THE GERMINATION OF TEA SEED

F. R. TUBBS.

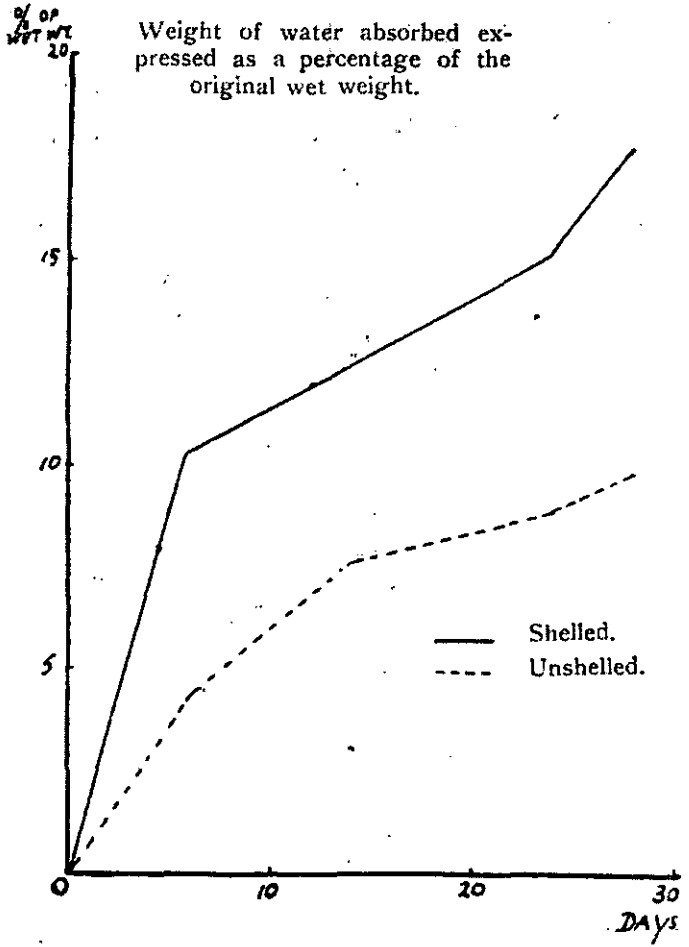
The seed of tea consists of 2 cotyledons enclosed by a thin papery integument and a thick woody shell. In ripe seeds an air space is usually found to occur between the cotyledons and the shell, which increases upon exposure to drying influences and decreases when the seed absorbs water. In a series of samples of normal seed as obtained for propagation, the mean volumes of cotyledons, air-space, and seed shell were found to be 1·664 cc., 0·211 cc. and 0·466 cc, respectively. Data have been collected on the rôle played by these portions of the seed during germination.

The air space within the seed appears to serve no function, its size depending upon the moisture content of the cotyledons which expand and contract markedly with fluctations in the amount of water they contain.

In Figure 1 is shown the effect of the presence of the seed coat upon the absorption of water from wet sand. The "shelled" seed, from which the seed coat had been entirely removed, absorbed water much more rapidly than did the unshelled seed, which was still enclosed in an uncracked shell. As would be expected, a similar effect is observable when the seed is allowed to dry out, the loss of water from "shelled" seed being more rapid than from unshelled seed (Fig. 2). In both cases the presence of the seed shell slows down the rate of absorption or loss.

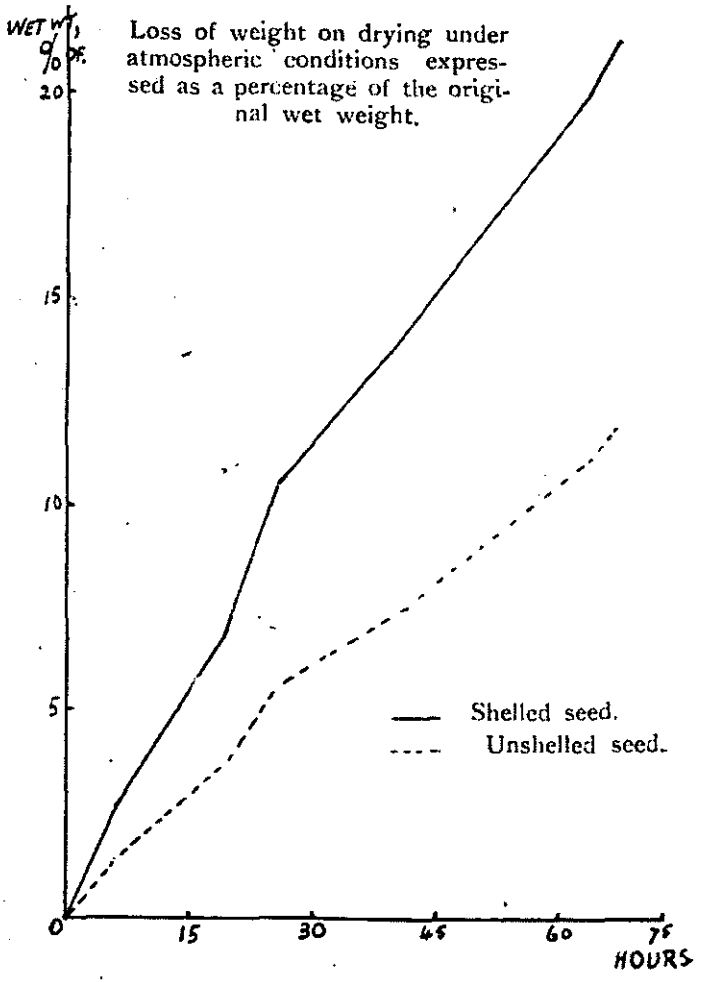
The effect of this barrier to free liquid and gaseous exchange between the soil and the living parts of the seed, as shown by the relative rates of growth of "shelled" and "unshelled" seed, has been

Fig. 1



Weight of water absorbed expressed as a percentage of the original wet weight.

Fig. 2



Loss of weight on drying under atmospheric conditions expressed as a percentage of the original wet weight.

examined. The "unshelled" seeds were weighed and sown at a depth of 1 inch in soil. The "shelled" seeds were cracked with a hammer and the cotyledons and seed shell separated and weighed, and sown similarly. The two lots of seeds, each 250 in number, were sown in parallel lines, randomised in pairs, to reduce errors due to differences in soil fertility.

Samples of each group were taken monthly, the plant organs being weighed individually in fresh and dry condition. It was subsequently found necessary to discard the records of plants suffering from insect injury.

The first visible sign of germination in the unshelled seed was the cracking of the seed shell; 52, 72, and 100 per cent being cracked after 1, 2, and 3 months, respectively. The cracking of the shell was associated with the absorption of water. This occurred at a lower rate than in the case of shelled seed. The water content of the cotyledons expressed as a percentage of the dry weight are given in Table I.

TABLE I.

Water content of seed leaves expressed as a percentage of the dry weight

Months	0	1	2	3	4
"Unshelled"	94·3	103·7	127·4	214·0	322·2%
"Shelled"	94·3	133·3	158·2	266·7	358·9%

The growth of the embryo is accompanied by a steady drain upon the reserves contained in the cotyledons, which decrease in weight and finally become morbid—a change that is accompanied by a large increase in the water content. About this time—five months in the case of "shelled" seed and six months in that of "unshelled" seed—abscission of the cotyledons commences. This appears to begin when about 60% of the original dry weight of the cotyledons has been lost.

TABLE II.

Mean loss in weight of cotyledons and the percentage cut off.

Loss in Grammes.

Months	Shelled	Loss in grms. unshelled	Months	Percentage shelled	Cut off unshelled
1	·049	·019	5	17·9	0·0
2	·084	·041	6	60·0	27·0
3	·333	·184	7	69·1	31·3
4	·560	·281	8	65·9	41·6
5	—	·555	—	—	—

As would be expected, the more rapid translocation of food materials from the cotyledons to the growing plant observed in the shelled seed is accompanied by more rapid growth of the seedling. (Fig. 3). This difference in growth rate is not continued indefinitely, however, a slowing off in the growth of the "shelled" seedlings occurring about the time of abscission of the cotyledons. This is followed by a new period of rapid growth dependent upon the supply of energy from the green leaves alone. The "unshelled" seedlings terminate the first growth period later than the "shelled" seedlings. These differences in amount and rate of growth are also discernible in the growth of the leaves, roots and stems (Fig. 4).

The seedling obtains its supplies of energy and salts at first from the cotyledons, but later from external media. The food reserves of the tea seed are in the form of starch and oil. During germination, the amount of ether soluble material in the cotyledons (oil, fat, etc.) falls, owing to its use by the growing plant, a loss of 65% of the oil occurring in three months in the unshelled seed, compared to 86% in the case of seeds from which the shell had been removed. At the same time 19% and 28% of the total nitrogen originally present was lost by the cotyledons of the unshelled and shelled seed respectively. The speedier removal of stored food from the cotyledons of the shelled seed is probably to be attributed to the earlier and more copious supply of water and oxygen to the cotyledons of the germinating seed.

The data show that an increased rate of germination and growth result from the removal of the seed shell. The complete removal of the shell requires considerable care, and destroys the mechanical protection to the seed offered by it. Gadd's* suggestion of *cracking* the seed is supported by the results of the experiment described. Such a method gives easy access of water and oxygen to the embryo and results in a higher percentage of germination in a shorter time.

* Gadd, C. H. *Tea Research Institute Bulletin* No. 3, 1928, p. 16.

Fig. 3

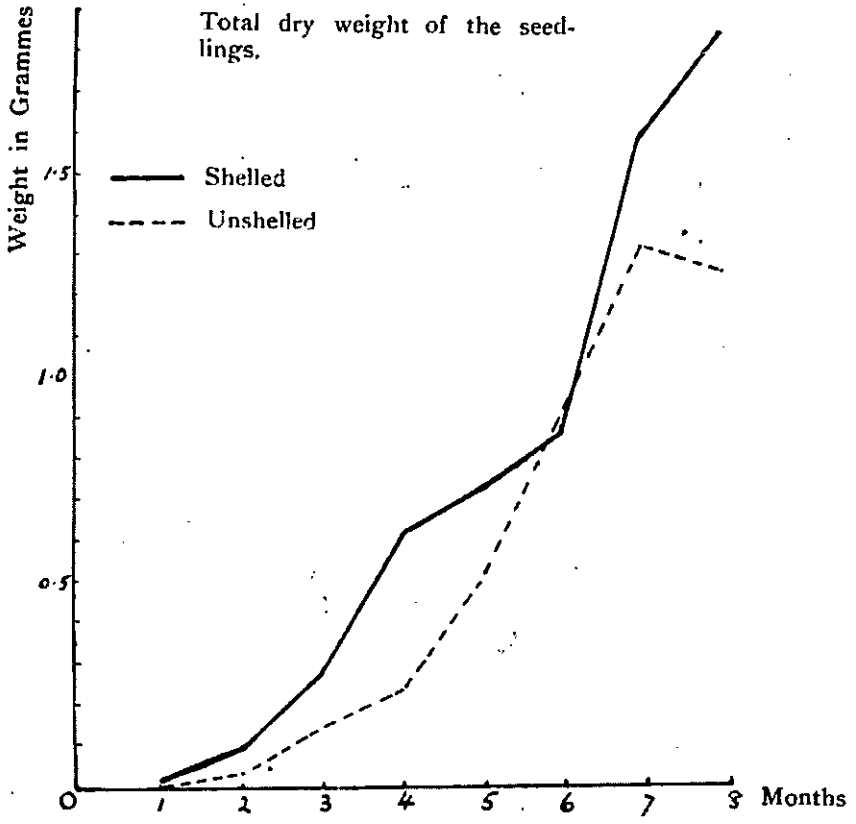
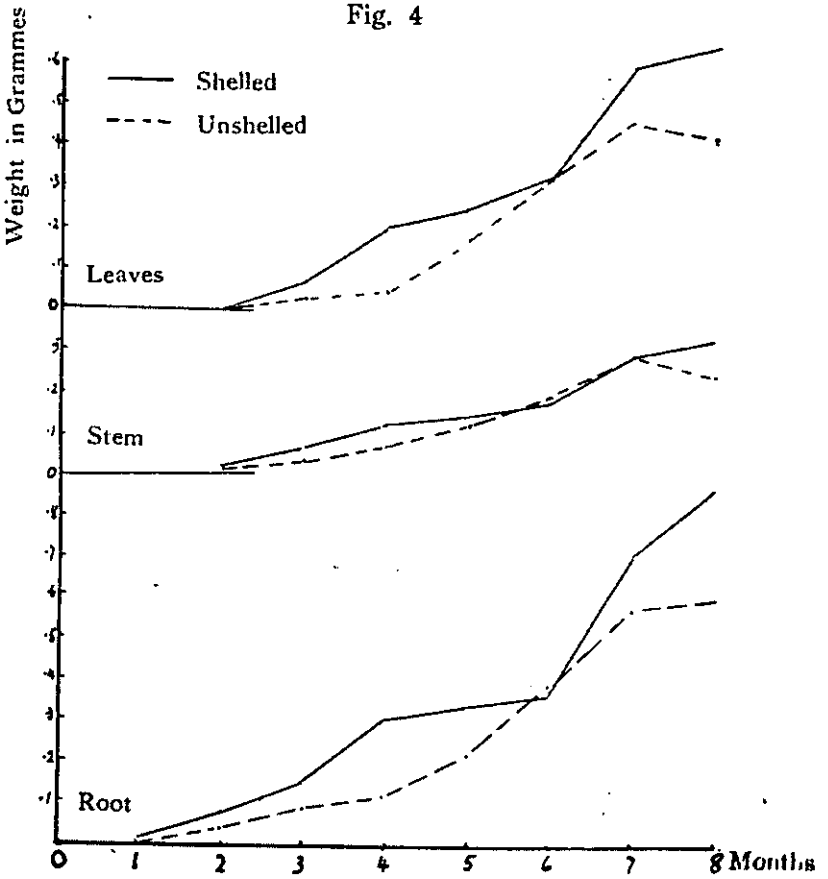

Total dry weight of the seedlings.
Weight in Grammes
Shelled
Unshelled
1·5
1·0
0·5
0
1
2
3
4
5
6
7
8
Months

Fig. 4


Weight in Grammes
Shelled
Unshelled
Leaves
Stem
Root
0
1
2
3
4
5
6
7
8
Months