present, is increased with increase of alkali. The values obtained are higher than the few given in the literature, but may be easily duplicated by other preparations from cows' milk. According to Béchamp[1] casein is slightly soluble in water; from such a solution he obtained a rotation $(\alpha)_j = -117.7°$, which is equivalent to about $(\alpha)_D = -105°$. This is practically the same as for the salts, as above described. The property is a constant, which may be utilized in the comparison of milks of different origin. Some experiments with human milk and the milk of the goat are now in progress.

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THE EFFECT OF RUST ON THE STRAW AND GRAIN OF WHEAT.

BY FRANK T. SHUTT.

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THE prevalence of rust this season in certain districts of Manitoba led to many inquiries regarding the general effect of this fungus upon the wheat plant—both straw and grain—and more particularly as to how it might influence their feeding value. The importance of the subject made it desirable to obtain data on these points and accordingly samples of both rusted and rust-free wheat were obtained and analyzed.[2]

In order that the results should be strictly comparable, it was essential in procuring these samples that the clean and the affected wheat be of the same age and grown on the same soil. We were able to secure such specimens, both wheats being collected by hand on the same day in the same field on the farm of Sir Wm. Van Horne, at East Selkirk, Manitoba.

There was a marked difference in appearance between them, both in straw and grain. The rust-free wheat had a clear, bright yellow, a well-ripened straw, a normal ear, both as to size and color, and a plump, well-filled grain. On the other hand, the rusted wheat straw presented in general a dirty greenish brown appearance, and on closer inspection showed many spots or

[1] *Bull. Soc. chim.* [3], 4, 18; 11, p. 152. *Ber. d. chem. Ges.*, 1890, III, 741.

[2] Mention should be made that certain analyses of "rusted and frosted" wheat (grain) were made at the Minnesota Experiment Station in 1889, by Dr. Harper. From the results Dr. Harper concluded that the grain of such wheat was abnormal, both chemically and physically, and was about 2 per cent. richer in protein than "graded" wheat.

patches of infection, while its ears were smaller than normal and the kernels light and much shriveled.

ANALYSIS OF RUSTED AND RUST-FREE WHEAT, STRAW AND GRAIN.

	Weight of 100 kernels. Grams.	Moisture.	Crude protein.	Crude fat.	Carbohydrates.	Fiber.	Ash.
Straw from rust-free wheat	....	7.92	2.44	1.65	39.00	39.95	9.04
Straw from rusted wheat	....	7.92	7.69	1.97	38.44	36.78	7.20
Grain from rust-free wheat	3.0504	12.26	10.50	2.56	70.55	2.29	1.84
Grain from rusted wheat	1.4944	10.66	13.69	2.35	68.03	3.03	2.24

The Straw.—We first notice that in crude protein the rusted straw is much the richer. Under the term crude protein is included all those nitrogenous compounds of a food that go to repair and build up muscle and tissue. It may safely be concluded, therefore, that the rusted straw, containing, as it does, more than three times the protein found in the rust-free straw, is very much superior in feeding value.

Further, in the rusted straw we have a slightly higher percentage of fat—the constituent next in value to protein—and somewhat less fiber—the element of least value in a fodder—and hence there is additional evidence of the most satisfactory character to support the statement respecting the more nutritious nature of the rust-affected straw.

The Grain.—The small and shriveled character of the grain from the rusted wheat may be deduced from the data in the first column of the table—the weight of 100 kernels being only one-half that of 100 kernels from the unaffected wheat. This fact, however, from the standpoint of a feed, does not betoken a lessening of its nutritive qualities; indeed, as the data from the protein show, it has, weight for weight, considerably the higher value.

The protein of the shriveled grain is 3.19 per cent. higher than that of the plump grains from the rust-free plant. Part of this higher protein content in the smaller grain is no doubt to be accounted for in its larger proportion of bran—but it is due chiefly to the fact that the transference and accumulation of starch in the kernel has been but partial and incomplete.[1]

Other features of note in the analysis of the grain from the rusted wheat are: (1) the somewhat larger percentages of fiber and ash—indicating more bran—and, (2) the lower water, carbohydrates and fat content.

Apart from the valuable information that these data furnish regarding the relative feeding value of the straw and grain of rusted wheat, we have in these results interesting evidence as to the physiological effect of the rust on the wheat plant. Speaking broadly, there are (after germination) two periods in the life of the wheat plant—the first, a period of feeding and assimilation; the second, a later and usually shorter period, during which the food materials accumulated in stem and leaf (straw) are transferred to and stored in the seed (kernel). There is, of course, no exact time when it can be said that the one ends and the other begins. Under normal conditions there is a gradual cessation of feeding, both by root and leaf, accompanied by an ever-increasing movement of the accumulated material to the seed. The first period is characterized by growth, the second is recognized by the maturation or ripening of the seed.

Further, it would seem that in the development of the seed, the albuminoids or protein are first transferred and later, towards the close of the maturation period, the carbohydrates (starch, etc.) are more particularly deposited.

The rust apparently does not affect the vitality of the wheat plant during the first stage or period, but as the season progresses and the ripening period advances the fungus attains the ascendency, crippling the energies and functions of the tissues and checking the movement of the food materials to the seed. In other words, the growth of the rust arrests development and induces premature ripening, which, as we have seen, means a straw in which still remains the elaborated food, and a grain containing less water, rich in protein and deficient in starch, and in appearance, small and shriveled.

It may be well to point out that although the rust makes the

[1] NOTE.—Some years ago in determining the relative feeding-value of frosted wheat (which presents a shriveled appearance very similar to that of the grain from rusted wheat), we found that the protein content was considerably higher than in the unfrosted, mature grain. It is evident that the effect of rust and frost, in this respect, is the same, resulting in a premature ripening, or rather a drying-out of the grain, which, as we have seen, means a kernel high in protein, but low in starch.

grain more nitrogenous, it at the same time very materially reduces the yield per acre, the present figures indicating a loss in weight of about 50 per cent.

We have not as yet been able to complete the analysis of the milling products of this shriveled wheat, but we may rest assured until such time as the data are available that the proportion of bran to flour will be higher than from normally ripened wheat. We may, further, conjecture that this bran will be found slightly more nitrogenous than that from rust-free wheat. It is held by certain millers that the rust makes flour somewhat "stronger," but at the moment there are no data, I believe, to support this contention. The probabilities, from deduction, rather point to a deterioration or lack of "strength" in the gluten.

DOMINION EXPERIMENTAL FARMS.
OTTAWA, CANADA.

THE PREPARATION AND NITRATION OF METETHYL-TOLUENE.

BY EDWARD BARTOW AND A. W. SELLARDS.

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WHILE the three possible ethyltoluenes have been made synthetically, and their properties studied, comparatively few of their derivatives have been prepared. There are recorded some halogen,[1] some sulphonic acid,[2] some nitro[3] derivatives and one amino[4] derivative. On account of the greater difficulty in obtaining *m*-ethyltoluene, only one derivative, a sulphonic acid, is recorded.

Some work done by one of us with *m*-isocymene[5] suggested the possibility of similar work with *m*-ethyltoluene.[5] We have prepared the *m*-ethyltoluene and tried on it the action of nitric acid.

The preparation of *m*-ethyltoluene presents some difficulties. It is best prepared according to the Fittig synthesis. The most convenient starting-point is, of course, a halogen derivative of toluene and an ethyl haloid, rather than a halogen derivative

[1] *Ber. d. chem. Ges.*, **11**, 225 (1878); **19**, 3088 (1886); **28**, 2651 (1895).

[2] *Ibid.*, **19**, 3090 (1886); **28**, 2649 (1895); *Ann. Chem.* (Liebig) **146**, 85; **193**, 199.

[3] *Ber. d. chem. Ges.*, **7**, 1513 (1874); **19**, 3090; **27**, 2084 (1894); **28**, 2649 (1895); *Ann. Chem.* (Liebig), **136**, 314.

[4] *Ber. d. chem. Ges.*, **15**, 1650 (1882).

[5] Inaug. Diss., Göttingen (1895).