however, to see the mind of Peter of Abano filled with a hopeless longing for a knowledge of the atomic weights of the elements, but it is not stated if he was guided thereto by Archimedes' celebrated discovery of specific gravity.

Roger Bacon fares badly at the author's hands, one is afraid, because we all in the last twenty years or so have been fed up on Bacon (no pun intended). The guides in Rome irritated the Innocents Abroad by all but ascribing the creation of the world to Michael Angelo, and we have grown a little sensitive about Roger Bacon being wholly responsible for the creation of experimental science, and Professor Thorndike stands so straight on the subject he seems to the dispassionate reader to lean over backwards a little For any one who has wrestled spiritually as well as physically with the tomes of Albertus Magnus, who seems to be his hero, it would be easy to make the Swabian leviathan somewhat of the same kind of a bore. One is, as it is, tempted to say he owes his fame to longevity and industry

There is a tendency to the repetition of certain phrases, which jars the attentive reader a little, there are some words used which are not to be found in the Century dictionary, some slips, but very few, in proof-reading. Indeed, such minor blemishes are exceptionally scarce for a work so extensive. Some perhaps not so negligible may nevertheless be passed over. It is hardly justifiable to refer further to these comparatively few shortcomings, since there is not more space permitted for an appreciation of the merits of a book which is, on the whole, an ornament to American scholarship.

JONATHAN WRIGHT

SPECIAL ARTICLES

ON THE ADAPTATION OF WHEAT TO GROWTH MEDIA DEFICIENT IN NUTRIENTS

IN the correlation obtained between differences in yield of grain of different varieties of spring wheats and that of their relative earliness of maturation appears a relation that suggests a factor which presumably plays no inconsiderable rôle in the adaptation of variety of wheat (and probably other plants) for maximum grain production from growth media markedly deficient in essential salt elements. Of nine different varieties grown in such a medium, the largest yield of grain, 200 milligrams per culture (average of 20, each containing 5 plants), was produced by the variety that ripened first, and the lowest yield, 46 milligrams per culture, produced by one of the last maturing varieties. The other varieties produced yields of grain that fell between these two limits, and the magnitude of yield generally corresponded with the relative earliness of the variety. Seven weeks elapsed between the time the earliest and latest varieties ripened. There was no correlation between the total dry weights of the different varieties and their comparative earliness. The average dry weight produced per culture was approximately 1.3 grams, regardless of variety.

The plants were grown in tap water, which as a growth medium can be defined as being markedly deficient in essential salt elements. Its osmotic value was equal to approximately 0.12 atmosphere osmotic pressure, with the ions Cl, So_4, Ca and Mg constituting the major portion of the solutes. The grain per culture was that which five plants produced, having available to them only those solutes contained in two quarts of tap water (two quart Mason jars were used as the culture containers) plus that which the seedlings 6–9 cm. high, germinated in tap water, contained when set in culture jars and one-half c.c. of .01 mol. solution of $FeSO_4$ per culture added at the beginning of the experiment. When the plants were six weeks old, from 300 to 500 c.c. of distilled water were added to each jar, this being the only change or addition made to the original two quarts of tap water.

As there was no correlation between differences in yield of grain of the different varieties and that of their relative earliness of maturation when they were grown in fertile soil, the question may be asked as to causes operative to bring about the results obtained when tap water was used as the growth medium. It appears that the tap water had no particular merit per se other than being a growth medium, deficient in nutrients, which enabled that variety of wheat that completed its growth cycle in the shortest period of time (that is, an early wheat) to utilize that small supply of salt elements most efficiently in the production of grain. Granted that the rate of utilization of nutrients for similar processes in these wheats was about the same, and that some of the nutrients were used in such a way during the vegetative growth period of the plants as to preclude their later utilization for the production of grain, then obviously the wheat which has a long-growing period, being a late variety, has less nutrients available for grain production than has an early variety. Whether a variety of wheat is early or late undoubtedly is largely determined by genetic and environmental factors, but the result of these factors—that is, whether the variety is early or late—in no small measure determines to what extent that minimum supply of salt elements in the growth medium can best be utilized for the production of grain.

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