

Dr. J. M. Burgers (van Houtenstraat 1, Delft, Holland); *Committee*, P. Eggleton, H. Eyring, A. Frey-Wyssling, G. van Iterson, jun., G. W. Scott Blair, R. Signer and Sir Geoffrey Taylor. The Committee intends to act as a central body for establishing contact between scientific men and societies engaged upon work in rheology. For this purpose it has chosen the following subjects for its initial activities: nomenclature; abstracting work in rheology; standards of high viscosity. A report on the nomenclature of deformations, prepared in Holland during the War under the auspices of the Committee for the Study of Viscosity and Plasticity of the Royal Netherlands Academy of Sciences (Amsterdam), was considered at the meeting. This report, after modification as a result of discussion, will be submitted both to the members of the Committee and to co-operating societies and groups, with an invitation to send in criticisms and, if desired, new proposals.

As regards abstracting work in rheology, a report will be prepared on what is already being done in this subject, and contact will be established with the United Nations Educational, Scientific and Cultural Organisation. Finally, information will be collected on materials suitable as standards of viscosity of the order of  $10^6$  poise and more.

#### International Rheological Congress

An International Rheological Congress will be organised by a Dutch committee, to be held in Scheveningen (near The Hague), during September 21-25, 1948. The Joint Committee intends to hold a meeting during this Congress, at which the information gathered can be discussed and eventually brought before the Congress. The provisional programme includes the following topics: recent developments in the theory of viscosity; nomenclature; fundamental experimental methods; solutions of macromolecular substances; Russian work on rheology; relations between stress and strain in complicated systems; abnormal substances and abnormal phenomena of flow; psycho-physical aspects of rheology; rheological problems in biology; rheology in industry.

An agreement has been reached with the Elsevier Publishing Company, Inc., of Amsterdam, to publish the Proceedings of the Congress in book form. Preprints of all papers will be forwarded to participants at least a month in advance of the Congress. Remarks in discussion will be included in the final edition of the Proceedings. Those intending to present papers should communicate with the principal secretary, Dr. R. Houwink, Rubber-Stichting, Julianalaan 134, Delft, Holland. Manuscripts must be received before May 1, 1948. A maximum of 3,000 words, formulæ and diagrams included, should not be exceeded, and the organising committee must, in consequence of present restrictions, reserve the right to cut down papers.

It is proposed that in the sectional meetings every speaker will give only a short account of his paper or mention the most important points, so that ample time will be available for discussion. The time to be allotted to each paper, inclusive of discussion, will be at most thirty minutes, but may perhaps have to be reduced if many papers are presented.

Due to generous support from Dutch industry and from some Dutch scientific societies, it will be possible to fix the Congress fee for participants at approximately f. 10 (£1), which it is hoped will also cover

the cost of the preprints. It does not, however, include the price of the final edition of the Proceedings, which can be fixed only when all papers have been received. The organising committee will assist in obtaining accommodation at Scheveningen.

The members of the organising committee are: J. M. Burgers (*Chairman*), R. Houwink (*Principal Secretary*), H. Kramers, A. J. Staverman, R. N. J. Saal, A. van Rossem, H. C. den Daas.

## RESULTS OF THE CONTINUOUS USE OF AN AMMONIUM PHOSPHATE FERTILIZER ON RICE IN LOWER BURMA

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CULTIVATORS in parts of the Irrawaddy delta complained that after a few years use of an ammonium phosphate fertilizer on rice lands, they had continually to increase the dose in order to obtain the same response. An experiment was devised to test this opinion<sup>1,2</sup>.

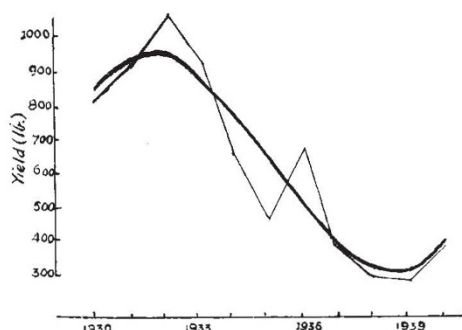
A proprietary ammonium phosphate fertilizer, the one complained of, was applied repeatedly for eleven years to a series of plots replicated five times on Myaungmya Farm in the Irrawaddy delta. The experiment continued from 1930 until 1940 inclusive, when it was interrupted by the War. The soil is a recent, acid alluvium; the rainfall averaged 93.14 in. a year during the period of the experiment; the variety of rice was the pure line *Ngasein C14-8*. The soil analysis is given in Table 1.

TABLE 1. MYAUNGMYA FARM SOIL

Insoluble residue	68.82		
Soluble silica	0.01	Stones, gravel	
Ferric oxide ( $Fe_2O_3$ )	6.06	and fine gravel	nil
Alumina ( $Al_2O_3$ )	10.95	Coarse sand	1.1
Lime ( $CaO$ )	0.15	Fine sand	8.4
Magnesia ( $MgO$ )	0.63	Silt	24.6
Potash ( $K_2O$ )	0.25	Fine silt	54.7
Soda ( $Na_2O$ )	0.14	Clay	11.5
Sulphuric acid ( $SO_3$ )	0.15		
Phosphoric acid ( $P_2O_5$ )	0.01		
Carbon dioxide	0.08		
Organic matter-combined water	8.16		
Moisture lost at 100° C.	4.55		
Manganese oxide ( $Mn_2O_3$ )	0.04		
Organic carbon	1.85		
Organic nitrogen	0.15		
Available $P_2O_5$	0.0016		
Available potash	0.0137		
pH	5.3		

The fertilizer contained 18.20 per cent of nitrogen and 18.43 per cent of  $P_2O_5$ , and was applied at the rate of 100 lb. per acre shortly before transplanting. Cultivation methods were those normal to the area, seedlings being raised in unmanured nurseries and transplanted. Rice in the Irrawaddy delta is grown continuously without rotation as a single monsoon crop.

In every year the yields of the manured plots were significantly higher than the unmanured, and this is the normal effect of ammonium phosphate fertilizers on soils of this type. The point which the following analysis brings out, and which is important, is that after the first few years there was a decline in the response to the fertilizer, though at the end of the experiment there was still a significant increment over the unmanured plots.



DIFFERENCES IN YIELD OF PADDY GRAINS OF TREATED AND UNTREATED SOILS, 1930-40 (IN LB.); THIRD DEGREE POLYNOMIAL. SMOOTH CURVE, CALCULATED; STRAIGHT LINES, OBSERVED

A polynomial of the third degree (see graph) has been fitted to the variability of the differences between the yields per acre of the treated and untreated plots. The calculated differences agree well with those found (Table 2).

TABLE 2. CALCULATED AND ACTUAL DIFFERENCES IN YIELD OF PADDY PER ACRE OF MANURED AND UNMANURED PLOTS. MYAUNGMYA FARM

Year	Actual differences over control in lb. per acre	Calculated differences over control in lb. per acre
1930	808	833.8
1931	908	932.4
1932	1062	939.7
1933	928	878.4
1934	647	771.2
1935	470	640.7
1936	695	509.7
1937	413	400.6
1938	332	336.4
1939	321	339.5
1940	431	432.6

The total variance contributed by the variation in differences in yield from year to year has been analysed into (1) the amount due to average rate of deterioration, (2) slow changes other than steady deterioration, and (3) annual causes. The smoothed curve shows the actual course and extent of the slow changes in mean differences in yields. The analysis of variance is given in Table 3.

TABLE 3. ANALYSIS OF VARIANCE

Sources of variation	Degrees of freedom	Sum of squares	Mean variance	F
Deterioration	1	498491.06	498491.06	35.52
Slow changes	2	88108.66	44054.33	3.139
Annual fluctuation	7	98228.46	14032.64	

The variation due to deterioration (represented by a linear function) is significant, but that due to slow changes is not reliably greater than the residual variance. The secular changes in yield differences examined are given in Table 4. The measures  $x_2'$ ,  $x_3'$ , and  $x_4'$  of the component of change can be compared with the residual *S.D.*

TABLE 4. SECULAR CHANGES IN YIELD DIFFERENCES

Component	lb. per acre
Mean difference	+ 637.7
$x_2'$	- 706.0
$x_3'$	- 8.8
$x_4'$	+ 296.7
<i>S.D.</i>	± 118.4

The linear regression coefficient is  $- 67.3 \pm 13.7$  lb. per acre per year.

After an initial rise in the first three years, the yield differences significantly decreased during the remainder of the period of eleven years when the fertilizer was repeatedly applied. We refrain from speculation on the causes of this result. The cultivators were justified in their complaint. There is

clearly need for caution before advocating the prolonged use of artificials without thorough tests in the field, and for further investigation into the causes of the present results. Conclusions based on incomplete results as reported in the Myaungmya Farm Reports from 1931 to 1941 are erroneous.

<sup>1</sup> Ann. Rept. Dept. Agric. Burma, 1941-42 and 1942-43, 2.

<sup>2</sup> Agric. Dept. Burma, Myaungmya Farm Reports, 1931 to 1941.

## NUTRITION AND CANCER

A SYMPOSIUM arranged by the New York Academy of Sciences and held in December 1946 on "Nutrition in Relation to Cancer" covered a wide field and included a number of interesting articles which have now been published\*. The paper by Dr. E. L. Tatum on chemically induced mutations and their bearing on carcinogenesis deals mainly with mutations induced in *Neurospora* and *Escherichia coli*, where the mutations have made the organisms more exacting in their nutritional requirements. Dr. W. J. Robbins, dealing with the botanical contributions to the cancer problem, suggests that the autonomous growth of plant tumours induced by *Phytophthora tumefaciens* is due to their ability to produce indoleacetic acid. In discussing the nutrition of tissue cultures, Dr. P. R. White indicates that if mammalian cells could be grown in controlled synthetic media, then the nutritional techniques used in the study of mutations in *Neurospora* could be applied to cancer tissue and carcinogenesis. This might give more insight into the relation of carcinogenesis and mutations involving changes in nutritional requirements.

The induction of cancer in animals is often greatly affected by diet. Dr. A. Tannenbaum describes how the restriction of the calorific intake of animals reduces the incidence of spontaneous mammary tumours, lung adenomas, hepatomas, sarcomas, and skin tumours, in mice treated with 3:4-benzpyrene. Restriction of calorific intake, however, has little effect on growth of established cancer. Perhaps the most interesting results of the effect of diet on carcinogenesis are seen in the experiments on hepatoma induction with azo dyes. Such experiments, carried out at Wisconsin, are described by Dr. J. A. Miller, and results obtained at the Memorial Hospital by Dr. C. J. Kensler. A high content of riboflavin in the liver reduces the chance of tumour development. Treatment with carcinogenic azo dyes tends to reduce the riboflavin content of the liver; but the carcinogenic action can be neutralized by adding riboflavin to the diet. Dr. J. White, Dr. F. R. White and Dr. G. B. Mider find that the incidence of leukaemia in mice treated with methylcholanthrene is not reduced if the dietary lysine or tryptophane is reduced to levels which prevent growth. On the other hand, reduction of the cystine intake to such a level did reduce the incidence of leukaemia in mice treated with methylcholanthrene.

Two independent groups of workers in the United States have produced tumours in rats by feeding choline-deficient diets. Dr. R. W. Engel, Dr. D. H. Copeland and Dr. W. D. Salmon of Alabama describe pathological changes including cancers which were seen in the lungs, liver, subcutaneous tissue, pancreas

\* "Nutrition in Relation to Cancer", by Charles Glen King, John J. Bittner, D. H. Copeland, R. W. Engel, C. J. Kensler, George W. Kidder, G. Burroughs Mider, J. A. Miller, Harold P. Morris, William J. Robbins, W. D. Salmon, Albert Tannenbaum, E. L. Tatum, Florence R. White, Julius White and Philip R. White, *Ann. New York Acad. Sci.*, 49, Art. 1, 1-140.