Chemistry of Vegetable Physiology and Agriculture.

Germination.

By A. Leclerc (Ann. Chim. Phys. [5], iv, 232—267).

Deherain and Landrin, in a recent memoir (*Ann. Sciences Natur. Botan.*, xix, 358), of which an abstract appears in *Compt. rend.*, lxxviii, 1488, and this Journal, xxvii, 1000, advance as a conclusion from their experiments the theory that germinating seeds condense the atmospheric gases, and that the heat so produced is the starting point of the germination. The author's experiments, at least with regard to the occlusion of nitrogen, give results in contradiction to this theory, and he states several objections to Dehérain's and Landrin's methods of working and conclusions, viz., that they placed their seeds in conditions very unfavourable for germinating, namely, in contact with mercury and water. Their results were discordant. They concluded that nitrogen was condensed, because they found a larger quantity of nitrogen on burning the germinating seeds with copper oxide over that obtained on burning with soda-lime, whereas results by this latter process are always lower unless special precautions are taken; and they also draw their conclusions equally from experiments in which the seeds germinated, did not germinate, and rotted.

The author points out the necessity of taking, in comparative experiments, seeds having an equal weight, as the percentage of nitrogen increases with the weight of the seeds. Three experiments were performed in an apparatus figured in the paper. Barley seeds were germinated in a measured volume of atmospheric air saturated with aqueous vapour, without coming in contact with mercury, and the air was renewed and analysed every twelve hours, the experiments being continued respectively two, three, and five and a half days. In these experiments no condensation of nitrogen was observed, but there was an excess of nitrogen in each case in the air of the apparatus, which was sensibly equal to the nitrogen lost by the seeds, as shown by analyses of the seeds after the experiments, and of similar seeds before germination. This shows that the nitrogen gas was derived from the decomposition of the albuminoïds in the seeds. The nitrogen was also determined by volume in barley seeds before germination, and after 24, 30, 48, 72, and 96 hours' germination but no evidence of any condensation of nitrogen was obtained. Ammonia was never observed in the atmosphere over the germinating seeds, neither were hydrogen, marsh-gas, carbonic oxide, or other combustible gases ever found.

E. K.

Chemical Changes in the Germination of Peas.

By Osc. Kellner (Landw. Versuchs-Stat., xvii, 408—424).

The amount of soluble mineral and nitrogenous substances was determined in (1) the original peas; (2) after complete swelling of the seeds after 40—48 hours' soaking in water; (3) when the radicle had developed but not the plumule, generally after five days' germination; and (4) when the first bud began to unfold and the side roots had appeared, usually after ten days' germination. For analysis, the peas were ground up, and 10 grams treated with 500 c.c. of water, and a stream of carbonic acid passed through, as recommended by R. Sachsse, to render filtering possible. The albuminoïds were determined by boiling and collecting on a weighed filter; the filtrate evaporated to dryness and burnt with soda-lime yielded the soluble nitrogen of the table.

The table shows the amount of soluble substances in 100 grams of the original peas, and after the different periods mentioned above. Each result is the average of two or three experiments.

	(1.)	(2.)	(3.)	(4.)
Fe_2O_3	·012	·004	·005	·006
CaO	·098	·069	·065	·053
MgO	·163	·112	·115	·115
K_2O	1·019	·998	·994	·955
Na_2O	·011	·004	·004	·004
SiO_2	·020	·005	·007	·007
P_2O_5	·820	·713	·602	·672
S	·477	·459	·433	·317
Albuminoïds	—	1·648	1·869	2·579
Soluble Nitrogen	—	·712	·762	1·000
Total soluble	—	15·906	17·876	20·292

The organic substances increase in solubility as the germination goes on, whilst lime, potash, phosphoric acid, and sulphur decrease, probably from entering into insoluble organic combinations. The quantity and decrease in amount of sulphur soluble in water is remarkable, and would seem to indicate that most of the sulphur exists in the seeds as sulphates, which are reduced and formed into insoluble organic compounds during germination. Arendt's observations on the sulphuric acid in the oat plant lead to the same conclusion, and Knop, in his *Agriculturchemie*, says that the sulphates which enter plants from the soil seem to be immediately deoxidised in the roots and again oxidised in the upper organs of the plants. Estimations of the sulphuric acid in the fresh peas gave ·125 and ·114 per cent. of SO_3, but after ten days' germination ·073 and ·064, so obviously a reduction had taken place.

Experiments were made to ascertain if nitric acid was also reduced during the germinating process. 10 grams of peas were soaked in 40 c.c. of a dilute solution of nitre containing ·1068 gram N_2O_5, and the nitric acid estimated by Schlösing's method after 48 hours' soaking, and after one day's and two days' germination. There was a mean loss, in six experiments, of ·0054 gram of N_2O_5 after the 48 hours' soaking, of ·0134 after one day's germination, and of ·0183 after two days'.

To ascertain if the presence of nitric acid increased the disengagement of carbonic acid, similar seeds were germinated under the same conditions, excepting that one series was moistened with pure water and the other with dilute solution of potassium nitrate. The carbonic acid expired was estimated, and found to be always greater from the seeds which had been treated with the nitre solution, but after the first three days of germination this increase gradually fell off. As an example of the influence of the nitrate the following may be taken, being one of six series. Column A gives the CO_2 expired by 27 peas, weighing 7·605 grams, soaked in water, and B that by 27 peas, weighing 7·6035 grams, which had been soaked in the nitre solution, and had absorbed ·0175 gram N_2O_5:—

	A.	B.
After 48 hours' soaking	·0571	·0653
" 24 " germination	·0519	·0646
" 24 " "	·0617	·0701
" 24 " "	·0596	·0656
" 24 " "	·0722	·0788
" 24 " "	·0748	·0794

E. K.

Occurrence of Crystallisable Sugar in Germinating Cereals.

By G. Kühnemann (Deut. Chem. Ges. Ber., viii, 202—206).

After noticing the contradictory statements as to the existence of sugar in cereals, whether before or after germination, the author proceeds to describe his experiments on malt. A considerable quantity of this grain in a finely divided state was exhausted with 95 per cent. alcohol, the extract mixed with twice its weight of ether, and the liquid agitated with about one-quarter of its weight of distilled water. The aqueous solution, after being separated from the supernatant ethereal layer, was examined and found to polarise light. It contained two kinds of sugar, one of which reduced copper solution, and another which did not. The latter is crystalline, and appears to be identical in its properties with cane-sugar.

The above-mentioned exhausted malt was now dried at 100°, further exhausted with cold distilled water, and the extract mixed with six times its volume of absolute alcohol. The white flocculent precipitate produced was collected, dissolved in a small quantity of cold water, and again precipitated by alcohol. It then gave characteristic reactions differing from those of dextrin. Its aqueous solution is precipitated by tannin and by basic lead acetate, but does not reduce copper solution.

The author has also found, both in germinated and ungerminated cereals, other organic compounds, including an organic acid.

C. E. G.

Absorption of Ammonia from the Air by the Volcanic Earth of the Solfatara of Puzzuoli.

By S. de Luca (Compt. rend., lxxx, 674).

The earth of the Solfatara of Puzzuoli, in presence of air and moisture, absorbs ammonia from the atmosphere. This is due to the sulphur and arsenic present, which, under the above conditions, first become converted into acids, and then combine with the ammonia The author suggests that as the nitrogenous matters thus slowly and progressively formed are as gradually available for the support of vegetation ; the fact may prove of some importance to agriculture.

H. J. H.