LETTERS TO THE EDITORS

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Auxin Production during the Development of the Grain of Cereals

IT has been shown by Gregory and Purvis[1,2], Kostjucenko and Zarubailo[3,4] and others that the developing grain can be vernalized in the ear during the period of embryo formation. It has further been suggested by Cholodny[5,6,7] and others that auxin or a similar hormone plays an important part in the vernalization process. It appeared important therefore to undertake a direct study of the auxin relations in developing grain of both spring and winter varieties of cereals. The work was carried out with pure-line spring and winter varieties of Petkus rye. At known intervals after anthesis grains were removed from the ears and the auxin content determined by Went's coleoptile method. The hormone was obtained in two ways: (1) direct diffusion into agar, (2) extraction of the ground fresh material in water and subsequent concentration under reduced pressure. Relevant details of the methods will be published elsewhere.

It was found that no diffusible or extractable hormone appears in the developing carpel until two weeks after anthesis, but from this time forward rapid production of auxin occurs reaching a maximum at some 5–6 weeks after anthesis. The maximum is simultaneous with the stage of complete differentiation of the embryo. In the interval mentioned the auxin content has increased nearly a hundredfold. The data are presented in the accompanying table and refer to (*a*) winter rye grown in the field, (*b*) winter rye grown in sand culture with controlled nutrition, (*c*) spring rye. No consistent differences are seen between the varieties; so that the different behaviour of these types with regard to their low temperature requirements for flowering cannot be accounted for on the basis of auxin production during development.

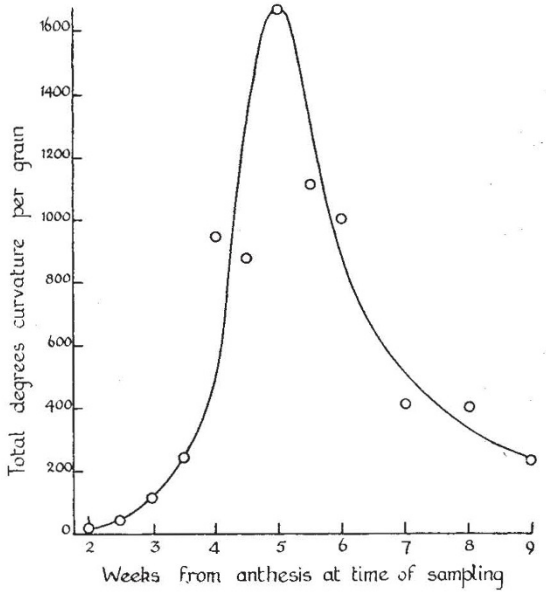
The mean values are presented graphically in the figure. It will be noted that after the maximum hormone content has been attained a rapid fall follows, so that in the completely mature grain the hormone content is so low that the diffusion method fails to detect its presence, though by extraction it can still be demonstrated. The apparent disappearance of the hormone is related closely to desiccation of the grain and has been found to be associated with its germinating capacity. It is worth noting that the hormone is confined to the endosperm and at no time

Auxin Content per Grain at Various Stated Times after Anthesis Measured by Extraction Method.

Weeks from anthesis	Winter rye in field	Winter rye in sand culture	Spring rye
2	18	—	—
2·5	—	45	35
3	96	122	116
3·5	—	240	—
4	865, 810	768	1210, 1120
4·5	—	877	—
5	1419	2301	1260
5·5	—	1113	—
6	357	789	1874
7	270	—	560
8	—	—	402
9	234	—	—

All values given in total degrees curvature per grain

$$= \frac{\text{Mean curvature} \times \text{dilution (c.c.)} \times 100}{\text{Number of grains in sample extracted}}$$



is sufficient auxin present in the embryo to detect it by the methods employed. In view of the low content of auxin in the mature endosperm of rye it may be pointed out that other cereal grains have been examined. The large hormone content of dry maize endosperm first shown by Cholodny has been confirmed. Oats is found to occupy an intermediate place, and diffusible auxin from this grain has been estimated. Wheat and barley resemble rye in that no diffusible auxin could be established.

E. S. J. HATCHER.
F. G. GREGORY.

Research Institute of Plant Physiology,
Imperial College of Science and Technology,
London, S.W.7.
Oct. 27.

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Egg-laying of Ducks as an Enforced Relaxation Oscillation

THE formation and deposition of a bird's egg can be described as a relaxation process[1], the egg material being piled up gradually and released suddenly. The sustained production of eggs can then be regarded as a series of relaxation oscillations. In an undisturbed relaxation system discharges take place when the accumulating material (energy) reaches a certain level, but the length of period may change if the stream of material (energy) varies. If a bird were