

be substantiated by statistical significance alone, since the test of significance would be vitiated by any uncontrollable occurrence of statistically significant deviations in randomized data. If my critics will re-read the passage (pp. 11–21) referred to in ref. 6<sup>1</sup> of my paper, they will see that the conclusions of the imaginary tea-cup experiment may not be drawn if we have to take into account a mysterious agency which might uncontrollably upset the random presentation of the cups of tea. If such an 'agency' could thus 'upset' a process of randomizing, then all our conclusions drawn through the statistical tests of significance would be equally affected, including the conclusions from the 'psychokinesis' experiments themselves. (How are the 'target numbers' for the die throws to be 'randomly chosen'? By more die throws?) To speak of an agency which can upset *any* process of randomization in an uncontrollable manner is logically equivalent to speaking of an inadequacy in the theoretical model for empirical randomness. The mysterious 'agency' which 'upsets' the randomizer, like the luminiferous ether of an earlier controversy, becomes, with the obsolescence of the calculus in which it occurs, a superfluous term.

(4) Finally, I did not in my paper make the inference that the results I obtained in matching columns of random sampling numbers invalidated the conclusions drawn from experiments in extra-sensory perception. On the contrary, it was from supposing that the conclusions drawn from experiments in extra-sensory perception were already invalid that I made the inference that similar data might be found elsewhere. In other words, the inference I drew was the converse of that which my critics have drawn for me.

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<sup>1</sup> *Nature*, 172, 154 (1953).

<sup>2</sup> Coover, John E., "Experiments in Psychical Research" (Stanford Univ. Press, 1917). Richmond, Nigel, *J. Soc. Psych. Res.*, 36, 577 (1952). Forwald, H., *J. Parapsychol.*, 16, 282 (1952).

<sup>3</sup> Soal, S. G., and Goldney, K. M., *Proc. Soc. Psych. Res.*, 47, 22 (1943).

<sup>4</sup> Soal, S. G., *Proc. Soc. Psych. Res.*, 48, 152 (1942).

<sup>5</sup> Fisher, Ronald A., "The Design of Experiments" (London, 1947)

### Sulphates in African Inland Waters

THE communication on this subject by R. S. A. Beauchamp<sup>1</sup> emphasizes the need for agricultural experiments designed to explore possible sulphur deficiency in African soils. Mention is made of Storey and Leach's work on sulphur deficiency in Nyasaland which causes the tea yellows disease<sup>2</sup>. The Tukuyu district of the Southern Highlands province of Tanganyika is similarly affected, and since 1945, when D. W. Duthie of the Amani Research Station diagnosed the disease, application of sulphate of ammonia to tea soils has been a routine operation and has effectively controlled the disease.

When this Institute was started in 1950, a series of survey manual experiments was planned, units of which are now in operation at Tukuyu and Mufindi (Southern Highlands, Tanganyika) and Kericho (Kenya Colony). A further extension to tea areas in Uganda is projected. These trials are based on the presence and absence of nitrogen, phosphoric acid, potash and elementary sulphur factorially combined. Nitrogen is supplied as sulphate of ammonia, potash as chloride, and phosphate as concentrated superphosphate in order to minimize the effect of adulterat-

ing sulphate ions; sulphur is applied in doses equivalent to those in the sulphate of ammonia dressings.

The two years results so far available appear in the annual report of the Institute. None of the experiments shows a response to sulphur, although it is known from other investigations being carried out that oxidation to available forms occurs within a matter of two to three months<sup>3</sup>.

The Tukuyu results are of special interest in that the nitrogen effect is very marked and is of the same order as that shown in fertilizer experiments on tea in Ceylon<sup>4</sup>. It thus appears that the applications of sulphate of ammonia carried out during the six years prior to the start of the experiments have been sufficient to control the tea yellows disease during the following two years of experimentation, and that no limiting factor inhibiting specific nitrogen response has been operative.

So far, visits to the other tea districts in East Africa have not disclosed the characteristic symptoms of tea yellows, although tea has been grown in some districts for more than twenty-five years.

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<sup>1</sup> Beauchamp, R. S. A., *Nature*, 171, 769 (1953).

<sup>2</sup> Storey, H. H., and Leach, R., *Ann. App. Biol.*, 20, 23 (1946).

<sup>3</sup> Tea Research Institute of East Africa Ann. Rep. (1952).

<sup>4</sup> Eden, T., "Monographs on Tea Production in Ceylon" (1949).

MR. R. S. A. BEAUCHAMP states, "... the only sources of gypsum in East Africa are those contained in the Cretaceous deposits along the coast of Tanganyika Territory . . .".

Somaliland seems to have been overlooked, for it is geographically included in, however politically apart from, 'East Africa'.

In the eastern half of British Somaliland and extending into Italian Somalia is found what may be the greatest deposit of gypsum/anhydrite in the world. Of Middle Eocene age, it is roughly 1,000 ft. in thickness and extends over some 27,000 square miles in the Protectorate alone<sup>1</sup>. Mutual benefit would accrue if some of this 5,000 cubic miles of rock could be worked to supply the sulphate needs of other parts of Africa.

Regarding Mr. Beauchamp's remarks about the scarcity of African waters with a notable sulphate content, I have recently published<sup>2</sup> analyses of 145 water samples from wells and other sources in British Somaliland and surrounding areas, all but two including sulphate estimations. Naturally many show very high sulphates, not uncommonly between 2,000 and 3,000 parts per million. At the tiny village of Eik in the Somaliland Haud the well-water yielded me a figure of 4,440 p.p.m. of sulphate ions, with total dissolved solids of the order of 10,000 p.p.m. This must rank as one of the most saline waters that is anywhere regularly used for human drinking, and it is so scarce and precious that the wells are fitted with padlocked trap doors!

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<sup>1</sup> Macfadyen, W. A., "The Geology of British Somaliland" (Crown Agents, 1933).

<sup>2</sup> Macfadyen, W. A., "Water Supply and Geology of Parts of British Somaliland" (Crown Agents, 1952).