Fig. 2. Hairs of cotton seed from Afyeh: (a) terminal unconvoluted end; (b) central convoluted section ($\times 450$).

cottons with which it was compared—*G. herbaceum* var. *africanum* and *G. arboreum* var. *soudanense*.

There was no archaeological evidence that the inhabitants of Afyeh made textiles. The nature of the organic material and the situation in which it was found suggest that the seeds were part of a small heap of feed and dung from a shed in which sheep or goats were kept. Thus we have the first evidence that cotton seeds were collected and fed to livestock before cotton lint was used for making textiles. This does not support Hutchinson's suggestion that no true cotton is indigenous to the Nile region and that *G. arboreum* var. *soudanense* was introduced from India for use as a textile raw material. A true cotton indistinguishable from it on archaeological evidence must have been indigenous to Nubia.

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¹ Ghosh, A., *Indian Archaeology*, 1961–62, 66 (1964).

² Hutchinson, J. B., *The Application of Genetics to Cotton Improvement* (Cambridge University Press, 1959).

³ Hutchinson, J. B., *Emp. Cotton Growers Rev.*, 26, 1 (1949).

Nitrogen in the Rainfall at Samaru, Nigeria

In 1960, E. Jones¹ reported an unusually high nitrogen level (5.355 p.p.m., representing 50.8 pounds/acre/annum, 56.9 kg/hectare⁻¹ per annum) and a high ratio of $\text{NH}_4\text{-N}$ to $\text{NO}_3\text{-N}$ (approximately 40:1) in Samaru (latitude 11.11° N, longitude 7.38° E) rainwater. Because an

annual addition of nitrogen in such quantities to soils generally deficient in available nitrogen would be of great agricultural significance, we decided to check these figures. During 1969 rainwater was collected in open containers and analysed for $\text{NH}_4\text{-N}$ and $\text{NO}_3\text{-N}$ by steam distillation methods, as soon as possible after each shower. Table 1 gives the results on a monthly basis. For the whole year, the total addition of mineral nitrogen was found to be just over 4.5 kg/hectare⁻¹ (4 pounds/acre). This figure is supported by additional data from an independent study for the 4 months from June to September. (i) At Samaru at this time the mean air concentration of $\text{NH}_3\text{-N}$ was 2.2 $\mu\text{g m}^{-3}$ (mean of 17 determinations; range 1.1–4.2 $\mu\text{g m}^{-3}$) and the mean rainwater $\text{NH}_4\text{-N}$ concentration was 0.18 p.p.m. The washout factor (personal communication from A. C. Chamberlain), $w = (\text{mg N} + 1/\text{l. of rainwater})/(\text{mg N} + \text{kg of air})$, of 80 calculated from these figures accords well with other values calculated from the literature^{2,3}. (ii) Analyses of rainwater collected monthly at other stations in northern Nigeria revealed very similar total mineral nitrogen additions to that found for Samaru (Table 2).

Table 1. RAINFALL AND RAINFALL NITROGEN AT SAMARU, 1969

Month	No. of showers	Rainfall (mm)	Mean shower size (mm)	Mean mineral-N in rain (p.p.m.)	Mean ratio $\text{NH}_4\text{-N}:\text{NO}_3\text{-N}$	Annual field addition (kg/hectare ⁻¹)
February	1	0.3	0.3	3.11	0.86	0.008
March	—	—	—	—	—	—
April	4	43.2	10.8	0.81	1.57	0.349
May	11	116.8	10.6	0.59	1.30	0.693
June	18	184.7	10.3	0.39	1.02	0.723
July	18	445.5	24.7	0.33	1.25	1.483
August	27	233.7	8.7	0.28	1.41	0.650
September	15	89.9	6.0	0.30	0.98	0.272
October	13	104.4	8.0	0.37	1.46	0.387
Year	107	1,218.5*	11.4	0.37	1.26	4.565

* Forty-five-yr mean—1924–68—is 1,096.5 mm. (Extreme ranges recorded; p.p.m. mineral-N, 0.11–3.11; $\text{NH}_4\text{-N}:\text{NO}_3\text{-N}$, 0.38–2.55.)

Table 2. RAINFALL NITROGEN AT SEVERAL SITES IN NORTHERN NIGERIA, JUNE–SEPTEMBER 1969

Site	Rainfall* (mm)	Mineral-N field addition (kg/hectare ⁻¹)
Katsina	436.9	2.51
Kano	322.6	2.48
Kontagora	843.3	3.46
Chafe	843.3	3.48
Minna	1,066.8	2.87
Samaru I	873.8	2.54
Samaru II	955.0	3.13

* Figures in this column, except those for Samaru II, are based on the volume of water collected, which was subject to evaporation losses from the collecting bottle. Samaru II data are taken from Table 1 and included for comparison.

The figures of 4.5 kg/hectare⁻¹ per year for mineral nitrogen and of 1.26 for the mean ratio of $\text{NH}_4\text{-N}$ to $\text{NO}_3\text{-N}$ are of similar magnitude to other reported values^{4,6} for tropical areas where rainfall is comparable. We conclude that the values published earlier were erroneous¹, and that in the Samaru area rainfall nitrogen makes little contribution either to the current crop requirement or to the build-up of soil nitrogen under local bush fallow noted by E. Jones.

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¹ Jones, E., *Nature*, 188, 432 (1960).

² Stevenson, C. M., *Quart. J. Roy. Met. Soc.*, 94, 56 (1968).

³ Egner, H., and Eriksson, E., *Tellus*, 7, 134 (1955).

⁴ Allison, F. E., in *Soil Nitrogen* (Amer. Soc. Agron., 1965).

⁵ Wetselaar, R., and Hutton, J. T., *Austral. J. Agric. Res.*, 14, 319 (1963).

⁶ Meyer, J., and Pampfer, E., *Nature*, 184, 717 (1959).