5	6	7	8	9	
Pear trees	King Karl (Starks)	.	3		3	Standards.	
	Triumph ..	..	4			.	4	
	Anjou ..	...	4			..	4	
	Lincoln ..	...	2		...	...	2
	Howell ..	...	4	..	...	...	4
	Duchess ..	...	5			.	5	
	Bartlett ..	...	6	..	..	..	6
	Seckle ..	...	4		..	...	4
	Marie Louise	.	2			...	2		
	Conference	...	2			...	2		
	Emile Heyst	..	2		..	..	2
	Madame Treyve	.	2		...	...	2
	Louise Bonne of Jersey	..	2		...	...	2
	Princess	...	2	...	..	...	2
	Doyenne du Comice	...	2	..		...	2
	William Bon Chretien	..	2	..	...	.	2
	Souvenir du Congres...	..	2	..		...	2
	Marie-Louise d' Uccle	...	2		..	.	2		
	Total	.	..	52	52	
	Conference	3	3	Upright trained.
Marie Louise d' Uccle	..	..	.	...	...	4	4
Louise Bonne of Jersey	...	...	..	..	...	4	4
Fondante d' Automne	...	...	..	...	...	3	3
Winter Nels	..	..	...	...	4	...	4
Conseiller de la Cour	...	...	..	...	...	3	3
Doyenne du Comice	...	..	...	...	...	3	3
Total	.	...	..	.	4	20	24

Species of fruit trees.	Variety.	Planted 1913-14					Planted 1912-13	Total number.	Description.	
		Upper garden.								
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden			
1	2	3	4	5	6	7	8	9	10	
Plum trees ...	Late Transparent	.				6		6		
	Deniston's Superb Gage.	...	...	..	.	..	10	10	
	Satsuma	.	...	.	...	1	.	1	
	Belle de Louvain	..	...	..	...	...	6	6	
	Greengage	..	.	.	.	6	6	11	
	Cox's Emperor	..	.	.	.	6	6	6	
	Starks Gold	...	3	..	.	..	..	3	
	Belgian Purple	..	.	...	.	..	10	10	
	Rutland Plumcot	..	1	.	..	..	..	1	
	Ponds Seedling	.	.	.	.	.	6	6	
	Starks Shire	.	1	.	.	..	..	1	
	Early Transparent	..	...	.	.	..	6	6	Early Trans.
	Starks Omaha	..	.	.	1	.	2	...	3
	Autumn Beauty	..	.	.	1	..	.	5	6
	Guthries Late Gage	.	...	.	.	...	5	5	5
	Reine Claude de Bavay	...	...	...	.	.	5	5	5
	Victoria	..	..	.	.	.	9	9	9
	Czar	..	...	...	..	..	6	6	6
	Starks Mammoth Gold	...	...	1	...	..	...	1	1
	King of the Damsons	...	..	...	..	3	..	3	3
	Starks Imperial Gage	...	..	1	...	..	...	1	1
	White Damson	.	...	..	...	3	..	3	3
	Bruce Shropshire	..	...	..	...	3	..	3	3
	Merryweather Damson	...	...	..	...	6	...	6	6
	Starks America	.	..	..	2	...	.	2	2
	Total	..	5	.	6	.	30	79	120	
	Decaise	1	..	1	
Kirkes	...	..	...	...	2	.	2	2	
Jefferson	..	...	...	..	2	.	2	2	
Deniston's Superb Gage	...	...	..	...	1	...	1	1	Far transd.
Malard	.	...	.	...	1	.	1	1	
Golden Esperen	...	...	...	...	1	.	1	1	
Oullins Golden Gage	.	...	...	..	2	.	2	2	

Species of fruit trees.	Variety.	Planted 1913 1914.					Planted 1912-13.	Total number.	Description.	
		Upper garden.								
		Top block.	South block.	East block.	North block.	Lower garden.	Lower garden.			
1	2	3	4	5	6	7	8	9	10	
Plum trees	Reine Claude d' Althan			1	.	1	} Fan trained.
	Early Transparent	...		..	..		1	...	1
	Coes Golden Drop	...	..	..		..	1		1
	Transparent Gage	...	...				1	.	1
	Greengage	...	..		..		2	...	2
	Golden Transparent Gage.	.			..	..	1	..	1
	Belgian Purple	...	.		..		1		1
	Total				13		13	
Cherry trees	Morello		2		2	} Trees.
	Kentish	.	...	...	.	..	20		20
	Bigarreau Kentish ...			..	..		6		6
	Gloire de France	..	...		..	..	6		6
	White Heart	...	..	...	.	...	6		6
	Napoleon	.	..	1	...	..		...	1
	Black Heart	...	..	..	..	..	6		6
	Lambert	.		1			...	..	1
	Montmorency King	.		1	...	..		1	2
	Montmorency Monarch	...		3	.		..		3	
	Turkey Black Heart	...	.	...	.		1		1
	Late Black Bigarreau	..	.	..			1	...	1
	Frogmore Bigarreau	..	...	..			1	...	1
	Noir de Guben	..	.	..	..		1	.	1
Belle de St Tronc	..	...	.			1	...	1	
Early Rivers	...	..	.			1	..	1	
	Total	..	6	.		6	47		59	
Orange trees	Japanese Satsuma		2	..	2	} Trees.
	Japanese Kunquat	..	..	4	...		8	..	12
	Malta Blood	.	..	4			3	2	9	
	St Michael's	...	...	...			4	...	4
	Jaffa	...	..	..	..	..	1	3	4
	Malta Oval	..	.	.			2	1	3
	Silver	.	...	1	.		1	3	5
Excelsior	...	.	...	.	..	2	...	2	

Species of fruit trees.	Variety.	Planted 1913 14					Planted 1912-13	Total number.	Description.	
		Upper garden								
		Top block.	South block.	East block.	North block	Lower garden	Lower garden			
1	2	3	4	5	6	7	8	9	10	
Orange trees	St Michael's Tangierin.				6	6	Trees.
	St Michael's Dom Louise.	.			.		3		3	
	St Michael's Sustain	..	.				1	1	2	
	Ditto Achilles	.		...			...	1	1
	Total		9				27	17	53	
Lemon trees	Imperial Lemon			..	.			2	2	
	Total				2	2	
Walnut trees	Dwarf Prolifo				10	10	
	Total	10	10	
Peach trees	Peregrine		.				5	14	19	Trees.
	Alexander	.	..		.		3	11	14
	Duke of York	.	.				1	16	17	
	Exquisite	.		.		..		4	4
	Late Devoman	.			...		3	..	3
	Lady Palmerston	.	.	..	.		3	.	3
	Duchess of Cornwall	.			.		1		1	
	Early Rivers	.	.				1	..	1	
	Gladstone ..			..	.		1		1
	Golden Bathripe			..			1	.	1	
	Sea Eagle . ..		..		...		1		1
	Alexander Noblesse ..						1		1	
	Waterloo .		.		.		1		1	
Thamas Rivers .	..	.	.	.		1		1	
Goshawk .	.	.				1		1		
	Total				24	45	69	

Species of fruit trees	Variety.	Planted 1913-14					Planted 1912-13. Lower garden.	Total number	Description.
		Upper garden							
		Top block.	South block.	East block	North block	Lower garden			
1	2	3	4	5	6	7	8	9	10
Apricot trees .	Superb (Starks) ...		2		.	2	..	4	} Trees.
	Blenheim ...	..	...	..		6	.	6
	Wenatchee Moorpark (Starks). ...	..	1	.	.	.	..	1
	Total .	.	3		...	8	.	11	
Fig trees	White Marseilles	5	5	} Trees.
	Bourjassotte Grise ..	..	...		...	.	5	5
	Monaco Bianco ..	..	.	..		.	6	6
	Total			..	..		16	16

Species of fruit trees.	Variety.	Planted 1913-14.				Planted 1612-13	Total number.	Description.
		Upper garden.						
		Top block.	West block.	North block.	Lower garden.	Lower garden		
1	2	3	4	5	6	7	8	9
Wineberry	1	...	1	Berries.
Lowberry	. . .	...	...	.	.	6	6
Newberry	. . .	..	...	.	1	...	1
Loganberry	. .	...	...	..	3	1	4
Phenomenal	. . .	...	.	.	3	1	4
Laxtonberry	. . .	..	...	.	5	.	5
Blackberry	Pyne's Giant Himalaya Berry of California.	..	...	.	12	.	12
Raspberry	Pyne's Royal	...	.	.	6	...	6
Strawberry	Gevon's late Prolific	900	900	Plants.
Ditto	Lous Gauthier	...	..	.	...	350	350
	Total	1,250	1,250	
Currant bushes.	Raby Castle	6	..	6	Fan trained.
	White Dutch	...	...	...	6	.	6
	Scotch Red	...	...	.	6	...	6
	Boskoop Giant Black	...	...	.	2	.	2
	Defender Black	...	..	.	1	.	1
	Mervin Crystal White	.	..	.	6	.	6
	Southwell's Black	..	...	.	23	.	23
	Total	..	.	.	50	..	50
Gooseberry trees.	Golden Drop Yellow	.	.	.	5	...	5	Gridiron trained
	Keepsake Green	..	..	.	6	.	6
	Whinnams Industry Red.	...	.	.	3	..	3
	Couzens Seeding Yellow.	...	...	..	4	...	4
	Total	...	...	.	18	.	18
Nut trees	White Filbert	3	.	3	Trees
	Red Filbert	...	...	.	3	...	3
	Prize Cob	...	...	..	3	...	3
	Kentish Cob	...	...	..	3	...	3
	Total	.	.	.	12	.	12	

Species of fruit trees	Variety.	Planted 1913-14.				Planted 1912-13	Total number.	Description.
		Upper garden.						
		Top block.	West block.	North block.	Lower garden	Lower garden.		
1	2	3	4	5	6	7	8	9
Grape Vines.	Campbell's Early (Starks).	2	...	2	Vines.
	Hicks Ab. (Starks)	...	...	..	2	.	2
	King ..	...	..	..	2	...	2
	Eclipse ..	...	...	...	2	...	2
	King Phillip ..	...	.	..	2	...	2
	Wilder ..	...	...	.	2	.	2
	Worden ..	..	...	...	2	..	2
	Total	14	...	14	

Summary of Fruit Trees planted to 30th June 1914.

	1912-13.	1913-14.	Total.
1	2	3	4
Bush Apple trees	295	1,420	1,715
Standard "	22	223	245
Horizontal trained Apple trees	5	26	31
Upright " "	10	...	10
Bush and Pyramid Pear trees	189	179	368
Single, Cordon "	50	106	156
Horizontal trained "	...	28	28
Standard "	...	52	52
Upright trained "	20	4	24
Bush Plum trees	79	41	120
Fan trained Plum trees	...	18	18
Cherry trees	47	12	59

	1912-13.	1913-14.	Total.
1	2	3	4
Orange trees	17	36	53
Lemon „	2	...	2
Walnut „	10	...	10
Peach „	45	24	69
Apricot „ ... ..	...	11	11
Fig „	16	...	16
Wineberry ... ..	...	1	1
Lowberry	6	...	6
Newberry ... ..	...	1	1
Loganberry	3	1	4
Phenomenal	3	1	4
Laxtonberry ... ..	...	5	5
Giant Himalaya Blackberry ... ..	...	12	12
Raspberry ... ..	...	6	6
Strawberry plants	1,250	...	1,250
Currant Bushes ... ..	...	50	50
Gooseberry trees ... ..	...	18	18
Nut trees ... ..	...	12	12

C. H. HOLDER,

- The 29th July 1914.

In charge, Fruit Experiment Station, Shillong.

Statement showing the Receipts and Expenditure of the Fruit Experiment Station, Shillong, from 1st July 1913 to 30th June 1914.

Receipts.	Amount.	Expenditure.	Amount.
1	2	3	4
	Rs. a. p.		Rs. a. p.
Sale proceeds of Timber ...	1,095 2 0	Allowance to Superintendent	3,000 0 0
		Establishment ...	1,348 0 0
		Petty Construction ...	3,891 1 6
		Seeds, plants and manures	3,453 7 9
		Instruments, appliances and machinery.	757 0 9
		Chemicals insecticide ...	238 5 6
		Wages of labourers ...	11,874 13 5
		Other charges ...	2,411 15 0
		Cost of Timber to Forest Department.	4,787 1 0
Total receipts ...	1,095 2 0	Total expenditure ...	31,761 13 0

ANNUAL REPORT OF THE KARIMGANJ AGRICULTURAL EXPERIMENT STATION FOR THE YEAR ENDING 30TH JUNE 1914.

The Karimganj experiment station or farm which is also known as the Sylhet Agricultural station came into being about the middle of the year under report. Rice being the most important staple of the district, it is proposed to devote the station principally to experimental work on that crop. The station is situated on the Sylhet road, $3\frac{1}{2}$ miles to the west of the subdivisional town of Karimganj, which lies on the Assam-Bengal Railway.

In selecting the site of the farm, care was taken to make it as typical as possible of the great rice-plains of Sylhet. The land is well adapted for the cultivation of the chief classes of rice grown in the district. These include autumn or *aus* rice, both broadcast and transplanted, winter or *sail* rice which is always transplanted, and a class of rice known as *asra* which comprises the comparatively short-stemmed varieties of deep water winter rice (*aman*). The only kinds of rice for which there is no suitable land on the farm are those varieties of broadcast winter rice (*aman*), which are grown in very deep water, and another class known as *boro* which is grown in the dry season on the margin of swamps and tidal rivers. There is no land in the farm which is low enough to grow these two classes of rice.

The land appears to be well suited to the cultivation of jute ; but it is proposed not to take up this crop until the work with rice is well advanced.

The total area of the farm is a little under 80 acres. Out of this area, a compact block of about 8 acres has been set apart for the farmstead and quarters for the farm staff.

The land which was private property has been acquired at a cost of Rs. 46,900-7-3. The average price paid including the statutory compensation of 15 per cent. was Rs. 591 per acre. It was only in January last that the Department was able to take possession of the land and the last three months of the financial year was mainly taken up in equipping the place with such appurtenances as were absolutely necessary before any agricultural work could be commenced.

2. The soil on the greater portion of the farm is a deep fertile alluvial clay of fine texture, though not particularly heavy. In the higher lands it partakes more of the nature of a loamy soil. The soil has not yet been chemically analysed.

The land slopes away from the Longai river which flows close by, but the slope is so gentle as to be barely perceptible to the eye. A level survey has been made with the object of enabling us to lay out the cultivated area in fields and plots of uniform level. The difference in level is only about three feet between the highest and the lowest points of the farm. The lowest parts of the farm ordinarily remain under one to three feet of water during the rainy season. The higher lands do not usually go under water and have to be embanked to keep in the rain water. In very high floods the farm receives the overflow of the Longai river and the whole area then goes under water varying in depth from one to four feet; but such high floods happen only once in many years. One such occurred in July last year.

3. The equipment of the station is still far from being complete. Ten pairs of country plough cattle were purchased during the year at an average cost of slightly under Rs. 100 per pair. At least five more pairs will have to be purchased.

A large amount of petty construction work was done during the year. The works constructed and their cost were as follows:—

	Rs.
Quarters for the Farm Superintendent	2,250
" Fieldman-Clerk	750
Godown	2,200
Nine sheds for cattle and coolies	395
Two tanks for drinking water	1,250
Two roads 1,525 feet long	200

All the works were executed under departmental management.

Several more houses remain to be built and one more tank to be dug. A more urgent work is the fencing of the farm. It is proposed to use the 'Ideal woven wire fence.' It is hoped these works will be completed before the close of the current financial year.

4. The farm also needs to be laid out in fields and plots of Crops and experiments. suitable size and uniform level for purposes of experimental cultivation. A level survey of the farm has been made for this purpose at a cost of about Rs. 250. The work of laying out the land will be undertaken as soon as the rice crop now on the ground has been removed.

The land having been taken up at the close of the last agricultural season, no crops were harvested during the year under report. Since March last, a considerable portion of the farm has been sown with non-experimental rice which is now on the ground. Towards the close of the year, an experiment in line breeding of rice was initiated in consultation with the Deputy Director and Mr. G. P. Hector, the Economic Botanist of Bengal, who kindly came over to Karimganj to advise us. The object of this important experiment is to produce improved seed for distribution to the raiyats. Ordinary rice seed is generally found on examination to be a mixture of different types of unequal quality and productive power. Our method of breeding will consist in growing as many varieties of rice as we can procure and in selecting from among the types found those which on testing will be found to breed true and prove more prolific and of better quality all round than other types within the same class and eventually in growing the selected types on a field scale to obtain seed for distribution.

5. There were no receipts during the year under report. The total expenditure exclusive of the cost of acquisition of the land amounted to Rs. 11,309-14-5 and was distributed as follows:—

				Rs.	a.	p.
Establishment	...	...	...	1,198	0	0
Implements	...	...	...	100	0	0
Purchase of cattle	...	...	...	997	8	0
Feed of cattle	...	...	...	51	2	0
Seeds, plants and manures	...	...	...	181	9	9
Wages of labourers	...	...	...	469	13	10
Petty construction	...	...	...	6,913	14	0
Reclamation	...	...	...	575	8	7
Country implements and petty repairs	...	...	...	272	14	0
Furniture	...	...	...	146	8	0
Stamps and telegrams	...	...	...	30	6	0
Unspecified charges	...	...	...	372	10	3
				<hr/>		
Total	...	...	...	11,309	14	5
				<hr/>		

Staff. — 6. The sanctioned staff of the farm consists of—

One Farm Superintendent on Rs. 100—10—200 ;

One Overseer on Rs. 30—2—50 ;

One Fieldman-Clerk on Rs. 25—1-8—40 ;

One peon on Rs. 8 ;

and four apprentices, of whom two are to be appointed annually for a period of two years on an allowance of Rs. 10 per month in the first year, and of Rs. 12 per month in the second.

The post of Overseer has not yet been filled up, and only two out of the 4 apprentices have been appointed. Babu Rukmini Mohan De, a graduate of the Nagpur Agricultural College, who had been serving as a fieldman-clerk at the Upper Shillong farm, has been appointed Superintendent of the Farm with effect from the 1st April 1913. He will remain on probation for two years from that date, and during probation his pay has been fixed at Rs. 75 during the first year and at Rs. 80 during the rest of the term. Babu Nirod Behari Sarma has been appointed fieldman-clerk with effect from 1st April 1914.

SHILLONG,

B. C. BASU,

The 21st July 1914. Special Officer, Agricultural Department, Assam.

REPORT ON THE KAMRUP SUGARCANE EXPERIMENT FOR THE YEAR ENDING JUNE 30TH, 1914.

Introductory.—India is the biggest sugar-producing and at the same time the biggest sugar-consuming country in the world. The annual production in round numbers amounts to 3 million tons, while the annual consumption is about $3\frac{3}{4}$ million tons, leaving a deficit of $\frac{3}{4}$ million tons, which is met by importation of crystalline sugar from Java and other sugar-producing countries.

Under orders from the Government of India the question of sugar production in India came up for discussion at the conference of the Board of Agriculture held at Pusa in November 1911.

Full details of the recommendations made at the conference will be found in the official report of the Board of Agriculture published by the Government of India. It is sufficient to state here that one of the recommendations was that Provincial Agricultural Departments should make enquiries and report as to the suitability of areas of waste land for sugarcane, with a view to the establishment of the central factory system. The central factory system can be worked in two ways, one by locating the factory in the centre of a cane growing tract, and purchasing cane from the surrounding cultivators, and the other by taking up a tract of waste land and cultivating cane on a large scale to supply the factory. The first way is only possible in a densely populated tract with good communications, and therefore in a thinly populated province such as Assam the second method is the only feasible one. Accordingly a rough survey of some of the tracts of waste land in Kamrup and Goalpara was made in 1912-13, and certain areas in north Kamrup along the Bhutan frontier were reported as being *prima facie* suitable for sugarcane growing on a large scale.

Subsequently, at the instance of the Agricultural Adviser to the Government of India to whom the report was submitted, proposals for the initiation of an experiment in sugarcane cultivation by means of steam tackle were put forward by the local Agricultural Department, and approved by the Assam Administration and the Government of India. Briefly it is proposed to take up an area of 1,000 acres more or less, and grow cane with the aid of steam cultivation with the object of ascertaining at what cost per maund cane can be produced. It is estimated that if cane can be produced at 5 annas or less per

maund* the manufacture of white sugar by a large factory will yield a handsome profit. It is however no part of the scheme to build and equip a factory. In the event of the experiment proving successful, it is intended to hand over the concern to capitalists, who will increase the area under cane and build a sugar factory on the spot. Funds have been provided for carrying on the experiment for three years, but if at any time before the termination of this period the public are satisfied that sufficient proof of success has already been obtained, our object will have been attained and no time will be lost in disposing of the concern.

The experiment proper has not yet been commenced, as the steam tackle is not expected before the beginning of next cold weather. In the meantime, however, in order to provide planting material, a certain amount of cane has been planted this year near the site by bullock power cultivation, and this preliminary report deals with what has been done up to date. On the arrival of the steam tackle it is proposed to open up, in the first instance, as large an area as can be planted with the material available, and probably about 150 acres will be planted next spring.

2. *Land*.—The tract chosen for the experiment is situated in North Kamrup, and is bounded on the north by the Bhutan Hills, south by Cachari villages, east by the new Pagladiya river, and west by the Kooklibari road. The greater portion is high land at present carrying grass jungle from 10 to 15 feet high. There are occasional swamps, which could however be fairly easily drained, since the fall from the hills to the south is from 15 to 20 feet per mile. Allowing for swamps, river beds and uncultivable land, there should be an area approaching 50,000 acres available for sugarcane cultivation in this tract. Irrigation, should it be required, could be arranged either from the numerous streams or from wells.

The actual site of the experiment is about 15 miles to the north of Nalbari station, Eastern Bengal State Railway, between the new and old Pagladiya rivers, and near villages Khagrabari and Tapilagaon. It is estimated that between these two rivers there is an area of at least 5,000 acres of high land suitable for cane, exclusive of at least an equal area to the south of this which could be made suitable by draining.

3. *Soil*.—The soil of the high land varies from good medium loam to sandy loam on a sandy sub-soil. In a few places the sand comes near the surface, but usually there is from 1 to 3 feet of good soil, while in the swamps the soil is stiff on a stiff sub-soil,

* One maund = 82 lbs.

although it is probable that sand would be reached at no great depth. Except on the few sandy patches the soil is dark brown or black in colour, which usually denotes a good supply of organic matter. On the whole the soil is a good loam, easily worked and very suitable for cultivation.

4. *Communications*—The site is approached from Nalbari station by a public road northward to Garhbithar village some 10 miles, where a village track leads off to Khagrabari gaon. About 3 miles of this track has been improved temporarily, and a new track made from this point to the site, a distance of some 2½ miles, at a cost of Rs. 728. These measures are only temporary, as the work had to be hurried through in order to facilitate carting. During the ensuing cold weather it is proposed to make a permanent road from Garhbithar to the present site, and extend it about two miles northwards to the proposed site of the steam tackle experiment.

5. *Buildings, tanks, fencing, etc.*—A sum of Rs. 330 was spent on temporary buildings of bamboo and thatch, including a cattle shed, rest house, sheds for coolies and a godown. A tank for supply of water to the cattle was excavated at a cost of Rs. 75. One mile of Ideal wire fencing, including four corner posts and gate, was purchased at a cost of Rs. 1,761.

6. *Cattle and Implements.*—Ten pairs of bullocks were purchased at Sonepur in November at a total cost of Rs. 1,623, including freight and attendance, etc. The following implements were imported from Messrs. Ransomes of Ipswich :—

- 2 four feet disc harrows,
- 3 Turn-wrest ploughs,
- 2 double mould board ploughs,
- 1 Cambridge roller,

from Messrs. Burn & Co.—

- 2 toothed chain harrows,

and from Messrs. Arthur Butler & Co.—

- 3 Spring tyned harrows.

The total amount spent on implements, including a few of country make, was Rs. 1,077.

7. *Preparation of land.*—It was intended at first to plant 40 acres of the three best varieties of cane grown at the Jorhat Experiment Station. Accordingly a square with side of 440

yards was set out in January and the grass burnt. Owing to the rawness of the bullocks and the fact that the land contained a mass of grass roots, it was found impossible to break up the land with the plough, so it was done with the hoe. Hoing was finished on February 20th. The next operation was to reduce the clods with the disc harrows, which were put over twice; then laddering and collecting of roots, etc., then ploughing 8 inches deep with the turn wrest plough; then harrowing again with disc harrows twice and in some parts with spring tyned harrows in addition; and finally laddering and collecting roots, etc., where necessary.

The fact that the newly purchased bullocks had not been broken to the yoke made these processes extremely laborious, and it was some weeks before much progress could be made. In order to help with the work, a pair of trained bullocks was borrowed from Jorhat and another pair from the Shillong farm; these were subsequently returned.

8. *Material for planting.*—In order to ensure a supply of good cane of proved varieties, the whole of this was obtained from the Jorhat Farm in Upper Assam. After harvesting, the cane was weighed, made into bundles weighing about 100 lbs. and wrapped in thatching grass. It was then carted 10 miles to the Railway. By special arrangement with the Assam-Bengal Railway the trucks were attached to passenger trains and despatched straight through to Nalbari station on the Eastern Bengal State Railway. From there the cane was carted 15 miles to the site of the experiment.

In all eleven consignments consisting of 1,315 bundles weighing over 60 Tons were despatched in this way, and all arrived within a week, except two consignments, which owing to a misunderstanding, were sent further down the line.

The total cost of packing and transport of cane was Rs. 2,118.

9. *Planting.*—The land was divided into four blocks each 620 feet square, leaving a space of 20 feet all round the outside of the area, and 40 feet between the blocks. Furrows about 6 inches deep and four feet apart were made from north to south with the ridging ploughs, and whole canes were laid end to end in the furrows. Women and children then covered them up to a depth of about 2 inches. This system of planting gave approximately $17\frac{1}{2}$ rows to the acre, so it was found convenient to miss one row after every eighteenth, leaving a space of 8 feet and thus forming plots of just slightly over an acre in area.

Owing to the supply of cane at Jorhat giving out, a total area of only 23 acres could be planted. This was made up as follows :—

B. 147	..	...	...	9.8 acres.
B. 376	...	...	...	7.7 "
Striped Mauritius	...	...	...	5.5 "

Total 23.0 acres.

Planting was commenced on March 3rd and was finished on April 20th.

10. *Other crops.*—On the remaining area the following crops were sown for trial :—

Cotton.—Buri and Garo Hills varieties 86 acre each, sown beginning of May.

Groundnuts.—Four varieties, viz, Raipur, Poona, Big Japan and Virginia, sown on small areas at beginning of May.

Green manure crops.

Indigo.

Cowpeas, 5 varieties.

Dhaincha.

Sann.

Soybeans.

11. *Expenditure.*—

		Up to 31st March.	From April 1st to 30th June.	Total.
1		2	3	4
		Rs. a. p.	Rs. a. p.	Rs. a. p.
Purchase of cattle	... ..	1,626 9 9	...	1,626 9 9
„ Implements	... ..	1,077 6 0	...	1,077 6 0
Petty construction	... ..	2,896 0 6	...	2,896 0 6
Seeds	.. ..	1,566 6 0	552 6 0	2,118 12 0
Labour	... ..	1,499 11 3	474 14 3	1,974 9 6
Cattle food	... ..	249 0 3	212 2 6	461 2 9
Postage	. . .	...	5 0 0	5 0 0
Miscellaneous	. . .	7.2 12 5	269 10 0	1,052 6 5
Total		9,697 14 2	1,514 0 9	11,211 14 11

Expenditure under " Petty construction " included :—

				Rs.	a.	p
Fencing	...	..	...	1,761	12	0
Roads	...	...	..	728	8	0
Buildings	...	...	...	830	12	6
Tank	...	...	...	75	0	0

and that under " Seeds " includes cost of packing and freight on cane from Jorhat.

12. *Staff*.—Up to the close of the year no regular staff had been appointed. A trained demonstrator from Jorhat was deputed to assist in the work which was closely supervised by the Agricultural Supervisor, who spent the greater part of his time there from November to the end of the year under report. The Deputy Director personally supervised the work as much as his other duties, which included the supervision of three other experiment stations, allowed. Mr. A. A. Meggitt, Agricultural Chemist, and the Farm Superintendent, Jorhat, arranged for the packing and despatch of canes from Jorhat, and the District Agricultural Officer, Kamrup, took delivery at Nalbari and despatched to the site.

SHILLONG,
The 22nd August 1914.

A. G. BIRT,
Deputy Director of
Agriculture, Assam.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN
THE ASSAM VALLEY, DURING THE YEAR ENDING
THE 30TH JUNE 1914.

Maulvi Fazlal Haq Ahmed, Agricultural Supervisor, was in charge, assisted by the District Agricultural Officer in Kamrup and two demonstrators in Sibsagar. Bireswar Das and Nabin Chandra Barua, the two demonstrators, were given permanent appointments on Rs. 25—1-8—40 from April 1st.

2. Manuring demonstrations with bonemeal and flour phosphate were made in ten centres in Sibsagar district and eight centres in Kamrup. In each centre 5 plots each approximately $\frac{1}{3}$ acre in area were taken. One plot received 3 maunds (246 lbs.) bonemeal per acre, and another plot 3 maunds flour phosphate per acre, while the three remaining plots were untreated. In Sibsagar all the demonstrations were on one crop land. In Kamrup it was intended to make the demonstrations on two crop land (*ahu* followed by transplanted winter paddy) but this could only be arranged for in four centres. The Kamrup results were so erratic, due partly to unevenness of land and partly to washing out of manures by flood, that I do not propose to publish them.

The results of the Sibsagar demonstrations are given in the following table :—

Sibsagar District.

No.	Locality.	Grain in lb. per acre.			Remarks.
		Bonemeal plots.	Flour phosphate plots.	Untreated plots.	
1	2	3	4	5	6
		lbs.	lbs.	lbs.	
1	Lakwa ..	1,707	1,927	1,572	
2	Sibsagar ...	1,953	2,176	1,632	
3	Nazira ...	2,172	2,692	2,172	
4	Chikonidhora (Jorhat) ...	1,681	1,811	1,326	
5	Kakajan (ditto) ...	1,284	1,884	1,134	

No.	Locality	Grain in lb per acre.			Remarks
		Bonemeal plots.	Flour phosphate plots.	Untreated plots.	
1	2	3	4	5	6
		lbs.	lbs.	lbs.	
6	Cherengia (Jorhat) ...	1,416	1,422	1,062	
7	Kaacharihat (Golaghat) ...	1,254	1,386	1,146	
8	Titabar ...	2,016	1,986	1,152	
9	Jhanzi ...	1,092	1,746	1,170	
10	Dergaon ...	...	...	...	Produce of plots mixed before weighing.

The flour phosphate plots in every case gave a substantial increase in yield over the untreated plots, the average increase being 513 lbs. paddy per acre valued at Rs. 15-12, while the cost of the treatment, taking price of the flour phosphate at Rs. 2-8 per maund, was only Rs. 7-8, leaving a net profit of Rs. 8-4 per acre on the first year.

The bonemeal plots gave an average increase of 249 lbs. paddy per acre valued at Rs. 7-8 over the untreated plots, while the cost of treatment, taking the price of the bonemeal at Rs. 3 per maund, was Rs. 9 per acre. This shows a net loss of Re. 1-8 per acre on the first year, but as the benefit of bonemeal has been found to last for 3 years, this loss should be converted into a handsome profit in the next two years.

Srijut Narayan Barua, Honorary Correspondent, Nakachari, made two rice demonstrations, under the guidance of the Agricultural Supervisor. On a plot manured with 3 maunds per acre flour phosphate he obtained 3,414 lbs. of paddy per acre as against 3,378 lbs. on a plot treated with bonemeal, and 3,075 lbs. per acre on an untreated plot.

In another demonstration he obtained 3,210 lbs. paddy per acre by transplanting *two* seedlings in a bunch 15 inches apart, 2,961 lbs. by transplanting *three* seedlings in a bunch 15 inches apart, and 2,226 lbs. by transplanting 6 to 10 seedlings in a bunch in the ordinary local manner.

3. With the object of introducing to the notice of cultivators the superior varieties of cane grown at Jorhat Farm, demonstrations were made in the Sibsagar district, and the results of the first crop were given in

Sugarcane.

last year's report. This year the plots were ratooned, but owing to the small staff of demonstrators at our disposal we were unable to obtain weighments for the ratoon crop.

The reports received from the cultivators, however, shew that the results were satisfactory. These demonstrations have resulted in a very large number of applications from cultivators for planting material of the superior varieties, and steps are being taken to supply the demand. This year, owing to the fact that all surplus cane at Jorhat was required for planting at the new Kamrup sugarcane station, we were unable to meet the demand.

Srijut Thaneswar Sarma Barthakur of Mohokuti, Sibsagar, obtained cuttings of B. 147 from the Jorhat Farm and planted them alongside an equal area of the local variety. He kept a careful account of cost of cultivation and outturn of each plot with the following satisfactory results per acre :—

	B. 147			Local variety		
	Rs.	a.	p.	Rs.	a.	p.
Total expenditure including cost of cultivation and gur making, etc.	136	14	0	102	0	0
	lbs.			lbs.		
Weight of cane	40,846			22,140		
Ditto of juice	22,801			10,608		
Ditto of gur	4,674			2,043		
	Rs.	a.	p.	Rs.	a.	p.
Value of gur	288	0	0	125	0	0
Profit	151	2	0	23	0	0

Demonstrations with three roller iron bullock power crushing mills were continued during the year. Nine mills were sent out in Sibsagar district and 6 mills in Kamrup. Five of these mills were sold during the year to the cultivators who had been using them. There is now a large demand for the mills from cultivators who hitherto had used only the country made wooden mills, but some agency is required for distribution and for making advances to enable the cultivators to purchase them. We find that the majority of cultivators are willing to take the mills only on the instalment system, and we have the greatest difficulty in recovering the money. With our present staff and funds, which are barely sufficient to carry on the demonstration work, it is impossible for the Agricultural Department to undertake this on a large scale. It would be, I think, a useful line of work for Co-operative Credit Societies to make advances for the purchase of mills, or to guarantee the recovery of the purchase money. The Agricultural

Department could then make arrangements for the supply of mills at convenient centres for sale to cultivators at cash prices. It is necessary, however, that all purchases should be on a strict cash basis so that the manufacturers can be paid without encroaching on the Agricultural Department funds. In this case the Department would simply be acting as agents.

Perhaps a better system would be for small capitalists to purchase a number of mills and let them out on hire. This system has been very successful in Bengal, where Messrs. Renwick & Co., have built up a large business. A man of Kamrup recently requested us to supply him with 50 mills next season for letting out on hire, and we have referred him to the manufacturers.

4. During the current year the demonstration work in the Assam Valley will be extended to include :—

- (1) Green manuring for sugarcane.
- (2) Conservation of cattle dung in covered pits.
- (3) Sorghum (*jowar*) for fodder.
- (4) Meston ploughs.
- (5) Potato cultivation.

A. G. BIRT,

Deputy Director of Agriculture, Assam.

SHILLONG,

The 28th August 1914.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN
THE KHASI AND JAINTIA HILLS DISTRICT, DURING
THE YEAR ENDING THE 30TH JUNE 1914.

U Harry Singh, Overseer, Shillong, was in charge of this work, assisted by three temporary demonstrators. From April 1st two of the demonstrators, *viz.*, Hir Sing and S. N. Biswas, have been appointed to permanent posts on Rs. 25-1/8-40 per mensem, while the third, U Mellison, has since been transferred to the Garo Hills.

2. Demonstrations, with the object of bringing to the notice of cultivators the advantage of applications of
Rice. raw bonemeal, have been made for several years in this district with such success that there is now a keen and increasing demand for bonemeal for this purpose, but the high price of bonemeal in this remote tract is tending to check the extension of the practice. It was hoped that the bonegrinding plant referred to in last year's report would be ready in time to produce a cheaper supply during the year under report, but unfortunately, owing to delay in delivery of some of the machinery, the plant was not ready in time, and we had to fall back on the dearer Calcutta supply. The total quantity sold this year was 141 maunds at Rs. 5-2-6 per maund. Of this, 80½ maunds were issued from the stock at the Upper Shillong Farm, and 60½ maunds from the depôt at Jowai.

This year demonstrations were made in ten centres. It was intended to have 5 plots each ½rd acre in area in each centre, one plot being manured with 3 maunds (246 lbs.) bonemeal per acre, another with 3 maunds (246 lbs.) flour phosphate per acre, the remaining three plots being left as controls. It was, however, only possible to arrange for the full number of control plots in three centres, there being only two control plots in each of three centres, and only one each in four centres.

The first year's results are given in the following table :—

No.	Place.	Cultivator.	Yield of grain in lb. per acre.			Remarks.
			Bonemeal plots.	Flour phosphate plots.	Untreated plots.	
1	2	3	4	5	6	7
1.	Smit	Baja Dakhor Singh (Siem of a hyrin)	642	597	556	Damaged by storm.
2.	Umlyngka...	Kpa Ka Kwai ..	1,929	1,616	631(a)	
3.	Marang ...	Kmie Ka Selma ..	1,843	1,625	761	
4.	Kynshi	Ka Mar	1,617	1,496	990	
5.	Khem Mawrah ..	Kpa U Rubin ..	1,605	1,402	727(a)	
6.	Mylhem	U Hira Shon ..	1,405	1,108	738(b)	
7.	Shangpung ..	U Simon Dhar...	1,601	1,277	1,045(a)	Damaged by storm.
8.	Sutnga	U Lakon Barnon ..	988	735	492(b)	Ditto.
9.	Jowai	U Tamon Nikhie ..	1,353	1,328	1,265	Ditto
10.	Mawlyngkneng ..	Ka Sngit Lawai ..	1,604	1,392	936(b)	

(a) Average of two plots

(b) Average of three plots.

Leaving out of account the plots damaged by storms, the average yield per acre on the bonemeal plots works out at 1,669lbs. against 1,421 lbs. for flour phosphatæ and 805 lbs. for the untreated plots. Thus the average increase over the untreated plots due to bonemeal is 864 lbs. and that due to flour phosphate is 616 lbs. of grain per acre.

Valuing the bonemeal at Rs. 5 and the flour phosphate at Rs. 4-8 per maund (82 lbs.) delivered at Shillong, and the paddy grain at Rs. 3 per maund, the bonemeal plots show a gross profit of Rs. 31-8 on an expenditure of Rs. 15 leaving a nett profit of Rs. 16-8 per acre, or over 100 per cent. while the flour phosphate plots show a gross profit of Rs 22-8 on an expenditure of Rs. 13-8 leaving a nett profit of Rs. 9, or over 66 per cent.

It must not be forgotten that these results are for the first year only, and that previous experience has shown that bonemeal does not exert its full influence on the crop until the second year, and that its effect remains until the end of the third year. The value of the increased yields which are to be expected in the second and third years, therefore, will be nett profit, since no further expenditure is entailed.

These plots are being kept under observation, and the second and third years' results will be published in due course.

3. The value of several of the imported varieties of potatoes grown at the Upper Shillong Farm is already well known to cultivators on the higher plateau of the Khasi Hills, and large amounts are sold annually for seed at market rates.

During the year under report, depôts for the sale of seed potatoes were opened in seven centres in the potato-growing tracts, *viz.*—

- (1) Upper Shillong Farm.
- (2) Marbisu.
- (3) Mawphlang.
- (4) Dumpep.
- (5) Cherrapunji (old village).
- (6) Cherrapunji (new village).
- (7) Lat Mawphlang.

The price at the farm was Rs. 3-4 per maund (82 lbs.), that being the average market rate at Shillong last season, while the price at the depôts was Rs. 3-4 plus cost of freight from the farm. The total quantity sold was 911 maunds, of which 804½ maunds were issued from the farm and 106½ maunds from the other depôts. With the exception of about 2 maunds the whole quantity sold consisted of King of potatoes and Farm Magnum Bonum 542 maunds of the former and 367 maunds of the latter.

At the request of some cultivators of Jowai in the Jaintia Hills, where potatoes are not generally grown, a demonstration of potato growing was made on the land of U Halikton Passah near Jowai village. The area taken for the demonstration was 4 acres. Cowdung was applied at the rate 120 maunds per acre and 5 maunds of Magnum Bonum potatoes were planted in April. The crop was sprayed once in May with 120 gallons of Bordeaux mixture per acre. The crop was harvested during the second

work of July, when 25 maunds of tubers were obtained. The cost of cultivation was Rs. 64-14-0 including cost of "seed," and the value of the crop was Rs. 75 leaving a profit of Rs. 10-2, equal to Rs. 25-5 per acre. This result is not satisfactory as the profit per acre should have been at least double that obtained. The land was raw and the manuring was inadequate owing to scarcity of cowdung, and this told against the crop. It is proposed to repeat this demonstration next year under better conditions.

In last year's demonstration report an account is given of our attempts to popularize spraying of potatoes with Bordeaux mixture as a preventive of disease, by sending out trained sprayers with machines to spray the crops of cultivators at cost price. This system was continued this year, but very little could be done as the cultivators, although acknowledging the benefits due to spraying, are apparently not willing to pay hard cash to have it done. Consequently only 9 acres were sprayed this year as against 32 acres last year.

This year, owing to favourable weather conditions and also to the fact that the majority of the cultivators are now using seed of disease resisting varieties obtained from the farm, there was little or no disease, so it is not difficult to understand the attitude of the people towards spraying, although it has been proved many times that, even in the absence of disease, spraying prolongs the life of the plant resulting in a considerable increase of crop.

4. As in previous years, demonstrations in grafting were made in the villages by the demonstrators while on tour. This year the following grafts were made in 26 villages:—

Grafting of fruit trees.					
	Oranges	..	...	...	684 (budding)
	Pears	...	...	...	63 grafts.
	Apples	...	...	...	9 "
	Peaches	..	...	...	61 "
	Plums	...	...	...	13 "
					830
	Total	...	...	...	830

Of the oranges budded, 256 were done on limes and wild citrus. The object of this is to check the orange disease which has been prevalent for many years on the southern slopes of the hills, and which has been referred to in previous reports. This disease so far has not been found on limes and wild varieties of citrus, so it is hoped that oranges budded on these stocks may prove immune. No sign of disease has appeared on any of the

budded oranges up to date, and one tree budded three years ago is now bearing fruit.

This is extremely important in view of the disease, which is reported to be gradually killing out the old orange groves, and for which no remedy has been found.

5. In the Report of the Agricultural Department for the year ending 30th June 1913, mention is made of this disease and the remedial measures which were being tried. This work was continued during the year under report.

Spraying as a remedy for disease of "Pan."

A garden which had been abandoned owing to the disease was taken for the experiment. It contained 56 betel vines nearly all of which were affected. The vines were sprayed twice, once in May and again in December, with Bordeaux mixture at a total cost of 11½ annas. Clearing of jungle was done at a cost of Rs. 1-8. In February only 42 plants were alive and nearly all of these still showed signs of disease.

Spraying was also tried in four other gardens with rather better results, but the owners report that the treated plants are not altogether free from the disease, although in some cases spraying was done three times.

Apparently once the disease attacks the stems of the plants spraying will not save them, and therefore all such plants should be immediately rooted up and burnt, since, if allowed to remain, they become a source of infection to healthy plants. If all cultivators could be induced to do this and at the same time to spray all remaining plants twice a year, there is reason to hope that the disease would be checked, if not got rid of altogether. It is proposed to continue the work on these lines, but with our limited staff of demonstrators everything depends on the co-operation of the cultivators.

6. With the object of checking "jhuming" on the steep gorges on the southern side of the Khasi Hills, about ½ acre of land in Maolot village was terraced in the cold weather of 1912-1913. The area was divided into three plots. The cropping in 1913 was:—

- Terrace cultivation.
- Plot I Raitrew (millet).
 - „ II Maize.
 - „ III Sweet potatoes.

The Raitrew and sweet potatoes were unmanured, while the maize received cowdung at the rate 200 maunds per acre. The Raitrew and maize produced *no crop at all*, and the sweet potatoes yielded only 152 lbs. valued at about Rs. 3.

The cropping in 1914 was :—

- Plot No. I Sweet potatoes.
- „ „ II Potatoes.
- „ „ III Raitrew.

The sweet potatoes and Raitrew were unmanured while the potatoes received 150 maunds cowdung per acre.

The potatoes have been harvested and yielded 136 lbs. tubers from 60 pound "seed." The sweet potatoes and Raitrew are still on the ground.

Cost of experiment to date—

				Rs. a. p.
Laying out terraces	...	...	...	62 8 0
Labour for this was given free by the villagers, and cost has been calculated by taking number of men employed at annas 8 per day .				
Tools	...	...	...	60 0 0
				<hr/>
First year cultivation—				
Raitrew	...	...	...	8 0 0
Maize	...	...	...	4 12 0
Sweet potatoes	...	...	...	14 0 0
				<hr/>
Total	...	...	...	26 12 0
				<hr/>
Second year cultivation—				
Sweet potatoes	...	...	...	10 7 0
Potatoes	...	...	...	10 15 0
Raitrew	...	...	...	12 8 0
Clearing jungle	...	...	...	2 12 0
				<hr/>
Total	...	...	...	36 10 0
				<hr/>
Grand total	...	...	...	185 14 0
				<hr/>

Against this we have total receipts of Rs. 7-3, for sweet potatoes Rs. 3 and potatoes Rs. 4-3. There is also the value of the sweet potatoes and Raitrew now on the ground, but this is not expected to amount to much.

So far this experiment has been a decided failure, and it is very doubtful whether any dry cultivation on this system would be successful until the soil has become weathered. The preparation of terraces on the steep slopes necessitates great disturbance of the soil with the result that the raw sub-soil containing unoxidised substances poisonous to most plants is exposed, and until this is thoroughly oxidised by cultivation, and a sufficient amount of organic matter has been incorporated, no results can be expected. From the cultivator's point of view then, I consider that it would be disastrous for him to abandon his present method of cultivating dry crops and launch out into terrace cultivation.

Wet cultivation on terraces is, however, quite another question, and provided that there is a convenient water-supply near by, there is a possibility that wet rice cultivation would be successful, since it is a well known fact that rice thrives under soil conditions which are toxic to almost any other crop. Arrangements for the demonstration of wet rice cultivation on terraces will be made next year, but whether the cultivators will be disposed to abandon their dry crop *jhum* cultivation and go to the trouble of making terraces for wet rice cultivation remains to be seen. So long as they have a sufficient area to *jhum* over, I very much doubt it.

A. G. BIRT,

Deputy Director of Agriculture, Assam.

REPORT ON AGRICULTURAL DEMONSTRATIONS IN
THE SURMA VALLEY, DURING THE YEAR ENDING
THE 30TH JUNE 1914.

There were twelve demonstrations made during the year in the Sylhet district, each at a separate centre, and all intended to show the effect of bonemeal and flour phosphate on the rice crop. These demonstrations had been commenced towards the close of the previous year, but the crops concerned belonged properly to the year under report. At each centre, a small block of land of apparently even quality and capable of growing two crops of rice in the year, namely, early or *aus* rice followed by winter or *sail* rice, was selected for the purpose of the demonstration. It was divided into three parts, one of which was manured with bonemeal at the rate of 3 maunds per acre, another with flour phosphate applied at the same rate as the bonemeal, and the third was left without any manure. The land belonged to private individuals and was cultivated and planted by them in their own way, the only new element introduced being the manures which were supplied to them free of cost. The manures were applied under the supervision of the District Agricultural Officer or of an Honorary Correspondent who volunteered to supervise the demonstration.

Unfortunately the majority of the demonstrations were spoiled by an exceptionally high flood which occurred in July 1913 and had to be abandoned. The flood not only destroyed the standing crop, but obliterated the effect of the manures by covering the land with a layer of silt. In only five places the flood was not severe enough to destroy the standing crop or to spoil the land wholly, and it was found possible to plant and reap both crops of rice on which the effect of the manures applied was to be tested. The results obtained at these five centres are exhibited in the following table :—

Locality.	Manure used per acre.			Total yield of grain from two crops of rice per acre.	Excess of yield of manured over unmanured plots per acre.	Value of excess at Rs 2 8 per maund of grain.	Profit + or loss—	Remarks.
	A. Bonemeal 3 mds.	B. Flour phosphate 8 mds	C. No manure.					
			Rs a. p.	Mds srs. chs.	Mds. srs chs.	Rs. a. p.	Rs. a. p.	
1. Bhanga ..	{	A ...	9 0 0	23 29 8	3 28 12	9 5 6	+0 5 6	
		B ...	7 8 0	25 11 8	5 10 12	13 2 9	+5 10 9	
		C ..	.....	20 0 12	.....	.....	.....
2. Barikha ...	{	A ..	9 0 0	20 2 4	5 3 4	12 11 3	+3 11 3	
		B ...	7 8 0	20 38 8	5 39 8	14 15 6	+7 7 6	
		C ...	.....	14 39 0	.. ...	.....	.....
3. Chunghar ...	{	A ...	9 0 0	22 24 12	6 19 6	16 3 6	+7 3 6	The land was considerably damaged by flood and both <i>aus</i> and <i>sail</i> were transplanted late
		B ..	7 8 0	17 27 4	0 21 14	1 5 10½	-6 2 1½	
		C ..	...	16 5 6	.	.....	.....
4. Gurabhui ...	{	A ...	9 0 0	12 28 0	2 35 0	7 3 0	-1 13 0	Ditto ditto.
		B ...	7 8 0	9 38 0	0 5 0	0 5 0	-7 3 0	
		C ...	.....	9 33 0	.....	.. .	...
5. Shaistaganj ...	{	A ...	9 0 0	29 24 0	6 4 4	15 4 3	+6 4 3	The crop was damaged by insects to some extent
		B ..	7 8 0	23 20 0	0 0 4	.. .	-7 8 0	
		C ...	.....	23 19 12	.....	.....	.....

It will be seen that the use of bonemeal gave a clear net profit in three out of the five demonstrations ; in one the cost of the manure was barely recovered by the increase in outturn of grain. In one case only, the increase in yield due to the manure was not sufficient to cover its cost, but it will be noted that the crop was considerably damaged by flood and gave a much poorer outturn than in the other demonstrations.

The use of flour phosphate showed a net profit in two and a net loss in three places. This was a new manure and had not been tested in any previous experiment or demonstration.

Both bonemeal and flour phosphate are manures which dissolve slowly in the soil, and their effect is known to last for several years. It is expected that the fields to which these manures were applied last year will give an increased yield of grain in the current year.

It was found that the paddy which was obtained from the fields manured with bonemeal or flour phosphate weighed 12 to 14 per cent. heavier, measure for measure, than the produce of the land which had received no manure.

An experiment was started on the Baikunthapur garden under the direction of the Agricultural Chemist and the Deputy Director of Agriculture to test the effect of treating up-land soil with lime, bonemeal and flour phosphate. The Manager of the garden was to conduct the experiment, but he gave it up in the middle of the year ; the experiment came in consequence to an untimely end.

One of our Honorary Correspondents, Maulvi Abdul Mannan Choudhury of Kanihati in the South Sylhet subdivision, was supplied with five maunds of Magnum Bonum seed potatoes from the Upper Shillong Farm. He planted a portion of the seed himself, and distributed the rest among his neighbours. The crops gave a fair outturn and left a handsome profit in each case after paying for the seed and manures used. It is expected that many cultivators of that neighbourhood will grow the Shillong variety of potatoes in the coming season.

In concluding this short note on demonstrations in the Surma Valley, I desire to mention that we are not yet in a position to undertake more than a very limited amount of demonstration work in the Surma Valley. Beyond the District Agricultural Officer we do not possess any staff at present for organizing and supervising demonstrations in that valley, and the cannot be expected to do much single handed. It is very necessary to provide him

with a number of trained fieldmen to help him in field work, but none will be available for two years yet. I do not expect any substantial help in the way of organizing or supervising demonstrations from our Honorary Correspondents or Associates. Our experience of them has not been very encouraging so far.

B. C. BASU,

SHILLONG :
The 13th August 1914. }

*Special Officer, Agricultural
Department, Assam.*