Digestibility of Straw

STRAW contains large quantities of carbohydrates, which can only be partially digested by farm animals. Various attempts have been made in the past to increase the digestibility of straw by some pre-treatment.

In Great Britain, Godden[1] carried out some preliminary work with soda in 1920, and states that "There is obviously need for much further investigation of the possibilities of soda treatment before a final opinion can be expressed as to its merit for introduction into farm practice".

In the course of a wide investigation of the problem, we have treated oat- and wheat-straws with caustic soda solutions of varying strengths and for different lengths of time.

Our best results were obtained with a concentration of soda of the order of 1·25 per cent with an immersion period of 20–24 hours without any heating. With the volume of solution used, this represented 10 lb. of caustic soda per 100 lb. of straw. Weaker solutions were not so effective, even if the time of immersion were increased. Of the 10 lb. of caustic soda there is a recovery of 40–50 per cent, which can be made up to the correct level for subsequent batches.

The treated straw is easily washed with water, and is then readily eaten by ruminants.

The process seems to depend upon the breaking down of the lignin-cellulose complex to such an extent as to allow of more complete utilization of the material in the paunch than is possible with the untreated straw.

The effect of treatment is shown by the following preliminary figures for the starch equivalent values of treated and untreated straw, calculated from the digestibility data obtained in metabolism experiments with sheep.

	Lb. starch equivalent per 100 lb. straw	
	Treated	Untreated
Oat straw	42·1	21·7
Wheat straw	32·0	13·0

The process is simple in operation, and is now being used on our farm. Treated oat straw fed to fattening bullocks and supplying 7·4 lb. of starch equivalent out of a total of 11·8 lb. has resulted in a daily live-weight gain of just under 2 lb. over a period of 62 days. The animals are in prime condition and ready for the butcher.

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[1] Godden, W., *J. Agric. Sci.*, **10**, 437 (1920).

Importance of Cytochrome *B* in Hydrogen Transport

IT is quite definitely known[1] that dihydrocozymase can be oxidized by molecular oxygen in the presence of diaphorase I plus the 'cytochrome system', but the nature of the cytochrome reaction has not been clearly demonstrated. On the basis of the experiments reported here, we believe that both cytochrome *B* and cytochrome *C* are required for the oxidation of both CoH_2I and succinate.

Using spectrophotometric technique, we have shown that the rate of oxidation of 60 γ of CoH_2I by a preparation poor in cytochrome *C* was doubled when 4×10^{-9} mols of pure cytochrome *C* were added. By measuring the rate of cytochrome *C* reduction in the presence of sufficient cyanide (10^{-6} mols per ml.) to block completely the action of cytochrome *C* oxidase, it was possible to show that CoH_2I would reduce cytochrome *C* rapidly in the case of a fresh enzyme preparation, and not at all or only slowly in the case of an acid-precipitated dried enzyme used in amounts which contained the same quantity of diaphorase I (as shown by the CoH_2I plus methylene blue reaction).

That the missing compound in the dried preparation might be cytochrome *B* was indicated, among other things, by the fact that the reduction of cytochrome *C* by CoH_2I in the presence of the fresh preparation is prevented by strong cyanide (10^{-5} mols per ml.). This is also the case when succinate is the hydrogen donator, and can be demonstrated spectroscopically or visually, using 10^{-7} mols of cytochrome *C* as the final reduced product. The degree of cyanide toxicity is undoubtedly affected by the enzyme concentration. The fresh enzyme mentioned above contained 3·5 mgm. per ml.

It seems possible that the missing component in the succinoxidase system described by Hopkins, Lutwak-Mann and Morgan[2] may include cytochrome *B*. Details and implications of our experiments will be reported later.

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[1] Potter, NATURE, **143**, 475 (1939), and references.
[2] Hopkins, Lutwak-Mann and Morgan, NATURE, **143**, 556 (1939).

Temperature Activation of the Urease-Urea System

THE activity of several enzymes (for examples yeast and malt invertase[1], and *E. coli* dehydrogenases[2]) has been shown to increase exponentially with temperature according to the Arrhenius equation,

$$K = Ze^{-\mu/RT},$$

where K is the rate, Z is a constant, e is 2·718, R is the gas constant, T the absolute temperature, and μ the energy of activation of the reaction in calories per gm. mol.

Heretofore, no comparison has been made of temperature activation of an impure and a highly purified enzyme. A study was made of the hydrolysis of 1·5 per cent urea in phosphate buffer at *p*H 7·0 using both crude and crystalline Jack bean urease[3]. The reaction was followed by measuring ammonia formation colorimetrically after Nesslerization, or carbon dioxide evolution volumetrically using the Barcroft differential manometer. For either crude or crystalline urease the rate of urea hydrolysis increases with temperature in accordance with the Arrhenius equation, where μ = 8,700 or 11,700 cal. over the whole temperature range up to the inactivation temperature, or μ = 11,700 below and 8,700 above a critical temperature of about 22° C. When urease is dissolved in water or in reducing or indifferent solutions, μ = 8,700. but when dissolved in oxidizing solutions, μ = 11,700. The activation energy seems