

this state it contains more starch or flour than an unripe seed, and this starch, being turned into mucilage by the process of vegetation, becomes a soluble food for the embryonic plant. Ripe seeds will be found to keep longest and to survive accidents or bad treatment better than partially ripe ones, but, from having their food in a state more easily soluble, spring more quickly and vigorously than when unripe. On the quantity of the food, thus furnished, depends the vigour with which the young plant will shoot, hence the best means to be used to furnish it in sufficient quantity and reduce it into an assimilable form, should be the study of cultivator to enable him to assist the process of germination.

Seeds which contain much oil perish sooner than those which are free from oil, and the seeds of the coffee tree and some others will not germinate after being kept only a few days beyond the time of ripening and gathering. On the other hand, many seeds possess an extraordinary degree of longevity : this has been proved by weeds growing in enclosed gardens, which, for a long series of years, have been carefully tilled. Some very interesting experiments have been made to ascertain the length of time certain seeds retain their vitality and germinating power ; in one case, a human skeleton was found, and a portion of the contents of the stomach containing a mass of small seeds which neither the digestion of the person, nor the lapse of twenty centuries had sufficed to destroy. Many of these seeds were subjected to various experiments to prove whether they had lost their vital principle, and Dr Lindley succeeded in raising fruit from some of them which proved to be the common raspberry. Most people have heard, or read, of the mummy wheat which was taken out of a mummy case which had been entombed for thousands of years, and yet grew when exposed to the necessary conditions (1).

The conditions requisite to energetic germination are, the ripeness of the seed, the exclusion of light, a certain degree of moisture, a free supply of oxygen, a certain degree of heat, the presence of some ammonia, and suitable circumstances of soil and season.

The ripeness, alluded to, is not that over-ripeness which renders the seed dry and hard, but the completed elaboration of the principles neces-

sary to the process of reproduction ; the former is essential to preserve the germinating power of the seed for a long period, but the latter is sufficient for its healthy germination, therefore fresh seed is to be preferred, because it will develop more quickly.

With regard to the exclusion of light : it may not be absolutely necessary to germination, because some seed will germinate in the full sunlight, but the growth will be weak, and the absence of light is indispensable to such a vigorous start as will ensure a well developed seedling plant. The covering of seed with soil, not only secures the requisite degree of moisture, but excludes the light and supplies the mechanical and chemical conditions required for the development of the radicle and plumule, and reducing the food for their nourishment contained in the seed, to its proper absorbable elements.

M. Decandolle, one of the most noted Swiss botanists of the beginning of the present century, denies that the exclusion of the light is a necessary condition of germination, but the position he took has been proved to be a false one, both by experiment and observation of natural phenomena, for the fact that the plants absorb carbonic acid, and exhale oxygen during the day, and absorb oxygen, and exhale carbonic acid during the night, distinctly suggests that germination is a *night* process demanding the exclusion of light. The effect of light upon a seed seems to be to reduce its oxygen, to fix, or harden the carbon of its starch and saccharine matter, and so to parch the whole as to render it much less easily reducible into mucilage. This will teach that it is well to keep all seeds in darkness until sown.

Seed kept dry will endure a considerably wide range of temperature, a dry seed exposed to a great heat would of course not germinate, and will bear intense cold without injury, but a seed which has imbibed moisture, whether it has begun to germinate or not, would be destroyed by freezing. Water is essential to the commencement and progress of germination, not only to convert the sugar and starch into gum but to maintain the conditions requisite to continued development and increase. Rain, therefore, is always acceptable to the farmer and gardener soon after the seed is sown, otherwise water must be artificially applied, which however should always be avoided as much as possible ; making the soil pretty firm about seed or newly trans-

(1) Has not the origin of the so-called "Mummy" wheat been subject to a good deal of suspicion? ED. J. OF AG.