the maximum amount the soil should contain, except for short intervals, in order to secure the best growth.

But even if the author's conclusions be not correct regarding the cause of the flow of water in the experiment, the line of investigation is important in that it has provided a means of securing water from field soil, perhaps, in a somewhat more concentrated condition than occurs in natural drainage and permits the sample to be taken where its history may be very definitely known; and it is to be hoped that they and others will apply the method in investigating the character of soil extracts thus obtained. We regard it extremely doubtful, however, that either the concentration or the composition of solutions so procured will be found to be the same as that which closely invests the soil grains or the root hairs at the same place and time. Certainly, if the movement is a capillary one, the observations recorded in the bulletin* on the 'Movement of Water-soluble Salts in Soils' indicate that very notable changes in the composition of the solution may take place as a result of the translocation. Our own observations also show that when only small quantities of some solutions are forced through such filters the concentration may be measurably changed.

F. H. KING.

MADISON, WIS.,
November 2, 1904.

HYBRID WHEATS.

TO THE EDITOR OF SCIENCE: In my original paper on hybrid wheats (Bull. 115, O. E. S.) the second generation of crosses between long-head varieties (*Triticum vulgare*) and club wheats (*T. compactum*) were divided into long, short and intermediate heads, these three types occurring in the proportion 1 : 2 : 1. Subsequent examination of later generations of these wheats, all of which continue to obey Mendel's law quite strictly, leads me to believe that the short head of the club wheats is really a dominant character, and that the apparent intermediate character of the heads of the heterozygotes of the several generations of hybrids is due to the greater vigor of the heterozygote individuals. It was found in the third and later generations that the long and intermediate heads could be separated without error, as shown by the purity of the long heads next year. But there were many small errors in separating the intermediate and short heads. If the latter separation had been perfect, the short-head type should have reproduced true to type. But in a majority of the plats supposed to contain only short heads, a few long and about twice as many intermediate heads were found, indicating that in most cases one or more intermediates had been selected with the shorts the previous year. When the seed of each plant was kept separate, this difficulty disappeared, each plant behaving either as a pure short head type or as an ordinary heterozygote.

One of the most interesting results which subsequent study of these hybrids has brought to light is the apparent effect of hybridization on the variation of single characters. For instance, the length of head of the long-head parent of the hybrid is fairly uniform, but in the hybrid this character varies between wide limits. The same is true of the length of the short or club heads. In the parent club variety the heads are fairly uniform in length; but in the pure short-head progeny of the second and later generations some of the heads were less than one fourth the length of the ordinary club heads. This induced variability of a character which has recently passed through the stage of what we may call heterozygosis probably accounts for the errors made in separating the intermediate and short heads above referred to. It is also of capital importance to the practical breeder. Those who are so situated as to attempt it will find an interesting problem in the effect of selection in fixing these variable characters, should the power of yielding large quantities of seed be rendered highly variable by hybridization, and should we be able to fix unusual yielding power thus induced, we could establish races of great economic value.

W. J. SPILLMAN.

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* 'Investigations in Soil Management,' by the author, Madison, Wis.